### ANN McELROY AND PATRICIA K. TOWNSEND



FIFTH EDITION

# Medical Anthropology in Ecological Perspective

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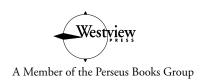


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### PREFACE TO THE FIFTH EDITION

Thirty years have passed since we collaborated on the first edition of this text. In 1977 there were almost no textbooks in the new subdiscipline of medical anthropology. We developed our text without benefit of published models. It turned out that several colleagues were incubating projects around the same time, and between 1978 and 1984 a variety of teaching texts became available.

In its infancy, medical anthropology was already an exceptionally eclectic field. Drawing on traditional, ethnographic study of illness beliefs, curing rituals, and herbal medicines, medical anthropologists also followed biological anthropologists in considering disease and climate as major factors in human evolution. Applied anthropologists had made valued contributions toward improving cross-cultural communication in public health projects. Ecological anthropologists were engaged in studies of the relationships of small populations of humans to their environment, in settings ranging from the Arctic to tropical forests to the Andes, and archaeologists and paleopathologists were using similar perspectives for studying the human past in changing environments. We wanted to pull all this work together into a coherent field of study, and the ecological model and the concept of medical ecology allowed us to do this.

A central purpose of this text from the outset was to demonstrate the value of the comparative perspective in health studies and the value of a holistic, ecological framework for learning medical anthropology. We continue to find that this approach encourages classroom dialogue between students in different disciplines. Students of the health sciences and the social sciences have much to learn from each other, in spite of departmental boundaries and curricular fragmentation.

Medical anthropology thrives on interdisciplinary stimulation. It is exciting when nursing students who understand the dynamics of disease transmission can exchange information with anthropology majors, who in turn can explain social networks in a community. As they discover together that the lines of disease transmission parallel the lines of social communication in a given case study, a unique kind of learning takes place. This is the very same kind of interdisciplinary collaboration that is at the core of medical anthropology, and it is only through such integrated work that we can begin to understand and solve the critical environmental problems that face North Americans today and threaten the future of peoples all over the world.

Each revision of the text has given us the opportunity to take a snapshot of the field of medical anthropology at that point in time. By the second edition, published in 1989, we found there had been a tremendous expansion in the amount of field research and publication in medical anthropology. While little of this work was explicitly ecological, we were gratified to be able to cite so much new work by anthropological colleagues working in a variety of health care settings. By the third edition, in 1996, the field had matured, with more reflection and development of theory in addition to empirical research. Constructive conversations between biological and cultural anthropologists and between ecological and critical anthropologists had encouraged the growth of biocultural research and the emergence of a political ecology of health. Ecological approaches were still relatively infrequent in the published literature of medical anthropology, but we found this dialogue promising.

By 2004, when our fourth edition appeared, we noted several trends. There was a resurgence of interest in environmental anthropology and in environmental health. Another positive development was the truly international scope of the discipline. We found increased attention in the literature and in applied work to issues of environmental justice, both globally and regionally, and concern with vulnerable populations displaced and threatened by war, civil conflicts, and genocidal policies. Five years later, these issues remain salient in a world troubled by terrorist acts and militant responses to conflict, by slow government responses to global warming, and widening inequality. Our discipline is maturing in a setting of political unrest, social injustice, and emerging infectious disease. We are confident that medical anthropology can contribute to amelioration of these problems in the twenty-first century, and we encourage students to use their training to prepare for good and effective work toward that end.

This edition features five new "profiles," case studies that exemplify points in a chapter and present details on current research in medical anthropology.

These profiles have been contributed by six colleagues and, in three cases, graduates of the University at Buffalo. Geographically, their sites include Ecuador, Costa Rica, India, Russia, and the United States. Methods range from demographic analysis of census data in post-Soviet Siberian villages to focus groups with inner-city teens in Hartford, Connecticut. One study describes a field school for anthropology students; another describes a team project designed to reduce the rates of cholera in rural Ecuador. It is gratifying to include material in our text that represents the excellence of current work in our discipline.

The fifth edition retains features that users of the earlier editions will find familiar, including the profiles. Although the sixteen profiles vary in length and focus, their overall purpose is to enrich and illustrate the text material with specific cases. They are not optional readings but an essential part of each chapter. We encourage instructors and teaching assistants to develop and assign additional case studies from their own research or communities that will further enhance the text.

We have also retained the appendix on recommended student projects and have tried to incorporate both timely topics and increased attention to the rights and protections of human research participants. Each chapter continues to list a set of instructor resources, including recommended readings, films, and journals for class enrichment.

This book is not the product of merely two individuals, but rather a work reflecting effort, support, and collaboration from colleagues, editors, students, and family. We express our gratitude to those who provided help and encouragement for earlier editions, and whose contributions remain part of the work. They include George Armelagos, Dean Birkenkamp, Janice Boddy, Carole Browner, Karen Ramey Burns, Napoleon Chagnon, James Clifton, William Dressler, Kaja Finkler, Marcha Flint, Robert Gordon, Candace Graser, Edward C. Green, Gail Harrison, David A. Himmelgreen, Edward E. Hunt, Jr., Marshall Hurlich, Carol Jenkins, Jennie Joe, Brigitte Jordan, Carol Laderman, David Landy, Michael Little, Margaret Lock, Michael H. Logan, Jeremiah Lyons, Debra Martin, Kellie Masterson, Emilio Moran, George Morren, Mimi Nichter, Catherine Panter-Brick, Pertti J. Pelto, Elizabeth Randall, Nancy Romero-Daza, Arthur Rubel, Lawrence Schell, A. T. Steegmann, Jr., Phillips Stevens, Jr., and Donald Watkins.

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As always, and most of all, we thank our families, now including a third generation, our granddaughters, for the patience, support, and love that have sustained us through this project.

### Chapter One

# THE ECOLOGY OF HEALTH AND DISEASE



Rural Nepali children carry heavy loads on Himalaya mountain slopes.

(Li

PHOTO BY PERMISSION OF CATHERINE PANTER-BRICK.

### **PREVIEW**

Medical anthropologists study human health in varied environmental and cultural contexts. Some human groups live in unusually rigorous conditions, while others enjoy mild climates and rich natural resources, but all societies must solve basic problems of acquiring space, food, energy, and resources for health. The methods and theories used by medical anthropologists in small, isolated populations can also be used to understand health problems in more complex societies. The comparative perspective and interdisciplinary teamwork of medical ecology allow us to document a wide range of human survival strategies as well as health repercussions of those strategies.

To introduce medical ecology, this chapter discusses two research settings, urban Nepal and the North American Arctic. A multidisciplinary research program in Nepal was designed to study the health, growth, and survival strategies of homeless children in Kathmandu, Nepal. A research profile on traditional arctic peoples describes strategies for acquiring food, staying warm, and limiting population growth in a challenging environment.

### Studying Nepali Children: An Example of Medical Anthropology

According to Hindu cosmology, a city is a microcosm of the universe. In the city of Kathmandu, at the foot of the Himalaya range, this microcosm contains sharp contrasts between ancient traditions and modern problems. Royalty and commoners, wealthy merchants and landless squatters, tourists and mountaineers all crowd into this capital of one million people. Nepal, one of the least-developed nations in the world, is a mountainous, land-locked country of 29 million people bounded by India to the south and China to the north. A monarchy for 240 years, Nepal became a secular democracy in 2008 after a decade of insurgency and conflict.

Nepal has many characteristics of a developing nation. The population growth rate is high, but infant mortality is also high. Eighty-seven percent of the people live in agricultural villages, where poverty is extreme. Increasing numbers migrate to urban centers each year seeking work, but jobs are hard to find. Families crowd into squatter settlements in small, makeshift houses



FIGURE 1.1 Homeless children sleeping on the streets of Kathmandu, Nepal. Photo by Permission of Catherine Panter-Brick.

where there is little room for older children. Consequently, many of these children spend their days in the streets, trying to earn some money by scavenging through dumps for material worthy of recycling, such as scrap metal and plastics, for resale to junkyard owners. They also beg from tourists, guard cars, wash glasses at teahouses, carry goods as porters, and look after the shoes of temple worshippers (Baker, Panter-Brick, and Todd 1997). As they grow older, some stop returning home and become street children.

In 1995, there were about 1,500 street children in Kathmandu, including about 600 homeless children and teens who slept with minimal shelter in different locations (Baker, Panter-Brick, and Todd 1996). (See Fig. 1.1.) Street children are called *khate*, meaning "rag-picker"; this term designates both those who are homeless at night and those who work on the street but live at home in squatter settlements. Those who make a living through rag picking regard it as dirty work, sometimes dangerous, but rewarding in terms of earnings. Making 25 Nepali rupees (then worth about 50 cents U.S.) was enough for a day's worth of food: morning tea, two meals of rice and vegetables, and a snack. The children could also get a noon meal for free at shelters run by non-governmental organizations (NGOs), and sometimes tourists and restaurant owners provided food.

Children earning more than 50 rupees a day bought meat, candy and ice cream, clothes, and tickets for the movies. They often shared money with each other; sometimes their money was stolen by older youths or adults. There were seasonal differences in earnings; the annual monsoon rains made it difficult to collect scrap and reduced the number of possible tourist benefactors. Income was unpredictable, and street children sometimes went hungry. They were also at risk of being beaten by local people, bitten by dogs, or taken into police custody. But friendships and social networks among the children themselves and with certain adults went a long way to minimize the hazards of street life (Baker 1998).

How do children become homeless in Nepal? Quarrels at home may motivate a child to leave home. Some children are thrown out of the home, especially by stepparents; others, dissatisfied with their lives or wanting greater independence, leave of their own accord (Baker, Panter-Brick, and Todd 1996). Given that children in rural villages are expected to start working at eight or nine years old, it is not surprising that parents encourage a teenager to seek better opportunities in the city (Panter-Brick 2002). The majority of homeless children know how to find their families, and teens are likely to keep in touch and to return home for religious festivals. Only 8 percent of street children in Nepal were reported to have no parents. Sonam Thapa, twelve years old, gives a common explanation for leaving home: "There was a lot of shouting at home and we didn't have enough food. I heard about jobs going in the city and decided to come to earn some money so I could send it home. My brothers were too young so it was my duty" (Baker 2000:51).

Although street children are found in many developing countries, little research has been done to appraise the health impact of homelessness independently from the impact of urban poverty. Most studies encourage stereotypical images of neglected and malnourished children without ascertaining the health status of other poor children, for example, those who have homes in urban squatter settlements or in rural villages. To get a more accurate view of the health impacts of homelessness in Nepal, Catherine Panter-Brick, a medical anthropologist at the University of Durham in England, conducted a collaborative project with Rachel Baker, a cultural anthropologist, and Alison Todd, a physician-anthropologist.

The research design was to compare homeless children with three other groups: boys living with their families in illegally occupied areas of the city called squatter settlements, boys in a remote farming village in central Nepal, and middle-class boys in a school in Kathmandu. (Since only 2 percent of

homeless children in Nepal were female, girls were not included in the study.) The researchers measured a variety of health indicators: growth and development, illness rates, food intake and physical activity, and stress hormone levels. They also studied the children's social support systems and day-to-day behavior. Investigating all these variables required a multidisciplinary approach, and the need to secure the cooperation of many local people: village leaders, school officials, the NGOs, the parents, and, most important, the children themselves as active participants in the research.

The first challenge was sampling the population appropriately. In the urban school and the village, the researchers drew a total sample of children in appropriate age groups, but for the squatter and homeless children, they aimed for representative samples. They mapped areas where street children could be found, consulted records kept by the NGO Child Workers in Nepal, and took their clipboards to the streets, temples, junkyards, and other places where children could be found. The sample of children studied for growth patterns comprised 111 homeless boys, 62 children in squatter housing, 52 village boys, and 80 middle-class boys from a private school in Kathmandu (Panter-Brick, Todd, and Baker 1996). Blood samples to assess exposure to infections were taken from a smaller sample of 104 children (Panter-Brick et al. 2001).

The next challenge was to ensure a proper balance of quantitative and qualitative methods. Quantitative data included anthropometric measures of height, weight, arm circumference, and amount of body fat, as well as the blood samples. Qualitative techniques included participatory exercises with children in groups talking about their health and discussing how they dealt with ill-health. The researchers also interviewed children and teens about their experiences on the street and reasons for leaving home, and noted changes, such as finding employment and a place to live, as the boys grew older. The findings clearly demonstrated differences among the four groups. Surprisingly, the homeless street children showed better than expected health outcomes. Measures of relative height-for-age, indicating stunting, showed that they were taller than village children and children from the squatter settlements. Furthermore, the length of time spent homeless on the streets (ranging from one week to nine years, averaging 2.7 years) did not correlate with nutritional status. There was no clear decline in nutritional health among those who had been homeless the longest. One interpretation is that the urban homeless sample was primarily boys who had thrived on the streets. Clearly, these children had effective coping strategies, including spending their money on food for themselves rather than handing it over to parents (Baker, Panter-Brick, and Todd 1996).

The rural children had the worst growth profile of the four samples. One reason could be that their nutrition was basically inadequate. The villagers had adequate amounts of food, but their diet was of poor quality, mostly cereal grains lacking in fats and micronutrients. Diets were more varied for the urban children, including the homeless. Village children also worked very hard, often carrying 130 percent of their own body weight up and down mountain slopes to transport firewood, fodder, and produce (Panter-Brick 1998). (See the chapter opener photo.) Despite reporting the fewest health complaints, village children were also found to have the highest levels of acute-phase proteins in their blood, indicating subclinical, inflammatory responses to infections. This finding shows that self-reports of illness need to be corroborated with blood analysis (Panter-Brick et al. 2001). Within the urban groups, the homeless boys also had high levels of acute-phase proteins, and they also reported far more health complaints.

Homeless children are very mobile, and it is difficult to trace them for follow-up study. But among those Nepali children who were followed up, it became apparent that homelessness is not necessarily permanent. Of 130 boys surveyed in 1993, just under half were still living on the streets two years later. Some had returned home, others had a job and a place to live, and some were enrolled in school (Baker and Panter-Brick 2000:174).

What generalizations can we make from these findings? Homelessness does not necessarily increase a child's risk of poor health, given the adverse environments from which these children originally came. We certainly don't claim that homelessness is advantageous for children, but it is clear that the long-term effects of their difficult lives, not only on their physical well-being but also on emotional development, need to be more critically and systematically examined.

In the decade since the research by Panter-Brick and her colleagues, the situation of Nepali children has not improved greatly. Political conflict and natural disasters have made life hazardous. One-third of boys and girls aged five to fourteen are laborers, many in carpet industries (UNICEF figures for 2006; Baker and Hinton 2001). The rate of stunting (being short for one's age) for children under the age of five is 49 percent; the rate of wasting (underweight for one's height) is 14 percent (UNICEF). The current number of homeless children is hard to document. Some sources estimate that numbers (including orphaned children) have risen into the thousands throughout Nepal due to political unrest and displaced populations.

### Environment, Culture, and Health

The Nepal research illustrates *medical ecology*, an approach in medical anthropology that emphasizes the environmental context of health. Medical ecology is concerned with basic questions: How do people survive in this environment? How do they cope with hunger and disease? What resources help them deal with problems affecting their health? Who controls these resources? Are resources restricted by ethnic and class boundaries? Is the population growing, and how rapidly will it exceed its resources if growth is not checked? Answers to these questions reflect relationships among community, environment, and health.

The Nepal research also illustrates how *biocultural anthropology* integrates methods and key concepts of physical and cultural anthropology. Children's growth and development patterns are markers of nutritional stress as well as of genetic variation. Comparisons of children's growth in varying environments allow controlled assessment of both biological and cultural factors influencing well-being.

Medical ecology and biocultural anthropology are just two of various specialized methodologies used by medical anthropologists to study health problems. Meshing three established disciplines—anthropology, ecology, and medicine—creates a framework for understanding medical problems that differs from typical clinical investigations. Combined with evolutionary theory and field methodology, medical ecology has provided some key organizing principles for medical anthropology. Although no single approach united medical anthropology in its early development, there was a "broad tacit consensus" that ecology and evolution were core concepts of the discipline (Landy 1983:186).

Medical ecology research often involves teamwork by specialists, as in the Nepal study where a biocultural anthropologist, a cultural anthropologist, and a physician collaborated. Interdisciplinary approaches allow medical anthropologists to be **holistic** in studying the entire system of factors affecting health. Medical anthropology is also flexible in choices of field sites. Many projects have been done in a single site with an isolated community, but multidisciplinary research can readily be used in contrasting regions.

An example of comparative research is Schull and Rothhammer's study (1990) of the Aymará Indians and other ethnic groups in northern Chile and western Bolivia. To study the effects of high altitude, twenty-six researchers studied the genetics, body shape and size, dental health, hearing, reproductive patterns, and nutrition of 2,525 people in three ecological zones: on the

coast, in the sierra about 3,000 meters (9,800 ft.) high, and in the altiplano at 4,000 meters (13,000 ft.) and higher. Regardless of ethnicity, people at higher altitudes had higher rates of infection than did people on the coast, especially respiratory diseases and ear infections. The researchers also assessed water quality and found toxic metals, especially lithium and arsenic, in many of the rivers. Edible shrimp taken from these rivers had high concentrations of arsenic, which is carcinogenic. Mummies from this region dated 600 years old also showed high arsenic concentrations in their skin, fingernails, and livers (Schull and Rothhammer 1990:43).

An alternative to studying regional differences is for research teams to document changes over time in one region, often involving several generations of researchers. This was done in a series of field studies beginning in the 1950s with Xavante Indians in Brazil (Coimbra et al. 2002). Some 10,000 Xavante live on reservations in tropical savannah and scrub vegetation. Originally hunter-gatherers and slash-and-burn cultivators, the Xavante added farming to their food economy after contact with settlers. In 1974 the Brazilian government established a commercial rice production project to enhance the Xavante economy. When the project ended, the rice plantations were converted to soybean crops and cattle pasture (Santos et al. 1996).

What were the effects of these environmental and economic changes? In comparing Xavante with other South American Indian groups, physical anthropologists have found that the Xavante gene pool has changed little since the 1960s despite economic transitions (Salzano et al. 1997). However, fertility and mortality patterns have changed. Data collected by cultural anthropologist Nancy Flowers show that birth rates declined and children's death rates increased between 1957 and 1971 in the village of Etenhiritipá. There were many deaths during this period, and antibodies analysis suggested that epidemics of measles, whooping cough, and polio had swept through the region in the 1950s (Neel et al. 1964). One in five babies died before the age of one, and 48 percent of boys and 59 percent of girls died before the age of ten. After 1972, a higher than usual birth rate helped the population to rebound from earlier losses, and child survival increased dramatically due to improved medical care, with 90 percent of both girls and boys surviving past the age of ten.

Ecological anthropologists also study people's work patterns and food resources. Time allocation projects comparing Xavante subsistence in 1976 and 1994 showed that planting and weeding of gardens declined, but hunting, fishing, and gathering increased because some Xavante had acquired trucks and could drive to fishing and hunting spots (Santos et al. 1997).

Food patterns had changed also. By 1994 Xavante people were eating less rice and more palm nuts and manioc, a starchy root crop. Their intake of protein from fish and meat had increased. The percentage of purchased food items, mostly sugar, coffee, and salt, was higher than before, but 90 percent of their food was still grown and foraged from their habitat.

The Xavante were not isolated from the external market economy. Some individuals received cash wages and government payments, rented land to ranchers, participated in television productions, and sold recordings of traditional music. Health care was available off the reservation for treatment of malaria and other parasitic diseases. Thus resources in the 1990s were not confined to local plants and animals but included purchased goods, external income, and services. Nutritionally the community was in better health than they had been twenty years earlier. This economic picture, considered with the fertility, mortality, and genetic data, indicates that Xavante people were surviving the pressures of contact with outsiders and rebounding from the worst of the disease impacts of this contact.

This case suggests that contact and change for an indigenous group do not invariably create the bleak picture of disease, political encroachment, and cultural genocide that we have come to expect. Internal resilience and political resistance may enable a community to retain traditional resources and cultural strengths while accessing new opportunities.

## Anthropological Subdisciplines and Medical Anthropology

Anthropology has four traditional subdisciplines: physical anthropology, archaeology, cultural anthropology, and linguistics. Ideally, each anthropology student receives training in all four areas. To be truly holistic in studying human behavior, one needs to know something about human biology, prehistory, cultural systems, and language, and needs to be able to integrate this knowledge. But the subdisciplines have drifted apart through increasing specialization, and most anthropologists are trained in only one or two subfields. Medical anthropology, as well as environmental anthropology (Townsend 2008), with their emphasis on viewing humans as both biological and cultural creatures, are among the few fields that bridge the subdisciplines. An unexpected dividend of recent work in medical anthropology has been the possibility of reintegrating the subdisciplines.

**Physical anthropology**, also called biological anthropology or human biology, studies the physical origins and variability of the human species. To

study human origins, physical anthropologists interpret the fossil record as well as study the behavior of living nonhuman primates. Physical anthropologists also describe physical variation—such as in skin color, blood type, hair form, bone structure, and stature among contemporary human groups. Anthropometry, the statistical measurement of the external dimensions of the human body, contributes to research on human growth and development. More often, though, the variations that give the most information about human adaptation are not these surface characteristics but rather traits like blood groups that are observable only in the laboratory. The physical and biochemical characteristics of humans are shaped by genes, which direct the processes of growth and development at the cellular level in interaction with the environment during development.

In recent years biomedical, biobehavioral, and biocultural studies have emerged as subfields of physical anthropology. These approaches focus on household and community patterns affecting nutrition, growth and development, physiology, and disease rates. The biological impacts of poverty, political inequality, and economic hierarchies in developing countries are of particular interest. An example is Katherine Dettwyler's *Dancing Skeletons* (1994), a study focused on causes of maternal and child malnutrition, high infant mortality, and high rates of childhood disease in Mali, a low-income African country. (See Fig. 1.2.)

Archaeology reconstructs the way of life of prehistoric peoples by analyzing artifacts and other material remains, including human skeletons. In studying the evidence of the material culture and social organization of past populations one can see how health, culture, and environment are related. Sometimes we can compare the health of populations living in the same area at different times. For example, between AD 550 and 900, Mayan culture in Central America was at its peak. The skeletal remains of Mayans who lived during this period show that people of the common class were shorter on average with each successive generation, while the elite—those who were buried in tombs—remained the same average height. Simultaneously, certain food remains, such as snail shells and animal bones, became more scarce. The evidence suggests that the height of working class people declined because their nutrition deteriorated during this period (Haviland 1967).

**Linguistics** seems at first glance to have little relevance to medical anthropology. Most of the work of linguists analyzing the sound systems and grammars of the more than 5,000 languages of the world has little to do with health. However, a major contribution to medical anthropology has been the development of ethnoscience or ethnosemantics, an approach that attempts



FIGURE 1.2 Biocultural anthropologist Katherine Dettwyler and research assistant Moussa Diarra weigh an infant in a suspension scale in Mali. Photo by Permission of Katherine Dettwyler and Waveland Press.

to find out how the participants in that culture categorize their experience. Ethnographic fieldwork using participant observation is combined with specific techniques derived from linguistics to understand the native's or insider's point of view by eliciting culturally significant categories. A classic example of ethnosemantics in medical anthropology is *You Owe Yourself a Drunk*, a study of homeless alcoholics in Seattle (Spradley 1970). The study found that the concept of "skid road alcoholic" was not a culturally appropriate term. The men did not consider themselves alcoholics; rather, they had other, nonmedical conceptions of their own identity.

Medical anthropologists emphasize the value of discovering how people classify and explain illness symptoms so that health care providers can communicate better with patients. Working with linguistic anthropologists, or using their methodology, a researcher can organize classification systems into folk taxonomies. Studies of taxonomies of respiratory infections in the Philippines have helped researchers understand people's decisions about whether to treat a cough at home, to consult a traditional healer, or to visit a Western-trained doctor (Simon et al. 1996).

**Cultural anthropology** has been important in the development of medical anthropology. The late George Foster, a pioneer in the field, distinguished three types of cultural studies as the roots of medical anthropology: the study of primitive medicine, witchcraft, and magic; studies of personality and mental health in diverse cultural settings; and applied studies in international public health and planned community change programs (Foster 1978). To this list we would add political ecology of health as a fourth, and more recent, contribution from cultural anthropology.

The concept of culture is central in anthropology. When we speak of "a culture," we mean a way of life that a particular group follows. "Culture" also means a unique characteristic of human beings in which the use and transmission of symbols, language, names and categories, rituals, rules, and other learned behaviors play a very important role in the adaptation of our species. Although many human behavioral traits clearly have a biological base, cultural patterns are categorized as shared, learned, and nonbiological attributes, in contrast to biologically programmed genetic traits.

### Distinctive Aspects of Medical Anthropology

As medical anthropology grew into a distinct discipline, it developed its own methodological and topical specialties. Although some medical anthropologists work comfortably in several subfields, combining and integrating diverse approaches, the field has become so complex that many researchers confine their activities to one specialty. *Biomedical* study of adaptation to disease is one specialty. The term "biomedical" refers to the dominant medical system in Europe and North America, with its own disciplines such as genetics, epidemiology, nutrition, and public health. (See Fig. 1.3.) Biomedical models can be used in studies of any population, although some anthropologists prefer to use indigenous categories rather than Western diagnostic categories and environmental models. An example of a biomedical approach is the long-term study of asthma in Puerto Rican children in northeastern U.S. cities such as Hartford, Connecticut (Singer and Clair 2003).

Ethnomedical studies of health and healing are a second major emphasis in medical anthropology. Researchers studying ethnomedicine attempt to discover the insiders' knowledge in various systems of healing. Researchers in this subfield are likely to concentrate on traditional healers such as shamans and bonesetters, but studies of contemporary alternative therapies, medical pluralism, and ethnopharmacology reflect the breadth of this approach.



FIGURE 1.3 Physician Richard V. Lee examines a Buddhist monk for goiter, which is common in mountainous areas such as the Himalaya of Ladakh in northern India. Lee's expeditions have provided field training for medical anthropology students. Photo courtesy of Candace Graser.

Third, many anthropologists focus on social problems and carry out interventions through *applied medical anthropology*. Topical areas include addictions, disabilities, and mental health issues; public health and family planning; environmental health; clinical anthropology and health care delivery in pluralistic settings (Shaw 2005). Applied medical anthropologists have made a significant contribution to our awareness of economic and political dimensions of the HIV/AIDS pandemic (Farmer 2004; Feldman 2008).

There have been three emerging emphases in recent decades: biocultural studies such as Panter-Brick's work in Nepal and Dettwyler's in Mali; the political ecology of health; and human dimensions research. Of these three, political ecology takes the most critical stance in analyzing phenomena. In a study of air quality and health in Houston, Texas, Janice Harper (2004) considers local understandings of health risks in a neighborhood bordering factories and highways. Comparing public health models of risk (which emphasize economic status, education level, and race as important health variables) to residents' perceptions (focused mostly on air pollution), Harper documents the struggles of people to deal with asthma in children and cardiac and respiratory

problems in elders. Contrary to information in public health brochures, the research participants did not believe that asthma was caused by cockroaches or dust mites, but rather by "the petrochemical plants, the concrete crushing facility, and the endless streams of trucks going in and out of the chemical plants." Harper emphasizes that "political ecology is not value-neutral; most people who identify themselves with political ecology support applying findings to policy in order to achieve social equity along with environmental protection" (Harper 2004:296, 315).

Inclusion of political and economic factors in ecological approaches is leading to productive collaboration. Emilio Moran, a distinguished ecological anthropologist, describes the new multidisciplinary field of **human dimensions research**, which ranges from local to global levels to assess climate change events. In addition to studying impacts of global warming, the new field focuses "on impacts of land use and land cover change on biodiversity, and on issues such as urban sustainability and globally significant resources such as water and energy" (Moran 2008:xvi).

While borrowing freely from various approaches, the theoretical base of this text is medical ecology. This framework does not specify what environmental factors maintain health, but it does emphasize that environment must be considered. Recognizing that change in an ecosystem often affects health, either adversely or positively, medical anthropologists also know that a narrow ecological model does not account for people being displaced from their homeland or deprived of basic rights. Politics and economics play a large role in a community's well-being and must be considered in any model of health.

Humans live in behavioral environments in which sources of threat and stress often come from other humans who impose oppressive conditions and who introduce life-threatening hazards and pathogens. Poor outcomes of these encounters are not to be construed as failures in adaptation but rather as disastrous transformations of environments in which benefits to one group often put others at risk. To be useful, an ecological model must be expanded to fit such cases, with permeable boundaries that account for external influences as well as internal dynamics.

### Adaptation and Resilience

Medical ecology has been influenced by the classic writings of René Dubos (1965) and Alexander Alland, Jr. (1970) in which **adaptation** emerged as a core construct. Whatever their orientation, be it biomedicine, ethnomedicine,

bioarchaeology, or political ecology, many anthropologists use concepts such as adaptive traits and strategies of adaption in discussing biocultural evolution.

This text defines adaptation as *changes, modifications, and variations enabling a person or group to survive in a given environment.* Like any other animal, humans adapt through a variety of biological mechanisms, yet they depend on cultural adaptation more than other species. Learned, culturally patterned behaviors lead people to live in social groups, to coordinate their efforts to get food, to protect themselves from the weather, and to nurture and train their young. However harsh or dangerous the environment, humans usually have the flexibility to survive, although it is only in cultural groups that they can go beyond sheer survival to achieve well-being. So pervasive is the human dependence on learning rather than on innate or instinctive strategies that it makes sense to consider the capacity for culture as an evolved trait.

The concept of adaptation is being challenged as medical anthropologists develop new constructs to describe human responses to environmental problems. One new construct is **resilience**, denoting the flexibility of humans to respond to problems through a hierarchy of response potentials, some genetic and physiological, others behavioral and cultural. We return to the theme of resilience in chapters on evolution and health and on stress and coping.

Key premises of this book are that environmental adaptation and health are closely linked, and that medical ecology creates a productive framework for understanding health. The text is organized around fundamental ideas about how human ecological systems operate, and about how humans perceive and use their environments and their resources. At times the focus will be on energy flow, subsistence strategies, and population regulation rather than on illness directly. At other times, the focus will be on the interpersonal or behavioral environment rather than the physical environment, as in the discussions of stress, culture change, and political factors affecting health.

The following section demonstrates the health ecology of the Canadian Arctic Inuit in a profile of traditional adaptations of northern hunting peoples. Today, in the twenty-first century, few Inuit live exactly as we describe here, but many grew up in traditional ways, subsisting "on the land" and maintaining skills needed for survival in the past. With the arrival of explorers, whalers, missionaries, and government agents over the last two hundred years, life has changed greatly in the Arctic. A visitor to Baffin Island sees Inuit working in offices and classrooms, using snowmobiles and trucks to travel to modern houses, and traveling by jet for modern medical care in

southern hospitals. Nevertheless, because traditional arctic lifestyles represent successful adaptations in the past to a rigorous biome, anthropologists study these patterns to understand the role that these strategies played in maintaining health. The information in this profile comes partly from publications by anthropologists, physicians, and other scientists and partly from ethnohistorical research by Ann McElroy in eastern Canada.

### ROFILE: ARCTIC ADAPTATIONS \_\_\_\_\_

Inuit tell a story of a woman who raised a polar bear cub as her son, naming him *Kunikdjuaq*. She nursed him, gave him a soft warm bed next to hers, and talked to the cub as if to a child. When the bear grew up, he brought seals and salmon home to his adoptive mother. Because of his skill in hunting, the people in the camp became envious and decided to kill him. The old woman offered her own life in place of the bear's, but the people refused. In tears she told him to go away and save his life. The bear gently placed his huge paw on her head and hugged her, saying, "Good mother, *Kunikdjuaq* will always be on the lookout for you and serve you as best he can" (Boas 1964:230–231).

Of all animals, the polar bear is the most admired by Inuit. They point out how the bear's hunting techniques resemble their own: slowly stalking seals that lie sunning themselves on ice floes or waiting quietly at the seals' breathing-holes in the ice. Because they admire and envy the bear and compete with it for food, Inuit feel a sense of ambivalent kinship with the bear, and they may even name a child *nanuq*, or "bear."

The symbolic closeness of the two species, bear and human, reflects their ecological relationship. They faced similar problems in a region limited by high winds and severe windchill, low precipitation, and poor, thin soil. They are both large animals with high caloric needs who must conserve body heat in a bitterly cold climate, and who must find enough to eat in a biome with low biological productivity; that is, one that supports relatively few species of animals and few edible plants. Because food resources are dispersed and vary seasonally, both bears and humans must also remain dispersed in small, nomadic units. Neither was seriously subjected to predation until humans acquired rifles about ninety years ago. Avoiding predators was far less a problem than finding food, keeping warm, and keeping population size within the limits of available food.

Bears evolved solutions to these problems such as thick fur, semihibernation in winter, and small social units. Cubs stay with the mother for eighteen months after birth, and adult males remain solitary most of the year. Human solutions to the same problems are quite different. Humans lack fur, but they know—not instinctively but rather through observation and learning—how to turn animal fur into clothing for protection against cold. They do not remain in dens in the winter but traditionally maintained a vigorous life of travel year-round in small camps of twenty or thirty people, all ages and both males and females. Unable to swim in icy arctic waters, as bears do, Inuit built boats. Rather than eating only a few species of large marine mammals, as bears do, humans used most species from both land and sea habitats in some manner, if not for food, then for clothing, fuel, or tools. Humans and bears lived in the same habitat, but their adaptations differed because culture played such a vital role in human behavior.

## **Accessing Energy: Selectivity in Exploitation**

The Arctic is depicted in movies and novels as a frozen land where famine constantly threatens and people must eat everything available just to stay alive. This stereotype creates a perception of the North as barren. In reality, boreal habitats provide ample resources. A simple ecosystem compared to tropical rain forests, the tundra provided twenty-nine edible species for Inuit. In fact, they heavily subsisted on only four categories: fish, seals, whales, and caribou. Some animals, such as fox, were not eaten at all except during severe shortages.

The growing season is short, usually about ten weeks during which long hours of daylight allowed plants to complete their life cycles before becoming dormant for another winter. Some were collected for immediate consumption, like the berries so abundant in August. Others were dried as medicinal herbs and teas. Everyone was taught from childhood to recognize and harvest edible and useful plants, but it was the midwives who most regularly depended on plants. Arctic cotton grass, for example, was mixed with charcoal and placed on babies' navels to hasten the drying and healing of the umbilical stump. If bleeding continued after giving birth, the midwife put shredded grass into the woman's vagina and gave her tea made from sorrel or from Labrador tea leaves (Traditional Medicine Project 1983).

Inuit exploited both coastal and inland food resources, often moving camp seasonally to pursue migratory species. They hunted game that provided



FIGURE 1.4 Inuit women use a traditional *ulu*, a woman's knife, to clean a polar bear skin. Lashed to the rack is the skin of a bearded seal, used to make boot soles. Hanging from the rafter is the soft, fine skin of the ringed seal, used for boot tops and clothing. Photo by Ann McElroy.

maximal yield for minimal energy output or relatively low risk, preferring species such as seals and whales that provided a good return of by-products such as skin, bones, and oil as well as meat. Before intensive contact with traders, Inuit manufactured all artifacts from natural resources, mostly from animal products because wood and usable stone were scarce. Bone, ivory, sinew, antler, skin, fur, feathers, blubber—every part of the animal was used for something, from sewing needles to harpoons, water buckets to boats, snow shovels, lamp fuel, and boots. (See Fig. 1.4.)

Arctic char, similar to salmon, was an important seasonal resource, with a high return for the energy invested by men, women, and children who netted and speared the fish swimming upstream to spawn. The fish not consumed immediately were cut into strips and dried in the sun, providing an important

protein source for late autumn and early winter. Migratory caribou herds also returned a good yield, each animal contributing several hundred pounds of meat as well as skins and sinew for clothing and tents. There were restrictions against consuming or working with caribou and seal products in the same season, and some cultural anthropologists, including Franz Boas as early as 1888, attempted to show adaptive aspects of these taboos. Seasonal hunting and skin-working taboos do not invariably demonstrate pragmatic benefits, but prohibitions against consuming caribou and seal at the same time show intuitive understanding that foods differ nutritionally by season.

Of all the animals available to Inuit, seals were the staple food. Inuit believed that seal is "life-giving" as a "rejuvenator of human blood" (Borré 1991:54). Following this belief, seal meat was fed to sick people as a remedy.

Musk oxen, in past centuries reliable sources of food and by-products especially for Inuit who lived in the high arctic islands, faced extinction in the twentieth century and were protected by law from being hunted. These regulations allowed the herds to recover in numbers, and now hunting of musk oxen is allowed, subject to government quotas (Nagy 2004). Polar bear hunting is also regulated by government quotas, but bears were never an important source of food, for several reasons. Hunting them was risky because a wounded bear might maul humans and dogs. Polar bear meat contained parasites, and use of precious fuel was necessary to cook the meat enough to prevent trichinosis. Bear liver, often containing excessive vitamin A, could also make humans sick.

Although their skins were used as bandages in treating wounds and boils, the tiny and unpalatable lemmings were rarely eaten by humans (Traditional Medicine Project 1983). Small animals had "high handling costs" (that is, they took too much time to catch relative to their nutrient yield), and some, like sea gulls, simply didn't taste good (Smith 1991:209–210). However, ptarmigans, small birds, were easy to catch because they could not fly well and provided a tasty snack, raw or cooked. Duck eggs, usually hard boiled, were popular, and digging for clams on tidal flats was a favorite midsummer activity.

Only rarely were Inuit forced to resort to cannibalism. During extreme shortages small hunting bands, usually fifteen to fifty people, would disperse into smaller units of one or two families, foraging for famine foods. They ate their dogs long before they considered killing a person for food, an abhorrent idea to Inuit. Thus dogs provided not only transportation but also a reserve food supply. However, dogs, foxes, and wolves carried a tapeworm that could be transmitted to humans and cause severe effects if lodged in the

brain, bone marrow, or kidneys (Oswalt 1967:79). We have no evidence that Inuit were aware of the risk of tapeworm, but they ate these animals only in times of great need and thus limited exposure to parasites.

Food-sharing partnerships among hunters were an important feature of Inuit cultural ecology that minimized food shortages (Balikci 1970). These alliances not only created political stability but also ensured cooperation rather than competition in exploitation of the environment. Food was rarely hoarded. When there was surplus, people feasted. Small amounts of left-overs were frozen and carried by the group; large amounts left from a whale kill or after a caribou hunt were stored to freeze under caches of piled up rocks. The food might be retrieved at a future time, or travelers needing food could help themselves to the cache.

## **Consuming Energy: Dietary Patterns**

Life in the Arctic requires high energy levels. Traveling by dogsled means much running, pushing, and pulling; rarely is there a chance to ride. When the family is traveling, a new snowhouse or tent must be erected whenever they set up camp. In summer, water is hauled from inland pools, and willow and heather are gathered for bedding and insulation. Men construct fish weirs by carrying hundreds of boulders, and women scrape animal skins for hours to remove fur from one side and to soften the skin for sewing. Babies are nursed and carried on their mothers' backs up to three years. Breast milk production requires extra calories, and it takes energy to carry a growing child five to ten hours a day. To keep warm, Inuit enjoy strenuous games, wrestling, acrobatics, and races.

Some subsistence activities have higher energy costs than others. For example, jumping from rock to rock while spearing fish involves almost twice the oxygen costs as sealing in winter on the floe edge. The average energy expenditure for Inuit hunters is about twice that of more sedentary groups (Shephard and Rode 1996:22). However, hunters do not maintain such high levels of activity every day. About 160 days a year are spent hunting, fishing, trapping, and traveling; the rest of the time is spent relaxing, repairing equipment, visiting, trading, and feasting.

Inuit look stocky because of their bulky clothing and relatively short limbs, but they are actually lean and muscular and have little body fat to burn during food shortages. The body fat of people measured in one eastern Arctic community in the 1990s averaged only 13 percent (Shephard and Rode 1996:29). Adult men expend about 2,700 calories per day (and at

peak activity periods, 3,600 calories) and require between 2,800 and 3,100 calories to support a weight of about 140 pounds (63 kg) at an average height of 5 feet 3 inches (160 cm) (Rodahl 1963:103). Women's caloric needs are usually less because they usually do not hunt but stay in camp preparing skins and tending children. But during other circumstances, such as digging clams, chasing ptarmigan, or traveling, and especially when nursing a child, they need almost as many calories as the men do.

Inuit consumed an average of 200 grams of protein per day as full-time hunters, about 32 percent of their total caloric intake (Draper 1977:311). Some Greenlandic Inuit consume as much as 44 percent of their diet in the form of animal protein. In contrast, North Americans' caloric intake averages about 15 percent protein, which is more than generally recommended by nutritionists. In most low-income countries, protein constitutes only about 2 percent of the diet.

Consumption of carbohydrates by Inuit was very low, 10 grams daily and between 2 and 8 percent of total intake, compared to U.S. levels (50 percent) and less developed countries (60 to 75 percent). Because of the cold and the long months of little daylight, it was impossible to cultivate plants for food. Small portions of berries, sourgrass, sorrel, and sea kelp gathered in summer added variety but not enough vitamins to meet nutritional needs. However, fat consumption was quite high, averaging 66 percent of the diet and 185 grams daily. In contrast, the average North American's consumption of fat represents about 30 percent of caloric intake.

With this diet of high protein, high fat, and low carbohydrates, we might expect traditional Inuit to have serious health problems. And yet they were generally well nourished, without deficiency diseases such as scurvy and rickets or heart disease from cholesterol buildup. How do they manage to thrive on this diet?

The key to getting maximum nutrition from available foods was found in food preparation. In sufficient quantities, when eaten raw or lightly cooked, meat can provide adequate amounts of all vitamins except ascorbic acid (vitamin C). Seal oil and fish are especially rich in vitamins A and D, and the B vitamins are adequate in traditional arctic foods. Eating fresh meat raw preserved small quantities of vitamin C that would be lost in cooking. This was shown by the anthropologist-explorer Stefansson, who ate meat raw, frozen, or only lightly cooked to avoid developing scurvy. Other sources of vitamin C include the plankton in the stomachs of fish and walrus, and lichen in caribou stomachs. *Maqtaq* (whale skin), a popular delicacy, is very high in vitamin C.

The all-meat diet is high in phosphorus and low in calcium. By eating the soft parts of animal bones, as well as dried fish and bird bones, Inuit compensated for the lack of dairy products. Adult Inuit molars are so hard, and their jaw muscles so strong, that they can crunch through bones easily. Nevertheless, some suffered from mild calcium deficiency, especially in winter when the lack of vitamin D from sunlight inhibits calcium absorption. This puts a particular strain on nursing women. Probably because they are nursed for long periods, Inuit children rarely have rickets. Among adults, however, there is elevated risk of loss of bone minerals due to low calcium and vitamin D intake and to high phosphorus intake. The elderly are especially prone to osteoporosis, a decrease in bone mass that increases the risk of fractures (Mazess and Mather, 1978:138). From age forty on, Inuit men and women lose bone mass at a more rapid rate than does the general U.S. population (Draper 1980).

Arctic diets are high in fat, yet the Inuit had low serum cholesterol levels, low blood pressure, and low rates of heart disease, perhaps because their meat was significantly lower in saturated fats than commercial beef. For instance, caribou meat has a much higher proportion of polyunsaturated fatty acid content, 21 percent as compared to only 3 percent in beef (Draper 1977). Diets rich in the omega–3 polyunsaturated fatty acids found in fish, seal, whale, and polar bear lipids are associated with a low rate of atherosclerosis and cardiovascular problems (Innis and Kuhnlein 1987).

Some of the animals of the Arctic, for example, caribou and rabbit, provide very lean meat. Although this would seem desirable, a diet of lean meat is not an adequate source of energy and essential fatty acids for people living in such a cold climate. The blubbery animals of the Arctic, especially the seal, provide the necessary fatty acids. Arctic populations that subsist primarily on caribou or reindeer may face nutritional deficiencies (Speth and Spielmann 1983).

## **Conserving Energy: Staying Warm**

How can humans cope with the severe temperatures of the Arctic, which remain usually well below freezing eight to nine months of the year? How can they work, travel, and even play outdoors when the thermometer reads –30°F (–34°C)? Do Inuit have an extra layer of body fat? Or perhaps an unusually high metabolism?

The extra fat idea has been disproved by skin-fold measurements. Inuit are no fatter than racially similar people such as Chinese and Japanese liv-

ing in temperate climates (Laughlin 1964). They do, however, respond to cold with an increase in cellular metabolism through nonshivering thermogenesis. This response, associated with a special kind of fat called brown adipose tissue, is found in all human infants and is maintained in indigenous adults in the Arctic (Little and Hochner 1973:6–7). Their basal metabolism is between 13 and 33 percent higher than among people in temperate climates, increasing core body temperature and reducing the risk of hypothermia. Diet contributes to higher metabolic rates, and when food intake shifts to lower protein and high carbohydrates, metabolism falls.

Because of this higher metabolism, Inuit had excellent blood circulation and resistance to cold in the hands and feet (Laughlin 1969:414). (See Fig. 1.5 top.) When Inuit are exposed to cold, the blood flow to their hands and feet rapidly increases. The response is cyclical, alternating between vaso-constriction and vasodilation. This ability to respond quickly to cold, called **high core to shell conductance**, is up to 60 percent faster among Inuit than among whites (Moran 2008:136). This is related more to diet than to genetic inheritance. It is an important physiological adaptation because the hands are the only part of the body frequently exposed to wet cold. There is a relatively thick layer of subcutaneous fat in the hands and feet, allowing tasks like untangling dog harnesses, spearing fish, or butchering seals to be done efficiently without mittens.

Under normal circumstances, only the hands and face are exposed to extremely low temperatures. Frostbite is very infrequent and tends to affect the face more than fingers and toes. Scientists once believed that the facial flatness and eve folds of Inuit were a genetic adaptation to cold, but these characteristics have been shown not to offer significant protection (Steegmann 1970). Outdoors, Inuit were clothed in double-layered caribou furs, with three or more inches of excellent insulation, and in waterproof sealskin boots lined with caribou fur. Caribou hairs are hollow and very dense, providing good insulation, light weight, and softness. Traditional Inuit clothing provided thermal equilibrium for a resting subject at -40°C (-40°F) (Shephard and Rode 1996:31). This created a microclimate as warm as a person could desire, sometimes even too warm during strenuous activity, but the "chimney effect" of venting at the hood, sleeves, and other openings in the parka helps prevent excessive sweating and hyperthermia. (See Fig. 1.5 bottom.) In addition, arctic peoples tend to sweat less from the trunk area and more from the face than other populations.

Inuit take advantage of body heat to keep their infants warm on the mother's back in the spacious pouch of the mother's parka, or *amauti*. (See

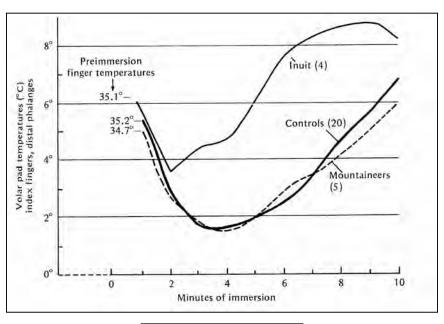




FIGURE 1.5 (top) Physiological adaptation in vascular responses to cold. Inuit retain warmer fingers after ice water immersion than other subjects. (bottom) The chimney effect in fur clothing, a cultural adaptation. Vents are opened by release of drawstrings during exertion to prevent accumulation of sweat. Figures from Emilio Moran, *Human Adaptability*, Second edition. Westview Press, 2000. Pp. 125 (top) and 121 (bottom). Original source of top figure: C. J. Eagan. 1963. *Introduction and Terminology: Habituation and Peripheral Tissue Adaptations*. Fed. Proc. 22:930–932.

Fig. 1.6.) The waistband of the *amauti* (*amautit* is plural) can be loosened to shift the infant around to the front to nurse without being exposed to cold air. Indoors on the elevated sleeping platform, Inuit slept side by side on platforms in close body contact, sharing the warmth of thick caribou furs covering a bed of heather branches. Warmed only by melted seal blubber and small flames from a length of moss wick in a stone lamp, plus the heat of human bodies, the interior of snowhouses are often 30 to 60°F (17 to 33°C) higher than outside temperatures. *Igluit* have excellent insulation because the snow blocks contain small air cells. The heat of the seal oil lamp slightly melts the inside snow surfaces. They refreeze at night to a smooth reflecting surface that conserves radiant heat. Attaching entrance tunnels with openings at right angles helps to prevent drafts and heat loss (Moran 2008).

From May to November, Inuit lived in tents lined with animal skins. In some regions, they built small huts called *qarmat* supported by frames of whale bone or timber and covered with layers of skins and sod. Moss and



FIGURE I.6 An Inuit child sleeps in an *amauti*, or mother's parka. Store-bought duffel cloth has replaced traditional caribou skin, but the garment style still provides the child warmth and security. Photo by Ann McElroy.

heather, gathered in late summer and early autumn and stuffed between the walls of these dwellings, provide effective insulation.

## **Conserving Energy: Limiting Population Growth**

Food resources are a critical factor limiting population size and density in the North. It is hard to accumulate surplus against hard times because of the mobile lifestyle and the need to travel lightly. Food supply is rarely dependable enough to allow people to settle in one place for long. Thus population density was traditionally very low: approximately 0.03 persons per square kilometer (0.08 per square mile) in Canada and 0.04 (0.1 per square mile) in Alaska.

If population size in any given region exceeds the area's resources, starvation threatens. Inuit kept their numbers well under the upper limits, usually fewer than a hundred persons per camp, with a social structure that allowed easy fissioning of groups and a seasonal cycle in which the size of the camp varied depending on the resources being exploited (Smith 1991). Several factors maintain stability in population size: predation, starvation, disease, accidents, and social mortality. Humans are rarely preyed on in the Arctic, although polar bears stalk people occasionally. Famine has not been a frequent cause of death, but it is certain that during serious food shortages as recently as the 1960s, mortality was high among elders and small children.

Infectious disease was also rare, for two reasons. One is that a simple ecosystem like the tundra has few parasitic and infectious organisms and few species of animals or insects that transmit diseases to humans (Dunn 1968). The second reason is that, before the days when people began to settle around whaling and trading stations, the communities were too small to sustain epidemic diseases. Prior to contact with Europeans, Inuit did not experience contagious diseases such as measles, smallpox, diphtheria, rubella, and flu.

The health problems of Inuit, before moving into settlements, were primarily chronic conditions: arthritis, eye damage, deficiency in enamel formation on the teeth, loss of incisors, and osteoporosis. A hysterical syndrome called *pibloktoq* affected people in winter, especially women. There was always a chance of contracting tapeworm and trichinosis from fish and walrus. Eating aged meat, considered a delicacy, posed a risk of fatal botulism.

Many health problems of modern societies, such as high blood pressure, heart disease, and diabetes, were absent or rare. Cancer was infrequent, but there are early cases reported by physicians of tumors of the nasopharynx,

the salivary glands, and the esophagus (Shephard and Rode 1996:41). These cases may be related to the ubiquity of tobacco use since the nineteenth century. By far the most common health problems were head lice and intestinal parasites, including protozoa, flukes from fish, pinworms, and hydatid disease contracted from dogs. Tapeworm infections from eating raw fish were the most prevalent parasitic diseases, in some communities reaching an 83 percent prevalence, but they did not cause serious illness. The risk was seasonal, as freezing the fish killed the tapeworms. Rabies among dogs and other animals posed a problem for humans in Alaska but was not introduced to northern Canada until 1945 (Shephard and Rode 1996:235, 236).

Elderly Inuit remember many traditional remedies for treating wounds, infections, and intestinal problems. Boiled seal flippers were given to children with diarrhea. Puffball mushrooms were used as bandages, and algae from seaweed was used to draw out pus from boils. Seal oil and human urine were used to stop excessive bleeding (Therrien and Laugrand 2001:25, 71–73). When a person was seriously ill or deeply depressed, a shaman (angakuq) would attempt a cure through getting the person to confess to transgression of taboos. Other rituals involved the shaman fighting with the spirits of deceased souls (Therrien and Laugrand 2001:281–287).

The predominant cause of injury and natural death was accidents, especially drowning or freezing to death after capsizing, but including house fires and attacks by sled dogs. Hunting accidents among men accounted for 15 percent of the deaths of a southern Baffin Island group (Kemp 1971). Young adult males have a high frequency of a painful skeletal defect in the lower back called spondylolysis. This condition is due to stress fracturing during adolescence, probably incurred during kayak paddling, harpooning, wrestling, and lifting heavy objects (Merbs 1996).

Social mortality, such as feuds, murder, and infanticide (Dunn 1968), was another regulator of population. Warfare did not occur in the eastern Arctic, but feuding between camps led to revenge murders. Suicide was frequent, especially by old people who could not keep up with the group and wished not to be a burden, and in younger people because of blindness or other crippling disability, and sometimes due to intense feelings of guilt or despair. Among the Netsilik, over fifty years there were thirty-five completed and four unsuccessful suicides among a population of about 300 people (Balikci 1970:163).

Rates of newborn female infanticide in various Inuit populations have been calculated as averaging 21 percent (Smith and Smith 1994). According to informants, it was most often the father, not the mother, who decided that a newborn baby must die. This was done, usually by exposure to the cold, immediately after the birth. The infant might be spared if the name of a deceased person were spoken, allowing the soul of the person to enter the child. Betrothal before birth, or an arrangement to let another family adopt her, also ensured a female infant's chance to live (Balikci 1970). Missionaries entering the North in the late nineteenth century preached that infanticide was a sin, and by the 1930s the custom stopped among Christian converts.

### **Resources for Survival**

The adaptive traits that distinguish Inuit from other mammals of the Arctic include the ability to make tools, to use language, to coordinate and plan hunting activities, and to teach their young necessary skills. An important aspect of the training of the young was to pass on knowledge and awareness about the sea ice, the snow, the weather, animal behavior, geography, and navigation. Children, learning not from books but from observation and from trial and error participation, became highly sensitive to subtle environmental cues such as shifts in the wind, changing humidity, the color of ice, and the restlessness of a caribou herd. Environmental sensitivity and indigenous knowledge was crucial for survival (Anderson and Nuttall 2004).

Inuit fully exploited the resources of the ecosystem, yet they remained a part of the system without changing it enough to threaten its equilibrium, and their health reflected this equilibrium. They lived in northern Canada, Greenland, and Alaska for 5,000 years or more in a relatively stable way of life, as a part of nature rather than separate from it. They could feel a kinship with *nanuq*, the bear, yet because of their tools, language, and creativity, they also felt a sense of competition and separation from the bear.

An Inuk elder once showed Ann McElroy an ivory chess set he was carving. He had chosen *nanuq* to be king of all the animals and *inuk* (the man) to be king of a whimsical ensemble of dogs, children, sleds, and snowhouses. The set was skillfully carved and would bring a fine price in Toronto, but it was more than just tourist art. It seemed symbolic of the human niche in the arctic biome: bear and human as equals, yet rivals in the carver's conception of the game.

## A Working Model of Ecology and Health

The model shown in Figure 1.7 will help the reader to organize the variables presented in this chapter. The environment can be conceptualized into three

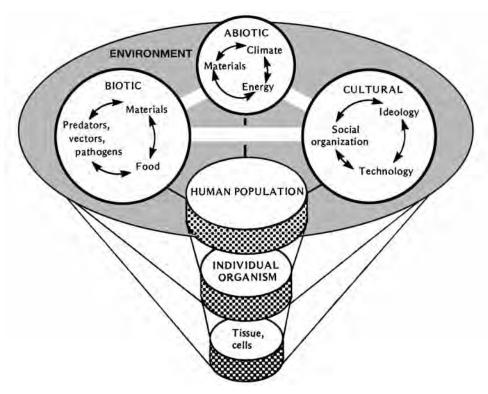


FIGURE 1.7 The environment affecting human health is made up of physical, biological, and cultural components forming an ecosystem. On a regional or global scale, environment is made up of multiple, overlapping ecosystems in which the flow of people, resources, and other organisms is only partially restricted by geographic and political boundaries.

parts: the physical, or abiotic, environment; the biotic environment; and the cultural environment. The parts are interdependent and continually in interaction; a change in one variable frequently leads to a change in another (this is what a system means). Although we usually focus on the separate parts and may think of them as causes and effects of change, it is also possible to imagine all these individual spheres and variables functioning as a single unit. If you look at the whole this way, you have a model of an ecosystem, a set of relationships among organisms and their environment.

In analyzing the impact of people on their environment and the impact of environment on people, we can shift focus from individual to population, and back, depending on our purpose. For example, a hunter puts on his snow goggles to protect his eyes from the glare of sun on snow and ice. The goggles are

a material artifact, a part of his cultural resources. They modify the impact of the glare from snow and ice and prevent snow blindness, a temporary but debilitating condition. The goggles themselves are made from bone or ivory, materials from the biotic environment. As we look at this simple act of carving and wearing snow goggles, we can focus on the effect on the whole population, considering the role of this artifact in the group's long-term adaptation to an environment with intense glare. We can then shift to the individual and consider his day-to-day success in finding food. We can even ask about the effect of the snow goggles on his eyes, lowering the focus to the organ, tissue, or even molecular level.

Where do health and disease fit into this model? A change in any one of the variables in the model in Figure 1.7 can lead to certain imbalances, potentially contributing to disease or stress. For instance, change in climate may lead to a decrease in food supplies. Erosion of soil may undermine agricultural productivity. Politically and economically powerful groups may impose changes that further disadvantage vulnerable groups. Industrial pollution in one area of the world may have long-term impacts on the climate, food resources, and air quality of other areas.

Our model builds on certain premises about the ecology of health and disease. First, there is no single cause of disease. The immediate, clinically detectable stimulus for disease may be a virus, vitamin deficiency, or an intestinal parasite, but disease itself is ultimately part of a chain of factors related to ecosystem imbalances. Second, health and disease develop within a set of physical, biological, and cultural systems that continually affect one another. Third, environment is not merely the physical habitat, the soil, air, water, and terrain in which we live and work, but also the culturally constructed environment: streets and buildings, farms and gardens, slums and suburbs. Further, people also create and live within social and psychological environments, and their perception of the physical habitat and of their role is influenced by social values and worldview. Thus, our model linking environment and health fully acknowledges the impact of human behavior on environment.

The holistic approach in medical ecology attempts to account for as many environmental variables as possible, but the analysis of so many variables is difficult conceptually and not always possible, as research is always limited by time and money. The model allows us to look at only part of the overall system. For example, we can consider how technological change (say, increase in low-level radiation) and change in health indices (such as rates of cancer) are related. While remaining aware that many ecosystem variables are involved

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in this change, we may choose to study only a few variables in systematic comparisons of populations or communities. A systems approach precludes easy explanations, but it does allow you to think about health and disease in ways that are both realistic and challenging. With this open model, the reader can analyze many of the specific cases discussed in this text, assessing the relative impact of one or another variable on health and comparing the adaptive strategies of various populations in terms of health benefits and disease risks.

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- Social Science and Medicine. An international, interdisciplinary journal. Published by Pergamon and Elsevier Science Ltd.

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- Netsilik Eskimo Series. 1967–1971. Available in video format from Documentary Educational Resources, Cambridge, MA, and in 16 mm films from Pennsylvania State University.
- Atanarjuat—The Fast Runner. 2000. 172 minutes. Directed by Zacharias Kunuk. Igloolik Isuma Productions. http://www.isuma.ca/.

## Chapter Two

## INTERDISCIPLINARY RESEARCH IN HEALTH PROBLEMS



Joetani, a Baffin Island hunter, lifts a seal into his boat.

(F)

PHOTO BY ANN McELROY.

### **PREVIEW**

Whether they are as exotic as kuru in New Guinea or as familiar as the epidemic of obesity in America, health problems have no respect for disciplinary boundaries. Understanding each health problem in ecological context demands many different kinds of information: *environmental* data, *clinical* data, *epidemiological* data, and *sociocultural* data. To acquire these varied data requires the contribution of biological and environmental sciences, clinical medicine, demography and biostatistics, and social and behavioral sciences. The student of medical anthropology who wishes to understand the ecology of health and disease in a community will need to learn something of the basic concepts, core vocabulary, techniques and ethics of research, and capabilities and limitations of each of these disciplines. One of the strengths of anthropology has always been its methodological flexibility.

As medical anthropology has grown, its practitioners have found varied employment in public health, clinical, and university settings. This chapter will introduce the work that they have done and some of the paths to training for this work, including the relevant ethical standards for research and practice.

### The Nature of Collaboration

Seals are sea mammals that must come to the surface and breathe every fifteen or twenty minutes. In winter, when ice covers the sea, seals keep several funnel-shaped breathing holes open. The hunting dogs of the Inuit locate these breathing holes. The hunter must wait motionless for hours at the hole, harpoon ready to strike when a seal appears. (See Fig. 2.1.) If one hunter watches a single hole, his chances of harpooning a seal are slight, for the seal uses many different holes as he covers the area where he feeds. But if a group of hunters watches several nearby holes, their chances of catching a seal are greatly increased (Balikci 1970:55–57, 74–77). This kind of communication and cooperation is the adaptive skill that human beings have developed most fully.

Just as Inuit subsistence depends on collaboration between hunters, so do medical anthropology and medical ecology depend on collaboration among many disciplines. Though these researchers do not think of themselves as



FIGURE 2.1 An Inuit hunter waits at a seal-breathing hole. This illustration came from a very early anthropological study by Franz Boas (1888). The clothing was drawn from a museum exhibit and shows a European, rather than Inuit, face. Source: Franz Boas, *The Central Eskimo*, Sixth Annual Report of the Bureau of Ethnology (Washington, DC: Smithsonian Institution, 1888).

watchers at seal breathing-holes, they frequently use similar metaphors such as medical "detective work" and research "targets."

The medical anthropologist may become a jack-of-all-trades, collecting environmental, medical, and cultural data. In doing research in Papua New Guinea, coauthor Pat Townsend, trained as a cultural anthropologist, found that she needed to take on tasks as varied as compiling a dictionary for a previously

unwritten language, diagnosing and treating skin diseases, taking photographs, measuring rainfall, and collecting plants to be sent to the national herbarium for identification. In small, isolated communities like the one she studied, a larger team of researchers would have overwhelmed the community. In other field sites it has been possible for a multidisciplinary research team of specialists to work together to describe the health status of a population.

A large research team headed by the geneticist James Neel studied the Yanomamö in a series of research expeditions beginning in the 1960s. The Yanomamö are a population of about 10,000 Indians living in small villages in tropical forests along the Brazil-Venezuela border. The team included scientists trained in human biology, cultural anthropology, dentistry, serology, and linguistics. An ethnographic filmmaker accompanied the team. They collected data on microevolutionary and linguistic differences between villages, demography, reproduction, disease patterns and parasite burdens, and immunological characteristics (Neel 1970, 1977). They also vaccinated people when a measles epidemic broke out in the study region in 1968. The cultural anthropologist on the team, Napoleon Chagnon, who conducted long-term ethnographic research there, served as a translator and liaison between the villagers and the researchers (Chagnon 1997).

The Yanomamö were generally well nourished and in good health, suffering primarily from minor viral infections and chronic parasites. The major causes of death were violence, tribal war, bacterial dysentery, and diseases brought by contact with outsiders, especially malaria and tuberculosis. Ninety-four percent of the Yanomamö tested earlier had never been exposed to measles (Neel 1982). The virus responsible for measles is a recently evolved organism not native to the New World, and American Indians exposed to it have high mortality rates (Black et al. 1982). A measles epidemic among other Indians in Brazil had been devastating, with a 26.8 percent mortality rate.

There was controversy over the genetic susceptibility of New World populations to measles. Black believed that the high death rates from measles are due to genetic traits associated with low resistance to the virus (Black et al. 1982). Neel, on the other hand, hypothesized that high mortality was due not to genetic susceptibility but to the collapse of village organization and the lack of medical care, and lack of food and water when everyone is weak and feverish (Neel 1982). A later study of blood samples showed that Indians exposed to measles during the epidemic had developed normal antibody levels, suggesting that Neel's hypothesis was correct. It is through such interdisciplinary collaboration in fieldwork and testing of competing hypotheses that models have been developed of the ecology of human health.

### **Bio-Environmental Data**

**Ecology** is the field of study concerned with the interrelationships between populations and their environments that constitute ecosystems. Small ecosystems such as a pond or meadow are nesting within larger ecosystems such as a forest. All of these together form the earth's *biosphere* (Callenbach 1998). An ecosystem is necessarily linked to a particular geographical region: however, a more general concept, that of **biome**, recognizes the similarities in the biological communities that have evolved in different places around the world under similar conditions of climate and terrain. As a biome they are grouped together, for example, the *tropical moist broadleaf forest* biome, the *desert* biome, or the *coral reef* biome.

The popular image of picking up beer cans and planting flowers gets at only a tiny segment of what ecology is all about. Ecologists have developed sophisticated models for describing the flow of energy and materials in ecosystems. These models may be applied to systems involving humans.

The basic unit of study in ecology is a **population.** The Yanomamö, for example, are a population of humans. The stands of *ediweshi* palms from which they gather fruits are a plant population, and the wild pigs, deer, tapir, and armadillos they hunt are animal populations in that habitat. The term "population" has been defined in many ways for different purposes, but, most simply, a population is composed of all the organisms of a single species that inhabit a given area. A **species** is a biological classification of organisms with shared genetic characteristics, a common origin, and the ability to interbreed.

All human beings belong to a single species, and yet the total world population divides into many groups with different cultural, physiological, and genetic traits. Consider European missionaries, Brazilian gold miners, and the Yanomamö tribes in the same region. All are members of the same species, and yet it is not useful to consider them all a single population. Their environmental adaptations differ and their evolutionary history is separate. Therefore, we will define a **human population** as a group of individuals living in a given habitat with the same pattern of environmental adaptation.

Each population has an **ecological niche**, that is, a specialized role in the habitat. Populations of different species share the same habitat by using slightly different resources or by using the same resources at a different season or time of day. Niche differentiation allows the coexistence of two species populations that might otherwise be competitors. The concept of niche has been applied to human ecology in a way that is only partly consistent with its use in biology. If one human population farms while another group herds cattle in

the same habitat, the two populations are said to have two ecological niches, even though they are one biological species.

## Population Interactions and Energy Flow

There are several kinds of possible relationships between populations coexisting in a single habitat. One possibility is that the two populations may be in **competition** for some of the same resources, as are Inuit and polar bears. When populations use the same food resources in this way, their niches tend to diverge in other respects, reducing the competition between them.

Another type of coexistence is the **predator-prey** relationship in which one population serves as a food resource for the other. For example, humans and caribou coexist as predator and prey. It is in the interest of the predator not to deplete the population of prey. Instead, the two populations mutually regulate each other.

A more intimate form of coexistence is **symbiosis**, in which two dissimilar species live together. One type of symbiosis is **parasitism**, whereby individuals of a population feeding on another population live on or inside individuals of the second population, which are called **hosts**. Inuit often told humorous stories about being hosts to lice; for example, the one about Mrs. Louse who made fancy sealskin trousers for Mr. Louse to go from their home on the back of a person's head to the forehead for a big dance (Gubser 1965:254).

The louse-human relationship is a very simple and direct form of parasitism. Other parasites require one or more **vectors**, which are insect species that serve as hosts to a stage in the parasite's life cycle before transmitting the parasite to its human host. For example, the tsetse fly is a vector carrying the trypanosome, a protozoan that causes sleeping sickness in Africa; the tick is a vector for the spirochete, a spiral-shaped bacterium, that causes Lyme disease. (See Table 2.1 for a list of other pathogens.) Some of these organisms are also called **microbes**, a generic term that is mostly used to refer to disease-causing bacteria.

An animal population that is an intermediary for parasites that are transferred to humans is called a **reservoir**; for example, monkeys can be a reservoir for yellow fever. **Mutualism** is a kind of symbiosis between populations that benefits both populations involved. The relationship between Inuit and their dogs is of this sort. Normal intestinal bacteria also live symbiotically with humans and help them digest food and resist infection.

These relationships among populations can be viewed as flows of energy and mineral nutrients through a living system. All organisms require energy—that is, the capacity to do work—in order to carry out biological processes.

TABLE 2.1

Some Kinds of Organisms That Cause Infectious and Parasitic Diseases in Humans

**Prions:** pathogens smaller than viruses and consisting of protein only, without DNA or RNA (e.g., kuru)

**Viruses:** microorganisms that grow only within other cells and consist of RNA or DNA, but not both, within a protein shell (e.g., measles)

**Bacteria:** Single-celled organisms lacking a membrane-bounded nucleus. They are characterized by their shape, including rod-like, spherical, and spiral shapes (e.g., strep throat, salmonella, syphilis).

**Protozoa:** single-celled animals including flagellates (e.g., trypanosomes that cause Chagas' disease and sleeping sickness), amoebae, sporozoa (e.g., plasmodia that cause malaria), and ciliates

Fungi: simple, branching plants that reproduce through forming spores; diseases caused by fungi are called mycoses (e.g., tinea pedis—athlete's foot)

**Helminths:** worms, including tapeworms, flukes, and nematode roundworms that cause worm infestations in humans (e.g., trichinosis)

Ecosystems run on energy, which originates from sunlight. Energy is not destroyed; rather, it is transformed into other forms of energy by various levels of consumers. Much of it is dissipated into the larger environment as heat and wastes that are not used by other organisms.

A plant receives radiant energy from sunlight and converts it into chemical energy through photosynthesis. Plants are called *producers* in an ecosystem. This energy from organic material is then transferred to animals (called *primary consumers*) when they eat the plants and then later to animals (*secondary consumers*) who eat those animals. Thus energy is transferred along a food chain. At each successive level of the pyramid, only part of the productivity of the previous level can be harvested; therefore each successive level has a smaller number of animals and a smaller total biomass, that is, energy stored by growth and reproduction of the animals on that level.

Organisms at the top of the food chain are also especially vulnerable to concentrations of toxics such as mercury and pesticides that accumulate in the tissues of animals lower on the food chain. When a nursing infant consumes breast milk containing these toxic substances that accumulate in fatty breast tissue, the infant is at the very top of the food chain and may be exposed to dangerously high concentrations of these substances.

Food chains are also called *food webs* to emphasize the complexity of these feeding relationships. Fallen leaves, bird droppings, and human remains alike are consumed by insects and microbes. These *decomposers* are part of the food web, too, recycling nutrients within the ecosystem.

One of the food webs in which the Inuit participate is shown in Figure 2.2. In this marine food chain, the Inuit are *carnivores*, or meat eaters, eating

very high on the food chain. Inuit also participate in other food webs that are not shown in Figure 2.2. When Inuit eat berries, they are acting as primary consumers or *herbivores*, eaters of plants. When they eat caribou, which in turn eat plants such as lichens and grasses, Inuit are acting as secondary consumers. We will discuss the wide variation in human food-getting strategies in Chapter 5. Here it is appropriate to note that anthropologists studying hunter-gatherers make direct use of models such as optimal foraging theory derived from the study of predator-prey relationships in other species. Optimal foraging theory predicts that choices to use or avoid plant and animal resources are based on the energy return for time spent.

Humans vary in their role in food webs. Some, like the Inuit, are primarily carnivores, while other groups mostly consume plants. Most human populations exploit a wide range of food resources at all consumer levels, however. Unlike many animals that occupy a specialized ecological niche, humans tend to be generalized. This contributes to their success, but it also entails the risk of population growth that may deplete resources.

All life forms reproduce themselves, and under optimal conditions each organism can reproduce well beyond simply replacing itself. Ecologists define carrying capacity as the maximum size or biomass of a population that can be sustained by an environment over a given period without degrading environmental resources. Such a limit is commonly set by food supplies or space. Attempts have been made to calculate the carrying capacity of environments for human populations, but they are complicated by people's ability to change their subsistence technology and with it the potential carrying capacity. Even with a specified technology, there are uncertainties about what the limiting factors are. For the Yanomamö, for example, the limits to growth are surely not set by food energy; more bananas and plantains could easily be grown. Some anthropologists suggest that the limiting factor is the depletion of game animals, but others deny that game is lacking. When population growth presses toward carrying capacity in one area, fissioning of the group and migration to another area relieve the pressure. Many anthropologists use models drawn from the behavioral ecology of nonhuman species to explore such questions concerning human reproduction and population.

## Studying Environmental Factors in Health

The concepts just presented are central to the discipline of ecology, and they provide a theoretical framework for the study of health and disease. In addi-

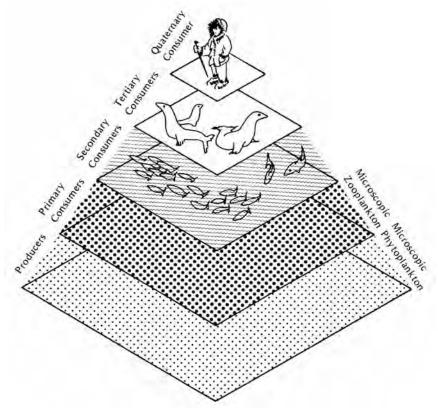


FIGURE 2.2 One of the food chains in which the Inuit participate is the marine food chain. Each successive consumer derives energy from organisms a step below in the food chain. The higher steps in the ecological pyramid have fewer individuals and less total biomass.

tion to this conceptual framework, however, the more specific techniques and findings of the environmental sciences are needed in medical ecology.

Environmental sciences such as geology, soil science, meteorology, and geography make their contribution to medical ecology by describing and analyzing the physical environment. Differences in underlying rock strata affect health by influencing the mineral content of drinking water, for example. Fluorine that is naturally present in excessive amounts mottles the teeth, but when it is present in insufficient amounts, tooth decay is more prevalent. A change in rainfall patterns, recorded by meteorologists, may be critical in understanding why an epidemic of pneumonic plague, which has very narrow temperature and humidity requirements, broke out in a particular time and place.

Biologists contribute specialized information about the habits of the plants and animals with which humans interact. These include the plants and animals used for food and other economic purposes, as well as pathogenic organisms and vectors of disease. Human biologists add specific understandings of human physiology and genetics. Biologists also have contributed to medical ecology on a higher level by formulating the theories and concepts of evolution and ecology.

The following health profile illustrates multidisciplinary collaboration in medical anthropology. Many different environmental factors were considered in attempting to understand the puzzling disease kuru, and the sophisticated laboratory methods of virology made a key contribution.

### ROFILE: CANNIBAL MOURNERS \_

Kuru began with tremors. Despite her trembling and jerky motions, in the early stages of kuru a South Fore woman in highland New Guinea could lean on her digging stick as she went about her work, weeding her sweet potato garden and caring for her children. In several months, her coordination was worse; she could not walk unless someone supported her. Her eyes were crossed and her speech was slurred. The symptoms indicated damage to the cerebellum, the region of the brain that coordinates movement. Within a year, she could no longer sit up and was left lying near the fireplace in her low grass-roofed house. Death was inevitable.

After her funeral was over, other women of the village prepared her body for cooking. The flesh, viscera, and brains were steamed with vegetables in bamboo tubes or in an earth oven with hot stones. Maternal relatives had a special right to their kinswoman's flesh, and specific kin had rights to certain body parts. A woman's brain was eaten by her son's wife or her brother's wife. South Fore warriors generally avoided eating human flesh, believing it made them vulnerable to the arrows of enemies. But, in any case, they avoided women's flesh because women were believed to be polluting to men. It was mostly women who were cannibals, and they shared the funeral meal with their children of both sexes (Glasse 1967; Lindenbaum 1979).

His wife dead of kuru, a Fore man would not find it easy to remarry, for men outnumbered women in the area, as a result of the higher death rate from kuru among women. He had lost his first wife to kuru, and a young son and daughter as well. Almost half the deaths in this village and nearby villages were due to the trembling disease. (See Fig. 2.3.)



FIGURE 2.3 A young Fore girl with advanced kuru. Photo by Dr. D. C. Gajdusek, Okapa, 1957 (used courtesy of Dr. Gajdusek).

*Kuru*, the Fore word meaning trembling or fear, is the name not only of the disease but also of the kind of sorcery that the Fore believe causes it. Divination rituals helped identify the suspected sorcerer, a jealous man in a nearby but distrusted group of Fore. The sorcerer was accused of stealing bits of the woman's old skirt, hair, food scraps, or feces. These personal leavings were wrapped up with magical charms and a spell was chanted:

I break the bones of your legs,
I break the bones of your feet,
I break the bones of your arms,
I break the bones of your hands,
And finally I make you die.

(Source: Lindenbaum [1971:281])

Buried in mud, the bundle rotted, and as it rotted, the disease progressed. The victim's kinsmen might kill the accused sorcerer, ritually marking his corpse so that all would recognize his guilt.

In the 1950s, Australian administration reached the Fore territory. The Fore were receptive to changes introduced by government officials, missionaries, and scientists. They abandoned cannibalism and warfare and began growing coffee for sale. When a medical officer, Vincent Zigas, encountered kuru in his patients, he consulted D. Carleton Gajdusek of the U.S. National Institutes of Health. What could be the cause of a lethal disease in this remote place? Gajdusek began an intensive program of research that engaged scientists of many disciplines in unraveling the etiology of kuru.

Zigas and Gajdusek did fieldwork from 1957 to 1959, bringing patients from Fore villages to the bush hospital to observe the clinical course of the disease and attempt treatment. They also worked at mapping the epidemiological patterns, of which the distribution of the disease by age and sex was especially perplexing. Of the 416 kuru deaths they recorded, 63 percent were adults and 37 percent were children and adolescents. Among the adults dying, women outnumbered men, about twenty-five to one. Among the children and adolescents, the sex ratio was more nearly equal (Alpers 1970).

Many hypotheses were explored as possible explanations of kuru. In the early 1960s, the most widely accepted explanation was that a lethal mutation had arisen in this population. Analysis of genealogies showed that kuru did tend to run in families, though there were some unexplained patterns. Most disturbing was the combination of high lethality and high incidence. Such a lethal gene could not maintain itself in the population unless it conferred some powerful, but unknown, advantage to carriers of the gene who did not themselves develop kuru. Those who questioned the genetic hypothesis explored other possibilities, such as nutritional deficiencies, toxic substances, and psychosomatic causes.

At its peak, between 1957 and 1968, over 1,100 deaths from kuru occurred in a South Fore population of 8,000 (Lindenbaum 1979:6). Even as the studies were continuing, the epidemiological patterns began to change: The incidence and mortality declined, first among the younger age groups and later in all age groups. (See Fig. 2.4.) It began to look as though kuru might eventually disappear, although no treatment had yet been found. Although the Fore lacked written history or a system of dating events, cultural anthropologists Robert Glasse and Shirley Lindenbaum were able to probe the memories of older informants during fieldwork in 1961–1962. They

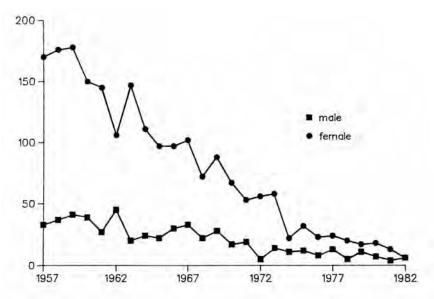


FIGURE 2.4 Number of kuru deaths by sex, Papua New Guinea, 1957–1978. Deaths continued to decline after 1982. In the period 1994–1998, only six men and twelve women died, all over the age of forty. Graph adapted from Huillard d'Aignaux et al. 2002. "The Incubation Period of Kuru." *Epidemiology* 13 (4): 402–408, Table 1.

found that both cannibalism and kuru were relatively new to the Fore. The custom of cannibalism had been adopted about 1910, and the first cases of kuru had occurred later. They suggested that kuru was transmitted by cannibalism. As cannibalism declined, the disease was not being transmitted to children who had never tasted human flesh.

Active epidemiological surveillance of the population continues. From July 1996 to June 2004, eleven persons with kuru were identified in South Fore, all of whom were born before cannibalism disappeared. The incubation period of kuru is long and variable (Collinge et al. 2006).

Laboratory research also contributed to unraveling the mystery. After an average incubation period of twenty months, laboratory chimpanzees inoculated with the brains of women who had died of kuru developed the disease. Although inoculating laboratory animals with infected brain tissue transmitted kuru reliably, simply feeding them infected brain tissue did not. This suggested that cannibalism was not a very efficient way to transmit the disease. It was known that the disease was transmissible by a substance assumed to be a virus, although its structure was not yet known when the 1976 Nobel

Prize in Physiology or Medicine was awarded to Gajdusek along with Baruch Blumberg for these discoveries about the transmission of infectious disease (Gajdusek 1990; Alpers 1992).

Research on kuru had taken scientists to the very borders of life and non-life, virus and protein, and infectious and genetic disease. The agent that caused kuru is a **prion**: smaller than a virus, it consists solely of a protein, without its own DNA or RNA (Prusiner 2004). Kuru is one of a small group of prion diseases that cause spongy deterioration of the brain, including Creutzfeldt-Jakob disease (CJD) in humans, scrapie in sheep, and wasting disease in deer. CJD was already known as a rare inherited disease that cropped up worldwide through sporadic isolated mutations of a single gene. It also had to be considered an infectious disease, for several children given a growth hormone that was accidentally contaminated with the CJD prion developed a disease that progressed very much like kuru.

Even as kuru virtually disappeared from the Fore population, a similar fatal prion disease emerged in England among young people (Lindenbaum 2001). The neurological disease, variant Creutzfeldt-Jakob disease, came from eating beef from cows infected with bovine spongiform encephalopathy (BSE), popularly called mad cow disease. The disease had spread in cattle through eating cattle feed that probably contained bone meal from sheep infected with scrapie. By the end of 2001, more than 100 people in Britain had died of the disease and additional cases had appeared in France. Some progress is being made toward developing tests and treatments for prion disease (Prusiner 2004).

In 2003, cows stricken with mad cow disease were found in Canada and the United States. The wide distribution of a rare disease entity is a warning that the globalization of food supplies has created very different conditions for the spread of food-borne disease than had been the case in the first highly localized outbreak of kuru in New Guinea a century ago.

#### Clinical Data

**Clinical medicine** is concerned with the diagnosis and treatment of disease in individual patients. Disease, defined biomedically, is a deviation from normal functioning, observable and measurable by biomedical techniques in the examining room and laboratory.

Diseases have a course of development. They may be **acute**, developing rapidly and of short duration, such as influenza. (Acute does not refer to

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severity, for both a mild common cold and severe pneumonia are acute diseases.) Or they may be **chronic**, persisting for a long time, such as tuberculosis or arthritis.

Clinical medicine is one of the basic sources of data about health and disease for the study of medical anthropology. The clinician's identifications and descriptions of the disease process are an essential starting point of our study. Since this is so fundamental and obvious, it is more to the point to note the *limitations* of clinical data. One such limitation is the clinician's preoccupation with pathology, with the abnormal. In medical anthropology, we are often frustrated to find that seemingly more is known about deficiency disease, for example, than about normal nutritional requirements or about gynecological disease than about normal pregnancy, menstruation, and menopause.

Another limitation of the clinical approach is that it is narrowly concerned with the individual patient's physiology. Thus we see neither the social context in which disease occurs nor how the individual or family members and community perceive and experience the illness. Kuru, from a biomedical perspective, is a disease process characterized by progressive degeneration of the central nervous system caused by a prion transmitted by cannibalism. However, the Fore concept of kuru refers to a kind of sorcery, which from the viewpoint of biomedical science is not part of the disease entity at all. Further, the Fore concept of kuru also includes some people who suddenly develop tremors from which they quickly recover. From a biomedical standpoint, these persons, lacking the characteristic central nervous system degeneration, exhibit still another disease entity, hysteria.

**Disease** may be defined narrowly, as a deviation from clinical norms, an organic pathology or abnormality. Or it may be defined more broadly, as impairment in the ability to rally from an environmental insult. Disease is seen from the perspective of the doctor, but illness is seen from the perspective of the patient, and sickness from the society as a whole. **Illness** is the sufferer's interpretation of his or her experience, using meanings and notions of causality provided by the culture to explain misfortune. **Sickness** is a social category—the sick role in a particular society, the way a person who is ill is expected to behave. A sickness occurs in a setting of time, place, and power relations between patients, healers, relatives, employers, and others in the society. This array of definitions opens up the possibility that an individual may have an illness without a corresponding disease, or a disease without an illness. For example, clinically a man may show high blood pressure; that is, he may have the disease hypertension, but if he is asymptomatic, he does not experience illness and may not be willing to take the prescribed medications, as required in the sick role.

Clinicians are involved in the *treatment* of patients. While researchers in medical anthropology also care about the people suffering from disease, their chief concern is not to treat but to gain a better understanding of health, which will ultimately feed back into *prevention* of disease as well as treatment. From this point of view, neither the failure to find a cure for kuru nor the small and declining numbers of kuru patients are relevant to judging the importance of that research.

Although it is possible to describe the work of a traditional healer without reference to its effectiveness in curing diseases, many medical anthropologists do try to diagnose the patient's problem in biomedical terms and to assess whether the patient was restored to normal functioning after treatment by the traditional healer. But this type of information is difficult to obtain, and it is not necessarily relevant as far as patients are concerned. If they feel well again, they are satisfied to be finished with the sick role.

When Spiritualist healers in temples in Mexican towns "cleanse" their patients, using light massage with aromatic substances, they symbolically and publicly terminate the sickness. Some patients may continue to experience symptoms of illness, while others regard themselves as successfully cured. In studying these Spiritualist healers, Kaja Finkler (1985) described the prescribed treatments, which included herbal teas, baths, and massages appropriate for the patient's symptoms. In order to assess the outcome of these treatments systematically, Finkler and her Mexican field assistants interviewed the patients at the temple where they received treatment and at home later. They learned that although the healers could not do much to relieve physiological symptoms beyond giving some relief for mild diarrhea and vaginal secretions, they were measurably successful in reducing many of the emotional symptoms of illness.

From Finkler's attempt to understand how well one ethnomedical system works to heal, it is a logical next step to look at Western biomedicine the same way. For those of us who were taught to value and trust science and doctors, biomedicine has considerable symbolic force beyond its logical successes. This explains why so many patients given placebos show improvement, even though a **placebo** has no active ingredient but is merely a sugar pill (or other substitute for medicine). In an irreverent look at coronary bypass surgery, medical anthropologist Daniel Moerman (1983) suggested that many of its benefits stem from the placebo effect. The reduction of symptoms of chest pain occurs after surgery even in many patients who have no measurable improvement in the blood supply to the heart. Further studies of

the placebo response indicate that it is highly variable between cultures and medical conditions. Germany has high rates of placebo healing of ulcers, for instance, while it has low rates for placebo effect in treating hypertension, compared to other countries (Moerman 2002).

## **Epidemiological Data**

**Epidemiology** is the study of the distribution of disease in populations and of the factors that explain disease and its distribution: the population rather than the individual is the unit of study. Epidemiology depends on input from the clinical sciences. Using birth certificates, death certificates, medical records, and surveys as sources of data, epidemiologists use statistical methods to identify subgroups that are at especially high or low risk of acquiring a particular disease. Epidemiologists observe how the frequency of occurrence of a disease is related to age, sex, ethnic group, occupation, marital status, social class, and other variables.

Health statistics can also be arranged to show the distribution of health and disease in space—by contrasting rates between countries, states, or cities—and in time—by comparing rates from day to day, month to month, or year to year. Long-term trends such as the trend toward taller, heavier, earlier-maturing children or the marked increase in mortality from lung cancer among males in the United States in the last fifty years are sometimes called *secular* trends.

If a disease affects a large number of people in a short period of time, the disease is an **epidemic** disease. In contrast, if the disease is present in the community at all times but in more moderate numbers, it is said to be **endemic.** Some types of disease are listed in Table 2.2, as they are categorized by biomedicine. These categories are constantly being rearranged or collapsed into one another as more is learned about the causes of disease.

A related term, **syndemic**, was proposed by Merrill Singer in 1996 and found quick acceptance within and outside of medical anthropology because it grasps so well the complex web of causation of many problems. Singer proposed the term to highlight the fact that violence, drug abuse, and HIV/AIDS (and prostitution, as well) "are not simply concurrent problems, but rather constitute a set of mutually reinforcing interconnected epidemics" occurring in the inner city (Romero-Daza, Weeks, and Singer 2003:235). Subsequent applications of the term include the historical example of the spread of the 1918 influenza pandemic among the Aboriginal communities of Manitoba, a

# TABLE 2.2 Types of Disease by Cause, as Classified in Western Medicine

**Genetic disease:** malfunction of an organ or system because of mutation or inheritance of a deleterious gene or an alteration in the number or arrangement of chromosomes

**Developmental or congenital disease**: malfunction of an organ or system resulting from an abnormal environment within the uterus during fetal development

**Metabolic disease:** disease due to faulty biochemical processes, including nutritional, endocrine, and poisoning

**Infection:** disease produced by viruses, bacteria and other parasites. (See Table 2.1.) Arbitrarily distinguished from **infestation** with parasitic insects

**Allergy:** abnormality of immune mechanisms that normally act to protect the body against foreign proteins; also include autoimmune diseases

Neoplasm: "new growth," including benign tumors and malignancies (cancers)

**Thrombosis:** a blood clot that forms in a blood vessel and blocks the flow of blood to an organ **Trauma:** injury produced by mechanical stress (e.g., a fracture), a physical agent (e.g., frostbite), or a chemical agent (e.g., burn from a strong acid)

Functional defect: disease for which there is no obvious anatomical explanation, including psychosomatic disease, in which emotional or social stress interacts with somatic functioning

**Psychiatric disease:** mental illnesses, including **psychosis**, a severe mental and emotional disorder, probably caused by a biochemical imbalance; **neurosis**, a moderate emotional disorder involving obsessive-compulsive behaviors, probably caused by learned behaviors in combination with biochemical factors; **addiction**, a dependence on substances, such as alcohol, or behaviors, such as gambling, that alter moods

syndemic in which the epidemic of flu was intertwined with an epidemic of tuberculosis and the decline of the northern fur trade (Herring and Sattenspiel 2007).

Another category of disease, crosscutting the categories listed in Table 2.2, is **iatrogenic** disease, that is, disease that is caused by medical treatment. Disease due to the serious side effects of either herbal or pharmaceutical drugs would fall in this category. One of the most devastating epidemics of iatrogenic disease is the heavy burden of liver disease in Egypt due to chronic infection with hepatitis C. Hepatitis was apparently spread there by carelessly using improperly sterilized needles for the injection of antimony compounds in a mass campaign to treat schistosomiasis, a parasitic disease, between 1960 and the early 1980s. In later years, oral drugs were used to treat the disease (Frank et al. 2000).

In describing the frequency of disease, epidemiologists use the terms prevalence and incidence. **Prevalence** is the proportion of individuals in a population who have a particular disease or condition at one time. For example, if a survey of a village in Egypt found that 46.9 percent of the people showed symptoms of schistosomiasis, the prevalence rate was 46.9 percent at

the time of the survey. It is estimated that in 2000 the prevalence of obesity among U.S. adults was 19.8 percent, an increase of 61 percent since 1991 (Mokdad et al. 2001). The state with the highest prevalence of obesity was Mississippi, at 24.3 percent, and the lowest prevalence was Colorado, at 13.8 percent. Obesity is defined, using weight and height, as a body mass index (BMI) of  $30 \text{ kg/m}^2$  or more.

**Incidence** is the rate at which new cases of a disease or other health-related events occur in a population over a given period of time. For instance, the suicide rate for American white males ages 20–24 was 21.3 per 100,000 population in 2005. In the same year the suicide rate for white males 80–84 years was 44.4 per 100,000, and for men aged 85 and over it was 48.5 per 100,000 (CDC 2008).

Rates of incidence of a disease are commonly used to assess risk factors. For example, in a study of 1,175 men in Tecumseh, Michigan, there was an incidence of fifty-nine cases of obstructive airways disease in the fifteen years they were followed. From this study it was determined that the risk of developing this lung disease was nearly three times as high among men smoking one pack of cigarettes a day as in comparable nonsmoking men (Higgins et al. 1982). Prevalence and incidence need not only refer to diseases but can also refer to other events and behaviors related to health, such as the *incidence* of abortions among women aged 25–29 or the *prevalence* of tobacco chewing among baseball players.

Disease statistics may be expressed in terms of **morbidity**, the number of cases of disease per unit of population occurring over a unit of time, or **mortality**, the number of deaths per unit of population in a unit of time. Epidemiologists have mostly worked in large populations with modern health care systems. In principle, however, the statistical methods of epidemiology are applicable to the smaller populations usually studied by anthropologists.

Epidemiologists go beyond describing the distribution of disease to analyze the **etiology**, or the determinants, of disease. Interviews conducted by an anthropologist or sociologist may complement data collected by other members of an epidemiological research team. Jeanne Guillemin, having previously done participant observation research in an intensive care ward for newborns in a Boston hospital (Guillemin and Holmstrum 1986), had an extraordinary opportunity to work on a multidisciplinary research team in 1992 and 1993 in Russia. The team consisted of a biologist (Guillemin's husband, Matthew Meselson, an expert on biological weapons), a pathologist, a veterinarian, and researchers specializing in vaccines and infectious disease. They were taking advantage of an opportunity created by the end of the

Cold War to investigate a 1979 anthrax outbreak in Yekaterinburg, an industrial city of some 1.2 million inhabitants. At the time of the outbreak, Soviet officials attributed it to tainted meat and destroyed much of the evidence. The pathologist on the American team argued from some autopsy material that had been preserved that the anthrax was the inhalation type, not the intestinal form. The interviews that Guillemin conducted with surviving family members concerning the daytime locations and the onset of symptoms in the sixty-four victims provided the critical data. With these data they could map and precisely time the accidental release of a cloud of anthrax spores from the ventilation system of a factory manufacturing biological weapons, even though Russian officials were still unwilling to confirm that such an event had occurred (Guillemin 1999).

Etiology involves not only well-defined primary causes, such as a parasite or a toxic substance or a deficiency of some nutrient, but the whole chain of factors that contribute to the disease process. When epidemiologists are employed by state or county departments of public health, much of their epidemiological detective work is concerned with investigating outbreaks of food poisoning and acute communicable diseases. In these diseases, the causal chain is simple. However, most diseases have a much more complex etiology.

Asthma is a respiratory disease with a complex mosaic of causes in the social, biological, and physical environment that interact with factors within the individual that increase or modify his or her susceptibility. The prevalence of asthma has increased dramatically worldwide in the past generation. Because it has increased most rapidly in wealthy, developed countries, improved health care and hygiene may even have contributed, perhaps by delaying the age at which children are exposed to infectious diseases, affecting the way their immune systems develop. Other factors include genetics, the mother's smoking during pregnancy, and exposure to allergens. While the mosaic of longer-range causes is poorly understood, the environmental triggers for attacks of wheezing and gasping for air are easier to identify. These triggers include upper respiratory infections; molds, cockroaches, and rodents in poor housing; outdoor air pollution from trucks and autos; and indoor air pollution from smoking and gas stoves.

Hypertension, or high blood pressure, is another disease with complex causes. At least one out of five American adults has high blood pressure, making it a major health problem, particularly among African Americans. It similarly affects other industrialized populations throughout the world. It is a quiet disease, present for many years without symptoms, before visibly and irreversibly damaging the arteries leading to the heart, kidneys, eyes, and brain.

Damage to the arteries feeding the brain can cause a stroke. The complex causation of hypertension includes a genetic predisposition and social stress. Diet is also relevant. It is not simply a high intake of salt, but a low intake of calcium, magnesium, and potassium that is associated with high blood pressure (Frisancho et al. 1984). Medical anthropologists have been involved in studying all of these parts of the epidemiology of hypertension.

Anthropologists working in epidemiology have made an especially important contribution by examining critically the cultural assumptions underlying epidemiology's measurements and design of studies and interventions. Indeed, epidemiology itself is a form of cultural practice, as a medical anthropologist with joint training in epidemiology has emphasized (Trostle 2005). Particularly as epidemiologists tackle questions of health disparities, such as those which exist between black and white Americans, it becomes important to refine and elaborate the ways in which "race" and "ethnicity" are operationalized in epidemiology. This is an area in which anthropologists have made active contributions. They have worked to tease apart the factors of popular or folk racial categories, ethnic group membership, and genetic variation that contribute to the risk of disease (Dressler, Oths, and Gravelee 2005).

#### Social and Cultural Data

Medical anthropology is both a fieldwork discipline and a comparative discipline. Fieldwork in many cultures builds a basis for comparative studies. The comparison may be built into the design of a single study, as when Panter-Brick compared rural and urban children in Nepal. More often, the systematic comparisons draw on fieldwork conducted by different investigators working in several different societies. Anthropological fieldwork usually means traveling to the study region and living there for an extended period, often six months to two years at a stretch. If possible, anthropologists try to live in the village or neighborhood they wish to study, perhaps even with a local household. Simply by staying throughout the year, a fieldworker can notice seasonal changes, such as variation in infants' nutrition as their mothers' agricultural workload varies, that a quick survey might miss. Fieldworkers who return to the research site at intervals over the years accumulate longitudinal data on personal and social change. (See Fig. 2.5.)

Because of the long stay, the researcher can form friendships with local people, learn the language, and get a total picture of how the physical and social environment affects health. Chances are good that the anthropologist will learn about health and ecology through firsthand experiences with stinging



FIGURE 2.5 Anthropological fieldwork depends on building rapport with informants over months and even years. In this photo from Papua New Guinea, Pat Townsend shares memories of fieldwork with Siruway, with whom she has been friends since they were both in their early twenties. Photo by William H. Townsend.

insects, parasites, native herbs prescribed to cure diarrhea, moldy shoes, frozen camera shutters, or other inevitable inconveniences. The fieldworker's own efforts to adapt to the situation become part of the data, which is why this kind of work is called **participant observation.** 

The method of participant observation has become the hallmark of cultural anthropology in much the way that the use of documents typifies the historian; the use of maps, the geographer; and the use of survey interviews, the sociologist. Although the fieldwork techniques of anthropology were developed in exotic settings, they have been applied in settings closer to home such as urban neighborhoods, school classrooms, and operating rooms. The intensive, face-to-face methods of anthropology produce different insights than do large-scale surveys. For example, cultural anthropologist Robert B. Edgerton and his co-workers studied a sample of adults with developmental disabilities for more than three decades. At the time, the term "mentally retarded" was commonly used. The study began with a sample, or cohort, of 110 persons who had been residents of Pacific State Hospital for the mentally retarded in southern California. The largest percentage of them had IQs in the mildly retarded range (55–69). Between 1949 and 1958, they were released from the hospital, under a program of vocational rehabilitation, to live and work in the community.

When Edgerton and his assistants contacted the patients in 1960–1961, they had been out of the hospital for an average of six years. It was possible to locate and study 48 of the original 110 (Edgerton 1967). In the 1972–1973 follow-up, 30 of these people were studied again, some twenty years after they had left the hospital (Edgerton and Bercovici 1976). By 1992, the researchers were only in touch with 15 of the patients, but the life history materials available by then were richly detailed (Edgerton 1993; Edgerton and Gaston 1991; Whittemore 1986). These materials help us to understand the impact of a stigmatizing diagnosis and the ability of individuals to cope with disability.

Edgerton's study, reported in his book *Cloak of Competence*, has been help-ful to those planning rehabilitation programs and delivering social services. The anthropological approach it used lets the participants speak for themselves and looks at their everyday lives in the context of home, workplace, and community. Other, non-anthropological studies of persons with developmental disabilities have been less holistic, and they have more often listened to social workers, teachers, employers, or parents rather than to the persons themselves.

When studying the residents of a retirement home in France, anthropologist Jennie Keith used written questionnaires late in her study. She found at the earlier stages of research that participant observation was a much more useful technique because these older people felt threatened by "papers." After rapport had been built up, participant observation was the best way to deal with sensitive topics such as sex and death. Direct questions on these topics would have been badly received, but when the subjects came up naturally in conversation, people were more than willing to talk (Keith 1986).

People may also say one thing and do another. Ethnographers studying registered medical practitioners in private clinics in south India found that all forty practitioners stated in interviews that needles and syringes should be placed in boiling water to be safe. All forty were able to name at least two diseases that could be spread by contaminated equipment, such as TB, AIDS, abscesses, and STDs. Yet the researchers observed only one injection in 200 that could be assumed to be sterile. The other 199 injections used syringes that had not been sterilized, disposable needles that were reused three to five times, or multidose bottles of medicine that might have been contaminated by these syringes (Lakshman and Nichter 2000).

The trained observer is the key factor in field research, though still and movie photographs, videotape, and tape recordings may supplement note-taking as a way to record data. Later, the films may be given frame-by-frame analysis. Fieldwork may have a very general goal to produce an **ethnography**,

which is a detailed, systematic account of a whole culture. It may also have one or more specific goals to collect information of specific kinds or to test a hypothesis.

When the Kenyan-born medical anthropologist Simeon Chilungu did his doctoral research in an American city on the shore of Lake Erie, he began with observing in the Lackawanna Community Health Center. He talked with patients, attended medical team meetings, and observed weight-control meetings at the health center and social activities in the wider community. Chilungu decided to compare the health problems of African Americans whose families had come to Lackawanna, New York, from the southern states since the 1930s to work in the steel mills with the Arab immigrants from Yemen who had arrived in the 1960s. (See Fig. 2.6.) The qualitative data collected earlier in the study helped him to design a questionnaire about local perceptions of health problems, administer it to fifty-four African American and thirty Yemeni residents, and interpret the results (Chilungu 1974).

The method of participant observation may entail becoming involved in the lives of the persons studied for several months, or even intermittently over many years. In such studies the investigator is usually an outsider, crossing a cultural or social boundary to do fieldwork. A few anthropologists have found themselves deeply engaged as insiders whose participation in the phenomena they studied was complete. After finishing studies of the Huichol Indians of Mexico, Barbara Myerhoff did anthropological research among elderly Jews in the oceanside community of Venice, California. In her film and book *Number Our Days* (1978), she said that she found it more satisfying to study these feisty senior citizens than to study Mexican Indians because she could never be a Mexican Indian, but someday she would be a little old Jewish lady. This was not to be, as she died at forty-seven of lung cancer.

Many anthropologists have found that reflecting on their own experience of illness provides a motivation or entry point for research related to that condition. While studying the environmental politics of sewage treatment and the religious significance of pollution and purity in the sacred river of India, the Gangâ (Ganges), Kelly Alley contracted viral hepatitis. When she discussed her illness with others in India, she found that they interpreted it very differently than she did. They were inclined to blame her lack of immunity and to place more emphasis on ritual devotion and less on expectations from government agencies than she did (Alley 2002).

Emily Martin had already done several projects in medical ethnography, including highly regarded studies of reproduction (1987) and of the immune system (1994), when she experienced a psychotic break with reality that was



FIGURE 2.6 Professor Simeon Chilungu and Jenna Alderwish, a college student and research assistant from the Yemenite community of Lackawanna, New York, discuss her family's migration from the Middle Eastern country of Yemen. Photo by Ann McElroy, printed with the permission of Simeon W. Chilungu and Jenna Alderwish.

diagnosed as manic-depressive illness. A few years after this diagnosis, she began attending meetings of support groups for manic depression, now known as bipolar disorder. She found that she was well accepted in the groups as a person wearing two hats, that of a writer-researcher and that of a patient diagnosed for a mood disorder and taking medication under a psychiatrist's care. The stigma attached to mental illness made it particularly challenging to do research, for in revealing this diagnosis a person is made highly vulnerable, personally and professionally. Her writing about our ambivalent cultural attitudes toward "madness" and "craziness" is enriched by her probing of her own experiences as well as those of others (Martin 2007).

Most of Juliene Lipson's research career as a medical anthropologist in the School of Nursing at the University of California in San Francisco has concentrated on Afghan refugees living in Northern California and, more generally, on cultural factors related to health care for refugees and immigrants (2005). When she developed multiple chemical sensitivities (MCS, also called environmental illness) that significantly disrupted her life, she began ethnographic research on MCS. Persons with MCS must learn to avoid exposure to substances that trigger symptoms, most often cleaning products, perfumes, pesticides, to-bacco smoke, and car exhaust. As she began interviewing, she found that their

shared experiences helped her to gain trust and rapport, to know what research questions were relevant, and to get more in-depth data. This kind of research is called auto-ethnography, insider research, or, Lipson's own preferred term, "peer research" (Lipson 2001, 2004).

At the opposite extreme on the participant-observer continuum, some fieldworkers are not able to participate in the activities they study. The illegal "shooting galleries" where intravenous drug users purchase and inject drugs are one such fieldwork setting. An anthropologist who observed several galleries in New York City found that the "works" (syringe and needle) or the "cooker," in which heroin is heated and dissolved, were often shared by "running partners" or "shooting buddies" (Des Jarlais, Friedman, and Strug 1986). This symbol of friendship increased the risk of transmission of the HIV/AIDS virus. The researchers gained an understanding of the social networks of drug users through observation, without the possibility of participating fully.

The Economic, Political, Geographical, and Historical Context

A medical anthropologist need not apologize for spending an entire year or more studying a single hospital ward or the practice of a few traditional healers, a single village, or an urban neighborhood. What is needed is to provide ways to connect the special insights derived from this intensive but highly localized face-to-face study with the larger entity it represents. Is this an impoverished or well-off community relative to the region or nation? Are the people served part of an ethnic minority? How does the health facility fit into the larger scheme of things, including the policy environment?

An anthropologist doing fieldwork in a small-scale society such as the Fore in Papua New Guinea or the Yanomamö in Venezuela will collect information on economic exchange and political leadership in this society as part of a general study of the culture. In a society without a written language, there are likely to be few written records of history, but an anthropologist might look into the historical archives that do exist: perhaps the reports written by explorers or government officers who visited the area or early missionary accounts. In her study of kuru, Shirley Lindenbaum (1979) referred to the unpublished patrol reports of the first Australian officer who visited the Fore and described a kuru victim in 1953, a decade before her own fieldwork.

Before Janice Harper entered the village of Ranotsara for fourteen months of fieldwork, she had spent time in language learning and doing archival work in Paris and Antananarivo, the capital of Madagascar. Her analysis of

ethnicity and health uses materials from published sources on the history of the area, as well as unpublished reports and documents concerning the Ranomafana National Park project, which has a great deal of influence on the villagers' lives (Harper 2002).

In using archival materials, an anthropologist is using the methods more typical of a historian and may need to learn some new research skills to use these materials critically. But this does not turn the anthropologist into an economist, a political scientist, or a historian. More often, to get a wider context for a localized study, the researcher relies on the work of other social scientists. To do this, anthropologists must be able to evaluate work from these other disciplines critically, understanding the strengths and limitations of data collected by large-scale surveys or a national census, for example, or from written records alone.

The newest set of methods to emerge as part of the medical anthropologist's toolkit is *geographical information systems* (GIS). GIS uses computers to store spatial (geographical) data in digital form and to analyze and map relationships among data sets. Anthropologists have always used and made maps of some kind, but as yet few of them have made use of GIS. Those who have done so have attained striking results.

A primatologist used GIS to study the parasites of primate populations living in the wild. His research team entered all the known data about protozoa, helminths, and viruses in primates, along with information about the geographic locations where sampling had been done. Statistical analysis showed that the diversity of parasite species was significantly related not only to sampling effort (that is, how much field research had been done) but also to latitude. The closer to the equator, the more species of protozoan parasites infested the primates, especially protozoan parasites transmitted by arthropod vectors (Nunn et al. 2005). The results of this type of work are important for predicting how climate change will affect the distribution of disease.

Much of biocultural anthropologist Fatima L. C. Jackson's research career had led her into examining the relationships among human genetics, the chemistry of food plants, and malaria in Africa. More recently, her use of GIS has allowed her to develop an alternative to the traditional, and misleading, model of crude racial categories that has dominated studies in biomedicine, epidemiology, and public health. What is referred to as "race" in such studies is mostly a socially constructed set of categories with some attention to physical features. Jackson's alternative is *ethnogenetic layering* (EL), a fine-grained analysis that uses GIS to integrate many layers of genetic, historical, environmental, occupational, and epidemiological data. This study of local patterns

of biodiversity allows Jackson to draw geographically defined categories, microethnic groups (MEGs). This system of classification has been particularly useful in identifying groups at risk for health disparities, for example, a form of aggressive breast cancer among African American women in the Chesapeake Bay region (Jackson 2008).

#### Labeling Disease

Interviews may seek to gain information organized in categories that the observer brings to the research setting from outside. Alternatively, the researcher may try to find out how the participants in that culture categorize their experience, by means of the ethnoscientific, or ethnosemantic, techniques discussed in Chapter 1. *Ethnosemantic* studies attempt to elicit the native, or insider's, categories and distinctions. The insider's categories are referred to as *emic*, in contrast to *etic* categories. The terms "emic" and "etic" come from the linguistic terms "phonemic" and "phonetic" (Headland 1990). A classic ethnosemantic study in medical anthropology is the study of some twenty terms that the Subanun of the Philippines use to classify different kinds of skin disease (Frake 1961). Studies of this kind are intended not primarily to provide a practical basis for local medical care, though they certainly do that, but to reveal the underlying basis of language and cognition.

Beginning with an ethnosemantic approach similar to Frake's, Brent Berlin and Elois Ann Berlin conducted long-term research among the highland Maya of Chiapas in southern Mexico. Their research was a collaborative project involving scholars from the United States and Mexico specializing in ethnobotany, medical anthropology, linguistics, botany, and pharmacology and a team of Tzeltal- and Tzotzil-speaking field investigators. The largest set of health conditions recognized by the highland Maya are the gastrointestinal diseases, among which they differentiate detailed signs and symptoms for many different types of diarrhea, pain, and worms. For treating these conditions, they most often use medicinal plants and less often purchase over-the-counter pharmaceuticals or bicarbonate of soda. At least thirty-eight species of plants from eighteen botanical families are used in treating these gastrointestinal conditions (Berlin and Berlin 1996).

A full understanding of medical beliefs and practices encompasses both their position in the local cultural system (emics) and their significance in relation to scientific categories (etics) that have validity outside a single cultural system. Anthropologists differ in what they regard as the primary means for determining etic categories. Some emphasize that etic categories are universal cultural categories derived from cross-cultural comparison. Others consider etic categories to be derived from underlying biological, chemical, and physical data. In neither case does the scientist merely want to impose his or her ethnocentric Western categories on another culture.

An illustration of the difference between emic and etic categories is the study of herbal medicines of a town in Oaxaca, Mexico. The twenty herbs used as hot herbal baths and teas for treating women after childbirth form an emic grouping by function. Emically, most of them are locally regarded as "irritating," and most are considered to be "hot" in the emic humoral classification system. When the same plants are evaluated biochemically, they turn out to contain various antiseptic chemicals such as tannins, limonene, methyl salicylate, and catalpol. This latter categorization of herbs by their chemical analysis is an etic classification (Ortiz de Montellano and Browner 1985).

The system by which people classify diseases is influenced by their observation and understanding of disease processes. The classification used can sometimes limit or obscure further understanding. This is as true of scientific systems of classification as it is of folk systems. Changes in disease terms over the last few centuries both reflect and generate new understanding. For example, who suffers any longer from dropsy or phthisis? Both were once common terms, but "dropsy" obscured the differences between different types of fluid accumulation, and "phthisis" similarly went out of fashion as a term for tuberculosis. More recently, the terminology for diabetes was revised to reflect that age of onset is not what reliably distinguishes type 1, or insulin dependent, diabetes (once called "juvenile") from type 2 (once called "adult-onset") diabetes.

Alzheimer's disease (AD) is another example of the way in which a disease is socially and culturally constructed. Alzheimer's is in the ongoing process of being construed as a biological, clinical entity. Research "advances" increasingly specify microscopically observable plaques in the brain and implicate particular genetic links on several chromosomes that seem promising as explanations of this degenerative disease. This corresponds to the development of pharmaceutical interventions. Yet medical anthropologists caution that there is a problem here, that mild cognitive impairment is an aspect of normal aging and not necessarily the first stage of a single, identifiable disease (Gaines and Whitehouse 2006).

Epidemiological research is also influenced by the disease-labeling process, since the kinds of categories entered into medical records or death certificates shape the statistics that epidemiologists work with. Epidemiologists worry whether an apparent rise in prevalence of a disease is simply a result of a change in classifying, diagnosing, or reporting. Because the early HIV/AIDS cases in

U.S. cities were almost exclusively reported in the male homosexual population, the syndrome was labeled as a sexually transmitted disease. This labeling by scientists and the mass media delayed the recognition of the importance of transmission by other means, such as directly into the bloodstream by intravenous drug users.

If labeling HIV/AIDS in English created problems, the subsequent translation of the term for the disease into other languages created extraordinary difficulty. In Nepal, for example, health workers were accustomed to using English for medical terms or translating into complex, highly literate Nepali equivalents. They balked at using a common folksy Nepali term to translate "syndrome." Translating it so informally made it feel less alien and "too emotionally compelling" (Pigg 2001).

Social scientists have been especially concerned with the ways in which diagnostic labeling influences the person who is labeled. Once labeled as diseased, the person may take on a sick role with great relief at the opportunity to rest from normal responsibilities. Or the labeled individual may be stigmatized, as when a successfully treated cancer patient has difficulty finding a job. Once labeled, all of a person's behavior may be interpreted in relation to the label.

Labeling is an especially touchy issue when the condition is one that is not simply present or absent in an individual, but continuously distributed along a scale. Blood pressure and intelligence test scores are distributed in this way in a population. How high does blood pressure have to be in order to be labeled hypertension? How much below the average score of 100 does IQ have to be in order to be labeled as disabled? The cutoff point is arbitrary, chosen because it has proved useful as a screening device. The outcome for the individual labeled, in terms of stigma or in terms of obtaining help, may be significant.

# Becoming a Medical Anthropologist

Because medical anthropology is a young discipline, with few courses or text-books available before the 1970s, many anthropologists gained degrees in anthropology first and developed a specialization in medical anthropology later, when a research project or teaching assignment led them to follow their interests in that direction. That is true of the authors of this textbook, who began with their primary training as cultural anthropologists, with a strong second interest in biological anthropology. In recent years we have found many of our students have traveled the opposite path, getting their first

training and employment in nursing, nutrition, or another clinical specialty, and then becoming interested in the cross-cultural aspects of practice.

In any case, the best prospects for employment as a medical anthropologist now require dual degrees, frequently a doctor of philosophy degree (Ph.D.) in anthropology and a master's degree in public health or epidemiology. There are even a few superstars in the field who are both medical doctors (M.D.s) and Ph.D.s, but that is not easily attained! This does not mean that even a course or two in anthropology along the way cannot be immediately put to good use in whatever field a person finds employment, though it most likely will not carry the job title "Medical Anthropologist."

Perhaps the most productive way to learn how to do medical anthropology is to read the reports of research that you find most interesting and useful, and then ask yourself, "How did they learn *that?*" Usually we find such work involves long-term immersion in a culture and a combination of qualitative and quantitative methods. Traditionally, anthropologists were "lone rangers," going off to work alone in isolated field sites in a foreign country and culture without much practical preparation. Now they are more likely to need the skills for working on a team and the training that can be acquired under supervision, either on campus or in a field school like the one described in the profile below.

# ROFILE: LEARNING FIELD METHODS IN COSTA RICA

Nancy Romero-Daza and David A. Himmelgreen

A priority of applied medical anthropologists is the training of future generations of social scientists for health-related research and intervention. Each summer since 2001, University of South Florida (USF) anthropologists Nancy Romero-Daza and David Himmelgreen, along with colleagues, have implemented the Globalization and Community Health Field School (GCHFS) to offer training in applied community health research. The GCHFS is offered in Costa Rica or Puerto Rico to graduate students and a few advanced undergraduates.

A theme of the field school is the understanding of how globalization permeates every aspect of our lives, from economic activities, to physical and mental health, to our relationship with the environment and with our peers. This helps students to study problems associated with globalization critically and to investigate possible solutions. Globalization is a multidimensional phenomenon that increases connections among people across the globe. Advances in transportation and communication technologies, increased flow of goods, services, and capital, and widening social networks increase the sharing of cultural ideas and information. While globalization offers increased economic opportunities, it frequently brings negative health and social effects.

The GCHFS in Monteverde, Costa Rica, is a collaborative effort between the Department of Anthropology at USF and the Monteverde Institute (MVI), a not-for-profit research, education, and community development organization. The Monteverde zone is located in north-central Costa Rica, along the Continental Divide, and enjoys a cool climate. The region includes the Monteverde Cloud Forest Preserve, one of the world's most threatened ecosystems. While *Ticos* (native Costa Ricans) have inhabited the area for many decades, the region was formally settled by North American Quakers in 1951. Today there are three densely populated communities and twenty-four outlying towns, ranging in size from 100 to over 3,000 people. During the last twenty years there has been a shift from dairy farming and coffee production to an economy based on tourism.

The GCHFS starts with an introduction to the Costa Rican health care system of socialized medicine. While in the capital city of San José, students interact with representatives from the Ministry of Health, community-based organizations, and health care centers, and with professors and students from the University of Costa Rica. They visit a national-level hospital, and thereafter, they visit district hospitals and local clinics before moving to the mountainous region of Monteverde.

Once in Monteverde, the students begin to immerse themselves in Costa Rican culture. They take Spanish classes, attend cultural events, and visit a *sobandera* who uses massage to treat gastrointestinal problems. By this point, at least one student is suffering from digestive problems and is willing to be treated by the healer. The students also attend an ethnobotany lecture and learn to identify local medicinal plants. The most important component of cultural immersion involves home-stays, where the students practice Spanish and participate in family activities—everything from attending social events and helping with meal preparation and farm chores to playing with the children. While most of the students are anxious during the first few days, they soon come to see home-stays as one of the highlights of the course and often form lasting friendships with the families.

Students learn qualitative methods such as unobtrusive observation, participant observation, key informant interviews, and focus groups. They also learn quantitative methodologies such as anthropometry, dietary assessments, and surveys. Additionally, they learn how to enter, manage, and analyze data using computer software and how to combine qualitative and quantitative methods. Working in small teams, students conduct research in collaboration with local residents acting as "community advisors" during the design and implementation of the projects. In addition to enhancing the cultural appropriateness of the research, this contributes to the development of research skills among local community members (e.g., identification of research questions, development of instruments), thus increasing their employability in future projects. For instance, a community advisor, Humberto Brenes-Cambronero, was hired as a research assistant in one of Himmelgreen's projects and became a coauthor in a scientific article (Himmelgreen et al. 2006).

The research topics that students address during the course have been identified and prioritized by local members of the community through public forums. Over the past six years, Himmelgreen, Romero-Daza, and their students have focused their work on two of these areas: nutrition and food habits, and HIV/AIDS.

#### **Nutrition and Food Habits**

Tourism has had a great impact on food consumption patterns and on the nutritional health of Latin Americans, leading local communities to decrease local food production and to rely on externally produced foods. Particularly significant is the increasing consumption of snacks and sodas that are high in fat and/or sugar and are often labeled as being "empty calorie" foods. The term "Coca-colonization" describes the commercialization of food systems in developing countries through marketing and the resulting changes in food consumption patterns (Leatherman and Goodman 2005).

Costa Rica has invested heavily in universal health care and in programs to improve sanitation, ensure safe water supplies, and educate people on health promotion and disease prevention. Infant and child mortality and communicable disease have declined, and life expectancy has increased on par with industrialized countries. Yet in recent years there has also been an increase in lifestyle-related chronic diseases associated with changes in diet and physical activity. A comparison of cardiovascular disease risk among rural and urban Costa Ricans (Kabagambe et al. 2002) found that low socioeconomic status and low intake of unsaturated fatty acids were risk factors for

rural adults. On the other hand, low physical activity, adipose tissue, and high transfatty acids in the diet were risk factors for urban dwellers. Among adolescents, high saturated fat intake was identified as a risk factor for coronary heart disease (Monge and Beita 2000). In addition, children (7–12 years) from thirty-four schools in and around San José exhibited a high prevalence of overweight (nearly 35 percent) and obesity (over 25 percent) (Núñez-Rivas et al. 2003). These studies suggest that Costa Rica has shifted from communicable disease to noncommunicable and diet-related diseases.

Himmelgreen and Romero-Daza have examined the food and nutrition situation of the Monteverde zone in the context of the changing economy. Although the shift from agriculture to ecotourism has had positive effects (e.g., improved infrastructure and more employment), there are also negative consequences such as road congestion, air and water pollution, and a rise in the cost of living. Their studies found that food insecurity (limited or uncertain access to enough food of adequate quality) is prevalent among a significant proportion of rural households (Himmelgreen et al. 2006). The high prices, set for rich tourists, make it difficult for local residents to buy fruit and vegetables. This leads to overconsumption of lower-price carbohydrate and sugar-laden foods. In addition, for many individuals, unemployment during the low tourist season makes it more difficult to procure a balanced diet for their families. Less reliance on agriculture also leads to less participation in food cooperatives that in the past provided a safety net for their members.

In collaboration with local advisors and community members, field school students and professors have identified areas for future research and intervention. For example, how does involvement in the tourism industry affect the nutritional health of individuals and households? What are the best strategies to combine food security interventions with nutrition education? Himmelgreen and Romero-Daza are initiating a multiyear community-based project, funded by the National Science Foundation, to compare the nutritional health of two communities with different degrees of involvement in the tourism industry. The project will identify strategies to maximize the ability of rural households to achieve food security throughout the year. This will help reduce overweight and obesity and the risk for cardiovascular disease, diabetes, and other chronic problems.

#### **HIV/AIDS**

The population movement accompanying globalization contributes to the spread of infectious diseases, especially to those transmitted sexually (Abdul-

lah et al. 2004; Romero-Daza and Himmelgreen 1998). For example, sex tourism (travel to specific sites with the intent to engage in sexual relations with locals) has facilitated the spread of HIV throughout the world.

While sex tourism is flourishing in Costa Rica, it is not a significant problem in Monteverde. Rather, the main tourist industry centers on ecotourism, which draws visitors from around the world to the protected forests rich in fauna and flora. The region also attracts long-term visitors such as language students, researchers, and volunteers, who potentially play an important role in the spread of sexually transmitted infections (STIs) in the Monteverde area.

Given the paucity of research on STIs and on HIV in Monteverde, the studies conducted through the field school have been exploratory in nature. Nevertheless, they have been useful to develop educational interventions and to collect data on the perceptions of local residents (youth, parents, teachers, health providers, and those in the tourism industry, among others) regarding STIs (including HIV/AIDS) as a community problem and specifically the role that tourism plays in the spread of STIs (Romero-Daza and Freidus 2008).

The research conducted by students has led to larger projects. For example, in 2004, Romero-Daza guided four students in a project with women in developing culturally appropriate AIDS prevention materials. Following the women's recommendations, Romero-Daza replicated the project with forty women from four towns with funding from the USF Globalization Research Center. The project included Oriana Ramirez-Rubio, one of the students who had participated in the field school.

Based on the principles of Participatory Action Research (PAR), which emphasizes the involvement of community members in all steps of research from conceptualization of ideas to data collection, analysis, and presentation, the project consisted of a series of three to five workshops in each town. During the first session, the researchers assessed HIV knowledge through individual surveys and group activities, and provided education as needed. The second session involved individual and group assessment of existing HIV/AIDS materials such as posters and pamphlets. During the final sessions, the women in each town developed their own awareness materials. (See Fig. 2.7.) Local artists reproduced the original designs and distributed the materials throughout the four communities. The official closing of the project was marked with a daylong community celebration in which all of the participating women, the local artists, and guests from the governmental and health sectors came together for the presentation of final materials.

In the first town, the participants created a twelve-page wall calendar using culturally relevant and even historical events to convey HIV messages



FIGURE 2.7 Costa Rican women designing keychains for HIV/AIDS awareness. Photo by Nancy Romero-Daza.

appropriate for adults and children of all ages. Participants in the second town created several designs for key chains intended for adult men and women. The women argued that using such utilitarian objects would not only remind people of the risk of HIV, but would also serve as a conversation opener among adults. In the third town, the women created notebooks/address books intended specifically for young women and teenage girls. The booklets contained an HIV-awareness message on each page and were produced using banana paper, one of the most commonly used craft materials in the region. In the fourth town the women created posters in both English and Spanish targeting young female tourists, whom they consider especially vulnerable to STIs through their sexual involvement with local men.

Romero-Daza and her colleagues plan to expand this project to other demographic groups and to different areas of Costa Rica. Although the rates of HIV infection at the national level are relatively low in comparison to other Latin American countries, this is likely to change in the near future due to rapid social and economic changes. Therefore, the provision of educational and preventive efforts is crucial to avert the effects of a full-fledged epidemic.

#### Fieldwork Ethics

Field-workers studying either HIV/AIDS or drug use face especially challenging ethical problems, but sensitivity to ethical issues is required of any fieldworker, even a student doing a class project. Protecting one's informants from possible harm is of the highest importance. Often this means giving them pseudonyms or disguising their identity to protect confidentiality, perhaps even concealing the name and exact location of the community.

A journalist traveling among the Yanomamö of Venezuela ignited one of the most inflamed discussions of fieldwork ethics that anthropologists have ever experienced. Patrick Tierney, in the draft of his book *Darkness in El Dorado* (Tierney 2000), accused a multidisciplinary team of researchers of causing a deadly epidemic of measles. Tierney's most extreme suggestions of wrongdoing by the researchers were quickly disproved and withdrawn even before the book went to press: the team had not started an epidemic but instead had made a valiant effort to stop one by immunizing and treating as many people as possible. (See Fig. 2.8.)

Other ethical issues raised about the fieldwork were not so easily dismissed, requiring rethinking of research practices throughout the discipline.



FIGURE 2.8 Napoleon Chagnon treating a sick Yanomamö man for malaria. The man recovered. Photo courtesy of Napoleon A. Chagnon.

One of these questions was whether the Yanomamö had given informed consent for Neel and Chagnon's research. For participation in a study to be truly voluntary, the people studied also need to have the research, including its purpose, risks, and benefits, explained to them in terms they can understand. This ethical requirement is called **informed consent.** The Yanomamö did not have formal education, so it would have been difficult to explain fully to them all the purposes and procedures of the research under the best of circumstances. The guidelines for informed consent that had evolved by 2000 were different from expectations when the original research was done in the 1960s. Problems may arise when old data are reanalyzed in ways that were not anticipated when the field study was originally done.

In the wake of the Yanomamö controversy, one of the most positive developments was the increased attention that it drew to the health status of indigenous people. It raised the question of how to design research and set research priorities to be more directly beneficial to the health of the indigenous, non-Western people themselves rather than to the countries from which the researchers originate. In the research on infectious disease among South American indigenous groups, for example, reviewers found that the health of highland peoples was relatively neglected compared to reasonably equitable coverage of lowland peoples. They also found that the planning of research and intervention failed to take into account the extraordinarily high prevalence of certain diseases in the indigenous populations, particularly intestinal parasites, hepatitis, and human T-cell lymphotropic viral infection (HTLV) (Hurtado et al. 2005).

Among the Yanomamö research team, and to this day, there are legitimate differences between disciplines in their understanding of what constitutes informed consent. One of the challenges specific to medical anthropology, as an interdisciplinary field, is that several different ethical codes may apply to the members of a team in any given field setting. A person who is both a nurse and an anthropologist is subject to the ethical codes of more than one profession, for example.

The American Anthropological Association (AAA) has a code of ethics (AAA n.d.). Because it comes from a profession in which most members are employed by academic institutions, its emphasis is slightly different from the statement of Ethical and Professional Responsibilities of the Society for Applied Anthropology (SfAA n.d.), where the employers and sponsors of research are a more diverse set of stakeholders (SfAA n.d).

Anthropologists are not licensed for practice by the state, as are health professionals, so the kinds of sanctions available for enforcing an ethical code

are consequently limited; anthropological codes tend to be more educational in purpose rather than regulatory. Generally speaking, when speaking of harm to participants, the ethical codes in biomedicine are mostly concerned with harm caused by data collection, while anthropologists have had to be more concerned about harm in the way that data are used and misused (Aagaard-Hansen and Johansen 2008).

Just as the Yanomamö controversy led to heated discussions of research ethics in anthropology, the research ethics of other disciplines were frequently forged under the heat of scandal. Biomedical research ethics were especially shaped by two terrible episodes: the revelations of the Nuremberg trials after World War II about the activities of Nazi doctors, and the Tuskegee Syphilis Study (1932–1972), in which treatment with penicillin was withheld from black subjects after it was invented in 1947 (Aagaard-Hansen and Johansen 2008).

Protecting the subjects of the study may lead to genuine ethical dilemmas for the fieldworker. Sometimes these ethical conflicts arise from conflict between different stakeholders in the research. On other occasions, the dilemma is one in which different positive ethical principles themselves come into conflict, so that adhering to one may violate another. One of the best ways for students to deepen their understanding of ethics is through discussing case studies of such ethical dilemmas (Whiteford and Trotter 2008).

When Kaja Finkler (1985) was studying Mexican Spiritualist healers, a mother brought a dying newborn infant to the temple for healing. This was unusual; the temple healers mostly treated chronic and emotional illnesses with some success, but they rarely dealt with such a serious, acute illness. Finkler was caught between respecting the mother's decision to bring the child to the temple and wanting to rush the child to a hospital for biomedical treatment.

Finkler confronted another dilemma when her informants insisted that she enter training as an apprentice healer. This involved going into trance during religious ceremonies. Despite her skeptical stance and initial reluctance to participate this deeply, she agreed to do so. She found that she was able to enjoy the relaxation produced by trance, although she never quite achieved the true trance state. The head of the temple told her the reason was that "You think too much." Indeed, Finkler suggests, her role as observer could never really be forgotten.

The extent of participation by the researcher in the culture she is studying is one question, but another whole issue with ethical implications is the extent to which the subjects being studied are full participants in the research rather than mere objects of study. In some cases local people may be well organized to participate in research, as for example when Native American

environmental groups insisted that the assessment of health risks from exposure to toxic chemicals must take into account the contamination of traditional foods and medicinal plants (Tarbell and Arquette 2000). In doing so, they participated in shaping the research and the very definition of what is good or poor health. In other field situations, such as the work with Nepali street children, the investigator may work hard to foster children's participation in decisions about how to study their health, and yet worry, in the end, that full participation may be impossible to achieve (Baker, Panter-Brick, and Todd 1996).

#### Medical Anthropology at Work

Medical anthropologists are accustomed to working on interdisciplinary teams, or at least to using information that comes from several disciplines, to contribute to a holistic understanding of health problems. In the following sections we will see how they have put this understanding to work, applying it in international public health programs and in clinics closer to home.

The Medical Anthropologist in International Development Work

Medical anthropology became established as an applied discipline by 1950 when the optimistic and well-intentioned efforts of public health professionals to introduce health-promoting changes in international settings were met with local indifference or opposition. In such cases, anthropologists were able to troubleshoot, locating some of the barriers to change. In the classic casebook *Health*, *Culture*, *and Community* (1955), Ben Paul assembled a series of case studies of applied research.

In one case, the anthropologist Edward Wellin explored the reasons for the limited success of a Peruvian health department program in persuading families to boil drinking water to kill germs causing diarrhea. Lack of time and firewood made it difficult even for those who might want to boil water to do so. Even the few who did boil water did not do so to eliminate germs. Rather, in boiling water they were conforming to the culture's hot/cold humoral classification. This belief system dictated that only sick people drank boiled water, whereas healthy people drank unboiled water (Wellin 1955).

In another case Richard Adams (1955) was the troubleshooting anthropologist on the staff of an agency that was conducting nutritional research in Guatemala. The project had run into serious trouble: parents had threatened to

kick the health team out of one village. Adams discovered four factors working together to create opposition. By befriending people from the progressive *barrio*, or neighborhood, the health workers had alienated the others. The second factor was that the villagers feared that the health workers supported pro-Communist forces in Guatemala and that the health project was part of a plot to take over their land. The third factor was the belief that taking blood weakened a person. The anthropologist urged the team to take fewer samples, changing laboratory procedures to avoid inefficiency and spoilage. The most unexpected factor was discovering, and addressing, the rumor that the children were being fed to fatten them up for shipment to the United States.

The role of the applied anthropologist in these and other public health projects was similar: Anthropologists brought in their regional experience to evaluate a program and suggest midcourse corrections to improve its functioning. Such evaluations fall into a familiar pattern. First, the anthropologist identifies a social barrier that prevents the health workers from communicating. Second, the anthropologist points out cultural beliefs that present a barrier that has to be subverted for change to occur. Third, the anthropologist shows that the change that seems so simple to the outsider is actually costly to the villager.

A recent example of this classic pattern of applied medical anthropology in international public health is Jeannine Coreil and Linda Whiteford's work on the household ecology of dengue fever in the Dominican Republic. They found that health educators had been successful in teaching the transmission of dengue by mosquitoes and the need to cover water containers. Women did cover the small containers of drinking water in the house. They considered that to be part of their responsibility for family health, but health was outside the men's sphere of responsibility. When the men filled the large containers that were kept outside the house with brackish water for washing, they only covered them haphazardly, leaving them open as mosquito breeding places. Whiteford went on to suggest the larger political context that made it difficult for the community to change (Whiteford 1997).

Anthropologists today are not only called in for midterm evaluations like these. Their role has expanded so that they may be involved at many stages of a project or program, from needs assessment and baseline studies prior to initiation, through project planning, to final evaluation after the project ends (Van Willigen, Rylko-Bauer, and McElroy 1989; Ervin 2005).

Anthropologists' involvement in international public health research has encouraged them to reexamine, make more explicit, and diversify their traditional fieldwork methods. Long-term field research remained the ideal, but researchers

familiar with an area could adapt anthropological methodologies to make more rapid assessments. Ethnographic techniques draw local people into research as the local experts on social and economic factors important to planning and evaluating programs at the local level. These community-based assessment techniques include rapid assessment procedures (RAP), rapid rural appraisal (RRA), and participatory rural appraisal (PRA) (Scrimshaw 1992; Messer 1999).

Rapid methods were especially important when medical anthropologist Barry Hewlett participated in a team from the World Health Organization that worked to control an outbreak of Ebola in Uganda in 2000 (Hewlett and Hewlett 2008). Medical anthropologists were already involved in health education and HIV/AIDS control projects throughout Africa, but this was the first time that an anthropologist had been invited to engage in containing a rapidly killing epidemic of an emerging disease. Hewlett found that his anthropological contribution helped to gain significant information about the spread of Ebola, beliefs and behaviors affecting its control, and relationships between the medical team and the community.

From a rich array of methods, fieldworkers can choose the ones that are most effective for studying a specific problem, as is illustrated by recent research on acute respiratory illness. There had not been much research on the social and cultural aspects of acute respiratory illness (ARI) before the 1990s, despite the fact that pneumonia is the main cause of death in poorer countries. In a project intended to test a wide array of methods for studying respiratory illness, Mark Nichter and Mimi Nichter undertook research in a village of Oriental Mindoro in the Philippines (Nichter 1993; Nichter and Nichter 1994). They began with open-ended interviews with local doctors, nurses, herbalists, pharmacists, midwives, community health workers, and grade school teachers. They gathered data on over-the-counter purchases of medicines, home medicines, and folk medicines.

Mothers and grandmothers caring for small children were the sample for the main study, in which both open-ended and structured interviews were carried out, the research at household level that anthropologists do especially well. (See Fig. 2.9.) The researchers also observed cases of respiratory illness in clinics. Focus groups met to discuss videos of sick children and illness stories based on real life, and participants were asked what advice they would offer the mother about the illness.

The diversity of methods was important because the researchers were interested in *embodied* knowledge, the things mothers note when a sick child is present (or is shown on video), as well as in their *cognitive* knowledge, their mental and linguistic categories for respiratory symptoms and illnesses. The



FIGURE 2.9 Recalling the last time her baby was sick with ARI, a mother points to her chest to illustrate the difference between a breathing sound emanating from the throat and one from the chest. Photo by MIMI NICHTER.

research learned that the villagers prefer to use biomedical treatments rather than folk treatments even though their ethnomedical beliefs are very different. The parents' concepts of causation associate respiratory illness with sweat drying on the back and changes in weather that shock the body rather than bacteria and viruses. Unless they had a child who had pneumonia recently, they also had rather poor ability to recognize some serious symptoms of pneumonia such as rapid breathing and an indrawn chest. This presented a clear agenda for health educators.

## The Medical Anthropologist in Public Health

While medical anthropologists remain at work in multilateral and bilateral international aid agencies such as the World Health Organization, which sponsored the research on pneumonia in the Philippines, it is anthropologists' work in their home societies that has expanded the most. American anthropologists have worked at the Centers for Disease Control and Prevention (CDC) in Atlanta, for example, in research on how to reduce the risk of HIV/AIDS

in hard-to-reach groups (O'Reilly 1991) and how to understand the large and growing gap in infant mortality between blacks and whites (Hahn 1995).

By 2007, there were forty-five to fifty-five anthropologists employed at the CDC, according to anthropologist-epidemiologist Jim Carey, who has worked there for more than fifteen years and now most often coordinates large multisite research projects. The largest number of anthropologists work in the Division of HIV/AIDS Prevention, as does Carey, but the rest are scattered through other research divisions such as Reproductive Health, Tuberculosis Elimination, Health Communications, Health Interview Statistics, Parasitic Diseases, and so on (Fiske 2007). Some work in administration. Similar work is done by anthropologists in departments of health at state and local levels in epidemiology, health education, and health care delivery. Others work for nonprofit organizations and private contractors that work in partnership with the CDC or state and local health departments.

As early as 1940, two physicians studying cultural psychiatry looked at barriers to medical care for Navajo Indians. Dorothea Leighton and Alexander Leighton found that medical doctors on the reservation were ignorant of native customs and antagonistic to native healers. When asked by the Bureau of Indian Affairs how to improve health services, the Leightons made recommendations leading to positive changes such as allowing medicine men to visit hospital patients and to perform rituals in hogans on hospital grounds (Leighton and Leighton 1944; Leighton n.d.). These are very early examples of what has come to be a major role for medical anthropologists in the evaluation of health services.

### The Medical Anthropologist in the Clinic

The clinical anthropologist may participate directly on a team engaged in diagnosis and treatment. One such team member is Richard Ward, a physical anthropologist who carefully measures a disfigured child's face before surgery at the Riley Hospital for Children in Indianapolis. In this role, the anthropologist is part of a team with the plastic surgeon, neurologist, orthodontist, pediatric nurse, genetic counselor, social worker, and other specialists (Ward and Sadove 1989; Bowers-Bienkowski 2002). The most common facial defects requiring such surgery are cleft lip and cleft palate, but more challenging to treat are congenital defects involving the whole face. In such cases the medical anthropologist does the anthropometric measurements but also provides a unique perspective, asking, What is the normal range of variation?

What is considered attractive in this ethnic group? This population perspective helps to balance the clinician's focus on the individual patient.

A related point about the clinician's individualism is made by a nurse-anthropologist, Eileen Jackson (1993). Jackson describes a persistent pattern in nursing research that "whites out" ethnic diversity. In interdisciplinary research on arthritis in elderly African American women in rural Missouri, Jackson insists that the social context be broadened to include not just the elderly patient but the grandchildren that she cares for. The social context includes not just the health care provider but also the system of health care payment and the economic impact of businesses moving out of the area.

Nurse-anthropologists bring the anthropological perspective to bear on a clinical problem much as the physical anthropologist on a craniofacial surgery team does, but because of their dual training, they approach a patient in their primary professional identity as a nurse. Nurses, like physicians, social workers, and clinical psychologists, are licensed and certified while anthropologists are not. Whether anthropologists have dual training in a clinical specialty or not, they need to keep clear their distinctive role as an anthropologist when collaborating with health practitioners (Chrisman and Johnson 1990).

Often the anthropologist's contribution that is most appreciated by other members of the clinical team is the knowledge of some belief or practice of the ethnic group to which a patient belongs that is relevant to the condition being treated. For this reason, anthropology has a long association with psychiatry. The anthropologist may be able to assure the clinician that beliefs in spirits or the evil eye are (or are not!) part of the patient's culture rather than evidence of psychiatric problems. Medical anthropologists also warn their clinical colleagues that overgeneralizing about an ethnic group is dangerous and that they should expect considerable variability within an apparently similar group of immigrants. With that warning made, they nonetheless have produced several helpful guides about what to anticipate when working with clients of particular immigrant backgrounds. Two of these up-to-date edited volumes are Cross-Cultural Caring: A Handbook for Health Professionals, which describes immigrants to Canada from seven major regions, and Culture and Clinical Care, in which the main contributors are members of thirty-five major ethnic groups, discussing cultural aspects of care for immigrants coming to the United States from countries ranging from Afghanistan to the former Yugoslavia (Waxler-Morrison et al. 2005; Lipson and Dibble 2005).

A more subtle role of anthropology is to point out when patients' use of biomedical terms such as "hypertension" may be quite misleading because their

understanding of these conditions is different from that of the clinician. The term "high blood" as used traditionally by African Americans may mean having too much blood, blood that is too high in the body, or blood that is too thick or too sweet. Traditional treatments are bitter herbal yellow root teas, Epsom salts, vinegar, and lemon juice. Prayer and faith healing often accompany folk medicines and prescription medicines (Snow 1993).

Some of the African American women attending a New Orleans clinic for treatment of hypertension used two terms, "high-pertension" and "high blood," which they considered to refer to two quite different conditions (Heurtin-Roberts and Reisin 1990). Women who said that they were suffering from "high blood" were more likely to take their blood pressure medication regularly. "High blood" was thought to be a blood disease caused by heredity or diet. Therefore the women considered that medication was likely to be useful. Other women, who considered themselves to be suffering from "high-pertension," were much less likely to take their medication regularly, even though they agreed that "high-pertension" was a more serious disease. They had apparently concluded that pills were unlikely to be of help for the "high-pertension" that results from stress and emotions.

Anthropologists doing research in clinical settings do not always focus their attention on patients or on patient-practitioner interactions. Sometimes the ethnographer's gaze is directed at the practitioners themselves, such as studies of the practice of surgeons, internists, and other specialists (Cassell 1991; Hahn 1985; Katz 1999).

Long-term participant observation in a clinical setting can also produce insights into medical practice. Lorna Rhodes (1993) spent two years studying a small psychiatric emergency unit in an inner-city hospital, observing actions and gestures, conversations and interviews. Dealing with sometimes violently psychotic patients, sometimes the demented or homeless elderly, the staff moved between at least three approaches in deciding what to do with patients: (1) *confinement*, excluding "the mad" from society, (2) the *medical model*, providing medications and psychotherapy, and (3) the modern *systems approach*, looking at social context.

By collecting life histories from distinguished physicians in their eighties, Sharon Kaufman (1993) developed rich materials on the history of American medicine. The physicians' careers spanned the change from the 1920s, when doctors relied on physical diagnosis with touch, stethoscope, and flashlight, to the present reliance on extensive laboratory tests. They began to practice when there were no antibiotics and very few effective treatments of any kind

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other than supportive nursing care. They continued their practice into a time of unbounded optimism in the 1940s and 1950s when antibiotics and new technologies promised a great deal. They grew old in an era of deep concern about economic, ethical, and moral issues in medicine.

#### CONCLUSIONS

Traditionally, anthropologists have worked outside their home cultures. In fact, it can be argued that special insights come from crossing a cultural boundary; an outsider may fail to understand much that insiders know, but he or she may also see things they are too close to notice. This is why some of the keenest observers of U.S. culture have been anthropologists from overseas. The techniques anthropologists have developed for listening to and learning from other peoples are also useful for the health professional who needs to learn from the culturally diverse population that he or she serves.

In this chapter we have contrasted the research orientations of several disciplines. Few readers of this text will master the methodological intricacies of more than one of these disciplines. Yet at the core of each discipline is at least one principle of method that can be applied to good effect by any health professional, any student tackling one of the term projects suggested at the back of this book, or anyone concerned with understanding a health problem. What are some of these principles? From the clinical sciences, to be precise in observing symptoms and cautious in interpreting them, a caution that comes from experience in making life-and-death decisions. From epidemiology, to respect the judicious use of statistics. From the environmental sciences, to be curious about the wider context of health, a counterweight to medicine's preoccupation with internal events. From anthropology and the other social sciences, to *listen*. The specific methods of the social sciences are mostly ways to make that listening more effective.

Sensitivity to cultural differences within our own pluralistic culture is important, but in a shrinking world, responsible citizenship demands some understanding of worldwide health problems as well. In the following chapters, you will explore the problems of population growth, world food supply, and the public health implications of economic development and industrialization. Rather than promote the helpless hand-wringing that accompanies most discussions of world problems, we want to set you to work at building a cultural and ecological framework for understanding these problems that can provide a basis for informed action.

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Human Organization and Practicing Anthropology are the journals of the Society for Applied Anthropology.

#### Films and Videos

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- Anthropology: Real People, Real Careers. 2006. 42 minutes. DVD. Available from American Anthropological Association, Washington, DC.
- Simple Courage: An Historical Portrait for the Age of AIDS. 1992. 58 minutes. Video. Produced by Stephanie J. Castillo and Hawaii Public Television. Distributed by Filmakers Library, New York.
- Unnatural Causes: Is Inequality Making Us Sick? 2008. 4-hour series, 7 episodes. Produced by California Newsreel with Vital Pictures.

# Chapter Three

# GENES, CULTURE, AND ADAPTATION



Peruvian Culina man making a net for river fishing.

6

PHOTO BY PATRICIA K. TOWNSEND.

#### **PREVIEW**

Human adaptation encompasses a range of mechanisms, responses, and traits that enhance survival in the face of environmental pressures. Humans have adapted over millions of years to climatic extremes, disease-causing organisms, food shortages, and natural or human-created disasters through genetic evolution, physiological adjustments, and cultural change.

Genetic change occurs at the population level through natural selection, migration, mutation, and other processes. Disease is a major factor in natural selection. The first profile illustrates how genetic change in hemoglobin is linked to increased incidence of malaria after the development of agriculture in West Africa. Genetic changes that promote survival in one environment may prove maladaptive in other environments. Darwinian medicine applies evolutionary theory to clinical problems such as diabetes, obesity, asthma, and degenerative diseases whose origins may be linked to survival patterns of Paleolithic peoples.

Human plasticity is a second category of adaptation involving physiological responses and developmental changes within an individual's life span. Some responses are very rapid, and others are gradual adjustments in childhood. High-altitude regions are rigorous environments that are especially suitable for the study of physiological and developmental adaptations. Not only do the people of the Andes and Himalaya face low oxygen pressure, but also cold, poverty, and soils depleted of important micronutrients. The second profile on goiter and iodine deficiency demonstrates comparative research methods in the study of human adaptation in high-altitude regions.

Medical systems have evolved through trial and error, and their diversity reflects interactions of cultural and environmental factors. Problem-solving and exchange of cultural information, including cumulative knowledge about healing and disease prevention, are a third form of adaptation at the population level as well at the level of families and individuals coping with illness and disability.

#### **Human Variability and Adaptation**

In the relatively brief span of one to two million years, humans have evolved rapidly. With increasing brain size, complex social systems and technology,

and behavioral flexibility, the human species dispersed from the savannas of Africa to diverse regions. Survival in habitats that sustain life precariously, with extremes of heat, cold, or altitude, is evidence of adaptability. This chapter deals with mechanisms that promote resilience in the face of environmental threats and challenges.

We define adaptation as *change and variation in a population developing over time in response to the challenges of a given environment.* Some anthropologists use the term **adaptations** to refer to evolved traits such as color vision, opposable thumbs, bipedalism, and large brains. Sociobiologists also refer to adaptations as physical and behavioral characteristics that enhance the ability to pass on one's genes or the genes of one's kin to the next generation. We prefer to emphasize that adaptation involves not only genetic and behavioral *traits*, but also *processes* related to survival and accommodation to challenges and threats in given environments. Some processes involve long-term genetic change in a population; others are immunological and developmental responses in an individual; and yet others are cultural responses in problem solving and coping with illness and disability.

Adaptation occurs primarily through change, but maintenance of stability across generations is equally important. Human biologists have discovered that *non-change* is also essential as population systems come into equilibrium and maintain plateaus for periods. Nevertheless, our concern here is mostly with the factors that drive change, the "prime movers" of human evolution, and the mechanisms through which change occurs.

Human variability molded by environmental stress is the foundation of adaptation. Differences in the body size and shape of the men shown in Figure 3.1 are largely hereditary but are also influenced by their physical development during childhood and their diets. The relatively short limbs and compact, bulky torso of the arctic hunter on the left may help conserve body heat in a climate of extreme cold, while the relatively long limbs and linear physique of the East African herder on the right may help him dissipate body heat in a hot, arid region.

Even more important than body shape, which changes little after maturity, is the capacity to make short-term physiological adjustments to variations in temperature. As the dry heat of the grasslands increases during the day, the African maintains a fairly constant temperature through sweating. The Inuk is also capable of throwing off excess body heat through sweating when the microclimate inside his fur parka becomes too warm. When exposed to cold air, both arctic and grasslands dwellers respond through constriction of peripheral blood vessels in the limbs, preventing loss of heat from

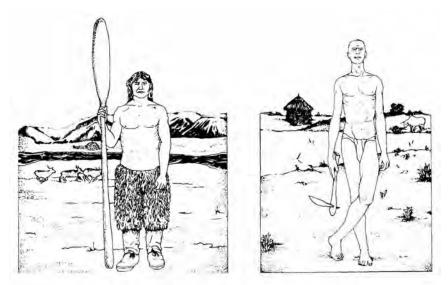


FIGURE 3.1 Differences in body size and shape reflect genetic adaptations to climate. The African's long limbs may help dissipate heat, while the arctic hunter's bulky body conserves heat. The dwellings constructed by these men illustrate cultural adaptation to climate.

the body core. However, the blood vessels of the Inuk's hands and feet quickly dilate again, allowing rewarming and protection against cold injury. The African's fingers and toes usually do not rewarm quickly, making him more susceptible to injury if exposed to severe cold (Steegmann 1975).

Housing also provides protection against the environment. The Inuk's snowhouse insulates against wind and heat loss, and the mud-and-thatch house of the African herder insulates against heat. Its thick mud walls absorb solar radiation during the day and radiate it during the cool night, leveling the temperature variation.

Body type, sweating and vasodilation, and housing are all buffers, shielding and protecting the person from climatic stress. They are different strategies, yet each contributes to survival. Body shape is highly influenced by heredity interacting with diet, metabolism, and activity patterns. Sweating and cooling are automatic physiological processes. Use of tools and raw materials to build houses is based on an ability to communicate, to plan, and to work together—all cultural traits. Individual differences in motivation, persistence, tolerance of stress, and creativity form the basis for behavioral variability and innovation in solving problems.

Not all habitats are as harsh as the Arctic or the African grasslands, but periodic fluctuations in temperature, precipitation, and food resources make

demands on all humans. In addition to ordinary fluctuations, long-term or permanent changes occur, including natural and human-made disasters such as earthquakes, famine, climate change, and war. These challenges evoke a variety of responses, some automatically programmed through genetic inheritance, and others the product of learning, innovation, and conscious choice.

#### Adaptation Through Biological Evolution

The Origin of Species by Natural Selection (1993, 1859). Although the specifics of genetics were unknown in Darwin's time, his argument rested on three premises: there is variation in every population; variation is inherited differentially in reproduction; and organisms may reproduce more offspring than can survive. From these facts, Darwin formulated an idea linking variability with differential reproductive success. Organisms with traits that are better adapted to specific local environments may pass these favorable traits to offspring. This basic idea, that reproductive success leads to the evolution of traits adapted to specific environments, describes **natural selection.** Although evolutionary theory has greatly changed since Darwin's day, his core argument about natural selection remains central.

Evidence of evolutionary change can be found in the fossil record and in historical sources, as well as in the fact that populations in various geographic regions vary in body shape, skin color, blood types, resistance to certain diseases, and other characteristics. Populations differ geographically and physically over time in part because of **biological evolution**, defined as change over time in the genetic characteristics of a population.

It is the population that evolves, not the individual, through changes in genetic characteristics over time that are derived from biochemical instructions for production of proteins in body cells. *Proteins*, large molecules made up of polypeptide chains of amino acids, are found throughout the body as enzymes, hormones, collagen, hemoglobin, and other elements. Proteins carry out many life processes of the body: metabolism, defense, repair. These instructions or codes are contained within the twenty-three pairs of chromosomes found in the nucleus of each primary cell of the human body.

Chromosomes contain molecules of DNA (deoxyribonucleic acid), long chains of alternating sugar and phosphate groups joined by base pairs. The structure of DNA is shown in Figure 3.2. Bases always bond in pairs (adenine with thymine, and cytosine with guanine), and the sequence of base pairs provides the chemical instructions for synthesis of proteins. The bases

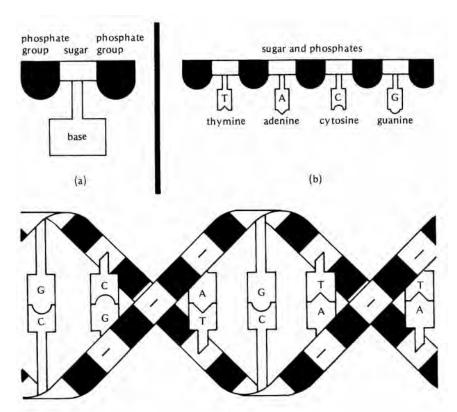


FIGURE 3.2 Each unit of DNA contains three parts shown in (a) a base, bonded to a sugar, bonded to a phosphate, making the chain shown in (b). DNA has four types of bases, which always bond in pairs: thymine (T) with adenine (A) and cytosin (C) with guanine (G), shown in (c). It is the bonding of the bases that holds the DNA double helix (c) together.

are copied into RNA (ribonucleic acid) in ribosomes in the cell nucleus, which translate the DNA codes into production of proteins.

A **gene** is a sequence of DNA bases that codes for a complete chain of amino acids. Each gene corresponds to a certain *locus*, or position, on a chromosome. Since chromosomes function in pairs, the genes are also paired. One gene is inherited from the individual's biological father, and the other from the biological mother. The two genes may be almost identical, or they may be slightly different, expressing two variants, or **alleles**, of the gene.

There may be more than two alleles for a trait. For example, there are three alleles for the ABO blood type. These variant forms are called **polymorphisms**. Each individual, however, will have no more than two of these

alleles. Many genes have no variants. Only about one-third of all chromosomal loci are variable.

An individual's genetic characteristics is called a **genotype**. For example, if a person inherits allele M from his or her father and allele N from the mother, the genotype is MN. Having different alleles at a locus is called a *heterozygous* condition. The person who inherits M from both parents is described as *homozygous* for that trait, with a genotype of MM. The genotype expresses the actual genetic makeup of an individual, while the **phenotype** is the expressed or visible trait.

Alleles may be dominant or recessive in heterozygotes, affecting the phenotypic expression, or they may be co-dominant (both alleles affect the phenotype, as in type AB blood). If M is dominant over N, the phenotype would be M. The heterozygote with MN and the homozygote with MM would have the same phenotype because the M allele is dominant.

#### The Human Genome

The DNA in a human body cell consists of about 6.4 billion base pairs, and in a gametic cell (sperm or egg), 3.2 billion pairs. The entire sequence of DNA in a human cell is called a **genome**. In each human egg or sperm is one complete set of the genome, and within each cell nucleus are two sets. Each individual has a genome, but because of variability there is no single, species-wide "human genome." Nevertheless, in 1990 the U.S. Human Genome Project began with the goal of discovering the complete nucleotide sequence of an "average" or representative person (Ridley 1999:145), a goal that was reached in 2003. Originally, the justification for DNA-sequencing research was to pinpoint the loci of genetic diseases. A second rationale was to study genetic diversity from various samples of people, especially aboriginal populations, and to reconstruct the genetic history of the human species.

To that end, three international projects have started: the Human Genome Diversity Project (HGDP), which has collected cell lines from 1,064 individuals of 52 populations spread over five continents; the Haplotype Map Project set up to study diseases in three populations; and the Genographic Project designed to study a small portion of the human genome in a large number of people (up to 100,000) representing a thousand indigenous populations (Stone and Lurquin 2007:261).

Attempts to understand genetic history have also been made through study of **mitochondrial DNA** (mtDNA) inherited only from the mother

and found outside the cell nucleus. The mtDNA of 150 people drawn from various contemporary populations allowed researchers to trace back to a single original sequence in one person, called "mitochondrial Eve." She lived about 200,000 years ago, when modern *Homo sapiens* was emerging (Marks 1995). It is estimated that about 86,000 ancestors contributed all the human DNA existing among 6 billion people today (Olson 2002). This research suggests that the human species has relatively little variability and also a fairly short history. Despite superficial differences between populations in skin color and facial features, we are an amazingly homogenous species compared to other primates.

Molecular study of the Y chromosome in males has allowed researchers to trace genetic markers in the paternal line back 100,000 years. The Y chromosome has only 128 genes, whereas an X chromosome has about 1,218 genes, and mtDNA has only 37 genes (Stone and Lurquin 2007:56). Studies of genetic variation previously used markers such as proteins, enzymes, and antigens, but currently researchers focus on variant forms of genetic structures (called single nucleotide polymorphisms or SNPs) and direct DNA sequences. Such studies tell us a lot about the genetics of ancestral populations and suggest behavioral and cultural patterns as well. For example, in mtDNA (from female ancestors), 81 percent of variation in SNPS is found within populations, and approximately 12 percent between populations. In contrast, analysis of Y-chromosome SNPs (from male ancestors) shows only 35 percent variation within populations and 52 percent between them. Anthropologists interpret these gender differences as suggesting that females migrated between groups more than did males, presumably in marriage exchanges among patrilocal groups where brides lived with their husbands' families (O'Rourke 2003).

The sum of the diverse inherited characteristics of all individuals in a specific population is called a **gene pool**. As children are born and the gene pool is transmitted between generations, much of the prior diversity is maintained. This replication of diversity is called the Hardy-Weinberg equilibrium model. (An example would be stability in the ABO blood type distribution over time.) There is always potential for change, nevertheless, and gene pools can and do change through microevolution.

Research on genetic diversity among South American Indians has shown the value of comparing small communities within regional populations. By analyzing similarities and differences of blood proteins (the ABO system, Rh, Kell, Diego, hemoglobin, 6–6-P-D, and twenty-three other systems) between Xavante villages, it is possible to reconstruct the nature of mating relationships

within the population. Similarly, comparisons of genetic patterns of Xavante with other indigenous groups can show whether a community has been isolated from others or there has been intermarriage and assimilation. Despite many political and economic changes in the late twentieth century, the Xavante remained distinct on at least thirteen of twenty-eight protein genetic systems. Clearly the gene pool had not changed greatly (Salzano et al. 1997).

## Factors in Genetic Change

Genetic changes occur in populations through several mechanisms. Some people migrate into the community, bringing their genes into the population. In very small populations, there may be genetic drift due to random factors such as early death. In the division of sex cells, there may be uneven crossing-over of chromosomes.

Mutations are another type of genetic change. They are abrupt changes in base pair sequences in the DNA molecules or breaks in chromosomes that lead to rearrangements of gene positions and code sequences. Mutations create changes in biochemical activity, with significant metabolic effects on the individual. Point mutations, involving the substitution of a single base in a code sequence, may seem particularly insignificant, but these tiny alterations are an important source of variation.

The genome contains repetitive DNA sequences, some of them coding for gene products and others intergenic (between the genes). Some repetitive DNA is called *satellite DNA*, with sequences of base pairs repeated over and over. Certain types of satellite DNA with shorter repeat sequences are called *minisatellite DNA*, or variable number tandem repeats (VNTR). One specific minisatellite is found near the insulin gene, and variants of this VNTR are linked to type 1 (insulin-dependent) diabetes (Weiss 2000:75), suggesting that mutations of this type can be a source of genetic change.

By itself, mutation is not inherently adaptive. It is simply a random process, often producing harmful effects and only rarely producing a change that happens to be of value. Like mutation, other genetic processes that introduce genetic variability are random, undirected, and not inherently adaptive.

Some mutations cause genetic disorders that can be inherited through generations. One condition is *achondroplasia*, a form of dwarfism that affects more than 100,000 people in the United States. People with this trait have a 50 percent chance of passing it on to their children. Another condition inherited as a dominant trait is *neurofibromatosis*, a disorder with internal and external neural tumors. Some genetic disorders caused by inheritance of recessive traits are

linked to particular ethnic groups or people coming from specific geographic regions. A well-known example is *Tay-Sachs disease*, a defect of brain lipid metabolism that causes early death in children. This disease is found ten times as frequently among Jews of Eastern European ancestry as in other groups, including Jews of other origins (Stone and Lurquin 2007).

Tay-Sachs disease is due not to inheritance of a single allele but rather to inheritance of one of several DNA sequences. It is puzzling that a defect lethal for children would have been retained in a population. It might be that this trait, originally arising as a mutation or replication error, could have offered some advantage in the past when inherited in the heterozygous form. Heterozygous inheritance of the trait linked to Tay-Sachs may have given some genetic resistance to tuberculosis or other diseases of childhood and youth (Hill and Motulsky 1999; Marks 1995). On the other hand, the high incidence of Tay-Sachs in Azhkenasi Jews may be due simply to the migration of Israeli Jews to Europe. This process illustrates the **founder effect** in genetic drift, in which change in a gene variant frequency happens due to chance after a small fraction of a population splits and moves away from the larger population (Stone and Lurquin 2007:113).

Individuals who survive childhood illnesses are more likely to reach adulthood and reproduce. Provided that environmental pressures and pathogens remain constant, descendants who inherit traits giving disease resistance are also more likely to survive. When differences in survival and in reproduction rates are due to a genetic variation, then that variation will increase in frequency in the population over time. This is how natural selection works. "Natural" refers to the forces that cause death, especially death during infancy or childhood or before one completes the reproductive years. It is the cumulative impact of these natural forces on birth and death that "selects" adaptive traits; that is, allows them to be retained in the population through the genes of survivors and their surviving descendants.

For reproductive success, it is not sufficient merely to have high fertility. Parents must also care for their offspring well enough to ensure their survival to adulthood. In addition to biologically programmed responses to the infant's cries, odor, and facial features, humans also have a wide array of culturally based birthing and infant care practices that contribute to generally successful strategies of reproduction (Trevathan 1987).

Genetic traits are fixed before a person is born, and these traits in the person's genome do not change after birth unless there is exposure to mutagenic agents such as ultraviolet radiation. It is the gene pool of the population and of future generations that changes, not the genome of the individual. Many

genetic factors do not affect survival or reproduction; it is only those characteristics that give some advantage, or degree of *Darwinian fitness*, that are subject to selective action. Fitness is not a measure of muscular strength, intelligence, or aggressiveness, but simply a measure of statistical differences in the reproductive success of various genotypes.

## Skin Color and Adaptation

A person's skin color is controlled by **melanin**, a dense pigment produced by melanocytes in the skin. Melanin levels vary within an individual: your palms are likely to be lighter than the back of your hands, for example. Melanin varies by age: you are born with lighter skin than you will have as a young adult. Females tend to be lighter than males. Thus, there is variability in skin color within populations as well as between them.

Humans native to tropical regions usually have darker skin than those who live in higher latitudes, and this skin color will be inherited by descendants even though they may move to non-tropical regions. Geographic variation in pigmentation, which is partly genetic and partly due to exposure to sunlight, has intrigued anthropologists. Does dark skin provide an advantage to people who live in areas of intense sunlight?

Levels of ultraviolet radiation (UVR) are higher in the tropics and in highaltitude regions and lower in northern latitudes, and UVR is the form of solar radiation that is most harmful to humans. Excessive UVR exposure can damage DNA in skin cells and cause cancer. It can also destroy **folate** or folic acid, the B vitamin that is critical in pregnancy for normal embryonic development. Protection from skin cancer is important, but protecting the body from folate depletion is even more important, especially for women in their childbearing years (Jablonski 2006).

Nevertheless, humans need sunlight. It is essential for stimulating production of vitamin D in the skin so that we can absorb calcium and phosphate from food. Children deficient in vitamin D often have weak and deformed bones. Girls whose pelvises don't develop properly will have difficulties in giving birth later in life. Adequate vitamin D is also essential for immune system functioning, for bone strength in old age, and for inhibition of cancer cells.

The significance of melanin levels in the skin becomes clear when one realizes that sunlight poses both benefits and risks. Melanin is "a superb natural sunscreen," according to physical anthropologist Nina Jablonski (2006:66), that "can absorb all wave lengths of damaging UVR, protecting the vulnerable biological systems and molecular structures of the body." Natural variation in

melanin provided the base for natural selection of increased melanin levels over generations, allowing a balance between beneficial exposure for vitamin D synthesis and protection against harmful effects of exposure.

How, and when, did northern Europeans and Asians evolve lighter skin? Before making an educated guess, we need to consider competing hypotheses about where humans originated and how far they migrated. Some paleontologists support an uniregional hypothesis, estimating that modern humans originated in Africa and migrated north and east about 60,000 years ago. Advocates of a multiregional theory hold that subspecies of the genus *Homo* evolved separately in Africa, Europe, and Asia beginning about 1.7 million years ago (Stone and Lurquin 2007).

If one accepts the African origin hypothesis, migrants with dark skin were at a disadvantage in areas with less sunlight. Lower production of melanin, especially in females of reproductive age, would be reinforced through differences in reproductive success, and the genes coding for this variant would be differentially transmitted to offspring. There are two variants of the gene (SLC24A5) for lighter pigmentation that have been subject to natural selection. One has a frequency of 99 percent among European-Americans; the other has a frequency of 93–100 percent among East Asians, Native Americans, and some African populations (Stone and Lurquin 2007:146).

It is unfortunate that pigmentation became a criterion for classifying races and a marker of status in the eras of colonialism and nationalism. Like body shape and blood groups, variability in skin, eye, and hair color reflects our genetic and physiological flexibility. As Jablonski (2006:3) so eloquently writes, "Skin color is one of the ways in which evolution has fine-tuned our bodies to the environment, uniting humanity through a palette of adaptation."

## **Evolution and Human Immune Systems**

As parts of ecological systems, humans encounter other organisms every day, and invariably some enter our bodies. We ingest food and water that may contain parasites or microbes. We breathe in pollen and pollutants. Our pets are hosts to insects, our beds and carpets provide habitats for microscopic creatures, and mold colonizes our basements.

Humans (as well as most animals and plants) have built-in defenses, specialized cells that can recognize these intrusive organisms and react to them in ways that protect the integrity of the body. We have not just one, but multiple lines of response, including **innate immunity**—our species' generalized ability to guard against threats—and **adaptive immunity**, an individual's

ability to respond to specific threats based on his or her previous exposure to pathogens.

Innate immunity provides some protection in the earliest stages of infection because the body is able to recognize that something has intruded that is non-self. For example, you may have fallen off your bike and scraped your knee. Before you can get home to clean and bandage the scrape, bacteria enter the wound. At home, you notice that the tissue around the cut is rather swollen, reddish, and warm—all signs of localized inflammation, which is the first line of defense. What has happened is that the immune system recognizes in the biochemical patterns of the bacterial cells that this is a pathogen (an organism that could cause disease). The innate defense proteins, which kill bacteria through various mechanisms (primarily through a type of white blood cell called neutrophils), are coded in our genes and are passed between generations (Clark 2008).

Within a few days, a second line of defense kicks in, the adaptive immune response. It involves individually created antibodies and T cells, initially formed as white blood cells (called *lymphocytes*) from stem cells in the bone marrow. Lymphocytes include B cells, which make antibodies against foreign cells, and T cells (which mature in the thymus, hence the "T" designation). There are two primary types of T cells, "helper" and "killer" cells. The CD4 "helper" cells facilitate activation of antibodies in B cells as well as maturation of the second type of T cell, CD8 "killer" cells (which can destroy foreign cells). Both T cells and B cells migrate to the spleen, an organ next to the stomach, and to lymph nodes found throughout the body.

If the person has been infected with the same bacteria before, the B cells will "remember" it and produce specific antibodies within a day or so in a process called *humoral immunity* (DeSalle and Brickman 1999). What B cells recognize is the **antigen**, the specific biological "signature" (the biochemically active molecules) of the microbe. Antibodies are always specific; they only bind to antigens that fit their receptors in terms of size and shape. "This property of **specificity**, like diversity and memory, is a key feature of the vertebrate immune system. An antibody against the smallpox virus, for example, does not react with and lead to the elimination of diphtheria toxin, or vice versa" (Clark 2008:34, emphasis in original). Similarly, in cellular immunity (or "cell-mediated" defenses), T helper cells bind to only one specific antigen (DeSalle and Brickman 1999).

Production of antibodies does not necessarily completely protect the individual from illness during first exposure to a virus or other pathogen. For example, before a vaccine for chicken pox (caused by the varicella zoster virus)

became available, about 4 million children annually in the United States contracted this usually mild disease and thereafter enjoyed lifelong immunity to chicken pox. In about one in 4,000 cases, complications such as encephalitis developed. Because children with impaired immune systems were at risk of severe cases of chicken pox, a vaccine was medically warranted (Gershon 1999).

The principle of adaptive immunity underlies reliance on vaccines to prevent serious illness previously responsible for high morbidity in childhood, including measles, mumps, polio, tetanus, diphtheria, and pertussis, as well as more recently developed immunizations against hepatitis, meningitis, and cervical cancer. Exposing children and teens to active immunization, through injection of molecular structures from dead or mutated microbes, evokes long-lasting immune responses without posing the risk of more severe infection. However, immunity is not lifelong, and booster injections are needed periodically in adulthood.

Given the success of therapeutic immunization, one would think that dealing with threatening diseases such as malaria and HIV/AIDS would be simply a matter of developing an effective vaccine. After all, smallpox has been essentially eradicated after worldwide vaccinations. The problem is that disease agents often have their own defenses. The protozoa that cause malaria are capable of rapid mutation, for example, as are many viruses.

What is particularly insidious about the human immunodefiency virus (HIV) is that it infects the T cells of the immune system, gradually reducing the individual's ability to resist other diseases. The proteins in which the virus is wrapped mutate at incredibly high rates. The virus has evolved into several strains and subtypes, some more lethal than others. Any vaccine developed might only be effective against an older strain of HIV and not against the most recently evolved strains. Thus, a cure for HIV/AIDS is still not available, and immunological prevention remains an elusive goal.

As effective as our immune system normally is, it can respond excessively to antigens in ways that threaten health and, in extreme cases, can lead to death. The term "anaphylaxis" actually means "opposite of protection" (Clark 2008:146). A person who goes into anaphylactic shock after consuming peanuts or being stung by an insect is the victim of hypersensitivity by the class of antibodies called IgE to the specific antigen. This reaction does not occur the first time the individual is exposed, but IgE cells bind to two types of immune cells (mast cells and basophils) that contain histamine and other reagents. When the person is exposed again to the antigen, histamine is released into the bloodstream and can lead to constriction of airways (Clark 2008:152).

Autoimmune diseases are another example of derailment of the immune system. Such diseases include rheumatoid arthritis, type 1 diabetes, fibromyalgia, multiple sclerosis, and many others. Often the symptoms of these conditions, such as inflammation, muscle damage, and cell destruction, are caused by normal defenses of the B and T cells against invaders, but instead the cells are attacking the person's own organs. Although some researchers attribute these reactions to stress or look for genetic factors, increasing numbers of physicians are searching for evidence of microorganisms that cannot be detected through standard tests.

#### Genetic Factors in Disease Resistance

Resistance to disease can develop through passive immunity, when antibodies are transmitted through the placenta or the mother's milk, and through adaptive immune responses when exposed to disease or to immunizations later in life. Genetically inherited traits are a third source of resistance. Genetic resistance plays an important role in childhood in the transition between passive immunity and active immunity. This defense is controlled by a specific gene or set of genes and does not promote overall adaptability in the way the immune system normally does.

Infectious disease has played an important selective role in human evolution. A disease that reduces fertility and increases mortality in infants and children can be especially potent in bringing about genetic change. Miscarriage can be caused by infectious diseases such as rubella (German measles), toxoplasmosis (a parasite transmitted by cats), and African trypanosomiasis (sleeping sickness). Chagas' disease (American trypanosomiasis), transmitted by the "kissing bug," is a major cause of death in Brazil and other Latin American countries. This disease can infect the fetus through the placenta and cause fetal and infant death (McFalls and McFalls 1984). Diseases affecting mostly older people, such as dementia, non-insulin dependent (type 2) diabetes, and arteriosclerosis, are less important as selective factors because people affected by them usually have completed reproduction before the disease develops.

Sexually transmitted diseases play a large role in reducing fertility. Chlamydia or gonorrhea may damage a woman's fallopian tubes, obstructing passage of a fertilized egg to the uterus and sometimes leading to a life-threatening ectopic pregnancy. If she has been infected by the type 2 herpes simplex virus, transmission of the virus during birth may cause blindness, brain damage, or death to the infant. Women infected with HIV may transmit the virus to the fetus during gestation or during birth, a process called *vertical transmission*. The virus can also be transmitted through breast milk.

Genetic factors were probably responsible for increased resistance over time to diseases such as tuberculosis, plague, and smallpox, which had as devastating an effect on populations of the past as AIDS has had in recent times. There is little conclusive evidence of genetic adaptation to these diseases, however.

Natural selection increases disease resistance directly through genetic change in human populations, but the ecological model reminds us that microorganisms are also evolving. Parasites, viruses, and insect vectors mutate and evolve just as humans do, and often at a much faster rate than humans.

Of the many parasitic diseases that affect humans, malaria is one of the most ancient. There has been ample time for populations living in endemically malarial environments to evolve genetic characteristics that contribute significantly to malaria resistance. These characteristics include many variants of hemoglobin, the protein that carries oxygen in red blood cells. Some variants are relatively rare or localized, such as hemoglobin E in Southeast Asia and hemoglobin C in West Africa. Hemoglobin S, which is more widespread, is discussed in the following profile.

#### ROFILE: MALARIA AND AGRICULTURE \_

Ancient Chinese mythology describes three demons who bring a debilitating disease. One carries a hammer to cause a pounding headache, the second carries a pail of icy water to chill its victims, and the third carries a stove to produce fever. Thus the demons afflicted humans with malaria, from the ancient civilizations of China, India, and Mesopotamia, to Renaissance England and the nineteenth-century United States, and the nations of Europe until World War II (Learmonth 1988). The name for the disease comes from the Italian words *mala* ("bad") and *aria* ("air"). For centuries, people avoided building homes near marshes because they believed that marsh air caused the illness.

Worldwide, between 350 and 500 million people suffer from malaria, and about one million, mostly children, die from the disease each year. It is the fourth leading cause of death worldwide in children under the age of five. Sixty percent of malaria cases, and 80 percent of deaths, occur in sub-Saharan Africa, and the disease has lower prevalence in tropical and subtropical areas

in Central America, South America, and Southeast Asia (Centers for Disease Control and Prevention 2008).

Malaria is caused by a protozoan of the genus *Plasmodium*, a parasite which lives in red blood cells. The protozoa cannot survive outside their hosts. When they grow and fission, the red blood cells rupture and are destroyed, releasing waste products and pigment that bring on severe bouts of chills, headache, and fever. These attacks last four to ten hours and recur every forty-eight to seventy-two hours, depending on the type of malaria.

Anopheline mosquitoes are the vectors that transmit malaria from one person to another. When a female mosquito bites a person already infected with *Plasmodium* merozoites, she ingests *Plasmodium* gametocytes and becomes infected, although with no negative effect on her health. The gametocytes go through a sexual reproductive cycle and release sporozoites (asexual forms) that migrate to the mosquito's salivary glands. When the mosquito feeds, she injects sporozoites into a new victim, thus completing the cycle of disease transmission. Each parasite depends on both an insect vector and a mammal host to live out its full life cycle, although it can reproduce asexually for an indefinite time in the host.

Four species of *Plasmodium* affect humans. Less severe forms of the protozoan (*P. vivax, P. malariae,* and *P. ovale*) have had a longer evolutionary association with humans. The most severe, *P. falciparum,* accounts for about 50 percent of all cases and causes acute symptoms, especially in children. When untreated, the death rate among nonimmunes is about 25 percent. Falciparum protozoa may have begun to affect humans fairly recently.

Two major groups of vector mosquitoes for falciparum malaria in sub-Saharan Africa are *Anopheles gambiae* and *Anopheles funestus*. The two species have very different ecological niches. Funestus mosquitoes breed along shaded river edges and in swamps in undisturbed tropical forest. Gambiae mosquitoes breed best in open, sunny pools and in ditches with slow-running water. When African forest dwellers lived as hunters without permanent village sites, there were relatively few breeding areas for gambiae mosquitoes. Funestus mosquitoes fed on other mammals and rarely on humans, and the incidence of malaria for humans was low.

The introduction of agriculture into sub-Saharan Africa about 2,000 years ago set off migration by Bantu tribes and changed the ecology of the tropical forests. Iron tools made it possible to clear the vegetation effectively (Livingstone 1958). Clearing forests and cultivating root and tree crops greatly increased the breeding opportunities of gambiae mosquitoes. Domesticating

plants and storing surplus meant that more people could be supported in one place than had been possible through hunting and gathering. This shift in settlement patterns also benefited mosquitoes. Agricultural villages provided not only sunlit, stagnant pools for breeding, but also a feast of human blood. (See Fig. 3.3.) This may have been the period in which *P. falciparum* began to adapt to human red blood cells as previous mammalian hosts decreased. Changes in the mosquito and parasite niches created serious disease problems for the human population. The health costs of the new subsistence strategy were high.

Infants in malarial areas are born with passive immunity to malaria acquired prenatally from their mothers, lasting about six months. Then they are highly susceptible until age three, when they begin to develop active immunity to the parasite. Any genetic factor that gives resistance to children from the age of six months to three years would be favored by natural selection. In fact, up to 40 percent of the people of West Africa have an inherited characteristic that provides resistance to malaria: the **sickle cell trait** for abnormal hemoglobin.



FIGURE 3.3 Bachama women of northeastern Nigeria cultivating a field of young Guinea-corn (sorghum). Photo by Phillips Stevens, Jr.

Hemoglobin is a molecule in red blood cells that binds, carries, and releases oxygen and carbon dioxide in the tissues. Because the hemoglobin molecule is large, there is considerable potential for point mutations to occur. At some time in the past, a point mutation occurred in one of the DNA base pair codes for the hemoglobin protein chains, affecting the synthesis of the amino acid at the sixth position on the beta chains. A simple reversal in the order of the base pairs changed the instructions for the sequence of amino acids. Instead of glutamic acid at the sixth position, as is found in normal hemoglobin, valine was produced.

The substitution of valine affected the hemoglobin's level of oxygen affinity. Glutamic acid has a negative charge, allowing easy change from high to low oxygen affinity, depending on the external environment of the red blood cell. But valine has no electrical charge and is structured differently, so that in certain conditions the hemoglobin molecules containing valine at the sixth position tend to clump together. When there is a deficiency of oxygen, the molecules combine and form rigid bundles of needlelike crystals that distort the cell membrane into an irregular, sickled, or curved shape. This hemoglobin is designated **hemoglobin S** (HbS) because of the sickle shape of these red blood cells.

The abnormal hemoglobin differs from normal hemoglobin only by a single amino acid on the beta protein chain, but this small change is important. Hemoglobin S greatly inhibits the metabolism and reproduction of the malaria parasite in the red blood cell, possibly because the cell sickles after being invaded by a parasite and then is removed and destroyed in the spleen. Mutation probably occurred more than once in various regions. There is evidence the sickle cell mutation arose and dispersed three times in Africa, once in India, and once in Saudi Arabia (Wierenga 2000, personal communication).

Individuals heterozygous for the sickle cell condition have both normal and abnormal hemoglobin in every red blood cell. Although they are not immune, heterozygotes have less severe cases of malaria. Persons homozygous for sickling inherit sickle cell disease and may die from complications of the disease. Without medical care, sickle cell anemia is usually fatal for children, who rarely survive long enough to reproduce. In West African populations, the disease affects about 4 percent of the children.

The adaptive value of any trait must be assessed in the context of a specific environment. The sickling trait proved adaptive in a malarial environment. In regions where malaria has been eradicated, the sickling trait no longer gives any special advantage. The prevalence of those inheriting the trait (heterozygous) has declined sharply among blacks in the United States from about 20

percent in mid-twentieth century to about five percent in 2008. The rate of sickle cell anemia (homozygous) is approximately 1 in 500 African Americans (National Institutes of Health 2008). In African nations, however, about 125,000 children are born every year with sickle cell disease, with a five-year survival of only 8 percent (Wierenga 2000, personal communication).

The shift to agriculture in Africa had far-reaching ecological repercussions, creating new adaptive opportunities for many animals and plants. As humans adapted culturally through new and more efficient methods of subsistence, the vector *A. gambiae* adapted behaviorally to the presence of humans in sedentary villages. Both the malaria parasite and the human population then underwent genetic adaptation. The parasites evolved into forms biochemically suited to the metabolism of the human red blood cell, while natural selection increased the frequency of human hemoglobin variants resistant to the parasite.

Hemoglobin S is only one of several mutations that act as genetic buffers against malaria. Thalassemia, found in North and Central Africa, Mediterranean countries, India, the Middle East, and Southeast Asia, causes some anemia in heterozygotes but also increase their resistance to malaria. G6PD deficiency (glucose–6-phosphate dehydrogenase deficiency) affects more than 400 million people worldwide and is especially prevalent in Central and South Africa, Italy, Sardinia, Greece, the Middle East, and India. The geographic distribution of G6PD overlaps endemic areas of *falciparum* malaria (Ruwende et al. 1997:74), and it is likely that this genetic trait gives resistance to malaria and has been retained through natural selection (Greene and Danubio 1997).

#### **Evolution and Medicine**

A new field, **evolutionary medicine** or "Darwinian medicine," has emerged since the 1990s (Nesse and Williams 1994; Trevathan, Smith, and McKenna 2008a). This discipline connects current health problems with our evolutionary past. Early humans evolved physically and culturally, between 2 million and 10,000 years ago, in "environments of evolutionary adaptedness," or EEAs. They lived as nomads in small kin-based groups, with access through hunting and gathering to "adequate but not overly abundant food resources" (Trevathan, Smith, and McKenna 1999:4). Their lifestyle required high levels of daily physical activity. Birth rates were low, infant mortality was high, and there were only a few million humans on the earth.

This way of life persisted until development of agriculture around 10,000 to 15,000 years ago, when some groups began to live in permanent human settlements, subsisting through cultivation and animal domestication. Up to the last few centuries, most humans lived in rural areas and small towns rather than in cities and industrial environments.

Even though our cultural environments are very different today from those of prehistoric humans, we retain many biological traits that were adaptive thousands of years ago. For example, our bodies store fat easily. In the past, food was abundant occasionally, but more typically there were shortages. In any given year, hunters and fishers might not harvest enough animals to feed everyone, and early farmers might lose crops to drought and insects.

During times of surplus, the ability to store body fat allowed physical reserves for times of scarcity. Today, "many of us still have the ability to eat more than our daily needs and to store the excess as fat, but we rarely encounter environmentally imposed shortages" (Trevathan, Smith, and McKenna 1999:5). This trait can lead to obesity and associated problems when metabolism or activity levels are not high enough to use the fat stores.

In figuring out the cause of obesity or other problems, Darwinian medicine uses two levels of explanation. A *proximate explanation* explains how an individual develops a health problem (Nesse 2008). Using the fat storage example, a person who overeats consistently and gets little exercise through work or recreation may eventually develop a condition in which the body's insulin is not able to remove glucose from the blood adequately. This is called type 2 diabetes.

Although a clinician might attribute the problem to faulty eating or exercise habits, Darwinian doctors look for an *evolutionary explanation*, asking what is "the adaptive significance of aspects of the body that make it vulnerable" to conditions such as obesity (Nesse 2008:417). An evolutionary explanation might focus on *trade-offs*, which occur when an evolutionary change gives fitness in one environment but increases vulnerability in subsequent generations to an inherited disease or condition. For example, alleles underlying the ability to store fat easily in childhood may also predispose carriers of the allele to metabolic problems such as diabetes. Looking at how natural selection affects individual health at different stages of life illustrates *life history theory* applied to trade-offs in the allocation of energy to life processes such as growth, reproduction, and maintenance (Trevathan, Smith, and McKenna 2008b).

A *defense* model claims that physical reactions to certain environmental triggers are not inherently defects but rather are defensive responses influenced by natural selection (Nesse and Williams 1999). Nesse cautions against searching

for simple evolutionary explanations because "with a few exceptions, natural selection does not shape diseases." Rather, natural selection of favorable traits in a species' EEA can lead to shared traits "such as the appendix, the narrow pelvic outlet, the limitations of the immune system" that leave all members of a species vulnerable in certain other environments (Nesse 2008:422).

The case of asthma illustrates the defense model. Asthma is generally considered an environmental disease; factors in the environment (allergens such as pet dander and dust mites) trigger inflammation and constriction of a person's airways. An evolutionary explanation focuses on the past rather than the present and asks how defensive responses such as inflammation evolved, rather than merely asking what triggers asthma attacks in contemporary environments.

Asthma is not a genetic disease, but it comes from a genetically based immune system reaction. Some individuals are said to have "the asthma phenotype," which develops through exposure to indoor allergens in association with low exposure to parasites, especially parasitic worms (called helminths). This phenotype may have been adaptive in the past as a defense against parasitic infection (Trevathan, Smith, and McKenna 2008). When the presence of parasites stimulates allergens in the body, immunoglobulin or IgE (a protein in the blood) binds to mast cells and leukocytes and sensitizes them to discharge histamines against the allergens. Histamines stimulate the generalized inflammatory response of asthma and bronchitis.

People with high parasite loads rarely have asthmatic reactions, perhaps because their IgE has allergen-specific activation. Simply stated, their bodies are fighting off an invasion of worms rather than responding to allergenic substances in the air. When children are exposed to parasites at an early age, as in isolated South American Indian groups, total IgE levels are extremely high and asthma rates are low or nonexistent (Hurtado et al. 1999). This gives a clue to the evolutionary basis of this immune response.

Does this mean that if we allow children to get dirty and exposed to out-door parasites, they will have fewer asthma attacks? Given our household ecologies, allergies may be inevitable. Mites are very difficult to eradicate from bedding, furniture, and carpets. Further, respiratory viral infections, smoke, and high ozone levels interact with household allergens, creating multiple triggers for asthma.

Evolutionary medicine first developed to understand metabolic disorders and immune system malfunction, but it allows interpretation of other disorders ranging from colic in small infants to back pain to alcoholism and depression. Depression and anxiety, for example, can be seen as points on an emotional continuum derived from a highly complex neurological system

that humans evolved. Perhaps depression, anxiety, and obsessive-compulsive behavior served some function in the past that we don't fully understand and thus can be viewed as evolutionarily adaptive even though they lead to abnormal behaviors in today's world.

Evolutionary medicine is still a young field. Many hypotheses are conjectural and do not yet have practical applications. It is likely, however, that fruitful collaboration between physicians and anthropologists will continue as they attempt to understand and prevent disorders of the metabolic and immune systems.

## Physiological and Developmental Adaptation

Step out of your air-conditioned room and jog along the pavement on a hot day, and your body makes certain adjustments to the heat. You begin to sweat: evaporative cooling is taking place. Your face reddens as an expanded flow of blood through the capillary bed allows more heat to be lost. The body is working to maintain **homeostasis**, the inner balance that maintains an organism's internal environment despite external change.

We all have the capability to respond to extremes of heat and cold, high or low humidity, ultraviolet radiation, excess or deficient nutrients, toxic substances, or disease-producing organisms. This capability is called **plasticity** by physical anthropologists. Some people are clearly more flexible than others in responding to different stressors. Some do better in heat and others in cold, for complex reasons of diet, physique, metabolism, and childhood development. But all humans can tolerate a range of environmental conditions; our adaptability is part of our genetic programming. In contrast to adaptive changes in gene frequency, which require generations to develop, physiological and developmental adaptations occur within a lifetime. Some changes are instantaneous, as when the pupil of your eye narrows in response to light. Other changes take longer, such as skin tanning after exposure to ultraviolet rays. Most types of physiological adaptation are reversible, but certain ones that develop over a long time may be irreversible, such as the barrel-chested physique that develops as children grow up at high altitudes.

Even bone undergoes adaptive changes, though we tend (mistakenly) to think of the skeleton as a stable framework on which the other body parts hang. Living bone is a tissue that remodels itself, changing shape and density in response to the mechanical stresses of daily use, and becoming lighter and more fragile with non-use. Additionally, in women the skeleton stores calcium, to be drawn on for pregnancy and lactation (Agarwal and Stout 2003).

Many scientists question whether physiological changes should be called "adaptation." They reserve that term for genetic change. However, we define adaptation as not only the *effect* of genetic change but also the short- and long-term *processes* that lead to change. Growth and development, metabolic responses to climatic and nutritional change, hormonal stress responses, and development of antibodies in response to antigens are just a few of the many physical processes underlying adaptability and resilience.

Physiological changes, also called *functional adaptations* by some human biologists, occur more rapidly than do genetic changes and are often more reversible. Several levels of physiological adaptation can be distinguished. *Acclimation* is rapid, short-term adjustment to a single stressor, usually experimentally induced. *Acclimatization* is a more pervasive but still reversible response to change over a more extended period. Plasticity or *developmental acclimatization*, a concept developed by Gabriel Lasker, is intermediate between genetic adaptation and acclimatization, consisting of irreversible but not hereditary changes made through growth and development (Schell 1995). The differences among these concepts are seen in the ways people adapt to high altitudes.

## High-Altitude Adaptation

Reduced oxygen pressure at high altitudes, defined as higher than 2,500 m (8,000 ft.), is one of the most severe forms of environmental stress. Low-landers who visit the mountains at 10,000 feet (3,000 m) above sea level may suffer acute mountain sickness (AMS) due to **hypoxia**, which is "less than the normal sea-level amount of oxygen in the inspired air or in the body" resulting from decreased barometric pressure (Beall 2001:425). Symptoms of mountain sickness are nausea, shortness of breath, fatigue, appetite loss, and headaches. People who live at high altitudes all their lives may experience hypoxia but usually can adapt to it, but a minority (mostly older people) develop chronic mountain sickness.

In the face of low oxygen pressure, visitors to high-altitude areas must make quick adjustments to ensure adequate oxygen. They breathe faster, have a more rapid heartbeat, and their basal metabolism increases, all adjustments that diminish after a week or so. Another short-term change is that the blood vessels in the lungs narrow to reduce oxygen diffusion in the bloodstream and to redistribute blood to better oxygenated parts of the lungs. Later there is gradual increase in the number of red blood cells circulating, which makes more hemoglobin available for carrying oxygen to the tissues.

The capacity to adapt to high altitudes varies individually. Some people who migrate as adults from lower altitudes to mountainous regions never do become successfully acclimatized, while others adjust but are not capable of full work effort. High-altitude natives, on the other hand, have the same basal metabolism and work capacity as people at sea level (Beall and Steegmann 2000), and under hypoxic conditions (as in climbing Mount Everest, for example), natives are superior in their ability to work without requiring supplemental oxygen.

It is possible that acute mountain sickness is actually an adaptation to hypoxia, and therefore a defense in evolutionary medicine terms, rather than a simple acclimatization response. The proximate cause of AMS is not known. Individuals who do not increase their breathing rate and volume of oxygen in the blood may be more likely to develop chronic AMS, but this hypothesis has not been proven. Increase in blood flow in the brain is another normal response to hypoxia, and abnormalities in the blood-brain barrier (that prevent pathogens from entering the brain) may also affect this response and cause the headache symptoms (Beall 2008).

Examining cellular responses to hypoxia in laboratory studies, Cynthia Beall (2008) describes a protein called hypoxia inducible factor 1 (HIF1) that induces expression of genes that regulate oxygen homeostasis. The HIF1 genes allow the body to switch to the more primitive anaerobic metabolism, which does not depend on oxygen to produce energy, and block the aerobic pathways. They also produce antioxidants, chemicals that limit damaging effects of reactive forms of oxygen. Beall hypothesizes that AMS results from imbalance between reactive forms of oxygen that can cause damage and antioxidants that limit damage. Several facts support her analysis. Mountain climbers who consume dietary antioxidants such as vitamin C have less severe AMS symptoms. Increased exercise (without taking antioxidants) increases the severity of AMS. Moreover, about 6 percent of the people in Chuvashia, central Russia, have a genetic disorder with high levels of HIF1. The symptoms of this condition, called Chuvash polycythemia, include characteristics of AMS, including headaches and difficulty in breathing (Beall 2008).

# Variation in High-Altitude Adaptation

About 140 million people in twenty-four countries live at high altitudes (Moore, Niermeyer, and Zamudio 1998). The best-studied groups are Tibetans and Ladakhis in the Himalaya, Andes Mountains residents in South America,

and Rocky Mountain communities in the United States. The Tibetans have had the longest occupancy at high altitude, possibly as long as 25,000 years (Moore, Niermeyer, and Zamudio 1998:30), although genomic analysis suggests that Tibetans split from low-altitude populations around 6,000 years ago (Beall 2001:438). Andean residents have occupied the high regions for about 6,000 to 9,000 years. Thus both Tibetans and Andeans have had enough time to develop genetic adaptations. In contrast, people have lived year-round in the Rockies only for the last few hundred years, without time for natural selection of adaptive traits. Since the human species evolved at low altitudes, differences in traits of people in these three regions may be due to phenotypic divergence, illustrating the tremendous plasticity of our species (Beall 2001).

How do Tibetan, Andean, and Rocky Mountain people differ in their developmental acclimatization patterns? Are there genetic differences? The vasoconstrictive response of newcomers seems to be a species-level response to general hypoxia, as long-term residents in Colorado at 3,100 m (10,170 ft.) and Andean natives at 3,700 to 4,540 m (12,000–14,900 ft.) also exhibit this response. But in Tibetan groups, the vasoconstrictive response does not always occur; some individuals maintain lower pulmonary artery pressure as if they were at sea level. Moreover, Tibetans have higher resting ventilation (rate of moving air and oxygen through the lungs) than the other groups (Beall 2001:429-432). The lack of vasoconstrictive response and the higher ventilation rate may be genetic. Newcomers acclimatize through gradual increase in hemoglobin concentration, which partly restores oxygen in the arteries. Hemoglobin stays elevated in Andean highlanders, with increased volume of red blood cells. Tibetans, on the other hand, have lower hemoglobin concentration except at very high altitudes (4,500 m), and even there, hemoglobin is lower than in the Andes; this may be another genetic difference (Beall 2001:436).

Many of the anatomical and physiological adjustments of high-altitude natives are developmental, occurring before birth and during childhood. In pregnancy, oxygen demands for the placenta and the fetus are high, but because there may be insufficient oxygen for optimal development, fetal growth is often retarded and birth weight is lower in some, but not all, high altitude regions. In the Himalaya regions of Tibet, lower birth weight occurs in Han Chinese but usually not in Tibetans, who have superior blood circulation in the uterus (Beall and Steegmann 2000:213).

In eastern Ladakh, a region in north India, birth weights of 168 infants born in 1990 in hospitals averaged 2764 grams, or 6.08 pounds. Male newborns were heavier (average of 2853 g) than females (2678 g), a statistically significant difference. Seventeen percent of males were under 2500 g (5.5 pounds), con-

sidered the cut-off for LBW (low birth weight) status, and 37 percent of the female newborns were under 2500 g (Wiley 2004:82–84). This rate of low birth weight in the Himalaya is considerably higher than the rates of 9 to 10 percent in the high altitude Andes of South America (Wiley 2004:147).

The relatively low birth weights of infants in the Himalaya have persisted over recent decades despite increased access to prenatal care. Measurements in 2006 of 1,073 infants born in hospitals to Ladakhi mothers who had received prenatal care showed an average birth weight of 3002 g in males and of 2894 g in females, with 11 percent of males and 17.1 percent of females under 2500 g (Wahlfeld 2008). (See Fig. 3.4.)

It is helpful to compare LBW rates in the Andes and the Himalaya with those in the state of Colorado, where about 13 percent of births between 1979 and 1982 in the highest altitude regions (over 9,000 ft.) were under 2,500 g, twice the rate as in lower altitude regions (Unger et al. 1988, cited in Wiley 2004). The average LBW rate in the United States in 2002 was 8 percent, similar to the rates for Canada and the UK (Childinfo.org 2005).



FIGURE 3.4 Dr. Padma Dolma prepares to measure a Ladakhi newborn for a study at Sonam Norboo Memorial Hospital in Leh, Ladakh. Photo by Christopher Wahlfeld.

Andean children grow more slowly than children at sea level, one to two years behind the norm, and they continue to grow through adolescence and into their early twenties. Poor nutrition may contribute to growth retardation in the Andes, but possibly not in the Himalaya, where children of Han Chinese ethnic groups (with higher economic status and better nutrition) have slower growth than Tibetan children do (Moore, Niermeyer, and Zamudio 1998). At high altitude, children's chest development is accelerated and their lung volumes are larger than those of children at sea level. Children of Andean ancestry who are raised at sea level also have enlarged chests, so this characteristic may also be partly genetic.

In addition to coping with hypoxia, people at high altitudes must also deal with widely fluctuating temperatures. Above 13,000 feet (4,000 m), night temperatures often go below freezing. Infants are particularly vulnerable to cold, but high-altitude Quechuan peoples protect infants by wrapping them tightly in multiple layers of clothing and blankets. The mother carries the infant horizontally on her back in a carrying cloth, a *manta pouch*, creating a microenvironment much warmer than the outside air. The manta pouch not only keeps out cold air, but also raises oxygen pressure. The lack of visual stimulation and restriction on the baby's movement may slightly delay development, but over time the swaddling is loosened, the manta is partly opened, and the infant is carried in an upright position (Tronick, Thomas, and Daltabuit 1994). Tibetan mothers also carry their infants swaddled inside a *chuba*, a traditional garment that allows the infant to be nursed without exposure to cold (Moore, Niermeyer, and Zamudio 1998).

The air is very dry at high altitude, and can irritate the lungs. About 60 to 70 percent of illnesses are respiratory, and the aridity combined with pollution, dust, and sand contributes to these problems (Wiley 2004). In winter, especially, when people stay mostly indoors, the hypoxia, cold and dry air, and fumes from cook stove are all factors in high rates of respiratory illness among Ladakhi infants and children in northern India (Wiley 2004: 126, 135).

# **Cultural Adaptation**

When environmental change occurs, humans can respond rapidly and flexibly by change in their behavior: They can come in out of the rain. Behavioral adaptation ranks along with genetic and physiological adaptation as a major type of response to environmental alterations. Some behavioral adaptations are specific to the individual regardless of cultural background. These *individual adjustments* are studied, for the most part, by psychologists. Other be-

havioral adaptations are shared by members of a society; these *cultural responses* are the special focus of anthropologists.

Many of the strategies used by humans to cope with environmental problems are based on information and skills that have been learned. In growing up, children learn from adults how to get food, to avoid danger, to secure protection against the weather, and to use raw materials for tools. Each generation has to learn basic survival techniques from the previous generation through a process of *cultural transmission*.

The **culture** of a group is an information system transmitted from one generation to another through nongenetic mechanisms. The information units are very diverse. Some are material objects, others are ideas and beliefs, and yet other units are ways of doing things: instructions or "recipes" in a broad sense. Tools, clothing, houses, weapons, music, laws, medicine, farming, raising children, regulating conflict: these and many more human behaviors and products of behavior form a complex informational system.

Although culture is non-genetic, genetically based characteristics underlie the human capacity for culture. First, humans have evolved extensive and complex neural connections in the cerebral cortex of the brain, with considerable overlap between specific association areas for vision, hearing, touch, coordination, and language. Without some form of language, human groups could not have developed the complex informational systems through which they adapted, nor could they have readily transmitted this information to children.

Second, the hand and fingers facilitate the manipulation of objects, a primate trait that has become specialized in humans in the making and use of tools. Our prehensile hands can easily grip, lift, and throw objects, and our opposable thumbs allow us to pick up and work with very small tools. Evolution of the hand paralleled evolution of fine visual-motor coordination in the brain.

Third, we are born as completely dependent beings and remain dependent on others for many years, allowing a longer time for learning than in other primate species. Intense attachments can form between infants and their caregivers. Humans normally form social bonds throughout their lives—with their peers, mates, and children—and they work together, creating and coordinating group strategies for meeting problems.

These three characteristics—a complex brain, the ability to make tools, and social bonding—have allowed humans to generate an impressive diversity of cultural systems and to survive in a wide range of ecological niches. Each of these characteristics provides only a generalized framework for adaptation; they do not specify what people must learn, how they must use tools,

how to organize themselves socially, and how to treat sick people. The content of cultural information varies from population to population and from generation to generation. A complex cultural pool of ideas, techniques, strategies, and rules encompasses far more knowledge and ideas than any one individual could learn or needs to learn. Living in cultural systems, people have at their disposal diverse sets of knowledge, skills, and ideas.

## **Direct Medical Control Strategies**

Each population has cultural systems of information, roles, and skills explicitly developed to maintain health. **Ethnomedical systems** include the beliefs and knowledge held by health specialists and non-specialists about sickness and health, childbirth, nutrition, dental care, disability, and death. They include classifications of illness by symptoms and cause, rules for expected behaviors of healers and patients, and healing methods, implements, and medicines. Ethnomedicine is not exclusively folk or primitive medicine. The biomedicine practiced in urban hospitals represents a "culture of medicine" with its own values, beliefs, and social organization. Each medical system reflects the core values of the people who use that system within "a matrix of values, traditions, beliefs, and patterns of ecological adaptation" (Landy 1977:131).

Medical systems have evolved over the last 50,000 years of human existence. There is a progression from the shamanistic and family-centered healing rituals of foragers to the empirical and philosophy-based systems of medical specialists of civilizations and empires. All systems share certain common features: suffering, worry, and fear within a social context; the need to be helped, and a desire to help and relieve those who are suffering; and "a framework of meaning pertaining to the nature and causes of sickness and the rationale of healing" (Fábrega 1997:75). The behavioral bases for these systems may have been formed early in the development of human societies, according to Horacio Fábrega, as a biological adaptation for sickness and healing (termed "SH"). The SH adaptation may have evolved even earlier among nonhuman primates, who exhibit signs of suffering that elicit healing responses from others such as licking wounds. Chimpanzees have also been observed to use medicinal plants that have antiparasitic properties (Fábrega 1997:39–44).

## Medical Systems

Western medicine is mostly *secular*, that is, a nonreligious institution which strives to heal the body while leaving spiritual health to other institutions.

It is also called *cosmopolitan medicine* to denote its worldwide distribution in cities.

In more traditional systems, medicine, philosophy, and religion overlap without distinguishable boundaries. The Navajo religion is concerned almost exclusively with maintaining health through spiritual harmony and healing ceremonies. Navajo healers or "singers" focus as much on restoring harmony and preventing future harm as on alleviating physical distress.

Humoral medicine, practiced for thousands of years in the Mediterranean and Middle East and brought to Latin America by Spaniards, has values based on a philosophy of balance among fundamental qualities of nature. To treat sickness, the practitioner attempts to restore the equilibrium of the body's intrinsic qualities, such as hot and cold, wet and dry. Diagnosis, therapies, and prevention follow the principle that foods, drugs, and even types of illnesses have innate qualities (Foster 1994). In Guatemala, diarrhea is classified as a cold disease, and therefore penicillin, a cold medicine, is considered not appropriate for treatment. But dysentery is considered hot because of the presence of blood, and penicillin is acceptable for treatment because the hot disease and cold medicine counterbalance (Logan 1978).

Every ethnomedical system has empirical treatments that are often quite effective. Navajo use sweat baths and emetics in their ceremonies; traditional Inuit used confession as a means of alleviating guilt and reducing group tensions. Widespread empirical techniques include the use of minerals, plants, and animal products as medicines. Tannins in bark and tea are effective in treating hemorrhage, ulcers, burns, and diarrhea. Oils can be used as cathartics, and as treatment for worms, burns, and frostbite. Compounds in willow leaves provide a medicine similar to aspirin. Marijuana, opium, and hashish are widely used as medicines, as is *rauwolfia*, an effective tranquilizer (Alland 1970; Etkin 1986).

Especially extensive are medicinal plants used to treat reproductive problems. In traditional communities of highland Oaxaca, Mexico, most women use plants to stop the bleeding after giving birth, to relieve pain, strengthen the back and uterus, and restore heat balance. Plants are often chosen because they resemble the desired effect; for example, the *Mimosa*, whose leaves close when lightly brushed, is taken as a tea to close up the uterus. *Psittacanthus calyculatus* is used to treat infertility and miscarriage. (See Fig. 3.5.) Its way of attaching to a host plant and sending roots into it seems analogous to villagers' belief that pregnancy ensues when a fertilized seed attaches itself to a woman's spine (Browner 1985a, 1985b).

While many ethnomedical treatments are beneficial, some have hidden risks. One example is the use of *greta* and *azarcon*, compounds used as folk



FIGURE 3.5 Medicinal plants in highland Oaxaca, Mexico. *Psittacanthus calyculatusis*, used to treat infertility and miscarriage. Photo by Barbara Frei Haller, University of Neuchâtel, Switzerland, Courtesy of Carole H. Browner.

remedies by Mexican-Americans to treat *empacho*, a folk illness involving intestinal difficulties. Public health workers believe that repeated doses of these remedies cause lead poisoning (Trotter 1985). Why has use of *greta* and *azarcon* persisted? One reason is that the symptoms of lead poisoning (diarrhea, vomiting) are regarded as signs that the treatment is successfully breaking up the lump of food believed to be blocking the intestines and causing *empacho* (Trotter 1985).

In the Andes of South America, the centuries-long practice of chewing leaves of the coca bush (species of the genus *Erythroxylum*) helps people deal with cold and hunger. Coca leaves contain a mixture of many chemical substances including alkaloids, one of which is cocaine. In residents of Nuñoa, Peru, living at altitudes over 13,000 feet (4,000 m), coca worked as a vaso-constrictor to conserve body heat. When blood supply is restricted, fingers and toes become cooler and less heat is lost. This conservation of body heat in coca chewers results in higher rectal temperatures after prolonged cold exposure than in non-coca-users (Hanna 1974).

Village	Altitude (in feet)	% Males	% Females	Mean	_
I	377	2.8	2.5	2.7	_
2	2,130	35.7	21.8	28.7	
3	6,150	45.4	10.4	27.9	
4	11,500	68.7	74.4	71.5	

TABLE 3.1
Relationship Between Incidence of Coca Chewing and Altitude

Source: Emilio Moran, Human Adaptability, second edition. 2000. Westview Press. Page 175. Based on Roderick Burchard, Myths of the Sacred Leaf: Ecological Perspectives on Coca and Peasant Biocultural Adaptation. 1976 Ph.D. dissertation. Indiana University, Dept. of Anthropology.

The higher the altitude, the higher the incidence of coca consumption. The rate approaches three-quarters of adults at 11,500 feet (3,500 m). (See Table 3.1). When asked why they use coca leaves, Quechua- and Aymará-speaking Andean highlanders reply that coca reduces fatigue, helps them keep warm, and satisfies hunger. They claim that these effects help them keep working longer at the chilly, tedious tasks of high-altitude farming and herding.

Researchers have attempted to identify the physiological basis of each of these reported effects. As a "hot" substance, coca is believed to balance the "cold" qualities of potatoes. The "hot" qualities of coca are a remedy against any illnesses caused by the cold and also help relieve symptoms of mountain sickness. Most research suggests that coca plays a positive role in nutrition. It contains vitamins A and B, calcium, iron, and phosphorus, and the lime that is chewed with it contains vitamin C (Allen 2002). It also plays a metabolic role, regulating glucose levels in the blood and aiding the intestinal absorption of glucose (Burchard 1992). Coca leaves are combined with other herbs and made into medicinal teas by traditional healers and used to treat many ailments, especially stomach upsets (Carter, Mamani, and Morales 1981).

## Variability and Change in Cultural Systems

Just as a biologic population contains varied genotypes, a cultural system contains considerable variation in its knowledge and information. Each person imperfectly replicates what he or she is taught. Young people reinterpret rules they have learned from elders in terms of their own experiences and problems. Changes occur also through selective retention of new ideas and techniques that promote the effectiveness of the group or of the individual in

dealing with problems. These new ideas may arise within the group, but frequently they are borrowed from outside.

Cultural adaptation is analogous to genetic adaptation, but not identical. Cultures evolve; that is, they undergo directed adaptive changes in response to environmental pressures and challenge, just as biological populations evolve, but through different mechanisms. Biological evolution in humans has paralleled cultural evolution, with natural selection for traits underlying the human ability to learn, to communicate, and to work together—fundamental requirements for a cultural system.

In turn, cultural patterns have affected biological evolution, at times protecting humans against the selective forces of disease and climatic extremes, at other times intensifying natural selection through ecological changes that increase disease. Indeed, some anthropologists argue that biology and culture are more than parallel but separate systems, but rather "interdependent and mutually complementary," in the words of William Durham (1991:164). Durham has developed a theory of coevolution of human genetic and cultural systems. Analogous to the differential reproduction of alleles through natural selection, variant cultural units change or remain stable through differential social transmission, that is as people adopt, sustain, and transmit ideas. Cultural selection occurs through a set of mechanisms ranging from free decision making by individuals or groups to imposed change through coercion, force, manipulation, or authority. One major difference between genetic change and cultural change is that in cultural systems people make decisions about change, whereas genetic evolution has not (until very recently) been subject to conscious choice.

## Cultural Adaptation and Health

Adaptation theory has been heavily influenced by functionalism, an orientation that looks for the "function" (the role or purpose served in maintaining the whole system) of any custom, institution, or belief. Functionalist hypotheses, suggesting that apparently "irrational" ethnomedical customs have underlying, unconscious adaptive significance, are appealing. We are eager to believe that the true significance of religious taboos on eating pork is to prevent trichinosis, or that circumcision of males, practiced for ritual reasons, later prevents cervical cancer in their wives or reduces a man's risk of contracting HIV.

Looking for ecological or adaptive functions in every ethnomedical custom reflects a cultural bias of Westerners, namely, the view that disease can ultimately be prevented or controlled. However, if evil eye, or witchcraft, or

soul loss are major components of a culture's explanatory model of illness, it is less likely that a person from that culture will believe that one can control disease through pragmatic, preventive measures.

In developing his classic text, *Adaptation in Cultural Evolution* (1970), Alland recalls that he "felt that many adaptations, at least in the area of disease prevention, occurred alongside of, or in spite of, native theories" of disease. His self-critique of this position is that "when disease functions in native theory as a metaphor for social problems, behavior concerning disease becomes a complex set of compromises involving social as well as ecological adaptation" (1987:427).

Whether one chooses to do symbolic analysis or functional analysis of health practices and beliefs of a society, it is possible to see unintended, adaptive benefits of various practices. When the effect of a custom is positive, anthropologists consider the pattern to be adaptive even though people may not be aware of the benefits of what they are doing. Positive biological feedback may have contributed to selective retention of these practices.

For example, many societies have postpartum sex taboos, which prohibit a couple from having sexual intercourse when the woman is lactating. People who practice this custom do not justify it in medical or contraceptive terms. Rather, they consider it a way of protecting the child, the mother, and the father from the mysterious, powerful, and polluting forces associated with sex and reproduction. But one adaptive function of the custom is birth spacing.

Some customs are deliberate attempts to reduce disease but are based on a "faulty" understanding of disease transmission differing from the Western model. In Peter Brown's study (1986) of genetic and cultural adaptations to malaria in Sardinia, the local explanatory model was based on the notion of *mal-aria*, literally "bad air." One custom was to restrict the movement of women, who were usually not allowed to leave the settlement, especially if they were pregnant. The settlements themselves were generally free of malaria-carrying mosquitoes; more mosquitoes were found outside the settlements, where mostly men farmed. Consequently, women had lower malaria rates than men. It did not matter whether beliefs about causes of malaria were correct or not, for the restrictions protecting pregnant women served as effective preventive measures, in any case.

# Studying Adaptation

Adaptation can be segmented conceptually into biological, developmental, and cultural components, but in real-life situations, there are no neat labels identifying what is happening. The spectrum of human responses for dealing

with everyday problems as well as emergencies and disasters must be studied through fieldwork and participant observation.

In field studies of cold adaptation in northern Ontario, human biologists found that adaptation to cold stress in the subarctic involves far more than mere physiological responses (Hurlich 1976; Steegmann 1977, 1983a). Their methods combined standard laboratory measures with additional monitoring of body temperature and other measures while Cree and Ojibwa men were riding snowmobiles, cutting firewood, hunting, and trapping (Hurlich and Steegmann 1979).

Coping with the cold was affected by the kind of food that Cree and Ojibwa consumed, their methods of handling equipment during travel, their knowledge of weather patterns, and their experience and ability to judge circumstances. Response to environmental stressors was never purely physiological; cultural patterns and individual behavioral variation also influenced survival. Physiological responses proved critical, however, in unexpected emergencies. The body's ability to conserve heat, to resist frostbite, and to keep active with very little food served as a kind of emergency reserve, allowing the habitual response repertoire to stretch well beyond the usual limits.

After completing several seasons of fieldwork, Ted Steegmann (1983b:4) concluded that extreme cold was one of the more manageable of the pressures faced by Cree-Ojibwa people. They had developed many strategies to prevent frostbite such as choosing appropriate footwear (often rabbit-skin socks inside moosehide moccasins) and preventing the hands from freezing in the wind while ice-fishing by dipping them in ice water. Frequent tea breaks on hunting trips prevented dehydration and helped to dry the sweat from interior clothing.

## Adapting to Climate Change

As evidence of global climate change increases, it is clear that arctic peoples must meet major challenges in order to continue harvesting northern resources. Northern populations have successfully dealt with periods of warming and cooling in the past (McGhee 1978), but the rapidity of warming over the last few decades poses unusual challenges. Estimates of warming in Alaska and Canada over the last fifty years range from one to three degrees Celsius.

Both terrestrial and marine impacts of global warming on arctic ecosystems have been documented. On Banks Island in northern Canada, high above the Arctic Circle, winters are warmer but more snowy, spring snow melts earlier,

and there is more freezing rain in spring and fall than in past decades. The Inuvialuit say that the caribou, once present in migratory herds numbering thousands of animals, are gradually disappearing (Nagy 2004). There was a 97 percent decrease in numbers of caribou in the High Arctic between 1994 and 1995–96 associated with poor foraging conditions (Walsh 2005).

Human activities in northern regions contribute relatively little to global levels of greenhouse gas emissions. There are few industries, and the "carbon footprint" of the population is miniscule compared to the cities of southern Canada and the United States. Yet there is little that the governments of the three northern territories can do to stop global warming. Unable to mitigate climate change, they are especially vulnerable to its impacts. **Vulnerability** is defined as a function of a population's exposure to hazardous conditions and its adaptive capacity, that is, its "potential or ability to address, plan for, or adapt to exposure" (Ford et al. 2007:153).

Vulnerability assessments by research teams in Nunavut Territory show a variety of strategic responses to climate change. At individual and community levels, Inuit hunters depend on behavioral flexibility intrinsic to the traditional culture. Weather has always been unpredictable, and Inuit have learned over generations to travel and to hunt with others and not alone. They have learned to take extra supplies, and with replacement of dog teams with snowmobiles, to take extra gasoline, in case of weather delays. The increasing uncertainty of ice thickness and migration routes of whales and caribou require similar flexibility in harvesting food when and where it is available rather than following rigid schedules.

The traditional ecological knowledge of Inuit, or TEK, is gaining recognition as a valuable body of information about weather, terrain, animals, ice conditions, and other conditions affecting hunters. As climate change increasingly influences these conditions, the flexibility and practicality of TEK make it a valuable resource. It is a different way of knowing, distinct from scientific knowledge, and acceptance of the legitimacy of TEK through court cases and government policy has been very slow. Differences between scientific theories of animal "management" and indigenous values regarding the interdependence of humans and other species have made cooperation challenging. However, with recognition of TEK and attempts to formalize and codify it, positive collaboration between Inuit and European Canadians on joint wildlife management boards is developing (Thorpe 2004).

Promoting and preserving Inuit knowledge are directly related to reducing vulnerability to climate change. The Inullariit Society, an indigenous organization in the town of Igloolik on northern Baffin Island, offers land skills training

programs for young Inuit. Elders train youth in "navigating, recognizing and preparing for various hazards, loading sleds, identifying snow formations, and predicting weather," as well as non-traditional skills such as firearm safety and vehicle management (Ford et al. 2007:158).

While respecting traditional knowledge, northern hunters readily accept new technology. VHF radios, satellite phones, personal locator beacons, and GPS systems make travel by snowmobiles and boats easier and safer than in the past. People are purchasing the immersion suits essential for preventing hypothermia and death by drowning if a boat capsizes or a snowmobile falls through ice. This technology is prohibitively expensive for many families. The Nunavut government offers several programs (funded by the Nunavut Land Claims Agreement of 1999) that underwrite costs and compensate hunters and fishers for their expenses and for losses (Ford et al. 2007).

## Geography, Water Systems, and Micronutrients

In addition to studying people's responses to climatic variation, medical anthropologists also consider variation in access to micronutrients through soil and water among various local and regional populations. Micronutrients—minerals and vitamins that are essential for health—are needed only in small quantities. Zinc and iodine are examples of micronutrients; deficiency of zinc can lead to growth retardation, and a lack of iodine can lead to swelling of the thyroid gland in the neck, a condition called *goiter*. Goiter is often found in high-altitude areas where there is less iodine in the soil and water.

The following profile focuses on goiter in the mountains of northern India, asking why rates of goiter are high in some valleys and low in others. The profile, written by a physician specializing in travelers' medicine, illustrates the importance of including geologic and geographic data in the study of disease distribution.

# ROFILE: LOCAL DIFFERENCES IN IODINE DEFICIENCY GOITER IN THE WESTERN HIMALAYA

Richard V. Lee

The complex interrelationship between human health and the environment is dramatically illustrated by the geography of iodine deficiency and goiter, enlargement of the thyroid gland in the front of the neck. There are numer-

ous "goiter belts" where the prevalence of goiter has been recognized for centuries: the mountains and high-altitude regions of Asia (the Tibetan plateau and the Himalaya), Europe (the Pyrenees and Alps), and the Americas (the Andes). Lowland regions of goiter prevalence are present in the Great Lakes regions of the United States and Canada, in the Amazon River basins, and in numerous small enclaves where crops containing substances (goitrogens) that interfere with the iodine metabolism of the thyroid gland are staple foodstuffs.

lodine is an essential micronutrient required for the production of thyroid gland hormones that regulate cellular metabolism. The thyroid gland captures iodine atoms and incorporates the iodine into hormones which are released and circulate in the blood. The level of thyroid gland activity is regulated by the pituitary gland which produces thyroid stimulating hormone (TSH) in a feedback mechanism triggered by the levels of thyroid hormones in the blood.

If the thyroid hormone levels are reduced, the pituitary gland releases increased amounts of TSH which increase the activity and the volume of the thyroid gland. When iodine intake is low, the level of TSH increases and the thyroid gland becomes larger in order to capture as much iodine as possible and attempts to release increased quantities of thyroid hormones. Over time, iodine deficiency results in the thyroid gland becoming very large, as shown in Figure 3.6. Goiters may not cause many symptoms to the patient, but iodine deficiency may produce hypothyroidism in the patient: fatigue, excess menstrual flow, infertility, mental slowness, and growth retardation. Iodine deficiency during pregnancy can cause fetal death and congenital mental and growth retardation (cretinism).

In nature, iodine is found in the oceans and marine creatures. Iodine is taken up in evaporated water from the ocean and is released in rainfall over land. In high-rainfall areas the iodine enters surface water and can be rapidly cleared in mountainous regions unless it is captured in lakes and ponds. In high-flow regions any iodine residues in the soil can be leached away, which explains why high-rainfall river ecosystems like the Amazon basin are iodine deficient. The receding glaciation that created the Great Lakes basin in North America leached iodine from the soil at the end of the last "ice age."

The findings of medical and anthropological fieldwork in the northwestern Himalaya, Kashmir and Ladakh over the past twenty plus years provide an outstanding example of the discrete local environmental and cultural determinants of goiter prevalence. Teams of about twelve to sixteen participants

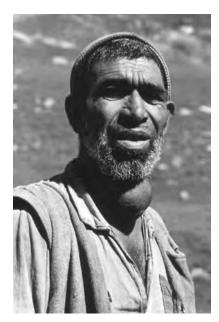




FIGURE 3.6 A man (left) and woman (right) of the northwestern Himalaya with goiters, enlargements of the thyroid gland due to low iodine in the diet. Photos by Richard V. Lee.

ranging from high school students to fully trained physicians and nurses volunteered to participate in strenuous treks to remote villages in the Warwan River Valley of Kashmir and the Zanskar River Region of Ladakh in northern India. At the study villages the teams established clinics and performed basic clinical examinations, including careful attention to the thyroid gland as well as the reproductive histories of the females. We took blood samples and urine samples which were used to measure TSH and iodine levels. We performed basic immunizations, especially tetanus toxoid for girls and adolescent females, and performed tuberculin skin tests to screen for the presence of tuberculosis.

Our team has documented a high incidence of goiter in the Warwan River Valley: a valley of Muslim villages at about 8,000 to 9,000 feet nestled between the Pir Panjal Mountain Range and the southern ridges of the Great Himalaya Range. (See map in Fig. 3.7.) Here half to two-thirds of the adult women had easily recognized thyroid enlargement, and about a tenth of adult men had goiter, some quite large. Pregnancy is accompanied by increased thyroid hormone requirements, which explains the preponderance of goiter among women compared to men and which explains the rapid increase in prevalence of goiter as women begin their reproductive years. Contraception was not widely practiced. Women may be married and begin

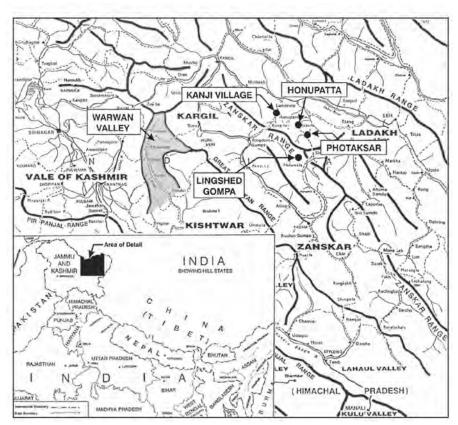


FIGURE 3.7 Map of northern India. In the Warwan Valley of Kashmir, the incidence of goiter is high. In the Zanskar Valley of Ladakh, 100 miles to the east, goiters are rare due to higher levels of iodine in the soil and water.

having children as early as sixteen to eighteen years of age and continue to bear children through their thirties. We found only one child in the two villages we studied with obvious mental deficiency and growth retardation, a possible case of endemic cretinism. Although iodized salt could be purchased in a few shops, 2 kg for one rupee, the villagers preferred the rock salt that came from the mountains to the north and east.

In contrast, among the Tibetan Buddhist population of the Zanskar Valley in Ladakh, less than 100 miles as a crow flies to the east of the Warwan Valley, but separated from the Warwan Valley by the ridges of the Great Himalaya Range, we found very few goiters; in fact, only rare minimal thyromegaly. (See Fig. 3.8.) The Ladakhis also do not use commercial, prepackaged salt, preferring to use rock salt which comes from high-altitude, brackish freshwater lakes

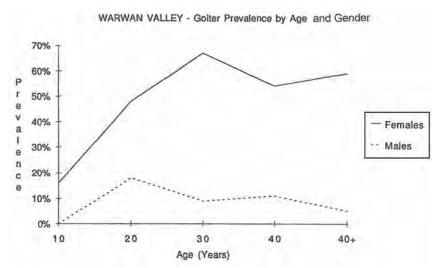


FIGURE 3.8 Cumulative results from field trips to the Warwan Valley in 1988, 1989, 1994.

that dot the Chang T'ang or Tibetan Plateau and valleys to the east. We were puzzled by the remarkable differences in goiter prevalence between the Warwan Valley and the Zanskar Region and searched for differences in natural sources of iodine. The most obvious difference was found in the origins and geologies of the mountains of each region.

The Pir Panjal mountain range is of volcanic origin and the soil does not contain iodine. Salt harvested from the lakes of this region is iodine poor. The Zanskar and Ladakh ranges of the Himalaya which define the Zanskar Region are uplifted sedimentary rock, and in the green rocks of the Zanskar Range there are marine fossils. An ancient seabed, pushed up by the tectonic forces that created the crustal wrinkles of the Himalaya and the Tibetan Plateau, provides a source of iodine in the soil, in the water in Zanskar, and in the salt harvested from the high-altitude salty lakes of the region.

Understanding the geology of the watershed helped to define differences in iodine availability related to agricultural and dietary practices. Ladakh is a high-altitude desert with little rainfall. The ultimate source of the water is the snow in the mountains: permanent snowfields and glaciers, and the spring-summer snow melt. The villagers throughout Ladakh (the Zanskar River Region, the Nubra Valley, and the Indus River Valley) have used surface waters for centuries, constructing irrigation ditches that traverse the mountains and

bring water to the small amount of arable, terraced land. Irrigation flow and impoundments for storage take iodine from the soil like the Zanskar River flowing north which has its origins in the Zanskar Range. Iodine-containing water from the river and irrigation ditches is used to water the Ladakhis' principal grain and their vegetables, and their food contains iodine. In the heart of the Zanskar Mountain Ranges, the diet consists mostly of barley in the form of *tsampa* (barley flour), *cha'ang* (barley beer), butter tea, yogurt, and vegetables (peas, collards, radishes, turnips), but not much salt.

In contrast, the Pir Panjal and the surrounding valleys have adequate rainfall and very heavy winter snowfall, and any iodine in the soil has been leached out by rain and snow melt. The lower altitude and greater rainfall allows the Warwan Valley folk the ability to grow grain other than barley without the necessity to employ irrigation. The Warwan Valley villagers grow millet, buckwheat, and some rice. Millet, which contains substances which can be converted to goitrogenic compounds, is a common crop in the Warwan Valley and a staple ingredient in the breads that are made. The greater variety of dietary staples in the Warwan Valley, especially millet, suggests the possibility that a dietary **goitrogen**, a compound that interferes with the metabolism of the thyroid gland, may exaggerate the existing iodine deficiency. The Warwan Valley villagers consume large amounts of salt tea made with iodine-poor rock salt and sodium bicarbonate; there is no lack of salt intake in the Warwan Valley. (See Table 3.2.)

The impressive difference in goiter prevalence between two culturally distinct neighboring populations illustrates the importance of including the environment in studying human health. In this case, there are two geographically and geologically separate environments, two distinct agricultural, dietary, and

TABLE 3.2
Environmental Factors Affecting Iodine in Soil and Water in Two Himalaya Regions

lodine in the Environment				
Warwan Valley	Zanskar			
lodine poor volcanic mountain soils	lodine rich marine sediments in mountain soil			
Regular rainfall, heavy winter snow	Minimal rain; heavy snow only at high altitude			
Little or no irrigation	Irrigation of crops using runoff from high altitude snowfields, trapping iodine rich water for crops			
Avoidance of iodized salt until only recently	Native salt with iodine content			

water use practices, and two distinct patterns of goiter prevalence. In recent visits to the region, however, we have identified a boundary other than the mountains that has shaped goiter prevalence. With the cross-border militancy between India and Pakistan, the traffic in rock salt into the Warwan Valley has been interrupted. The villagers have been forced to use packaged iodized salt, and the prevalence of goiter in adolescent girls and young married women has declined.

### Studying Adaptation to Illness and Disability

Our discussion has focused on how populations adapt to environmental pressures, but medical anthropologists are also interested in how individuals face the challenges of disability. A person who is severely injured, born with a disabling condition, or suffers degenerative disease often experiences an altered integrity of the body and the self. When a society values personal autonomy, adaptation to disability is particularly difficult. Caring for an adult who can no longer function independently requires members of his social network to change their roles and expectations. When a person has a terminal illness or a disabling injury, family members also develop defenses to cope not only with the burden of managing the individual's care, but also with feelings of grief, guilt, anger, and helplessness.

In *The Body Silent* (1987), anthropologist Robert Murphy describes his experience of becoming progressively paralyzed from a spinal tumor and his frustration at being dependent on others to do simple tasks such as brushing his teeth, shaving, using the telephone, and getting dressed. His training as an anthropologist facilitated his keen observation of changes in how colleagues, students, and family regarded him as he became increasingly disabled.

Illness narratives help anthropologists understand that coping with illness and disability develops over time. An analysis of personal accounts of multiple sclerosis (MS) shows that the sense of self, the body, and time gradually changes in a series of stages. For individuals newly diagnosed with MS, the first stage brings profound changes in perception of one's body (Monks and Frankenberg 1995). The second stage involves balancing "self-time" (one's work and relationships) against the body's gradual deterioration. In the final phase, the sense of self and purpose begins to merge with the body's condition. For some individuals, this merger brings acceptance and resolution despite restricted mobility and increased dependence on others.

Multiple sclerosis is usually an adult-onset disease, but asthma often begins in childhood, requiring the learning of behavioral strategies. Asthma is a chronic, inflammatory lung disease involving airway reactivity to allergens or irritants. Affected individuals are susceptible to episodes of severe breathing difficulty.

A study of adult African Americans, Latinos, and European Americans with asthma showed that stress was a central concept in the way they talked about their disease; that is, the **discourse** used to explain causes and describe prevention and treatment. Almost half believed that stress triggered their attacks, and most felt vulnerable during the episodes and discussed strategies to manage their vulnerability. One woman stated that she called friends when she sensed that an attack was imminent and asked them to call back in thirty minutes. She unlocked her door so that, if necessary, emergency personnel could enter the house easily. Others described stress-reduction methods such as meditation, praying, and visualization, believing that control over their own level of stress might help prevent attacks. Such strategies reflect the way that North Americans incorporate stress into their explanations of disease and concepts of disease causation and notions of individual responsibility to avoid illness (Pohlman and Becker 2006).

Children living with asthma and their families in the United States use various forms of disease management. Medical technology plays a large role: nebulizers (devices that deliver medication continuously to young children), peak flow meters to monitor exhalation, and metered-dose inhalers are ubiquitous in the homes, as well as many medications. Parents often try to pinpoint the cause of a child's attacks, which could be animal dander, mites in carpets or bedding, changes in weather, or mold, in efforts to prevent attacks. They may feel overwhelmed because the child is never cured and sudden attacks may be triggered by yet another factor. Children also feel helpless, especially when they need hospitalization, and they describe fear and worry that they might die during a severe attack. Parents realize that the efficacy of medication is limited but realize that children receive emotional reassurance from medicine and equipment. "The nebulizer not only provides relief from breathing distress, but also serves as a vehicle for transformation to normalcy for child and mother alike" (Clark 2003:66).

Unlike type 1 diabetes, which is recognized widely as a serious childhood illness, asthma "does not carry the same weight of cultural recognition," according to ethnographer Cindy Clark. Because schools, teachers, and neighbors are often indifferent and minimize the child's symptoms, parents feel that there is a "cultural cycle of denial," perhaps because the child's condition "casts doubt

over the air others must breathe." Although parents were genuinely distressed by the lack of community support for their child's condition, some also seemed to be operating at a level of denial by smoking in the house, keeping pets, and failing to use air conditioners (Clark 2003:87–88).

Children cope with asthma through forms of "imaginal coping": play, story-telling, identifying with superheroes, and having favorite stuffed animals. Clark explains that these activities allow the creation of meaning and understandings about the suffering that the child experiences. When parents or friends join in these activities, the child's coping is socially integrated rather than solitary. An example is a performance at a camp for children with asthma of the "Three Little Pigs" story in which the wolf happened to be afflicted with the disease. In this version, written by a group of campers, the wolf was unable to blow down any of the pigs' houses and had to be hospitalized, where he received a lung transplant and was restored to the ability to "huff and puff and blow any house down" (Clark 2003:103).

The self-identity of a person born with a disabling condition is influenced by what the child learns early in life from family and peers about the "social construction" of the condition. *Venus on Wheels* (Frank 2000) is a life history of a woman, Diane DeVries, born without arms or legs and otherwise in good health. Her parents raised her as a normal child, albeit differently abled. She briefly used prosthetic limbs in childhood but found them to be uncomfortable and clumsy and decided not to use them. When anthropologist Gelya Frank first met Ms. DeVries, she was a college student, living and working independently. Throughout their research collaboration, she defined herself as a survivor rather than a victim. After graduating, she married and became a well-known activist, protesting the workplace discrimination that she encountered from coworkers.

Individuals who are deaf from childhood and who attend residential schools develop strong identification with classmates, and they often become more interdependent and less individualistic than is the norm in North American society. Interacting with hearing people leads to feelings of inadequacy, whereas interacting with deaf peers "tends to reinforce positive feelings about one's abilities and validate one's worth as an individual" (Becker 1980:41). Essentially, formation of a deaf community is an effective way to meet many emotional and practical needs.

In her ethnographic study of deaf people in California, Gay Becker found that their long-term support networks were tremendously adaptive as her research participants aged. Becoming old often involves decreased autonomy and mobility, and this loss of independence is difficult for many North Amer-

icans. However, the interdependence developed in adapting to hearing loss also proved to be "preadaptive" in adjusting to old age.

### CONCLUSIONS

Adaptation is inherently an ecological process in which relationships among organisms create feedback loops that affect energy consumption, work, reproduction, and mortality. These loops can be described as informational codes: genetic codes for biochemical processes and cultural codes for technological, social, and cognitive processes.

The mode of inheriting cultural codes differs from genetic inheritance, but in both cases information is transmitted, with considerable potential for error and modification. The "poor copying" of cultural forms in intergenerational transmission leads to change and innovation; similarly, encoding errors are responsible for point mutations in chromosomes. It is these "errors" that allow flexibility and variability within populations.

Are all responses to environmental challenges adaptive? The evidence suggests not. Although one could say that a society that has survived must have maintained at least a minimal level of adaptability, to say "what is, is therefore adaptive" is circular reasoning. When we consider human ailments such as allergies, asthma, and autoimmune diseases, we can see the flaws in this reasoning. And history teaches us that humans are capable of maladaptive behaviors on a grand scale through warfare, slavery, and genocide.

Critics of the adaptationist perspective argue that there is too much poverty, deviance, and exploitation to accept the claim that most human responses to environmental challenges are adaptive. Durham (1991) acknowledges that cultural solutions are often nonadaptive. Why do the people of Ladakh continue to consume non-iodized salt? Why do young people in North America continue to smoke cigarettes despite health educators' warnings? In other words, if humans have the capacity to foresee and to avoid problems, why aren't they more successful?

Durham (1991:362–372) explains that two mechanisms, imposition and imperfect choice, account for the evolution of nonadaptive traditions. **Imposition** is the use of coercion, force, manipulation, or authority to bring advantage to some members of a population while being of little or no benefit to others. Exploitative labor relations, conquest and colonialism, and gender inequality are examples of imposition that benefited some and brought suffering to others.

**Imperfect choice** is a mechanism in which decisions are faulty, in part because people do not see the negative consequences of their choices or do not

understand the cause of these negative consequences. The practice of cannibalism of dead relatives at funerals among the Fore of Papua New Guinea, beginning around 1910, turned out to be maladaptive due to the chance introduction of a pathogen that contaminated the tissues consumed by women at these funerals. Once the epidemic took hold, the Fore did everything they could think of, within their ethnomedical understanding of the causes of kuru, to eradicate the lethal disease. They took preventive measures against sorcerers, enlisted the help of curers, and imposed quarantines (Durham 1991:409–414). In other words, they mobilized their social and informational resources in an effort to adapt to the disease. None of their efforts, with the possible exception of quarantine, was effective. Nevertheless, the incidence of kuru declined over the course of forty years due to change in behavior after cannibalism was abolished by the government rather than curative measures.

Human adaptability has a high price. Years ago, René Dubos (1965) expressed dismay that people can adapt to the noise, pollution, and crowding of industrial cities and come to consider the urban environment as normal. Tolerance of adverse conditions is a negative side of adaptability. In considering the variety of primate adaptations, Hans Kummer (1971:90) observed that "discussions of adaptiveness sometimes leave us with the impression that every trait observed in a species must by definition be ideally adaptive, whereas all we can say with certainty is that it must be tolerable since it did not lead to extinction" (1971:90).

The point is well taken. Some ethnomedical practices do more harm than good. Agricultural practices can leave soil eroded or full of parasites. Some people are malnourished because of poor dietary choices. Some are limited by racism or sexism. Yet in spite of these flaws, humans usually maintain a close margin of success in balancing poor or shortsighted choices against wise or fortuitous choices. How we have managed to maintain that narrow margin through cultural evolution will be examined in the following chapter.

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### Chapter Four

# CHANGING PATTERNS OF DISEASE AND HEALTH



Saniyo women and children talk to Pat Townsend in Yapatawi (1967).

(C)

PHOTO BY WILLIAM H. TOWNSEND.

### **PREVIEW**

Culture is the distinctively human strategy of adaptation. At the same time that specific cultures have adapted to specific environments, there has been a general trend for culture to become more complex. This process of sociocultural evolution includes an increase in the inventory of artifacts, ideas, and knowledge, the use of increasingly large amounts of energy from new sources, and population growth.

All these facets of sociocultural evolution have altered human environments and thereby influenced patterns of health and disease. As technology evolved and human population grew, the characteristic settlement changed from a small, mobile hunting-gathering band to a farming village and then to a preindustrial and industrial city. In each of these environments, human populations entered into characteristic relationships with populations of other organisms, including those causing infectious and parasitic diseases. Hunter-gatherers tended to suffer mostly from chronic, endemic infections. As farming settlements increased in size and more people were in face-to-face contact, epidemics of acute infectious disease became significant. Mortality from epidemics became massive in preindustrial cities and their rural hinterlands, as the health profile of plague in fourteenth-century Europe illustrates.

In industrial and post-industrial nations, degenerative diseases suffered by older people took the place of infectious disease as the main causes of death. In addition, new environmental dangers and occupational risks specific to industrial society came into prominence. These chemical and physical hazards are exemplified by the Bhopal and Chernobyl disasters.

The evolutionary overview of demography and epidemiology in this chapter covers several thousand years of human history. To reconstruct this history, medical anthropology draws on several disciplines. *Medical historians* depend on written, archival sources. *Bioarchaeologists* use material remains such as bones and pottery to reconstruct health history in places where written records are lacking. *Ethnographers* help to flesh out the "dry bones" of history and archaeology by describing contemporary people subsisting by hunting and gathering or simple farming, like the Papua New Guineans profiled in this chapter.

### Culture as Environment

Each culture defines a specific environment with unique risks and opportunities for the people who follow that way of life. Consider these patients admitted to an emergency room: a driver injured when his van hit a utility pole, a child poisoned by drinking paint thinner stored in a soft drink bottle, a woman with a gunshot wound from a family fight. Each of these persons has met with **environmental trauma**, a physical or chemical injury. Each was injured by a cultural artifact: automobile, paint thinner, bullet. Culture shapes the environments in which people live and the hazards they face.

Far from the city, another cultural environment presents people with different resources and hazards. The Hadza are hunters and gatherers of wild foods in the dry scrublands of East Africa. The greatest number of severe accidental injuries is to men who fall from trees they have climbed in search of wild honey. Another hazard is the dust of the camps and the smoke of cooking fires, which irritate the eyes of Hadza children, causing conjunctivitis (Bennett et al. 1973).

Although automobiles and honey trees create hazards limited to certain cultures, some environmental hazards seem more nearly universal in their human impact. Earthquakes, for example, endanger people in several geologically unstable zones. In the tropics, palm-thatched houses, built of small timbers and flexible rattan, simply sway with the force of a quake. The people who live in them are likely to survive unless they get in the way of a tidal wave or a mountain landslide. In densely populated agricultural areas, such as the high valleys of the Andes, timber is scarce and houses are built of clay bricks with heavy tile roofs. When these houses collapse under the force of an earthquake, their inhabitants are buried. In industrial societies, engineers can design buildings to withstand moderate earthquakes, but the existing buildings of a city are shaped as much by economic and political factors as by technological know-how. People at work in a tall office building may be safe, while nearby pedestrians may be struck by bricks falling from the facade of an old store. Even though a natural force, such as an earthquake of a given magnitude, is constant from place to place, culture modifies its human impact.

The idea of an evolving interaction between culture and environment is not new in anthropology. Julian H. Steward began to apply this approach in his research in the 1930s and summarized it in his *Theory of Culture Change* (1955). Steward's "method of cultural ecology," as he called it, places special emphasis on the technology for producing food because he found subsistence

systems to be conspicuously related to environmental resources. Ecological and evolutionary studies in anthropology have continued to be strongly identified with the study of subsistence.

Cultural evolution has three facets: increase in *complexity*, increase in *energy flow*, and increase in *population* size and density. Each of these has significant effects on health and disease. The increase in the inventory of artifacts and knowledge is cumulative and accelerating. Over time, footpaths evolved to graveled roads, which evolved to paved highways. Collecting edible seeds from wild grasses evolved to grain farming. The folk healer's collection of herbs evolved to a vast pharmacopoeia. From the point of view of the total system, complexity has increased. However, any individual participant is cut off from much of this by increasing specialization. An assembly-line worker tightening the same few bolts hundreds of times experiences less varied activity in a day than a hunter who repairs a bow, prepares arrow poison, and stalks small and large game. The factory worker controls a fraction of an enormous cultural inventory; the hunter controls virtually all of a much smaller inventory of tools and knowledge.

Another dimension of sociocultural evolution is the flow of energy through the system. Leslie White (1969) was the major anthropological proponent of the view that cultural evolution is fundamentally characterized by increasing amounts of energy flow. In small-scale societies, heat from firewood and food energy transformed into muscle power represent the entire energy flow through the cultural system. As culture evolved, animal power, wind power, and water power were added in agricultural societies. In industrial societies, fossil fuels vastly expand the flow of energy through the system. As this chapter moves from low-energy, hunting-gathering communities to high-energy industrial society, the implications of this aspect of technological evolution for human health will emerge.

### The Study of Population

The growth of the human population in the twentieth century was astounding. It took many thousands of years for the human population to reach its first billion about the year 1800, just over 100 years to its second billion by 1927, less than 50 years to add another 2 billion (by 1974), and 25 years to add another 2 billion (in 1999). (See Fig. 4.1.)

**Demography** is the study of human population. It involves the collection and statistical analysis of information about populations, with a great deal of mathematical precision in the analysis of census data from large, modern na-

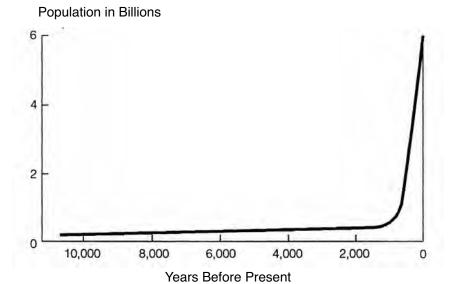


FIGURE 4.1 World population growth.

tions. *Demographic anthropology* uses the methods of demography to study population but is concerned with the kind of small communities typically studied by anthropologists (Howell 1986). These communities are often geographically remote (or even remote in time, when studied by paleodemographers). The data may also be incomplete because people may not know their own ages and there may not be written records of events. Demographic anthropologists can use techniques that help to cope with these limitations of their data. Just as anthropology borrows methods from demography, demography gets from anthropology the information that intensive fieldwork can provide about how people make the decisions that affect fertility, mortality, and migration (Kertzer and Fricke 1997; Johnson-Hanks 2007).

The following profile gives an anthropologist's glimpse into a small community in Papua New Guinea similar to both hunter-gatherers and tropical forest farmers. This population had an extraordinarily high rate of infant mortality. Living in a modern society as we do, where fewer than one in a hundred children now die in infancy or childhood, it is sometimes difficult to realize that the expectation that nearly all children born will live to adulthood is only a recent development.

## ROFILE: INFANT SURVIVAL IN A PAPUA NEW GUINEA SOCIETY

Life is full of hazards for Saniyo infants in lowland Papua New Guinea. Until recently one infant out of ten was killed immediately after birth. Of those who remained, one out of three died of infectious disease as an infant or toddler.

The Saniyo live along the Wogamus River, a small tributary of the Sepik, which is a vast muddy river flowing through equatorial swamps. (See Fig. 4.2.) They live in small villages of thirty to forty people in one or more houses built on low hills rising out of swamp forest. Food is provided by the sago palm, which grows wild and abundantly in the swamp forest. Women process the pith of the palm into sago, a starchy staple food (Townsend 1974). To balance the diet, men hunt and both men and women fish, gather wild fruits, vegetables, and insects, and grow a few vegetables and fruits. Pork from both wild and tame pigs is a main source of protein, though the tiny quantities of fish are more dependable on a daily basis.

Pat Townsend began a study of the people and culture in 1966. Townsend, then a graduate student in anthropology at the University of Michigan, and her husband, Bill, a civil engineer, spent more than a year observing the way of life of the Saniyo (See chapter-opening photo.) The central purpose of the research was to describe food-getting activities and how they were related to culture and ecology. The study established closest contact with the 234 people speaking the western dialect of the Saniyo language, but the whole language group included little more than 500 people. The language had never been described by linguists, was unwritten, and had no written grammars or dictionaries. Much of the research time was spent simply establishing communication. At the time they were first studied in the mid-1960s, the people had just begun to encounter steel axes, money, Western medicine, and Christian missionaries. All these had been present for decades along the coast and in the densely populated highland valleys of Papua New Guinea.

Through interviews, Townsend recorded complete reproductive histories for the twenty-five women whose childbearing years were over. They might have neglected to mention a child who died many years ago if the naming system did not permanently record each child's order of birth. When a child who was present was called "number-five-daughter," daughters one through four must be accounted for. Women were willing to talk about births freely. These twenty-five women had given birth to an average of 5.3 children, with a range of one to ten (Townsend 1971). Marriage occurred within a



FIGURE 4.2 This map of the island of New Guinea in the South Pacific shows the location of the Saniyo-Hiyowe. The highlands location of the Fore, discussed in the kuru profile in Chapter 2, is also shown. The island of New Guinea is located immediately north of Australia and south of the equator. It is the second-largest island in the world, exceeded in area only by Greenland. The eastern half of the island is an independent nation, Papua New Guinea, which includes the smaller islands to the east. The western half is under Indonesian government.

few years after puberty. It was usually monogamous and very stable: none of their marriages had been disrupted by divorce.

In a society without a concept of dates and ages, it is difficult to determine the intervals between births or the total length of the reproductive span. Crudely estimating the ages of women and their children suggests that the reproductive span lasts only about twenty years, which is about two-thirds as long as in populations living under better conditions of nutrition and health. This was obviously a factor reducing the total number of births.

When a Saniyo-Hiyowe woman had only one child, gossips usually said that someone had given her a drug to induce sterility. Nothing is known about the scientific or magical properties of this "barrenness ginger." One man was said to have given it to his wife because he was too crippled with yaws to want any children, and another was said to have given it to his sister out of pique at not getting a fair share of bridewealth for her marriage.

One major limit on fertility was the postpartum taboo. Until their infant was ready to be weaned, parents were not supposed to have sexual intercourse. This taboo lasted at least two years, ideally, though it was difficult to

know how carefully it was observed. People are concerned about the nutrition of older infants because of the scarcity of good weaning foods. In fact, the conventional question about a child was not "Does he walk yet?" or "Does he talk yet?" but "Does he eat sago yet?"

If births were not properly spaced and an infant is born before the older child was judged ready for weaning, the new infant might be killed. Nearly one-quarter of infant deaths were the result of infanticide. When a mother judged that her older child still needed breastfeeding, she strangled the newborn with a length of vine. A seriously deformed infant was also killed at birth.

Infanticide affected three times as many female infants as males. Although in other parts of the world infanticide may be concealed or punished, these women did not hesitate to report it, although they did regret that the killing was necessary. When one looks at the high rates of mortality from infectious disease, especially malaria and pneumonia, complicated by marginal nutrition, one cannot help but regard their assessment as accurate.

Of 132 children born to the twenty-five women, fifty-seven died in infancy or early childhood (roughly under five years of age), a mortality rate of 43 percent. Even making allowance for infanticide, girls were more likely to die in infancy than boys, which makes one wonder whether boys received better care, though Townsend did not observe any neglect or abuse of infants.

Although they believe that all infants are vulnerable to harm from ghosts and evil spirits, the Saniyo think that baby girls are especially vulnerable to the ancestral spirits whose voices are the sounds of secret flutes blown in the men's cult house. The death of a little girl was likely to be given this explanation. The health of infants of both sexes may be affected by food taboos prohibiting some kinds of meat to women during pregnancy and during lactation at times when the infant is sick.

The result of the unbalanced infant mortality was that in the whole population of 234 in 1967, males outnumbered females 130 to 104. Women marry at an earlier age than men, so there is no real shortage of marriageable women. This society is male biased in its ritual and ideology even though women make important contributions to family decision making. They also make an important economic contribution: women produce nine-tenths of the food.

High mortality in infancy and early childhood reduced the average number of surviving children to three for each of the women. Even this number would be enough to assure a steady growth in population except that fewer than half the children are females and not all of them survive a full repro-





FIGURE 4.3 The Townsends' fieldwork with the Saniyo-Hiyowe spanned a generation. Sera, the infant shown on the left in a 1967 photo, had her first baby, a son, in 1983 (right). PHOTOS BY WILLIAM H. TOWNSEND.

ductive life. Disease continues to take a toll, and warfare or homicide removed nearly as many women as men in this society.

Between 1980 and 1984, the Townsends returned to Papua New Guinea and restudied the same population. (See Fig. 4.3.) Some cultural changes had come with the occasional visits of Christian missionaries and government representatives to the area, but the subsistence economy and health conditions had changed very little. Interviews with a further twenty-four women who had now completed childbearing indicated that the levels of fertility and early childhood mortality were as high as in the 1960s (Townsend 1985).

One might ask whether it was infanticide that kept this population from growing. Infanticide could have that effect, particularly because it tends to remove more females who would otherwise have the babies in the next generation. This population impact was blunted in this case, however, because the likelihood was so great that the infant who was killed, and perhaps an older sibling as well, would have died anyway. By the 1970s infanticide had been suppressed, yet the larger number of infants dying from disease counterbalanced this.

It should be noted that early childhood deaths are not as numerous in coastal and highland areas of Papua New Guinea where malaria and other mosquito-borne diseases are less prevalent and in areas with better access to medical services. In urban areas of Papua New Guinea infant mortality is

less than one-tenth as high as in the rural community profiled above. The national population of Papua New Guinea grew by 2.4 percent per year from 1970 to 2006, while isolated pockets of rural population like the Saniyo were stable or declining. ©

The profile above includes a unique record of the practice of infanticide. It is usually not possible to gather such direct and reliable statistics of infanticide because governments and missionaries have been quick to suppress it. Indirect evidence of female infanticide is present in many populations in the form of skewed sex ratios, with males greatly outnumbering females in the younger age groups. Most societies forbid infanticide except in well-defined circumstances such as the birth of a deformed infant or twins.

In the Arctic, disproportionate gender ratios in the nineteenth and early twentieth centuries led ethnographers to infer that female infanticide was common. Among the Netsilik of the central Arctic, a 1902 census counted 138 boys and 66 girls. However, censuses for some groups showed more females; nine Baffin Island groups had a ratio of 76 men to 100 women in the nineteenth century (Smith and Smith 1994), probably due to high death rates among male adults.

Some anthropologists question the validity of the Netsilik data, suggesting that census takers could have misidentified some girls as boys. It was not unusual for a family without sons to train a daughter to help with hunting and other male tasks (after puberty she would normally marry and assume female roles). Inuit naming customs could have added to the confusion for census takers. After a person died, the first child to be born would be given the deceased's name, regardless of gender. Then family members addressed the child with terms specific to the gender of the deceased. Thus, a girl could be called "son" or "grandson" (McElroy 2008).

From a demographer's point of view infanticide is technically part of infant mortality rather than birth control, but it functions as an alternative to abortion. With the development of new reproductive technologies it has become possible to practice sex-selective abortion in the same way that formerly infanticide was practiced. The census of 2001 showed a pronounced deficit of young girls in several provinces of north India. This provided indirect evidence that amniocentesis and ultrasound were being used in this way, despite legislation passed in 1994 in India that made the use of prenatal diagnostic tests for this purpose illegal. Even in sophisticated urban families, sons are preferred for the higher status they confer. The custom of dowry, once

limited to certain Hindu castes, has spread widely through Indian society as a means of upward mobility, reinforcing the view of girls as an economic and social burden to their families (Patel 2007). In China even more than in India, the smaller family norm makes it even more important to ensure the birth of a son.

Causes of death vary in different environmental and cultural settings. The patterns in this variation are discussed throughout this book. Here we need only emphasize that the *timing* of death is of importance for population growth. The mortality that has the biggest demographic impact is death at an early age, before reproduction. And it is this infant and juvenile mortality that has undergone the biggest changes in the last century. Average life expectancy at birth in the United States increased from about thirty-five years in the 1780s to fifty years in 1900, seventy in 1960, and seventy-seven in 2000. This change was almost entirely due to the reduction of the death rates of infants and children by protecting them from infectious diseases and malnutrition. The other industrial nations were able to reduce infant mortality even more than the United States, where the children of the urban poor remain at risk. Table 4.1 compares infant mortality and life expectancy at birth in several countries. The lowest mortality levels are found in Japan and the Scandinavian countries, and the highest are found in war-torn, low-income countries such as Sierra Leone, which was still suffering the effects of a protracted civil war that began in 1991 and displaced more than half of the population from their homes.

Warfare disproportionately kills children. During the Persian Gulf War of 1991, the Allied forces, including the United States, boasted of "surgical" air strikes, high-technology weapons precisely aimed at military targets to avoid hurting civilians. A survey of Iraqi households showed that infant and child mortality in Iraq was three times as high during the war as during peacetime. The highest increases were in the north, among Kurds, and in the south, among Shiite Muslims. These were the groups that had been forced to flee their homes as refugees. Between January and August 1991, more than 46,900 children died in Iraq who would not have died without the war. The main cause of child deaths was diarrhea, related to the disruption of water and sewage systems that depended on electric power that was destroyed early in the war (Ascherio et al. 1992). The pattern of mortality was somewhat different following the 2003 invasion of Iraq, when many more deaths were attributable to direct violence, particularly by gunshot wounds to adult men. Household surveys indicated excess mortality of more than 600,000 Iraqis of all ages in the first four years of the war (Burnham et al. 2006).

TABLE 4.1 Infant Mortality Rate and Average Life Expectancy at Birth in Selected Countries, 2006

Country	Under 5 Mortality	Infant Mortality	Average Life Expectancy (years)
Sierra Leone	270	159	42
Afghanistan	257	165	43
Ethiopia	123	77	52
Kenya	121	79	53
Papua New Guinea	73	54	57
India	76	57	64
Nepal	59	46	63
Mexico	35	29	76
Ecuador	24	21	75
China	24	20	73
Russian Federation	16	14	65
Costa Rica	12	11	79
United States	8	6	79
Canada	6	5	80
Japan	4	3	82
Sweden	3	3	81

Source: UNICEF, The State of the World's Children, 2008. (Accessed May 6, 2008, at http://www.unicef.org/sowc08/fullreport.htm.) Note: The Under 5 Mortality Rate is the probability of dying between birth and exactly one year of age expressed per 1000 live births. Life expectancy is the number of years newborn children would live if subject to the mortality risks prevailing to the cross-section of population at the time of their birth.

If the birth rate exceeds the death rate, a population will grow; if death rates exceed birth rates, the population will decline, and if the situation is not reversed, the population will eventually become extinct. The number of Native Americans of New England declined from about 36,500 to about 2,400 in 300 years of European settlement on their lands. This decimation is most carefully documented for the islands of Martha's Vineyard and Nantucket, where the Native American population was reduced at a rate of about 1.5 percent per year during the colonial period (Cook 1973). Much of the mortality occurred in two severe epidemics: plague in 1617 and smallpox in

1633. Tuberculosis, dysentery, and warfare with settlers contributed to the year-by-year decline.

Massive depopulation of the Polynesian population of Hawaii followed the visits of Captain James Cook beginning in 1778. The islanders were decimated by tuberculosis, syphilis, gonorrhea, typhoid, influenza, measles, mumps, whooping cough, and smallpox. From a precontact population estimated at 800,000, the population fell to 130,000 by the time of the first official all-island census in 1830. It continued to fall, bottoming out at about 37,000 in 1900 (Stannard 2000).

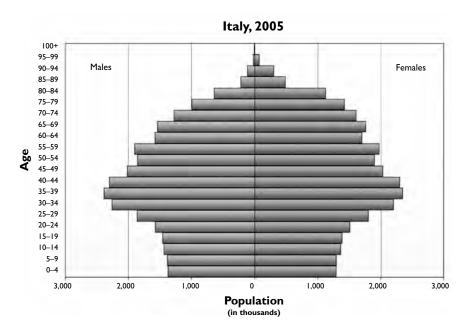
The growth rate of the total world population reached a peak of over 2 percent per year during the 1960s. Since then growth has slowed somewhat, dropping to 1.2 percent per year by 2006. The slowing of growth was due partly to the increase in death rates from HIV/AIDS in many countries but more to the sharp decline of birth rates in newly industrializing countries such as Thailand, Brazil, and Indonesia. The average annual rate of growth among the industrialized countries in 2006 was 0.6 percent, while it was 2.5 percent or more in the least-developed countries (UNICEF 2008).

Populations that are growing rapidly have a different age structure than those that have experienced declines in fertility. This can easily be seen as a *population pyramid*, a kind of bar graph that arranges population data by age and sex. (See Fig. 4.4.)

Population growth rates reflect primarily the difference between birth rates and death rates, along with the initial age distribution (the number of women in their reproductive years). Migration is another factor that is sometimes a significant influence on the growth rate. The largest of these population movements are precipitated by warfare and civil disruption that lead refugees to flee, usually from one impoverished country to its equally impoverished neighbors. Other international streams of migration include those from lower-income countries seeking employment in Europe and North America. These have been of special interest to medical anthropology because of the challenges that host countries encounter in providing appropriate health services to the new ethnic minority groups.

### Life and Death in Hunter-Gatherer Camps and Farming Villages

Until about 10,000 years ago, all human societies were sustained by hunting and gathering. Nomadic foragers have nearly disappeared, but remaining



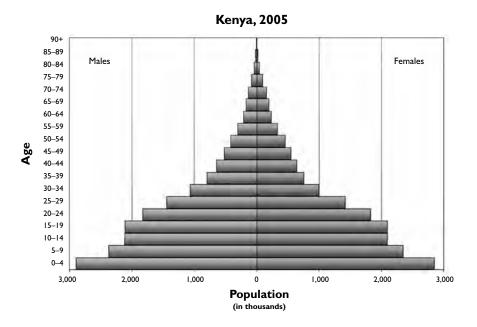


FIGURE 4.4 Population pyramids of rapidly growing Kenya and zero-growth Italy. Source: United Nations, World Population Prospects, 2004 Revision.

groups offer clues to the human past. They also provide clues to the ways humans adapt to extremes of climate, because the peoples who maintained themselves as foragers into the twentieth century lived in extreme environments: deserts, deep tropical forests, or arctic and subarctic cold. These habitats were inhospitable to expanding populations of farmers and herders.

Regardless of environment, foraging populations were alike in the small size and temporary nature of their settlements. In small and briefly occupied camps, sanitation is not as serious a problem as in larger, more permanent communities. More important, in small isolated populations, epidemics of acute disease dependent on direct person-to-person contact cannot readily occur. If a disease such as measles were introduced into a camp, it quickly spread through the group. Then, finding no more susceptible individuals, the disease-causing organism died out.

Given this limitation, what sorts of infectious diseases were prevalent in foraging populations of the remote past? Certain parasites have probably been with humans throughout history, since closely related forms are shared with the other primates. Some of these are head and body lice, pinworms, and many intestinal protozoans. Other diseases that can maintain themselves in small groups of hunters are *zoonoses*, diseases of non-human animals that can be transmitted to people. For example, yellow fever is predominantly a disease of jungle monkeys that is incidentally transmitted to humans.

Organisms causing disease can also maintain themselves in small groups of people if the disease organism lingers to infect newly susceptible individuals who are born into or join the group. Malaria is one of these diseases, as are many of the *helminthic* diseases; that is, diseases caused by worms. In other words, small isolated populations are likely to avoid *epidemic* disease, occurring widely and suddenly throughout the community. Their diseases are more often *endemic*, occurring continuously at low levels.

Present-day hunters no longer live in a world of hunters. Instead, they live in close and prolonged contact with farming or herding peoples and the outposts of industrial civilization. This contact has exposed them to new diseases. They have lost much of their land and mobility. Often they survive only in a kind of symbiosis in which they provide foraged products in exchange for agricultural and industrial products.

As far as the hunting-gathering way of life free of these modern influences can be reconstructed, it seems to have been a health-promoting lifestyle. Food was varied and nutritious. Infectious and parasitic diseases were less of a threat than in farming villages. Accidental injury may have been more frequent

among hunters than among other peoples, however, especially in the far North, where drowning, burns, and exposure added to the accident toll. Homicide played a variable role in mortality as well, though large-scale warfare cannot be organized in small-scale societies. Most often, they simply move to avoid conflict.

Hunting populations may not always have succeeded in staying in balance with their resources. It has been suggested that Pleistocene hunters, in combination with climate change, were responsible for the extinction of the mammoth and other megafauna (Barnosky et al. 2004). With the large game animals gone, people turned to hunting small game and seed gathering, and eventually to plant domestication.

Settled farming villages go back about 10,000 years in the Old World and 5,000 years in the Americas (Bellwood 2005:52). The shift from food gathering to food producing had important implications for human nutrition. But simply from a population standpoint, the new circumstances had a significant impact on health. Farming allowed for increased population densities. Villages could be larger. Farming called for more enduring settlements, tied to a site by stores of food from last year's crop and by the need to protect this year's plantings from predators. As people settled down and women no longer needed to cover as much ground in gathering food or moving between camps, children became less burdensome. The work that children did in tending animals and caring for younger siblings made larger families valuable. In settled villages, new problems of sanitation arose and new types of diseases evolved. Mortality therefore increased, but fertility increased even more, producing population growth.

In farming villages, people were in closer contact with animals ranging from purposefully domesticated cows, pigs, and chickens to unchosen companions such as rats, which fed on stored grain, and mosquitoes, which bred in water containers. Agricultural practices modified the landscape and created new and increased opportunities for transmitting old diseases. Clearing land made new breeding places for the mosquito vectors of malaria. Irrigation ditches provided new homes for snails, which harbor the flukes that cause schistosomiasis.

Settled life also opened up the possibility of a new set of transmissible diseases, the *acute crowd infections*. These depend on direct contact between an infected person and a susceptible person, one who has not acquired immunity to diseases such as measles, rubella, mumps, chicken pox, and smallpox. These are called childhood diseases because before immunizations were available, they swept through every few years. Those who got sick were the chil-

dren who had not been exposed during previous epidemics. However, when a crowd disease is transmitted to a community that has no previous experience of this disease, people of all ages fall ill. Many may die, especially if so many people are sick at one time that they overwhelm the ability of others to care for them.

Because the childhood diseases infect humans only briefly, they could all be eradicated if there were no active infections anywhere in the world at some time. In this respect, they differ from chronic infectious diseases, which persist in human carriers or animal populations. This made it possible for the World Health Organization to declare in 1980 that smallpox had been eradicated, after a worldwide vaccination campaign, although laboratories retained specimens of the disease organism.

Disease-causing organisms evolve just as other living things do. In fact, their short reproductive span allows them to evolve rapidly. Probably many of these strictly human diseases of settled life evolved out of closely related diseases of domestic animals (Armelagos, Brown, and Turner 2005). New diseases evolved from previously harmless or mild strains of microorganisms.

The worldwide influenza epidemic of 1918–1919 was probably the most devastating epidemic in history. Two billion people were sick with a very rapidly acting strain of influenza. In the United States in October 1918, 196,000 people died of influenza, almost twice as many in one month as died of AIDS in the first ten years (Radetsky 1991:231). Even today, new strains of influenza regularly emerge from the ideal conditions created in the duck, pig, and fish farms of China, where wild ducks are the primary animal reservoir for the influenza virus.

The 2002–2003 pandemic of SARS (sudden acute respiratory syndrome) also emerged out of south China, moving from Guangdong Province to Hong Kong. SARS spread quickly in this age of global travel, resulting for a time in quarantines in Toronto, Canada. This viral disease (caused by a coronavirus) may have crossed the species barrier to humans through various species of small carnivorous mammals imported from Southeast Asia to China and sold in markets to be eaten as meat. The implicated species include the masked palm civet, the Chinese ferret badger, and the raccoon dog (Bell et al. 2005).

The evolution of disease is especially noticeable in a group of very closely related organisms or a single organism that causes different symptoms under different conditions, such as the **treponemas**, single-celled spiral bacteria causing the closely related diseases yaws, pinta, bejel, and syphilis. *Syphilis*, transmitted by sexual contact, is most destructive of the internal organs and may also be transmitted congenitally. Syphilis emerged as a "new," rapidly

spreading scourge in Europe in the late fifteenth century. Quite possibly it was introduced from the New World, although its origin and evolution have been a long-standing controversy, only now beginning to be resolved by molecular genetics. What may have been a less virulent and nonsexual disease in the Americas, or even perhaps in tropical Africa, was transformed into a virulent, sexually transmitted disease after its spread into Europe (Harper et al. 2008). *Yaws*, a disfiguring skin disease transmitted by skin contact and generally found in moist tropical lowlands, continues to be prevalent among the Saniyo and other New Guineans. *Pinta*, named for its white, blue, pink, yellow, or violet skin blotches, is the mild variant of treponematosis that occurs in Central and South America, and *bejel*, also called endemic syphilis, is most common in the arid Middle East.

### Paleopathology: The Study of Disease in Prehistory

Simply projecting the current health conditions of hunting or farming populations into the past is a risky strategy that is no longer necessary, now that **paleopathology** has developed as the discipline that studies disease in prehistoric populations. Before moving on to discuss health in urban and industrial societies, we will use the methods of paleopathology to look at hunting and farming people of the past.

**Bioarchaeology** links archaeologists' studies of the environment and material culture to evidence in associated skeletal remains, studied by biological anthropologists, to give time depth to the study of the ecology of health. Sometimes even written historical records can be linked to skeletal remains to complete the picture.

About 15 percent of skeletons in a typical archaeological sample from North America show evidence of significant disease, and this is about equally divided among trauma, infection, and arthritis (Ortner 1992:5). Other diseases that leave clear evidence in bone tissue, specifically the many forms of cancer that metastasize to the skeleton, are remarkably rare in ancient populations. This is one line of evidence that the prevalence of cancer sharply increased in the industrial era (Klepinger 1980). Bones and teeth also give evidence of nutritional status that will be discussed in more detail in Chapter 5. (See Fig. 4.5.)

The infections that involve bone tissue and are thus visible to a paleopathologist are usually chronic bacterial infections such as tuberculosis or yaws. The individual whose bones show the lesions of chronic disease clearly



FIGURE 4.5 The teeth of a child who died at age eleven to twelve at Black Mesa in the American Southwest. These permanent teeth show multiple enamel hypoplasias that suggest repeated stress, perhaps due to seasonal differences in the availability of food, that occurred when the child was two to four years old. Photo by Debra Martin.

managed to survive the early, acute stage of disease. The disease that left its mark on the bones was thus not necessarily the one that finally caused death.

The deadly epidemics of acute viral diseases such as measles and smallpox do not show up by direct examination of the skeleton. Although the epidemics that devastated Native American populations after contact thus did not leave obvious marks on bone tissue, nonetheless, the violence of early contact with Europeans is visible in sword cuts on the arm and shoulder bones of Florida Gulf Coast Indian burials (Hutchinson 2006).

Evidence of trauma in skeletal remains may be from fresh injuries that caused the death, old healed fractures, or arthritic inflammation of the joints. A consistent pattern of such injury or inflammation in a population indicates culturally specific stresses. For example, when a series of female skeletons shows many broken arms, the kind of break that occurs when the arm is raised to guard the head from a blow, one may infer a pattern of violence against women.

Patterns of trauma also reflect social inequality. Archaeologists studying the cemeteries of Pontecagnano in southern Italy from the period between the fifth and third centuries BC learned about social differentiation from

grave goods. The tombs of the wealthy contained a large number of these—knives, coins, beads, and other ornaments—while the poor had few or none. From skeletal evidence, rich and poor alike seem to have had adequate nutrition in childhood and to have grown to similar adult stature. The poorer males, however, showed many signs of trauma: broken bones giving evidence of violence and heavy manual labor (Robb et al. 2001).

Another rich source for the bioarchaeological study of inequality is the population of Native Americans who lived at Dickson Mounds in Illinois from about AD 950 to 1300 (Goodman, Martin, and Armelagos 1992). During this time, the inhabitants of Dickson Mounds shifted from seasonal hunting-and-gathering camps to a larger, more permanent village with farming as well as continued hunting and gathering. Halfway through this time period, both the burial goods and the garbage heap begin to show evidence of trade with Cahokia, a Mississippian ceremonial center about 100 miles to the south near the present-day city of St. Louis.

Bones and teeth from burials at Dickson Mounds show declining nutrition, health, and life expectancy. It appears that the Dickson inhabitants were trading food for luxury goods such as shell necklaces from their more powerful neighbors. In the later period there are also more broken arm bones and arthritis, suggesting harder work and more strife, the price they paid for being a peripheral part of a larger economic system.

Osteoarthritis has been studied in skeletal populations. The stress put on joints by repeated activities is one factor in the development of this common condition in older persons. The elbow and knee are the joints that are most distinctively affected. The elbows of Inuit skeletons show the same pattern of osteoarthritis as baseball pitchers, presumably because of their subsistence activities such as throwing harpoons (Jurmain 1999).

Paleopathologists have thus begun to learn about patterns of work and occupational injury. In the early Neolithic farming village of Abu Hureya, in northern Syria, occupied about 9,000 years ago, women's foot bones show grossly arthritic big toes. The skeletal remains of forty-four adult women give evidence that women knelt on the ground to grind cereal grains on the stone mills that were also found in the archaeological site. The stress of long hours grinding grain showed in damage to the women's big toes. It also showed in noticeable bulges where the deltoid and biceps muscles attach on the arm bones, enlargement of the knee joints, and injuries to the vertebrae of the lower back of women. These signs were found only in *women's* bones: It appears that men did not grind grain very often.

The coarsely ground grain at Abu Hureya damaged the teeth of both men and women. They did not have many decayed teeth, but the condition of their worn and broken teeth was probably due to biting down on hard grains or small stones while eating cooked cereal, prior to the invention of sieves that remove this grit. In later times at the same site there was less tooth wear, suggesting that they had learned to weave baskets, sieves, and mats for sifting and carrying their grain. The baskets themselves are too fragile to survive in an ancient site. Basket-weaving skills are evident from the teeth of a few women, apparently the basket-making specialists, who had grooves in their front teeth from holding canes as they worked (Molleson 1994).

### Beyond the Skeleton: Icemen and Mummies

Paleopathologists usually must depend on bones and teeth, but under unusual conditions where a corpse has remained frozen or covered by the peat bog, soft parts may be preserved. No ancient remains of this kind have captured the imagination more than the 1991 discovery of the Tyrolean Iceman, in the Alps near the border between Italy and Austria. His body was preserved by freezing for more than 5,000 years in a gully covered by glacial ice but protected from damage by flowing ice or water, the oldest naturally mummified remains ever found (Spindler 1994; Fowler 2000).

Stray grains found in the Iceman's clothing and equipment confirm that he was from a community that grew wheat and barley at lower altitudes. They herded sheep and goats in seasonal mountain pastures, as well as hunting and foraging. For food on his journey, he carried some dried meat from an ibex, a wild mountain goat. He had tools in his backpack and belt pouch: a copper axe; an unfinished bow and a quiver with fourteen arrow shafts; a flint scraper; blade and drill; a bone awl and antler spike; and birchbark containers. He wore fur clothing, a grass cloak, and leather shoes stuffed with grass for warmth.

The forensic specialists and anatomists who have been working with the Iceman, whom they nicknamed Ötzi, have learned a great deal about his health. His bones suggest that he was probably about forty years old, but he already shows some signs of hardening of the arteries that nowadays would only be expected in an older man. He had no dental caries, but the heavy wear on his teeth, from eating stone-ground cereals, is also consistent with an age of forty. In life he was probably about 5 feet 4 inches (160 cm) and possibly weighed about 110 pounds (50 kg) before his corpse became dehydrated in the ice.

Well-healed fractures show that he had broken five ribs on his left side some years before his death and more recently four ribs on his right side. After a decade of speculation on the cause of Ötzi's death, computerized tomography (a CT or CAT scan) of his left shoulder located a small arrowhead beneath his upper left shoulder that indicated he died of the bleeding from an arrow wound (Pernter et al. 2007). DNA analysis of food residues in his intestines indicated that his last two meals were meat from ibex (wild goat) and red deer along with cereals and other plant foods (Rollo et al. 2002). Blue tattoos on his back, legs, and feet are near joints that showed some degeneration when x-rayed. This leads to the guess that these tattoos were not decorative but rather a folk treatment for the pain of arthritis. He also carried pieces of birch fungus, used in European folk medicine until the present time.

In ancient Egypt and Peru, where conditions are very dry rather than icy, mummies also give evidence of a wider range of diseases than would be known from bones alone. Mummies have shown evidence of arteriosclerosis, smallpox, and schistosomiasis (through the eggs of parasitic schistosomes in the kidneys). Paleopathologists working with the mummy of a woman who died 1,000 years ago in Peru found DNA from the bacteria that cause tuberculosis in lesions in her lungs (Salo et al. 1994). This is the clearest evidence that tuberculosis was indeed present in the Americas before Columbus, although deformations of bone had suggested that this was so before DNA provided more definitive evidence. Researchers have also identified the DNA of other pathogenic organisms associated with ancient humans, including the organism causing Chagas' disease in a 4,000-year-old mummy from South America (O'Rourke, Hayes, and Carlyle 2000). Although tumors can be preserved in mummies, it is quite striking that relatively little evidence of cancer is found in mummies, considering how significant cancer mortality is in modern times. The explanation for increased cancer rates is probably some combination of more people living to old age and more exposure to industrial pollution (Lynnerup 2007).

### Life and Death in the Preindustrial City

The emergence of cities brought even more people into face-to-face contact. In consequence, epidemic disease became even more serious than in villages. Cities grew to several thousand inhabitants in the Old World by 3000 BC and somewhat later in the Americas. These cities were made possible by an intensive agriculture that supported craft specialists, rulers, and bureaucrats

who did not have to produce their own food but obtained it from the peasantry by taxation, rent, and trade. Supplying such large numbers of people with food and water and carrying away their wastes was a challenge; contamination of a single source of food or water could cause widespread illness. Typhoid and cholera are two of the diseases associated with mixing water supply and sewage in cities.

The earliest urban center in the New World, Teotihuacan, was occupied from 150 BC to AD 750. Teotihuacan was a Mexican city of 125,000 to 200,000 people living in apartment compounds like Tlajinga 33 (Storey 1992). The 206 skeletons from Tlajinga 33 probably represent 450 to 500 years of burials for this neighborhood of fairly poor craft specialists. Infant mortality in this urban center was very high: 41 percent of the skeletons were those of infants. After determining the age at death of the skeletons, the pale-odemographer constructed a life table. Life expectancy at birth was found to be twenty years. A person surviving to age fifteen in the Tlajinga neighborhood could expect to live, on average, twenty-three more years, dying at age thirty-eight. The death rates among the urban poor were so high that Teotihuacan (like that other famous preindustrial city, imperial Rome) could only have maintained itself through migration from rural areas.

The emergence of cities was associated with increasingly marked social stratification and differences between rich and poor lifestyles that led to disparities in risks of illness and death. Such differences do sometimes occur in tribal societies. But in class-stratified societies, disparities in wealth and health become sharper. Contrasts in infant and childhood mortality between rich and poor reflect the interaction of many factors: nutrition, exposure to infection, poverty housing, and availability of medical care. The following profile on the fourteenth century European epidemic of plague shows that although neither rich nor poor can escape the effects of *pandemics* (worldwide epidemics of infectious disease), war, social disorder, and inequality set the stage for these events.

### ROFILE: THE BLACK DEATH \_\_\_\_\_

Possibly the earliest description of bubonic plague is the biblical account in the book of I Samuel of a plague of swellings and rodents that struck the Philistines. The plague later struck the crumbling Roman Empire in the sixth and seventh centuries. And from AD 1348 to 1350, the "Black Death" swept

across Europe and the Middle East, killing more than one-quarter of the population. According to some estimates, England and Italy lost as much as half their populations.

Recently, with the development of new techniques of DNA analysis, it became possible to confirm what the historical accounts had suggested: the Black Death was caused, at least in some places, by the bacteria *Yersinia pestis*, the same microorganism that causes plague today. French scientists studied the dental pulp from unerupted teeth in jaws obtained from fourteenth-century plague cemeteries in southern France. The bacterial DNA they recovered from within the dental pulp corresponded closely to modern plague bacteria (Raoult et al. 2000).

Bubonic plague is fundamentally a disease of field rodents, but sometimes people accidentally get in the way of the normal rodent-to-rodent transmission of the bacteria causing the disease. (See Fig. 4.6.) Many different kinds of rodents are infected with the plague bacillus, among them marmots, ground squirrels, prairie dogs, chipmunks, gerbils, rats, mice, and rabbits (Stenseth et al. 2008). Sometimes the disease is spread from field rodents to species of rats that live in closer association with humans. The bacteria are spread by fleas. When a flea feeds on an infected rodent, its gizzard becomes blocked with masses of plague bacilli so that it cannot suck blood effectively. In trying again to feed, it regurgitates blood and bacilli into another animal.

Various species of fleas can transmit the plague bacillus, but one of the most effective is *Xenopsylla cheopis*, a flea of an indoor rat, the black rat. This species of flea is more likely to venture out and attack humans than some other flea species, which prefer to stay in the rat's nest. When a rodent dies of the plague, its fleas leave the cold body and look for another host. Now a human may be bitten and infected. The person develops the symptoms of bubonic plague—fever, pain, and swollen lymph nodes in the groin or armpit, which are called buboes—and usually dies within a few days as infection of the blood stream leads to heart failure. Under some conditions the plague infects the lungs; this pneumonic form is extremely infectious because the sick person's cough spreads the bacillus to other people.

An outbreak of plague in Asia led to the Black Death. Several rainy years in Russia may have led to a buildup of the flea population in marmots, gerbils, or ground squirrels (Orent 2004). The subsequent spread of plague across Europe from Italy north and west to England in the years 1348–1350 is documented in parish records (Kelly 2005). After two centuries of rapid growth of

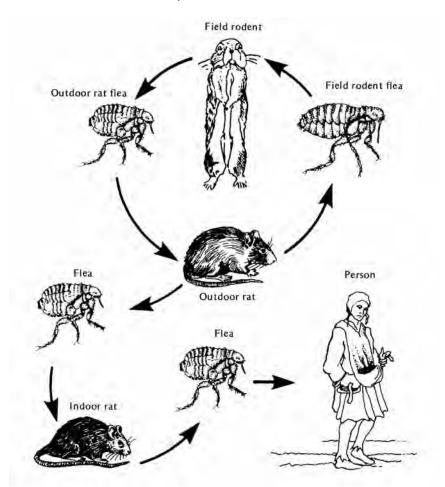


FIGURE 4.6 Cycle of plague transmission. Plague is transmitted from fleas to mammals. The disease is normally maintained in populations of wild rodents in the grasslands and in the populations of fleas associated with them. Under certain conditions, outbreaks of the disease spill over into other rodent populations and affect humans.

the economy and population, several years of famine and economic depression seem to have prepared the way for an epidemic, one which may have included other diseases in addition to bubonic plague. Small but crowded and unsanitary medieval cities such as London provided ideal conditions for disease transmission. The wattle-and-daub houses of the time offered good hiding places for black rats, and stored grain attracted them.

As the plague advanced across Europe, it was regarded as a judgment of God. Astrological observers noted the fateful conjunction of Saturn, Jupiter, and Mars. Jews were persecuted and killed as rumor claimed they had poisoned wells. People fled the plague-ravaged cities for the countryside. Medical interpretation was divided between those who thought the cause was miasma, corruption of the air, and those who assumed that direct contact was the cause and advocated quarantines.

The Black Death decimated both rich and poor in fourteenth century England. Individuals who were more frail, showing poorer nutritional status, were more likely to die of plague than others, as indicated by the paleopathological evidence from cemeteries (Dewitte and Wood 2008). Later plague epidemics began to show increasing class discrimination. Parish records reveal that the highest mortality was in outlying parishes in the crowded, poorly constructed houses of the working poor. As the wealthy built new brick houses in the central cities, plague mortality declined in the richer parishes. During the epidemic of 1665, the Town Clerk of Norwich wrote, "We are in greater fear of the poor than the plague" (Slack 1985:143).

For two centuries after the Black Death, severe plague occurred every several years. In the Muslim empire of the Middle East, the Black Death led to population decline and disruption of the economy (Dols 1977). Several years of extremely high or low water levels on the Nile River combined with the shortage of agricultural workers to produce famine. Muslim beliefs prescribed rather different responses to the plague than did the Christian religion in Europe. While Christians interpreted the plague as God's punishment for sin, Muslims tended to view it as a calamity decreed by an unknowable God. Because the plague was fated by God, flight from it was discouraged.

In the next plague pandemic, which began in the 1890s, over 13 million people died within forty years. The disease spread from one seaport to the next, entering the port of San Francisco and spreading to rat-infested warehouses. Eighty-nine people died in San Francisco in the epidemic of 1907–1908, and plague became established for the first time in the wild rodent population of the United States. 😩

An epidemic of plague broke out in Vietnam during the war in the late 1960s and 1970s. In the 1990s ten to forty cases were reported per year in the United States. Most occurred in the Southwest among people who came in contact with wild rodents such as rabbits or prairie dogs. The plague bacillus in these cases responded to antibiotics, but treatment had to begin promptly.

In the twenty-first century, occasional cases of plague continue to be reported in Asia and South America. Plague in the Middle East and North Africa is sometimes spread by consuming the meat of infected camels (Stenseth et al. 2008). But the largest number, several thousand cases per year, are now reported in rural areas of several countries in Africa.

With rural reservoirs of plague in rodent populations in so many parts of the world, epidemics spreading into populations of city rats are always a possibility. This is particularly worrisome because rats are becoming resistant to rat poisons and fleas to insecticides. Whenever social conditions deteriorate, people may get in the way of an outbreak of the disease in rats, but an even more disturbing scenario is the possible use of plague in bioterrorism, for which these historically feared bacteria are particularly well suited in the industrial era (Orent 2004).

### Life and Death in Industrial Society

When the industrial age began to get under way, population was growing very rapidly. The population of Europe nearly doubled in the hundred years from 1750 to 1850. This population growth was made possible by the cultivation of potatoes in the north and maize in the south, both highly productive crops introduced into Europe from America. In Ireland, especially, the potato went hand in hand with population growth. The population of Ireland grew from 3.2 million in 1754 to 8.2 million in 1845. In addition, another 1.75 million emigrated during these years (Crosby 1972).

There were some checks on population growth. Although fertility was very high for married people, many people delayed marriage until their late twenties or did not marry at all. In addition to the voluntary celibacy of clergy, many of the poor were unable to marry while employed as servants or soldiers. Disease played a role, as well. In Europe from 1750 to 1850, infectious diseases, especially smallpox, plague, tuberculosis, and typhus, were the major cause of death. Though morally disapproved and legally penalized, infanticide continued. Often newborn infants were abandoned. In some of the foundling hospitals established to care for these children in Bologna, Italy, 57 to 70 percent of the infants died in the nineteenth century (Kertzer 2000).

In the crowded, sooty industrial cities of the nineteenth century, infectious diseases were still the leading cause of death. Air pollution contributed to the prevalence of tuberculosis and respiratory diseases in the industrial environment. Studies of children's skeletons from four medieval and postmedieval cemeteries in England showed that child health declined with

industrialization. In the Christ Church cemetery in London, children buried from 1729 to 1859 showed higher mortality, poorer nutrition, and shorter stature than rural areas several centuries earlier (Lewis 2002).

By the mid–nineteenth century, European patterns of mortality began to change. Some of the best statistical evidence for studying historical epidemiology comes from military records. Young soldiers are not typical of the whole population, but they provide good insight into the decline of infectious disease because they are not likely to die except from infectious disease, accidents, or trauma in battle. Military records show that deaths from infectious disease dropped steeply between the earliest surveys in the 1820s and the beginning of World War I in 1914 in both Europe and the tropical countries to which the soldiers were sent. Most of the decline came before scientific medicine and sanitary engineering had much impact. Smallpox inoculation and quinine for malaria helped, but the biggest changes were due to behavioral adaptations such as moving troops to the hill stations of India to escape malaria and improving the water supply to avoid cholera (Curtin 1989).

The decline in mortality that began in the nineteenth century was followed by a burst of rapid population growth, as birth rates greatly exceeded falling death rates. The late nineteenth century and early twentieth century saw high rates of European migration to less densely populated frontiers. After death rates fell and the life chances of individual children began to improve, birth rates began to fall as well. This two-stage shift to the modern pattern of low mortality and low birth rates is called the **demographic transition.** (See Fig. 4.7.) Although it is unlikely that third-world nations will experience a demographic transition identical to that in the original industrial countries, birth rates have declined in many different parts of the world.

The role of medical developments in reducing the toll of infectious disease should not be exaggerated. The most effective techniques to avoid disease in the nineteenth century came from social measures introduced to combat the injustices brought about by industrialization and to provide reasonable working hours, decent housing, pure water, and adequate nutrition. The laboratory sciences made their chief contributions later, well after the infectious diseases were already on a downward trend. Tuberculosis declined long before vaccines and drugs were available. Improvements in social and economic conditions, linked to changes in the biology of the microorganisms, were causal factors (Kunitz 1983).

The history of environmental health shows that change was something of a trial-and-error process. The larger American cities installed waterworks be-

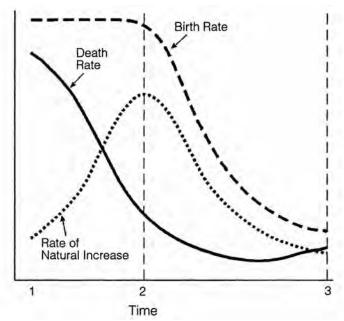


FIGURE 4.7 In a population undergoing demographic transition, the death rate declines before the birth rate, resulting in a period of rapid population growth.

tween 1800 and 1860, but they did not construct sewers until the vastly increased household use of water created problems with flooding and pollution. When they began collecting sewage and dumping it into waterways, they created pollution problems for downstream cities, which in turn had to develop a technology of filtering and chlorinating water early in the twentieth century (Tarr 1996).

By the mid-twentieth century, new vaccines and antibiotics had led to widespread optimism that infectious disease had been all but defeated, and it only remained to distribute these innovations more widely in the poorer countries. The era of infectious disease had given way in a major **epidemiological transition** to the era of degenerative disease such as cancer and cardiovascular disease.

Before the end of the twentieth century, still another epidemiological transition began, with the onset of a new era of infectious disease. The emerging diseases included HIV/AIDS, multidrug-resistant tuberculosis, and a host of lesser-known diseases (Barrett et al. 1998; Farmer 1999; Armelagos et al.

2005). The situation was exacerbated by the decline that had taken place in the public health infrastructure and by increasing economic inequality both within and between countries.

As we learn more about epidemics, it becomes increasingly possible to anticipate them. Usually "new" diseases are not new microorganisms but ones that have been around in an animal population and come into new contact with humans because humans have changed their behavior. Lyme disease emerged in the northeast United States where suburban homes were built in forested areas, bringing people and their pets into contact with ticks that usually fed on deer. Argentina hemorrhagic fever, a virus carried by small rodents, emerged when the grasslands of Argentina were cleared to plant cornfields. Lyme disease and Argentina hemorrhagic fever are examples of emerging diseases, a term applied to the resurgence of infectious disease at the end of the twentieth century

### Chemical Hazards in Industrial Societies

Industry itself has shaped new environments to which the human body is not adapted. The name Bhopal has become a symbol for the hazards of modern industry. In the largest industrial accident ever, toxic gases leaking from a Union Carbide chemical plant in Bhopal, India, killed more than 2,500 people and injured an additional 20,000 in 1984.

Bhopal is a city of 700,000 in Madhya Pradesh, central India. The Union Carbide plant there made pesticides used in India on food and cash crops, particularly cotton. The technology used at the plant was the same as that at Union Carbide's plant in West Virginia, involving the storage of a toxic ingredient, methylisocyanate (MIC). A toxic cloud of MIC and other chemicals exploded from a tank when water accidentally entered the line. Many factors contributed to the accident, including poor design, inadequate training of workers, poor maintenance of an unprofitable facility, the lack of an emergency plan, human error, and possibly even sabotage (Shrivastava 1987; American Public Health Association 1987; Rajan 2002).

Attracted to the area by employment at the Bhopal plant and in businesses catering to plant employees, people had settled in a crowded, unplanned residential area across the road from the plant. Many residents had little knowledge of what was produced at the plant or what the risks were. Many of those who died were asleep in this settlement when the gas exploded in the middle of the night. Estimates of the number who died are disputed, ranging upward

from 2,500 to 6,000 or higher. Even the lower figures made it the largest industrial accident to that time. Emergency health workers were hindered in treating the victims by not being given information about what chemicals might be involved or what treatment was appropriate. The impact of a disaster like Bhopal is as much a product of the infrastructure (settlements, transportation, medical facilities) of the region as of the industrial technology involved.

A meager settlement of 470 million dollars for the 300,000 known victims was reached in the Indian courts in 1989. At the time of this hasty settlement only half of the claimants had been medically examined, and very few of these had pulmonary function tests despite the fact that it was becoming clear that MIC would have long-term effects on their lungs, eyes, and immune systems. An Indian social anthropologist wrote of the court case as silencing the victims, adding to their pain by not allowing them to voice their suffering, while giving authority to the voices of legal and medical professionals (Das 1995). Advocacy on behalf of the victims continues on an international scale, making connections with workers in the petrochemical industry. Those living near plants in West Virginia and Texas asked whether accidents on such a scale might also be possible in the United States (Fortun 2001).

Industrial accidents account for only a part of the health effects of the chemical industry. Thousands of totally new organic chemicals are being synthesized and released into the environment. Because living things have not previously been exposed to these chemicals, adaptation has not occurred.

Among these new chemicals are the pesticides, and the farm workers who apply them are most intensely exposed to their health hazards. Ironically, the move away from persistent pesticides such as DDT to those that break down more quickly has made this problem worse. The newer chemicals are more toxic at the time of application and farm workers rarely wear protective gear. The workers also frequently wash and drink from water supplies contaminated by the same weed-killers and insecticides.

A group of applied anthropologists in North Carolina, working to find ways to reduce farm worker exposure to pesticides, learned that education would be an uphill battle. Farm workers were largely unaware that chemicals could be absorbed through the skin as well as the lungs and mouth. The workers did not know that chemicals continue to be dangerous even after the spray has dried and can no longer be seen, smelled, or felt on the plants. They were mostly concerned with symptoms of acute exposure, such as nausea, headaches, and skin rashes, and unaware of chronic health effects of long-term, low-level exposure. These chronic effects include neurological

deficits, cancer, and sterility. The farm owners were even more poorly informed about the health risks to farm workers (Quandt et al. 1998).

Among those endangered by pesticides are farmworkers who migrate from southern Mexico to northern Mexico to work in fields producing for the U.S. export market. The Mexican workers illustrate vividly the link between population issues and occupational health issues. The "push" factors behind their migration come from the soil erosion and population growth in their home area and the extreme and growing gap between rich and poor in Mexico. The "pull" factors come from the demand for fresh produce in winter in the north (Wright 2005).

Not all chemical hazards are unique to industrial societies. Lead poisoning is a particularly good example of how specific environmental sources may be transformed by cultural changes. Women in the Middle East, India, and Pakistan use *kohl*, a black eyeliner containing lead sulphide. They also use it on their young daughters, even infants. The lead is absorbed into the growing child and can be detected by X-rays as lines on the bones and by simple blood tests. The resulting lead poisoning can cause death, but more frequently it causes mental retardation (Kershner 1985). In other cultures outside the Middle East, children's exposure to lead usually comes from lead-based paint used on houses and toys, automobile emissions, and lead solder on copper plumbing.

Mercury is another toxic heavy metal in the industrial environment. Mercury poisoning is called Minamata disease, named for the Japanese town on Kyushu island where it was first described in 1956. People who ate fish and shellfish from Minamata Bay and the surrounding sea developed numbness in their fingers, toes, and lips and constriction of the visual field. Several people died of acute poisoning, and pregnant women who ate fish from the bay gave birth to children with abnormalities. The source of the pollution was a chemical factory that discharged highly toxic methyl mercury into the water for almost twenty years, until 1968. As much as thirty years after exposure to methyl mercury ceased, many people still showed symptoms of chronic poisoning, attributed to central nervous system damage (Ekino et al. 2007). (See Fig. 4.8.)

Workers in a given industry usually bear the brunt of damage from a hazardous substance. Asbestos fibers that lodge in the lungs produce asbestosis. Those who are most at risk are workers who manufacture asbestos or use it in their work; for example, steamfitters in shipyards and auto mechanics who replace brake and clutch linings. Often different substances have effects that interact; for example, asbestos workers who smoke cigarettes have unusually high rates of lung cancer. Stricter regulation of occupational health standards

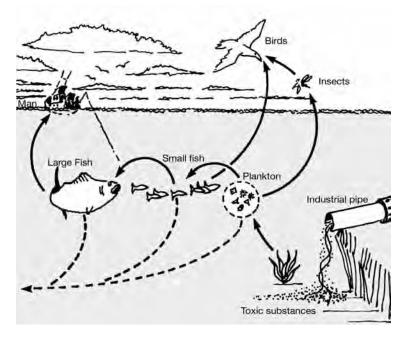


FIGURE 4.8 Toxic substances are concentrated in the aquatic food chain. The highest concentrations are found in the animals on the highest level of the food web, here the fish-eating birds and humans. The bacteria involved in decomposition may also modify the pollutants, making them more toxic.

may reduce exposure to the hazard, or it may simply encourage the company to move the more hazardous operations to newly industrializing countries where occupational health regulations are weaker.

Besides affecting workers, industrial chemicals travel far from their point of origin to affect those who are not employed in the industry. Random samples from umbilical cord blood of ten newborn infants born in 2004 throughout the United States showed measurable traces of 287 of the 413 different chemicals for which they were tested, including pesticides, consumer product ingredients, and wastes from burning coal, gasoline, and garbage. The infants averaged 200 industrial contaminants (Houlihan et al. 2005). Currents of wind and water also carry toxic metals and organochlorines far northward from coal power plants and industry where they reach arctic dwellers, primarily through their diet. The greatest risk is to the developing fetus, where prenatal exposure has been linked to deficits in immune function, lower birth

weight, and an increase in respiratory infections in arctic infants (Van Oostdam et al. 2005).

In addition to the chemical hazards discussed above, new biological hazards accompany industrialization. The bacteria causing Legionnaire's disease are spread through air-conditioning systems, a technological innovation in industrial society. Another kind of bacteria, causing toxic shock syndrome, only became a serious threat to health after the marketing of a new type of superabsorbent tampons created a microenvironment in which the bacteria thrived. Still other bacterial diseases have evolved resistance in the specialized environments created by modern, high-technology hospitals, places where people have come to fear drug-resistant bacterial infections.

Technological evolution also created new forms of transportation that changed the risk of accidental injury and death. While medical anthropologists as such may have had little to say (so far) about car crashes, the work of biological anthropology contributes to making vehicles and other equipment ergonomically more safe and comfortable. Vehicle accidents are the leading cause of death among young people ages ten to twenty-four. The risk is extremely variable among countries. The World Health Organization's (WHO) highest reported traffic-death rates are in El Salvador and the Dominican Republic, at over 40 deaths per 100,000 population, compared with 15.0 in the United States and 9.3 in Canada. Rates are lower in Western Europe (WHO 2004).

### Nuclear Hazards in Industrial Societies

Just as societies choose the benefits of chemicals to increase agricultural productivity despite risk to the biosphere from accidents and accumulated wastes, the attraction of cheap electric power has led to reliance on nuclear technology with similar health and environmental risks. On April 26, 1986, a chemical explosion at the Chernobyl nuclear reactor in the Soviet Union spewed nuclear debris into the atmosphere, high enough to reach the jet air streams 39,000 feet (12,000 m) above ground level. The explosion was followed by a graphite fire that burned for a week, continuing to release radioactivity in the lower atmosphere. Surface winds carried it around Europe and the Ukraine. Thousands of people were evacuated from their homes. Agricultural produce and milk were contaminated over a wide area.

The Soviet government suppressed information about the event so that it remains difficult to know how many died. Several million people in the Ukraine and Belarus were exposed to radiation sufficient to result in increased anemia, leukemia, and other cancers. Already the World Health Organization has reported dramatic increases in rates of thyroid cancer in the children of this region. The fallout covered the Northern Hemisphere. The resulting incremental increases in cancer deaths and genetic damage will continue for many years, though it will not be possible to pinpoint whether any one of these deaths is due to Chernobyl . Meanwhile, residents of the region suffer many indignities as they attempt to understand their health problems and negotiate their way through the maze of assistance (Petryna 2002).

The fallout from Chernobyl adds a fractional load to the low-level exposure to natural background radiation that we all experience every day, for example, from the radon that seeps into basements in areas located on rock formations containing uranium. The results of increased exposure to radiation are increased death rates from certain types of cancer, mutations producing birth defects, and a heavier burden of mild and chronic illnesses. Those who experience the most intense exposure to radiation are those employed in the nuclear industry, but in the end all of us experience the increase of background radiation that results from nuclear technology (Bertell 1985).

Preparations for nuclear war are another source of exposure to radiation. During World War II, most of the uranium used in the Manhattan Project was imported from other countries. In order to develop a domestic source of uranium for the Cold War buildup of armaments, during the 1950s and 1960s uranium was mined on Navajo lands near Shiprock, New Mexico. Many of the mine and mill workers were Navajo Indians who worked under poor conditions of occupational health and safety. Their families were also unknowingly exposed to radioactive dust that came home on the uranium miners' clothing. Still others in the area were exposed to the radioactive mine tailings. Many developed lung cancer, birth defects, and other radiation-related diseases (Johnston et al. 2007). During the period between 1951 and 1962, when nuclear weapons were tested above ground at the Nevada test site, families living in southwestern Utah, southeastern Nevada, and northwestern Arizona were heavily exposed to fallout. Even after above-ground testing ended with the 1963 Limited Test Ban Treaty, exposures to radiation continued from the venting of underground nuclear blasts. The Mormon residents of southwestern Utah developed a significantly higher than average incidence of the types of cancer that are most associated with radiation exposure, especially leukemia and cancer of the thyroid. The ranchers in this area noticed deformed and dying lambs, and soon a high rate of miscarriages and birth defects was also apparent among the human "downwinder" population as well (Boutté 2007). It

is generally the case that those downwind or downstream from an industrial hazard bear a higher share of the cost; the danger is not spread evenly through the society that chooses to use a risky technology.

### CONCLUSIONS

As culture has evolved, its relationships with the physical and biological environment have altered. In this chapter, we have seen how the risks of accidental injury or exposure to harmful substances and interactions with pathogenic organisms differ among hunters and gatherers, settled agricultural peoples, and preindustrial and industrial city dwellers. While medical anthropologists have derived much of their understanding of the evolution of disease patterns by inference from the study of contemporary peoples, some of that understanding comes from historical and paleopathological studies.

The oldest subsistence technology, hunting and gathering, carried with it characteristic patterns of disease, influenced by climate and other local specifics, but everywhere constrained by life in small foraging groups. The shift to agriculture brings with it opportunities for population growth—both families and villages are larger than in hunting societies. But agricultural groups are vulnerable to new patterns of infectious disease, famine, and economic exploitation that hunter-gatherers are able to avoid. Given time, humans have adapted to many of the risks of farming. The growth of preindustrial cities stepped up some of these processes: The massive mortality from epidemic disease in the fourteenth century, for example, must have left a population much altered by natural selection in ways we cannot readily reconstruct. The shift to an industrial system of harnessing energy was accompanied by further acceleration of population growth and pollution. Each change in disease patterns offers new adaptive challenges.

The approach taken in this chapter has built on the concept of adaptation introduced in Chapter 3. Here we have examined the challenges to human health that come along with social and cultural change. In this view, an emerging disease is an indicator that cultural and biological adaptation has not yet caught up with recent changes in behavior that provided a new foothold for the disease. This is equally true whether it is an emerging disease caused by a newly reported virus or an increasing incidence of an already widely known condition such as hypertension or clinical depression.

In this chapter, the focus has been mostly on trauma and disease, the uneasy relationships humans have with their environments. In Chapter 5, the emphasis will be more positive, and the environment will be seen as a resource. The Resources 167

plant and animal species of concern will be food plants and domesticated animals rather than the pathogens and vectors of infectious disease.

### RESOURCES

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### Chapter Five

# THE ECOLOGY AND ECONOMICS OF NUTRITION



Saniyo women prepare sago starch for cooking.

Car.

PHOTO BY WILLIAM H. TOWNSEND.

### **PREVIEW**

Nutrition is heavily determined by ecology and economics. This chapter will develop that theme on a worldwide scale, with studies of subsistence ecology among hunter-gatherers and farmers of the past and present. The first research profile in this chapter will continue the discussion of paleopathology begun in Chapter 4, showing how human skeletal remains reflect nutritional health.

Dietary patterns are shaped by the biophysical and cultural environment. The specific nutritional diseases that may occur are deficiencies related to weaknesses of the staple foods of each region. People who are able to maintain a highly diversified diet tend to have good nutritional health.

Malnutrition in urban areas, and in rural areas where people depend on cash crops, is more closely tied to economic inequality than to the ecology of subsistence crops. Poverty and population growth contribute to protein-calorie malnutrition among disadvantaged children. With cash cropping, a family's nutritional state depends on the food they can afford to buy rather than on what they grow. Because fats and sugars are relatively inexpensive to market in packaged foods, obesity has also become increasingly a nutritional problem of the poor.

In the most extreme case, economic and environmental stresses combine to produce famine. However, national and international politics are even more significant in understanding why famine occurs, as the Ethiopian profile shows.

Different cultures put together different meals and menus from many of the same ingredients, creating symbols of ethnic identity. The chapter discusses the cultural symbolism of food and of non-food items that are also ingested and have an indirect impact on nutrition.

### **Human Foodways and Nutritional Needs**

Central to every culture is its way of obtaining food. Kalahari Desert hunters track game and shoot it with a bow and poisoned arrows. Later they tell the story of the hunt while munching nuts and fruits collected by the women of the band. New Guinea women toil in sweet potato gardens cleared from

tropical forest by their husbands. Peasant farmers in the Andes at an altitude of 11,000 feet (3,400 m) above sea level plant potatoes, one of the few crops that can endure the chilly nights. North Americans choose among thousands of products marketed mostly by large corporations. Increasingly, these corporations control every step of the process of food production and preparation from the farmer's field to the fast-food restaurant.

Nutritional anthropologists remind us that people do not eat protein and carbohydrates, but rather food, whether it is hamburgers and french fries or rice with fish sauce. In this chapter, the focus will be on food: the way it is produced in different ecosystems, the way it is prepared in different cultures, and the way it is distributed in different economies. Each of these factors has certain implications for human nutrition. It will become clear that there are certain characteristic nutritional problems of tropical farmers that are different from those of sedentary office workers.

Generally speaking, what are the nutritional needs for which societies must provide? People need energy, for maintenance and growth as well as for the internal and external work their bodies do. Carbohydrates, fats, and proteins are all sources of energy, which is measured in kilocalories. If there are too few calories, protein will be metabolized for energy. People need protein for growth and tissue repair. People need fats, not simply to provide a concentrated source of energy, but to supply certain essential fatty acids, necessary for building nerve tissue. People need water. They also need vitamins, organic compounds found in very small concentrations in the body. The body cannot synthesize these substances, and if one is missing from the diet or poorly absorbed, its absence leads to deficiency disease. And people need minerals, inorganic elements present either in fairly large amounts in the body such as calcium and phosphorous, or as trace elements such as iron, fluorine, copper, and zinc. Another term for vitamins and minerals is micronutrients, in distinction from the macronutrients (protein, carbohydrates, and fat). Just what amounts of these various nutrients are needed, either as a minimum for survival or for optimal functioning? These vary with individual characteristics such as age, sex, health status, level of activity, and individual idiosyncrasies in metabolic processes. The Recommended Dietary Allowance (RDA), was developed by governmental agencies as part of food and nutrition policies. The RDA is the average daily dietary intake that would meet the needs of most healthy people, of a particular age and gender. The RDA was regularly revised as results from ongoing research became available and as policies changed. It is now being phased out in favor of dietary reference intakes (DRIs), a set of tables that, in addition to minimum intakes, also give 172

estimated average requirements and safe upper intake levels. With many vitamins and minerals, more is not necessarily better. Now that many persons take supplements and eat fortified foods, it has become necessary to calculate tolerable upper intake levels as well; that is, levels of intake that begin to pose a risk of adverse health effects.

If people don't eat enough of the right foods, a shortage of micronutrients at the tissue level eventually shows up as a deficiency disease; for example, the deficiency of iodine, producing goiter, as discussed in Chapter 3. Another common deficiency disease results from a deficiency of vitamin A. This deficiency can produce **xerophthalmia**, the leading cause of blindness in the world today. Adequate consumption of dark green vegetables can prevent it, as can vitamin tablets or inexpensive injections.

### Putting Foods Together: What's on the Menu?

Recommended values are always approximate because the combinations of foods that are eaten affect the absorption of nutrients from these foods; in other words, the **bioavailability** of nutrients is influenced by the whole mixture of foods in the diet. Some leafy green vegetables that are valuable for the vitamins they contribute contain oxalates, chemicals that bind calcium and make it less available for use at tissue level. Iron from hemoglobin in meat is more bioavailable than iron in vegetable, grains, and nuts.

The combination of foods in mixed diets does not always reduce bioavailability; in fact, it can be beneficial. A well-known instance is **protein complementarity**, the combination of proteins from different vegetable foods. Proteins are composed of chains of nitrogen-containing organic compounds called **amino acids**. Most of the amino acids needed for growth and metabolism can be synthesized by the human body, but the eight *essential amino acids* are ones that cannot be synthesized by the body and therefore must be present in the diet. (A ninth essential amino acid, histidine, is required by infants but not adults.)

For protein synthesis to take place in the body, all eight essential amino acids must be present simultaneously in appropriate amounts. If one or more of them is lacking, the amount of protein that can be synthesized will be limited. Protein from a single plant source does not usually match up to the proportions of the different amino acids that the human body needs as closely as protein from meat, fish, egg whites, and dairy products. By combining the protein from several common plant foods, however, a better match can be made. The traditional American Indian diet of maize and beans, or the Mex-

ican equivalent of tortillas and frijoles, exemplifies protein complementarity. Maize is relatively low in the amino acids lysine and tryptophan, while beans are relatively lacking in the sulfur-containing amino acids such as methionine. Although either food eaten separately is an incomplete protein source, if eaten together at the same meal they provide fully adequate protein even without milk, eggs, fish, or meat.

Nutritional requirements are complex. We are constantly learning more about the effects of excesses and deficiencies of particular nutrients. Because these basic needs can be met in a wide variety of ways, human beings have been able to thrive in environments offering very different food resources, as the following sections will show.

### Subsistence by Hunting and Gathering

Much less than one percent of the world's people subsist by hunting and gathering today, yet studies of this foraging pattern have a special importance to medical anthropologists. After all, taking the long-range evolutionary view, humans are basically hunter-gatherers with a brief, recent history of farming and industry. *Homo sapiens* may have existed in essentially modern form at least 50,000 years before people seriously started to farm, about 10,000 years ago.

One striking fact about foraging peoples is that they are as fit and well nourished as they are. Their traditional diets are well balanced and adequate, except for seasonal shortages and bad years. Food is shared within their small communities. This evens out some of the variations in luck and skill among hunters.

Foraging peoples have so much variety in their diet that specific nutritional deficiencies are unlikely. A leafy fern may be rich in vitamin A and iron, a fruit in vitamin C, a root in carbohydrates, and nuts and seeds in protein. The diversity leads to a balanced diet. Typically, the more serious nutritional problem of hunter-gatherers is one of seasonal variation in the foods available. The balance between animal and vegetable foods depends on the resources of the environment. Among the many possible foods from their environment, foragers put together a selection of diet choices that tend to maximize energy efficiency and avoid risk (Winterhalter and Smith 1981).

The highest proportion of animal foods is found in the traditional diet of the northernmost arctic peoples described in the profile in Chapter 1. Immediately to the south of the Canadian Arctic, the First Nations of the boreal forest also traditionally had a predominantly meat diet that has been modified

by the flour, sugar, and canned goods available at trading posts. Although the diets of hunters are high in protein, they are not necessarily high in fat, because game animals are typically lean.

Except in the far north, hunting tends to provide a smaller proportion of total food intake than gathering. The hunter-gatherers living in desert and semidesert regions seldom get as much as one-third of their calories from animal foods. In these regions, anthropologists have studied the subsistence of foragers in the Great Basin of North America, the deserts of central and western Australia, and the Kalahari Desert of southern Africa.

One group of desert foragers were the Ju/'hoansi, a group of Bushmen (also called !Kung San) first studied by Richard Lee in the 1960s in southern Africa. (See Fig. 5.1.) The Dobe area in which they live includes some 110 species of edible plants: roots and bulbs, berries and fruits, melons, nuts, edible gums, and leafy greens (Yellen and Lee 1976). For most of the year, the vegetable foods were so plentiful that the Jul'hoansi could bypass those that are less tasty or more difficult to collect, concentrating on the most attractive ones. At the end of the dry season, when food is scarce, people walked longer distances to get these foods or ate less desirable foods such as bitter melons, roots, and edible gum.

The major, year-round food resource of the Ju/'hoansi was the mongongo nut. Mongongo nuts are a high-energy food, rich in protein and polyunsaturated fats and similar in nutritional value to soybeans and peanuts. Other wild vegetable foods, such as the tsin bean and the baobab nut, are equally nutritious. About two-thirds of the diet came from the vegetable foods gathered by the women.

During the wet season, the Ju/'hoansi dispersed to small camps of one or two families at seasonal waterholes to take advantage of hunting and gathering throughout a wide area. The habitat is a semidesert, in which areas of thorny shrubs alternate with open woodlands. During the dry season, they congregated in larger camps of thirty to fifty people, building their grass huts near one of the eight permanent waterholes in the Dobe area. Food resources were less abundant when the people were this closely settled.

The Ju/'hoansi prized meat highly. It contributed about one-third of the caloric value of their diet and a little more than one-third of the protein during July 1964, when Lee weighed all the food that came into camp (Lee 1968). Another anthropologist, Edwin Wilmsen, studying the diet yearround at /ai/ai waterhole in 1975-1976, learned that there were very few months in the year when meat contributed as much as Lee had observed. Frequently meat contributed only a tenth of the caloric value of the diet

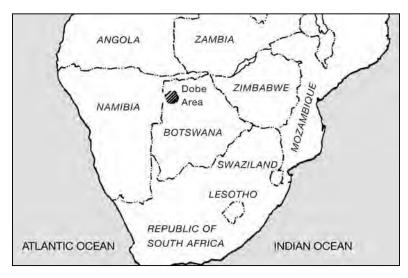


FIGURE 5.1 Map of southern Africa. The hatched area shows the Dobe area.

(Wilmsen 1982). In contrast to the abundance and reliability of vegetable foods, game animals were scarce and unpredictable, making meat more of a luxury food.

Lee had observed that hunters made an average of one kill per four mandays of hunting, while gatherers got some food every time they went out of camp. (See Fig. 5.2.) One way that hunters adapt to the risks of hunting is to concentrate on the game animals that give the highest return for their time and effort. The big antelopes and giraffes are difficult to stalk and likely to escape even when wounded. Success is greater with smaller mammals, especially the warthog, the small antelopes, the spring hare, and the porcupine.

The dry season shortage of calories seems to be the only nutritional problem the Ju/'hoansi had. This energy shortage accounted, in part, for why they were short and slow to mature, though otherwise healthy as adults. This quantitative deficiency was not matched by any qualitative deficiency in their diet. The mixed diet of these hunter-gatherers protected them against specific deficiencies, just as their wide knowledge of the diverse food resources of their environment helped buffer them against hard times.

As studies of the Kalahari continued, anthropologists found fewer and fewer people who depended primarily on wild foods. When Wilmsen returned to the Kalahari in 1979–1980, he found that wild foods constituted only about 20 percent of the diet at /ai/ai. Milk from local cattle, corn meal,





FIGURE 5.2 (left) Bushmen discussing a hunt near Tsumkwe, 1986. (right) Woman foraging firewood from the camelthorn tree on a settler ranch in Namibia.

Photos by Robert J. Gordon.

and store-bought sugar were now the main foods. The seasonal pattern of weight loss and of births was no longer apparent. Young children benefited most from the grain and milk available to settled Bushmen . Early childhood mortality (ages one to four) dropped sharply among settled Jul'hoansi compared to nomadic Jul'hoansi.

Rather than being seen as isolated hunter-gatherers, anthropologists now understand the Bushmen as a frontier people, violently dispossessed of their land, who might have shifted back and forth among foraging, pastoralism, wage labor, and trade in copper, salt, and ivory as opportunity afforded, perhaps for centuries (Wilmsen 1982, 1989). It would therefore be a mistake to take them as living representatives of our "stone age ancestors." Nevertheless, their diet has been taken, along with similar hunter-gatherer diets, as an influential model for contemporary nutritional advice.

Proponents of Darwinian medicine argue that humans have been eating foods such as dairy products, separated fats, and cereals for only 10,000 years or so, and our bodies have had a relatively short time to adapt to such a diet.

Therefore, it should not be surprising that diabetes, cardiovascular disease, and other chronic diseases have become common. Foods more like those our Paleolithic ancestors ate may be optimal for humans. Such a diet would emphasize lean meat, fish, nuts, vegetables, and fruit (Lindeberg, Cordain, and Eaton 2003). It might well include a wide variety of insects, particularly caterpillars, termites, and grasshoppers. Although Western cultures are irrationally prejudiced against them, insects have always been important foods for humans and other primates (Morris 2008).

### **Nutrition in Prehistory**

Living populations of non-human primates and human hunters and gatherers can give us some insights into our past, but it is increasingly possible for human biologists to reconstruct the diets and nutritional status of the past more directly. For example, *collagen*, the main protein found in bone, can be subjected to chemical tests that reveal the diet of the people whose skeletons are excavated from a prehistoric site. Different groups of plants show distinctive ratios of isotopes of carbon, and different isotopes of nitrogen can suggest changes in the amount of meat eaten from one era to the next.

With or without associated skeletal remains, *coprolites* can also give information about nutrition. Chemical tests help the researcher decide whether the fossilized fecal specimen is of human origin. Diet is indicated by parts of food that passed through the digestive tract unchanged, such as the scales of fish and bits of animal hair. The undigested outer coats of seeds show whether a person had been eating blackberries or chili peppers. In some cases they even show how the food had been prepared, as when crushed grains indicate pounding and split grains give evidence of grinding.

Episodes of nutritional stress are recorded in the teeth and skeleton for paleopathologists to decipher. One kind of evidence is **Harris lines**, lines that show up on X-rays of long bones. Another indicator of nutritional stress is **enamel hypoplasias**, spots or bands where the enamel of the teeth is thinned. During periods between birth and age seven when growth is disrupted by food shortage or infectious disease, the development of the teeth is interrupted. By studying changes in the frequency of these lesions in bones and teeth at different levels of an archaeological site, paleopathologists can suggest changes in nutritional health over time.

The teeth of a sample of 111 adults from the Dickson Mounds site in Lewiston, Illinois, showed enamel hypoplasias. During the years that this site was occupied from AD 950 to AD 1300 the population density increased, and

the people had fewer kinds of food resources and became more exclusively dependent on maize. Over the same time period, the number of enamel hypoplasias increased, revealing the increasing nutritional stress (Goodman, Armelagos, and Rose 1980). Other paleopathological findings back up the same conclusion about declining nutrition at Dickson Mounds, for example an increase in porotic hyperostosis, a sign of iron deficiency anemia. In this condition, the flat bones of the cranium and the bone above the eye sockets become thickened and porous. (See Fig. 5.3.)

The interpretation of porotic hyperostosis and iron-deficiency anemia is complicated by the possibility that it may be less the result of an iron-poor diet and more the result of increasing exposure to infections that comes with densely settled populations that accompany agriculture (Stuart-Macadam 2006). In any case, the findings of paleopathology support the picture given in Chapter 4 of the negative health consequences of the shift from hunting and gathering to agriculture. Paleopathological data from archaeological sites in many parts of the world show an increase in infectious disease and in

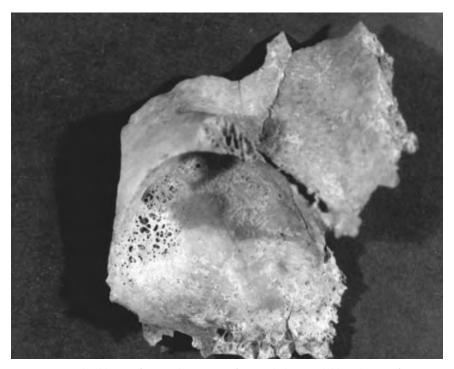


FIGURE 5.3 Orbital lesion of porotic hyperostosis from a Black Mesa child aged two to four years. PHOTO BY DEBRA MARTIN.

episodes of nutritional stress with the adoption of farming (Cohen and Armelagos 1984). Although hunters and gatherers experienced seasonal shortages, their skeletons show that they were not as vulnerable to famines as farmers were.

The quality of life for Native American farmers declined as they shifted from foraging to more dependence on corn in coastal Georgia, for example, prior to the arrival of Europeans. The skeletons showed that the people were shorter and had more signs of infection. The teeth showed more decay as well as enamel hypoplasia that reflected poorer nutrition. However, along with the shift away from foraging they experienced a reduced workload, visible in a lower frequency of osteoarthritis, that is, less wear and tear on the joints. Perhaps because they still ate reasonable amounts of fish, they did not show poor iron status (porotic hyperostosis), as many inland farming peoples did (Larsen 2000).

Anemia and porotic hyperostosis sometimes result from factors other than diet and infection, as researchers discovered at Poundbury Camp, a site in southwest England occupied in third to fifth century Roman times. The more than 1,000 skeletons buried at Poundbury Camp represent one of the earliest Christian cemeteries in Britain. Thirty percent of the skulls showed porotic hyperostosis, mostly in the eye sockets, indicating that many of them experienced anemia during their lifetime, probably in early childhood. The bones do not seem in other respects to indicate malnutrition, and animal bones at the site show that many kinds of animals were used as food, including ox, sheep, goat, pig, and deer. The staple foods at Poundbury Camp were a coarse flat bread and porridge made of several grains: wheat, barley, and oats. Lead poisoning may have been more important than diet in causing anemia at Poundbury, for the bones show a high concentration of lead. Lead was mined nearby and used in pipes, cooking utensils, coins, toys, and wine-making (Stuart-Macadam 1991).

One skeleton may tell us something about the presence of a disease or a type of injury at a particular time and place, but a whole population of skeletons yields epidemiological and demographic information. By estimating the age and sex of individuals buried in a cemetery, judgments can be made about average life span. This field of study is called **paleodemography** (Buikstra and Mielke 1985).

The following profile illustrates the techniques of paleopathology and paleodemography in the context of a single site in the American Southwest. Much of what was learned from the skeletons at this site has to do with the adequate nutrition and healthy functioning of the population rather than with disease and death.

## ROFILE: DRY BONES: HEALTH IN SOUTHWESTERN PREHISTORY

By studying disease through the archaeological record we can see how long-range changes in the environment, diet, and political and economic structures affect populations. One example of archaeological study is Black Mesa in the American Southwest. A group of archaeologists and physical anthropologists excavated and studied Black Mesa in northeast Arizona between 1967 and 1983, just prior to the destruction of the sites by the Peabody Coal Company, strip-mining the area under lease from the Hopis (Martin et al. 1991).

The Southwest is best known for spectacular cliff dwellings built by the Anasazi over 1,000 years ago. The remains of these big cultural centers can still be seen in national parks at Mesa Verde and Chaco Canyon. The majority of the Anasazi did not live in these big centers but in small outlying farming communities. Black Mesa consisted of small villages occupied by farmers of the Anasazi cultural tradition from about 800 BC to AD 1150. The people lived in small settlements in the floodplain area of streams feeding into the Little Colorado River. Seasonally they camped out in higher areas on the mesa.

Subsistence at Black Mesa was a mixture of farming, foraging wild plants, and hunting deer and rabbits. The main crop was maize, ground into cornmeal on stone metates with cylindrical stone manos. The extent to which beans and squash were used is not known for certain, but remains of both are found in the middens.

Black Mesa is a near-desert environment of pinyon and juniper trees and sage brush. There are a dozen edible species of wild plants and grasses. The area is a desert plateau at an elevation of 1,800 to 2,700 meters. Rainfall fluctuates greatly from year to year, and water is easily available only during the rainy seasons of late summer and midwinter.

The skeletal remains studied at Black Mesa include 172 burials and another 100 or so isolated human bones. The skeletons included all age categories. About 10 percent were infants. Just over half were adults, and the average life expectancy at birth was estimated to be twenty-five years. Almost all of the burials found at Black Mesa came from the early Pueblo period, from AD 800 to 1150, though there are signs of camps and tools that suggest people moved through the area at times during the 500 years prior to this. The Pueblo period is dated by both ceramic and tree-ring data.

By using new techniques for analyzing bone collagen, researchers are able to estimate the proportion of the diet that came from different foods. The ratio of stable carbon isotopes in collagen from the Black Mesa skeletal remains indicates that C4 plants, that is, maize and amaranth seeds, were much more important than other plants, such as prickly pear, yucca, and agave that are also found locally.

Another chemical test, the analysis of nitrogen isotopes in collagen, indicates that during the years that Black Mesa was inhabited, as the population grew, beans may have begun to replace meat as a source of protein. Analysis of the bones for trace elements such as strontium and zinc is also consistent with the idea that the Black Mesa diet included some meat, but not much and not on a regular basis.

The physical anthropologists who observed and measured the shape and size of the skeletons from Black Mesa used many techniques that give insight into the adaptation of individuals and populations. From the length of children's long bones such as the femur they could tell that growth seemed to slow around ages two to four. Adult men averaged 5 feet 4 inches (163.4 cm) and women 5 feet (153.5 cm). Although this achieved stature is comparable to other indigenous people in this area, chronic malnutrition may have been prevalent in the form of growth disruption, nutritional anemia, and chronic infections.

Evidence of biomechanical stress in the bones of both men and women shows that hard work was done by both sexes. In fact, the muscle ridges and areas of built-up bone on the arm bones (corresponding to use of the biceps) are as pronounced in women as in men. Of course, physical work that places stress on bones is not necessarily negative for health. Activity helps to prevent the bone loss called osteoporosis that occurs in sedentary people and leads to leg and hip fractures in later life. Studies of the pre-Spanish period at Pecos Pueblo, near Santa Fe, New Mexico, show that bone strength was maintained among older men and women and fractures were rare. Pecos women showed an asymmetry in the leg bone structure between right and left legs that was not found in the men, probably indicating that women engaged in an activity like hoeing that placed different biomechanical stresses on the left and right sides (Ruff 1991).

Although both men and women worked hard on Black Mesa, in other respects their skeletons revealed differences between them. For example, men had more dental abscesses and tooth wear but women had more caries. Judging by this difference, men may have eaten a gritty, abrasive, rougher

diet with more wild plants and women may have eaten more sticky gruels that would cause decay. Most people had lost a tooth before they were twenty-five and were completely toothless by fifty years of age.

The teeth of the Black Mesa burials tell the most detailed story of the stress of living in a marginal environment. Permanent teeth show lines indicative of enamel hypoplasias. No matter at what age the individual died, young or old, these lines are the permanent markers of the disease and nutritional stress that the individual had experienced as a young child when those teeth were developing. The specific teeth that were developing at the time of stress are the ones that show enamel defects, so the whole dentition is a kind of autobiography or health record. Almost everyone showed these enamel defects. This is consistent with other lines of evidence that show that infectious disease and iron deficiency were chronically present.

Almost all Black Mesa individuals (87 percent) showed some evidence of anemia in the form of porotic hyperostosis, porous, coral-like lesions that are found on certain bones: the cranium, the eye orbits, and the ends of long bones. The lesions come from the thickening of a layer of bone called the diploe. This thickening happens when a person's red-blood-cell-producing bone marrow proliferates as a response to iron-deficiency anemia. Iron-deficiency anemia is most common worldwide during childhood and in childbearing women. The Black Mesa skeletons reflect this: children and young women are the groups with active lesions. In older individuals the lesions have healed and only mild pitting remains as evidence of past stress. (See Fig. 5.4.)

Interpreting the evidence of violence is currently the most controversial aspect of studies of ancient bone in the American Southwest. Black Mesa skeletal material shows very little evidence of violence, but that is not the case at other sites in the Southwest. Some archaeologists have suggested that the ancient Anasazi, the ancestors of the Pueblo Indians, practiced cannibalism, at least briefly around AD 1150 in the area around Mesa Verde. It might have been a ritual introduced from Mexico or perhaps a tactic of warfare when immigrants were attempting to terrorize residents and take over their land. A coprolite from one such site seems to provide an additional line of evidence in support of the cannibalism hypothesis, since enzyme tests of the fecal material reveal *myoglobin*, a protein found in human muscle tissue. This, if accurate, indicates that the person who defecated on the cold hearth before abandoning the site had been eating human meat, and not much else (Marlar et al. 2000).



FIGURE 5.4 Healing, or remodeling, of porotic hyperostosis on the parietal bones at the back of the head of a teenager, aged sixteen to eighteen, from Black Mesa. Photo by Debra Martin.

Debra Martin and her colleagues have been among the strongest critics of those who suggest that broken, disarticulated, and burned human bones are always signs of cannibalism. Martin argues that the prehistoric pattern of violence was much more complex and researchers need to be cautious about feeding the media appetite for the macabre (Dongoske et al. 2000).

The Black Mesa research covers only a few centuries in the prehistory of the American Southwest. In time, people stopped making seasonal visits to the dry, inhospitable area. For these few centuries Black Mesa gives us a close-up view of the outskirts of a farming population that was increasing and making slight shifts in subsistence. For a longer and broader picture, many such studies are pieced together.

### Subsistence in the Humid Tropics

The subsistence of tropical forest peoples is perhaps easier to misunderstand than that of desert or arctic dwellers. We tend to think of the tropical forest as rich because it is lush with vegetation, but high temperatures and rainfall create acid soils that are leached of minerals. The tropical plants adapted to

these conditions are consequently high in bulk and low in nutrients. They tend to reproduce vegetatively (by sending out suckers) rather than producing nutrient-rich seeds and fruits. This scarcity of nutrients means that animals are generally few and small, in contrast to the large herbivores of grasslands or temperate forests. Many of the tropical animals, like monkeys and birds, live high in the trees and are difficult to hunt. Despite all these difficulties, small numbers of hunter-gatherers are found in the tropical forests of Africa, Southeast Asia, and South America. All trade with neighboring non-foraging peoples, exchanging forest products such as feathers, furs, and plant resins for agricultural and industrial products such as rice and steel knives.

The differences along the continuum between gathering wild plants, protecting natural stands of useful plants, and actively cultivating plants are subtle. By depending on cultivated plants rather than wild ones, people intervene in the natural process of ecological succession to produce more of the plants that they are interested in eating and using as medicines.

Tropical farmers intervene in this process, just as any Kansas wheat farmer does, but the kind of intervention is somewhat different. In their technique, called *swidden* cultivation, or *slash-and-burn horticulture*, farmers cut the tropical forest with axes and bush knives and then dry and burn the debris. They interplant the crop plants of many species in the mineral-rich ashes of the burned-over field, planting and cultivating with the aid of digging sticks or hoes. After harvesting one or more crops, the farmer moves on to a new clearing.

The major food crops of tropical cultivation, like the non-domesticated plants of the forest, are high in bulk and low in nutrients. They are mostly propagated by cuttings rather than by seeds. The edible parts are most often not seeds but other parts of the plants where starch is stored: usually underground tubers. Some of these plants are shown in Figure 5.5. They include manioc or cassava, sweet potatoes, yams, and many others. In other tropical crops, the edible starch is found in other parts of the plant, for example, bananas and plantains and the stem of the sago palm (Ruddle et al. 1978). Some cereal crops are grown in slash-and-burn cultivation, too, especially rice in Southeast Asia and maize in Central and South America.

The starchy tropical crops are effective sources of food energy but all are poor sources of protein. (Table 5.1 shows the protein-to-energy ratio of several of these foods, along with some cereals, legumes, and foods of animal origin.) What are the nutritional implications of these low protein-to-energy ratios for tropical farmers? First, as long as they have such abundant, reliable

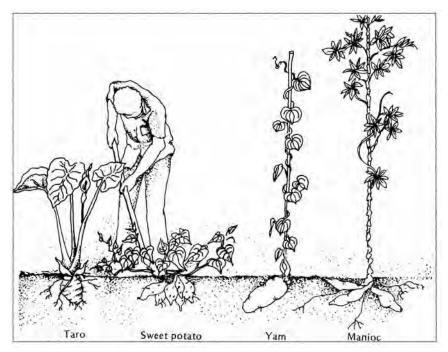


FIGURE 5.5 Major tropical root crops.

sources of carbohydrates, they may easily meet their requirements for food energy. In a world where many people cannot meet their basic caloric requirements, this is not to be taken lightly. Second, they cannot satisfy their requirements for protein and many vitamins and minerals simply by eating larger amounts of their staple foods. The sheer bulk of these starchy foods and the calories taken in would have to be excessive before the protein would be sufficient. This is especially true for children, who need proportionally more protein than adults.

Growing a wide variety of green leafy vegetables, fruit trees, and other crops and gathering wild foods can help to meet the need for vitamins and minerals and liven up monotonous starchy meals. Protein and fat are more of a problem, one most often met by adding meat or fish. Some cultures have met this need in unusual ways. People who use sago palm starch also eat the larvae of beetles that tunnel their way through the pith of the sago palm. The plump, white grubs are a source of fat and protein.

Many tropical farmers keep domesticated animals. For example, in New Guinea farmers who grow sweet potatoes, taro, and yams also raise pigs. Roy

TABLE 5.1
Grams of Protein per 100 Kilocalories in Certain Foods

Sago	<1
Cassava (manioc)	<1
Sweet potato	1
Rice, highly milled	2
Maize	3
Wheat	3
Soybeans	9
Milk, human	2
Milk, cow's, whole	5
Milk, cow's, skim	10
Beef, lean	9
Poultry	14
Fish, freshwater	19

Application: If one were to eat enough sweet potatoes to provide 2,000 kilocalories per day, one would get 20 grams of protein. If one were to eat enough wheat to provide 2,000 kilocalories per day, one would get 60 grams of protein in the wheat.

Source: Data recalculated from B. S. Platt, "Table of Representative Values of Foods Commonly Used in Tropical Countries" (London: Medical Research Council, Special Report Series, No. 302, 1962).

Rappaport's 1968 study of the Tsembaga Maring, a milestone in the development of ecological anthropology, was titled *Pigs for the Ancestors*. The title underscored the fact that pigs were butchered only on ritual occasions as sacrifices to the ancestors. These rituals, Rappaport argued, served to regulate the production and consumption of this scarce animal protein. Although most of the Marings' protein came from vegetables, the pigs they raised effectively converted waste food such as sweet potato peelings into needed protein and fat.

### Agriculture

Most of the food energy and protein for most of the world's people comes from cereal crops such as wheat, rice, and corn. (See Fig. 5.6.) Modern farmers use heavy machinery, petroleum, and fertilizers to grow these crops, but peasant farmers still employ technologies much like those used thousands of years ago. These agricultural techniques are typically more intensive than in slash-and-burn farming of root crops; that is, higher amounts of labor are ex-

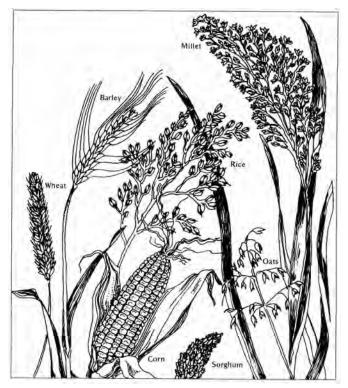


FIGURE 5.6 Major cereal grains.

pended per acre of land. This more intensive use of land may take the form of irrigation, terracing, use of natural fertilizers, or other methods of increasing productivity. Peasant cultivators typically harness the energy of domesticated animals to pull a plow. Domesticated animals also provide dairy products and meat.

Peasant farmers tend to have a diet dominated very heavily by a single cereal staple: rice throughout much of South and Southeast Asia; wheat in temperate Asia and Europe; maize in the New World; millet or sorghum in Africa. Where a single food dominates in this way, its nutritional limitations become the critical nutritional problem for the population. Lack of diversity in the diet leaves poor peasants vulnerable to deficiencies. Specific deficiency diseases tend to have a distribution that reflects the ecology of food plants unless people are protected from deficiency in some way through cultural or biological adaptation.

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Maize (corn) was the principal cereal to be domesticated in the New World. Populations that heavily depend on maize may have two related nutritional problems: (1) pellagra, a disease caused by a deficiency of niacin, and (2) protein deficiency, because the protein in maize has relatively small amounts of the amino acids lysine and tryptophan.

Pellagra is a disease characterized by a distinctive rash, diarrhea, and mental disturbance. It was a disease of poor sharecroppers in the southern United States and in southern Europe, whose use of cornmeal contributed to niacin deficiency. Yet the corn-eating peoples of Central and South America rarely developed pellagra, possibly because they traditionally prepared maize by treating it with alkali (lye, lime, or wood ashes). They did this in order to soften the hull, not knowing that they were improving the bioavailability of niacin and protein (Katz, Hediger, and Valleroy 1974).

The balance among the amino acids found in maize is another nutritional problem for which there was a cultural solution, combining maize and beans at the same meal to achieve protein complementarity. Prior to the Spanish conquest, maize was also paired with the cereal amaranth. Amaranth, like quinoa, but in contrast to other cereals, is rich in the amino acid lysine. Because amaranth dough was used to make images of the Aztec gods and other ritual objects, the Spanish banned the cultivation of amaranth grain (Ortiz de Montellano 1990:108). Other familiar food combinations that pair the complementary proteins in cereals and legumes are the peanut butter sandwich, hominy grits with black-eyed peas, and rice with tofu.

Rice was originally domesticated in Asia and is still the staple for the dense populations of that area. Rice as a staple cereal has its distinctive pattern of limitations. Even brown (unmilled) rice has a rather low ratio of protein to carbohydrates and bulk, so that children can seldom eat enough of it to meet their protein needs. Fortunately, many rice-eating people have fish to help fill the protein gap. In most cultures, white rice is preferred, and the milling and washing process removes the water-soluble vitamins. The resulting deficiency of thiamine can lead to beriberi, a vitamin-deficiency disease that involves inflammation of the nerves. Rice that is parboiled or steamed before milling retains more of its vitamins because the water-soluble vitamins become diffused through the whole grain and are not lost in milling. In India, where parboiling is practiced, beriberi is less prevalent than it would otherwise be. Boiled white rice has become the imported staple for the poorest urban slum dwellers in postcolonial cities from Cape Verde in the North Atlantic to Papua New Guinea in the South Pacific. It is cheaper on many levels, including requiring less time and cooking fuel, than the local foods it replaces (Rodrigues 2008)

Wheat has also spread far from its homeland in the Middle East. While low in the amino acids tryptophane, lysine, and threonine, wheat does not seem to be associated with a particular vitamin deficiency. In parts of the Middle East, poor rural people living on wheat bread do show signs of mineral deficits. A deficit of the micronutrient zinc shows up as retardation of growth and sexual development in young men (Sever 1975). The problem stems from the coarse, unleavened whole wheat bread eaten in the area, bread high in fiber and phytate, a substance that interferes with mineral absorption. The poorest rural people who eat the coarsest bread and have few other food sources are most susceptible.

The nutritional status of peasant agriculturalists thus differs from the subsistence economies that we have discussed previously. Dependence on a single staple food increases their vulnerability to specific deficiencies of vitamins or minerals. In addition to a diet lacking in specific micronutrients, peasant farm families may suffer from seasonal hunger, especially in the months before harvest. Food shortages are not the only reason for seasonal stress. Seasonal variations in the workload, requiring increased energy expenditure, are also a significant source of nutritional stress.

### Pastoralism

Early hunters had domesticated dogs, and with the emergence of farming villages many additional species such as cows, goats, and horses were domesticated. Animals began contributing meat and milk to the diet and draft power for plowing. In the Americas, there were few native species of domesticated animals other than dogs, but when cattle, sheep, and other animals were introduced after the European conquest, they quickly became important.

The amount that meat and milk contribute to the mixed diets of farming peoples depends on both economic and ecological factors. Where people are very short of land, they cannot afford to feed their animals grain or other food that humans could eat directly. On the other hand, animals may serve as storage on the hoof for surplus food that humans would not readily consume. Specialized herding economies exist in parts of Asia and Africa where lands are too arid for farming but animals may still find forage.

Although most pastoralists eat some grains, along with the milk and meat from their herds, the Turkana of northwest Kenya are exceptionally reliant on their livestock. The Turkana are herders of cattle, camels, goats, sheep, and donkeys. Turkana obtain 62 percent of dietary intake from milk and 18 percent from meat and blood. Some milk is drunk fresh, and the rest is processed into buttermilk and ghee (clarified butter), which keeps well in the tropical climate. Only 20 percent comes from wild plants, cereals, and other foods obtained in trade, such as sugar and oil (Galvin and Little 1999).

Turkana caloric intake is low. They must conserve energy by limiting activity and resting a lot, especially during the dry season and during the hottest part of the day. Nonetheless, at other times they are physically active and capable of hard work. Their tall and linear build, with very little body fat, results from the interplay of genetics with the adaptive demands of their climate, diet, and activities.

Significant use of milk as a food for adults has been facilitated by **lactase persistence**, an adaptation that is commonly found in populations with a long history of dairying, such as northern Europeans and East African herding peoples. Populations with this genetic trait have the ability to digest lactose, a sugar found in milk. The intestinal enzyme lactase breaks down lactose into simpler sugars that can be absorbed and metabolized as a source of energy. Lactose also plays a part in the absorption of calcium in the small intestine. This may be especially important in the northern latitudes, where less vitamin D is synthesized in the skin because of less exposure to UVB in sunlight.

Lactase activity generally disappears after infancy. That is, most humans become more or less lactose intolerant after they are weaned. Although they may be able to drink a small glass of milk without much trouble, a large amount of undigested lactose cannot be absorbed and causes diarrhea, bloating, and gas. People who cannot absorb the lactose in milk as an energy source may be able to make use of the protein, calcium, and fat in milk, if they drink small enough amounts to avoid distress and the nutritional losses incurred with diarrhea. Alternately, cultural adaptations such as making cheese or yogurt reduce the lactose content (Wiley 2008).

### Cash Cropping

Farming families who live on the land and produce their own food are not as vulnerable as the poorest slum dwellers, who must buy, beg, or steal their food. But if they do not own enough land for the family's needs, their food supplies may be inadequate. The family may have to market food or sell their labor in order to get cash for clothing and other expenses. Peasants do not produce for themselves alone but are parts of a larger society in which they

support (through taxes, rent, and trade) landowners and town dwellers who produce no food. Even a farm family raising food for others can go hungry.

More serious nutritional problems are faced by the rural family that grows a cash crop for the world market. Every year an increasing proportion of land is planted in cash crops or is taken out of agricultural production to build roads or factories. Often the land devoted to export crops is the best land. During the African drought and famine of the early 1970s it was noted that the cash crops of cotton and peanuts were least affected because they were planted on the best-watered lands (Messiant 1975:67). When land is diverted from producing local foods to producing an export crop, there may be nutritional repercussions.

One example of the impact of cash cropping is northeastern Brazil, where traditional subsistence farming provided a precarious living because droughts were frequent. The dry conditions were well suited to growing an export crop, sisal, used to make twine. An anthropologist and a nutritionist (Gross and Underwood 1971) documented the deleterious effects of the shift to growing sisal on the nutrition of the population. The energy requirements of the workers were high because of their heavy physical labor. Almost all their wages were spent on food, but few families earned enough money to buy sufficient food to prevent their children from being malnourished.

Even low-paid workers in export crops may be able to maintain an adequate diet if they have access to some land to raise food. For example, the workers on sugar plantations in Jamaica studied by Ehrlich (1974) were able to grow their own rice on wetlands unused for sugar cultivation. When the landowners drained the wetlands to increase the area under sugar cultivation, the workers suffered because they were no longer able to supplement their diet of store-bought foods.

Anthropologists have not limited themselves to studying the impact of the export economy on the rural end of the exchange. Sidney Mintz (1985) discusses in *Sweetness and Power* the link between European workers during the Industrial Revolution and Caribbean slaves on sugar plantations. Heavily sugared coffee and tea were the "proletarian hunger killers" that kept the factory workers going for long hours when they had neither the time nor the money to prepare a full meal.

Cash cropping can have positive effects on health if the producers retain control of the profits as well as sufficient land to meet their subsistence needs. In the highlands of Papua New Guinea, the health and nutrition of children improved as a result of the introduction of coffee as a small-holder cash crop. The income from coffee made it possible for parents to buy rice and canned

fish, higher protein foods to supplement the traditional diet of sweet potato, a staple that was too starchy and bulky to promote optimal growth in young children. The areas most involved in cash cropping also had the best access to education and health services (Harvey and Heywood 1983).

Different groups within a rural population may be affected differently by the dietary changes that come with economic change. In the Solomon Islands of the South Pacific, women in traditional villages lost weight under the stresses of garden work and lactation. As communities prospered with cash cropping, female nutritional status changed more than male. Females matured earlier and were fatter than previously, as measured by the triceps (upper arm) skinfold (Friedlaender and Rhoads 1987). In contrast, in nearby Papua New Guinea near the Ok Tedi mine, young village men with new opportunities for unskilled employment grew taller and heavier, while the women left at home to garden without male assistance were nutritionally deprived (Hyndman 1994).

Economic development through the export of food has often been ecologically as well as nutritionally detrimental to local populations. Central American countries dramatically increased their production of beef in the 1960s and 1970s to serve the North American fast-food industry while at the same time decreasing their own per capita consumption of beef. When the beef boom ended in the declining economy of the 1980s, Hondurans took up new, nontraditional exports, such as shrimp and melons, each creating its own environmental problems (Stonich 1993:78-85). Shrimp farming drastically altered the vulnerable mudflats and mangroves of the south coast of Honduras, and melon growing was dependent on escalating applications of insecticides. The limited fresh water supplies of the coastal region were depleted by irrigation for the melons and contaminated by the runoff of pesticides, threatening the new shrimp industry as well as human health. Neither the shrimp nor the melons contributed to the diet of local people, and the profits from their export went increasingly to large investors. All of these beef, shrimp, and melons—are examples of **delocalization** of food production and distribution, the process by which people lose local autonomy in food supply (Pelto and Pelto 1983).

Export cropping combined with local malnutrition is not a new phenomenon. During the Great Starvation in Ireland in 1845 to 1848 after the potato blight, Ireland continued exporting large amounts of grain and livestock to England (Regan 1983). During China's misnamed "Great Leap Forward," Mao was determined to demonstrate the success of his policies. He ordered a doubling of grain exports to the Soviet Union and other communist countries

and cut food imports from 1958 through 1960 (Becker 1996). To meet these goals, officials extracted higher grain levies from the farms and locked them up in state storehouses. Meanwhile, they ignored and actively suppressed information about the famine that was already occurring. It is now estimated that 35 to 50 million Chinese may have died from starvation between 1959 and 1961, making it the greatest famine in world history, but the outside world did not know about it until many years later. The export of food during famine is one indicator that famine has a political dimension and is not simply a direct result of climatic disaster, as the following profile shows.

### ROFILE: FAMINE IN ETHIOPIA \_

The Ethiopian famine of 1984–1985 was the first (and last) that was widely covered on television. Its images of starving children are what come to mind when people think of famine. Celebrities raised money for emergency food aid from a responsive public that all too soon began to suffer "compassion fatigue." People tuned out images of horror and failed to respond as generously to subsequent disasters. In seeking to understand Ethiopian famine, this profile will focus on contributions from anthropologists.

In the midst of widespread hunger it is ethically and practically impossible to do the kind of participant-observer fieldwork that is the trademark of the anthropologist's search for understanding. How could an anthropologist possibly pack a lunch and go out in the village with a notebook computer to observe and interview the villagers under such conditions? Some anthropologists have gotten around this difficulty by going to work in aid programs and only later writing from their experience. Others have interviewed refugees in camps outside the worst-affected areas. Still others have studied famine-prone areas in normal, non-emergency times and have looked at ordinary coping strategies that people use to deal with dry spells and seasonal food shortages. They have interviewed survivors about how they lived during food shortages. Increasingly, anthropologists have also come to study the aid and development institutions directly (de Waal 2002).

One of the most distinctively anthropological contributions to understanding the 1984–1985 famine in Ethiopia is the work of paleopathologists, who help us to put things in a much longer perspective. From their research, it is clear that hungry times are not only a modern problem in the Horn of Africa. Nutritional stress goes back many centuries. Biological anthropologist George Armelagos (1990:140–141) studied the skeletal remains of the

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farming people who lived in Sudanese Nubia, to the immediate west of Ethiopia, between AD 350 and 1300. Young women whose ages are estimated at nineteen to twenty-five showed signs of premature osteoporosis that Armelagos interprets as signs that the calcium was being withdrawn from their bones to support lactation. Remains of the same young women as well as children ages two to six also show porotic hyperostosis, an indicator of iron-deficiency anemia. This skeletal evidence is consistent with historical evidence from more recent times, when there is written evidence of famines occurring at least once in every generation for many centuries, interspersed between times of plenty (Kebbede 1992:157–161).

Although it was not unusual for drought to precipitate food shortages in Ethiopia, in 1984 the consequences were magnified by fighting between several independence movements and the ruling government. The government also undertook a massive program of resettlement, moving people out of the densely populated highlands. While it was claimed that this would relieve pressures from overuse of the land, certainly the resettlement program itself created tremendous suffering. All these factors combined to make the 1984–1985 food shortages worse than earlier ones.

The famine was precipitated by a widespread drought that severely affected the entire Sahel, the band of countries all along the southern edge of the Sahara. The lack of rainfall resulted in a small harvest of grain and legumes, the staples of the Ethiopian highlands. Studies of farmers show how they adapted to these food shortages. When food was short, households began to change their eating patterns, cutting back to fewer meals, often monotonous meals consisting only of boiled or roasted grain. Variety was introduced by collecting wild plants. In Ethiopia the famine foods that were most frequently collected were leafy greens and wild fruits and berries. Some of these are very bitter unless boiled; others cause side effects if eaten in large quantities (Rahmato 1991; Addis, Urga, and Dikasso 2005).

Under stress, families began to sell off their livestock, particularly sheep and goats. If possible, they tried to barter or pawn the animal, in exchange for grain, to a friend or relative in an area not so hard hit, rather than selling on the open market at a low price. Small traders and moneylenders may make a profit off hard times but they perform a needed service in channeling assets away from drought-stressed areas and then returning them. One peasant told Rahmato's field assistant that after the crisis he was able to buy back the same ox he had sold a year earlier (1991:181). (See Fig. 5.7.)

In normal times, when a peasant family needs to raise some cash, they sell young male goats first, but in drought times they sold male sheep first



FIGURE 5.7 Ethiopian farmers using oxen for plowing. The vertical plow they are using is a cheap and effective innovation that improved productivity. It was provided through a project supported by Oxfam America, one of the NGOs that were active in development projects after the famine as well as in relief during the famine. Photo by Diana Fried, Oxfam America, 1992.

because goats withstand drought better. Families divested themselves of other assets such as fuelwood, tools, building materials, and clothing.

As local strategies for dealing with shortages failed, peasants looked for work elsewhere. Men migrated to other rural areas where drought and insect damage had not destroyed crops. They worked on the harvest for pay in cash or grain. Women were more likely to find work in the town, carrying water and firewood for sale, working in beer houses or as servants, or even begging (Pankhurst 1992). Further research into migration within Ethiopia from drought-prone areas showed that people rarely give drought as a primary reason for their movement. They primarily migrated for marriage or to help elderly relatives, but these rural-to-rural moves also removed adult consumers from households in the most drought-prone areas (Ezra and Kiros 2001).

Only as a last resort were peasants willing to go to aid shelters, considered to be centers of disease and death, or to resign themselves to joining the government's resettlement program. Within the shelters, run by many international non-government organizations (NGOs) such as Oxfam and church

groups, food was available from international donors. However, crowding and poor sanitary conditions, added to underlying malnutrition, meant that death rates from infectious disease were high. The most common causes of death were measles, diarrheal disease, and acute respiratory tract infections.

In response to the famine, the government of Ethiopia undertook a massive program of resettlement. Between October 1984 and January 1986, 593,000 persons, from more than 200,000 households, were moved (Pankhurst 1992:56). The plan was intended to reduce population pressure on the environment in densely settled areas in the highlands and to open up settlement in less densely populated lowland areas.

The motives of the government in conducting the resettlement project were heavily political: They wanted to introduce rural socialism with collectivized villages and mechanized farming. The government also needed to be seen as doing something positive and independent, mindful of the fact that the previous government of Haile Selassie had fallen to revolution in part because it was seen as inept and callous in its lack of early response to the 1974 famine.

The resettlement program was portrayed in the international media as brutal, forced relocation. Resettlement was denounced by many groups overseas, especially in France, England, and the United States. One of these groups was Cultural Survival, an organization founded by American anthropologists to protect the rights of indigenous peoples (Clay, Steingraber and Niggli 1988). Many countries and aid agencies did offer help in the resettlement program, regarding it as preferable to give assistance even under the terms set by the totalitarian government than not to be able to help the suffering at all. Those who opposed it objected that it was a political tool to undermine resistance to the government. Peasants in some places were resettled by coercion, but social anthropologist Alula Pankhurst observed that most had come voluntarily to the village she studied (Pankhurst 1992).

The hastily executed resettlement plan resulted in much disease and death. Highlanders were exposed to lowland diseases they had not previously encountered, such as malaria, onchocerciasis (infestation with a parasitic worm causing river blindness), and yellow fever. Other environmental health problems were caused by sand flea bites and damage to the lymphatic system from walking barefoot on the basaltic clay soils of the resettlement area (Kloos 1990).

In 1986, as farms began recovering, whether the farmers had stayed at home or were returning home from another area, they faced common problems. Peasants in Wollo said that the biggest problems they faced were the shortage of oxen for plowing, shortage of seeds, and their own poor health.

Non-government organizations were most helpful at this stage of the famine by providing the draft animals and seeds to get farms going again. In Wollo, most peasants chose to reduce risk and labor by planting sorghum and maize even though traditional crops such as teff, wheat, lentils, and peas sold at higher prices (Rahmato 1991:195).

The more than 600,000 Ethiopians who had taken refugee in neighboring Sudan during the war and famine remained in Sudan until 1993, when they too began returning home. Highland peoples found that their former lands had been given to others, and they needed to resettle in lowland areas in order to have access to land and minimal help until their first harvest (Hammond 2004).

Anthropologists are most known for micro-level studies of the sort that give insight into how farmers make choices about whether to move or stay as famine begins and what crops to plant as it ends. This micro-level approach needs to be linked with macro-level issues, that is, the world-system that supported the war that led to starvation (Reyna 1991). During the Cold War, the major powers competed for influence in the area. Until the 1974 revolution, it was the United States that supported the military buildup of Ethiopia. After 1974, the Soviet Union supplied arms. By the time of the famine of 1984, more than 40 percent of Ethiopian government expenditure was being spent on the military.

At the end of the 1990s, Ethiopia was engaged in a border war with neighboring Eritrea. Three years of drought led to renewed food shortages prior to a bumper harvest in 2001, followed by depressed grain prices that discouraged farmers from planting grain. When drought returned, an even greater famine ensued in 2003. In times of food shortage, health workers tracked elevated levels of mortality among children under five, who were dying of measles, diarrhea, and starvation. The border war with Eritrea hampered delivery of relief food, as well as continuing to divert scarce government resources to the purchase of arms. Ethiopia might be able to produce adequate grain if it were stored in good years. Instead maize surpluses in good years were exported to meet debt-service obligations for money that had been borrowed abroad, mostly to finance military expenditures. Famine recurred in Ethiopia in 2008. The rains were late in coming and food stores were again inadequate. In addition, shipments of free overseas surplus grain had so depressed local prices that farmers now had little incentive to plant more (Perry and Addis 2008). While the government leaders and the details change, famine was again the result of the interplay of international and domestic politics with climate and disease ecology.

War-related hunger continues to stalk the Horn of Africa. In addition to the media images of rock stars and starving children, however, research indicates that more appropriate images are those of soldiers and power-hungry politicians and of undernourished peasant farmers actively seeking to make a living through a variety of survival strategies such as gathering wild plants or migrating for work. Children are the main victims, but the diseases from which they die during a famine are the same infectious diseases that children in poverty experience everywhere, even when the TV cameras of the world are not watching.

# **Industrial Agriculture**

Much of the food relief provided to Ethiopians suffering from famine came from the stored grain surpluses of industrialized countries, providing a further example of dietary delocalization in shipping foods long distances. When famine recurred in Ethiopia in 2000, much of the grain that was shipped from the United States was genetically modified grain, unwelcome in the overseas markets of Europe and Japan.

Genetically modified (GM) food crops are currently the most controversial issue in the agriculture of the industrialized world. GM organisms are created by transferring genes from one organism to another. Within a period of a few years after their introduction into the U.S. food supply in 1995, GM plants had taken over a large part of the corn and soybean crop. Initially they did not cause much controversy in the United States, despite vocal rejection of such foods in Europe. Plants that are engineered to be resistant to a specific herbicide allow for heavy use of that herbicide to eliminate weeds from a field without damaging the crop. Other genetic modifications made squash resistant to viruses, delayed the ripening of tomatoes, and improved the oil in soybeans.

One danger of GM foods is that they may expose people to foreign proteins and thereby produce unanticipated allergic reactions. GM foods were introduced essentially without regulation in the United States, without testing and monitoring to ensure their safety for human health. Ecological concerns include how the GM plants might affect wild plants, soil invertebrates, beneficial insects and other wildlife. Superweeds and new resistant pathogens might be created. Polluting the gene pool of wild relatives of crop plants in the countries of their origin is also a concern. Ethiopians worry about protecting the gene pool of the wild relatives of barley, and Mexicans are con-

cerned about genetically modified corn cross-pollinating with their native corn varieties.

Genetic experimentation is not limited to plants but has begun with several fish species. The development of faster growing fish for fish farms, or fish with greater disease resistance, raises the danger, already observed with hatchery fish, that these fish might accidentally be released into ecosystems with wild fish. Escaped fish could compete for food with and even outbreed native species, yet produce young that are not well suited to surviving the full range of conditions in the wild.

In a parallel development, industrial-scale dairy farmers in the United States continued to inject their dairy cows with recombinant bovine growth hormone, rBGH, to increase milk production, even after research indicated potential cancer hazards. Canadian and European authorities were more cautious than the U.S. Food and Drug Administration (FDA) and recommended against eating dairy products from animals given hormones. Prior to the introduction of recombinant DNA technology, industrial livestock production was already causing health concerns through the extravagant use of antibiotics to foster the growth of animals.

Factory farms that produce hogs and poultry are now among the most polluting industries. In North Carolina and Iowa, where the hog factory farms are concentrated, environmental disasters have followed illegal or accidental dumping of animal manure into streams and rivers. The bacteria that contaminate waterways have evolved resistance to the antibiotics that are used heavily at the farms. Nearby wells were contaminated and neighbors suffer from odors and respiratory illnesses exacerbated by pollution (Durrenberger and Thu 1997; Thu 2001). The eastern shore of Maryland, the center of the poultry industry, has similarly endangered the waters of Chesapeake Bay.

While strengthened environmental regulations may resolve the worst of the pollution problems, the economic implications of the factory farms are difficult to reverse. Large factory farms have driven most of the small family-owned farms in the United States out of business. They have done this not only by economies of scale or efficient production but by taking a loss on their own farms, driving down the wholesale price of meat, and taking their profits on meat processing. Today's meat industry has a high degree of vertical integration, that is, the same mega-corporations control everything from the animal feed to the chicken or hog farm to processing and packaging the meat. The meat-packing industry also has the highest rate of occupational injury of any industry, with the use of sharp tools under pressure for rapid production and assembly-line butchering that can lead to repetitive-motion damage.

Industrial farming is highly productive, insofar as large amounts of food can be produced at relatively low economic cost with low labor requirements but high energy and pollution costs. Anthropologists, whose perspective is conditioned by their familiarity with the long worldwide history of the development of farming, tend to join the environmentalists in expressing caution about the sustainability of industrial farming, with its dual threats to ecosystems and to the knowledge held by small farmers.

The industrialized diet is a product of a system in which food processing and distribution are controlled by large companies. Through advertising and marketing their brand-name foods, they change food habits, staying within the cultural tradition but shaping it in ways that increase profitability. Increasingly, the food-processing companies control the farms and fast-food restaurants, so that they dominate the entire process from field to table. Whether controlled by a large firm or owned by a family, farms in industrialized societies are involved in a very different kind of food production from the subsistence farms described in earlier sections. They are larger and involve a much smaller percentage of the population, less than 5 percent of the work force in contrast to 90 percent or more of the work force in traditional societies. This decrease in the input of human energy is accompanied by a much greater increase in the input from other energy sources, mostly petroleum. These energy sources power farm machinery, produce fertilizers and pesticides, and ship food long distances.

The profits of the food industry largely depend on processing and packaging and not on producing the raw food. Advertising and marketing techniques influence people to buy the foods that offer companies the highest profits. A major factor in the shift to more highly refined and processed foods was their longer shelf life and ease in shipping, both of which increase profitability. Many of the chemical additives serve the same purpose, adding color and flavor to increase sales. The addition of sugar, salt, and fat increases consumer prices much more steeply than manufacturing costs.

Highly refined foods are more concentrated sources of calories than foods that contain large amounts of bulky indigestible fiber. Consumption of sweeteners and fats, which are highly concentrated sources of food energy, is high in the United States. The distinctive fact about the American diet, in addition to the high intake of sugars and fats, is the *sources* of protein, more than the total *amount* of protein. Because protein in the wealthy nations comes more from animal than plant sources, it is accompanied by a high intake of animal fats. In addition, industrial processes for producing high-fructose corn syrup have made this the most common sweetener for soft drinks and a wide variety

of other foods. Hence, the epidemic of obesity in the industrialized world is partly the result of an industrialized food supply. With the globalization of food supply, this industrialized diet of energy-dense foods has rapidly been exported throughout the world.

# The Global Epidemic of Malnutrition

Malnutrition is an imbalance in the consumption of nutrients needed for good health. It takes several forms: underweight, overweight, and deficiency of specific nutrients. By this broad definition, half of the world's people are malnourished: at least one fifth are underfed, another fifth are overfed, and perhaps as many as half (including some overlap with the underfed and overfed) are deficient in vitamins and minerals (Gardner et al. 2000). For example, in the United States a significant number of adults, many of whom are also overweight, also lack calcium. This deficiency can lead to osteoporosis, periodontal disease, and other problems. This situation became more marked as people substituted cola beverages for milk. Even without dietary surveys, it is obvious that the U.S. diet has inadequate calcium; the total amount of calcium in the marketed food supply falls short of the calcium needed by the population (U.S. Department of Agriculture 2008). Worldwide, deficiencies of iron (causing anemia) and iodine (causing goiter and brain damage) are most prevalent.

# Overweight and Obesity

About two-thirds of Americans are overweight or obese. Overweight is defined as a body mass index (BMI) of twenty-five or over, while obesity is defined as a BMI above thirty. The BMI is calculated as weight (in kilograms) divided by height (in meters) squared. The rising prevalence of overweight and obesity, although led by the United States, is a worldwide phenomenon that includes people living in poverty as well as the affluent. It is related to consuming energy-dense foods and to changing activity patterns while maintaining food intake at levels appropriate to higher activity. In agricultural societies, people get sufficient exercise in the course of a normal day's work, while those using motorized transportation and working at sedentary jobs and unemployed people do not.

The obesity epidemic has spread to other countries with astonishing rapidity. Mexico now has rates of obesity and overweight that are almost the same as those in the United States. As recently as 1989, fewer than 10 percent of

Mexicans were overweight, but by 2006, 69.3 percent of adults were overweight or obese (Popkin 2007). The high consumption of soft drinks was especially implicated in Mexico. The "coca-colonization" of the Mexican diet led to a situation that in a single community young children may be undernourished while adults are overweight (Leatherman and Goodman 2005).

Of the many diseases related to obesity, type 2 diabetes is the most common, so much so that researchers have come to speak of "diabesity," the growing pandemic of diabetes associated with obesity. Once referred to as "adult onset diabetes" it is now seen in children and young adults as well. Chronically high levels of blood glucose define diabetes, although this may go undetected until long-term damage has already been done to pancreas, eyes, nerves, heart, and blood vessels. Anthropologists proposed the "thrifty gene hypothesis" and the "New World syndrome" to explain the recent epidemic of these associated conditions in certain populations of Native Americans. This is a Darwinian explanation that suggests that the feast-or-famine existence of the human past in certain populations favored a genetic propensity to store food energy effectively and release insulin quickly. However, the Native Americans were only the leading edge of what is now a worldwide health problem due to an obesity-and-diabetes-promoting environment of energy-dense foods and decreased physical activity (Lieberman 2003, 2008).

Although the diseases related to obesity mostly emerge after people have been overweight for many years, it is of concern that a spiral of inactivity leading to obesity leading to further inactivity is increasingly a childhood problem throughout America. The emergence of television and video games as major leisure activities is another factor in children's decreased activity and overweight. A study of families living on the impoverished east side of Buffalo, for example, showed extraordinarily high rates of overweight and obese children (age 6–12). Not surprisingly, the factor that contributed most to children's obesity was having an obese parent. But another variable associated with children's obesity was having multiple television sets in the household. Children with a TV in their room also slept fewer hours, a factor also contributing to obesity (Cadzow 2008).

Anthropologists and nutritionists at the University of Arizona studied girls in four Tucson high schools. The study used focus groups, telephone interviews, food records, measurements of height and weight, and annual faceto-face semistructured interviews for three years, in addition to informal ethnography in the school cafeteria. The researchers found that the reality of teenage life was much more complex than the simple statistics of overweight and eating disorders would indicate. "Fat talk" and "diet talk" were prevalent

among girls who were not significantly overweight and did not diet to change their weight. Despite all the talk about dieting, what was much more common was "watching what you eat"; that is, attempting to eat in a healthy way. Unfortunately, there was much confusion about healthful eating and very little reliable education to counter confusing messages in media advertising. The girls were in a constant tug-of-war between their desire to be in control and the predominance of high-fat foods and sodas in school vending machines and fast-food restaurants (Nichter 2000).

# Hunger and Undernutrition

How much hunger is there in the wealthy, industrialized countries? In the United States, 4 percent of households have one or more members who are hungry at some time during the year, often a parent who is going hungry to provide for a child. However, at least 11 percent of households experience "food insecurity"; that is, have difficulty in ensuring that nutritional and safe food is consistently available (Nord et al. 2007). The U.S. Department of Agriculture, the agency that is responsible for programs such as food stamps and school lunches, has developed surveys and screening questions to identify vulnerable households. Generally, food insecurity is associated with poverty, though this is especially true in areas where housing costs are high. Ironically, such a household may well include individuals who are obese or overweight and are unable to afford more healthful foods.

Households composed of a single woman with children and Hispanic and black households are the most likely to experience food insecurity. Nutritional anthropologists have helped to document localized pockets of hunger and identify factors that contribute to it. For example, they have shown that in rural Appalachia, older adults living near the coal fields of eastern Kentucky are more likely to be food-insecure if they eat alone or if they have to purchase several prescription medications with limited income (Quandt and Rao 1999).

In some neighborhoods, healthful foods are simply unavailable. In the inner city of Syracuse, New York, a medical anthropologist studying the causes of high infant mortality noted that supermarkets had fled the city. In the neighborhoods with the highest infant death rates, corner stores prominently market and sell cigarettes, malt liquor, and lottery tickets, while stocking very few fresh fruits and vegetables or dairy products (Lane 2008).

While obesity has increased, malnutrition in the sense of hunger and underweight has receded somewhat in much of the world. Between 1990 and 2005,

the proportion of children who were underweight throughout developing regions declined, going from 33 to 27 percent (United Nations 2007). The greatest decline was in Eastern Asia, largely due to nutritional progress in China. The greatest proportion of underweight children was in South Asia. In India, the National Family Health Survey showed that 42.5 percent of children age 0–5 were underweight (IIPS 2007). Childhood undernutrition remains an enormous problem. In addition to deaths from severe protein-energy malnutrition (PEM), millions of children die from infectious disease where the underlying cause is malnutrition. Even mild to moderate malnutrition increases the risk of mortality from diarrhea, acute respiratory disease (ARI), measles, and other common childhood infectious diseases.

Protein-energy malnutrition (PEM) is the most prevalent form of childhood malnutrition. When it is primarily the result of a weaning diet that is sufficient in quantity but deficient in protein, it may appear as kwashiorkor. Kwashiorkor is a West African term that literally refers to a child displaced from his or her mother by a subsequent pregnancy. Kwashiorkor is significant in West Africa, where children are weaned to starchy, protein-poor cassava, plantain, and yams. It is by no means limited to the tropics and has been diagnosed by pediatricians in New York City. The key sign of kwashiorkor is edema, or fluid retention that begins with the feet and lower legs and progresses until the child looks blubbery. The body's biochemical self-regulation breaks down as well. The child may have a distinctive moon-face appearance, muscle wasting, a skin rash that looks like flaking paint, and limp, pale hair. (See Fig. 5.8.) These symptoms are noted by the Mixe and Tzeltal Mayan peoples of southern Mexico in their children. It leads to their recognition of a syndrome that they call "second hair" illness. This form of severe PEM remains particularly prevalent among the indigenous Maya in Chiapas where public health programs have failed and soft drinks, sugar, and other aspects of the globalized diet have penetrated an impoverished region (Luber 2005).

Most commonly, nutritional status is anthropometrically measured by recording the height and weight of a child whose age is known and converting these measurements to percentiles of weight-for-age (WA) and height-for-age (HA) on a growth chart such as that produced by the U.S. National Center for Health Statistics (NCHS). A child with a WA of less than 80 percent of the median WA is considered malnourished; a child with a WA of less than 60 percent of the median WA is considered severely malnourished. Weight-forage is the best measure of current under-nutrition, while height-for-age reflects more the long-term picture. Low weight-for-height, or *wasting*, reflects an acute, short-term shortage of food. Children who were malnourished



FIGURE 5.8 A South Indian child suffering from kwashiorkor. The signs are edema, muscle wasting, presence of subcutaneous fat, a "moonface," and "flaky-paint" skin. PHOTO COURTESY OF D. B. JELLIFFE/WHO

when they were younger but are currently getting enough food may be *stunted*, that is, shorter than they would have been if allowed to reach their potential.

The four groups of children in Nepal discussed at the opening of Chapter 1 show clearly the differences in height-for-age that emerge under different living conditions. The well-to-do school boys were tallest, and the village boys were shortest. Within the city, homeless boys were taller than those living in squatter settlements. (See Fig. 5.9.) Though many children showed stunted growth because of chronically poor conditions, none of the boys in the study suffered from acute malnutrition, that is, extremely low weight for height (Baker, Panter-Brick, and Todd 1996).

In the poor community of El Progresso on the outskirts of Guatemala City, most children attend the neighborhood primary school from the age of seven. Looking at the relationship between their parents' education and income level makes it apparent that education is the route to material improvement. Households where the parents had a few years of primary education were more likely to own a few electric appliances (perhaps a radio, an iron, and a television) and to cook with gas rather than firewood. The diet of the poorest families consisted of bread and coffee for breakfast, tortillas with cream for

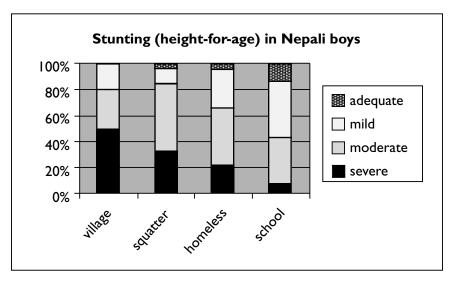


FIGURE 5.9 Growth status of Nepali boys age six to fourteen years. Graph redrawn from data in Table 5, Panter-Brick, Todd, and Baker 1996.

lunch, and rice, tortillas, beans, and milk for dinner. With extra income, they were able to add eggs, chicken, salad, and other foods from the market.

Nutritional anthropologists conducted a longitudinal study over seven years to assess how much difference nutrition made in the cognitive development and school achievement of the children of the urban poor in El Progresso. Measuring over 500 children, they found that two-thirds of them were mildly to moderately malnourished. Following their growth from age three to eleven, they found that physical growth was strongly correlated with socio-economic status within the community. Children's IQ scores were also related to their physical growth. However, IQ had more varied determinants than only physical growth. Even in the poorest households the amount of stimulation and interaction the child received made a substantial difference in IQ that was in turn strongly correlated with school achievement test results (Johnston and Low 1995).

# Breast or Bottle

For the first four to six months after birth, breastfeeding is normally sufficient to provide for infant nutrition. After six months, it remains an important protein supplement to a diet that contains other foods. One of the most significant changes in human nutrition occurring in the industrial era was a

shift from breast to bottle in infant feeding. Ironically, this change has the potential to contribute to both kinds of malnutrition—the malnutrition of obesity and of undernutrition. Because overfeeding is easier when feeding from a bottle, obesity can started in infancy, but where poor families lack the cash to purchase milk or formula, they may dilute the formula, leading to protein-energy malnutrition.

The decline of breastfeeding in European countries began three centuries ago. Well-to-do women hired wet nurses to breastfeed their infants, and the wet nurses gave up their own infants to foundling hospitals. There the infants were fed on cereal cooked in water and many of them died. The regular use of cow's milk only became prevalent later, when canned and dried milk became available. Cow's milk is adapted to the nutritional needs of fast-growing calves, not humans. It is higher in protein than human milk, with a different balance among various amino acids and fatty acids that milk contains. Some infants have allergies to cow's milk or difficulty in digesting it.

By 1966 breastfeeding had reached a low point in the United States. Only 18 percent of infants were being breastfed on leaving the hospital (Meyer 1968). The trend then reversed itself, with educated and upper income women and the Western states leading in the change. In 1993–1994 sixty percent of infants were being breastfed. By 2005–2006, breastfeeding rates had risen to 77 percent. The lowest rates of breastfeeding continued to be found among African Americans, lower-income families, and younger mothers.

The rise of bottlefeeding that began in industrialized countries spread to lower income countries in the 1960s and 1970s. Noting the threat to sales of formula that was posed by smaller families and the increase in breastfeeding, the multinational food and drug companies turned to new markets in Asia, Africa, and Latin America. Through aggressive marketing in advertising and distribution of samples in hospitals they spread the message that bottlefeeding is the modern, high-status way to feed infants. In some countries the pace of change was phenomenal. In 1960, 95 percent of mothers in Chile breastfed their infants beyond the first year; by 1969 only 6 percent did so (Monckeberg 1970). In countries such as Thailand, women were entering the industrial workforce without policies to support them in breastfeeding, but the marketing of bottlefeeding also succeeded in cities like Nairobi, Kenya, where few women had jobs (Van Esterik 1989).

The spread of bottlefeeding has many important effects on the health of children of poor families, whether in affluent or poor countries. If the bottle contains only rice water, tea, sugar water, or heavily diluted formula, it will supply few nutrients. This may be done because milk is believed to be "too

strong" for infants or because money is scarce. While the nursing mother needs additional food and fluids if her own nutritional stores are not to be depleted, foods for adults are usually less expensive than milk or formula.

Bottlefeeding increases the risk of infection from contaminated water or milk while at the same time decreasing resistance. Gastroenteritis, an inflammation of the stomach and intestines, is a significant cause of illness and death in infants and young children in many countries. Breast milk has immunological factors that afford protection from infections and childhood-onset malignancies. Bottlefed infants do not have this advantage. There are also advantages for the health of the mother and the psychological relationship between mother and child. Only if the mother takes certain drugs or is HIV-infected are the risks of breastfeeding likely to outweigh those of bottle-feeding (Lawrence 2000).

Efforts to promote breastfeeding repay themselves in significantly reduced infant illness and health care costs. Medical anthropologist Anne Wright worked with a team that evaluated the impact of a breastfeeding promotion program at the Indian Health Service Hospital in Shiprock, Arizona, serving the Navajo. The intervention included public service announcements, a video, a billboard, and free infant T-shirts. During the program, breastfeeding rates increased from 16.4 to 54.6 percent. Health records indicated a significant decline in infant pneumonia and gastroenteritis (Wright et al. 1998).

Weaning is a critical time for child health because inadequate nutrition, infection, and psychological stress interact synergistically, magnifying the effects of each. The toddler displaced from a mother's breast by the birth of a sibling is no less under stress than a pressured executive or harried commuter. Infections increase the need for certain nutrients, such as protein. At the same time, gastrointestinal infections reduce the body's capacity to absorb these nutrients, and appetite may be reduced. When a child is marginally nourished, an episode of infectious disease may push her over the line into outright malnutrition. Caught in a vicious circle, the poorly nourished child is less resistant to infection because antibody production is impaired. *Gastroenteritis* is the most important of the infections that interact with malnutrition in young children, so much so that it is even called "weanling diarrhea." Diseases such as measles and chicken pox that are usually trivial in a well-nourished child may be fatal to a poorly nourished child.

Children in impoverished communities are not all equally at risk of malnutrition or death. Even in a poor, urban community in the West African country of Mali, where many children from six to thirty months old are malnourished,

still other children thrive. Mothers' attitudes toward feeding children are among the variables that seem to make the most difference, according to the observations of Katherine Dettwyler (1986). The mothers whose toddlers thrived in Mali were those who made sure that the child was present at meals, rather than napping or playing. They prepared and purchased special foods for the child. They also made sure that a sick child was taken to the doctor and given medicines.

# The Anthropology of Food and Cooking

Throughout this chapter we have emphasized that a people's diet is the product of ecology and economics. Farmers everywhere choose crops that are suited to their soils and climate. The urban poor of Papua New Guinea eat imported rice and tinned fish rather than local vegetables and fresh fish that they might buy in the market because rice costs less. In addition to these ecological and economic factors in diet there are customs and traditions that influence the food choices that people make.

Traditional foods become symbols of ethnic identity that may be resistant to change. A certain amount of dietary conservatism can be seen as adaptive. After all, traditional cuisine has been subject to adaptive selection over time, and change is more likely to be harmful than helpful. In Bangladesh, where most people eat little or no meat, protein complementarity was achieved by combining lentils and rice in the traditional diet. Due in part to outside food aid during famine that brought in North American wheat surpluses, people acquired a "modern" taste for wheat bread, but the wheat bread is generally eaten without other foods that would complement the incomplete protein in the wheat (Lindenbaum 1987).

Among many groups of Native Americans, an epidemic of obesity and diabetes followed a dietary transition from "way back" traditional foods such as buffalo meat and wild berries to the ethnic foods developed after settling on reservations. This dietary transition began more than a century ago with the distribution of government rations that included fatty beef and pork and flour. For the Dakota, the new ethnic cuisine came to feature fatty stews and large quantities of fry bread. Needless to say, this makes it very hard for the Dakota to follow a diabetic diet, though many suffer from diabetes (Lang 2006).

One of the earliest comparative studies of nutritional change was done by a dentist, Weston A. Price, who traveled around the world for many years, looking at the teeth of Eskimos, Swiss, Africans, peoples of the South Pacific, and Native Americans. Everywhere he found that the change from traditional to modern diets produced dental caries and a narrow dental arch with crowded, crooked teeth (Price 1939).

Although resistance to change in food habits is usual, when ecological and economic conditions change, it is amazing how rapidly people modify even their staple foods. In nineteenth-century England, bread was largely replaced by potatoes, a New World domesticate. In Africa, many populations shifted from sorghum to maize and then to cassava, attracted by higher yields on increasingly depleted soils.

People make significant and rapid changes in their diet under the influence of advertising, educational messages, economic change, and lifestyle changes. In the United States, beef consumption doubled between 1950 and 1970 and then declined from 80 pounds (36 kg) per person in 1970 to 62 pounds (28 kg) per person in 2005. This decline was more than compensated for by a rise in the consumption of chicken, fats, and oils (Wells and Buzby 2008). Soft drinks increased from 24 gallons (90 l) per person in 1970 to 53 gallons (200 l) in 1997. Americans now drink, on average, more than a 16-ounce (500 ml) bottle a day (U.S. Bureau of the Census 2000).

Nutritional anthropology moves beyond simple description of food preparation techniques to consider their implications for health. Cooking may alter the chemical composition of food as well as making it more digestible. Soybeans, for example, are an Asian legume rich in the amino acids that complement the protein found in cereals. But soybeans can cause serious indigestion because they contain antitrypsin factor (ATF), which binds the enzyme trypsin that the digestive system uses to break down the protein in the soybeans. If the soybeans are boiled for hours or roasted at a high temperature, the ATF is deactivated, but the amino acids are also destroyed. Chinese and Japanese cooking uses fermentation to make soy sauce, in which the action of microorganisms has deactivated the ATF. The ATF is also chemically removed in the process of making tofu by using certain salts to precipitate the digestible proteins out of boiled soybeans (Katz 1990).

Fermentation of foods by lactic acid bacteria has a wide variety of benefits, pointed out by anthropologist-ethnobotanist Nina Etkin, who has studied food systems of the Hausa of northern Nigeria (2006). The Hausa consume a wide variety of fermented foods that include sour milk, fermented grain, and cassava meal, and a nutty-tasting soup base made from the seeds of the African locust bean tree. In addition to improving nutrient availability and digestibility, fermentation may reduce toxicity, synthesize B vitamins, add

antioxidants, and act as a medicine to control pathogenic microorganisms that cause diarrhea.

Anthropologists are also concerned with the symbolic meaning of foods in different cultures and with the ways in which foods are combined to form culturally acceptable meals. Particular foods come to carry heavy symbolic weight, to be "real food" as the Pacific Islanders regard their traditional starchy roots or the Japanese value their rice. Japanese-born anthropologist Emiko Ohnuki-Tierney dedicated her book Rice as Self (1993) to her elementary school teacher. He not only encouraged her study of science but shared his family's rice with her during World War II when the school children had only potatoes to eat. Rice is of tremendous ritual significance in Japan, but prior to the twentieth century it was not eaten as much as one might assume. Except for the elite, the Japanese people ate more millet and other grains and tubers than rice. After World War II, when the Japanese people could afford to eat rice as a daily food, Western influence led to other changes. Bread replaced rice at breakfast first, and then noodles, hamburgers, and pizza replaced it at lunch. At dinner, meat and vegetable side dishes displaced all but a small quantity of rice. Still, rice remains a dominant metaphor for the Japanese in their encounters with others; they contrast the long-grain rice of the Chinese with their own short-grain rice.

Few things are more culturally distinctive than the spices used in ethnic recipes. "Spice" is a culinary term, not a botanical one, and can refer to any plant or part of a plant from root to bark to flower and seed. The distinctive flavors of spices come from phytochemicals, chemicals that protect a plant against predators and pathogens. It has often been assumed that the herbs and spices used in cooking would be one of those things that are random or unique, part of the seeming arbitrariness of cultural variability. However, a Darwinian, or evolutionary, approach to spices suggests that if the phytochemicals in plants evolved because they protect the plant against bacteria and other enemies, perhaps they also protect humans by inhibiting the growth of bacteria.

Hausa food is very hot, Etkin found (2006). The Hausa use chili peppers for flavoring as well as using it as a medicine for various illnesses. They also flavor their food with a composite spice, called *yaji*, that contains several non-local ingredients, such as various kinds of pepper, ginger, and cloves. They use this spice following childbirth and male circumcision. Analysis confirms that together these have significant antimicrobial and anti-inflammatory properties and are rich in vitamins, antioxidants, and carminitives (that is, substances that reduce gas in the digestive tract).

# All That Goes in the Mouth Is Not Food

The line between food and medicine is not a clear one, as Etkin illustrates with her book title *Edible Medicines*. She found that the Hausa used 264 locally growing plants as medicines. She describes most of these as "semi-wild," meaning that they are not deliberately cultivated but are gathered from grazing land and the borders of paths or are left growing in farm fields when weeding the millet and sorghum crops.

Also sitting on the border of food and medicine are the various "social plants." These are stimulants, such as coffee and tea, that are used to cement social relationships, whether or not they are consumed with other foods. For the Hausa this would be kola nuts. The kola tree is indigenous to West Africa. Its seeds are chewed or grated. At one time they were limited to the elite and to special occasions, but in the twentieth century they came to be mass consumed in social, romantic, and business relationships. Kola contains both caffeine, the stimulant ingredient of coffee and tea, and theobromine, the stimulant characteristic of cocoa. (Caffeine primarily stimulates the brain and skeletal muscle; theobromine, primarily the heart, kidney, and lungs.) Kola also contains other chemical constituents with varied medicinal properties, and was used for centuries in Islamic medicine.

Even when a substance is not consumed for its nutritional value, it may have important effects on nutrition. One effect that nonfood substances have on nutrition is simply to displace a food that might otherwise be consumed and thereby reduce the intake of essential nutrients. Alcoholics, for example, may meet some of their energy needs by drinking, for alcoholic beverages are high in calories. At the same time, their diet patterns are usually poor and protein intake is frequently low. This deficit can lead to a degeneration of the liver that progresses to cirrhosis. Not all alcoholic beverages are alike in this respect. An African millet beer, thick and unclarified, is a rich source of calcium, iron, and vitamins B and C. Furthermore, the people themselves may recognize this beer as food, and anthropologists have found that drunkenness is seldom socially disruptive when a culture defines alcoholic beverages as food (Marshall 1979:455). The change to a prestigious imported beer will deprive the drinker of an important and inexpensive source of nutrients.

Drugs also have implications for nutrition and health that go far beyond their intended effects. This is so whether the drug is a popular stimulant or is medically prescribed. A person taking an antibiotic to bring a disease-causing microorganism under control may disrupt the relationships among the normal, nonpathogenic organisms inhabiting the gastrointestinal tract. The re-



FIGURE 5.10 A Quechua-speaking family chews coca during animal fertility rituals on the feast of San Juan in a Peruvian village. Unprocessed coca leaves are the traditional social plant of Andean people. Photo by Catherine J. Allen. Reprinted by Permission.

sulting imbalance in the ecology of the mouth or intestine may lead to inflammation or diarrhea. This, in turn, influences the individual's nutritional state.

The line between food and drug may blur when a plant is used in many cultural contexts or when an investigator discovers effects beyond those acknowledged by the users. The Hausa of Africa eat many kinds of leafy vegetables at the end of the rainy season, the time of greatest risk of malaria infection. These are food plants, but they also may treat malaria, for laboratory investigation shows that they increase red blood cell oxidation (Etkin and Ross 1983).

Even items that are chewed, but not normally swallowed, can have an impact on health. Adults in urban Mali have good dental health. They can be seen walking around every morning chewing on a tooth-brushing stick, a twig from a tree that not only cleans the teeth but also has antibiotic and anticavity properties (Dettwyler 1994:92). On the other hand, chewing betel, a widespread practice in South Asia, has been linked to cancer of the mouth.

# CONCLUSIONS

On a snowy winter day, you may eat a fruit salad of fresh strawberries, bananas, and pineapple. At a huge cost of energy used in transportation and refrigeration, you enjoy the fruits of the process of delocalization discussed in this chapter. Your culture includes a system of food production and distribution that may provide you with a nutritious diet, if you can afford it and if you choose well. The very diversity of your supermarket diet helps to ensure that you are likely to meet your body's needs for vitamins, minerals, and other nutrients.

In other ecosystems, diversity in the diet is attained in other ways. Huntergatherers seek many species of edible plants and animals. Subsistence farmers who grow a cereal or root crop in their fields also plant small kitchen gardens with vegetables, fruits, and herbs that add interest, and varied nutrients, to otherwise monotonous fare.

With rural or urban poverty comes a loss of diversity in diet. People narrow their focus to obtaining in barely sufficient quantities just those few foods that they can afford. This leads to the prevalence of deficiency diseases, such as anemia, protein-calorie malnutrition, and xerophthalmia. Or they may buy only the cheapest, energy-dense foods, leading to obesity. The presence of such malnourishment, when overall national and world food supplies are adequate, reveals inequalities of access to food. Human rights advocates have come to assert that a "right to food" should be included among the more commonly discussed civil and political rights.

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# Chapter SIx

# CULTURE, ECOLOGY, AND REPRODUCTION



Mother and child in Kashmir, North India.

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PHOTO BY CANDACE GRASER.

# **PREVIEW**

Like other life processes, conception, pregnancy and birth are rooted in biology but patterned by culture. There is much variation in cultural ideas of how and when conception occurs, how the fetus develops, how to protect the pregnant woman, and where birth should occur. This chapter's first profile illustrates how food taboos and behavioral restrictions in Malaysia reflect the vulnerable status of new mothers and newborn infants.

Humans have evolved specific reproductive patterns with characteristically low birth rates and high parental investment in offspring. Bipedalism and increase in brain size, leading to changes in maternal pelvic structure and in fetal head size in the course of evolution, increased the risks associated with labor and delivery and the value of birth attendants.

Levels of human fecundity and fertility vary considerably and are influenced by nutrition, work roles, and general health. Practices to enhance fertility, methods of birth control, and behaviors to prevent disease are also diverse. Factors affecting decisions about use of condoms are discussed in our second profile on young adults in the northeastern United States.

The universality of parental bonding with infants has been debated by anthropologists. Under conditions of high infant mortality, maternal detachment may be a more natural response. Child abandonment as an alternative to abortion or infanticide figured significantly in European history, suggesting that poverty places particular stress on maternal-infant bonding.

# Three Birth Stories

This chapter begins with three birth stories: in the Kalahari Desert in Botswana, southeast Africa; in a Yucatán village in Mexico; and in a hospital in St. Petersburg, Russia. Each story describes a birth that seems normal to the participants. The diversity in how these births were managed illustrates how important culture is in defining what is "normal."

# Nisa's Account

A few days before I gave birth, we went to live in a bush camp so the men could hunt. There were very few of us: Tashay [her husband], myself, his grandmother,

and his grandfather.... [At dawn] I lay there and felt the pains.... I walked a short distance from the village and sat down beside a tree.... The pains came over and over, again and again. It felt as though the baby was trying to jump right out!... I thought, "I won't cry out. I'll just sit here. Look, it's already being born and I'll be fine...." After she was born, I didn't know what to do. I had no sense.... I sat there and looked at her, looked and looked and looked (Shostak 1981:192–193).

Nisa is a Ju/'hoansi: (!Kung) woman of the Kalahari Desert. Her community subsisted by gathering wild plants, hunting wild game, and trading with nearby farmers. Women usually kept working as gatherers through the pregnancy, right up to labor. Those who followed the ideal of physical courage isolated themselves during labor and used whatever delivery position was most effective: sitting, lying on one side, or squatting. By birthing alone, the chances of infection were less. If the baby were abnormal, the solitary birth would allow the mother to decide whether to keep the baby or to abandon it.

Nisa was about eighteen when her first child was born. She had been taught not to be afraid and not to cry out during labor, as fear might cause her death. She knew she was expected to deliver the baby without relief from pain, without help from others, in the dry scrub brush several hundred yards away from the village or encampment. When relatives heard the newborn's cries, sometimes they came to help in cutting the umbilical cord and carried the infant back to camp. At other times the new mother handled the afterbirth and cut the cord by herself, although others criticized her for having exposed herself and the baby to danger from wild animals (Shostak 1981). The cultural ideal was a solitary birth, but !Kung women gave birth alone in only half of the birth accounts recorded by Konner and Shostak (1987). Nisa's case was unusual; most first-time mothers relied on female relatives to help. There were no midwives in this population of hunter-gatherers. About one in 250 women, or four per 1,000, died in childbirth. One in five babies died in the first year of life. Nisa's baby, a female, died from illness before her first birthday.

# Doña Lola's Story

A messenger arrives at the home of the Mayan midwife, Doña Juana, to tell her that one of her patients is in labor. She picks up her black case filled with medical supplies and walks to Doña Lola's house. When she arrives, "there is a friendly exchange of greetings with the family. She asks about the frequency and strength of contractions and has the mother lie down for a massage, during which she feels

for the baby's head to see if it is engaged or still moving freely. . . . If it appears . . . that labor has begun in earnest, she arranges her case on a chair, washes her hands, and settles down on a wooden chair in front of the woman's hammock" (Jordan 1993:31).

Birth in a Mayan village in the Yucatán Peninsula, northeastern Mexico, is a family affair. A woman's husband is expected to be with her during labor so that he can "see how a woman suffers" (Jordan 1993:33). Her mother is also there. If the labor is long and difficult, other women come: sisters, godmothers, her mother-in-law, neighbors. Lying in a hammock in her home, supported by her husband or other helpers, Doña Lola is urged to work hard and to keep pushing. Her co-laborers, breathing and pushing with her, create a stream of "birth talk" to encourage her.

After the birth, Doña Lola rests in the hammock with the baby on her belly. The midwife waits for the placenta to pass and the cord to stop pulsating before cutting it, and she examines the placenta to make sure it is complete. She sponges the mother, dresses the umbilical stump, and washes and swaddles the baby in a cotton blanket. If a girl, the baby will have her ears pierced right away. While the family relaxes, a meal is served to the midwife and the birth helpers. Doña Juana's modest fee will be negotiated later.

This baby's birth was quick and easy; it was not Doña Lola's first child. Some births in the village were more difficult, and more problematic cases were referred to the closest hospital. Doña Juana prevented complications through regular prenatal massage to adjust the fetal position, and the births she attended had favorable outcomes. Because she avoided examining the mother internally and left the fetal membranes intact, infection rates were low. She also packed alcohol-soaked cotton around the umbilical stump and sometimes cauterized the stump as well. In her records of about three hundred births over three years, she noted several stillbirths but no maternal deaths (Jordan 1993:25).

# Oksana's Account

I wanted a normal delivery room, in which no other patients were around, attentive care, and for my baby to be born in the best conditions. Plus, I wanted my baby to be put to my breast immediately, for the baby to be with me, and not to be left somewhere screaming.

I wanted it to be superb . . . I showed them this big American encyclopedia and said, "I want to deliver like that." On a bed, not in gynecological stirrups (Rivkin-Fish 2005:199–200).

Oksana, a thirty-one-year-old woman with a Ph.D. in St. Petersburg, Russia, had high expectations for her first birth in 1994. During her pregnancy, she and her husband looked for a maternity hospital that was modern and would provide a normal delivery for "a normal amount of money," the official sum equivalent to \$200.

Oksana went to the hospital during early labor and was allowed to walk in the halls. After twelve hours, the midwife insisted on "breaking the water," piercing the membrane of the amniotic sac to release fluid so that labor would go faster. However, there was meconium (fecal material from the fetus) in the fluid, putting the fetus at risk of inhaling the meconium. The midwife required Oksana to move to the standard delivery table with stirrups, where they did an episiotomy (a controlled cut to enlarge the vaginal opening).

Despite the attractiveness of the facilities and the reasonable fee, Oksana was dissatisfied with the birth. It was a case where you want something specific and are aiming for it, and your illusions are shattered . . . I thought that if they hadn't broken the water and I'd have given birth myself, the meconium would've come out during the birth, and they wouldn't have given me an episiotomy. I was terribly upset afterward; I cried and cried (Rivkin-Fish 2005:201).

# Evolutionary Comparisons of Birth Management

The three types of birth described above represent a spectrum of human societies. Some foraging groups, like Nisa's community, encourage a solitary birth as an ideal, but most foragers provide assistance at birth. Arctic hunters traditionally built a separate dwelling for birthing, where the laboring woman was attended by a few women. Solitary birth is also rare in farming peoples, but there are exceptions such as the Bariba of Benin, who praise a woman giving birth alone for her courage and endurance. Their midwives attend births only if complications arise, although neighbors or relatives usually cut the cord and help deliver the placenta (Browner and Sargent 1996).

Birth attendants probably began to assist women in the Upper Paleolithic period, some 50,000 to 20,000 years ago, long before the transition to agriculture. Birth became more difficult due to change in the human pelvis, and assistance by midwives may have reduced maternal and infant mortality (Trevathan 1987, 1997). Postpartum hemorrhage is a major cause of maternal mortality, and midwives' knowledge of how to slow the bleeding and stimulate the uterus to contract reduced mortality. Medicinal plants for obstetric and gynecological problems, such as a mixture of ginger and sedge

used by Jívaro Indians of Peru, may have been the first ethnomedicine (Berlin 1985).

After the Neolithic transition, many women bore eight, nine, or more children, although not all survived. (Among foragers, birth rates were lower, often three to four children per woman, with spacing of four or more years between births.) With higher birth rates in larger communities, midwives attended more births and encountered a wider range of birth complications. Pregnancy and birth not only were family centered but also were based within the realm of women's knowledge. As Sheila Kitzinger (a British social anthropologist and childbirth reformer) notes, "Birth is women's work. . . . Even though a man may be present, he is marginal to the community of women who use skills passed on by women, sometimes from mothers to daughters and often by apprenticeship" (1997:211).

Midwives continue to practice in many low-income countries and in rural areas of industrial countries, usually with supervision and licensing. Some lay midwives are required to take additional training. Doña Juana, the Mayan midwife described above, attended a course in Mexico City at the peak of her career, already having delivered hundreds of babies successfully. She returned from the course with equipment to put into her supply case: a gown, cap, face mask, and thermometer. She applied her training in care of the umbilical cord and infant nutrition in her practice, but she did not use the thermometer or face mask because their use was not demonstrated in class. Midwifery "upgrading" programs are usually geared toward biomedical techniques and not toward improvement of traditional, indigenous skills (Jordan 1993).

Like many midwives, Doña Juana knows from experience how to avoid a breech birth (feet or butt down), which in U.S. medicine is typically handled by surgical delivery. Using external pressure to turn the fetus to a head down position a few weeks before labor begins, she ensures a safer delivery. She avoids infecting the woman by not "breaking the waters" (rupturing the amniotic membranes); obstetricians routinely do this to speed labor. She avoids internal examinations, also routine in modern obstetrics, and she allows the woman to choose the most comfortable labor and delivery positions, often in a hammock or birthing chair (see Fig. 6.1).

Doña Juana's intuitive knowledge and diagnostic ability are based on direct touch, providing an "embodied knowledge" of fetal development and position. She assumes that most pregnancies are normal, leading to normal labor, or they can be made normal through proper adjustment of fetal position. With thirty years of experience and the formal training and minimal



FIGURE 6.1 Birth on a chair, Maya women in Yucatán. While the traditional midwife tells the laboring woman that the baby is "at the door," the husband supports the woman through each contraction. Drawing by Pat Basore. Reprinted by Permission of Brigitte Jordan and Waveland Press. From Brigitte Jordan, *Birth in Four Cultures*, Fourth edition, 1993, Waveland Press, Inc.

medical supplies provided by the Mexican government, she is competent to handle about 95 percent of the clients who seek her services.

It is that 5 percent complication rate that is considered problematic by critics of midwifery. In modern societies, the death or injury of 5 out of 100 infants, or 50 of every 1,000 women, is not acceptable, medically or culturally. Increasingly throughout the world, hospital delivery has become the norm, even for low-risk deliveries.

When many women delay childbearing, relying on contraception and/or abortion to avoid unwanted pregnancy and ultimately giving birth to fewer children in their lifetimes, minimizing of risk is essential in each pregnancy. Because pregnancy involves a major emotional and social investment for couples, a powerful ideal in North America is intensive management through tests, monitoring, and medical interventions from conception to birth.

# Well-Being in Pregnancy: Biological and Social Factors

When a couple has sexual intercourse, their odds of conception are low. Although a man normally releases millions of sperm during every ejaculation, most women release only one egg every twenty-eight to thirty-two days. It is difficult to tell externally when a woman has ovulated, and there is a narrow window of opportunity for fertilization, usually only twenty-four to seventy-two hours after ovulation.

Once conception occurs, the human embryo and (after eleven weeks) the fetus develop through a gestation of about thirty-eight to forty weeks, around 270 days, in three trimesters. After implantation of the embryo into the inner lining (or endometrium) of the uterine wall, nutrients and oxygen are transferred from the mother through the placenta, and wastes are transported in the opposite direction. (The placenta is an organ that develops within the uterine lining after the implantation of the embryo, a few days after conception. Connecting maternal blood and fetal blood vessels with only a single membrane separating them, the placenta provides oxygen, nutrients, and hormones to the embryo and fetus and removes waste products from the fetal blood).

The first trimester is critical, as the embryo can be exposed via the placenta to chemicals and pathogens that affect normal development. Although the tiny but rapidly growing embryo makes only small demands on the mother's nutritional stores, it is essential that the placenta be well established. The placenta develops poorly if the mother herself is malnourished, is still growing as a young teen, or has poor blood circulation. A woman who smokes may have an undersized placenta and subsequently a low-birth-weight baby.

Consuming two or more alcoholic drinks daily during pregnancy can cause birth defects. Prenatal exposure to alcohol creates a higher risk of fetal death and infant mortality (Burd 2004). With heavy drinking, the baby's growth before and after birth may be stunted, and the brain, head, and face may develop abnormally. The most severe cases are diagnosed as fetal alcohol syndrome (FAS). FAS babies are small in size, with undersized heads, flat faces, small eye slits and drooping eyelids. They often have difficulties learning. Less severe exposure to alcohol may cause more subtle behavioral disorders (Moore et al. 2002). An estimated 40,000 infants (2004 data) are born annually in the United States with birth defects and learning disorders from prenatal alcohol exposure. This estimate includes only those who have been

diagnosed; some 90 percent of children and adults affected by prenatal exposure are either undiagnosed or incorrectly diagnosed (Burd 2004:2).

Almost anything the mother consumes can cross the placenta. When it is an addictive drug such as heroin or cocaine, the newborn will also be addicted and will suffer from withdrawal after birth. Infectious agents such as the retrovirus causing HIV/AIDS and the spirochete causing syphilis can cross the placenta. Heavy metals can contribute to neurological damage.

The nutrients that reach the fetus through the placenta and umbilicus are those circulating in the mother's blood. Her diet during pregnancy is the source of most of these nutrients, but pre-pregnancy stores are also tapped. If she is calcium deficient, the calcium stores of her teeth and bones may be depleted during pregnancy. The popular concept of the fetus as the perfect parasite, taking what it needs even at the cost of the mother's health, has some validity, but it is also misleading. Poorly nourished mothers may give birth to healthy infants, but at low birth weights and with subnormal stores of nutrients (Martorell and González-Cossío 1987).

Seasonal differences in food supply and women's heavy workload in farming communities can cause low birth weight, an important indicator of the quality of the intrauterine environment. Infants who weigh less than 5.5 pounds (2,500 g) at birth are more likely to die in the first month than are normal weight infants. Low birth weight can result from premature birth or from inadequate nourishment. The premature infant is more likely to die than is the small but full-term infant.

# Pregnancy Sickness and Cravings

Food cravings and nausea are early signs of pregnancy. Aversions to certain foods, and intense cravings for other foods, are common. **Pica**, compulsive eating of non-food substances such as clay, dirt, and laundry starch, is more frequent in pregnant women and may be related to mineral deficiencies, especially low iron stores.

About three-fourths of women in the United States report nausea by the second month of pregnancy, and about half have vomiting episodes. Because nausea, excess saliva, a heightened sensitivity for odors, and loss of appetite often occur early in the day, the syndrome is sometimes called "morning sickness." Actually, these symptoms occur at any time and the preferred term is pregnancy sickness. By the fourth month, most women have passed this stage and feel increased well-being, energy, and appetite.

Many societies have lower rates of pregnancy sickness than in the United States, but the phenomenon seems to be universal. Some anthropologists hypothesize that diet plays a role. Evolutionary medicine speculates that the increased sense of smell that triggers nausea is a product of natural selection linked to mate selection and fetal-maternal compatibility (Lee 2002). Sensitivity to odors and lack of appetite would reduce the chances of a pregnant woman eating toxic plants or spoiled meat and eggs, and the vomiting response would allow her to expel any toxic substances (Profet 1988). Whatever the ultimate cause, women who have morning sickness have a lower rate of spontaneous miscarriage, of premature labor, and of stillbirth (Fessler 2002).

Given the importance of maternal nutrition for fetal development, it is difficult to explain the restrictive food taboos during pregnancy in many cultures. The Mbum Kpau women of Chad in equatorial Africa eat no chicken, goat, eggs, or game birds even when they are not pregnant because they fear pain or death in childbirth, birth of an abnormal child, or sterility. During pregnancy, they avoid even more foods, such as the meat of antelope with twisted horns and bony-headed fish, to avoid bearing deformed children (O'Laughlin 1974). These are examples of the rules and restrictions that surround pregnancy and birth, reflecting the anxiety that people often feel about reproduction. The following profile addresses the issue of food taboos in pregnancy in coastal Malaysia.

# ROOD TABOOS IN MALAYSIA

In coastal Malaysia, in Southeast Asia, the transitions of pregnancy and birth require women and their husbands to be particularly careful about how they behave. After her baby is born, the woman is subject to even more restrictions for a while. Certain **taboos**, or cultural rules that carry symbolically heavy constraints, apply to a variety of foods. The power of a taboo lies in the belief that if a person violates the rule, she or her child may experience misfortune: a difficult labor, slow recovery after the birth, injury to the baby. Many life transitions in Malaysia, for example, male circumcision in adolescence, require avoidance of foods classified as "cold" and as *bisa*, having magical power. Many fish are classified as bisa, such as catfish, which are bottom feeders and have slimy skin. "Cold" foods include cucumbers, watermelon, and sour fruit.

During anthropological fieldwork in Malaysia from 1975 to 1977, Carol Laderman studied these food taboos, along with other topics related to pregnancy, midwifery, birth rituals, and postpartum care (Laderman 1983). The people she studied were Muslim villagers who lived by farming, fishing, lumber work, and commercial rubber tapping.

The women marry young, most by sixteen. Pregnancy comes soon after marriage, and three-quarters of the women had given birth to five or more children by the age of forty-five. One-third had eight or more children. Marriage is usually monogamous, although polygamy is allowed; 62 percent of the women in a given village married only once, but 61 percent of the men had married two or more times, finding partners outside the village after being widowed or divorcing their first wives.

Men play an important role in conceiving a child, for Malays believe that the father is pregnant in his brain for forty days before his wife becomes pregnant. During this time he may have cravings for certain foods. The baby receives *akal*, the quality of self-control and rationality, in his father's head. Then the baby moves to the father's eyes, then his chest, and finally to his penis. When the baby enters the womb, it acquires *hawa nafsu*, animal nature, from the mother.

When the mother has food cravings, the Malays say it is really the baby who is craving specific foods. Except for a few fruits, most foods are acceptable. The mother must also be careful not to tie cloths around her throat or arms, for this could cause the umbilical cord to wrap around the baby's neck and prevent it from breathing at birth. If the mother is startled, the baby could turn out abnormal, and if she gets too close to a corpse, the baby might waste away.

The father is supposed to avoid sitting on the house steps and blocking the entrance because this could later cause an obstructed birth canal. Most important, he must postpone hunting until after his child is born. In handling animals, he must be careful not to injure them, and when cutting wood, he should not leave jagged edges or splinters.

These beliefs suggest a concept of harm by association. For example, if the father cuts off a crab's claws, the baby's fingers may be deformed. Taboos don't guarantee specific harm if they are violated; they just suggest a possible connection between parents' behaviors before the birth and the health of the baby after it is born. The beliefs are reinforced when something negative happens. When an infant is born with a large birthmark on its face, the parents search for the cause by trying to remember something frightening that they saw or perhaps an animal they ate that had distinctive facial markings.

In the communities that Laderman studied, surprisingly few foods were prohibited during pregnancy. A fruit called durian, a high-fat fruit with chemical breakdown products similar to alcohol, makes people feel hot, and pregnant women usually avoid eating it. They classify certain medicines, like penicillin, as "hot" and prefer not to use them; the pregnant woman should avoid ingesting "hot" substances. But in the postpartum period, food restrictions must be followed. This fact has intrigued medical anthropologists. After giving birth, a time when women should have nourishing food, why would fruits, vegetables, and certain species of fish be prohibited?

The answer lies in the Malay humoral system, which ascribes hot and cold qualities to foods, remedies, and states of health. Women are considered to be in a cold and vulnerable state following birth. To protect their health they sleep on a wooden platform, called a "roasting bed," raised over a low wood-burning fire. (See Fig. 6.2.) During the day they spend some time resting on the platform, too, though they also follow some of their normal activities. Because fruits and vegetables are considered "cold" foods, eating them would add to their humoral imbalance, so they are avoided. For



FIGURE 6.2 A Malay woman who has recently given birth rests on her "roasting" bed. The object in her hands is a flat stone heated on the hearth and used to warm her abdomen. Photo by Carol Laderman. © 1984 The Regents of the University of California. Reprinted by Permission from Carol Laderman, Wives and Midwives: Childbirth and Nutrition in Rural Malaysia (Berkeley: University of California Press).

the forty-day period of "roasting," women continue eating the rice and fish seasoned with black pepper that are staples in Malay fishing villages, as well as store-bought items such as European-style bread, biscuits, coffee, and sugar.

This pattern was first described by Christine Wilson, who did fieldwork in RuMuda, a village of about six hundred on the northeast coast of Malaysia. She found that the postpartum diet was adequate in energy and protein but deficient in minerals, particularly calcium, and in vitamins, specifically thiamine, riboflavin, ascorbic acid, and vitamin A. Wilson was concerned that these deficiencies might affect the health of the women and their nursing infants. A physician collected and analyzed blood samples from two of the new mothers in her study and found them to be anemic and folic acid deficient (Wilson 1971, 1973).

A few years after Wilson's study, Carol Laderman studied childbirth in another coastal village, Merchang, only 12 miles (20 km) from RuMuda. Laderman apprenticed herself to a traditional midwife and also observed the work of the government midwife. She studied nutritional issues to document the effects of the postpartum food taboos on the health of childbearing women. Although primarily trained in ethnography, she learned to draw blood and analyze diets. Like Wilson, Laderman was working alone and was able to get detailed data from only a small sample of nine women, comparing their nutritional status during pregnancy with their status after the postpartum period.

Some of the women followed the food restrictions for the full forty days, others for shorter periods, and some not at all. There seemed to be little evidence that the postpartum restrictions had a negative effect on health. Some actually had better diets during the postpartum period, with more protein, fat, and niacin than was available in the usual diet, but most had low levels of thiamine, a nutritional problem common to people eating rice as a staple food.

In the postpartum period, the baby is considered as vulnerable as the mother. The infant is "tired after its long journey from the darkness of the womb to the light of day," and the mother is tired from "the exertions of giving birth" (Laderman 1983:201). In this state, both can easily be attacked by spirits, and precautions are needed such as placing thorns under the house and putting a knife under the baby's mattress. Occasionally these precautions don't work, and the mother loses her appetite, cries a lot, and has trouble sleeping, a condition called *sakit meroyan*. The baby cries incessantly

and won't nurse. These are signs that the *Hantu Meroyan*, which comes from the placenta and amniotic fluid, is unsatisfied and is venting resentment.

If the problem becomes serious, much like postpartum depression in European women, the usual treatment is a séance held by the shaman to force the spirits to leave the woman. Supported and encouraged by relatives, she goes into a trance, which allows her to express emotions. This ceremony usually breaks the spell and cures the patient (Laderman 1983:203).

# Care Providers in Pregnancy and Birth

Before the early twentieth century, in Europe and North America home births were the norm. In colonial America, midwives handled most births. New England towns provided free housing to midwives and in some cases, salaries. Historical records show that midwives were expected to attend both wealthy and poor women. They had a low rate of mortality associated with their cases and no recorded epidemics of childbirth (puerperal) fever (Wertz and Wertz 1989).

Routine interventions in labor and birth began in the seventeenth and eighteenth centuries with the invention of forceps by physicians of the Chamberlen family in the late 1700s. Female midwives met competition from barber surgeons and male midwives, who used forceps and hooks to facilitate difficult deliveries, although without adequate clinical training. By 1710 in England, male doctors began to specialize in gynecology and obstetrics. They attended royalty and wealthy women, mostly in home births but after 1745, in lying-in hospitals (Cody 2005).

Early maternity hospitals had a controversial history, Attendants who neglected to wash their hands unknowingly transferred infection between patients, inducing childbirth fever and causing many deaths. Introduction of antiseptic precautions greatly reduced maternal mortality. Paradoxically, the high mortality associated with hospital births led to an increased sense of danger associated with labor and delivery in the early twentieth century. This perception contributed to attitudes that midwives were ignorant and harmful and to eventual decline in home births.

By the 1950s hospital births became dominant in the United States, although home births attended by trained midwives were still popular in the United Kingdom and other European countries. In the 1970s, reacting to unsatisfying hospital experiences and finding it increasingly difficult to arrange physician-attended births at home, some American women turned

to "direct-entry" midwives—those who entered practice without formal nursing training—for care during pregnancy and birth. As of 2003, about 3,000 direct-entry midwives practiced in the United States, attending 1 percent of births, and about 5,500 nurse-midwives attended 7 percent of births, mostly in hospitals. In 1995 members of the Midwives' Alliance of North America created a national certification, the CPM or Certified Professional Midwife, to assure patients of a midwife's competence. By 2003 there were over 700 CPMs in the United States and three in Mexico (Davis-Floyd 2003:1915).

In many low-income countries, midwives attend a sizeable proportion of births, and there is often stiff competition between providers. For example, on the Caribbean island of Jamaica, doctors, professional nurse-midwives, and folk midwives, called *nanas*, all compete to provide services. *Nanas*, who attend about one-quarter of all births, provide supportive care throughout the pregnancy, including massages with castor oil or olive oil to "shape the baby" and to free the woman's body for birth (Kitzinger 1994). Massage with oil, a traditional form of therapeutic touch, is called "anointing" and is believed to bless the woman and child (Kitzinger 1997).

Not all developing countries support the continuing participation of midwives in pregnancy care. In Mexico, most *parteras* are aging and are not training replacements, and funding for midwifery courses has been cut. Traditional midwives attended fewer than 17 percent of births in 1995. A sign that Mexico has embraced biomedicine is the fact that the C-section rate (around 40 percent) is one of the highest in the world (Davis-Floyd 2003:1916).

# Biomedicine and Authoritative Knowledge

In biomedicine, women are urged to begin prenatal care in the first months of pregnancy. However, in the clinical setting, their awareness of their own bodies is often discredited as inaccurate or too subjective. A self-diagnosis of pregnancy is not accepted until blood tests are done. It is the physician or nurse-practitioner who has "authoritative knowledge" and who controls the laboratory tests and measures that legitimate that knowledge (Jordan 1997).

Although the newly pregnant woman may perceive changes in her body, for others the reality of the pregnancy is confirmed through the first sonogram of the fetus, created through reflection of sound waves through ultrasound. The scan allows for accurate dating of gestational age and detection of multiple fetuses or developmental anomalies. Some parents keep a videotape of the sonogram or put prints of it in an album. Ultrasound imaging has become

routine in most modern societies, including Greece, where 93 percent of women in Athens have at least one fetal ultrasound scan during pregnancy. Many of the women feel that seeing the image makes the fetus seem real and helps to relieve anxiety about the pregnancy (Georges 1997).

Ultrasound also allows early identification of the baby's sex. Some expectant parents prefer to wait until the birth, but the trend in North America is to know as early as possible so they can choose a gender-specific name, prepare the crib or cradle with certain colors and toys, and begin to identify with the fetus as a person. This level of preparation reflects the low perinatal and neonatal mortality in societies where biomedicine dominates, at least among those with access to high-quality care.

Amniocentesis, an invasive procedure considered a more definitive test of fetal sex, has been widely used in India and China, where male offspring are preferred (Patel 2007). This controversial practice gives couples the option of abortion if they are not satisfied with the sex of the fetus. However, fetal cells cannot be cultured from amniotic fluid before sixteen weeks' gestation, and abortion at this stage is neither simple nor painless. Many practitioners view the use of amniocentesis for gender selection as unethical.

Tests can be done early in pregnancy to detect certain abnormalities, including maternal serum alpha-fetoprotein screening to detect neural tube and abdominal wall defects. Amniocentesis is available for patients who fall into one of several risk categories, including "elderly" mothers over thirtyfive, those who have had a child with genetic abnormalities previously, and those who have had infertility treatment. (See Fig. 6.3.) Genetic counseling routinely accompanies prenatal genetic tests, and patients should be informed of the risks associated with procedures like amniocentesis, in which amniotic fluid is withdrawn from the uterus with a syringe. The tests inform parents of any genetic abnormalities and also the sex of the baby. Should abnormalities be confirmed, abortion is an option. In the case of physical defects such as spina bifida, there is a possibility of fetal surgery to correct the abnormality. Gene therapy is mostly used to treat children with genetic abnormalities, but the success of fetal surgery suggests that in utero gene therapy will become conventional in the future to avert genetic diseases and metabolic abnormalities.

While middle-class women often seek out genetic services, ethnic minority women in North America tend to refuse fetal diagnosis and genetic counseling. Miscommunication between care providers and their clients is one factor behind these refusals. A study of Latina women in California uncovered the semantics of this miscommunication. For example, explanations of serum alpha-

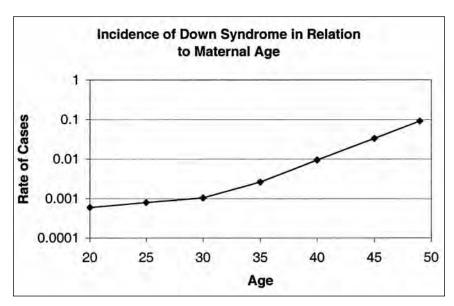


FIGURE 6.3 Rate of Down syndrome by maternal age. The risk of Down syndrome, trisomy 21, increases with maternal age. For twenty- to twenty-five-year-old mothers, the incidence is one in 1,400. For thirty-five-year-old mothers, the rate is one in 350. At age forty-five, there is a one in thirty chance of conceiving a child with Down syndrome, but since the over-forty group makes up less than 2 percent of all pregnant women, the risk is high but the frequency is low.

fetoprotein screening characterized the baby's protein as being high or low. Hearing this, clients understood "protein" to be an element in food and declined testing, saying "I can eat more protein" or "I'm sure I could catch up with my weight if I make an extra effort to eat for two" (Browner et al. 2003). Whatever the reasons for refusing prenatal diagnosis, when poor women do not receive the same level of care in pregnancy as more affluent women, the result is "stratified reproduction" that differentially rewards and supports reproduction depending on class and ethnicity (Rapp 2001:469).

# Vulnerability in Pregnancy

Among life transitions, pregnancy is an especially vulnerable time. Many anthropological studies have emphasized the importance of the pregnant woman's social network in meeting her emotional and physical needs. Health care systems play an important role in the woman's well-being. Medical and nursing staff can form a support system for the pregnant woman, or they can create barriers to her seeking care. Urban Hispanic and African American

women who lack private insurance often delay seeking prenatal care, dreading the negative attitudes of clinic staff, the long waits, and the brief and impersonal exams. Rural white communities in Appalachia also have limited resources for the care of pregnant Medicaid patients, and the prenatal and perinatal environments in West Virginian hospitals are often stress-inducing (Dye 1993).

A study of prenatal care among Medicaid patients in Alabama found that friends, family members, and staff at a pregnancy testing agency all influenced women's decisions to seek care. However, women with several previous, uncomplicated pregnancies tended to delay seeking care. One factor was that clinics discouraged women from coming to appointments with their small children, who would have to be left unattended in the waiting room while the woman was examined (Winston and Oths 2000).

The pregnant woman's economic vulnerability is an important factor as well, especially when her connection to the baby's father is tenuous. In a study of pregnant women in the city of Cali, Colombia, Browner (1983) learned that a woman's perception of her partner was related to her dependence on him for financial and (even more importantly) emotional support. Specifically, that perception focused on the *man's* symptoms such as nausea, vomiting, headaches, cravings, and tiredness; these were perceived as definitive signs that the *woman* was pregnant. In interviews with 120 women, 73 (61 percent) reported symptoms in their partners. Analysis of the backgrounds of the entire sample showed that women with large support networks among kin, neighbors, and friends reported pregnancy symptoms in partners less frequently than did women who had no relatives nearby and fewer friends.

# Medicalization of Childbearing

Intensive management of pregnancy and birth has, in the span of only eighty years, become the cultural norm in North America, Europe, Japan, Australia, and other developed countries. If a woman has passed her due date, she is advised to schedule induction or surgical delivery. In the hospital she is likely to have a fetal monitor strapped to her abdomen, to be attached to intravenous drips, and to have the amniotic membranes broken to speed labor. The baby undergoes multiple tests and procedures after delivery. The Apgar test routinely given to the newborn right after delivery represents, to many parents, the first quantitative evidence of the child's normalcy. Fathers especially are known to brag when their child is a "perfect 10" right after birth.

Alternatives to this pattern exist, such as home births or birth centers attended by licensed midwives, but their availability varies by nation. In Holland birth centers and home births attended by midwives are popular, and in France maternity centers where women labor without interventions have been available since the 1970s. In the United States, approximately 94 percent of all births are in hospitals, and 92 percent of these are attended by obstetricians (Davis-Floyd 2003). In developing nations such as India, hospital births have increased even in remote areas such as the northern regions of Ladakh and Kashmir. (See Fig. 6.4.; also see chapter-opening photo.)

Despite the generally good medical management of birth, in industrial and post-industrial settings a sense of risk and danger surrounding pregnancy persists. The cultural definition of pregnancy is that it is an abnormal condition requiring medical intervention. "What if something goes wrong?" is the standard question of couples when considering alternative birth settings.



FIGURE 6.4 The labor room at Mahabodhi Karuna Charitable Hospital, a private hospital in Ladakh, northern India. The delivery table with "stirrups" to enable the lithotomy position of the laboring woman (legs up, back flat against the table) is similar to equipment used in North America in the 1950s. The lower part of the window has been "painted" to prevent anyone from looking into the labor room, which is on the first floor of the hospital. Photo by Christopher Wahlfeld.

When birth inadvertently occurs at home, or in a car, the standard procedure is to rush the woman and newborn infant to the nearest hospital even if both are in good condition. This response suggests that the hospital setting provides an aura of safety that is as important symbolically as it is medically.

Robbie Davis-Floyd describes "technobirths" in American hospitals as performances of staff and equipment that tell "a cultural story about the female body as a defective machine in need of assistance by technical experts and other more perfect machines. It also enacts and displays the technocracy's supervaluation of speed, efficiency, control, high technology, and the flow of information through cybernetic systems." She notes that this birth management is supported not only by physicians trained in this approach, but also by women who value the elimination of labor pain (Davis-Floyd 2003:1914).

### Management of Menopause

Medicalization of reproductive health affects women not only in their child-bearing years, but also during menopause, when female fecundity declines and ceases. Anthropologists find it striking how problematic this life stage has become in Western societies. Medical textbooks and popular articles emphasize themes of deficiency, failure, and imbalance in describing hormonal changes, and in fact many North American women do subjectively experience feelings of loss and decline (Martin 1987). Hormone replacement therapy has been recommended routinely until recently by physicians to relieve symptoms such as hot flashes, insomnia, or depression and to prevent bone loss and heart problems (Lock 2001:485).

Comparisons with Japanese views of menopause show major cultural differences. Menopause, roughly translated as *kônenki*, has a broader meaning than just the end of menstruation. It is an inevitable and natural process, with temporary symptoms, "a turning point in one's life," according to a fifty-four-year-old teacher. *Kônenki* is "when your sacred function as a woman, the bearing of children, is over" (Lock 1993:9). Most women interviewed in Japan give little weight to the importance of menopause in their narratives about middle age and aging. Instead, they focus on "human relationships, and the way in which in middle age a woman turns from being concerned primarily with children and their care to enjoy a brief spell of relative freedom . . . before she becomes fully occupied with the care of aged people" (1993:45).

The medical model of menopause holds less salience in Japanese culture, a fact demonstrated by comparisons of menopausal women in Japan, Canada,

and the United States. A pain medication for menopause symptoms was used by 62 percent of U.S. women, 45 percent of Canadians, and 14 percent of Japanese women. Eight percent of the American sample, 6 percent of the Canadians, and 3 percent of the Japanese used hormone replacement therapy. Sixty percent of the Japanese women had never discussed *kônenki* with a doctor (Lock 1994:314–315).

### Species-Specific Reproductive Patterns

The preceding section introduced the diversity of reproductive patterns noted by cultural anthropologists. Underlying this variation are some universal traits of human reproduction that have evolved over 3 million years or longer. Regardless of environment, cultural complexity, or ethnicity, these biobehavioral traits affect human sexuality, reproduction, and infant care.

Of particular interest to physical anthropologists and human biologists are the **life history** parameters of humans. Life history refers to a species' "pattern of ontogeny," the process and timing of "growth, development, and maturation of the individual organism from conception to death" (Bogin 2006:202). Compared to other species, humans have relatively long childhoods and adult lifespans. As in the great apes, we develop sexually fairly late. The average age for the first birth is 10 years for gorillas, 13.3 years for chimpanzees, 15.6 years for orangutans, and 19.5 years for human foragers (Robson, van Schaik, and Hawkes 2006).

A basic premise is that life history traits affect reproductive fitness and thus are subject to natural selection and to selective compromise. Human biologists remind us that energy must be allocated for body maintenance and repair and for growth, as well as for reproduction. However, resources for reproduction are limited, particularly the time and energy needed for gestation, lactation, and child care. Differences in allocations of time and energy are termed "trade-offs" in life history models. Delayed puberty involves a greater allocation of energy toward growth and body size than to reproduction, which may reduce the number of offspring. However, adults have lower pregnancy complications and better infant survival than do young teens.

The following sections present an evolutionary overview of certain human traits. Some, like extended life spans past menopause, are central to life history theory. Other traits, such as loss of estrus cycles, have received less attention from demographers but nevertheless contribute to theories of human pair-bonding and male investment in the care of offspring.

### Loss of Estrus Cycles

Non-human primates, including apes, have estrus cycles, as do many mammals, going into "heat" at certain seasons, ovulating, and being receptive to mating for limited periods. In nonhuman primates, mature females who are not nursing young usually go into estrus at the same time, exhibiting genital swelling, changes in skin color, and body odors that arouse males. Behaviors such as mutual grooming, male dominance interactions, temporary pair-bonding (in some species), and promiscuous mating (in others) intensify for days or weeks until most females have conceived.

In contrast, adult human females ovulate monthly and are (in theory) receptive to mating at any time, as are most adult males. At some point in human evolution, estrus was lost and was replaced by regular menstrual cycles and concealed ovulation (Hrdy 1999). Perhaps this occurred as Australopithecines were evolving, some 3 million years ago. Perhaps it was later, perhaps half a million years ago. As the fossil record does not demonstrate hormonally-controlled traits like estrus and menstrual cycles, we can only speculate about conditions that favored hidden ovulation and year-round mating. Sexual receptivity independent of procreation may have favored pair bonding between males and females, resulting in better parental care. A more random distribution of pregnancy and birth throughout the year might also have contributed to higher infant survival than if all births occurred in one season, when drought and famine could lead to high infant mortality.

### Bipedalism and Fetal Head Size

In most mammals, at least half of brain growth occurs before birth. A rhesus monkey's brain at birth is 65 percent the size of an adult's. However, at birth the human infant's brain is only 25 percent the size of an adult's, and by three years of age, the child's brain reaches 75 percent of adult size. Such extensive brain development after birth is clearly an evolutionary change that coincided with general *encephalization* (increased brain size and complexity) in the human species (Trevathan 1987).

Why this delay in humans? The trait may be linked to the evolution of *bipedalism*, walking on two limbs instead of four. The structural changes that made habitual bipedal movement possible probably were selected as early as 5 million years ago. These changes involved the shape and articulation of the bones that make up the pelvic girdle, allowing for strength and stability when standing or walking upright. (See Fig. 6.5.) When the distance be-

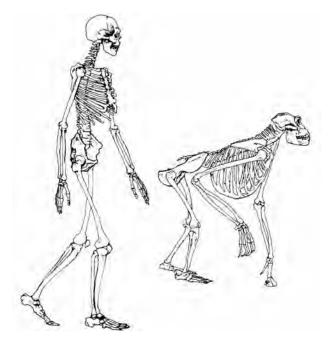


FIGURE 6.5 Differences in the pelvis of the bipedal human (left) and the quadrupedal gorilla (right) reflect structural changes in human evolution. Changes in the pelvis in turn affected childbirth.

tween the hip joints and the sacroiliac joints shortened, the pelvic opening became narrower. This increased the constraints on head size in passing from the uterus first through the pelvic inlet and then in passing through the pelvic outlet during labor. Passage through the birth canal involves a series of rotations that can make birth prolonged and difficult. Clearly there has been severe selective pressure on fetal head size. Before surgical delivery became a realistic option, infants whose skulls were too large might not survive the birth, nor would their mothers.

Natural selection has also favored a narrow range of birth weights. Infants weighing over nine pounds are difficult to deliver vaginally; those weighing under five pounds may not survive without intensive care. The normal gestation of thirty-eight to forty-two weeks in humans is probably also a product of natural selection. Given the size and shape of the female pelvis, pregnancy past forty-two weeks with continued fetal growth could not have allowed good survival rates. There may have been some exceptions: Variations in the pelvic structure of Neanderthals may indicate larger birth canals in this extinct species

than in modern humans, permitting larger fetal head size and gestation as long as twelve months (Trevathan 1987:227).

### Infant Immaturity

The newborn human is neurologically immature and quite helpless, in many ways still a fetus. Sleeping most of the time, with poor vision and inefficient reflexes, the infant needs good parental care. Many cultures have found that newborns thrive best if they are swaddled (tightly wrapped in cloths or blankets) or placed in a pouchlike carrier most of the day: a cradleboard, or the hood of the mother's parka, or a sling on her hip or back. In the carrier, infants feel the motion and warmth they knew in the womb. Held against a parent's chest or back, they sense familiar heartbeats.

Nursing on demand, whenever the infant expresses hunger, also replicates the steady nourishment from the placenta. These infant care practices, found in so many societies, reinforce what physical anthropologists assert: that human gestation includes a fourth trimester outside the womb, a period of *exterogestation* during the first three months of life (Montagu 1971).

# Survival Past the Reproductive Span in Human Females

Menopause is a period of five or more years in which estrogen declines, ovulation becomes irregular, and menstruation diminishes and eventually stops. Conception is unlikely after menopause ends. Other primate females enter menopause late in their lifespan, beginning irregular cycles around fifty years in chimpanzees, thirty years in macaques, and twenty-four years in baboons, and usually surviving only a few more years. Humans also enter menopause around the age of fifty, but they can live another twenty or thirty years (Hrdy 1999:274).

There has been much debate on the evolutionary advantage of human menopause. One theory, called the "grandmother hypothesis," suggests that it is adaptive to have caregivers in a community who are not directly reproducing but rather are providing resources to their own descendants. Life history theorists point out that food-gathering by post-menopausal women contributes directly to the nutrition of children after they have been weaned. Observations of Hadza foragers in Tanzania note that children help in foraging but do not have the strength to pull out a deeply buried tuber that is a dietary staple and depend on grandmothers and aunts to help them. "If the

older females help feed their weanling grandchildren, the mothers of those weanlings can have shorter interbirth intervals without reductions in offspring survivorship" (Hawkes 2006:118).

Sarah Hrdy (1999:275) prefers "the prudent mother hypothesis," since childbearing past the age of forty is more risky than at a younger age. It is more adaptive for a woman in her forties to stop reproducing and to provide care to her children, including extended breastfeeding of the youngest child.

### Constraints on Reproduction

Until the last half of the twentieth century, the human population was kept in check through various biological and cultural constraints. In AD 1800, the global population was one billion. Over the next two centuries, the number of humans on this planet increased to 7 billion. This level of overpopulation is a recent phenomenon.

Is it normal for humans to have rapid population growth, or do human life history characteristics show that slow growth is more typical? Like many other large mammals, humans tend to reproduce relatively few offspring. Since women usually give birth to one infant at a time, and it is often two or more years before the next pregnancy, few women bear more than ten children in their lifetime. Men are able to father many more children, but cultural rules also limit male procreation. If you compare human reproduction to the numbers of offspring produced by rodents, amphibians and fish, and reptiles, you will realize that even ten children per couple is a relatively low rate.

This pattern of low birth rates is related to the demographic terms, "K-selected" and "r-selected." "K" denotes "carrying capacity," meaning that a K-selected population reproduces slowly and generally stays at a size compatible with environmental sustainability. Humans and other large mammals are K-selected. R-selected species, on the other hand, reproduce large numbers of young over a short time ("r" stands for "rate"). Mice, rats, and rabbits are typically r-selected; they have short life spans, mature rapidly, and have several litters a year, yet only the strongest of the young survive to maturity. Parental care may be minimal.

R-selection emphasizes quantity over quality, with extreme oscillations over time in population size (for example, in the number of lemmings in the arctic tundra from year to year). The K-selected pattern emphasizes quality over quantity, with fewer offspring per birth, longer periods to mature, and generally longer life spans. K-selected species provide prolonged and intense parental care, reflecting the considerable genetic investment in each offspring.

The dichotomy of r-selected versus K-selected, first introduced by Robert MacArthur and E. O. Wilson (1967), was empirically tested and criticized by various researchers in the 1990s. Within certain taxa, some species fit the scheme, and others did not. Comparing body sizes in different taxonomic groups, such as vertebrates and insects, also evoked criticism. Demographers found the dichotomy problematic because the distinction between r and K "ignores differences in mortality rates with age." Recent refinement of taxonomic comparisons of life history traits has come from E. L. Charnov (2002), who emphasizes trade-offs in reproductive timing and demographic patterns (Hawkes 2006:51–53). Despite these criticisms, the K-selected pattern does correspond well to human reproduction and demography.

### Fecundity and Fertility

Demographers use two terms to describe reproductive capacity: **fecundity** and **fertility**. The distinction is important because a population can have high fecundity but moderate or even low fertility. Fecundity means *potential reproduction*; the term comes from the Latin word *fecundus*, meaning "fruitful." Fecundity is a female's physical ability to become pregnant, or the male's ability to produce sperm that lead to a viable pregnancy.

Fecundity is usually high in young, healthy adults. It is lower in people with poor health, in those just entering puberty, in females nearing menopause, and in males experiencing decline in sperm counts. Disease and malnutrition can reduce fecundity dramatically. In sub-Saharan Africa, women with malaria have higher miscarriage rates than those free of malaria. Sexually transmitted infections (STIs) and pelvic inflammatory disease (PID) contribute to subfecundity (lowered pregnancy rates) in central Africa. In this region where childbearing is highly valued, childless women face ostracism and despair.

Fertility comes from the Latin term *ferre*, "to bear," and refers to a live birth. Fertility depends on both physical and behavioral factors. Not every fertilized egg develops into a fetus; at least 40 percent of embryos do not survive. If there are genetic defects in the embryo, or if for some reason implantation does not occur, the embryo dies and is flushed out of the uterus.

**Natural fertility** refers to reproduction in the absence of deliberate birth control or abortion. This concept assumes that fertility rates will invariably be high among non-contracepting women. In fact, there is much evidence that natural fertility varies greatly and may be fairly low even without contraception. Among the Ju/'hoansi described in Nisa's story, the total fertility rate

was 4.3, even though women did not deliberately limit their pregnancies. The average interval between births was twenty-seven months (Wilmsen 1986:65–66). The high natural fertility for Hutterites of Canada was more than twice the birth rate of the Ju/'hoansi throughout most of the twentieth century, with an average completed fertility of nine (Lang and Göhlen 1985). The Hutterites are a communal farming society, similar to Amish or Mennonites.

Both Ju/'hoansi and Hutterites have been non-contracepting societies, but natural fertility is higher for Hutterites due to superior food security and medical care. Their average family size has declined in recent decades, however, as some Hutterite women have started using contraceptives. Ju/'hoansi settling near cattle ranches in southern Africa have also experienced demographic change, in this case increased birth rates and closer birth spacing.

Fertility can be measured in several ways. The *crude birth rate*, the number of live births per thousand people in a population per year, is useful for comparing national differences. The *total fertility rate* is a hypothetical figure projecting the number of children that would be born to each woman if she were to live to the end of her childbearing years (usually forty-five to fifty) and were to bear children at the prevailing fertility rates, with age adjustments. *Average completed fertility* is the average number of live births in a cohort of women after menopause. It differs from the total fertility rate in that it reflects fertility rates in the generation just past rather than at present.

Total fertility varies greatly from country to country. Nations with high fertility in 2006 included Niger (7.3), Yemen (5.6), and Ethiopia (5.4). Although these three countries have especially high rates, Table 6.1 shows that fertility has in fact declined in each since 2000. (See Table 6.1.) Among the lowest fertility rates in 2006 were those reported for Canada (1.5), Italy (1.4), Japan (1.3), and Russian Federation (1.3) (UNICEF 2008).

Fertility rates under 2.0 are below replacement rates and will lead to population decline unless immigration increases significantly. Many countries have shown dramatic decreases in birth rates and family size as they have developed economically. The total fertility rate in Brazil dropped from 6.2 in 1960 to 2.2 in 2001. In Thailand, the rate declined from 6.4 in 1960 to 2.1 in 2001.

The case of Bedouin pastoralists in Lebanon shows that fertility can gradually decrease during subsistence change in a still-growing population. Traditionally nomadic herders of sheep and goats, tribal groups since the 1960s in the Bekaa Valley have gradually become more dependent on agriculture as sharecroppers and wage laborers. Camels as the main form of transport have

TABLE 6.1
Total Fertility Rate of Selected Countries, 1985–1990, 2000, and 2006

	1985–1990	2000	2006
Niger	7.0	8.0	7.3
Yemen	7.7	7.6	5.6
Ethiopia	7.0	6.8	5.4
Nepal	6.7	4.7	3.4
Papua New Guinea	5.3	4.5	4.0
India	4.3	3.2	2.9
Malaysia	4.0	2.8	2.7
Ecuador	4.1	3.0	2.6
Mexico	3.5	2.7	2.3
Brazil	3.2	2.3	2.3
Costa Rica	3.2	2.8	2.1
U.S.	2.0	2.0	2.1
Australia	1.8	1.8	1.8
China	2.4	1.8	1.7
Canada	1.8	1.6	1.5
Japan	1.5	1.4	1.3
Italy	1.3	1.2	1.4
Russian Federation	1.7	1.2	1.3

Source: UNICEF, The State of the World's Children, 2002, 2008. Reports available in PDF version at http://www.unicef.org and United Nations Statistical Yearbook, 1992.

been replaced by trucks, reducing community mobility, and groups have begun purchasing land and building houses (Joseph 2005).

The total completed fertility rate among Bedouin women of post-reproductive age was 8.9; among ever-married women, ages 15–49, the rate had dropped to 5.5. The women married at around 18, weaned their infants early, and had median birth intervals of 25 months. They had a low incidence (about 1.5 percent) of infertility. Infant and child mortality was also very low due to high-quality weaning foods and good health services (Joseph 2005:208–209).

# Factors Affecting Fecundity and Fertility

A population's fertility is influenced by many factors. One determinant is variability in the female reproductive span between **menarche**, the first men-

strual period, and **menopause**, the gradual cessation of periods. If this duration is around thirty years (say menarche at thirteen, first birth at sixteen, and last birth at forty-six), hypothetically a woman could bear ten or more children. However, female fecundity reaches its peak in the mid twenties and begins to decline in the mid-thirties, and pregnancy is less likely in the decade before menopause. Male fecundity, in contrast, peaks during adolescence and then persists through middle age (Ellison 2001). Reaching puberty later, delaying the first pregnancy, and entering early menopause could entail a reproductive cycle of only twenty years and fewer children.

Such a shortened span is found in the Gainj of highland Papua New Guinea, a non-contracepting people with a total fertility rate of 4.3. Gainj females reach menarche at an average age of 18.4 years, much later than in European populations, where menarche is usually around twelve to fourteen years. This delay is probably due to undernourishment, low fat reserves, and protein deficiency. Because they begin menstruation and ovulation so late, Gainj women also have their first child late, at an average age of 25.7 years. There is a long interval between births, three years on average, in contrast to 19.6 months for Hutterites (Wood 1994).

Nutritional stores laid down during adolescence are significant for later childbearing. In some societies, puberty rituals for girls involve deliberate fattening. In Sierra Leone, West Africa, initiation schools provide young girls with copious amounts of rice, palm oil, chicken, and fish. In the rituals, beauty, health, and fertility are linked to fatness, and "the opposite of fat is not thin, but dry, connoting among other things a dry and barren uterus" (MacCormack 1994:112). Ample food in adolescence promotes a growth spurt and a changed ratio of lean body weight to fat weight suitable for sustaining pregnancy.

In addition to food intake, nutritional and reproductive health is also affected by women's productive roles and the physical work required by those roles. In agricultural societies, women's tasks can be endless and draining. For example, in rural Uttar Pradesh, in northern India, adult women and older girls work twelve to sixteen hours a day, depending on the season and socioeconomic class. Women are responsible for many outdoor tasks: hauling water for cattle, milking cows, taking food to workers in the fields, collecting firewood, milling wheat and husking rice, taking dung from animal stalls to make fuel cakes, and sometimes cutting sugar cane and threshing wheat. Indoors, women care for children and elderly relatives, cook food, clean the house and courtyard, haul water, wash clothes and dishes, patch the walls and floor with mud, spin cotton, make rope, and mend clothes. Nevertheless, many of these tasks

are not culturally classified as "work" because they don't directly earn money. One woman stated, "Women become old bearing children. They can't keep their strength. Their spirit drains away" (Jeffery, Jeffery, and Lyon 1988:172).

Fertility was high in this region of India in the years 1976–1985: about 40 births per 1,000 population, with an average completed fertility of 7.5. However, infant mortality was also high, 86 per 1,000 infants. Further, female mortality rates in the childbearing years were high, 1.5 times higher for women than for men. The risk of dying in childbirth was considerable, about 5 women per 1,000 deliveries (Jeffery, Jeffery, and Lyon 1988:60–61, 170). Fifteen years later, by 2002, the mortality statistics had not changed greatly: infant mortality was 71 per 1,000, and maternal mortality was 517 per 100,000, the highest in India (Chowdhury 2008).

### Seasonality and Reproduction

Seasonal stress also influences reproductive health. In remote farming villages in the foothills of the Himalayas, in Nepal, both men and women of the Tamang caste of grain farmers and pastoralists work much harder in the monsoon season. During this season, with three-quarters of the annual rainfall, they spend almost every day in the fields and work long hours each day. Even women who have just given birth return to the fields within a week. The workload does not slacken until transplanting of rice and millet is complete. In winter, workloads are lighter, but firewood must be gathered and cattle taken out to graze, activities that require climbing up and down steep slopes. Women carry heavy loads of firewood, rice straw, and cereal crops, often more than half their weight (Panter-Brick 1989, 1991).

Panter-Brick's study of rural Nepali women provided the first anthropological evidence of how seasonal activity affects fecundity. Nepali women had low levels of ovarian activity throughout the year, when compared with U.S. women by measuring the hormone progesterone in saliva samples. In the hard work of the monsoon season, when women lost weight, they had significantly lower levels of ovarian function, making it less likely they would conceive a child. (See Fig. 6.6.) This resulted in a seasonal pattern of births in the villages studied (Panter-Brick and Ellison 1994).

# Controlling and Enhancing Fertility

Methods to enhance fertility have been far more important than contraception in societies valuing large families. In the Middle East, both men and



FIGURE 6.6 Nepali woman harvesting finger millet with her two children. Photo by Catherine Panter-Brick. Reprinted by Permission.

women traditionally consumed teas containing opium, hashish, and catnip in the belief that this would increase fecundity (Newman 1985). Many plants, for example willow, date palm, and pomegranate, contain estrogenlike substances. Farming peoples may have observed the effects of these plants on their livestock and then experimented with the plants themselves (Taylor 1996).

Practices that restrict fertility also have a long history. The earliest condoms were made of dried sheep gut, and women discovered long ago that cervical plugs made of plant material could block sperm. Egyptian women used *pessaries* (vaginal pastes made of crocodile and honey), and Greeks and Romans inserted cervical plugs made of copper and lead (Finch and Green 1963). Copper is used in modern IUDs, suggesting that copper may have been known in ancient times to have some contraceptive efficacy.

Withdrawal before ejaculation (*coitus interruptus*) and douching with acidic or caustic substances were used with varying success in the past to prevent pregnancy. A sixteenth-century device, a small kettle that a woman straddled after intercourse, was believed to prevent conception by "steaming"

or "fumigating" the vagina (Finch and Green 1963:29). Another traditional method widely used (and continued today) includes a range of intimate behaviors involving non-penetrative sex that prevent pregnancy and maintain virginity.

Even with the development of oral contraceptives in the twentieth century, traditional methods to prevent pregnancy persist in many countries. A survey in Nigeria showed that 18 percent of Yoruba women had used indigenous methods to space pregnancies, and 7 percent were currently using them. Most popular were finger rings that were worn after being placed inside chameleons, frogs, or eggs for a period of time. Another method was to rub an herbal powder into an incision made near the vagina, on the abdomen, or the back of the knee. Some women mentioned drinking a soup of herbs, papaya, and tortoise, and wearing a waistband containing herbal materials (Koster 2003:222).

Yoruba women liked these methods because they were easily accessible from traditional medical practitioners who could assure privacy to clients, and there were no complications associated with their use (Jinadu, Olusi, and Ajuwon 1997). A follow-up study of efficacy compared seventy-two women who used one of the four indigenous methods with seventy women who were not using indigenous methods. Neither group contained women who were breastfeeding or using other contraceptives. Of those using traditional contraceptives, only four (5.6 percent) became pregnant over an eighteen-month period; none of those using herbal remedies as soup or as power rubbed into incisions became pregnant . Thirty-four percent of those not using traditional contraceptives became pregnant (Jinadu and Ajuwon 1997).

Mechanically induced abortion has been practiced throughout history to terminate pregnancies, usually through crude methods such as injuring the abdomen or taking purgatives to induce severe vomiting and miscarriage (Devereux 1976). Plants known to bring on labor contractions in late pregnancy can, in large doses, induce early labor and miscarriage before the fetus is viable. Ayurvedic medicine in India uses many plants as early-term, "morning-after" abortifacients (Taylor 1996).

Today emergency contraception and the accessibility of safe abortions for unwanted or hazardous pregnancy vary considerably, especially in developing countries. A study of abortion in Nigeria in 1998 showed that 45 percent of 1,447 women surveyed had had abortions. Of these, 13 percent reported moderately serious complications. Of the married women, 30 percent described unsafe abortions leading to complications; 40 percent of the single women described experiences of unsafe abortions. Unsafe methods included

self-induced attempts through various over-the-counter and prescription drugs such as quinine, Epsom salts, antibiotics, and menstrual regulation drugs. Termination not performed in a hospital or clinic, performed after the first trimester, or using a method other than dilatation and curettage or vacuum aspiration were classified as unsafe (Koster 2003).

Total fertility rates are most highly correlated with the percentage of people using contraception and abortion. Oral contraceptives ("the pill"), the IUD or intrauterine device, injections of Depo-Provera or other hormones, the contraceptive patch, and male condoms are common methods of contraception, but each has its drawbacks. The Yoruba women interviewed by Ajuwon and colleagues believed that oral contraceptives and IUDs endangered a woman's health. Brazilian women distrusted the IUD method, believing the coil could get lost in the body and could cause cancer. They also said that "pills made the body swell up or get dry and thin and these fluctuations were out of the individual woman's control" (Dalsgaard 2004:167).

Despite the lack of an ideal contraceptive, throughout industrialized countries over 70 percent of married women in their reproductive years use some form of contraception. In overpopulated countries like the People's Republic of China, an official policy of one child per family is encouraged through incentives for those who conform and penalties for those who have two or more children, although this policy is easing in rural areas. The history of China's demographic planning since the 1980s is characterized by Susan Greenhalgh (2005, 2008) as a form of biopower related not only to issues of overpopulation, but also to mechanisms for surveillance and political control.

Female sterilization, a surgical procedure usually requiring anesthesia, is a widely used option after the desired family size has been reached. Vasectomy, or male sterilization, is a simpler, lower-risk procedure, but it is a less favored option in many societies. India encourages contraception and rewards men who have vasectomies. In Brazil, 27 percent of all women ages 15–49 have been sterilized; 52 percent of all married women who desire to end childbearing choose sterilization (data for 1996). Vasectomy is rarely done in Brazil, as it is believed that loss of male potency is a serious risk (Dalsgaard 2004:109).

# Infertility

Many traditional cultures regard infertility as abnormal and tend to blame the woman if a married couple does not produce children. In her book *Infertility and Patriarchy* Marcia Inhorn describes the case of Fayza, who has been seeking a cure for infertility for thirteen years. Fayza says, "Because of the problem

of children, I feel that I'm smaller than all other people." Although her marriage is stable and her in-laws have been kind, she feels that others pity her and she is empty, like a "flowerpot without flowers" (Inhorn 1996:56–58).

In recent decades, infertility has also become a concern in the United States, the United Kingdom, and other high income countries, with increasing numbers seeking treatment or choosing options such as donor insemination. Because female fecundity declines after the mid thirties, couples who have postponed childbearing or who have just begun their relationship and want children feel a particular urgency to seek medical help if they cannot conceive naturally within a few years. Sensing that the "biological clock" is running out, infertile couples readily seek professional services in spite of the expense. Infertility treatment in the United States is mostly a middle-class phenomenon. Fertility clinics for low-income clients are virtually nonexistent even though infertility rates are higher among minorities than among middle-class whites (Becker 2000:23, 270, note 48).

At the same time that technology for diagnosing and treating infertility is becoming increasingly sophisticated, social changes have made adoption more difficult. Older, sometimes disabled children are available to adopt or for foster care, but the couples seeking adoption usually prefer an infant. Consequently, increasing numbers of couples choose medical intervention. They face an array of options: in vitro fertilization, donor eggs or sperm for artificial insemination, and contracts with surrogate mothers. Fertility treatment, with a low and unpredictable success rate, is often not covered by medical insurance. Success sometimes leads to multiple births of four or more children, putting the woman at risk.

### Environmental Factors in Infertility

P. D. James's dystopian novel, *The Children of Men* (1993, and produced as a commercial film in 2006), describes a pandemic of human infertility in the year 2021. Science fiction? Perhaps. Conditioned as we are by prophecies of runaway population growth, a scenario of fertility decline seems unlikely. Nevertheless, wildlife biologists report that some animal species are declining in numbers, and some are disappearing. Frogs and other amphibians, for example, are not reproducing in normal numbers, and their young have developmental abnormalities.

It is not known whether these anomalies are due to global warming, disease, or pollution. Exposure to pesticides and herbicides is a common denominator among cases of abnormal reproductive development among animals in

the United States. In Florida lakes with high concentrations of DDT, researchers have found male alligators with feminized penises. Trout exposed to polychlorinated biphenyls (PCBs) in the U.S. Great Lakes also show feminized sexual organs. Herring gulls are having trouble reproducing; many of their eggs result in unhatched chicks, too deformed to develop normally. Seven polar bears caught in 1998, tagged, and released on Spitzbergen, a Norwegian island, were found to be hermaphroditic. Nearby, on the Svalbard archipelago, female bears showed a 60 percent decline in the number of cubs reproduced. Biologists think these abnormalities are due to PCBs in the food chain (Colborn, Dumanowski, and Meyers 1996).

Animal populations decline for many reasons: habitat destruction, predation, climate change, and pollution. Of these causes, chemical exposure is the most difficult to prove. Adult animals are not immediately threatened; toxins build up gradually in their fat reserves. But the young are more vulnerable, especially when exposed to *endocrine-disrupting chemicals*, or EDCs, which affect hormonal development and sexual behavior. These chemicals are found in pesticides, in dioxin, in areas where DDT was previously used and is still degrading, and in accumulations of PCBs in our waterways and food chains even though their production and use are now regulated by law. PCBs were used for decades in hydraulic fluids, lubricants, plastics, paints, inks, carbon paper, electrical transformers, and many other products (Steingraber 2001).

Abnormally early breast development in girls, called **thelarche**, has been reported in Puerto Rico and other places. From 1984 to 1993, the rate of thelarche in Puerto Rico was eight cases per 1,000 females, eighteen times higher than normal, and possibly caused by exposure to *estrogen mimickers*, substances that can initiate hormonal changes in the way that natural estrogen does. Analyses of the girls' blood did not show significantly high levels of pesticides, but there were high levels of *phthalates*, chemicals found in plastics and solvents. Phthalates are found in baby food and infant formula, in cosmetics, hair straightener, dyes, and plastic food wrap (Colon et al. 2000).

# Constraints on the Frequency of Sex

Although limited data are available on the frequency of sex in traditional societies, there is every reason to expect sexual practices to vary cross-culturally. Some cultures regard frequent sexual contact to be dangerous or weakening for men. Other societies regard sex and eroticism as normal and healthy, and this attitude leads to more frequent and varied sexual behavior. There is

ethnographic evidence that when the husband-wife bond is viewed as primarily emotional and romantic, sexuality becomes central in the relationship. If the bond is pragmatically based on economic convenience, sexual relations may diminish after children are born.

Every society places constraints on sex and thus limits the rate of unplanned pregnancies. If people believe that sexual intercourse should be restricted to marriage, teens' opportunities for sexual experimentation may be curtailed. These controls include segregation of boys and girls in schools and in play groups, seclusion of females after puberty or use of chaperones in social settings, a high value placed on female virginity at marriage and female fidelity after marriage, and severe punishment if a woman or girl becomes pregnant before marriage or through an adulterous relationship. Cultural norms encouraging lifelong celibacy in some individuals, such as nuns, monks, and priests, also serve to reduce birth rates.

When men are away from their homes for military service, migrant labor, or hunting and trapping trips, these absences help to space pregnancies (Binford and Chasko 1976). The custom of adult men sleeping in ceremonial men's houses also constrains fertility. In precontact Alaskan Yup'ik communities, adult men usually slept in semisubterranean houses, called *kashim* or *kashgee*, where they also held religious rituals and took sweatbaths. When eighteenth- and nineteenth-century Christian missionaries condemned the men's houses as sinful, many of the *kashim* were destroyed and men began to sleep in their family dwellings. One result of this change was an increase in birth rates (Oswalt 1967).

Societal norms also prohibit sexual intercourse for specified intervals. Especially widespread is the **postpartum sex taboo**, which forbids intercourse while an infant is still being breastfed. The taboo is reinforced by the belief that if the couple has sex, the infant will be harmed because semen may contaminate breast milk and sicken the child. If an infant fails to thrive and dies from malnutrition or infection, the parents may be accused of having broken this taboo. As long as the prohibition is observed, repeat pregnancy will be delayed, and the infant will continue to have optimal nourishment from breast milk. Even if a couple does not refrain from sex, lactation may suppress ovulation and delay conception. However, well-nourished women who breastfeed often resume menstruation and ovulation about four to six months after birth, so any contraceptive benefit from lactation is brief.

In indigenous societies and low-income countries, where women's access to nutritious food is less reliable, frequent nursing may maintain high levels of **prolactin**, the hormone that promotes milk production and inhibits ovulation.

In Zaire, women who nursed their infant more than six times a day were more likely not to menstruate than those who nursed less frequently. !Kung foragers, who maintained an average of four years' spacing between births without contraception, were observed nursing their infants completely on demand, sometimes every fifteen minutes (Ellison and O'Rourke 2000:570–571).

Western physicians often give "permission" to new parents to resume sex within six to eight weeks after the birth. Unless reliable contraception is used, the chances are high that the woman will become pregnant again within a year. This is problematic particularly when the mother is still an adolescent. In studying Latinas in Los Angeles, Pamela Erickson found a high rate of repeat pregnancies among teen mothers. In a sample of 140, 17 percent became pregnant again within six months despite using contraception for at least six months. Teens who changed from a more reliable method, such as oral contraception, to a less reliable one such as foam, condoms, or abstinence, were more likely to have a repeat pregnancy. They followed several criteria in choosing one method over another: how effective it was, their familiarity with the method, and its acceptability for personal use (barrier methods, such as a diaphragm, were unacceptable to many). Care providers and family planning counselors had focused mostly on efficacy and were not aware of the importance of familiarity and acceptability to these teens (Erickson 1998).

Communication between sexual partners about birth control is complex and difficult to study. Medical anthropologists such as Pamela Erickson have been trying to tease out what variables influence whether sexual partners will use condoms and other preventive measures against unwanted pregnancies and disease. The following profile discusses research methods in a project on decision factors in condom use among young adults in a northeastern U.S. city.

# ROFILE: USING ANTHROPOLOGICAL METHODS TO UNDERSTAND CONDOM USE FOR STI PREVENTION IN THE INNER CITY

Pamela I. Erickson

At present, condoms are the only means for sexually active young adults to prevent sexually transmitted infections (STIs) and HIV/AIDS, but rates of STI remain high among inner-city young adults. Past studies of condom use have not been able to identify the communication and negotiation strategies people use to decide whether or not to use a condom during sexual intercourse, a

factor crucial for designing prevention programs. Our study\*, funded by the U.S. Centers for Disease Control and Prevention (CDC), used qualitative anthropological research methods to understand how people negotiate prevention in everyday life. The goal was to contextualize condom use within sexual and romantic relationships and to gain experience-near data on how people decide (or don't decide) to use (or not to use) condoms.

The research included qualitative methods (focus groups, informal interviews, diaries) and quantitative surveys to study how young people negotiate sexual behavior and risk reduction. Here I describe three methods—extended focus groups, relationship history interviews, and coital (sexual intercourse) diaries—which helped us describe the "culture" of sex, romance, and STI prevention among emerging adults in inner-city Hartford, Connecticut. All participants were between the ages of eighteen and twenty-five, self-identified as African American or Puerto Rican, and had had sex with a member of the opposite sex in the last year. We recruited participants using street outreach and flyers in low income, minority neighborhoods in places where young people are found and also accepted referrals from cooperating agencies. The mean age of participants was twenty years; 58 percent had graduated from high school; 41 percent already had one or more children but only 4 percent were married; 38 percent were employed at the time of their participation, and 45 percent lived with their parents. Forty-four percent reported more than five lifetime sexual partners; 37 percent had had more than one sexual partner in the last month; 15 percent reported having ever had an STI; and 95 percent reported ever having used a condom. In sum, these emerging adults (Arnett 2000) are characteristic of urban inner-city youth who have lower completed education, earlier childbearing, higher unemployment, and higher sexual risk behavior than their counterparts in higher-income areas.

At the outset, we needed to understand the kinds of sexual and romantic relationships inner-city emerging adults have and how structural factors such as poverty might affect individual behavior. We began our research with focus group discussions of six to ten participants led by a facilitator and conducted

<sup>\*</sup>The five-year project (2003–2008), Communication and Negotiation about Barrier Contraceptive Use among Young Adults at Risk, is a cooperative agreement among the CDC, University of Connecticut, and the Family Planning Council of Philadelphia and is supported by Award Numbers U58/CCU123064 and U58/CCU323065 from the CDC. The study was approved by the human subjects' protection committees at each of these institutions and at the subcontractor, the Hispanic Health Council. This work is the sole responsibility of the author and does not necessarily represent the official views of CDC.

separately by sex and ethnicity (eight groups, two each by sex and ethnicity). Topics included the kinds of sexual and romantic relationships people have; attitudes toward abstinence and monogamy; knowledge of safer sex and condoms; and the ways people negotiate safer sex with their partners.

We discovered that, while inner-city Hartford youth have a rich vocabulary for different kinds of relationships, there were three basic types: (1) casual relationships like "one night stands, booty call, and jump" (a person who gives you things like a cell phone, money, clothing) that are just for sex, pleasure, or resources; (2) enduring friendships like "friends with benefits" that are intermittently sexual; and (3) more serious (or potentially serious) relationships like "hubby and wifey" (not legally married) and "girlfriend and boyfriend" that are for love, emotional fulfillment, and having children as well as for sex and pleasure. We also learned that abstinence is not a realistic or attractive option for this age group. While monogamy is the ideal in serious relationships, both men and women commonly have more than one sexual partner even when they are in serious relationships. (See Focus Group 1.) The following discussions are from focus group transcripts. The names are pseudonyms.

### **Focus Group 1**

(Puerto Rican Female Focus Group)

Neli: Abstinence is used by ten-year-olds! Eleven and up, uh uh [no].

Interviewer: Between eighteen and twenty-five [years old]?

Yesenia: There is no abstinence!

(African American Female Focus Group)

Interviewer: In which of these relationships do you really have to be

monogamous?

All participants: Husband!

Kaleitha: That's a given, right there.

Charde: Man, hubby? [serious relationship, not legally married], eh, not

even 'cause hubby got a side shot [partner on the side] too.

**Tashonna**: Or if you're leading into a serious relationship, that's when you

give all that up.

Condoms are used in casual relationships when they are available and when drugs or alcohol do not impair decision making or performance, but once a relationship becomes serious, condom use drops off quickly since the couple feels they know and trust each other. Overall, both men and women prefer sex without a condom because it is more pleasurable and more intimate. (See Focus Group 2.)

### **Focus Group 2**

(African American Male Focus Group)

Jamal: If you don't want STDs you go and use a condom.

**Tom**: Or else you go to a clinic and get checked up at the same time, you and your girl, like if you want kids.

(Puerto Rican Female Focus Group)

**Marisol:** But, it's like, now, people get more serious about it [using condoms] because of the whole AIDS/HIV thing. People don't really think about pregnancy when they think of condoms. They think it's just going to prevent you from having a STD.

**Elisa:** 'Cause you so wrapped up into what this guy is telling you, you not actually thinking about yourself. Damn, he love me, he want to be with me. Damn, what if I tell him to put a condom on, will he leave me? You got some people that think like that and they don't realize the consequences 'til it's done.

Carmen: No glove, no love. How about that?

The participants recognize the STI risk with casual partners but trust serious partners either not to have sex outside the relationship or if they do, to use condoms with the other partner. They can ask directly for condom use in casual relationships because there is no emotional risk, but direct communication about infidelity and condom use in serious relationships is rare because it signals mistrust.

With this understanding of the social context and norms for relationships and condom use, we then began the individual interviews about sexual and romantic relationships. We interviewed sixty young people (equally divided by sex and ethnicity) and asked them to tell us the story of their self-identified "most important" relationships from the first to the most recent. The stories, lasting one to two hours, provided a picture of the different ways young people begin their sexual lives, transition from one partner to the next, and their feelings about their different relationships.

Most people told us about four or five partners on average (range 1–9). Almost all talked about their first love, usually a classmate but not always their first sexual partner. Most talked about when, how, why, and to whom they lost their virginity (modal age range 9–13 for boys and 11–15 for girls); the person they most cared about; and the heartbreak caused by infidelity. Some talked about having a child with one or more of their partners and how having a "baby mama/daddy" (the mother/father of your child) complicated subsequent relationships. Some got pregnant accidentally at a young age, but others when a relationship became serious. In serious relationships, pregnancy (unless specifically not desired) was just part of a package that included trusting your partner to be faithful, stopping condom use, and living together. Most participants were opposed to abortion. Other emerging themes included how alcohol, drugs, violence, abuse, incarceration, deprivation, and family dysfunction disrupted lives and relationships.

These narratives provide a counterpoint to the group norms derived from the focus groups. The stories revealed a variety of experiences punctuated by feelings of happiness and sadness, love and loss, agency and victimization, and hope and fear. The first loves, often called "puppy love" by the participants, were often endearing stories of twelve- to fourteen-year-olds meeting at school, walking each other home, getting to know each other, and stealing kisses. Later romances were more complicated by life circumstances. Virtually all participants were affected by the violence, illegal activities, and poverty of their neighborhoods. Some had already lost an early love to death from illness, homicide, or other dramatic separations. Many of the young men had served time in juvenile or adult penal institutions. Jail time, in fact, was a major disruption for young families, and many women talked about having side partners while their baby daddy was in jail. Domestic violence was also reported and often involved physical fights over cheating. The high levels of infidelity in this group, most of whom had cheated (about 72 percent) or been cheated on (about 82 percent), resulted in their view that cheating is just a part of life. By the time we interviewed them, they were wary of "catching feelings" (becoming emotionally involved) but were still hoping for true love.

With this understanding of sexual and romantic relationships, we were ready to ask how people really behaved during sexual encounters. We used daily diaries of sexual behavior (coital diaries) to collect the kind of experience-near data needed to understand how these youth negotiated condom use for prevention of STIs.

Forty participants (evenly divided by sex and ethnicity) kept a diary for six weeks, recording each day whether or not they had sex and with whom, whether they used condoms, and whether sex and protection were discussed directly. Participants were debriefed weekly by an interviewer who reviewed the written diary and asked questions to fill in areas that were incomplete or unclear.

We found that diary participants mostly used a condom with a casual or new partner if they had it handy and were not impaired by substance use, and that they just used it without the need for conversation. If they were in a serious relationship, they had already established ground rules that entailed not using condoms but perhaps using other contraception to prevent pregnancy. If the relationship was changing or there was a mismatch in assessment of its nature (casual or serious), condoms became a tool for negotiating the status of the relationship, since stopping condom use signals a shift to greater commitment. Discussion about sex and protection did not occur at each sexual encounter, but was conditioned by the kind of relationship the person had with that partner. What takes place in a sexual encounter depends on situational factors that are not entirely predictable: if there is a place to have sex, if a condom is available, whether drugs and alcohol impair judgment, competing time commitments and desires.

These three different qualitative research methods, each providing a different window on attitudes and behavior, were powerful tools for gaining a comprehensive, grounded, and nuanced understanding of the context of sexual and romantic relationships; the social norms surrounding behavior within different kinds of relationships; and individual, hard-to-observe behaviors. We conclude that prevention of STIs through condom use is viable and already normative in casual relationships, with the understanding that unpredictable situational factors like drug or alcohol impairment or the availability of a condom are important factors for actual condom use. Prevention of STIs in serious relationships depends on trust in monogamy or, more practically, in trust that condoms will be used with extra-relationship partners.

While our results offer no magic-bullet intervention for STI prevention among emerging adults, especially those in serious but non-exclusive relationships, they do humanize and explain inner-city patterns of behavior within social and cultural contexts. Immediate situational factors and emotional rather than rational decisions underlie condom use and non-use, as they do in all matters of the heart.

### Reproduction and Social Support Systems

Postpartum depression, or "baby blues," is a global phenomenon. In Western countries surveyed, between 10 and 20 percent of women experience postpartum depression, and of those, between one-quarter and a half have episodes lasting six months or longer. Surveys of Asian countries show a wide prevalence, from 1 percent to 20 percent (Bina 2008). As the first profile in this chapter shows, traditional societies may attribute this state to spirits, while westerners blame hormones.

Some societies recognize that rituals of social support are needed to mark the transition from pregnancy to parenthood. Hispanic women traditionally observed a period called *la cuarenteña*, lasting about forty days after birth, during which they rested, were helped with housework and childcare by family members, and avoided upsetting experiences (Kay 1982). However, in a study of immigrant Mexican women in the United States, 53 percent had postpartum depression, perhaps due to being isolated from extended family members and the stress of migration and low income (Bashiri and Spielvogel 1999).

Family support networks must meet the new mother's needs and not induce additional stress. In Taiwan, women are allowed to rest in seclusion for a month after giving birth, a ritual called "doing the month." They eat special, high-protein foods, avoid cold air and water, do no housework, and rest. The woman's mother or mother-in-law does most of the housework and infant care during this period. When women received help in their own homes, from their own parents, rates of depression were lower than average, but when women stayed at an in-law's home, levels of depression were higher (Heh, Coombes, and Bartlett 2004).

Why do North American women experience postpartum depression at such high rates? Bashiri and Spielvogel (1999:84) note that prenatal rituals include baby showers, childbirth classes, and regular medical checkups. However, "the mother's return from the hospital appears to be the most vulnerable of the stages in becoming a parent" due to social isolation, financial pressure, and a dearth of supportive activities.

Physical and emotional problems may result from a birth that doesn't go as planned, including having an unscheduled cesarean section, which occurs in one out of four births in the United States. Not only is recovery from a C-section slower due to pain, but women may feel that they "failed" by not having the vaginal birth they expected, or by agreeing to pain medication after having planned a "natural" birth.

Another issue for both the mother and father is fatigue. Having to wake up and go to an infant's room for night feedings contributes to exhaustion in the weeks following birth. Mother-infant co-sleeping, practiced in many societies, allows easier nursing and less sleep disruption, but this arrangement seems not to fit North American norms. Fatigue becomes worse when a woman returns to work within six weeks, and her husband in only a week or two. In Europe, extended, paid maternity leave is required by law in many countries, allowing more time for family adjustment to the newborn.

### Maternal-Infant Bonding

At birth the human infant is dependent on the care of others for survival. The probability of suitable care is reinforced through **bonding**, biologically based but primed by cultural cues. Bonding is a strong, deep emotional response, somewhat like "falling in love" but more enduring. In fact, mothers often begin to bond with their infants as they perceive fetal movement, called *quickening*, after the fourth month of gestation.

Fathers begin attachment by feeling the baby move in the womb and seeing the fetal image on the ultrasound monitor. In some cultures, paternal bonding is expressed through a set of behaviors called **couvade**, ritualized or expressive behaviors of men during their wives' pregnancy, labor and delivery, and postpartum period.

Involvement of contemporary fathers in pregnancy and birth is often overlooked in research. Interviews with American fathers about involvement in their partners' pregnancies by anthropologist Richard Reed (2005) revealed that males face particular challenges from childbirth educators, hospital policies, and the "authoritative knowledge" of biomedicine. For example, in birth preparation classes, American dads are encouraged to focus on being rational and controlling themselves and their partners, leaving "little room for a man's capacity to be empathic and nurturing" (Reed 2005:212). (See Fig. 6.7.) A study comparing Japanese fathers in Japan and Canada with French and English Canadian fathers showed that Eurocanadian fathers participated in labor and delivery more and took paternity leave more than did Japanese fathers. Nevertheless, all four groups provided more infant care than was traditional in their cultures (Steinberg, Kruckman, and Steinberg 2000).

The moments right after birth, when family members can see, smell, and touch the newborn, are especially conducive to bonding. The infant is primed to attach to those who interact with it soon after birth. But when there are complications, the infant may be taken to intensive care, preventing



FIGURE 6.7 A father's chance to sit quietly with his six-week-old daughter facilitates bonding.

or postponing opportunities to bond. Infants who are institutionalized or separated from their mothers for many months due to illness or wartime conditions often fail to grow well or to resist infection even when adequately fed. Later, after reunion with the mother, these children seem depressed and either cling to the mother or avoid contact with her (Hrdy 1999:394–399). Bonding theory would explain that a "sensitive period" has been missed, making it difficult thereafter to establish a strong attachment. However, parents and infants do manage to form emotional bonds in cases of adoption, although children neglected for years in orphanages may prove particularly challenging due to persistent attachment disorders.

Bonding theory first developed through clinical research in North America and Europe, without much input from anthropological accounts of maternal-child interactions in diverse cultures (Crouch and Manderson 1995). Ethnographers observing births in indigenous societies did not always witness early

bonding. Instead, they noted that often there is a "period of indifference" toward the infant as the mother recovers her strength after labor (Trevathan 1987:60). After the cord is cut and the infant is breathing normally, it is allowed to lie quietly while the mother rests, is bathed, or takes nourishment. The mother's breasts produce only colostrum at first, a yellow fluid that contains antibodies. Many societies do not consider this to be food, so the baby may not be nursed immediately.

Birth in North America involves some unique rituals of celebration including expressions of joy and relief, phone calls to relatives, photographs and camcorder movies of parents and siblings holding the baby. Hospitals provide champagne and sometimes gourmet meals for the new parents. In a culture with low infant mortality, where survival is assumed, these rituals are warranted. But in many societies where birth is more risky, it may be inappropriate to celebrate until both mother and child have stabilized. "Expressions of ebullience at birth would be regarded as unseemly, like tempting fate. . . . [E]motions are put on hold until people can be assured all is well" (Hrdy 1999:166). The ritualized celebrations in these cultures may occur later when the umbilical cord stump drops off, or perhaps at the first birth-day or the first haircut. Sometimes even naming is delayed until the child begins to thrive.

In situations of extreme poverty and high child mortality, maternal indifference may be normal. In *Death Without Weeping*, Nancy Scheper-Hughes challenges conventional bonding theory and suggests that the Brazilian women she studied have a gradual process of attachment to newborns, a "process of guarded, watchful waiting" (1992:410). They approach pregnancy with ambivalence and seem detached from newborns who are frail and sickly.

Just as anthropologists assume diversity and variation in the experience of birth, there is every reason to assume variation in mother-infant relationships. The nuclear family of suburban North America requires intense maternal involvement with children, as there simply is not the social support network found in more traditional settings. In many cultures, children have many caregivers, allowing the maternal-child bond to decrease emotionally after weaning and the arrival of a new baby.

# Infant Abandonment and Neglect

When a baby is too great a burden, in every society there are options, ranging from adoption to abandonment to infanticide. When ethnographers collect

data on causes of death, it is clear that neglect and violence leading to infants' deaths are widespread. Among the Ache, foragers of Paraguay, violent deaths were high before settling on reserves. About one-quarter of deaths were caused by another Ache person, and in some cases extreme child neglect led to death. Children born with defects were killed shortly after birth. Female children over the age of four were particularly at risk. When an adult died, a child was sometimes sacrificed to accompany the person in the grave, especially if the child was orphaned. Children without mothers, or children of divorced parents, were three times as likely to be killed as those whose biological parents were still living and in a stable union (Hill and Hurtado 1996).

Infant and child abandonment seems to be increasing in contemporary times, but it may simply be that awareness is increasing through media attention. In fact, child abandonment was practiced in Europe centuries ago. Women who could not care for their infants had an option to leave them at an orphanage without legal or moral blame. To protect infants from abandonment in doorways or in fields, orphanages provided a rotating barrel, called a Napoleonic wheel, set into a window or aperture in an exterior wall. Before leaving, the mother rang a bell, which signaled nuns to rotate the barrel to the inside wall. The infant then officially became a foundling and a ward of the church. Records kept on sex, ages, and baptisms showed that many of the foundlings died within a few months from malnutrition and infection (Panter-Brick 2000; Hrdy 1999).

The earliest orphanage, established in Florence, Italy, in 1419, began to use the rotating barrel in 1660. Catherine II opened imperial foundling homes in Russia in 1764. England, Sweden, Sicily, and many other countries also opened institutions to cope humanely with a wave of child abandonment. Based on baptismal records, estimates of the percentage of newborns abandoned in Italy range from 10 to 43 percent, varying by region and by year. Over 300,000 children were left at a single foundling home in Milan, Italy, between 1659 and 1900 (Kertzer 1993, as cited in Hrdy 1999:304). These figures remind us that when abortion is not available or legal, people have dealt with unwanted children in other ways.

Infant abandonment is testimony to the fact that under difficult economic conditions, maternal-infant bonding may not occur or is easily eroded. Poverty and inadequate social support are not only modern stressors but have affected families for centuries. In the following chapter we examine the concept of stress more fully and consider the range of human responses and resilience to stressful environments and life circumstances.

### CONCLUSIONS

As human universals, pregnancy and birth are ideal for studying the relative influences of biology, ecology, and culture on health. In the past, ecological factors in reproduction were generally neglected by anthropologists, but recent studies have closed the gap in understanding environmental influences on the evolution of reproductive physiology (Ellison 2001; Townsend and McElroy 1992).

It is not only the environment that influences reproduction, but also learned behaviors, as research by animal behaviorists and physical anthropologists has shown (Hrdy 1999). Our biology influences but does not determine our reproductive and parenting behaviors, although future research will clarify the relative influence of genes versus nurturance on children's health and behavior.

Human evolution loosened the programmed, instinctive connections between hormones and behavior. Human sexual development and choice of mates, lactation and infant feeding, and the rearing of youngsters all show much cultural variability. Reduction of instinctive responses allows room for variation and change, and perhaps for emergence of new forms of reproduction not possible in the past, such as cloning.

Stressful environments can lead to less than optimal parenting behaviors, but in most societies the majority of humans do nurture their young, and generations do reproduce despite adversity. The nature of the parent-child relationship varies culturally, and notions about bonding taken from affluent societies may not fit all socioeconomic situations. Nevertheless, as a species our reproductive strategy emphasizes quality over quantity, long parental relationships over brief ones, and inheritance through learning rather than exclusively through genes. Human reproduction requires high expenditure of energy and resources for relatively small numbers of offspring. As any parent will acknowledge, personal returns often seem quite delayed. But for the species, high investment despite unpredictable returns has proven successful in terms of child survival and population growth.

### RESOURCES

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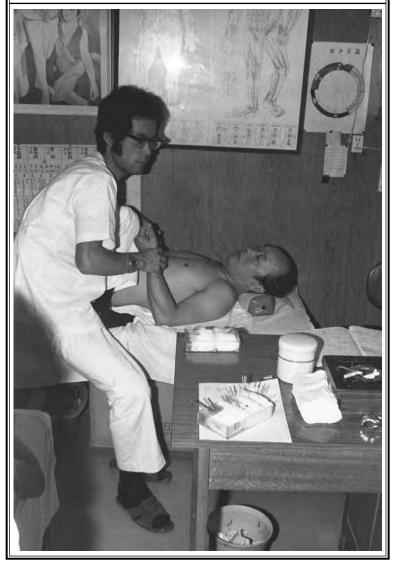
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# Chapter Seven

# STRESS, ILLNESS, AND HEALING



Discussing shoulder tension before treatment in an acupuncture clinic in Kyoto, Japan.

C.

PHOTO COURTESY OF MARGARET LOCK.

#### **PREVIEW**

When a person experiences excessive pressures from the physical or social environment, the body responds with hormonal, neurological, and immunesystem defenses. Physiological defenses have evolved to protect the individual against injury and to mobilize the "fight or flight" response. However, these responses can be maladaptive, contributing to health problems such as heart disease or autoimmune disease. Stress responses are measured through clinical and field methods such as blood pressure readings, saliva and urine analysis, and self-reported symptom lists. Population stress can be measured with epidemiological data such as suicide rates and prevalence of psychiatric disorders including post-traumatic stress.

While clinicians mostly focus on negative stress, medical anthropologists also study adaptive aspects. The stress response can induce healing, and practices such as trance, fasting, dance, acupuncture, and bloodletting found in various ethnomedical systems use this response to enhance well-being. Post-traumatic stress disorder, culture-bound syndromes, and some forms of mental illness also may respond favorably to stress reduction through ethnomedical rituals.

There is much variability in the ways people cope with environmental trauma, life crises, and sudden change. Support structures and maintenance of sustainable resources often foster resilience in the face of environmental disaster and economic change. Examples of current anthropological research on stress, highlighted in the profiles, are quantitative study of changes in cardiovascular health after migration in Brazil and demographic shifts after major economic reform in post-Soviet Russia.

## The Concept of Stress

The terrorist attacks of September 11, 2001, in New York City and Washington, DC, forged a chapter in history that will long be remembered. In the weeks following the attacks on the World Trade Center and the Pentagon, millions of people reacted with classic stress responses: difficulty in sleeping, inability to concentrate, a heightened sense of awareness and vigilance. Even people who lived far away from the disaster sites felt traumatized, as if they personally had seen and heard the planes hitting the Twin Towers, had in-

haled the smoke, run from the collapsing buildings, watched helplessly as people died in smoke and flames, and searched in rubble and debris for lost firefighters and police. Such is the power of the mind, the strength of imagination, and the influence of mass media, that people far removed from the disaster sites could still experience helplessness and grief.

For rescue crews, relief workers, and people searching for lost relatives, the stress was far greater. Although many felt surges of energy and strength, and many acted heroically, the physical hazards took their toll: irritated eyes, skin, and lungs; difficulties breathing; injury from collapsing structures; exhaustion and insomnia. Underlying the physical effects were feelings of helplessness and for many, emotional numbness. Fear, rage, and guilt would come later, producing profound cultural bereavement similar to that experienced by refugees and disaster victims.

The cumulative effects of the images and emotions associated with September 11, 2001, can be described as "acute stress." Other nations have experienced comparable or worse disasters: earthquakes, hurricanes, floods, tsunamis, civil war, ethnic genocide, and nuclear explosions. Although few of us directly encounter conditions as harsh as those inflicted on victims of earthquakes or genocide, no life is free of hardship or loss. The death of someone close to us brings feelings of helplessness. Exams cause unwanted pressure; a new job makes high demands. Most people cope with these pressures, using physiological defenses and emotional flexibility, but these defenses are costly. If the immune system becomes compromised by excessive or prolonged demands, there is risk of lowered resistance to illness. The very process of defending against the insults and crises of life can cause damage to the body. To understand this paradox, we need to understand stress.

In this text we define stress as *physical responses of the body to environmental demands* that threaten an individual's well-being. This differs from the popular view that stress is an external force, similar to pathogens that make us sick. Instead, we view stress as an internal, defensive process.

Stress and adaptation are closely linked concepts. Adaptation involves genetic, developmental, or behavioral change, while stress evokes physiological defenses. There are at least three major pathways of defense: (1) the immune system, (2) the nervous system, including reflexes and autonomic responses, and (3) the hormonal system.

The stages of defense are shown in Figure 7.1. The top ring symbolizes the habitual range of responses to the ordinary pressures of daily life. At the second level, a *stressor* (an external stimulus) elicits a defensive response. Too much heat is a stressor; so is too much cold. Being bored can be as stressful as being

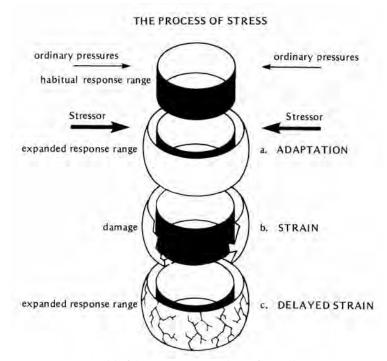


FIGURE 7.I A model of the stress process. A change from ordinary pressures to stressful challenges evokes one of three possible responses: (a) adaptation as the response range expands, (b) strain from inadequate or inappropriate response, or (c) initial adaptation but delayed strain.

too busy. Hypoxia is a stressor at high altitudes. The demands that humans place upon one another can also be stressors.

In the second ring in Figure 7.1, as the individual's response range expands, *adaptation* occurs. However, if the individual's responses are not adequate, *strain* occurs, as shown in the third ring. Or the individual may adapt to the stressor at the time but later will show signs of *delayed strain*, as in the case of post-traumatic stress disorders. The bottom ring in Figure 7.1 shows this outcome.

Another term for responses that lead to strain is *accommodation*. When an individual's response to a stressor enhances survival but also entails some loss in functioning, accommodation occurs. The term has been used mostly to describe physiological changes under conditions of deprivation or unusual demands on the body, as in pregnancy (Frisancho 1993).

Since stressors vary in their intensity and degree of threat, we should separate them into several categories. Changes that disrupt the order of a person's life

suddenly and severely lead to *acute stress*. Hurricanes, floods, or war are examples. Pressures that impinge on individuals every day or at frequent intervals induce *chronic stress*. Many people, such as police, air traffic controllers, and intensive care nurses, experience chronic stress in their professions. Whether stress is categorized as acute or chronic depends on previous experience. The person who travels to high-altitude regions for the first time will experience short-term acute stress through hypoxia. A person born and growing up in the same high-altitude region copes with low oxygen tension as a chronic stressor.

We tend to think of stress as negative, perhaps because the term often describes the emotional state of victims. Yet changes culturally defined as positive can be stressors also. Receiving a job promotion, moving to a new city, getting married, or having a baby are all positive life events, yet each requires special coping techniques, increased energy, and new learning. Most of us have the capacity to adjust, but when too many life changes occur at once, even positive changes can lead to strain.

The stress process is a normal part of life. The person who drives to work in heavy city traffic experiences stress; so does the person who jogs or cycles to work, although the residual effects of the stress will be different for the driver than for the jogger. The Inuit hunter in his kayak, the Iranian farmer threshing wheat, the Peruvian miner working in high mountains—all experience stress as their bodies expend energy to cope with problems, both those that arise unexpectedly and those that are a constant part of the environment.

### Understanding the Physiology of Stress

Two scientists, Walter Cannon and Hans Selye, developed stress theory. Cannon's work as a physiologist focused on the autonomic nervous system. Selye, a biochemist, argued that the endocrine system, notably the pituitary and adrenal glands, played an important role in resistance and adaptation, but Cannon was not convinced (Selye 1956). It is not unusual for scientists to disagree. Like all theories, Cannon's and Selye's ideas have been challenged, tested, and revised over time.

# Cannon's Concept of Homeostasis

Cannon's work (1929, 1932) was influenced by Claude Bernard, a French physiologist, who theorized "that one of the most characteristic features of all living beings is their ability to maintain *the constancy of their internal milieu*, despite changes in the surroundings" (Selye 1956:11–12, emphasis in the

original). This "self-regulating power" of the human body was termed **homeostasis** by Cannon.

Cannon was also interested in the emotions of fear and anger. Our capacity to be afraid and to respond to danger comes from our mammalian heritage. When a hunter encounters a dangerous situation, perhaps a bear in his path, his body responds automatically. Cannon called these automatic responses the *fight-or-flight* reaction. Blood pressure increases, heart and breathing rates rise, blood flows to the muscles, and hair stands on end. The hunter is ready to deal with the danger, either by fighting or running away. Most of us don't encounter bears on a daily basis, but we are familiar with how rapidly our bodies respond to everyday hazards.

What creates the quick burst of energy and alertness of the muscles and brain when danger is encountered? Natural selection has enhanced the ability to respond quickly to danger and to use biochemical reserves for mobilization of energy. The response is due to the autonomic nervous system and to hormones secreted by the adrenal glands and the pituitary gland.

The stress hormones include *catecholamines* (epinephrine and norepinephrine) secreted by the adrenal gland. Catecholamines raise blood pressure and blood sugar levels by stimulating release of glycogen from the liver and inhibiting release of insulin from the pancreas. Epinephrine also acts to mobilize fat reserves and release them into the blood stream in the form of free fatty acids that muscles can use as fuel.

When a person is afraid or angry, the **sympathetic nervous system** goes into action, transmitting impulses that widen the pupils of the eyes, direct more blood to the muscles and brain, accelerate the heartbeat, raise the blood sugar, and inhibit intestinal activity. A second response to stressors involves the **parasympathetic system.** This system conserves body resources and energy levels. It constricts the pupils, protecting the eyes from light, lowers blood pressure and heart rate, encourages digestion by increasing salivary secretion and digestive juice secretion, and causes the bladder and colon to empty waste products. Both the sympathetic and parasympathetic nervous systems may respond to stress at the same time, or one may predominate, usually the sympathetic system in most mammals.

# Selye's General Adaptation Syndrome

Hans Selye became interested in stress as a medical student at the University of Prague in 1925, when he noticed that the earliest symptoms of infectious diseases were all quite similar and nonspecific. Fever, aches, and loss of ap-

petite were considered "the syndrome of just being sick" (Selye 1956:16). Although others dismissed these symptoms as unimportant, Selye was eager to study this syndrome further.

Ten years later while doing research on sex hormones, Selye found the opportunity to study the body's nonspecific responses to infection or other disturbances. When he injected laboratory rats with extracts prepared from animal ovaries and placentas, distinctive tissue changes appeared: enlargement of the adrenal cortex, increase in discharge of adrenal hormones into the blood, shrinking of the thymus, spleen, and lymph nodes (all made up of white blood cells that give resistance in disease and injury), and deep, bleeding ulcers in the stomach and duodenum. Thinking that he had discovered a new ovarian hormone, Selye continued injecting substances into rats to isolate the hormone in pure form. Many kinds of extracts produced the same kinds of tissue changes. The more impure the extract, the more severe the symptoms. Selye suddenly realized that it was not a hormone, but rather some toxic factor producing these effects.

Remembering the syndrome of "just being sick" in humans, it occurred to him that he might have elicited a similar syndrome in laboratory animals. He found that many substances stimulated the stereotypical response to irritation—adrenaline or insulin, excessive cold or heat, X-rays, forced and prolonged exercise and other noxious conditions. This followed a three-stage response pattern which he called the **general adaptation syndrome**. (See Fig. 7.2.)

The body defends itself by releasing hormones from the adrenal cortex that stimulate inflammatory responses and also limit the extent of inflammation, a normal response to injury. When the tissue around an injured area swells, reddens, and becomes warm, this indicates dilation of blood vessels and proliferation of connective tissue in the affected area. Inflammation is not the same thing as infection, although the symptoms are similar.

Hormonal and neurological pathways of stress have been identified in ongoing research. The limbic system connecting the cerebral cortex and the brainstem interacts with two neuroendocrine pathways, one which controls the catecholamines and another which regulates the *glucocorticoids* that stimulate production, conversion, and release of glucose (blood sugar). Cortisol is responsible for most of the glucocorticoid activity. It modulates energy release, acts as an anti-inflammatory agent, and regulates alertness.

When a stressor acts on the individual, ACTH (adrenocorticotrophic hormone) is secreted from the pituitary gland in the brain, stimulating output of the glucocorticoids from the adrenal cortex. Normally, there is a feedback effect from cortisol levels, but when stress is severe and prolonged, ACTH

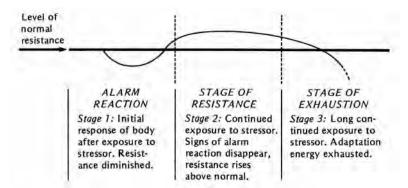


FIGURE 7.2 Stages of the general adaptation syndrome. Source: Adaptation of Chart from Stress without Distress by Hans Selve. Copyright © 1974 by Hans Selve, M.D. Reprinted by Permission of Lippincott-Raven Publishers.

continues to be released. STH (somatotrophin), also called growth hormone, elevates glucose and lipids in the blood under conditions of emotional arousal, exertion, cold exposure, trauma, or hypoglycemia. Some hormones decrease under stress, including FSH (follicle stimulating hormone) and LH (luteinizing hormone), leading to lowered female fecundity. Stress may also lower sperm counts.

Selye's work has had a major impact on medicine and on the social sciences, but critics point out the circularity of his reasoning. In theory, stress is an independent variable, but it can only be known by its effects (the dependent variables). The fact that Selye attributed a wide range of conditions to stress, calling them "diseases of adaptation," creates a paradox: is stress homeostatic or pathological? (Goldstein 2006:151).

Another issue is that Selye viewed stress as a nonspecific, stereotyped response of the body to injury, insult, or arousal. Current thinking is that responses to stressors can actually be very specific through a number of "effector" systems controlling responses and through "homeostats" (physiological regulators) compensating whenever there is discrepancy between what is normal or homeostatic for the body and the actual conditions of the environment (Goldstein 2006). Our understanding of the etiology of stress symptoms has become more sophisticated after decades of research on autoimmune diseases. For example, discovering that bacteria can be a major factor in stomach ulcers (long thought to be a prime example of a disease of adaptation) has changed prevention and treatment methods (Wedding and Stuben 2006:119).

#### Measuring Stress

Physical indicators of stress responses can be measured and compared, either in the laboratory or in the field. Some measures are relatively noninvasive and convenient for fieldwork, such as blood pressure readings. Analysis of urine or saliva samples showing levels of stress hormones is especially suitable for research with children. A study in rural Dominica, a Caribbean island, showed variable levels of stress hormones in saliva samples from school age children. The researchers were able to correlate cortisol levels with household conflict. Where parents quarreled frequently, threatened the children, and punished them more often, cortisol levels were higher in children (Flinn and England 1995).

Blood pressure, which reflects how hard the heart muscles are working, has long been a key measure since classic studies of stress and culture change showed that South African Zulu migrants to cities had higher blood pressure readings than those who had remained on a rural reserve. Blood pressure is affected by genetics, diet, and body size, but when those factors are held constant, other social and behavioral variables can be correlated with blood pressure.

In addition to clinical measurements, most medical anthropologists collect behavioral data by talking with people or doing surveys on stress symptoms. A short inventory, the Health Opinion Survey, asks straightforward questions about problems in sleeping, loss of appetite, increased use of alcohol, and other symptoms. A longer inventory, the MMPI (Minnesota Multiphasic Personality Inventory), has been used by psychologists to predict personality traits likely to contribute to cardiovascular disease. However, this method requires that participants be literate and be willing to answer many questions.

In fieldwork, anthropologists prefer to work with shorter surveys and to measure *cumulative* stress, which may have more serious health effects than acute stress. The Social Readjustment Rating Scale developed by Holmes and Rahe (1967) attempts to quantify the stress that a person has experienced in a specific period, usually the last one to two years. The participant is given a checklist of life changes, such as starting a new job, moving to a new city, getting married, having a baby, divorce, or death of a spouse. Each change has a weighted score, so a stressful life events score can be used to calculate the risk of disease. Individuals with high scores, regardless of whether the events were positive or negative, are at higher risk of heart problems, stroke, cancer, and mental illness.

One criticism of the checklist is that researchers may ignore social support factors, that is, relationships that help buffer the impact of life changes. Having

a new baby could be very stressful to a couple without relatives nearby, but less so when family members can help with childcare and housework. Another criticism is that it measures only major life events. What about chronic, low-level stressors, the series of small problems (burnt toast, lost keys, the car won't start) that can lead to a "last straw" response?

Nevertheless, life event measures have been used productively by anthropologists. A study of stress and diabetes in Mexican-American farmworkers in Wisconsin assessed experiences and life events characteristic of migrants, such as separation from family. Diabetic and non-diabetic participants rated how disruptive certain events were and then reported which of these events they had experienced recently. Blood samples were analyzed "blind" to assess levels of an enzyme, DBH (dopamine-beta-hydroxylase), associated with stress hormones and with diabetes. There was a statistically significant correlation between the number of disruptive life events reported and diabetes, especially in females. The most stressful life events involved experience of loss through death, marital separation, theft of property, and loss of social support (Scheder 1988).

#### Social Support

Social support systems are relationships that provide both emotional and practical resources to a person. These relationships can be especially important in times of crisis, but they also play a preventive role in health, creating a "buffer effect" against stress (Orth-Gomér 1994). When a person becomes isolated after divorce or the death of a spouse, the percentage of helper T cells declines, and the individual's immune system is weakened. Those who maintain friendships and kin ties after losing a spouse show better immune system function (Hall, Anderson, and O'Grady 1994).

There is some evidence that social support lowers the risk of cardiovascular disease. Longitudinal studies spanning five years in Sweden and Finland assessed variables affecting job stress and heart disease. Men who had stressful job conditions but who had support from colleagues at work had better cardiovascular health over the study period. Men working in similarly stressful conditions who lacked social support networks had increased risk of mortality from coronary heart disease. However, these correlations did not hold for women (Orth-Gomér 1994). Clearly gender must be considered when generalizing about the buffering effect of social support. Because women are more often caregivers rather than receivers of care in kinship units, the sheer number of social ties is not an adequate predictor of beneficial relationships.

When individuals develop heart disease and must undergo coronary bypass surgery, social support is a factor in recovery. In post-surgery followup of male veterans in New York State, biocultural anthropologist Gemmae Fix found that a significant variable for regaining health was the positive or negative influence of a caregiver in the home, usually a spouse. Caregivers who provided "negative support," for example by smoking in the house, had a detrimental effect on the patient's ability to regain strength and well-being (Fix 2008).

In probing the relation between social support and health, we need to look at specific variables. Gender and age are important, as are class or socioeconomic status (SES) and ethnicity. Equally important in ethnographic studies have been choice of lifestyle and the availability of resources to achieve that lifestyle. By "lifestyle" we do not mean sexual orientation, or whether a person smokes and drinks, but rather the aspirations of an individual that lead to certain choices in education, leisure activities, religious behavior, mobility, and especially accumulation of material goods (a car, clothing, house, appliances, furnishings). The focus on behavioral factors has led to a productive series of studies by medical anthropologist William Dressler, as discussed in the following research profile.

# ROFILE: STRESS, SOCIAL SUPPORT, AND HEALTH: THE DRESSLER RESEARCH \_\_\_\_\_\_

On his first field trip to the Caribbean island of St. Lucia (pronounced "Loosha"), medical anthropologist William Dressler noticed that people were very concerned about the quality and condition of blood in the body. They believed that natural forces such as wind, dampness, or cold air made the blood too cold, causing arthritis. Blood could be "rich," meaning having too much blood, or "poor," having too little. With "high blood," the blood builds up in the upper body and in the head and is believed to cause strokes and mental illness (Dressler 1982).

The St. Lucian term "pressure" (or "high pressure," san-ho in French-English Creole) is roughly equivalent to the clinical condition of **hypertension**, (high blood pressure). Caribbean people of African descent have a high prevalence of hypertension. It is a chronic condition involving no physical discomfort but nevertheless much physical risk, as the heart muscles are consistently working against elevated resistance to force blood through the arteries. Long-term complications of hypertension include strokes, kidney disease, and heart disease.

When blood pressure is measured, two numbers are recorded and are referred to as "systolic over diastolic," for example 120 over 80. Systolic blood pressure, the top number, represents the maximum pressure exerted when the heart contracts. Diastolic blood pressure, the bottom number, represents the pressure in the arteries when the heart is at rest. Readings for any one person vary, so a diagnosis of hypertension cannot be based on only one measurement.

In 1976, Dressler returned to St. Lucia to study cultural variables associated with hypertension. St. Lucians believed that worrying too much or being afraid could contribute to hypertension. Dressler reasoned that stressors came from inequities associated with cultural change. As the banana industry developed and tourism grew, there emerged wide status differences in land ownership and material wealth. Consumer goods such as wristwatches, stereos, furniture, and cars became markers of success, and even the poorest homes had a radio. Other markers of status were occupation (ranging from occasional laborers to professionals), land ownership, education level, and marriage.

Dressler hypothesized that when a person's position was high on one of the status dimensions but low on another, **status inconsistency** acted as a stressor contributing to hypertension. For example, an individual with a high material lifestyle (having purchased a home, furniture, a car, and other goods) but with little education or holding a low-paying job might experience a stressful level of status inconsistency, especially if the material aspirations resulted in debt. Calculating correlations between status inconsistency and blood pressure, Dressler found that one pair was statistically significant: material style of life and occupation. People with high material lifestyle but holding a low-paying, low-status job had on average higher blood pressure readings.

The study in St. Lucia also probed social support and psychological resources as buffers against stressors. In St. Lucia, as in many Caribbean societies, many people had several domestic partners over their lifetimes in both stable consensual unions and less stable liaisons. Although couples often postponed legal marriage until middle age, men were expected to support the children born in these relationships. Consequently, men often had connections to two or more households. These connections provided both material support and warm emotional ties. Even after marrying, a man maintained links to other households where children of previous liaisons lived, and these links helped to "enhance his self-esteem and social status among other males . . . [giving] evidence of a man's sexual prowess and his desirability" (Dressler 1982:64).

Psychological resources included perception of the social environment, religious behaviors, and access to information. Analysis of social and psychological variables and blood pressure readings showed that people who had both high multiple matings (a high number of partners in serial relationships) and low material lifestyle had the lowest average blood pressure. Those with a low number of partners and high material lifestyle had considerably higher systolic readings.

In the 1980s, William Dressler applied concepts from his Caribbean research to African Americans in Alabama. This study analyzed the community resources and social supports that affected rates of depression in "Westside," a black community of 20,000 people. As in St. Lucia, African American communities in the United States developed in a post-colonial, post-slavery context of economic exploitation. It was not until mid-twentieth century that economic and educational opportunities widened for southern blacks. Still, the early decades of integration were stressful, in part because of changed expectations, generational differences, and continued frustration.

To measure depression, Dressler used a symptom checklist with thirty-one questions, such as "In the past week, how often did you have trouble remembering things? Do you have trouble concentrating? Do you feel nervous or shaking inside?" In addition, he asked people to rate a variety of stressors on the job, in a marriage, in the neighborhood, and so on. He also recorded information about life events and coping styles.

He found that females in the Alabama sample had higher depression scores than did males. Younger people aged seventeen to thirty-four had higher depressive symptoms than older people, and young people with lifestyle incongruity had more depressive symptoms. Unmarried people, those with less education, those with lower incomes, and unemployed people also ranked higher on depression scores.

The study also focused on the black family as a protective unit against stress. The operational concept of "family" was a "linkage of households into networks of mutual support" (Dressler 1991:126). To the research participants, family meant more than just a household. It also meant people who helped one another and looked out for one another, including neighbors and in-laws. These networks functioned as extended families, giving care and discipline to children, moral support and advice, and sometimes financial help. Most important, the networks functioned as social support. Other buffers against depression, called **resistance resources**, included church activities and religious beliefs; self-reliance; and active coping rather than passive helplessness.

Do resistance resources reduce depressive symptoms? People with low resources and high lifestyle incongruity scored high on the depression symptom scales. Those with high resources and high lifestyle incongruity still had depressive symptoms, but at lower rates. Resources included not only kin support but also non-kin support from ministers, doctors, social workers, co-workers, or friends. Non-kin resources played a large role in helping people deal with stressful life events and in moderating stressors associated with work and home life.

After completing the research in Alabama, Dressler shifted his interests to another stress-related problem, coronary heart disease (CHD). Mortality rates from heart attacks and stroke were declining in North America, but elsewhere in the world, especially in developing countries, cardiovascular disease rates continued to increase. The risk of CHD increased in Brazil from 12 percent in 1930 to 33 percent in 1980 (Dressler et al. 1993:10). By 1996, diseases of the circulatory system were the leading cause of death in Brazil, with a mortality rate of 225 per 100,000.

Why study heart disease and stress in a developing country? Brazil, like many nations, is in an epidemiological transition. Although child malnutrition and parasitic disease continued to affect health, Brazil's epidemiological profile in the 1990s resembled that of more affluent nations as chronic, degenerative conditions such as heart disease showed a sharp increase, especially among migrants from rural areas to cities. Urban migrants often become more sedentary than their rural counterparts, with less physical labor. Their diets include more fat and salt, which in turn increase blood pressure and lipids (fats) in the blood. Changes in activity levels and changes in diet clearly put people at risk of heart disease, but social factors also play an important role. In studying CHD in southwestern Brazil, William Dressler, José Ernesto Dos Santos (a physician) and Fernando Viteri (a nutritional scientist) tested hypotheses about the health effects of modernization. (See Fig. 7.3.) Earlier studies of blood pressure and modernization showed stress in people who aspired to a high-status lifestyle but could not achieve it because of economic or class constraints. The goal of the Dressler study was to see if similar lifestyle contradictions would contribute to (or be correlated with) higher blood lipids, thus elevating the risk of coronary heart disease. The issue was not just the level of fats, but the ratio between total cholesterol and high-density lipoprotein cholesterol. HDL-C is sometimes called "good cholesterol" because high levels are linked to lower rates of heart disease. If total cholesterol is high and HDL-C is low, there is greater risk of heart disease.



FIGURE 7.3 William Dressler in Brazil conferring about interview procedures with a Brazilian colleague and research assistant. Photo courtesy of W. Dressler.

The research site was Ribeirão Preto, a city of half a million in the state of São Paulo. Although historically the region was agricultural, with sugar cane plantations, during industrial development many people moved to the city in hopes of raising their standard of living. The study sample included four occupational categories in four residential areas: irregularly employed sugar cane cutters living in squatter settlements, full-time agricultural workers living on a plantation near the city, factory workers living in a factory-owned housing development, and bank employees living in middle- and upper-class neighborhoods. Within each group, twenty households were randomly selected. The following data were gathered on 116 individuals in eighty households.

- Blood samples, blood pressure, height and weight
- Measures of total cholesterol (TC) and high-density lipoprotein cholesterol (HDL-C)
- Dietary intake estimates, based on twenty-four-hour recalls; analysis of specific fats eaten
- Surveys of ownership of material goods (e.g., radios, television, car, house) and exposure to mass media to calculate "style of life" measure
- Occupational rankings of all employed persons in the household
- Calculation of "lifestyle incongruity" (style of life score minus occupational rank score)
- Survey data allowing assessment of social support from kin and non-kin

The primary sociocultural variable was lifestyle incongruity, based on discrepancy between aspirations for material well-being and a person's actual achievements in occupation and employment. As in previous studies, Dressler hypothesized that kin networks and social support systems could buffer the effects of lifestyle incongruity.

Analysis showed that fat intake for the entire sample was high, an average of 43 percent of total calories. Total cholesterol was most significantly related to age (older people had higher levels) and body mass index (fatter people had higher total cholesterol). There were few sex differences.

The higher the socioeconomic rank, the higher the total cholesterol to HDL-C ratio, a clinically favorable outcome. Low rank, with high lifestyle incongruity, correlated significantly with a low total cholesterol to HDL-C ratio, a clinically unfavorable condition. However, kin support also mattered. In testing the variable of lifestyle incongruity, the researchers found that high incongruity (high aspirations, low resources) was associated with high blood pressure.

To study blood pressure variation in Brazil, Dressler and colleagues used a method called **cultural consensus analysis** to test whether people of different socioeconomic classes shared the same cognitive model of a successful lifestyle. They found that success for Brazilians did not mean ostentatious "conspicuous consumption" of material goods, but rather a level of "middle-class domestic comfort" (Dressler 1999:598).

After generating a cultural consensus model shared by lower- and middle-class Brazilians, the researchers then developed a "cultural consonance" measure based on how close a person's actual lifestyle was to the ideal described by research participants. Then cultural consonance scores were correlated with blood pressure readings, adjusting for age and body mass.

Both men and women with high cultural consonance had lower systolic readings; those with low consonance had higher readings. There was no significant difference in diastolic readings. Further, those with higher cultural consonance in social support also had lower blood pressure.

Dressler has refined the cultural consonance model during recent work in Brazil. In addition to drawing from cognitive anthropology methods to make data collection and analysis more precise, he has expanded cultural domains by including national identity, family life, and food. Further, over ten years his research team has replicated the association of cultural consonance and blood pressure (Dressler 2007).

William Dressler's long-term research illustrates the value of applying similar models and techniques in varying field sites. The work has advanced

anthropological theory of culture change and stress by showing the impacts of delocalization. External forces of change bring new opportunities, but also increased potential for frustration and disappointment. Combining ethnography, clinical measures, and survey techniques, this research on the long-term health impacts of adaptation to change sets a gold standard in biocultural methodology for studying stress.

# Can Stress Induce Healing?

To this point we have been discussing stress as a physiological response measured in laboratory and field settings. However, the stress concept also relates to healing processes through a mechanism called *cross-resistance* discovered by Selye in experiments with lab animals. Two groups of rats had oil (an irritant) injected into air sacs on their backs. In one group, a weak irritant of diluted oil was injected, and in the second group, a strong irritant of concentrated oil was injected. Then both groups were subjected to immobilization, which would normally lead to ulcers in the sac. The stress of being held down allowed the rats with the weak irritant to create an inflammatory barricade on their backs (illustrating cross-resistance), but the group with the strong irritant could not maintain an inflammatory barricade under stress and developed ulcers.

The principle that the body has internal healing mechanisms is certainly not new. More than 2,000 years ago, Hippocrates taught his students in Greece that disease is the work of the body to restore itself to a normal state. Old medical practices such as inducing fever with herbs, deliberately exposing mentally disturbed people to infectious disease, flogging, and bloodletting may have activated the body's healing defenses through the principle of cross-resistance. Such techniques were not always successful.

Traditional healers in many societies induce the stress response for therapeutic purposes. Mexican *curanderas* (curers) employ cross-resistance when they treat an arthritic patient with a bee sting or with ointments containing mildly irritating oils such as eucalyptus or camphor. Both remedies help to relieve inflammation and pain.

Sensory overload is another stressor used in healing rituals. The Jul'hoansi of the Kalahari Desert in southeast Africa use prolonged dancing to heat up the medicine they believe is in their bodies. Once heated, the medicine or energy, called *n/um*, can be transferred from dancer to patient. Without using any drugs, the Jul'hoansi enter an *altered state of consciousness* with dizziness and disorientation, hallucinations, and muscle spasms (Lee 1967; Katz 1982).

Hallucinogenic plants are used in many societies to induce trance in healing ceremonies. The *ayahuasca* vine (*Banisteriopsis* sp.) used by *curanderos* in Peru and Ecuador affects the mind much as does LSD or mescaline, causing visions, temporary change in thought patterns, an altered sense of time, change in body image, and feelings of rejuvenation. *Ayahuasca* is not addictive, and its use is confined to healing and religious contexts. (See Fig. 7.4.) The plant is perceived not as a curative agent in itself, but rather as a powerful substance that brings visions to the healer and the patient, allows diagnosis of the problem, and neutralizes evil forces responsible for the illness (de Rios 1972; Lovecchio and Glaser 2003).

In North America, the Native American Church uses the peyote cactus containing mescaline as a sacrament in its rituals in combination with other trance-inducing practices such as drumming, singing, staring at the fire, and breathing cedar incense. Many native American societies traditionally induce altered states of consciousness through ceremonial rituals without drugs in order to acquire supernatural power during a vision quest. Among the specific stressors that elicit visions are fasting and thirsting; pain stimulation; extreme heat or cold; acoustic stimulation through drumming; and sleep deprivation.

These self-induced stressors are thought to release substances called *endor-phins* from the anterior pituitary gland. Endorphins, similar chemically to opium or morphine, are sometimes called "endogenous opiates." Apparently there is linkage between the neuroendocrine system that controls endorphins and areas in the central nervous system involved in integration of signals of pain, hearing, and touch.

Acupuncture, an Asian therapy of inserting and manipulating needles at various points in the body to relieve or decrease pain, is another practice that may stimulate the release of endorphins. (See chapter opener photo.) Insertion and twirling of needles are believed to stimulate nerves in the muscles that send messages to the brain to release endorphins from the pituitary gland and from the midbrain (Pomeranz 1982). Although skeptics have attributed the effectiveness of acupuncture to the *placebo effect*, that is, a therapeutic effect due to belief or suggestibility, the fact that animals and infants also experience decreased pain after acupuncture undercuts the placebo argument.

Acupuncture is becoming increasingly accepted in Western countries to relieve pain and to treat chronic conditions and addiction, even though few randomized control clinical trials to assess efficacy have been carried out (Barnes 2005). Acupressure, a similar but less invasive therapy that uses manipulation by the hands rather than needles, is also becoming popular. A



FIGURE 7.4 Preparation of ayahuasca (*Banisteriopsis* sp.), a plant used by *curanderos* in Peru and Ecuador to induce trance in healing rituals: (a) cutting the vine and rasping the bark; (b) arranging the rasped vine and bark; (c) cooking the pieces for five to six hours; (d) the potion is ready to be consumed by the curer and in some communities by the patient as well. Photos by J. Luis Lovecchio and Kathryn M. Glaser. Reprinted by Permission of K. Glaser.

tooth can be extracted with little or no pain once the facial muscles and gums have been numbed by acupressure. The degree to which acupuncture is being integrated into Western medicine is demonstrated by the fact that in 1996, the U.S. Food and Drug Administration reclassified acupuncture needles from experimental devices to regulated surgical devices. And in 1997, the U.S. National Institutes of Health declared that "acupuncture was efficacious in the treatment of adult post-operative and chemotherapy nausea and vomiting" and may be useful as "an acceptable alternative" for treatment of various conditions, including addiction, fibromyalgia, myofascial pain, carpal tunnel syndrome, and asthma (Wedding and Stuben 2006:284).

### Stress and Psychiatric Disorders

Cultural psychiatry integrates anthropology and psychiatry in studies of mental illness, concepts of abnormality, and indigenous healing as psychotherapy in various societies (Jenkins 2007). The label "mental illness" implies a disease process, but not all forms of psychopathology fit a disease model. Undoubtedly biochemical and neurological factors are central in schizophrenia, depression, bipolar disorder, and obsessive-compulsive neuroses, whose conditions vary in severity and may not require intervention. Yet, under unusual stress, an individual may develop symptoms or act in ways that alarm or threaten others. Often there is no cure, but medication and/or various treatments can lessen the severity of symptoms. Other problems classified as psychiatric, such as anorexia or agoraphobia, may be more related to learned defenses against stress than to changes in brain chemistry. Yet other disorders, for example transvestism (cross-dressing) and fetishism (obsession with objects that are sexually arousing), seem culturally relative and more a product of social labeling than of pathology.

What stressors contribute to psychiatric disorder? One is a social environment that blocks a person from succeeding or from meeting basic needs. A childhood filled with chronic frustration, a cycle of failures, and shame can lead to a traumatized and thwarted adult at risk of disordered behavior. Not all individuals are equally vulnerable; some emerge from difficult environments as resilient, self-reliant adults, perhaps due to buffers such as religious faith or a mentor's support. Some communities, especially ethnic minorities, may have less access to mental health services or are less likely to be referred for psychiatric care. South Asians in the UK, for example, express symptoms of distress differently than do white British patients and are less likely to be diagnosed as needing care (Bhui and Bhugra 2007). Communities that incur chronic frustration in their members have high rates of pathology, often undiagnosed and untreated. A classic case is the study of rural, maritime communities in Nova Scotia, Canada, by cultural psychiatrists Dorothea Leighton and Alexander Leighton. Known as the Stirling County study, the research correlated rates of psychiatric disorder in the study sample with indices of social disintegration, measured in terms of divorce and separation, lack of leadership, high rates of crime and delinquency, little available recreation, and fragmented communication. Interviews with 1,000 household heads showed that 57 percent of the population had psychiatric problems. Of those, 24 percent had significant impairment, although few had been hospitalized. Both women and men showed more impairment in disintegrated neighborhoods than in integrated ones (D. Leighton et al. 1963).

Cultural psychiatry traces family and community dynamics that contribute to disorder. In an exploration of mental illness in rural Ireland, Nancy Scheper-Hughes (1979) found that bachelor farmers and fishermen from small, isolated villages were at much higher risk of schizophrenia than were married men and married or single women. To probe why unmarried men were at high risk, she used the Thematic Apperception Test, a projective test using ambiguous pictures. The stories that subjects tell about the pictures can be analyzed for cultural themes, values, perceptions, and interpersonal dynamics. Stories told by Irish research participants revealed themes of lovelessness, lack of tenderness, feelings of abandonment and loss, and troubled or repressed sexuality.

Scheper-Hughes's ethnography documented that many men with abnormal behavior were never hospitalized. Their communities were generally tolerant of people who were eccentric, developmentally disabled, or alcoholic. Tolerance is partly related to the strength of the kinship network. A disturbed person who had a large, supportive family was often not labeled as insane. Psychiatry tends to locate disorder within the individual, but Scheper-Hughes's study shows that disorder is also rooted in society.

#### The Culture-Bound Syndromes

We can contrast the wide-ranging distribution of disorders such as schizophrenia and depression with more rare disorders called **culture-bound syndromes**, acute behavioral disturbances usually limited to specific culture areas (Simons and Hughes 1985). They are sometimes called folk illnesses or ethnic psychoses, referring to behaviors rarely seen by psychiatrists in the United States. Some, such as magical death, occur in more than one culture. Others, such as *windigo*, historically attributed to Canadian Ojibwa Indians, are confined to single cultures.

Often culture-bound syndromes are temporary dissociative or phobic states with no discernible biochemical basis. Rather than being labeled as mentally ill, the person is considered to be a victim of witchcraft, soul loss, severe shock, vengeful ghosts, or other forces. After recovery, little stigma is attached to the person.

One of the culture-bound syndromes most studied by medical anthropologists is arctic hysteria, or *pibloktoq*, a disorder seen in polar regions. Arctic

hysteria was a temporary condition rather than a chronic mental illness. The explorer Robert Peary described *pibloktoq* in 1910 in this manner:

The patient, usually a woman, begins to scream and tear off and destroy her clothing. If on the ship, she will walk up and down the deck, screaming and gesticulating, and generally in a state of nudity, though the temperature may be in the minus forties. As the intensity of the attack increases, she will sometimes leap over the rail upon the ice, running perhaps half a mile. The attack may last a few minutes, an hour, or even more; and some sufferers become so wild that they would continue running about on the ice perfectly naked until they froze to death if they were not forcibly brought back. (Quoted in Foulks 1972:13.)

Inuit generally agreed that *pibloktoq* is a physical illness like a cold. There was less agreement among social scientists whether the syndrome was a physical or psychological disorder. Since it was more prevalent in women, psychological anthropologists argued that this syndrome allowed females to express feelings of helplessness and insecurity in a dramatic way that evoked group support rather than stigma or censure.

Anthony F. C. Wallace proposed a biological hypothesis that *pibloktoq* was due to calcium deficiency. Hyperventilation (rapid, shallow breathing) during emotional stress could have depleted the blood of carbon dioxide, altering the acid balance and reducing the proportion of calcium ions in the blood, and thus inducing seizures or spasms in persons who already had low calcium levels (Wallace 1972).

Edward Foulks (1972) supported an environmental hypothesis, that the light-dark cycles in the Arctic affected the body's circadian (twenty-four-hour) rhythms, putting some individuals at risk. Analysis of a sample of Alaskan Eskimos showed that while body temperature and potassium excretion remained in phase throughout the year, the urinary excretion of calcium became "free-running" (desynchronized) in winter, possibly leading to irritability and depression. In analyzing the biological rhythms of one of the patients, Foulks found the same pattern of calcium desynchrony (pp. 83–84).

An alternative hypothesis was that an excess of vitamin A in the diet caused *pibloktoq* (Landy 1985). The symptoms of hypervitaminosis A include disorientation as well as weakness and skin problems. High concentrations of vitamin A are found in the liver and fat of marine and arctic animals. In winter, when animals are at their lowest weight but have large concentrations of vitamin A in the liver and fat, the risk of hypervitaminosis from eating these ani-

mals is highest. Yet this is the time of greatest food shortages, when people might be tempted to eat bear liver even though they know the risk. This would explain why *pibloktoq* occurs more often in winter and why more women than men experience the disorder: they are smaller and cannot assimilate as much vitamin A. Finally, the hypothesis explains why dogs, which eat seal and bear liver, also suffer from *pibloktoq*. Nevertheless, the cause of arctic hysteria remains controversial, and since cases are very rare among modern arctic populations, chances to study this syndrome are disappearing.

## Classifying Culture-Bound Syndromes

It is difficult to compare culture-bound syndromes because anthropologists do not use a single classification system. When each syndrome is considered a unique illness, and hence "culture-bound," classification is almost impossible. Simons and Hughes (1985) dealt with this problem by reducing 162 syndromes to five major categories: sleep paralysis, sudden mass assault, fright illness, cannibal compulsion, and anxiety about genital retraction. Further, they excluded some syndromes, including arctic hysteria, from their taxonomy.

Some culture-bound syndromes involve neurophysiological responses, such as startle matching. *Latah* in Malaysia and Indonesia is an exaggerated response to a startling stimulus. The person becomes flustered and may say and do things that amuse bystanders, including matching the words and movements of people nearby. If it is correct that the cause of *latah* is largely neurological, it should be found in other populations. Through newspaper advertisements in the United States, Simons was able to find twelve persons with severe startle problems, suggesting that the neurological base for startle responses is universal, although rare (Simons 1985:43).

In reviewing accounts of a syndrome called "nerves" found in Costa Rica, Guatemala, Puerto Rico, Newfoundland, Greece, and elsewhere, Setha Low (1985) recommends that "nerves" be reclassified as a "culturally interpreted illness," not a culture-bound syndrome. In spite of common symptoms such as headaches, fatigue, dizziness, weakness, stomach problems, and feelings of anger and fear, there is considerable cultural variation in the meaning of "nerves" (Davis and Guarnaccia 1989). Greek women in Montreal, Canada, describe *nevra* as "being grabbed by your nerves." *Nevra* is attributed to conflicts and pressures in women's roles (Dunk 1989:32).

Expression of a disorder through physical symptoms illustrates **somatization**: the body expresses distress through symptoms that elicit concern while avoiding stigma. In Newfoundland, Canada, minor psychosomatic complaints

as well as emotions are conveyed in the concept of "nerves," conceived as "little strings that hold you together." Nerves may "come unraveled" and can be "pulled," "stretched," or "frayed" like an elastic band (Davis 1989). In contrast, for Puerto Ricans and Dominicans, *ataques de nervios* express strong emotions through shaking, numbness of the hands, heart palpitations, shouting and swearing, and sometimes loss of consciousness. Men as well as women experience these attacks, which Latinos classify not as illness but as a sign that a stressful event has upset the family network and the person's emotional balance (Guarnaccia, DeLaCancela, and Carrillo 1989).

Like physical illnesses, culture-bound syndromes vary epidemiologically. Not everyone is equally at risk. For Canadian Greeks, *nevra* mostly affects women. *Amok*, a form of hysteria in New Guinea, Indonesia, and Malaysia, occurs mostly among young men. In a study of health in Andean communities in Peru, the prevalence of culture-bound illnesses was higher in young people and elderly people, while fewer people were affected in their middle years (Carey 1993:288, 292).

### Culture-Bound Syndromes in North America

Are there culture-bound syndromes in North American culture? Eating disorders, rarely seen in low-income countries, may fit this category (Nasser 2007). In *anorexia nervosa*, the individual follows a near-starvation diet and intense exercise. Anorexics, typically young females, have an obsessive fear of becoming fat and often have distorted perception of their bodies. If the disorder is left untreated, death is a very real risk. *Bulimia* is another disorder of young women and sometimes young men. The bulimic person compulsively overeats and then vomits the food or uses laxatives. Frequent vomiting damages the teeth and esophagus.

Cultural emphasis on the youthful, boyish body shape of movie stars and fashion models contribute to these disorders. There are strong family and peer pressures against being overweight, yet parents urge or force their children to "clean their plates" before leaving the table at mealtimes, provide calorie-laden foods on holidays and birthdays, and use sweets as rewards. Such cultural paradoxes are the basis of many compulsive behaviors.

Eating disorders have increased in other countries in recent years, including Japan, India, Argentina, and Israel. In Eastern European countries, rates have increased considerably after the collapse of communism, particularly in Hungary, Poland, and the Czech Republic. Researchers view these trends as related to economic transitions and increased wealth, access to fast food,

changing gender roles, and the rapid diffusion of ideas and fashion via the Internet (Nasser 2007).

Obesity is a culture-bound syndrome as well, not in the sense that it is a mental illness, but rather because it is classified as a major problem by the medical profession and by laypeople alike. Mild to moderate obesity was considered a sign of beauty and health in the United States until the twentieth century, but social attitudes have changed, and obese people are now considered to be out of control and have the "moral failings of gluttony and sloth" (Ritenbaugh 1982:352).

The bias of medical professionals against obesity affects health care utilization by many people, including Samoan migrants, who view large body size as a sign of high social status. Janes notes that "the single-minded focus by health care providers on obesity as an indication of the individual's health and social worth causes many Samoans to avoid clinical encounters as much as possible" (1990:157).

Other culture-bound syndromes of Western culture include agoraphobia, the fear of leaving the home and going to public places alone or without a family member, compulsive shoplifting, and Münchhausen syndrome by proxy, in which mothers induce medical crises in their children. Each of these disorders affects women more than men. A syndrome more prevalent in males is mass assault behavior, in which men or boys assault and kill people at random, often with automatic rifles. Other predominantly male syndromes include "flashing" (displaying genitals in public), voyeurism ("peeping Toms"), and fetishism (excessive preoccupation with objects such as women's shoes or underwear). Transvestism, or cross-dressing, is a mostly male phenomenon. It is not exclusive to Euroamerican cultures, as shown in ethnographic studies of men who dress and behave as women, such as the hijras of India who fill essential ritual roles at traditional weddings (Nanda 1999). Because transvestism is viewed as abnormal by many cultures but nevertheless is permitted in ritual contexts (for example, during Mardi Gras, Halloween, and the performances of female impersonators), it could be classified as a culture-bound deviation rather than as a syndrome.

A recently noted syndrome is "road rage," aggressive behavior by drivers who become enraged at others on the road. This phenomenon is especially prevalent in the United States but also occurs in the United Kingdom and Holland. Twice as many men as women are involved in road rage incidents. Explanations of this syndrome often focus on the stress of driving, but E. O. Smith proposes an evolutionary model (2002:32 ff.). Extreme aggression when a driver feels threatened by others or senses territorial intrusion is simply a

manifestation of the fight-or-flight response. Smith also suggests that our evolutionary programming equips us poorly for coping with the speed, congestion, and fatigue of high-speed driving.

#### Role Conflict Models

Anthropologists consider some culture-bound syndromes to be expressions of the distress and dissonance a person feels when receiving negative feedback about role performance. Feelings of inadequacy and frustration in carrying out one's expected social role are stressful for most people, regardless of cultural setting, and role conflict is usually a contributing stressor rather than a primary factor in mental illness. It is often difficult to decide whether role inadequacy is the cause or the effect of stress.

An example of role conflict is the folk illness *susto*, "fright," found in Spanish-speaking societies in the New World. It is believed that a frightening experience causes the illness or that the soul of the patient has been captured by spirits and taken from the body. The symptoms include loss of appetite, listlessness, loss of weight, apathy, depression, and withdrawal. Other symptoms such as diarrhea, pain, swelling of the feet, nightmares, and headaches are attributed to being *asustado*. (See Fig. 7.5.) Treatment involves restoration of the equilibrium of the hot and cold humors of the body (Rubel, O'Nell, and Collado-Ardon 1984).

Rubel and his associates, carrying out an epidemiological and clinical study of *susto* victims, predicted that "persons suffering *susto* would concurrently perceive themselves to be inadequately performing crucial social roles. The discrepancy between their expectations and their performances was presumed to cause them stress" (Rubel, O'Nell, and Collado-Ardon 1984:55). Rubel developed the Social Stress Gauge to gather data on social expectations, perceptions, and performances of individuals in the study sample. This test was given to *susto* victims and to a control group to assess levels of differences in role conflict and social-stress scores. The researchers also assessed the level of psychiatric impairment and arranged clinical exams of both *asustados* and controls to assess organic disease.

The results showed that *asustados* had more physical impairment than did their controls. They experienced more symptoms such as loss of appetite, loss of weight, tiredness, and lack of motivation. Only physical health problems and role stress showed statistically significant differences, while psychiatric impairment was not significantly different in the two groups (Rubel, O'Nell,



FIGURE 7.5 Chinantec woman in Oaxaca, Mexico, undergoing treatment for *susto*. Photo used by Permission of Arthur J. Rubel and the University of California Press.

and Collado-Ardon 1984). These results show connections between emotional and physical debilitation, each reinforcing the other in a downward spiral of distress.

Susto is used to explain a variety of health problems. In a study of health beliefs about type 2 diabetes among Mexican Americans in Texas, Jane Poss and Mary Ann Jezewski (2002) found that many individuals being treated biomedically for diabetes used the term susto as a possible cause of their condition. Although most had a good understanding of the physiology and symptoms of diabetes, participants stated in focus groups that a specific, frightening episode or a profound emotional experience contributed to the development of their diabetes. They also attributed fluctuations in blood sugar to worry or fright.

#### Alcohol Abuse

Many behavioral disorders develop within a matrix of genetic predisposition, impaired learning, and stressful life circumstances. Culture plays a significant

role in shaping appropriate expressions of distress that signal the need for help (Kleinman and Good 1985). Addictive behaviors, especially alcoholism, employ rituals and idioms that not only communicate emotional distress but also provide buffers against emotional pain, feelings of helplessness, and anxiety.

Although the lay person's explanation may be that too much stress drives a person to drink, the clinical picture is more complicated. Some people have a greater hereditary risk of becoming an alcoholic than others do. A genetic mutation manifested clinically as a deficiency of acetaldehyde dehydrogenase which affects ethanol metabolism may contribute to a predisposition to alcoholism (Gallant 1987). This defect will not lead to alcoholism, however, unless the individual learns to drink and gradually becomes addicted for psychological as well as physical reasons.

Use of alcohol, and attitudes toward its consumption, vary widely. In some societies, alcoholic beverages are consumed daily and serve as an important vehicle of social interaction. For the Kofyar people of northern Nigeria, their home-brewed, millet-based beer is "both the symbol and the essence of the good life" and a source of valuable nutrients (Netting 1979:355–356). In Islamic societies, drinking of alcoholic beverages is forbidden, although not all Muslims observe this rule.

In comparing patterns of alcoholic beverage usage throughout the world, one needs to distinguish between alcohol use that fulfills ritual and social functions and alcoholism as a compulsive, progressive illness leading to physiological deterioration as well as impaired work and social relationships. It is only in a minority of individuals that drinking behavior leads to alcoholism, and anthropologists question stereotypes that depict members of entire cultures as problem drinkers. For example, indigenous North Americans have high rates of alcohol consumption, but whether they also have a disproportionate number of alcoholics is debatable (Honigmann 1979; Room 1984). Centuries of involuntary change and, in many cases, loss of land, autonomy, and pride, are often perceived as the reason that aboriginals consume alcohol, but anthropologists are skeptical of the "change as pathology" explanation.

In their study of drinking styles among southwestern Indians, Levy and Kunitz (1974) focused not on causes, but on the *functions* of alcohol use, that is, the roles that sharing of alcohol and public drunkenness play in a society. They believed that most Navajos are not alcoholics at all, even though consumption is high. Relatively few have liver disease, nor do they typically experience delirium tremens (DTs) or withdrawal symptoms when abstaining from alcohol. They theorized that drinking among Navajos was an expression of traditional values rather than a response to stress or subordination. Nevertheless, for a

minority of drinkers, especially those classified as delinquents before the age of fifteen, severe alcohol-related problems occurred, such as domestic abuse, loss of employment, imprisonment, and premature death (Kunitz et al. 1999). It should be noted that Navajos themselves did not define alcohol abuse in terms of how much or how often a person drinks, but whether the person shares his supply and drinks with others. They consider the "lone, selfish, unsharing drinker" to be the problem drinker (Waddell 1980:231).

During follow-up study in 1990 of the same Navajos interviewed in the mid-1960s and in 1974, Kunitz found that 54 percent of the men and 50 percent of the women living on the rural reservation had stopped drinking as they became older. Most said that the Native American Church helped them stop. Thus, the use of alcohol was not necessarily lifelong and had diminished or ceased by middle age. Those who had been social drinkers in the 1960s were more likely to have stopped alcohol use than those who had been solitary drinkers and more alcohol dependent (Kunitz 2006).

A study of Mayan women's attitudes toward alcohol use in Highland Chiapas, Mexico, showed that binge drinking of rum and *chicha* (fermented sugar cane juice) was a problematic part of community festivals. Life histories collected by Christine Eber narrated women's painful memories of alcoholic parents and abusive husbands and ambivalence about their own use of alcohol. Some drank to deal with the loss of children. "Rather than getting used to the pain, most women seem to layer one painful loss on top of another. Children's deaths chip away at a mother's identity" (Eber 1995:140). Alcohol also played a central role in women's ritual roles. Female shamans drank to the point of intoxication in order to contact the saints and to speak authoritatively in securing health, good crops, and prosperity for people.

Recognizing the negative aspects of alcohol use, some women found ways to stop or reduce drinking. Religion and dreams played an important role in the decision to abstain. Some Protestant converts maintained sobriety by giving their drinking problem to God, while Catholic Action converts mobilized against alcohol distributors. Initially focused on problem drinking, through workshops and meetings the women developed a new perspective "that alcohol was not the cause of their poverty and other problems, but a tool of their oppression in the context of growing class stratification" (Eber 2001:256).

#### Post-Traumatic Stress Disorder

Many clinicians have accepted the idea that intense stress can have long-term effects on a person's physical and emotional health. The general public considers

trauma to be a legitimate cause of abnormal behavior. The media, as well, use stress as an explanation for sudden, unexplained acts of violence.

Nevertheless, some anthropologists question the assumption that stress causes abnormal behavior. The concept fits cultural biases held by many Europeans and North Americans who use medicalized explanations of deviance. Allan Young, a medical anthropologist, notes that stress theory fits what most middle-class Americans think they "know" about human nature. But this explanatory model places disorder in the arena of the mind and body. An alternative model would be to focus on the social and political contexts, the "pathogenic events" in which individuals become victims (Young 1980:138).

The history of post-traumatic stress disorder (PTSD) illustrates how the labeling of individuals as psychiatrically impaired shifts focus away from the devastating circumstances that initiated the stress reaction for the individual. In *The Harmony of Illusions*, Young (1995) notes that PTSD is a recent diagnostic category but that its symptoms had been observed much earlier. In World War I, the category "war neurosis" encompassed several diagnoses based on symptoms: shell shock, hysteria, neurasthenia or "nerve exhaustion," and disordered action of the heart. These symptoms developed during or after intense combat with high casualties; men were trapped in trenches with mortar shells exploding around them. Military policy was usually to provide essential medical care and then to send soldiers back to the front as long as they could fight.

Despite long-standing interest among clinicians in stress disorders, post-traumatic stress did not become a diagnostic category until the 1980s. This diagnosis was first applied in the treatment of veterans who had served in Vietnam. Estimates of the percentage of troops returning from Iraq with PTSD range from 15 to 30 percent.

Symptoms of PTSD include reexperiencing the trauma of combat through dreams, flashbacks, and intrusive memories; avoidance of memories and general emotional numbness; and persistent autonomic (nervous system) arousal (e.g., startle responses, difficulty sleeping) (Young 1995:117, Table 2). For soldiers, trauma included a variety of disturbing experiences: being imprisoned and tortured, seeing fellow soldiers killed or maimed in combat, participating in the killing and maiming of enemy soldiers and/or civilians, being injured and losing limbs or becoming paralyzed. Trauma specialists now consider "war trauma" as a distinctive category of PTSD arising from prolonged, lifethreatening conditions and personality change during the course of combat experiences (Singer 2007).

Since the 1980s, PTSD has been applied to victims of trauma outside the military sphere. Physical violence, for example rape or domestic abuse, can

trigger PTSD. Long-term effects of violent assault are especially severe for children and adolescents. In one case, a twelve-year-old girl in India, who was abducted, tortured, and gang-raped by three men, remained emotionally traumatized even after her injuries healed. For months she had recurring dreams of the event, refused to leave the house or to talk with anyone, and attempted suicide three times (Shah and Mudholkar 2000).

Civil war in Sudan and Darfur during the first decade of the twenty-first century has taken a devastating toll on children and young women, many of whom have been gang-raped by soldiers. We can expect persisting trauma, both physical and emotional, from these attacks long after hostilities cease. As a case of torture victims coming from Liberia shows, even after refugees find safe haven in host countries, persisting effects of trauma make it difficult to build their trust and acceptance of help (Stevenson and Rall 2007).

Children living in war conditions experience chronic, daily stressors as well. An account of a ten-year-old boy's life in post-war Nicaragua describes his coping strategies in an unstable environment (Quesada 1998). In the political transition after the defeat of the Sandinistas, Daniel's family was evicted from their home by the former owner of the house. His stepfather, a former Sandinista officer, began to drink heavily, and his mother developed *nervios* and suffered severe headaches and fatigue. Daniel responded by becoming unusually responsible for his age: hauling water and firewood, digging ditches around their squatter house to prevent flooding, scavenging for useful household items. His family considered him resourceful and independent, calling him *hombrecito*, "little man."

Anthropologist James Quesada realized that the boy's resourcefulness was taking its toll. Daniel couldn't sleep well, and he rationed out the family's food and regularly gave larger portions to his brother and mother than to himself. When it rained, he held up plastic cloths to protect his brother from water leaking from the roof. One day he disclosed to Quesada that he felt like dying, explaining that "it would be better if I just died since that would help everyone." It is clear that the resilience of this child came at the cost of deep, masked depression (Quesada 1998:60).

## **Populations Under Stress**

Cultural psychiatry is best suited to deal with troubled individuals and the origins of their traumatized behavior. When entire populations experience life-altering disasters, medical anthropologists look to specialists in trauma response to understand the lasting impacts throughout a generation's lifespan

and onto consecutive generations. Among the populations at particular risk for historical trauma are victims of genocide, of hate crimes, and of discrimination. Refugees, especially those held in internment camps and sometimes tortured and exposed to brutality, are also at risk.

The term *historical trauma* refers to "cumulative emotional and psychological wounding . . . from massive group trauma experiences" that often lead to delayed and unresolved grief. Evidence of the lack of healing is seen in "self-destructive behavior, substance abuse, suicidal thoughts and gestures, depression, anxiety, low self-esteem" and a range of other responses among survivors and their descendents (Brave Heart 2007:177–178).

Recent attention has turned to the long-term practice throughout North America of forcing indigenous children to attend residential schools, where they were punished for speaking their own language and were physically and sexually abused. In Canada, residential school survivors from aboriginal communities have filed grievances against the government and religious agencies that ran the schools. Some have received compensation for being mistreated and deprived of their rights, and others are still in litigation. Grievances have also been filed by Canadian Inuit families for the suffering they experienced in the mid-twentieth century when they were forced to abandon their traditional hunting territories and were relocated by government officials to unfamiliar regions without adequate supplies or services (McElroy 2008).

Colonialism brings its share of trauma, as we will consider in depth in the next chapter. But even in post-colonial eras, aboriginal communities are often buffeted by forces outside their local economy and politics. The following profile describes population stress related to changes in indigenous communities in Siberia after the collapse of the Soviet Union and subsequent economic reorganization.

# ROFILE: STRESS, ALCOHOL, AND DEMOGRAPHIC CHANGE IN NORTHERN SIBERIA

John P. Ziker

Ust-Avam is an indigenous community of about 700 individuals 300 km north of the Arctic Circle on the Taimyr Peninsula in Siberia (Russia). The community is located at the tundra-taiga transition in the Central Taimyr Lowlands. Ust-Avam is ethnically mixed with Dolgan, Nganasan, and a





FIGURE 7.6 (left) Three generations of Nganasan residents of Ust-Avam, Taimyr Peninsula, Russian Siberia: Sveta (right), her youngest daughter, and her granddaughter. (above) John Ziker and Sveta's granddaughter. Photos by John Ziker.

small minority of non-native newcomers. I have conducted ethnographic work there since 1992. (See Fig. 7.6.)

The Dolgan population includes Sakha, Evenk, and Russian "tundra peasant" ancestries. Dolgan families traditionally practiced reindeer pastoralism, in combination with game hunting, fishing, trapping, and mercantile trading. The Nganasan traditionally hunted wild reindeer, fished and trapped with dog-teams, and kept small, domestic reindeer herds. They rejected Russian Orthodox missionaries, unlike the Dolgan. After 250 years as subjects of czarist Russia, the Dolgan and Nganasan were incorporated into the planned economy under the Soviets beginning in the early 1930s. As permanent settlements were built most adults came to work at state-managed rural enterprises, schools, the post office, and village administration. As a result of development, by the 1970s residents of Ust-Avam had lost their domestic reindeer (and their ability to travel independent of technology and fuel supplies).

The collapse of the USSR in the 1991 significantly affected Taimyr economy. In Ust-Avam, most working-aged adults were laid off their jobs in 1993. From 1993 to 1997, I documented drastic decreases in fertility rates and increases in mortality due to alcohol (Ziker 2002). Native community members across Siberia blamed uncontrolled sales of alcohol and binge drinking for many of the deaths.

## **Age-Sex Structure and Fertility**

With a community census, an age-sex structure can be constructed and used to visually represent demographic patterns. Combined with longitudinal ethnographic data, hypotheses about changes in age-sex structure (indicating changes in fertility, mortality, or migration rates) can be developed. The village council of Ust-Avam supplied census materials, and the village clinic supplied death records in 1997 and 2003. In 2007, I developed an updated census with the help of native research assistants.

The 1997 census showed something significant happening: there were approximately half as many children in the 0-to-4-year age category as in the 5-to-9-year age category (See Fig. 7.7). In addition, age-specific fertility rates indicated that it was women in the middle of their reproductive careers (ages 25–34) giving birth most often, as is found in other post-demographic-transition societies.

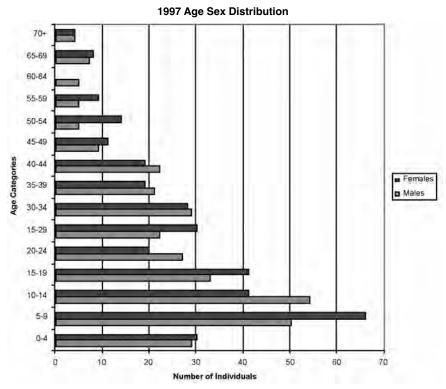


Figure 7.7 The 1997 age-sex distribution of Ust-Avam based on community records.

The economic changes resulting from the collapse of the planned economy in the 1990s appear to be major factors in the declining birth rate. The intervening variables are likely to be the stress of economic uncertainty and increased alcohol consumption following the disbanding of the state agricultural enterprises, layoffs of working-aged adults, and rapid increase in the cost of consumer goods and services in the 1990s.

Overall fertility rates continued to decrease through 2003, beginning with the average effective fertility rate (EFR) of 0.73 in 1987–1993 and declining to an EFR of 0.57 in 1994–1997 (Ziker 2002:92–93). The EFR further decreased to 0.33 in 1998–2002. The EFR (number of children less than 5 years of age divided by the number of women 15 to 49) is a useful indicator for small communities.

In 2007, it was apparent that the fertility rates were beginning to *increase* in the community, with a total of 58 new births from 2003 through the first half of 2007 (see Fig. 7.8). With 89 women aged between 15 and 49, the

#### 2007 Age Sex Distribution

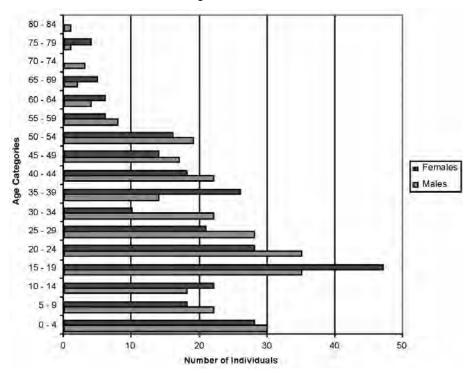


Figure 7.8 The 2007 age-sex distribution of Ust-Avam based on Ziker's census.

EFR for 2003–2007 period was 0.65, returning to the range that is closer to expectations for this small community. In addition, the age-specific birth rates shifted to women in the 20–24-year age category (18 births), followed by women in the 25–29-year age category (11 births). There were even 7 births by women in the 15–19-year age category in 2003–2007, whereas in 1997 there was only one birth by a woman in that category.

These patterns indicate that while fertility rates are increasing, it is largely due to younger women who are staying in the village. This trend may reflect the stabilization of the Russian economy beginning in the early 2000s. All sorts of payments (from pensions to salaries) are currently received regularly without delay, whereas in the 1990s there were significant delays. Also, since travel costs in Russia are high and educational opportunities require payment, it seems difficult for high school graduates to pursue higher education from remote places like Ust-Avam. Another possible factor is the village's "baby boom" in the late 1980s (a stable economic period) which produced a relatively populous generation that is now entering their reproductive prime.

#### Causes of Death

Fertility is part of the picture, but mortality patterns also indicate social and ecological stress. A word on definitions used below. Mortalities are categorized as "natural" (internal) or "unnatural" (external) following the Russian demographic literature (Vishnevskii 1999:83). This typology is helpful in tracking trends over time, but does not imply causation. Unnatural deaths included the following fatalities: accidents, poisonings, traumas, homicides, and suicides. Natural deaths included infectious or otherwise internal maladies.

In addition, the categories are not so clear cut when it comes to alcohol. Community members in Ust-Avam stated that some internal maladies were themselves created through a history of alcohol consumption due to high levels of unemployment of men and the increase in frequency of village drinking binges since 1993.

From 1998 to 2002, over 70 percent of all deaths in Ust-Avam were attributed to unnatural causes (n = 34) with a minority due to natural causes (n = 14). Neither ethnicity or gender accounted for any differences between Dolgan and Nganasan groups within the community, although in 1993–1997 it appeared Dolgan women were least affected by unnatural death (Ziker 2002:101–103). The five-year average annual mortality rate was 0.023 in

1998–2002. These data reflected no improvement in community mortality rates compared to the 1991–1997 period, during which 60 percent of deaths were violent (Ziker 2002:97) and the overall mortality rate was 0.026.

From 2003 to 2007 there was a reduction in the overall mortality rate with 35 deaths: 21 unnatural, 7 natural, and 7 of unknown cause. Unnatural deaths continued to account for 60 to 70 percent of mortality, but the average five-year mortality rate decreased significantly to 12 per 1,000, or 0.012. There are indications that the economic situation is improving, as there were only two deaths in the first eight months of 2007.

## **Demographics and Alcohol History**

Misuse of alcohol and other drugs is one of the most serious issues facing indigenous populations as constituent minorities in industrial states (Saggers and Gray 1998). This seems to be the case whether the context is a colonial, post-colonial, or post-socialist state (Coyhis and White 2006; Hawkins and Blume 2002). This profile has illustrated how, beyond its addictive properties, alcohol misuse is problematic for economic, political, and geographical reasons.

In order to better understand the relationship between stress and demographic processes, it is helpful to look at previous literature. Russian anthropological demographers of indigenous Siberians documented a decrease in child mortality rates and increase in adult mortality due to unnatural causes, beginning in the 1960s and 1970s when settlement into permanent villages with state enterprises (<code>sovkhozy</code>) was policy (Krupnik 1987). Modern medical care was especially important for reducing infant and child mortality.

On the other hand, living in villages meant dependence on the larger economy. For example, Bogayavlinskii (1997) showed that unnatural deaths in Kamchatka became more frequent during major holidays and periods of inactivity when people drank. Sales of alcohol were closely managed during Mikhail Gorbachev's sobriety campaign of the late 1980s. With these controls relaxed along with increasing periods of inactivity due to unemployment in the 1990s, post-socialist freedom seemed particularly harsh.

In Ust-Avam, spending money on alcohol further impoverished a poor population and caused a demoralized atmosphere. Loss of access to hunting lands (through loss of domestic reindeer in the 1970s and loss of state supports of mechanized travel in the 1990s) worsened the problem. People spent more time in the village and ended up binge drinking.

On the positive side, regional government programs introduced in 2006 and 2007 appear to be improving the situation. The new *kochevye* (nomadic) payment for adults involved in traditional hunting, fishing, and trapping that replaces unemployment payments is a morale booster. Similarly helpful, in a 2007 "pilot project" the Ust-Avam store agreed to curtail sales of alcohol during the workweek, and the administration hired unemployed women and men to paint house exteriors and clean up trash in the village.

#### **Environmental Disasters as Stressors**

Northern populations in Alaska have faced equally rigorous environmental conditions as do the Dolgan and Nganasan in Siberia. In both regions, culture contact with Westerners and a gradual shift in economy led people to settle in permanent villages serving as home bases for hunters, trappers, fishers, and reindeer herders. With sedentism, environmental vulnerability increased rather than decreased. When natural resources diminished, it was not as easy to move the community as in the past. This is one reason that environmental disasters are doubly devastating in areas where indigenous hunters and trappers subsist.

When the supertanker Exxon Valdez spilled 11 million gallons of crude oil into Alaskan waters around Prince William Sound in 1989 due to human error and negligence, it contaminated water and endangered wildlife for thousands of square miles and destroyed the livelihood from fishing and harvesting of marine products for many communities. In addition to these initial impacts, the cleanup effort, involving 11,000 local people as well as outsiders, further disrupted their lives. Fishing ceased, workers were absent from home for months, and the seasonal cycles of communities were affected. Although wages were good, the impacts were disastrous: workers trampled "ecologically sensitive beaches," allegedly looted cultural artifacts, and were mistreated by crew chiefs (Dyer 2002:177–179). Workers returned home traumatized by the extensive damage to wildlife, and rates of domestic violence rose. Children were left in day care or with relatives when married couples worked on cleanup, and this disrupted family routines.

A year later, a study was carried out to assess whether psychiatric disorder rates had increased in the regions most directly affected, in contrast to a control population in southeast Alaska not affected by the spill (Palinkas et al. 1993). Native Alaskans showed higher rates of depression than non-natives,

and young adults aged eighteen to twenty-four had the highest rates of depression. The more direct the exposure to the oil spill and the cleanup activities, the greater were the rates of anxiety disorder, post-traumatic stress disorder, and depression in both men and women. As the researchers state, "When the *Exxon Valdez* ran aground in Prince William Sound, it spilled oil into a social as well as a natural environment" (Palinkas et al. 1993:1522).

Hurricane Katrina in August, 2005, was one of the greatest disasters of the twenty-first century in North America. Affecting 40,000 square miles in the southeast, primarily Louisiana and Mississippi, the storm's damage was compounded by massive flooding in New Orleans.

Unfortunately, rescue efforts were hampered by a series of faulty decisions. Some residents decided to sit out the storm without anticipating the threat of flooding from broken levees. Those who evacuated at the last minute and those rescued from rooftops were given shelter at the Super Dome. But without electricity, adequate medical care, and sufficient reserves of fresh water and food, the evacuees became victims of poor emergency planning. The trauma experienced by residents of New Orleans and the coastal towns was shared by those who attempted to provide emergency services, as well as those watching the drama unfold on television. (Secondhand exposure through media coverage and participation in rescue and relief efforts is termed *vicarious trauma* by clinicians). Impact assessment researchers concluded that "the delay and mismanagement of the initial response has affected the psyche of the entire nation" (Petterson et al. 2006:665), with continuing consequences for public perception (mostly negative) of government agencies and political leaders.

The greatest devastation came to approximately 1.5 million people who were displaced from some 350,000 destroyed or damaged homes (Petterson et al. 2006). Many stayed in cities such as Houston and Baton Rouge for months, unable to return because of slow recovery of basic infrastructure in their home communities. Many who did return were living in temporary housing, often trailers, as they attempted to rehabilitate their homes contaminated with mold and dry rot. In 2008 there were reports of health hazards from formaldehyde in the trailers' construction materials, and many still living in trailers were forced to leave.

Perhaps even more devastating than the loss of homes and communities were the violation of civil rights and the social injustices that accompanied government actions and lack of actions in the aftermath of the hurricane. The aftermath of Katrina was a worst-case scenario for disaster management. Most of the victims were African Americans living in the poorest neighborhoods of the sixth-poorest city in the United States (2000 census figures, cited in Miller

and Rivera 2007). The notion that natural disasters affect entire populations without discrimination did not apply in this case.

Vulnerable even before the hurricane due to its location below sea level, the constant shifting of delta soil, and the gradual loss of protective offshore habitat, post-Katrina New Orleans continues to be at risk socially and ecologically. Yet the current plans are to rebuild it. As John Petterson and his colleagues (2006:644) note, "Rather than resettle elsewhere to avoid these problems, people have continually attached meaning to life in this unique location and have invested in physical engineering solutions to protect it." This observation reminds us of the deep resiliency of human communities as well as their willingness to take risks to maintain what is important and good in their lives.

#### Resilience: A Buffer Against Stress

Refugee, migrant, and homeless families inevitably experience a chain of cumulative stressors. Whether or not these stressors lead to long-term trauma depends in part on the **resilience** of the family unit and the community. Resilience includes personal qualities and behaviors that make it possible to rebound from adverse situations (Wise 2007) and to "adapt to a changed reality and capitalize on the new possibilities" of the post-disaster environment (Paton 2006:8).

The sources of resiliency are variable and depend on ethnicity and class, but in general resilience comes from individual and community resources for solving problems (Mullings and Wali 2001). In order to adapt, communities require the competencies to use their own resources appropriately, mechanisms to integrate and equitably distribute resources, and strategies to sustain environmental health in the recovery process (Paton 2006). Among the important resources are trained emergency response workers who know the language and culture of the community and can mobilize survivors to begin rebuilding in spite of terrible personal losses. One such case is the quick response by non-profit relief organizations to the South Asian tsunami of December 2004. Within a few weeks after the disaster, aid workers had set up temporary housing along coastal Sri Lanka and organized health care and food distribution. (See Fig. 7.9.)

Factors such as shared spiritual beliefs and traditions, maintenance of established routines, intelligence, and humor all help in building resilience. Finding meaning in suffering is important. There is also an elusive "spirit of survival" in some cultures with a history of adversity, for example the Taiwanese whose island location is prone to natural disasters. In 1999, an earthquake of 7.6 on the



FIGURE 7.9 Aid workers from the non-profit organization World Life Institute facilitate donations and resources for victims of the December 2004 tsunami in the refugee camp of Nilaveli, on the eastern coast of Sri Lanka. Temporary camps with uncertain futures became prominent along coast-lines in the months after the tsunami. Photo by Alana Huzair, courtesy of David E. Bell.

Richter scale struck Taiwan. This earthquake was particularly devastating, with extensive damage of factories, roads, bridges, water supplies, and schools along a surface rupture extending 105 km, along with almost 2,500 deaths and U.S.\$30 billion in costs. In the town of Tung Shih, with a fatality rate of 30 percent, themes of spirituality and self-reliance were prominent in interviews with survivors and volunteers. Described as the "*Hakka* spirit," in reference to the northern Chinese Hakka people who immigrated to Taiwan centuries ago, the concept includes diligence, persistence, frugality, responsibility, and being family-oriented. Some interviewees defined Hakka spirit as the "*spirit of sturdy neck* which means to hold on firmly despite extreme adversity . . ." and described this quality as "the key to quick recovery in Tung Shih" (Jang and Lamendola 2006:179–180).

Perhaps most critical for resilience are social relationships and support systems. These are sometimes difficult for refugees and immigrants to maintain. Research by Leith Mullings and Alaka Wali (2001) in Harlem, New York City, explores community resilience in a stressful urban environment. Stressors include poor housing, lack of steady jobs, crime, and inadequate social services. Deeply rooted racial discrimination underlies these immediate problems, along

with class inequality and gender inequity. Many Harlem residents reported depression, guilt, anger, self-blame, and especially a sense of failed expectations. Nevertheless, women-centered support structures from within the community acted as buffers by providing information, advice, childcare, and financial help.

A life history study of Puerto Rican women, who had migrated in the 1950s with their husbands to Chicago, Illinois, demonstrates the impact of immigration on the family unit and on women themselves (Toro-Morn 1998). Housing discrimination against Puerto Ricans was severe, and it was often necessary for two or more family units to share one apartment, not always in harmony. Men did not want their wives to work and sometimes took two jobs to support the family, but in some cases the husband's alcohol abuse and gambling made it necessary for the wife to work. If this happened, childcare was handled by grandmothers or aunts. After girls reached the age of nine, they were expected to watch their siblings after school, clean house, and help with cooking. Some marriages ended, and women found themselves forced to develop a number of strategies to keep their families intact. These strategies included seeking public assistance, getting an education, and finding loans to buy a house, all examples of resilient behaviors in difficult circumstances.

Support structures can also be found outside the family unit, especially in cases of political refugees recently traumatized in their home country. Immigrants to the United States who had been tortured in the west African nation of Liberia or had witnessed torture and abuse (including repeated public rapes) of family members exhibit many symptoms of trauma: exhaustion, depression, anxiety, and agitation. The women needed testing for sexually transmitted diseases as well as counseling, but they resisted medical care.

In order to establish a sense of safety, control, and trust for these victims, social workers identified *cultural brokers* to assist in working with the families. The culture brokers in this case were women from Liberia who had themselves been victims of torture previously and who had received medical treatment in the United States. They provided "culturally acceptable explanations of the medical procedures," accompanied the women to their appointments, and "assisted the doctor in building a trusting relationship with each woman" (Stevenson and Rall 2007:250–251).

#### CONCLUSIONS

Stress theory offers useful models linking environment, culture, individual health, and population well-being. In studies of social stress, the best research designs attempt to link biochemical factors with social and environmental

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pressures. Without neuroendocrinological data, anthropologists are unable to study the biochemical pathways that may lead to mental illness, addiction, and culture-bound syndromes. Similarly, without consideration of the sociocultural matrix of health and disease, the biochemical perspective fails to account for the role of emotion, learning, cognition, and symbolic stressors in human resistance and adaptation.

Students often ask whether stress is greater in the contemporary world than it was in the past. Does the urban resident suffer more stress than a hunter or farmer? These are difficult questions. Context makes a difference, and there are dangers in every environment. Many kinds of threats evoke stress responses in the body, and the body does not discriminate among stressors. It is true that the incidence of stress diseases is higher in industrial societies, however, and there are several reasons for this. One is that infectious and parasitic disease rates are lower, and thus individuals tend to live longer and to accumulate gradual wear and tear after years of coping with stress. A second factor is that hunters, fishers, and farmers have physically active lives and utilize serum cholesterol and glucose more efficiently than those who are sedentary. Thus they are more likely to avoid build-up of cholesterol in the arteries or the insulin resistance that leads to diabetes. When hunters and farmers change their lifestyles and move into cities or towns, they show predictable and striking relationships among diminished physical activity, increased intake of sugar and fat, and increasing rates of stress-related diseases.

The answer to who experiences more stress, the hunter or the office worker, is difficult because the question is misleading. The total amount of stress is not the issue. Rather, one should ask: What are the differences in how the hunter and the office worker experience stress, in how their bodies respond, and in their general level of energy utilization? It is more productive to compare lifestyles, response capacity, and resiliency than to compare levels of stress. Stress itself is not abnormal; rather, it is inadequate resources to cope with stress that contribute to disease and behavioral disorder.

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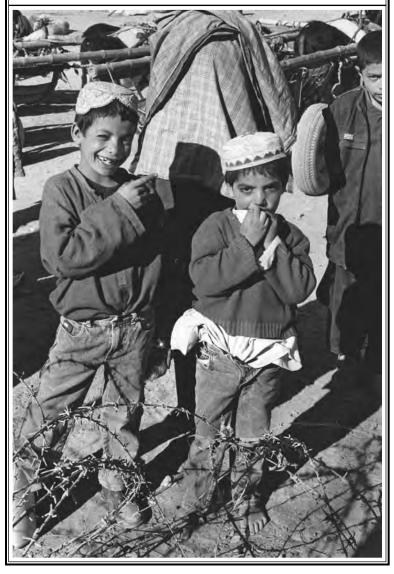
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# Chapter Eight

# HEALTH RESOURCES IN CHANGING CULTURES



Afghan refugee children in Pakistan in 2001.

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PHOTO COURTESY OF UNHCR, THE UN REFUGEE AGENCY.

#### **PREVIEW**

Rapid culture change is one of the most devastating stressors on a population's health. Cultural change resulting from exploration, trade, migration and other forms of contact between populations has affected health ecology in many ways. Whatever the motives of contact agents—to find a home, to preach the gospel, or to make a profit—these intruders have disrupted the lives of indigenous peoples. Outsiders introduced disease organisms to which native people had little immunity. They cut off access to traditional foods and encouraged the use of imported foods, resulting in nutritional imbalances. Colonial governments forced or persuaded nomadic peoples to relocate to permanent settlements, leading to long-term demographic and epidemiological effects. Our profile on two Canadian Inuit families illustrates the long-term trauma of this relocation.

Agents of change often discredited native healers and indigenous health beliefs. Attempts to replace traditional medicine led in some cases to medical pluralism, with coexisting systems of care. Modern societies that have experienced rapid change in the last century, such as Japan, are characteristically pluralistic in health systems.

Caregiving is a distinctive feature of human existence. Health care involves organized behaviors for health maintenance, for prevention of physical illness or emotional distress, and for management of illness or disability. Applied medical anthropologists have focused on the health needs of vulnerable populations. The needs of refugees and populations displaced by natural disasters and political conflict create challenges for host countries, aid workers and organizations, and social scientists. The health crisis posed by HIV/AIDS is testing the limits of public health policies, medical ethics, and financial resources in every nation. Research on transmission and prevention of HIV/AIDS illustrates cultural, social, and political factors influencing the impact of this disease on global health.

With the death of each of these individuals
There disappeared from the face of the earth
The last living representative of
A people
A language

An independent tribelet-state
A particular way of interpreting life and its mysteries
The last survivor confronts
An absolute loneliness
He possesses total identity only to himself
(Source: Kroeber and Heizer [1968:20])

#### The Story of Ishi

The Yahi Indians were a tribe of some 400 people who lived in the foothills of Mount Lassen in northern California. After years of conflict with white settlers, by the late nineteenth century it was believed that all Yahi had been killed. But in 1911 a wild-looking, middle-aged Yahi was found near the town of Oroville. His hair burnt close to his head as a sign of mourning, starving and terrified, he had come down from the hills to give himself up.

Since the man would not tell anyone his name, he came to be known as Ishi, "man" in his language. He worked with the anthropologists at the museum until his death in 1916 from tuberculosis. (See Fig. 8.1.) The anthropologists were fascinated with Ishi's account of his forty years of isolation.

The Yahi were one of many tribes in the Mount Lassen foothills and Sacramento River valley subsisting through hunting, fishing, and gathering nuts and seeds. During the gold rush of the 1840s and after, ranchers, farmers, and miners moved into the region. The settlers' livestock spread into the hills and overgrazed the vegetation, and miners polluted the streams and cut off salmon runs. Hostile ranchers cut off the natives from areas where they seasonally gathered acorns. Their usual food sources diminished, the Yahi began raiding the farms, taking cattle and horses, flour and other supplies. In retaliation, the new settlers organized posses to raid Yahi villages, shooting many Indians in the process.

The hill tribes continued raiding. Sometimes, in revenge, they killed settlers and kidnapped their children. Vigilantes increased retaliatory attacks, not only on Yahi but also on other, more peaceful native tribes in the region. Many Indians were kidnapped and enslaved during the 1850s, and many died from sexually transmitted diseases, malaria, flu, and smallpox.

The Yahi suffered greatly, and by 1870, when Ishi was eight or nine years old, only twelve Yahi survived. By 1894, only five persons remained alive, subsisting by fishing, hunting, and occasionally raiding cabins. Only Ishi and his sister provided food to the group; the others were too old, and one of them died during the long hiding.





FIGURE 8.1 (left) Ishi at Oroville, California, August 29, 1911. (right) Ishi showing anthropologists how to make a bow from juniper wood. Photos courtesy of Phoebe A. Hearst Museum of Anthropology, University of California at Berkeley.

In 1909, settlers tracked and discovered the camp of the four Yahi. In the rush to escape, Ishi's sister and the old man disappeared, probably drowning. The raiders took as souvenirs the group's total means of livelihood—all their stores of food, their tools and weapons, and their utensils and clothing.

Ishi's elderly mother died soon after this attack by settlers. Ishi then lived alone in the hills for two years, hungry and grieving, and finally in desperation surrendered to the feared world of white men (Kroeber 1961).

# Change and Adaptation

Just as stress does not inevitably lead to disease, change is not inherently damaging to a population. Human populations frequently change through adaptation to environmental problems. But when one population intrudes on another, es-

pecially where they are technologically unequal, ecosystems are disrupted, with consequences for nutritional and reproductive health. The entire population experiences stress, and physical survival may be at stake. Most societies do survive contact, although at some costs to individual health. The history of groups that do not survive, like the Yahi, shows the limits of adaptability.

Extinction after contact is certainly not inevitable. Many groups initially decline in size and then eventually recover and even exceed precontact numbers. The fairly predictable stages in culture change involving disease patterns, demography, nutrition, and health care will be the theme of the first part of this chapter.

#### Stages of Contact

Anthropologists distinguish five stages in the contact history of a population. The first is **pre-contact**, a baseline period before interaction with another cultural group or with their artifacts via trade networks. Archaeologists and pale-ontologists can reconstruct the health status of a group before contact, and indigenous histories provide information about cultural ecology. **Diffusion**, the process of discovering and accepting ideas, foods, tools, and behaviors from other people, occurs during early contact. The wide diffusion of tobacco since its introduction into Spain from America in 1558 is an example.

**Acculturation** involves continuous and intense contact between two previously autonomous populations. It may occur in situations of colonialism, immigration, or conquest. One or both systems are extensively changed by this contact. The health problems of acculturation are many, ranging from poor nutrition because of changes in diet to the emotional stress of political subordination.

**Assimilation** occurs when one group becomes fully integrated into a dominant society. This is a long-range process, more easily accomplished by individuals than by total groups. It may involve educational and occupational avenues not usually taken by members of the group. In some cases, marriage is the path to assimilation. The new lifestyle choices pose new disease risks such as increased rates of cardiovascular disease and cancer.

A fifth type of culture change is **ethnic revitalization**, which may occur when racial or class barriers make assimilation difficult or when people become disillusioned with the new culture. New political structures or ritual organizations help them revitalize aspects of their traditional culture and thereby regain a sense of control and pride. Although anthropologists think of diffusion, acculturation, assimilation, and ethnic revitalization as stages along a continuum

of culture change, there is much intracultural diversity in people's response to contact. No community moves steadily through each stage. Some families modernize easily, and others resist change. Some people try out different lifestyles but later reject them. It is difficult for groups to reverse their direction, however, if they become dependent on imported goods and resources.

The type of contact situation plays a role in how people change. If explorers and settlers come seeking new land, they may force the removal of native peoples to reserves or push them to more marginal areas. Acculturation and assimilation are likely to be slower in such circumstances. But if colonists need indigenous labor to extract valuable resources in mines or on plantations or whaling ships, some degree of integration may occur (Kunitz 1994).

Contact history also differs depending on colonial policies. In Latin America, many native peoples were gradually incorporated into peasant underclasses created by Spanish and Portuguese land administration. To this day, indigenous and *mestizo* peoples in Central and South America live in poverty, with low average life expectancy. In North America, English and U.S. policy was initially to remove and exclude many native peoples without creating a peasant class in respect to land holdings or labor. This exclusion brought decimation and trauma.

The Indian removals had profound, far-reaching effects. The Potawatomi migrations in the United States between 1833 and 1851 are well documented. Pressure by settlers and by the U.S. government to obtain lands used by approximately 9,000 Potawatomi Indians living around Lake Michigan, for example, led to a series of forced moves to Kansas and Nebraska. Most of the Potawatomi removals occurred without significant disease or death, but the migration of 850 people and their leader Menomini from Indiana in 1838 was more difficult. Forty-two people, almost all children, died from typhoid en route. The deaths ended after the Potawatomi left the area; the forced migration may actually have reduced the death rate by moving the group away from the source of infection (Clifton 1988, personal communication). The removals fragmented Potawatomi people into small communities throughout the Midwest and Canada. Although some bands refused government enticements such as the offer of citizenship in exchange for land, gradually title to land was lost as people died without leaving wills. (See Fig. 8.2.)

### Models for the Study of Contact Processes

The changes in health that follow culture contact occur in four major categories: epidemiology, demography, nutrition, and health care. These subsys-



FIGURE 8.2 A Prairie Potawatomi elder and his grandson in 1964. The bond between grandparents and grandchildren is strong in many Native American communities, providing continuity with the traditions of the past and a sense of positive identity. Photo courtesy of James A. Clifton.

tems are linked synergistically. When there is change in one system, we can expect change in the other three. For example, increase in incidence of a disease (an *epidemiological change*) may lead to higher death rates among the youngest age groups (leading to *demographic change*). The need for adults to care for sick children may disrupt food acquisition (*nutritional change*).

Health care by shamans or herbalists may not prove adequate during an epidemic, leading people to try the medicines offered by missionaries and traders (*health care change*).

To study the health impact of culture change and health systematically, it helps to focus on subsystem changes in each of the major contact stages, as shown in Table 8.1. The information in the table was derived from the history of contact between Canadian Inuit and Europeans, but the trends may be generalized to other cases.

We need to distinguish between the contact history of the New World (the Americas, Oceania) and the Old World (Africa, Eurasia), as the health impacts of expansion differed in the two hemispheres. In the New World, notes Stephen Kunitz, "contact-induced diseases were as much a prelude to European domination as its aftermath" (1994:8–10). Because of the low immunity of indigenous populations to European diseases, smallpox and measles spread into the interior while Europeans were arriving at coastal ports. In the Old World, because of geographic connections among Europe, Africa, and Asia, many indigenous people were already immune to the diseases that Europeans brought and were not decimated by introduced diseases. Instead, the endemic tropical diseases such as malaria proved a threat to the settlers.

Disease and malnutrition played a significant role in contact history throughout the New World. The Chumash Indians of California, who were settled at missions by Spanish priests in the late 1700s, experienced severe population decline due to malnutrition and disease. The mission diet, mostly corn gruel twice a day and soup with meat and vegetables once a day, was inadequate for normal growth. The skeletons of the first generation to be missionized were indeed smaller than their ancestors.' Mission records also showed there were more than twice as many women aged thirty to fifty as men. Men were traders in an exchange network among villages, which exposed them more to infectious disease. High male mortality was also due to warfare (Walker and Johnson 1992).

Between 1830 and 1833, malaria decimated at least half of the native population in Oregon and north central California (Cook 1972). The epidemic began at Ft. Vancouver, affecting both whites and Indians. The original carrier may have been a sailor who had contracted the disease in the Pacific. The presence of anopheline mosquitoes along the Columbia and Willamette rivers in Oregon and the Sacramento and San Joaquin rivers in California ensured that vectors were available to transmit the parasite to non-immune populations living close to the rivers. The migration of infected frontiersmen and set-

tlers from Oregon to California, and the fact that West Coast Indians had never been exposed to malaria, increased the chance of a massive epidemic. Malaria was one of many diseases introduced to native California. The indigenous population, estimated as being between 230,000 and 310,000 before contact, declined to about 30,000 by 1860 (Cook 1976; Thornton 1980).

In discussing historic cases, we usually focus on the health repercussions on only one of the societies in contact, usually the one whose territory has been invaded. But intrusive populations also faced disease risks. Explorers and whalers often developed scurvy, due to the deficiency of vitamin C in their standard diet of salted meat, hardtack biscuits, lard, molasses, rice, and dried beans. They had little access to fruit, vegetables, or fresh meat. If they had been willing to eat raw seal meat and whale skin, they would have avoided scurvy (Fortuine 1988).

Settlers and explorers often became malnourished, depressed, and demoralized. Theodora Kroeber gives us insight into the Californian settlers responsible for the extermination of the Yahi. Searching for an answer to why "people of principle, many of them, and of good upbringing and antecedents, some of them, could act toward their Indian predecessors on the land with such ferocious inhumanity and brutality," Kroeber read historical accounts and journals. She concluded that "between frustrated cupidity, scurvy, dysentery, starvation, filth, exhaustion, and disillusionment, they arrived in California already dehumanized and brutalized in their behavior to one another and to strangers alike" (Kroeber 1961:52–53).

# Repercussions of Culture Contact on Health in the Arctic

The history of health changes among Inuit illustrates the variables in Table 8.1. Before extensive contact with Europeans, Canadian Inuit had remarkably good health, considering their rigorous environment. Infectious diseases were rare, and accidents were the most frequent cause of death. The food supply was varied and nutritionally adequate. Famine did occur occasionally, but chronic malnutrition was rare.

Relations between Inuit and explorers, whalers, and traders, beginning in the sixteenth century and reaching a peak between 1840 and 1900, were mostly reciprocal and interdependent. Europeans provided employment on whaling vessels and expeditions, paying workers with trade goods, food rations, imported cloth, and alcohol, tea, and tobacco. Inuit in turn supplied land food, skins and clothing, and labor as guides and oarsmen. Some Inuit

TABLE 8.1	
Changes in Health Subsystems During Stages of Culture Contact	t

	Stage I  Pre-Contact	Stage II Early Contact and Diffusion	Stage III Settlement and Acculturation	Stage IV Modernization and Assimilation
Epidemiological subsystem	Few pathogens in ecosystem; low immunities to infections	Epidemics of infectious diseases	Hyper-endemic infectious and nutritional diseases	Endemic infectious, nutritional, and stressrelated diseases
Demographic subsystem	Births≅ deaths, population stable	Births< deaths, population decline	Births> deaths, population growth	Births deaths, slow population growth
Nutritional subsystem	High protein, low carbohy- drate; fluctu- ating supply	Carbohydrate supplements; famine inter- acting with epidemics	High carbohy- drate, low protein; food supply steady but nutrition- ally poor	High carbohy- drate, low pro- tein supply; quality varies by socio- economic status
Health resources subsystem	Shamans and midwives fulfill limited medical & psycho- therapeutic needs	Shamans discredited in epidemics; missions pro- vide relief	Government & missions provide modern medical care; health needs greatly increased	Modern medicine continues; birth control increases; health care and ethnic politics interconnected

women became seasonal wives of whaling captains, traders, and explorers (Stevenson 1997).

Europeans brought not only employment and trade goods, but also infectious disease. Many Inuit died from diphtheria, pneumonia, measles, flu, tuberculosis, and syphilis. The Baffin Island population declined sharply from an estimated 1,600 in 1840 to 328 in 1883 due to disease and relocation (Boas 1964). An epidemic among the dogs in 1883 stranded many families in the Cumberland Sound area, leaving them unable to carry out hunting activities and facing famine.

Anglican missionaries arriving in 1894 provided food and medical supplies, attempted to persuade people to stop using alcohol, and taught people to read and write in *Inuktitut* (the Eskimo language) with syllabics, a writing system first developed by missions for Cree Indians. They also attempted to discredit the work of *angakot*, the shamans, who could not deal effectively with infectious disease.

The medical missions could not stop the epidemics. In 1902 the entire population of Saglermiut of Southampton Island died from a disease resembling typhus contracted from Scottish whalers (Ross 1977). The worldwide flu of 1918–1919 caused many deaths, and tuberculosis became a leading cause of death in most northern groups.

Southern Baffin Island took on military importance in the Second World War, and local people began to settle around the U.S. Air Force Base at Iqaluit (then called Frobisher Bay) between 1942 and 1958, living in shacks constructed from discarded materials and finding work at the base. A Hudson's Bay Company store provided goods and hunting supplies for Inuit families. By 1963 Frobisher Bay had grown to 906 Inuit, 583 Eurocanadians, and 130 U.S. Air Force personnel. Roads, new houses, a hospital, churches, and schools were built, and by the 1990s, a new kind of community had emerged, representing a mosaic of arctic tradition and southern Canadian institutions. In 1999, the political landscape changed significantly with creation of the new territory of Nunavut. (See Fig. 8.3.)

Although the nearby community of Pangnirtung had been a center of health care and mission work since the 1920s (Hankins 2000), it was not fully settled until after 1962, when distemper decimated the dog teams and

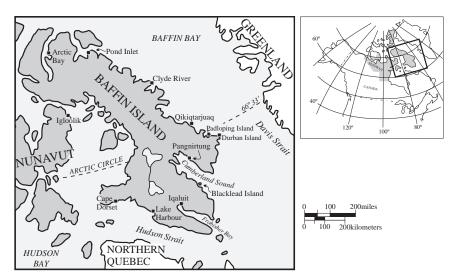


FIGURE 8.3 The Eastern Canadian Arctic. Iqaluit and Pangnirtung, primary sites of McElroy's research, are now part of the new Nunavut Territory, shown in gray shading.

stranded people in hunting camps. Famine set in, and people had to be airlifted to the town.

# Repercussions of Change on Inuit Health

From about 1820 to 1970, generations of Baffin Islanders faced new challenges through a series of intrusions that created negative repercussions on health, ecology, and social organization (McElroy 2008). Using the grid of health changes by stage of contact in Table 8.1, we can trace the specific impacts on Inuit health. Epidemiologically, diseases and causes of death transitioned from chronic, endemic disease and accidents to epidemic diseases and famine. Demographic changes included initial population decline and then later, population rebound leading to larger and denser communities. Nutritional change was also significant. During early contact, Inuit depended increasingly on high-carbohydrate rations from missions and trading posts. Bannock (a thick pan bread), molasses, and tea became staples for families working at whaling stations. This nutritional shift contributed to low disease resistance for several generations. During this period missionaries, and later mission doctors and nursing sisters from the UK, supplanted the ritual practices of shamans, leading to change in the health resources subsystem.

Shifts to settlement living between 1950 and 1970 helped Inuit avoid famine, but many were newly exposed to infectious disease. In the 1950s rubella (German measles) caused the death of many children in Cumberland Sound. Meningitis also killed some children and left a few other children deaf and blind (Hankins 2000). The prevalence of hepatitis B, a chronic but serious disease, reached as high as 56 percent in northern Baffin Island in the 1970s (Shephard and Rode 1996).

By 1960, almost every Canadian Inuk had a history of active tuberculosis (TB). The incidence of new and reactivated cases of TB for Inuit in the Northwest Territories remained high by 1976, at 137.8 per 100,000; all Canada rates were 13.7 per 100,000. By 1986, after introduction of the BCG vaccine, the Inuit rate had reduced to 16.2 per 100,000 (vs. all Canada, 8.4) (Muir 1991).

The birth rate in 1965 was 64 per 1,000, compared to 24.6 for all Canada. By 1985 the rate dropped to 36.7 per 1,000 but remained 2.5 times the rate for all Canada. In 1965 the infant mortality rate was 124.4 per 1,000 in Frobisher Bay, six times as high as the rate for all Canada, but by 1984–1985 it declined to 19.9 per 1,000 live births vs. 7.8 for all Canada (Muir 1991). By 1999–2003, infant mortality remained at 18.5 per 1,000 (Wilkins et al. 2008).

Traditionally, infants nursed for three years or longer. By the 1960s, most mothers in the larger settlements chose to wean their babies by twelve months, substituting canned or powdered milk for breast milk. By the 1970s, many mothers were weaning their infants by three months. Bottlefed infants had a higher incidence of gastrointestinal disease, middle-ear infections (otitis media), anemia, and respiratory infections than did breastfed infants. After a public health campaign to encourage Inuit mothers to breastfeed longer, the percentage of three-month-old infants still nursing had increased from 32 percent in 1973 to 58 percent in 1978 (Schaefer and Spady 1982).

In the 1980s, potentially carcinogenic chemicals (PCBs, or polychlorinated biphenyls) were found in seals, walrus, caribou, and narwhal skin, foods that most Inuit consumed daily. The source of these chemicals was not local, but rather through the marine food chain from distant industrial pollution. Testing showed that about one-fifth of the people on Broughton Island (now called Qikiqtarjuaq), on the east coast of Baffin Island, had consumed more than the acceptable daily intake of PCBs. In Nunavik (arctic Quebec), to the south of Baffin Island, breast-milk samples from Inuit women showed concentrations of POPs (persistent organic pollutants, including PCBs and chlorinated pesticides) at five to ten times the level in the breast milk of women in southern Quebec (Dewailly and Furgal 2003).

PCBs can be transmitted to children through breast milk as well as through meat consumption, and there was concern that extended nursing might increase early exposure, with uncertain impacts on children's growth and disease resistance. Among Inuit children in an earlier study, 63 percent of those tested had PCB blood levels above acceptable contaminant levels (Kinloch and Kuhnlein 1988). Infants exposed through breast milk to persistent organic pollutants had a higher rate of ear infections than bottlefed infants (Dewailley et al. 2000). Health educators face a dilemma: should they advise Inuit mothers to stop nursing altogether? Or do the benefits of breastfeeding outweigh the possible risks of chemical exposure? The current policy is that breastfeeding continues to be promoted by settlement nurses and doctors.

#### Nutritional Health

Nutritional change was especially profound after people moved to settlements in the 1950s and 1960s. In 1965, Inuit in Frobisher Bay consumed only one-fourth as much seal meat as did residents of Pangnirtung, a smaller village (Schaefer 1965). The primary substitutes were carbohydrates, particularly

bread eaten with lard, butter, or jam. This was a major shift for a society that had traditionally used marine animals as staples.

Families increasingly depended on grocery and takeout food, especially for quick lunches. Hamburgers and fries were popular in the 1960s, and, by the 1990s, takeout food ranged from barbeque ribs to pizza to Chinese stir-fry. Nevertheless, most Inuit regarded country food as superior to store food in taste and nourishment, and elders preferred to eat fresh, uncooked meat whenever possible. Although high gasoline prices made hunting costly, people continued to participate in food-sharing networks. Elders in Clyde River, another Baffin Island community, believe that seal meat caused a person's blood to become fortified and flow faster, giving warmth and strength, and "when the body is warm with seal blood, the soul is also protected from illness" (Borré 1991:54–57). In fact, seal meat has three to seven times more iron than beef, twenty times as much vitamin A, twice the amount of protein, and less fat (Mackey 1988; Wenzel 1991).

High consumption of sugar through soda pop, candy, and baked goods has been typical for several generations of Inuit. Otto Schaefer (1971), a physician, noted a fourfold increase in sugar consumption between 1959 and 1967 in Pangnirtung. Comparing measurements made in 1938, by 1971 young adults were 1 to 2 inches (2.54 to 5 cm) taller on average than their parents (Schaefer 1977). They were also reaching puberty earlier, and Schaefer attributed this change to increased carbohydrates rather than to improved nutrition. He also detected glucose intolerance (difficulty in keeping blood sugar levels stable after ingesting sugar). Tests did not find a high prevalence of diabetes mellitus in the 1960s (Schaefer 1968), and continued surveys between 1991 and 2001 showed that Inuit had lower rates of type 2 diabetes than the general Canadian population. Dental health also suffered from high-sugar diets and lack of fluoridated water, with increased rates of dental caries. Many adults had lost all their teeth and wore dentures.

#### Growth, Physical Fitness, and Tobacco Use

Studies of growth and development in Igloolik compared anthropometric data collected in 1970–1971 and ten years later (Rode and Shephard 1984). Earlier trends toward increased height had stopped by 1980. Both young and older adults were on average three-quarters of an inch (2 cm) shorter than people of the same age in 1970, although puberty continued to be earlier and girls were heavier than ten years before. The adults showed decreased physi-

cal fitness, less muscle strength, less lean tissue, and decreased cardiorespiratory performance.

In 1970–1971, the Inuit of Igloolik performed well in lung function tests, but by 1980–1981, the group showed decreased fitness in the tests, possibly due to increased smoking. Snowmobiles may also have contributed to decreased fitness (Rode and Shephard 1985). Decrease in height may have been related to the jarring effect of bumpy rides on snowmobiles that damaged vertebrae. By the 1980s, "four-wheelers" or all-terrain vehicles were available for transportation all year round in many settlements, further decreasing physical fitness.

Cigarette smoking became an adult practice after WW II when soldiers stationed in the North freely distributed cigarettes to Inuit. By the 1980s many teens and pre-teens had started smoking. In 1987, 13 percent of boys and 16 percent of girls aged ten to fourteen were already regular smokers, and half of older teens smoked (Muir 1991). Despite efforts by nurses and health educators, Inuit women continued to smoke during pregnancy for decades, and average birth weights decreased after the 1970s (Schaefer 1977; Muir 1991). By 2002, laws restricted smoking in public facilities and required restaurants to offer separate areas for smokers. Many people stopped smoking in their homes, going outside even in the coldest weather. However, teen and pre-teen smoking continued unabated, and there were increasing cases of teens sniffing inhalants.

# Causes of Death

In addition to substance abuse, Inuit children are often victims of accidents and violence, including suicide. In 1983, 62 percent of all suicides in the Northwest Territories (NWT) were committed by Inuit, yet Inuit made up only a third of the population. In the past, people sometimes resorted to suicide in response to extreme distress, but rates rose sharply in the twentieth century. Eight of the thirteen Inuit suicides in 1983 were young people aged 15–24; a teen suicide sometimes sparked a series of "copycat suicides" (Condon 1987). Between 1984 and 2002, there was a drastic increase in suicides among eastern Arctic Inuit: from 40 per 100,000 in 1984 to 170 per 100,000 in 2002. (The all-Canada rate in 2002 was 11.6.) Teens aged 15–19, primarily males, had the highest rates (Hicks 2007).

Lung cancer is now the leading type of cancer among Inuit men, and the second leading cause in women (cervical cancer is first). Although injuries

Leading Causes of Death among Canadian multi and this treations, 2000–2004					
	<u>lnuit</u>	First Nations*	All Canada		
	%	%	%		
Injury+	34	22	6		
Cancer	22	25	27		
Circulatory	16	23	44		
Respiratory	12	12	11		

18

12

TABLE 8.2
Leading Causes of Death among Canadian Inuit and First Nations 2000–2004

16

Other causes

Source: Statistics Canada; Health Council of Canada; Health Canada.

due to accidents and violence remain the leading cause of death, cancer is the second highest cause and circulatory disease (heart disease and strokes) is third. Average life expectancy for Inuit in Canada in 2001 was 68 years, 12 years lower than Canada's overall rate but considerably higher than in previous decades (Wilkins et al. 2008). A major reason for the low life expectancy is the violent death rate among teens and young adults. (See Table 8.2.) Gender disparities in life expectancy are striking: 63 years for male Inuit, and 72 years for women (for all Canada, life expectancy is 77 for men and 82 for women) (Statistics Canada 2006).

#### Change in Health Care

In the early twentieth century, most settlements had a nursing station (a small clinic) staffed by one or two nurses and periodically by visiting physicians. A mission hospital was built in Pangnirtung in 1931, and a government hospital opened in Frobisher Bay in the 1960s. Previously, most medical and dental services were provided to arctic communities once a year by a government ship, the *C. D. Howe*. Patients needing hospitalization were transported by ship to Quebec City, Montreal, or Hamilton, Ontario. Even young children were taken by ship to southern hospitals for long stays, sometimes two or three years. Returning to their home settlements was often difficult, and some did not return, having died from tuberculosis or other illnesses. They were buried in unmarked graves, causing unresolved grief for families that lasted for decades.

Because specialized care was not available at the local clinics and hospitals in the 1960s and 1970s, patients were evacuated for a wide range of condi-

<sup>\*</sup> First Nations is the term for "Indian"

<sup>+</sup> Includes intentional (suicide, homicide) and unintentional injury (accidents)

tions, including normal pregnancies and minor eye problems (Gillan 1991). Evacuation was far more expensive and more stressful than care in the settlement. In recent years, more health care is available in the communities. For example, the Iqaluit Home Care Program has provided services to elders with chronic bronchitis and emphysema. This program allows patients to receive care in their homes through weekly nursing visits and employs local home care assistants and homemakers, providing training in health careers for native people. The cost savings are very favorable: it costs up to a hundred times more per day to be hospitalized (Miles-Tapping 1994). When a trip to a southern hospital is necessary, as when a pacemaker must be installed to regulate the heartbeat, an efficient MedEvac system by plane gets the patient quickly to Montreal or Ottawa. Dental and eye care are now available year-round in the larger settlements.

Inuit health systems were still out of balance in 1967–1971, when Ann McElroy did doctoral research comparing two Baffin Island communities: Iqaluit, with 1,200 Inuit and 900 Eurocanadians in 1971, and Pangnirtung, with 700 Inuit and 75 Eurocanadians. (See Fig. 8.4.) Her study of Inuit child rearing was not initially focused on health, but it was clear that health problems affected people's adaptation to town life, especially tuberculosis, ear infections, and alcoholism (McElroy 1977). During McElroy's follow-up studies (1992 through 2006), the communities were addressing the health problems that had undermined their quality of life in previous decades (see Figs. 8.5 and 8.6.). The following profile contrasts two Inuit families in the late 1960s and the early 1990s to illustrate changes in health problems and development of resources for recovery.

# ROFILE: CULTURE CHANGE AND INUIT HEALTH: TWO FAMILIES

# 1967-1968: The Kobuk Family

After the Kobuk family moved away from Frobisher Bay in 1968, word came back that their oldest daughter had committed suicide. The neighbors were not particularly surprised. The family was more unlucky than most, but their troubles were familiar ones.

In 1967 Sam Kobuk returned to Frobisher Bay after having been treated for tuberculosis in southern Canada for two years. He got back his old job as a school bus driver, but his boss complained about Sam's being hung



FIGURE 8.4 An important part of any anthropological fieldwork is participant observation, in this case, babysitting. Ann McElroy joins two pre-teen friends in 1969 in carrying toddlers in *amautit*, or mother's parkas. Photo by Ann McElroy.

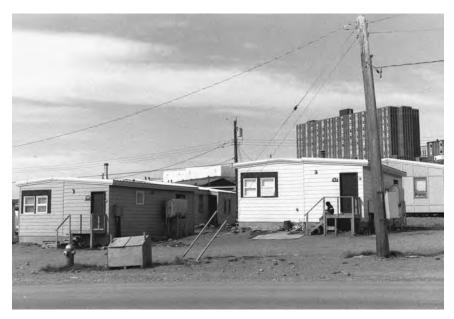


FIGURE 8.5 Prefabricated Inuit houses in Iqaluit, 1992, equipped with electricity, telephone, cable TV, and indoor water storage. The building in the background has stores, offices, apartments, a hotel, a swimming pool, and a restaurant. Photo by Ann McElroy.



FIGURE 8.6 Ann McElroy with Pangnirtung host family, Pauloosie and Rosie Veevee, with their grandson Jerry, in 2002.

over in the morning. He knew that drinking so much beer was making him sick, but he needed something to help him forget how his little boy had died, strangled by the ropes of an infant swing. He drank and played cards, gambling for quarters, almost every evening with buddies. The kids were scared of the rowdy men, and sometimes ran to their cousins' house when the party got too rough.

His wife was pregnant again. Sam hoped the baby would be a boy, but Mary didn't really care. This was her ninth pregnancy and she was only twenty-seven years old. She planned to ask about birth control after the baby was born. The nurses hadn't suggested it earlier, but she was tired of having babies. It was hard to be pregnant, hold down a part-time job, and take care of three little children. It seemed as if the children were sick all the time with ear infections and coughs. When four-year-old Tommy had been hospitalized in Ontario for tuberculosis, things had been easier, but now he was on antibiotics at home. He often complained about stomach pain from the medicine. Her youngest child wasn't as strong as he should be, and Mary suspected that the canned evaporated milk, tea, and sugar that she mixed in his bottle were causing diarrhea.

By the winter of 1967, Sam's drinking was worse, and he was coughing up blood. He was afraid the TB had come back. The new baby was due soon, and Mary stopped working. They argued about Sam's spending his paycheck on beer and cigarettes. Mostly they ate potatoes, canned beans, and bannock. Sam was in no shape to go out ice fishing or seal hunting, and they didn't have a snowmobile. Although it was customary for neighbors and kin to share land food, especially fish and whale skin, Sam and Mary couldn't reciprocate and had dropped out of sharing networks.

Evie, Sam's oldest daughter, was a bright girl who liked school. During the summer of 1967, Sam was proud when she was chosen to go with a group of schoolchildren to visit Ottawa. But he worried because she was not yet fourteen but was already dating construction workers. He was afraid she would get pregnant like so many other young girls.

When Evie tested positive for gonorrhea, Sam was furious. As his anger escalated, Mary tried to intervene, and Sam beat her so badly that she miscarried the baby and almost died. Friends urged Mary to press charges against Sam or to leave him, but she would not, and the police could not charge him. The family relocated the following year to another northern settlement. Shortly after the move, Evie shot herself during a family argument. Several other teenagers took their own lives in 1968, and the following two decades brought a virtual epidemic of suicides by teens and young adults in Baffin Island towns.

# 1993-1994: The Aivik Family

Susie and Jimmy Aivik see their decision to give their drinking problem to God as a turning point in their lives. Like most of their friends, they had been drinking since they were about fifteen, even though it had always been illegal in Iqaluit for teenagers to drink. Now in his mid-thirties, Jimmy made good money in construction, and Susie's wages as a day care center teacher had helped them fix up their house. They purchased a new CD player, a VCR and camcorder, and a microwave oven. Still, it seemed that alcohol used up a lot of their money, especially now that the liquor store had been closed and most people drank at the hotel bars or at the Canadian Legion club. They weren't sure why they drank so much. It was just something to do with friends, a way to relax.

It was harder to get liquor now. You had to order months ahead to have your supplies shipped in, or you had to know who the bootleg distributors were. Susie's dad, Markosie, said the new policy was voted on by the town in 1976 after a tragic accident. A six-year-old boy was hit by a snowmobile driven by his own father, who was drunk at the time.

Between 1961 and 1976 about forty people had died in alcohol-related accidents in Iqaluit. Markosie supported the new liquor policy. With almost 4,000 people now, Iqaluit was hoping to be chosen as the capital of Nunavut, the new Eastern Arctic territory to be established in 1999. There was concern that the town's reputation for violence might prevent this.

In the summer of 1994, about two hundred Inuit and European Canadians held a public rally to protest the alleged activities of drug dealers who were said to be providing liquor and drugs to local teenagers. In subsequent weeks, protest leaders tried to close the businesses of the suspected dealers and drive them out of town. A community barbecue was held to build support for the anti-drug campaign. As Inuit and Qallunaat (Eurocanadian) organizers passed out grilled hot dogs and caribou meat, they also gave out bright green buttons with the slogan "Say 'No!' to Drugs"—some in Inuktitut and others in English.

The Aiviks were worried about the effect of drugs and drinking on their three children. They had seen a program on Inuit Broadcasting Corporation television about children inhaling solvents and gas fumes to get high. In Cape Dorset, a nearby settlement, three children had died after sniffing propane gas. The Aiviks worried that the same thing might happen to their son. Jaco was only eleven, but they knew that some of his friends smoked already.

The kids were all healthy and free of tuberculosis. The food allowances that came with their jobs helped the family with food costs. Not only did they have fresh fruit, vegetables, and milk from the store, but also plenty of fresh fish, seal, and caribou from kin and neighbors. Susie's dad provided a lot of this meat. Retired from his work as a Department of Transportation mechanic, Markosie now lived most of the year in a warm, well-constructed little house, a *qarmaq*, in an outpost camp, about thirty miles down the bay. More old people were living in the outpost camps now, and some of the children got to spend entire summers with grandparents in the camps while their parents worked in town.

With Susie working full time, four children were enough, and she planned to continue using birth control. Still, now that Meeka was four, it seemed strange not to have a little one to carry in her *amauti*. Susie thought she might arrange an informal "custom adoption" of a baby once Meeka started school. With so many young teen mothers, there was certainly no shortage of available babies in the area.

Susie and Jimmy talked from time to time about trying to stop drinking, but they weren't sure how. They didn't communicate well with the Qallunaat social worker at the hospital. In the past the lay ministers of the Anglican Church had condemned drinking. But when the minister agreed to let traveling evangelists hold a healing service at the church in 1993, the Aiviks and hundreds of others, Inuit and Qallunaat, crowded into the sanctuary, curious to see what would happen. They had seen some evangelical services on satellite television but were skeptical about whether healing could really occur through prayer.

During the service the evangelists spoke, with the help of interpreters, about their own histories of past alcoholism and addiction, of pain and hopelessness, and then of being "born again." These testimonies touched many people in the audience. In tears, Susie and Jimmy raised their hands during prayers, asking for help for their drinking. The evangelists knelt beside them, praying and trying to comfort them. The sobbing and confessions of guilt and pain were unlike anything the Aiviks had experienced in church, and they left feeling a sense of hope.

After the revivalists left town, Susie Aivik decided to attend Alcoholics Anonymous meetings at the Upassuraakut Centre, a new native-run counseling program that she had heard about. She found a number of her friends attending the meetings, and several of her friends were employed at the Centre as counselors.

It was about a year before Jimmy agreed to go to an AA meeting, but once he went, he found the meetings helpful. Usually just five or six people attended, and Jimmy found he could talk for the first time about painful memories of his older brother's suicide twenty years ago. It seemed that almost everyone at the meetings had lost a relative to violence or sickness or had experienced abuse at a boarding school. Usually Inuit didn't like to talk about feelings like this, but the counselors said this was a way to healing. Jimmy felt a sense of hope that he had been missing for a long time.  $\[ \bigcirc \]$ 

# Health Care as an Adaptive System

Caregiving is a distinctive feature of human adaptation. Every society must ensure the well-being of its members, including those who are vulnerable. Emotional bonds and ethical values lead most societies to care for a broad spectrum of dependent people such as pregnant women, the frail elderly, those with illnesses, injuries, and disabilities, refugees, and victims of natural

disasters. In this section we look at various systems of care in contexts of culture change and pluralism.

Is care of people with disabilities universal? There is evidence from paleopathology that prehistoric peoples provided care to people who were not able-bodied. At an Upper Paleolithic site in Italy, a skeleton of a dwarf with an abnormal arm was found. This person lived about seventeen years. At another site in Florida, dated 7,500 BP (before present), archaeologists found the skeleton of a person with *spina bifida*, a serious birth defect of the spinal cord. This person also lived to be a teenager. While it is possible that these individuals survived only by the compassion of others, we should not assume that these were helpless, non-productive individuals. They probably contributed to their societies in various ways (Dettwyler 1991). Just as people with disabilities today often have important roles, in the past they may also have excelled in religious and healing roles, in making tools and pottery, in art, and in music.

Health care involves organized behaviors for health maintenance, for prevention of physical illness or emotional distress, and for management of illness or disability. Care occurs in many settings besides clinics or hospitals. Parents comforting a distressed child enhance his emotional health. A day care center for elders reduces their isolation, ensures nourishment, and eases the burden of family members. Educating young people about preventing HIV infection is a form of care. Health care can occur at the household and community level as well as in institutional contexts, and it may be preventive as well as curative.

Caregiving occurs through networks and interactions among people connected in collaborative roles. Through these networks, technology is developed and used, knowledge is shared, decisions are made, and work is allocated. We refer to all these elements (the people, technology, knowledge, and behaviors) as **health care systems**. Such systems, regardless of societal complexity, include types of *people* (e.g., patients and healers, children and parents, midwives and apprentices) and types of *settings* (a clinic, dentist's office, halfway house, or *curandera*'s home). Thirdly, there are categories of therapeutic and preventive *behaviors* (undergoing heart surgery, exorcising spirits, working out at an aerobics class, preparing herbal medicine, testing a new mouthwash to prevent gum disease).

Health care systems also involve *beliefs* about the causes of illness and injury and *ethical principles* underlying decisions about how to treat patients. In small-scale societies, such as the Yanomamö or traditional Inuit, most people hold similar beliefs about the meaning of illness (for example, that

sorcery or malevolent spirits bring illness). In more complex societies, views about the meaning and management of illness may vary by ethnic group, by class, and by nationality. In the United States and Canada, when brain death (loss of integrated brain functioning) occurs, physicians routinely seek permission to harvest body parts for organ donations to other patients needing transplants. In Japan, however, where many people do not equate brain death with absolute death, organ transplants remain highly controversial and are only infrequently carried out. Public debate about organ transplants in Japan centers on lack of trust of doctors and rejection of westernized medical ethics and policies (Lock 1995).

#### Medical Pluralism

It is rare for a society to have a unitary health care system, with only one option for dealing with illness. Alternatives range from home remedies to spiritual healing to consultation with specialized practitioners. People are especially open to alternatives when dealing with chronic conditions. A North American with lower back pain might first try exercises, massage, an over-the-counter analgesic, or replacing a mattress. If the pain continues, the person could consult a physician, a chiropractor, a doctor of osteopathic medicine, or a physical therapist, who will each give a diagnosis and recommend certain courses of action. If relief does not come, or if the recommended therapy is not feasible, one might try less conventional methods, perhaps acupuncture, yoga classes, or healing services at church.

Having a choice of a neurologist, chiropractor, or acupuncturist indicates a *pluralistic* system. In situations of **medical pluralism**, traditional (or alternative) medical systems coexist with modern or "cosmopolitan" medicine. While the systems may compete, as do allopathic, osteopathic, and chiropractic medicine, there is also potential for collaboration or integration. This is the case in Andean mountain communities of Peru and Bolivia, where people draw from a variety of treatment options: from indigenous specialists such as bone setters and herbalists to modern pharmaceuticals and hospital care. In fact, pluralism has increased as new practices and commodities are introduced by practitioners, including ginseng from Korea, Chinese herbs, American vitamins, and packaged roots from Amazonian regions. Biomedicine remains the "official" system supported by the government, but indigenous systems continue to flourish as well (Miles and Leatherman 2003).

Some researchers prefer the term **health pluralism** to denote that societies often support a range of integrated indigenous systems for health mainte-

nance independent of influence from Western biomedicine. These systems, blurring distinctions between religion and therapy, serve important ritual and psychological functions for the people who go to traditional healers. Health pluralism in Sri Lanka has provided valuable resources for a country torn by ethnic violence since 1983, as well as by the devastating tsunami of December 2004 (Tribe 2007).

Health care in modern Japan, with its mosaic of medical practices and belief systems, is also highly pluralistic. It includes East Asian medicine, originally introduced from China, which emphasizes the balance of energy systems in the body and the principles of *yin* and *yang*. East Asian practitioners use herbal treatments, massage, acupuncture or acupressure, or other methods. *Shinto*, a traditional system, is especially effective for symptoms caused by spirit possession. Western medicine is also widely practiced, with private physicians, hospitals, and public health institutions (Lock 1980).

In comparing health systems in North America or Europe with those in other modern nations, it is an error to assume that specific medical roles or procedures are the same. You might envision a pharmacist's role, whatever the cultural context, as preparing medicines, filling prescriptions, and giving advice and cautions to patients. But this assumption would not be completely correct. In the following section, to illustrate medical pluralism, we look at the training and practice of a Japanese pharmacist.

# Health Care in Japan: An Example of Medical Pluralism

In downtown Kyoto, a city of 2 million, people seeking relief from allergies, asthma, and tiredness often purchase herbal medicines at small pharmacies. These pharmacies are one of several health care resources studied by Canadian anthropologist Margaret Lock (1980). Mr. Watanabe's pharmacy, started by his father fifty years ago, is a tiny shop where customers can purchase herbal mixtures. Most herbs are imported from mainland China, Korea, and India and are subject to government inspection and regulation. Folk medicines are made from animal materials, such as deer antlers, rhino horns, and monkey skulls.

Since World War II, the Japanese government has required pharmacists to be graduates of a four-year university program and to take a national examination for licensing. Mr. Watanabe graduated from Kyoto University, where his son is now also studying pharmacy. Because the university program emphasizes standard pharmacology, his son will receive training in herbal preparations from his father after graduation.



FIGURE 8.7 Pharmacist at a kanpō clinic in Japan. Photo courtesy of Margaret Lock.

Customers do not come to the pharmacy with written prescriptions, as they would in North America. Rather, Mr. Watanabe must reach a diagnosis before deciding what to prescribe. By law he is not allowed to touch his customers, so diagnoses are made through observation and lengthy questioning about symptoms, diet, and personal history. (See Fig. 8.7.)

His customers are mostly middle-class people with chronic rather than acute problems. He keeps records on all customers and carefully notes changes in symptoms over time. If he is uncertain about his diagnosis, he sends his customers to a Western-trained doctor. Mr. Watanabe reminds his customers that "poor diet is the most fundamental cause in all sickness." He tells them to avoid depending on synthetic medicines (factory-made pharmaceuticals). His goal is to persuade his customers to develop the attitude "of being in harmony with nature by living a life without excesses and by modifying behavior on the basis of subtle signals, both emotional and physiological, emitted by their bodies" (Lock 1980:153).

Japanese who find herbal medicine beneficial also go to clinics specializing in East Asian medicine. *Kanpō* clinics feature a system brought from China to Japan in the sixth century. Other clinics specialize in acupuncture, massage, and moxibustion (placing a burning plant or stick on the skin). About a

third of the licensed practitioners in Kyoto offer East Asian therapies; the rest are oriented to Western medicine. About a hundred physicians, all trained and licensed to practice Western medicine, specialize in *kanpō*.

Lock found that many Japanese turned to *kanpō* only after Western medicine failed to cure an acute condition. An example is Mr. I., a twenty-nine-year-old high school graduate who worked ten hours a day in a dyeing factory, sitting in one position all day with few breaks. He suffered back pain, stomach problems, tiredness, and depression. After having X-rays and injections, his doctor told him that he was neurotic and there was nothing wrong with him. A friend introduced him to the clinic where he receives acupuncture and herbal medicine. He expressed satisfaction with the clinic and says he trusts the doctors completely. However, the doctors say that his physical condition will not improve unless his work conditions change.

#### **Decisions About Care**

Health care in Japan is a complex mosaic of practitioners and traditions. Nevertheless it is a coherent system that can be studied ethnographically. Just as ecology provides a model for studying the distribution of resources and energy in a natural habitat, ethnography provides models for understanding how people use health care resources and make decisions about the kind of care to seek. Financial costs, perceived risks and benefits, convenience, and the cultural acceptability of certain options can be described in an algorithm (a decision tree) indicating values, priorities, and constraints.

The various pathways taken in seeking care are sometimes called **hierarchies of resort**, meaning that people choose health care solutions according to principles that follow a cultural logic. This concept was developed by Romanucci-Ross (1969) to describe sequences of cure-seeking in Melanesia. The cure of "first resort" was likely to be a traditional therapy; the "last resort" was often European medicine. The notion of hierarchy here is that choices are made in a particular order according to ideas about cause, diagnosis, and appropriate therapy; severity of the illness; and the individual's ethnicity, class, level of education, and financial resources.

What factors lead people to chose a particular system of treatment? Whether the illness is perceived as minor or severe makes a difference. In the Philippines, a modernizing nation with strong public health programs, Western doctors are consulted for major physical illnesses. Yet of 237 people surveyed in eleven communities, 89 percent had consulted a traditional healer at some point. The respondents believed that native practitioners were very

effective in treating minor complaints such as menstrual cramps, postpartum pains, colds, and skin problems and traditional ailments caused by sorcery (Tan 1987).

It is not unusual for people to try several health systems to deal with a problem. An elderly Cambodian immigrant to the United States seeking help for headaches went to a mental health clinic, where she received injections and drugs. She also went to a private Vietnamese doctor, hoping to get him to sign a form for disability benefit, and to a *krou kmer*, a traditional healer, to see if her headaches were caused by the "spirits of those who had perished but had not been appeased by the living" (Ong 2003:120). Although choices of therapy are cognitive decisions, they are also influenced by social structure, especially class divisions and power relations.

In rural Egypt, structural factors shape choices of treatment for trachoma, a prevalent eye disease that can lead to blindness (Lane and Millar 1987). Three tiers of eye care are available. There is home treatment with lemon water eyedrops, onion or tomato compresses, or herbal mixtures or antibiotic ointments purchased at local markets or stores. There is treatment from traditional healers such as the hallag sahha or the health barber, who removes the eyelid lesions and irritating in-turned eyelashes in late-stage trachoma with a razor blade. Thirdly, biomedical treatment with antibiotics is available from physicians in private practice or at government clinics. Most Egyptian villagers respect biomedical practitioners and believe that their treatments are superior to traditional healers, but not everyone goes to private doctors for trachoma. The two most prevalent hierarchies of resort are home treatment followed by traditional healers, or home treatment followed by biomedical practitioners. The choice doesn't depend on how severe the infection is, or individual beliefs about the efficacy of different therapies, but rather on the patient's social role and status. If home treatment doesn't work, adult males, especially heads of households, usually go to a private doctor. But children, who have the highest rates of trachoma, and women continue to be treated at home. Because of their lower status, they are taken to a traditional healer only if the condition becomes more severe, and usually don't see a biomedical doctor (Lane and Millar 1987).

Delay in seeking biomedical treatment may also be due to a misdiagnosis of symptoms or to fears of being diagnosed with a stigmatized illness. Mexican laborers in California, for example, waited an average of eight and a half months before going to a doctor for diagnosis of symptoms such as weight loss, fatigue, and coughing. Attributing these symptoms to bronchitis, grippe (flu), or the folk illness *susto*, many tried self-care strategies such as getting more sleep,



FIGURE 8.8 An anthropologist, Anastasia Johnson, interviews a young Hispanic mother at a migrant farmworker clinic. Photo by Sarah Johnson. Reprinted by Permission.

smoking and drinking less, and over-the-counter remedies. Some sought treatment by *curanderos*. Ultimately, the biomedical diagnosis was tuberculosis, a stigmatized disease. Fearing loss of social support, some missed appointments or dropped out of treatment (Rubel and Garro 1992). (See Fig. 8.8.)

Sometimes decisions about seeking health care involve the question of when to shift from home care to clinical care. Childhood illnesses are often resolved with simple home remedies: soup, juices, warm compresses, and bed rest. A study of sick children with diarrhea in Jamaica showed that in 90 percent of cases, caretakers initially treated the child at home. Of those children who did not improve, almost all (93 percent) were taken to a hospital, clinic, or doctor as a second level of resort. However, about a third of these involved a delay of six days or longer.

Diarrhea can be dangerous if the child becomes dehydrated, and most mothers tried to prevent dehydration with coconut water, tea, sugar water, or fruit juice. But other treatments they used such as salt water or salt laxatives actually increased the risk of dehydration. Why were they using such dangerous remedies? One answer is that rural medical aides encouraged treatment with drinks made from manufactured rehydration packets containing glucose, sodium bicarbonate, and sodium and potassium chloride. These packets could not be bought at local shops but were available at clinics. A caregiver wanting to comply with these instructions was faced with two options: to travel some

distance to a clinic and sit there half a day just to obtain one packet, or to seek remedies that seemed similar to the ORT (oral rehydration therapy) packets (MacCormack and Draper 1988).

Our discussion about decision making in pluralistic systems has centered on care seeking by patients' families, but decisions are also made by professional care providers about how much to trust families. Can preventive care be taught effectively? Some biomedical practitioners question the safety of home care, but advocates of household health management emphasize that with a minimum of training, oral rehydration therapy can be done with ordinary water, sugar, and small amounts of salt. In mild cases of dehydration, parents can learn to give sweet drinks, gruel, or soup. Advocates of clinical management argue that lay people are not educated enough to judge the benefit or harm of a particular remedy. Debates over these two approaches to primary health care continue to affect planning and evaluation of health care delivery in developing countries.

# Communication About Health Care in Developed Nations

In the early stages of medical anthropology, health care communication in developed countries was a major focus (Paul 1955). A pioneering ethnography, Margaret Clark's study of urban Chicanos in San Jose, California, dealt with linguistic and cultural barriers that impeded health care delivery. Language differences blocked Chicano access to health information in telephone calls to clinics, in reading labels, in understanding the instructions of doctors. The terms used by doctors were challenging even for English-speakers. A patient planning to wean her child probably would find "apply a tight pectoral binder and restrict your fluid intake" puzzling and might be too shy to ask for an explanation (Clark 1970:220).

Treatment prescribed at clinics and sanitoriums often conflicted with Chicano beliefs that illness can be caused by exposure to air currents. People being treated for pulmonary tuberculosis with pneumothorax (collapsing the lung by injecting air into the chest, thereby resting a diseased lung) were fearful of the procedure and likely to leave the hospital when it was prescribed. Another source of difficulty was social distance between clients and staff. Although placing Chicano physicians and nurses in the clinics improved communication, class differences remained. Chicano health professionals had moved up to a higher status in San Jose, and barrio residents both envied and resented them (Clark 1970).

Differences in class also proved to be a barrier to communication between health care providers and patients' families in a study of an urban pediatric clinic in western New York State (McElroy and Jezewski 1986). Lifestyle and class differences, unwarranted assumptions about parents' knowledge of medical terms and procedures, and lack of follow-through in eliciting details from parents or in giving thorough directions were all barriers to good communication. There was a particularly high frequency of communication breakdowns between clinic staff and Native Americans. In spite of a shortage of interpreters, Puerto Rican families were very supportive of the clinic, named the Roberto Clemente Clinic after the famous Puerto Rican baseball player, and used it for primary care far more than did blacks and Native Americans in the neighborhood.

Influenced in the last few decades by anthropological studies of clinics, health care providers and educators have developed concepts of "cultural sensitivity" and "cultural competence" in communication. As the terms suggest, sensitivity to the values and beliefs of patients is a good first step, but becoming competent to interact effectively with people of diverse backgrounds is even better. Toward that end, nurse-anthropologist Mary Ann Jezewski has proposed a **culture broker** model for health service providers. Culture brokering involves "bridging, linking, or mediating between groups or persons of differing cultural background for the purpose of reducing conflict or producing change" (Jezewski and Sotnik 2005:37). Culture brokering can be learned through trial and error during conflicts or (preferably) through formal or informal learning about cultural differences before conflicts arise.

An example of brokering is a conversation between Mr. K., a director of a mutual assistance association center for Cambodian refugees settled in the United States, and a care provider interested in offering disability services through the center. Mr. K. mentions that some people in his community had lost limbs from land mines, and others had nightmares and flashbacks, but he doesn't consider them "disabled" because they are able to work and fulfill expected roles, and none of them is crazy or violent. The provider then tries to explain that disability has a broader meaning in mainstream U.S. culture and gives examples of people who are "differently abled" but still able to work and live independently with assistance.

In this case, the interpreter can take a brokering role by going beyond literal translations of words to actually explaining different meanings of disability for Cambodians and North Americans. Mr. K. will also play a brokering role if he decides to introduce disability services through the center, and the care provider will have opportunities to broker as plans for the new services

develop (example used with slight modification from Jezewski and Sotnik 2005:59–60).

#### Refugee Health Care

The health needs of refugees and immigrants are among the greatest challenges to modern health care systems. A refugee, as defined in the U.S. Refugee Act of 1980 and based on the United Nations' definition, is a person who is unable or unwilling to return to his or her country because of persecution due to race, religion, nationality, membership in a particular social group, or political opinion. Refugees are part of a larger category of **displaced populations**, which includes people displaced from their homes due to natural disasters, military conflict, or economic development but still living in their country.

Estimates of the numbers of displaced peoples worldwide in 2005 included 9 million refugees, 5 million internally displaced people, 1.5 million stateless people (those deported or denied citizenship), and 838,000 asylum seekers, those who have applied for refugee status or asylum but have not received a decision (UNHCR 2006). Although high-income nations often serve as hosts for third-country resettlement of refugees, initial emergency settlement occurs in low-income countries in Asia and Africa that barely have the resources to provide food and medical care even with assistance from the United Nations.

War inevitably displaces people. During five years of war in Iraq (2003–2008), a million and a half Iraqis fled to Syria, and to Jordan, another 700,000. This has led to overcrowded schools and medical clinics in the host countries and creates a financial burden on their economies. The United States has accepted relatively few Iraqis for resettlement. Although policy relaxed a bit in 2007 to allow resettlement of 7,000 Iraqis fearing for their lives after supporting the United States, this is a miniscule fraction of the numbers seeking asylum (Refugees International 2007).

Among the highest refugee populations in 2005 were Afghans, 960,000 of them living in camps in Pakistan and 953,000 in Iran. (See Fig. 8.9.) Refugees from Sudan numbered 225,000 living in Chad, 215,000 in Uganda, 91,000 in Ethiopia, and smaller numbers in other countries. People originating from Burundi numbered 444,000 in Tanzania and smaller groups elsewhere. Palestinians, displaced from their home territory since 1947 and termed "protracted refugees," number 4.2 million and are dispersed throughout the Middle East



FIGURE 8.9 Unregistered Afghan refugees from the urban slums of Quetta, Pakistan, are transferred to a camp where they can be provided full protection and assistance packages. Photo courtesy of UNHCR, the UN Refugee Agency.

and other regions (UNHCR 2006:16, 112). Another example of protracted refugee status are the 103,000 Bhutanese Lhotshampas who have been living in camps in Nepal since 1990.

More than 800,000 Southeast Asian refugees entered the United States between 1975 and 1987 in the aftermath of the Vietnam conflict (U.S. Coordinator for Refugee Affairs 1987:31). The first places of asylum were temporary camps in the non-Communist nations of Southeast Asia, particularly Thailand. Refugees often lived in these camps for several years before being resettled in the United States, Canada, and other countries. Although Southeast Asians were the largest group of refugees to enter the United States, other large groups have come from the former Soviet Union and several African countries. After the terrorist attacks of September 2001, the numbers admitted to the United States dropped sharply. The numbers of refugees coming to the United States have declined more than 50 percent since 1994, whereas numbers admitted to other countries have been more stable (UNHCR 2006:141).

The United States is not the only high-income country hosting refugees, nor is it even a major destination of refugees, if their total numbers relative

to the host population are considered. Refugees fleeing the former Yugoslavia in the 1990s went to Australia in significant numbers. Settlement in Australia should have been somewhat easier for them because they share a European heritage with Australians. But Australian medical anthropologist Lenore Manderson and colleagues found that Yugoslavian refugee women experienced unemployment, financial hardship, and social isolation. The women reported declines in physical and mental health, including symptoms of post-traumatic stress (Manderson et al. 2000).

Coming from different environments, food traditions, and medical systems, refugees pose a challenge to the health care systems in their host countries. Displaced people who have survived torture, natural disasters, and civil war need particular help for emotional and physical trauma. Those held in detention camps for up to five years, while countries such as Australia processed their asylum applications, may be retraumatized by conditions in the camps (Silove 2003).

#### Nutritional Needs

Refugees typically face food shortages during the political and environmental crises leading to their displacement. When they are placed in camps hosted by low-income countries, nutritious food and potable water are often inadequate and inefficiently distributed. Even when aid is sent by donor organizations and countries, supplies may spoil or be diverted en route. In such camps, between 20 and 50 percent of children become malnourished. If they contract an infectious disease such as dysentery, malnutrition worsens. In Rwandan refugee camps in Zaire, about 20 percent of children developed acute malnutrition following outbreaks of cholera and dysentery during the first month of settlement (Toole 2003).

Because they are dependent on external food aid in the camps and rarely have a chance to grow gardens, go to markets, or keep livestock, refugees remain chronically undernourished even when provisioning of grains is adequate. This situation puts them at particular risk for micronutrient deficiencies, including iron, iodine, vitamins C and A, riboflavin, and thiamine. Iron-deficiency anemia is the most reported problem, occurring for example in 65 percent of Burmese refugee children in Thailand. Thiamine deficiency and cases of beriberi were reported in studies of immigrants and refugees in Taiwan, Thailand, and Nepal. Intervention attempts have included development of nutritious spreads that are easily transported and do not spoil easily (Dye 2007).

#### Children in Protracted Refugee Situations

Many people are not aware how difficult conditions are for children living as protracted refugees in detention camps, sometimes with their families and sometimes alone. Processing of application materials can take up to five years, when asylum applicants are denied many basic rights. Already traumatized while escaping from the country of origin, child detainees "live behind razor wire, surrounded by uniforms, identification badges, roll calls and searches." In Australian camps, guards routinely wake children with flashlights during night patrols. They sometimes put children in solitary confinement for minor infractions and sometimes handcuff people who are being forcibly moved (Pittaway and Bartolomei 2003:87). Children experience physical and sexual abuse, receive little if any education, and sometimes witness their parents carrying out hunger strikes and suicide attempts to protest conditions.

Tibetan children and teenagers as well as young adult Buddhist monks and nuns, fleeing the oppressive regime of China, have become an unique refugee group in recent decades. Sent by their parents to Nepal and India so that they can get a good education and escape the turmoil of their home villages, children trek in small groups, often without adults, for several weeks through the Himalaya mountains from Tibet to Nepal. Some eventually resettle in northern India. Young monks recount their experiences as teenagers of torture and prison brutality after being arrested for public protests against the Chinese occupation of Tibet.

# Trauma of Internal Displacement

Internally displaced groups have many needs similar to those of refugees. Displaced by natural disasters such as the Indian Ocean tsunami of 2004 and Hurricane Katrina in 2005, as well as development projects that have taken their lands and livelihood, these groups have increased in numbers without adequate planning or facilities for their care. In Darfur, in East Africa, 2 million people have been displaced internally by conflicts between the government and tribal groups and have been living in camps where they receive little protection and inadequate aid. Another 200,000 fled to Chad early in the conflict in 2003. Despite being well informed about the genocidal practices of government troops, the international community has not intervened effectively. Especially troubling are reports of attacks on refugee camps and rapes of women and children.

More than 2 million people were displaced by the conflict in Bosnia and Herzegovina in the 1990s. While humanitarian aid was more effectively delivered in Bosnia than it has been in Darfur, political and military intervention again proved inadequate to protect civilian populations and to prevent genocide. The extensive sexual violence during this conflict, especially rapes of women by soldiers and prison guards, has unfortunately occurred in Darfur as well. Some anthropologists regard systematic rape during wartime to be a terrorist weapon designed to humiliate and subjugate the victim and her family. Rape of women "is a weapon used by men of one ethnic group against those of another," especially where "female chastity is central to family and community honor" (Olujic 1998:39; Hayden 2000).

# Long-Term Physical Health

Many researchers focus on immediate needs and overlook medical and emotional issues affecting long-term refugees and migrants. Some populations have been displaced for decades, awaiting the chance to return home without imprisonment or persecution, and entire generations have grown up in a context of **diaspora**: being scattered as a people and settled outside one's homeland, yet still linked culturally and emotionally to that homeland (Anderson and Lee 2005).

Greek-Cypriots have been displaced for more than thirty years. Fleeing their homes in 1974 after an attempted coup by Greek-Cypriots and retaliatory invasion of Turkish troops supporting Turkish-Cypriots, some settled in the south of Cyprus and others emigrated to Australia, Canada, and the UK. In a study of long-term refugees, Loizos and Constantinou (2007) compared the cardiovascular health of two villages in Cyprus, one of refugees and the other of non-refugees. Even though Greek-Cypriots benefit from free medical care and assistance with housing and education and have recovered well economically, they described their lives in exile with the Greek word *angkos*, "stress," and they believed that refugees die earlier than others. In fact, refugees died no earlier, on average, than non-refugees, although cardiac disease, especially myocardial infarction (heart attack), was almost twice as high in middle-aged, long-term refugees as in non-refugees. Rates of cancer and depression were also much higher in refugee villages.

# Culturally Appropriate Health Care

Many refugees follow a pluralistic pattern of health care seeking, combining use of hospitals and clinics with self-care and traditional medicine. Decisions

about whether to use Western medicine or traditional medicine may be influenced by basic principles such as the yin-yang dichotomy in Chinese medicine. For example, Vietnamese in Canada view Western medicine as *yang* (strong, potent, fast-working) and use it for serious infectious diseases and acute problems. They prefer their own herbal medicines, considered *yin* ("cool" and gentle) for less serious conditions such as colds, insomnia, or digestive problems (Stephenson 1993).

Traditionally, Vietnamese perceived physical disability as a form of punishment for ancestors' sins and mental disability as due to possession by spirits. A gradual shift has occurred toward attributing disability to exposure to herbicides such as Agent Orange used by the U.S. military during the Vietnam conflict. Regardless of cause, persons with disabilities are considered to be vulnerable and helpless, and the family is responsible for their care, values that conflict with rehabilitation programs in the United States that emphasize restoring independence to the individual (Hunt 2005).

Communication difficulties between Hmong and health care providers continued long after refugee families began to assimilate into communities in the midwestern United States and on the West Coast, including Seattle, Minneapolis-St. Paul, Missoula, Montana, and Merced, California. These difficulties are vividly depicted in Fadiman's account (1997) of the management of a Hmong child's illness in Merced in the 1980s. Believing that their infant daughter, Lia, had developed seizures because a sudden noise caused her soul to leave her and to become lost, the parents recognized that her condition was serious. Epilepsy, or *quag dab peg*, was potentially dangerous but could be a sign that Lia might become a shaman or healer. Fundamental differences between these beliefs and the determination of local hospitals and physicians to treat Lia's seizures created barriers that probably worsened the child's condition (Fadiman 1997).

Refugees and migrants may be reluctant to seek health care because they are not treated with respect in clinics and hospitals. Muslim women may feel uncomfortable being examined by a male physician. A man from Bosnia had a distressing experience in a Swedish clinic where he was examined as a "potential carrier of Mediterranean diseases" (Peterson 1999, quoted in Ioannidi-Kapolou 2007:45). Many refugees sense that they are regarded as inferior, ignorant, and infectious when encountering Western doctors, dentists, and other care providers.

Western medical and dental practices have been slow to modify their procedures and policies to accommodate cultural differences, but a few small clinics have been more flexible in developing cultural competence in providers. The

Asian Pacific Family Center in Rosemead, California, near Los Angeles, is an example of a clinic geared toward cultural competence in mental health services. At the time of the research in 1995, eight Asian languages were spoken at the clinic and all but one of the sixteen therapists had emigrated to the United States. Nine were Chinese, and the others were Korean, Vietnamese, and Japanese-American. The counselors made an active effort to accommodate their clients' beliefs and family structure and values. Family members were involved in therapy sessions and played a role in decisions. Constant negotiations and modifications of counseling dynamics brought increased effectiveness in services (Ito and Maramba 2002).

Health research with refugees also needs to accommodate cultural differences through methodological modifications. A project on tuberculosis beliefs among Vietnamese refugees to the United States in 1994 used trained, bilingual interviewers who themselves were refugees from Vietnam. The interviews were conducted in the refugees' homes rather than in clinics to make them more comfortable. Participants' perceptions of symptoms and risk factors showed awareness of Western disease models, but their belief that asymptomatic, latent infection with TB was not possible had obvious implications for patient education (Carey et al. 1997).

# Anthropology and HIV/AIDS

Acquired immune deficiency was first identified in 1981 as a syndrome that severely compromised the immune system and increased susceptibility to various infections, particularly pneumonia and cancer. By 1983, researchers had identified the probable cause of this syndrome as a virus that enters cells bearing CD4+ surface receptors and either replicates in those cells or enters a latent stage, integrated into the host genome. It is depletion of CD4 lymphocytes that influences immune function (Bell 2007).

HIV mutates rapidly, and two major strains have been identified, HIV-1 and HIV-2, with at least nine identified subgroups of each strain and a number of sub-subtypes (that is, recombinant forms), with varied geographic distribution. Progression from initial infection to development of AIDS is normally quite extended in HIV-1 cases, often ten years or more. HIV-2 progresses even more slowly. Antiretroviral therapy, first available in 1987, has become increasingly effective in slowing the disease progression from HIV infection to AIDS. Some people have lived with HIV for more than fifteen years without serious illness, but they continue to be infectious, will need treatment indefinitely, and must live with side effects of the medications. An-

tiretrovirals have also been successful in preventing mother to child transmission (Lange 2006).

Effective treatment was not generally available in low income nations through the 1990s. It was only after 2001, amidst protests against the pharmaceutical industry for its reluctance to provide drugs at or below cost, that effective treatment became possible in African nations and other areas. Kofi Annan, secretary-general of the United Nations at the time, called for a global trust fund of 7 to 10 billion dollars annually to support a massive effort toward prevention and to provide low-cost treatment to those infected. The International Monetary Fund, the World Bank, and the Gates Foundation endorsed this proposal and pledged funds. By 2005, a Global Fund was created whose funding reached \$8 billion annually, an amount that still was not adequate to contain the epidemic (Bayer 2008).

Research to develop a vaccine began in 1987, but after more than twenty years of clinical trials, a vaccine that is effective with humans had not been found by 2008. In a few cases, clinical trials have been cancelled after finding that some test subjects actually converted to HIV+ during the trials at a higher rate than those receiving placebos. The genetic variability and high mutation rate of the virus make it difficult to develop vaccines that would be effective across various types of HIV or of newly mutating forms (Esparza, Chang, and Gayle 2006:109).

# Epidemiology

When first detected in the 1980s, AIDS primarily affected men who have sex with men (MSM). In the United States, this category continues to have the highest prevalence. Sixty-three percent of new cases in 2003 were among MSMs, nearly 50 percent of them not aware that they were infected (Davis 2007).

In 1995, AIDS ranked as the highest leading cause of death in males and females aged twenty-five to forty-four in the United States, affecting 3.5 times as many men as women, and by 2004 it was the sixth leading cause of death in this age group (Kaiser Foundation 2007). In 2005, 1.3 million adults in North America were living with HIV, one-fourth of them women.

Among various ethnic groups in the United States, African Americans, making up 12 percent of the population, are disproportionately affected by HIV/AIDS, approximately half of all cases. Among African American women aged twenty-five to thirty-four, AIDS was the leading cause of death in 2004. About 15 percent of cases are among Latinos.

In Canada, an estimated 58,000 people were living with HIV/AIDS in 2005, one-fourth of them women and 30 percent not aware of being infected. The majority were MSMs and injection drug users. By ethnicity, 62 percent of HIV positive cases were white, 15 percent Aboriginal, and 11 percent black (Centre for Infectious Disease Prevention and Control 2007).

The global profile of HIV/AIDS has changed in the last decade. The United Nations estimated the number of cases in 2005 as 38.6 million worldwide and 24.5 million in sub-Saharan Africa, 59 percent of them women (O'Brien and McCarthy 2007).

Sub-Saharan Africa continues to have the highest prevalence. Sixty percent of all people infected with HIV in the world live in Africa, yet Africans represent only 10 percent of the world's population. Rates are also rapidly increasing for East Asia, Eastern Europe, and the Caribbean. Countries where infection rates have been low but are now rising include Guyana, Sudan, Iran, Nepal, India, China, Papua New Guinea, and Ukraine (Stanecki and Marais 2008).

Mortality from AIDS has decreased in North America (18,000 in 2005) and western Europe (12,000) but continues to be high in sub-Saharan Africa (2 million in 2005). No other region approached the African mortality rates, although half a million people in South and Southeast Asia died from AIDS in 2005 (O'Brien and McCarthy 2007).

Modes of transmission vary regionally. In African nations, heterosexual transmission is primary, and women are disproportionately infected. In Latin America and the Caribbean, sex between men is a significant mode of transmission; those who are bisexual put their female partners at risk. In India and China, major forms of transmission are needle sharing by injecting drug users (IDUs) as well as infection of men by sex workers. In St. Petersburg, Russian Federation, where 48 percent of sex workers are HIV+, transmission is through drug use as well as failure to use consistent protection with clients (Stanecki and Marais 2008:42–49).

Researchers predicted devastating impacts on family integrity and child health in third-world countries, especially in Africa, when rates began to rise globally in the 1990s. For the most part, their predictions have been borne out. By 2001, 14 million children worldwide had been orphaned by AIDS, and 11 million of these lived in sub-Saharan Africa (WHO 2002, 2003). Even in normal times, poor households in southern Africa cannot afford to lose an adult wage earner or subsistence worker. When both parents become too sick to work, children are especially vulnerable. Orphaned children, some of them infected with HIV at birth, are a burden on grandparents and other relatives.

The epidemic has become particularly severe in the Republic of South Africa. By 2003, 5.3 million people (2.9 million of them women) were living with HIV/AIDS (Stanecki and Marais 2008). Among pregnant women in South Africa, ages 15–24, 25 percent were infected in 2004, and nearly one-third of pregnant women in Botswana, Lesotho, Namibia, and Swaziland were HIV+. These statistics fail to reveal the enormity of the epidemic in South Africa, however. So many people come to hospitals and clinics for AIDS-related illnesses that the provincial hospitals lack sufficient beds to accommodate them. Mortuaries have problems of overcrowding and unclaimed bodies, and there is not enough land for burials (Leclerc-Madlala 2001).

# Anthropological Approaches

Before 1990, there were few publications about HIV/AIDS by anthropologists. Shortly after Ralph Bolton (1989) challenged colleagues and students in 1989 to contribute to research on the emerging epidemic, Douglas Feldman's edited volume, *Culture and AIDS* (1990), presented pioneering studies on AIDS in Haiti, Rwanda, England, and the United States. By the mid-1990s, ethnographic studies of communities affected by AIDS had increased. Intervention studies, such as Green's proposal (1994) to collaborate with African healers in preventive efforts, were also significant as early contributions.

Although publications were sparse, anthropologists were active in consulting roles and applied research from the beginning of the epidemic. For example, Douglas Feldman founded and directed an HIV/AIDS service organization in Queens, New York City in the mid-1980s and was a consultant for AIDS projects in Bangladesh and Uganda in the late 1980s (Feldman 2008, personal communication).

Early research often focused on *types* of people at risk. Initial connections between HIV and being gay or using drugs made it difficult for health educators to convince the public that *anyone* could be at risk. We now know that HIV/AIDS is not exclusively a sexual disease. It can be transmitted through contaminated needles and knives during tattooing, ear piercing, ritual circumcision, or self-injection of steroids by athletes. Paramedics, emergency room personnel, and dentists can be exposed at work. People have contracted HIV through transfusions, organ transplants, and other tissue donations, and infants can be infected during vaginal birth or from breast milk.

Too often, studies linking ethnicity, socioeconomic status, and lifestyle created notions of cause that essentially blamed the victims. Arguing that prevalent

assumptions about risk factors for AIDS were based on naïve views of what motivates people and why they take risks, some anthropologists focused on the cultural perceptions and meanings of HIV/AIDS (Farmer 1992; Parker 2001). Asking whether laypeople truly understood how HIV was transmitted, medical anthropologists used cognitive and decision-making models to understand why denial plays such a large role in public attitudes. Before interventions could be attempted, basic studies of people's understanding of a disease, that is their "cultural models," needed to be done.

Interviews by David Beine (2003) in rural Nepal attempted to determine whether villagers had yet developed a model of HIV/AIDS. Using cognitive methodology, including interviews that elicited illness narratives and listing and sorting of terms, Beine found that most villagers had heard of AIDS and classified it as a major, infectious, and fatal disease, associated with foreigners and prostitutes. It was not linked to traditional illness factors, such as spirits or bad *karma*. However, the traditional concept of *randi* (promiscuity) was central in their view of AIDS. A person who was *randi* if female or *rando* if male was viewed as having bad character, committing bad acts and being negligent, and likely to be ostracized. Using a "moral geography," some villagers stated that infection with HIV/AIDS was more likely in "a low place," referring to a region of lower altitude believed to be "a place of low moral values" (Beine 2003:179).

A basic premise in anthropology is that social relationships influence health as much as beliefs and cognitive categories. An early ethnography focusing on drug users in the United States showed the pivotal nature of relationships among addicts in HIV transmission. "Running partners" or "shooting buddies," who helped one another obtain money to purchase drugs, locate supplies, and inject drugs, also shared needles without sterilizing them—creating high risk for viral transmission. A person's first injection of drugs was a ritual initiation, called "giving them their wings" in which friends donated their own "works" (needle, syringe, cooker, and other implements) to inject the novice. This initiation was experienced as a kind of spontaneous seduction; interviewees said that using a separate set of works would spoil the "romance" of the experience (Des Jarlais, Friedman, and Strug 1986:116).

Intervention research has shown that it is not only sexual practices but also drug practices that put sex workers at risk. They need to find private spaces for injecting drugs that are safe from the threat of arrest by police. To minimize the chances of arrests, the women cooperate in preparing the syringes and looking out for police. Sharing supplies and equipment in order to save time increases the chances of HIV transmission (Luciano, Sotheran, and Clatts 2000).

Relationship dynamics between two people, whether they are lovers, drug users, or prostitute and client, offer clues to risk perception. People who trust one another are less likely to fear contracting HIV from each other. Pamela Erickson's study of how relationships affect condom use, presented in Chapter 6 of this text, illustrates the value of probing these dynamics through various research methods.

Building on earlier research with addicts, applied anthropologists have tried to combine research and community service through projects providing needle exchanges, free condoms, HIV testing, and information about prevention to drug users as well as homeless people and sex workers (O'Connor and Leap 1993). The Hartford Needle Exchange Project was successful in reducing HIV transmission through exchange of used syringes and needles for sterile ones. Although needle exchange programs have been controversial (Singer, Irizarry, and Schensul 1991) because authorities view it as condoning drug use, programs have been successful in reducing or stabilizing AIDS rates in Hartford and elsewhere in the northeastern United States (Himmelgreen et al. 1994).

An approach to research called "community-centered praxis," works with the community rather than trying to dominate it with legal and biomedical structures of the larger society (Singer 1994). Merrill Singer and colleagues at the Hispanic Health Council in Hartford, Connecticut, urge social scientists to take a stand against the AIDS pandemic and become activists. Models of activism range from direct intervention such as the Needle Exchange project described above to proactive research such as Romero-Daza's prediction (1994) of an epidemic in Lesotho to assessment of the sexual practices and beliefs of homeless street boys in urban Tanzania (Lockhart 2002).

The trend in intervention research has been for anthropologists to work on teams, especially in international settings. A technical assistance program in India supported by the Ford Foundation, initially focused on general reproductive health, shifted toward studies of sexual behavior after the AIDS epidemic took hold in India. By 2000, HIV had shifted from urban centers to rural parts of southern India. Communication and collaboration through an informal network of Indian and international researchers led to various interventions to reduce the risks of HIV infection (Pelto 2002).

# The Politics of Blame

HIV infection is becoming increasingly a condition of poor city dwellers, mostly people of color. Observing that much of human suffering is caused or aggravated by social forces, Paul Farmer (1992:259) wrote: "HIV has become

what Sabatier (1988) has termed a 'misery-seeking missile.' It has spread along the paths of least resistance, rapidly becoming a disorder disproportionately striking the poor and vulnerable." The fact that AIDS, like many diseases, affects certain groups disproportionately, illustrates Farmer's concept of structural violence developed in Pathologies of Power (2005), a book focused on inequality and health disparities. Whether one is studying AIDS, diabetes, or mental illness, class relationships come into play not only in differential disease rates but also in perceptions of who is at risk, who is to blame, and who is responsible. When a threatening disease appears without clear etiology or geographic origin, there is a tendency to blame others, to search for causes outside the society or within marginalized and powerless segments of society. The conventional view in the United States is that HIV/AIDS originated in Africa, but many Africans are convinced that AIDS came from America. Some people of color in the United States consider AIDS to be a government plot to rid the country of "undesirables": drug users, minorities, gays, and bisexuals.

In *Aids and Accusation* (1992), Farmer takes a macrocultural approach to studying perceptions of AIDS in Haiti, both in the cities and in small rural villages. He frames AIDS within broad geographic and social connections, reaching from the village he studied, to the capital Port au Prince, to Brooklyn and other centers of Haitian immigrants in the United States. He also attends closely to the microcultural level of personal suffering of Haitian villagers with AIDS and how they define the meaning of their illness and ascribe blame to "powerful classes of people" and "unjust social structures" (Farmer 1992:248). Some attribute AIDS to sorcery by enemies; others blame poverty and racism. North Americans, in contrast, often attribute HIV infection to the ignorance or self-damaging behaviors of the infected person.

# The "Gendering" of AIDS

Anthropologists refer to the "gendering of AIDS" to denote meanings of AIDS that are connected to ideas about female sexuality, relative status of males and females, and reproductive rights. For example, among Zulu-speaking people in South Africa, the bodies of sexually active women are thought to be dangerous and to weaken men. Thus in making sense of the current AIDS epidemic, long-standing notions of women and their polluting nature come into play. This connection has generated a unique response of trying to contain the epidemic by conducting virginity testing of young girls to make sure that they are sexually chaste (Leclerc-Madlala 2001).

A study of poor, drug-using, African American and Latina women in New York City, all HIV positive, found that their reproductive decisions were correlated with their general lack of power and the trauma of having lost significant relationships in the past. Those who became pregnant and who still lived with their children often agreed to have an abortion. Those women whose children had been taken away by welfare authorities or by family members usually decided to continue the pregnancy, even though they knew they might die of AIDS and could infect their baby. Viewing themselves as victims of abandonment or neglect by their own mothers, and as victims of unstable or abusive marriages and partnerships, many of these women believed that giving birth would be a positive accomplishment and would give them a constructive focus. A relationship with a child meant "somebody you have who'll love you always" (Pivnick 1994:51, 54).

Agency, a term used by anthropologists to denote a person's ability to make choices and to act in ways that allow control of one's existence, is sometimes used in place of the term "power" to understand decisions about prevention. Research illustrating how relationships affected women's agency focused on use of protection by prostitutes in London, England. In their professional work, 80 percent of the women insisted that clients use condoms, but almost none used condoms with their boyfriends. They knew their boyfriends were not monogamous, but they felt that requiring condom use during intimacy would "simply finish the relationship" because it would connote lack of trust and blur the boundaries between the woman's working life and private life. Consequently they were at greater risk of infection from their personal partners than from their clients (Day 1990).

Sexual relations between tourists and locals have been identified as a risk factor for HIV transmission since the late 1990s. Research on visitors to Costa Rica suggests that agency may not necessarily lead to healthful behaviors. Nancy Romero-Daza and Andrea Freidus carried out interviews in 2003–2004 with foreign visitors and residents in Monteverde, Costa Rica (described in Chapter 2 of this text) to assess the potential for spread of HIV through intimate relationships. The researchers focused on women, some who had lived in Costa Rica for extended periods and others whose visits were of shorter duration. They found that a considerable number of women travel to the region looking for sexual adventures. Even though the women knew about STIs and HIV and intended to use condoms, "the allure of the exotic Latin lover" contributed to failing to use protection (Romero-Daza and Freidus 2008). The local males stated that they initially agreed to use condoms during sex with a foreign woman, but after a month or so, use of protection diminished. The



FIGURE 8.10 AIDS awareness poster developed by rural Costa Rican women. The message is intended for young foreign women who become involved with local men. Photo by Oriana Ramirez-Rubio, courtesy of Nancy Romero-Daza.

women expected their male partners to have condoms but discovered these were not readily accessible for purchase in most bars. Language barriers also affected negotiation between tourists and locals about condom use. (See Fig. 8.10.)

Sex tourism is not confined to traveling women, of course. It is available to straight and gay men and to pedophiles as well. Typically, sex tourists are affluent white men, but military personnel and migrant workers also seek out sexual liaisons in the countries they visit. The Costa Rican example above involves non-commercial transactions, but in many countries, particularly the Philippines, Thailand, and India, commercial sex industries dominate the market, with young women, teenagers, and even children providing sexual services. Some women enter sex work voluntarily, usually through destitution, but in a practice called **human trafficking**, many are lured with promises of work as a model or are kidnapped outright and then forced into prostitution. Their clients are solicited not only by local pimps and guides, but also by Internet websites offering "sex tours." This phenomenon is fueling the HIV epi-

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demic, particularly in the Caribbean and Latin America, where young women and children—already vulnerable through brutal exploitation—are placed at even greater risk of suffering and death from AIDS and other infections (Sönmez et al. 2007).

#### CONCLUSIONS

Disease has played a significant role in history, and it continues today to affect the destinies of entire societies. With eradication of smallpox and prevention of polio, optimistic observers believed that infectious disease was generally under control. But the 1990s brought successive waves of health problems: antibiotic-resistant tuberculosis, mosquitoes unaffected by standard insecticides, the lethal Ebola virus in West Africa, and rapid evolving forms of the HIV/AIDS virus.

Mobility has been a characteristic of human adaptation to various environments, but in this age of globalization, migration and travel have some maladaptive aspects by transmitting diseases across national and cultural boundaries. Despite the sophistication of medical technology and our knowledge of disease transmission, the challenge to human adaptability remains as great as ever. The problem is not only one of immunology, but also of health care resources. Stretched and compromised in industrialized nations, financial resources and manpower are wholly inadequate in the less developed countries. In the following chapter, we explore political and economic factors that contribute to the global health problems faced by humans today.

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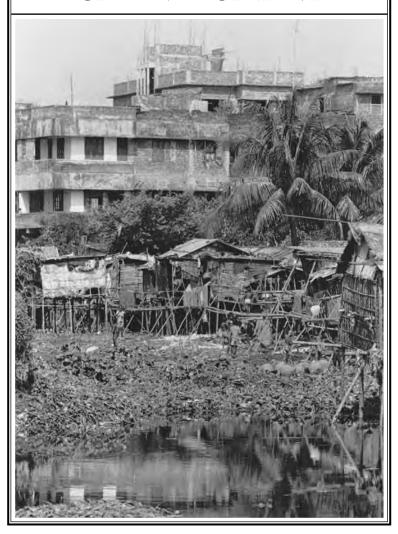
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- *Ishi in Two Worlds.* 1960. 19 minutes. Produced by Richard C. Tomkins. McGraw-Hill Films # 406755–9.
- Kikkik E 1–472. 2003. 90 minutes. Produced by the Inuit Broadcasting Corporation, directed by Martin Kreelak and written by Elisapee Karetak. 90 minutes. Available in VHS or DVD, in English or in Inuktitut. (The trial of an Inuk woman who kills a man during a period of famine in the 1950s.)
- The Split Horn: Life of a Hmong Shaman in America. 2001. Video and DVD. 55 minutes. Distributed by Filmakers Library.
- Speaking Out-Women, AIDS, and Hope in Mali. 2002. 56 minutes. Director: Joanne Burke. Distributed by Women Make Movies. http://www.wmm.com. In French with English subtitles.
- Yesterday. 2004. DVD. 95 minutes. (AIDS, Africa.) Zulu language with English subtitles. Distributed by HBO Home Video.

# Chapter Nine

# COSTS AND BENEFITS OF DEVELOPMENT



A neighborhood of Dhaka, Bangladesh.

Photo courtesy of World Health Organization (WHO/J.-L. RAY/AKF).

#### **PREVIEW**

This chapter discusses globalization, economic development, and health. Linked to global economic systems through industrialization, trade agreements, and political alliances, many low-income nations are embracing modernity. With unprecedented mobility of workers, displaced peoples, and tourists, infectious diseases are rapidly dispersing across national and geographic boundaries. Ecological changes due to natural disasters and to development projects expose populations to increased incidence of previously endemic diseases such as schistosomiasis. A political ecology of health helps us understand ill health as a product of development projects that exploit cheap labor, displace communities, and degrade habitats.

Like any other fundamental change in human ecology, economic development has both risks and benefits. Among the benefits of modernization are new knowledge and new resources for public health. The risks include population growth that exceeds a nation's economic growth. Lacking employment and adequate land, many laborers migrate to cities or to other countries where they face new health problems and experience severe health care disparities. The preventive strategies of public health workers are essential in this era of new and reemerging infectious diseases such as West Nile virus, avian flu, drug-resistant tuberculosis, and cholera.

Anthropologists carry out both basic and applied research in economic development and environmental health studies, as shown in the chapter's first profile on a cholera epidemic in Ecuador. In the twenty-first century, global violence, terrorism, natural disasters, and environmental hazards demand an "anthropology of trouble." Our second profile on Superfund sites in the United States illustrates this approach. Many medical anthropologists are taking an activist stance in research, encouraging sustainable development and the protection of human rights.

People say that the workplace is haunted by the *hantu* who dwells below. . . . Well, this used to be all jungle, it was a burial ground before the factory was built.

(Source:—a Malaysian electronics factory worker, quoted in Ong 1987:207)

#### Spirit Possession in a Malaysian Factory

Thousands of young adults in the Southeast Asian country of Malaysia work in electronics and micromachinery factories located on rural industrial estates called FTZs, or free trade zones. The mostly Japanese and American corporations that run these factories prefer to employ young women between sixteen and twenty-four years old who have the endurance to work long shifts and whose eyes are good enough to use microscopes for hours at a time. One manager explains that "females are more dexterous and more patient than males" in handling miniature components (Ong 1987:152).

Operators assemble miniature electronic semiconductors at a rapid pace, processing an average of 2,500 microchips in an eight-hour shift. (See Fig. 9.1.) Many women work overtime, as the wages are low and bonuses are given for extra work. The work is exhausting, and employee turnover is high. About 6 percent of employees leave each month, some because their eyes have deteriorated, others because they cannot tolerate the working conditions. Many



FIGURE 9.1 Young women at work in an electronics factory, Malaysia. Photo by International Development Research Centre, Social Sciences Division, Ottawa. Reprinted from *Spirits of Resistance and Capitalist Discipline* by Aihwa Ong (Albany: SUNY Press, 1987) by Permission of the State University of New York Press.

cannot quit because their families are poor, having sold their land to rubber plantations and other agricultural industries.

Similar to many developing nations, Malaysia has a large and youthful work force eager to fill wage labor positions. Subsistence agriculture predominated before colonization by Great Britain, but now the country is geared toward cash cropping and industrial production, and many families are landless or hold only small plots. Between 1957 and 1987, as land became a commodity that could be bought, sold, or mortgaged, about 10,000 rural Malaysian families became landless every year. From the previous self-sufficiency of subsistence farming, people became sharecroppers, wage laborers on plantations or in factories, shopkeepers, and civil servants. These economic transformations, begun during British colonial rule, continued after Malaysia achieved political independence.

Globalization has brought many changes to people's lifestyles. In the past, daily life was "framed and balanced by the symmetry of Islamic prayers," agricultural cycles, and domestic tasks (Ong 1987:111). Most industrial workers commute considerable distances from their rural homes. They now experience time as segmented into work and leisure, weekday and weekend, and rotating work shifts. On the job, operators are frequently scolded and harangued for being absent, late, or too slow. Supervised by male foremen, women are pressured to meet increasingly higher production targets. In plants with automated production, operators must tend several machines at once. Those who meet production quotas are rewarded with bonuses; those who cannot comply are threatened with dismissal.

Working conditions are indeed oppressive. Permission for medical leave is difficult to obtain, and zealous foremen sometimes withhold permission from workers to use the toilet, to go to the factory clinic, or to go to the prayer room for ritual observances. The women feel that they are controlled excessively, even to the uniforms, tight overalls, and heavy rubber shoes that they must wear.

How do Malaysian factory women respond? Among themselves they express outrage, but there is little they can do except to cry when scolded or threatened. Some deliberately slow down their work, become careless, or even damage equipment. They also request frequent breaks to go to the prayer room, the lockers, or the toilet. However, on these breaks they may meet unexpected dangers. Spirits called *hantu* are believed to inhabit these places and may possess humans, causing them to become hysterical and out of control.

Aihwa Ong, an anthropologist studying transnational firms in West Malaysia, describes the case of a factory operator possessed by a were-tiger: "It

was the afternoon shift, at about nine o'clock. All was quiet. Suddenly, [the victim] started sobbing, laughed, and then shrieked. She flailed at the machine. . . . she was violent, she fought as the foreman and technician pulled her away" (Ong 1987:207).

The hysteria is contagious: when one woman enters a possession state, others succumb. In one American-owned plant, 120 workers in the microscope section became possessed and the factory had to shut down for three days while a *bomoh*, a spirit healer, was brought in to cleanse the premises ritually, by sacrificing a goat and sprinkling holy water. Workers who had been possessed were allowed to drink the holy water or wash their faces with it. The attacks declined but never completely disappeared. Women reported seeing tiny devils through their microscope lens, tall mysterious figures in the bathrooms and prayer rooms, and were-tigers on the factory floor.

What caused the attacks? Some employees mentioned hunger or emotional conflict. Many preferred a supernatural explanation. The stress of working conditions is yet another explanation. Stress increases catecholamines, which in turn leads to increased lactate in the blood, reducing the body's ability to use calcium. Hypocalcemia contributes to anxiety attacks and, under the influence of Malaysian beliefs, to spirit possession states (Raybeck, Shoobe, and Grauberger 1989).

Ong's interpretation is political: *kena hantu* "disclosed the anguish, resistance, and cultural struggle" of female workers (Ong 1987:220). An "idiom of protest," spirit possession is also a way of expressing "a sense of dislocation in human relations" in an industrializing society (Ong 1987:207).

#### Globalization and Health

Whether we use a biomedical, supernatural, or political model to explain *kena hantu*, we must look at the context: an agrarian society being transformed into an industrial nation. This transformation is at the core of **economic development**, which we define as planned, systematic change, with increased use of modern technology, new patterns of production and consumption of goods, and intensive extraction of natural resources to sustain a nation's growth and to create export markets.

Economic development is an abstract concept, often imposed top-down upon traditional peoples by governments at various levels, but there is also a human face to development. The wellbeing of factory workers in Malaysia is affected by environmental and economic pressures linked to transnational systems of trade and production. Miners in South Africa, tea growers in Sri

Lanka, cattle ranchers in Nicaragua, and fishermen in Korea all experience similar pressures. Human ecology has become ever more complicated as politics and political economy affect access to resources in all populations, even the most isolated and traditional.

Since World War II, as the economies of Asia, Africa, South and Central America, and Eastern Europe have become increasingly enmeshed in the global economy, repercussions on health have been substantial. New diseases such as HIV are diffusing to every nation through contacts between travelers and locals. Farm land is being sold to developers who then build factories. Unable to grow food, landless people who migrate to cities in search of work often find only substandard housing and polluted water in squatter settlements such as the Bangladeshi neighborhood shown in the chapter opener photo. Desperate to improve their lives, many migrate to other countries.

Population mobility and migration are major parts of **globalization**, a process in which human activity within economic, political, cultural, and demographic processes becomes increasingly integrated across national and regional boundaries. These processes "take place within nations but also transcend them" with an "intensification of social relations linking distant localities" (Kearney 2005:548). Anthropologists are particularly interested in discovering how the *global* and the *local* levels affect and articulate with each other. The proliferation of biomedicine around the world is an example of global processes. When a community adopts Western medical practices and integrates them into the traditional medical system, this is change at the local level.

Globalization is propelled by population mobility. In 2005, there were 191 million international migrants. International tourists numbered 806 million in 2006 (Apostolopoulos and Sönmez 2007). The transnational flow of people includes refugees, workers, military troops, pilgrims, international students, and tourists. These travelers introduce new customs, foods, health beliefs, and sometimes pathogens to the host countries.

The ships, planes, buses, and trucks in which people travel may also carry insects that are disease vectors. Mosquitoes, the vectors for malaria, dengue fever, and other tropical diseases, are intrepid travelers, surviving for six to nine hours in the wheel bays of airplanes and for months in old tires and water containers on ships. Tsetse flies, native to West Africa, are vectors for *try-panosomiasis* or sleeping sickness. This infectious disease was once controlled through public health programs but is now re-emerging as a threat in areas where tsetse flies are carried in trucks along newly constructed highways. As migrant laborers and travelers move from one region to another, they are bitten by the flies at river crossings.

Trypanosomiasis is a "disease of development" in the sense that its rise in incidence is linked to road construction and other development projects. When habitats change, disease rates often change as well. In South America, road construction and deforestation in Amazonia have led to increases in malaria. Attempts to eradicate it have met limited success, especially when irrigation projects, dams, housing construction, and new roads contributed to increased opportunities for mosquitoes to breed.

The mobility of laborers is a primary reason for this dynamic epidemiological picture. As in the Malaysian case that opened this chapter, rural people in many countries are no longer self-sufficient and depend on the wages of family members employed in industries, mines, plantations, and other work sites. In countries with little arable land, migration of laborers is necessary for survival. Bolivia has been transformed from a rural nation to a mostly urban one because so many people have migrated to cities. In the small mountainous kingdom of Lesotho, with some 2 million people, over half of the males work out of the country, many as miners in the Republic of South Africa, which surrounds Lesotho on all sides. The women who stay behind often receive little or no money from their husbands. They try to grow and market fruits and vegetables, and some are street vendors of prepared food and clothing. Still, many cannot generate enough income for economic survival unless they enter long-term extramarital relationships, called bonyatsi, in which they receive money, food, clothing, and furniture from their lovers. However, such multipartner relationships pose a heightened risk of transmitting HIV and other STDs (Romero-Daza 1994).

Migrant workers also face health risks due to poor living and work conditions. Often the lack of safety regulations and medical care places workers in harm's way. South African miners are often injured, at times fatally, by underground rock falls. Migrant workers developed lung disease in quartz factories in the Jiangsu Province of China, and female workers in shoemaking factories in China experienced benzene poisoning. Filipino domestic workers in Hong Kong reported abuses ranging from lack of medical attention and inadequate eating arrangements to being sexually molested by employers (Lurie 2007:79).

Whatever the setting, development projects and migratory labor create new health risks. Workers on plantations are exposed to pesticides. Asbestos plants are unregulated. Mercury from industrial wastes pollutes fish in the Philippines. The goals of economic development include extracting natural resources with modern technology; building and expanding infrastructure such as roads, bridges, sewers, and power sources; improving the living standards,

education, and income of people; and increasing a nation's or region's international status and influence. Increased disease, pollution, and work hazards are not the goals of economic development and modernization, but they are too often the costs.

# Limitations of the Development Paradigm

From the end of World War II through the 1970s, advocates of economic development held a rather naïve view of the process, assuming that low-income countries could industrialize easily and catch up economically with the developed countries. There was optimism about introducing technology to less developed countries. Some introductions were simple innovations: boiling water and building latrines to prevent diarrheal disease, using a system of gates to turn a river into an irrigation system. But often a greater emphasis was placed on major, capital intensive innovations such as constructing huge hydroelectric dams to power new industries. Development economics became the ruling discipline, advocating a judicious combination of loans of foreign capital and technical advisors to increase economic productivity. Agriculture needed to be modernized, as well, as industrial workers required supplies of cheap food efficiently produced with fertilizers, pesticides, irrigation, and new seed varieties.

By the 1980s optimism about economic development had been sobered by experiences of famine, disease, the heavy foreign debt taken on by developing nations, and the persistence of poverty and malnutrition. Many nations remained underdeveloped. One theory accounting for the persistence of underdevelopment was *dependency theory*, also called "the development of underdevelopment," to emphasize that nations do not become underdeveloped in isolation, but through political and economic relationships with the developed nations.

Dependency theory is closely related to world-systems theory (Wolf 1982), which argues that development in the "core" (or developed) countries takes place by exploiting the resources of the "peripheral" (less developed) countries. European economic growth occurred in part through trade, conquest, and colonialism. Between 1500 and 1800, northwestern European countries extracted raw materials such as gold, silver, sugar, cotton, and timber from peripheral countries; in turn these peripheral countries became markets for the industrial products. Although colonized nations gained independence, unequal economic relations persisted, and the peripheral countries remained

chronically underdeveloped. The core-periphery distinction is now seldom used by researchers focusing on globalization, but it does provide a historical basis for understanding economic and health disparities in the world.

The *political economy of health* explores the implications of these theories of underdevelopment for medical anthropology. Looking beyond individual illness and local treatment options, it takes into account the political and class interests involved in development. The *political ecology of health* is similar but adds environmental factors to the analysis of the politics of health. For example, following construction of the Akosombo Dam in Ghana, the parasitic disease *schistosomiasis* increased in prevalence among humans who used Lake Akosombo for fishing, washing clothes, and bathing. The decision to build the dam was politically and economically motivated to accommodate the hydroelectric power needs of the aluminum industry; the health consequences were unintended (Mayer 2007).

# Measuring Development

The usual measure of development is purely economic, the gross national product (GNP), defined as the value of all goods and services produced in an economy plus or minus transfers such as money sent home by people working abroad. By itself GNP is an imperfect measure of development because the use and distribution of income differ greatly from one country to another. Some countries spend on armaments what others spend on health and education.

Other measures such as literacy and life expectancy can be combined with incomes to give a more nuanced picture of development. Some countries such as Costa Rica, Cuba, and Sri Lanka with quite low incomes have been able to give priority to health and education and seem by social welfare measures to be much more developed than on economic measures alone. In contrast, some of the oil-rich Middle Eastern countries have high incomes but have a long way to go to attain developed-nation standards in child health and education, largely because of the low status of women. In Table 9.1 comparisons are shown among several high-, middle-, and low-income countries.

One of the comparisons in Table 9.1 is energy use, one measure of the fact that industrial countries and their affluent inhabitants use a disproportionate share of the world's renewable and non-renewable resources. Such extensive use of resources is clearly detrimental over the long haul, leading to calls for change in the direction of **sustainable development.** This concept is usually

TABLE 9.1
Selected Health and Development Indicators in Five Nations

	Japan	United States	Ecuador	India	Mozambique
Gross National Income Per capita 2006	\$38,410	\$44,970	\$2840	\$820	\$340
Energy use (oil equivalent) Per capita (kg) 2003	4040.4	7794.8	781.5	512.4	435.8
Population growth rate Percent per year 1990–2006	0.2	1.0	1.6	1.8	2.7
Percent of population urbanized 2006	66	81	63	29	35
Total fertility rate 2006	1.3	2.1	2.6	2.9	5.2
Contraceptive prevalence (per cent)	56	76	73	56	17
Skilled attendant percent of births 2000–2006	100	99	99	47	48
Infant mortality Per 1000 2006	3	6	21	57	96

Sources for country data: UNICEF, State of the World's Children, 2008. Energy use from http://earth trends.wri.org. Accessed August 23, 2008.

defined as social and economic changes that meet the needs and aspirations of a generation without degrading the environment and thus jeopardizing the ability of future generations to meet their own needs.

Discouragement about the prospects for sustainable development has led to questioning the concept of development and to speaking of this as a post-development era (Escobar 1995). We might even say that the industrialized world is overdeveloped. From a health standpoint, this is an accurate description. Beyond a certain point, the industrialized countries have found it difficult to achieve further increases in life expectancy and reductions in mortality and morbidity. Industrial technology has created new health risks, as discussed in Chapter 4. Modern diets, stress, and unhealthful activities contribute to degenerative diseases. Use of tobacco, alcohol, and other drugs increases

despite evidence of the risks they pose. Even the increased use of technology at the end of life to prolong the process of dying without restoring health can be viewed as an indicator of overdevelopment; that is, a process of industrialization leading to a decline in quality of life.

Nevertheless, underdevelopment and poverty continue to be major antecedents of infectious disease in much of the world, as Paul Farmer points out in his book, *Infections and Inequalities*. The forces shaping the HIV/AIDS epidemic in Haiti, for example, are not limited to biological factors. Other determinants of the epidemic are political upheaval, gender inequality, racism, inadequate response by public health authorities, and lack of prevention tools (Farmer 1999:146).

It is simplistic to classify the world's nations as developed or undeveloped, affluent or poor, modern or traditional, or to assume that the high-income nations are shielded from the pathogens and environmental hazards that threaten people in low-income countries. Globalization theory emphasizes that boundaries between societies are highly permeable as goods and people move back and forth.

In North America, we depend on imported foods for year-round availability of fresh fruits and vegetables. As U.S. consumers learned in 2008 when imported jalapeño peppers were found to be contaminated with *E. coli*, inspection of imports is fallible. Importation of live animals is another bridge to human infection. Many of the animals intended for sale as pets are not screened sufficiently before being shipped. In 2003, an outbreak of monkeypox in humans was traced to captured prairie dogs in the United States that were housed with infected rodents imported from Ghana. There is particular concern that imported or migratory birds could carry avian influenza H5N1, a virus that can infect mammals, including humans (Wilson 2007).

# Evaluating the Health Effects of Agricultural Development

How shall we evaluate the relationship between globalization and the health of populations? Is the promise of longer life and freedom from hunger an illusion for most of the developing world? To answer this question, we need to look at both sides of the issue, considering unexpected consequences or negative repercussions as well as benefits of development projects.

We begin with discussion of efforts to improve agricultural productivity. Worldwide, over a billion people are chronically hungry at any given time. That is, they do not get enough to eat to provide the energy required for an

active life. Therefore, it is not surprising that high priority has been given to increasing agricultural productivity. Ironically, most of those people suffering from famine live in countries that produce adequate food. The problem is that they are simply too poor to buy it. Much of the food leaves the country as exports, even in periods of famine, as in Ethiopia in 2008 after months of drought, a failed harvest, and inflated food prices (Perry 2008).

In the twentieth century, during an international effort called the Green Revolution to increase food production, developing nations were encouraged to use high-yield varieties of grains, fertilizers, irrigation water, and pesticides. The initial results of these efforts were encouraging. After years of dependence on imports, countries such as the Philippines were able to grow enough grain to feed their populations. But by the 1990s, the less developed countries, with an average rate of population growth of 2 percent, had an annual increase in agricultural production of slightly over 2 percent, meaning that they were barely keeping ahead of their food needs.

With the construction of the Aswan High Dam in Egypt in the 1960s and reclamation of desert lands in the Nile delta, agricultural productivity increased dramatically. However, soil fertility diminished because the flow of silt was interrupted with irrigation systems, and there was danger of waterlogging and salt accumulation in soil. In addition, the reservoirs and canals of irrigation systems were suitable habitats for parasites and their intermediate hosts such as snails, sparking an epidemic of schistosomiasis that took decades to control.

# Agricultural Development and Schistosomiasis

Ancient Egyptians described an ailment called  $\hat{a}$  a  $\hat{a}$ , recording some twenty remedies for the illness on 3,500-year-old fragments of papyrus scrolls. Calcified eggs found in kidneys of mummies who died around 1100 BC indicate that the cause was a parasitic worm, a **schistosome**. In Africa and the Middle East, *Schistosoma haematobium* is the dominant species infecting humans, and in Africa, Caribbean, and South America, *S. mansoni*. The eggs of *S. japonicum*, the major form in Asia, have been found in mummies and in human remains in mausoleums in China dating 2,000 years old, and the disease was described in historical writings dated AD 290 (Jian 2006).

Schistosomiasis became a serious public health problem in many countries, spreading as humans migrated. *S. mansoni* was brought to the Caribbean and South America by African slaves in the seventeenth and eighteenth centuries. It diffused to Brazil, where it spread through labor migration. The shift in

Puerto Rico around 1905 from mountain coffee cultivation to coastal sugar cane production was correlated with increase in schistosomiasis rates.

The increase in worldwide prevalence in the last century was linked to changes in agriculture that intersected with the complex life cycle of the schistosome. (See Fig. 9.2.) The definitive hosts of the parasite are humans or

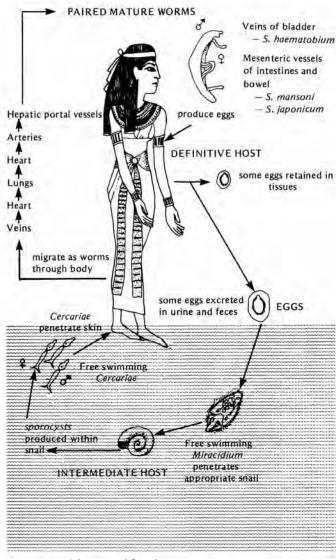


FIGURE 9.2 Schistosome life cycle.

other vertebrates; the intermediate hosts are snails that thrive in the slow-moving streams and canals of irrigation projects. With seasonal irrigation, the dry periods helped to keep the snail populations down, and schistosomiasis remained endemic. After perennial irrigation was introduced, the rate of disease rose sharply.

The adult forms of the parasite are trematodes, blood flukes that live in the definitive host from four to twelve years or longer. It is their eggs that cause disease symptoms. Most people with low intensity of infection experience no noticeable problems. Several years after infection, those with heavier parasite burdens have inflammatory reactions to the eggs. The infected person loses weight, may become anemic, and has low immunity to other diseases. Schistosomiasis is rarely fatal, but it is linked to other lethal diseases such as bladder cancer.

Constructing water reservoirs with slow drainage enhances transmission. This includes fish ponds developed as a protein source, hydroelectric projects, and road building and construction that do not provide adequate drainage. Land reclamation projects, for example the one that transformed desert in the Sinai Peninsula into agricultural land, also led to increased rates, putting the Bedouin tribes migrating to this area at risk (Mehanna et al. 1994).

Rural communities in developing countries often lack flush toilets, bath-houses, and laundries. In Egypt and other Islamic countries, religion dictates that one should cleanse oneself with flowing water, if possible, after defecation and urination, and streams and canals may be used for this purpose. Through these forms of water contact, both egg excretion and cercariae penetration can occur. Human waste may seep from latrines or be discharged as untreated sewage into the streams where people wash clothes, fish, and swim.

In most countries with endemic schistosomiasis, males have higher rates than females. Men's work more often brings them into contact with water, and women may be prohibited from swimming or other water recreation (Michelson 1993). But when women are infected, their work productivity suffers. Women in Sudan who were infected with *S. mansoni* picked cotton more rapidly than those who were not infected, meeting their minimum needs for cash income in a morning's work, but they were more likely to report feeling tired and weak and were less likely to return to the fields in the afternoon (M. Parker 1992, 1993).

Strategies for controlling schisosomiasis are improving, even as the conditions leading to its spread are also increasing. In 1955, the prevalence of infection in Egypt was 47 percent. Twenty years later, after intensive control efforts, the prevalence was still high at 32 percent (Mobarak 1982:87). By



FIGURE 9.3 Bachama people fishing communally in a pond left by the annual flooding of the Benue River in northeastern Nigeria. Fishing in this manner exposes people to the cercariae that transmit schistosomiasis. Photo by Phillips Stevens, Jr. Reprinted by Permission.

the late 1980s effective diagnosis and treatment had reduced the prevalence of *S. haematobium* infection to less than 1 percent in the Nile Delta, but it was replaced by *S. mansoni* as the more prevalent species of schistosomiasis, with rates up to 70 percent in some villages (El Katsha and Watts 1995:136).

The decline of prevalence in *S. haematobium* indicates the success of multiple control strategies. Development of safe and inexpensive drugs made mass chemotherapy programs possible in many countries, although reinfection occurred through infected migrants from endemic areas (Chandiwana and Taylor 1990). Earlier forms of treating schistosomiasis led to the spread of hepatitis C throughout Egypt through unsafe injection procedures (Whyte 2000).

Engineering and ecological management approaches such as lining canals with cement, keeping water free of weeds to maintain a rapid flow of water, or simulating wet-dry cycles through control of irrigation may be more effective approaches to disease reduction than public health education, even that using modern media such as television. The engineering approach was taken by mainland China in a massive and successful effort to reduce the high prevalence of *S. japonicum* in the last decades of the twentieth century. However, schistosomiasis, called "big-belly disease" because liver damage leads to fluid

buildup in the abdomen, is now considered a reemerging disease in China; some 800,000 cases were identified in 2004. Among the reasons for this resurgence were construction of reservoirs and irrigation systems in the Yangtze River Valley, flooding that allows snails to increase, and continued contamination of water by infected animals. (Both humans and animals can be hosts.) As China transformed itself from a planned economy to a market economy, each household became an independent economic unit, and it is more difficult to mobilize a community to carry out disease control projects than in the past. Many people migrate to other provinces in search of work, thus spreading the disease (Jian 2006).

# Water Systems, Disease, and Applied Medical Anthropology

Anthropologists have seen communities and ecosystems disrupted by the impact of development, leaving many of them skeptical of the notion of "progress" and reluctant to do applied work lest a well-intentioned project develop unintended consequences. The massive exposure to arsenic-contaminated drinking water of at least 20 million people in Bangladesh is such an case.

Infants and children in Bangladesh had historically high rates of diarrhea because the surface water used for drinking was contaminated with bacteria. To provide safe drinking water, UNICEF and other agencies installed tube wells and hand pumps. When the UNICEF project began in the 1970s, the water was not tested for arsenic because it was not yet recognized as a potential hazard. By the time that systematic testing started, millions of tube wells had already been drilled by the private sector.

The contaminated wells were those that tapped water from the arsenic-rich, middle levels of alluvial sediments that had washed down from mineral deposits in distant mountains. Water from the poisoned wells appeared as clean and clear as water from the harmless wells, fortuitously drilled into uncontaminated sediment layers. Arsenic poisoning in people who drank the water was first recognized through its characteristic skin lesions, including changes in pigmentation and thickened spots (keratoses) on the palms of their hands and soles of their feet. In time, those exposed to arsenic are at increased risk of developing cancers of the skin, liver, lung, kidney, or bladder, and the full magnitude of the public health disaster will be experienced in the future (Smith et al. 2000).

Applied anthropologists are not often in the position of making decisions such as whether to undertake a program of well-drilling. More often they are

in the position of laying out options for those who will decide. Policy makers then make decisions more fully informed of the relative costs, risks, and benefits of each course of action. Anthropological input can clarify the trade-offs in which choices for economic development are balanced against hazards to health generated by particular kinds of development.

Ideally, the advice of anthropological consultants carries as much weight in policy decisions as the input of economists. In reality, development planning is heavily dominated by economic considerations. Even so, assessments of environmental and social impact may be taken into account in making decisions about development, especially when it involves participation of the community that will be most directly affected. This kind of assessment is best done by a multidisciplinary team including an anthropologist, as described in the following profile on cholera in South America.

# ROFILE: THE MEDICAL ECOLOGY OF CHOLERA IN ECUADOR

Linda Whiteford

In 1991, an epidemic of cholera, an acute intestinal infection, began in Peru and spread for the next two years across South America. Before it was over, more than 9,000 people died and many more were infected (Whiteford 1993). At the time, I was an associate professor at the University of South Florida, trained as a medical anthropologist with a special interest in a vector-borne disease, dengue fever, and in child and maternal health. I was also a consultant for the Environmental Health Project (EHP) run by CDM (Camp Dresser McKee), an engineering and consulting firm and prime contractor for the U.S. Agency for International Development. When EHP asked me in 1992 to become involved in a proposed project to study the continuing presence of cholera in indigenous communities of highland Ecuador, I accepted.

Cholera is a water-borne disease, caused by bacteria in fecal-contaminated food or water. It can also be transmitted by eating raw or undercooked seafood infected with the cholera *vibrios*. With a short incubation period, the bacteria produce a toxin that activates enzymes in the intestines, causing copious amounts of watery diarrhea, vomiting, and muscle cramps. Cholera can quickly result in severe dehydration and death if left untreated. It is particularly deadly among children and the elderly, or anyone immunologically compromised or nutritionally stressed. It is sometimes called "the blue death," because

patients nearing death from cholera have been known to turn a shade of blue or gray from the loss of fluids circulating in their bodies (Kiple 1993). The bacteria that cause cholera are curved or spiral organisms called *vibrios*. They thrive among aquatic plants, including seaweed and algae. Warmer sea temperatures increase the growth of algae, thereby increasing the threat of cholera as well. These coastal algal blooms may be one of the first warning signs of global warming (Townsend 2008).

Cholera holds a significant place in the history of understanding disease transmission. Enduring six cholera epidemics in the nineteenth century, Europeans held various theories of the disease, ranging from notions of vapors rising from gutters filled with sewage and garbage to beliefs in divine punishment for immorality. John Snow, a surgeon in London who was Queen Victoria's personal physician, argued that the epidemic spread not through the air, but through water contaminated by excretions from victims (DeSalle 1999).

In 1849, Snow demonstrated that cholera was indeed a water-borne disease by persuading authorities to remove the handle of a water pump (thus making the water in that system unavailable), at the intersection of Broad and Cambridge streets, where 500 residents had become infected within a ten-day span. This simple action stopped the spread of cholera along the lines of that water system. It was not until four years later that Snow learned precisely how the toxin was introduced into the drinking water: seepage from a contaminated cesspool leaked the bacteria into the water.

Water-borne diseases such as cholera are intimately affected by human activities. These activities may be related to development projects, such as dam-building and associated human resettlement. When water systems lack sanitation infrastructure, such as filters and chlorine to disinfect water, and especially when untreated human or animal sewage gets into open water systems, there is serious risk of infection. Labor migration is a key factor in transmission, as returning migrants who carry the bacteria can reinfect local water systems.

In addition, patterns of water usage are shaped by cultural beliefs, gender-based labor patterns, history, and the environment. Once the cholera bacteria are introduced into human hosts who unknowingly ingest water contaminated with human or animal feces or urine containing the pathogen, the means to disrupt transmission will depend on many factors. A medical anthropologist or public health worker hoping to intervene needs to know certain details about the population: its location (urban or rural?), its size and density (concentrated or dispersed?), access to water and sanitation, beliefs

about disease transmission, and especially the power (or "agency") of the people experiencing the outbreak.

In the Ecuadorian case, governmental and international health authorities were able to control the outbreak in the urban centers within the first fifteen months of the initial epidemic. However, the rural, dispersed, and indigenous communities of the Andean highlands continued to suffer from ongoing deaths due to the disease. To understand this disparity, it is helpful to consider the history and cultural geography of Ecuador.

Ecuador is one of the smallest countries in South America, slightly smaller than Nevada, and located in the northwest between larger and more powerful neighbors, Colombia and Peru. (See Fig. 9.4.) The population is close to 13 million. Ecuador straddles the equator (hence, its name), situated in both the northern and southern hemispheres. Geographically limited (260,000 sq. km.), it encompasses both an extraordinary natural biodiversity of birds and plants and a rich cultural diversity. Indigenous cultures compose some of the more than fourteen distinctive ethnic groups spread from the Amazonian lowlands, and coastal beaches, to the Andean highlands.

Ecuador is a popular tourist destination and one of the most sought after non-English-speaking hosts to U.S. study-abroad programs. Most travelers to Ecuador know the two primary cities: Quito, the Andean capital situated between the two cordilleras of volcanoes that create the "spine" of volcanoes running from the north to the south of Ecuador, and Guayaquil, the large coastal city on the Pacific. Other visitors know the Amazon in the south or the famous weaving center, Otovalo, in the north. While the cool, high mountains of the Andes attract many visitors, the lush and fascinating Amazon region draws others. Birders and hikers from around the world visit the Galapagos, Ecuador's offshore islands. Often visitors see the geophysical beauty, the cultural diversity, and the colonial architecture, but fail to notice the great disparities in wealth, health, and education of the population.

As a secondary center of the Spanish empire, Ecuador never experienced the degree of glory nor endured the hardships that Peru and Colombia did, but its customs and architecture reflect many cultural and physical inheritances from the Spanish occupation. Along with these influences, Ecuador adopted beliefs about European superiority, with the result that indigenous groups are among the most economically deprived in the country, living in the remote regions with limited access to resources, including water and sanitation.

The twenty townships where the epidemic continued to rage in 1993 were in five states, two along the Pacific coast and three inland, in the highlands.



Figure 9.4 Map of Ecuador. Courtesy of Linda Whiteford.

The three mountain states with the highest on-going rates of cholera were Chimborazo, Cotopaxi, and Imbabura. They also had the largest concentration of indigenous people. These are states rich in indigenous traditions, festivals, rituals, and cultural beliefs and practices. All five states share high levels of poverty and the structural violence maintained by distance, both geographic and social, from power. The three mountainous states suffered be-

cause their population was predominately indigenous, rendering them targets for prejudice and further isolating them from access to resources.

The Environmental Health Project, the water and health component of Camp Dresser McKee, with funding from U.S. AID, agreed to work with the Ecuadorian government to study the situation and make recommendations to reduce the cholera-induced suffering in those communities. Along with May Yacoob, a medical anthropologist working for EHP, a field team was put together to conduct research on five highland communities in southern Ecuador with continuing high levels of cholera. I was the Team Leader representing EHP, and we created an Ecuadorian counterpart team composed of a physician from the Ecuadorian Ministry of Health (Dr. Carmen Laspina), and an Ecuadorian psychologist trained in non-formal education (Dr. Mercedes Torres). With May Yacoob in the United States and the three of us working in the field, we began the project. (See Fig. 9.5.)

Knowing how geography, ecology, and history intersect to shape patterns of diseases like cholera, we established goals to:

- 1. use both local and EHP teams to identify cholera-related adult behaviors in high-risk communities and to discover behaviors and beliefs associated with potential increased risk of cholera;
- 2. have both local and EHP teams gather and analyze data on environmental and domestic health behaviors;
- 3. develop and implement local interventions to change high-risk behaviors;
- 4. establish a locally controlled monitoring system; and
- 5. train local people to continue the monitoring and to document activity results.

To accomplish these goals, we developed a health intervention model, the Community-Based Participatory Intervention (CPI) (Whiteford 1996). We trained fifty-five individuals in community education techniques and leadership skills, conducted ethnographic and epidemiological research, and designed and led community-based interventions (Whiteford with Laspina and Torres 1996).

The project successfully identified beliefs and behaviors implicated in the spread of cholera, and brought about the sustained reduction of cholera in the two project states. Using a medical ecology perspective (with political economy added), we found several actions that directly and indirectly facilitated the spread of cholera: defecation in fields or other areas close to living



FIGURE 9.5 Linda Whiteford and a member of the local cholera control team in Ecuador who was very pleased to have clean water for her family. Photo COURTESY OF LINDA WHITEFORD.

and eating activities; substandard hygiene related to water; water insecurity; consumption of food prepared by street vendors as well as the conditions in which they served food; communal food preparation and distribution during religious and community festivals; and contact with migrants returning from endemically infected coastal areas.

Common throughout the world and through time, defecation in open fields is a response to living without access to latrines or sanitation systems that include toilets. In much of the world, human and animal feces are used as fertilizer for crops. Sometimes feces are buried or turned under the ground, thus removed from people coming into contact with it. However, if the feces are not buried, and if they carried the cholera *vibrios*, then its spread can continue through the fecal-hand-oral transmission. Likewise, in much of the world, water systems are limited to rain barrel water collection or water that is brought from a distance. Often such systems are never disinfected, but only transported.

When water is scarce, people use it sparingly, and that means that people do not often wash their hands. In the fields, hands may come into contact with cholera-infected feces and transport the *vibrios* to the next host. This is also how communities become reinfected. In addition, people returning from coastal communities where the disease is endemic may bring the *vibrios* back in their system. It may get on their hands, and when hands are not washed frequently and are used to reach into common food bowls, the others sharing the food may also become infected. The same route of transmission often occurs when people eat food prepared and sold on the street when there are inadequate facilities for washing hands or plates.

We identified contributing environmental factors such as the disposal of hospital waste in open canals from which downstream residents drew their drinking water. Poor rural communities often lack closed water systems, relying instead on systems of open aqueducts that channel water from the source to the communities. Without adequate garbage pickup and disposal, it is easy to imagine how waste might be dumped into these open aqueducts to get rid of it, similar to throwing trash along the side of the road in the United States.

Disease transmission in the Andean highlands was further influenced by international trade and lending policies. In the late 1990s, as national governments turned their attention to global trade, they further excluded the marginalized, rural, indigenous communities from basic services. This placed the responsibility on local communities to provide the necessary resources for developing or maintaining infrastructure, making adequate water and sanitation impossible for the poor.

In the case of the cholera epidemic in Ecuador, the beliefs and behaviors of individuals in the most highly affected communities were relatively easy to identify. Even before the intervention, some people recognized ways to change their own behaviors to reduce the likelihood of contacting and spreading cholera. But they needed help so that they could pay for soap, chlorine, and household water-storage tanks. Others in the communities learned these ideas with the help of the intervention and their neighbors. With resources made available through project funds, five target communities in two states (Chimborazo and Cotopaxi) were successful in controlling cholera and sustaining the reduction.

The use of a medical ecology framework allowed the communities to identify geophysical barriers to care such as population dispersion, lack of piped water or sanitary systems, distance from urban centers and their resources, and the lack of local jobs necessitating labor migration. In addition, the perspective incorporated the importance of local beliefs and actions that

became the framework for changes identified and supported by the community such as increased hand washing, disposal of fecal materials away from water storage, awareness of disease transmission routes like common bowls for food sharing at ritual occasions or on the street.

A final success of the project was the development of leadership among both young people and women, groups traditionally excluded from leadership positions in traditional Quechua societies. When I returned to these communities on another project ten years later, I learned that two of the community leaders from our cholera-reduction project had gone on to complete college and then returned to their communities as leaders. I also learned that cholera was no longer present in any of the five research communities.  $\[ \]$ 

### Strategies for Improving Health

The previous section discussed problems created by development; here we consider ways in which developing nations have sought to address those problems. Developing countries must decide how to allocate financial resources, whether these are gained from taxes on businesses and individuals, state-run enterprises such as mines, or overseas loans and aid. Governments do not make these decisions in isolation, but under pressure to do what is politically acceptable and to meet conditions imposed on them from outside, for example, by the World Bank or donor nations who assist in funding programs. Assuming that one of their primary goals is to improve the health status of their citizens, governments must decide which kinds of expenditures are likely to produce the most improvement. Even then, they may be unable to make abrupt changes, for example in matters of staffing health services, where past patterns of training and hiring limit the pace of change.

Direct expenditures on health services are not the only way to improve health. Expanding curative services may not produce the same return in child health as ensuring that girls get primary education; educated mothers are more likely to have healthy children. Health centers offering free treatment may still be inaccessible if poor families cannot afford transportation to get to them. Within the health care sector, there are decisions on how to allocate resources among different programs. Hospitals, primary care facilities, health education campaigns, vaccines, and pharmaceuticals all compete for limited funds. (See Fig. 9.6.)

Often policies in one sector conflict with policies in another, as when an African country funds DDT spraying of houses as a strategy to control ma-



FIGURE 9.6 Papua New Guinea nurse examining an infant at a monthly maternal and child health clinic. The nurse is engaging in one-on-one health education with the child's mother. Photo by Patricia K, Townsend.

laria, while at the same time maintaining a tariff on the importing of bednets. The use of insecticide-impregnated sleeping nets may be a more effective way of preventing exposure to the mosquito bites that transmit malaria, but the tariff increases the cost enough to discourage people from purchasing them (McGinn 2003).

The building of health facilities is not normally the biggest part of a health budget, but decisions about which ones to build and which ones to modernize and keep open are highly charged politically. A rural community in Papua New Guinea may succeed in getting the capital funding for the small hospital or clinic building that it wanted, only to discover that it cannot obtain the staff and medical supplies to keep it operating. Health workers tend to be concentrated in the largest urban centers.

Developing countries with large underserved rural populations have attempted to deal with staff shortages by creating new categories of health workers. Their training is geared toward meeting primary health needs without creating expectations for high income and urban lifestyles that would pull the health workers out of areas where they are needed. To achieve close follow-up

of tuberculosis patients in an impoverished rural area of Haiti, for example, the *Proje Veye Sante* relied on village health workers who could make daily visits to patients during the first month after diagnosis (Farmer 1999).

Another strategy in developing countries has been to enlist the support of indigenous healers, providing them with additional education or supplies. Even before receiving such training, they often have incorporated Western biomedicine into their curing practices. In South Africa, more than two-thirds of traditional healers said they used medicines from pharmacies along with their traditional remedies. For example, healers treated sexually transmitted diseases (STDs) with "Flowers of Sulphur," a powdered form of sulfa (an antibiotic) mixed with herbal medicines (Green 1994:183).

The availability of pharmaceuticals is another issue in health care. Drugs that are routinely available in the United States for treating multidrugresistant tuberculosis, although they can be purchased in generic form, are still not available to the poor in developing countries. The international health organizations do not consider it to be cost effective for developing countries to provide these treatments, despite the fact that infectious diseases readily cross international boundaries, and the local authorities follow their guidelines (Farmer 1999:32–33). As for more expensive drugs, such as the latest therapies for HIV, developing countries have not been able provide them until recently, after drug companies made special concessions.

The pressures to provide curative services frequently win out over investment in public health infrastructure to ensure a safe water supply and safe food and to identify disease-causing microorganisms. This is as true in countries with high health expenditures such as the United States as in the poorest countries.

Among the strategies for improving health, medical anthropologists have been particularly active in health education. Consider the challenge faced by researchers in Kansas and Oklahoma of developing a culturally appropriate smoking cessation program for an Indian Health Service clinic that served persons from over 200 different nations. More Native Americans (41 percent) smoke than other ethnic groups in the United States. (Among blacks and whites, 24 percent are smokers.) Tobacco use was traditional in many, but not all, native communities, but the ritual contexts varied. An appropriate health education program for a pan-Indian clientele would need to be respectful of the cultural values of sacred tobacco, yet face up to the harmful effects of recreational cigarette smoking of addictive commercially produced cigarettes. Beginning with the Second Wind smoking cessation program developed by the Muscogee Nation of Oklahoma, the researchers and clinic staff worked

through a process of testing and revision to tailor the program to its intended beneficiaries (Daley et al. 2006).

Health education is assumed to be very important, not only by medical anthropologists but by most health care professionals, yet educational interventions have limited success in changing many risky behaviors. Why is this so? Is it simply that the health education is culturally inappropriate? Sometimes this is the case, and this is where anthropologists have been helpful in designing better materials, but sometimes contradictory advertising messages out-compete health education messages. Often people who are fully aware of the risks find it difficult to change because of physical addiction, social pressures, or economic constraint.

It is hard to imagine a group more likely to be better informed of the risks of smoking than cardiothoracic surgeons spending long hours of work cutting open chests in mainland China. Yet an American medical anthropologist doing fieldwork in these Chinese hospitals found that between surgeries, in an office away from patients, most of these physicians smoked together incessantly. Even those who had tried to give up smoking found it impossible because of the pervasive practice of offering around a pack of cigarettes prior to lighting up and initiating conversation. Sharing cigarettes is an important, formalized aspect of male sociability and hospitality among the surgeons as well as with their hospital administrators, drug representatives, and other men. An additional factor that makes it difficult to quit smoking is that they do not have aids such as patches and gums (Kohrman 2008).

# Health Disparities in Developed Economies

From the statistics presented previously in this chapter, as well as those in Chapter 4, it is clear that there is a major gap between the health of people living in the poorest and richest countries. In the poorer countries, average life expectancy at birth is typically between forty and sixty years, while in the richest countries it approaches eighty years. This corresponds closely with large differences in the health and survival of infants and children. This international inequality reflects the difference between countries that have passed through the health transition and those that have not. The **health transition**, also called the **epidemiological transition**, accompanies economic development. It is a shift to lower mortality and from a heavy load of gastrointestinal and respiratory diseases in early life to cardiovascular disease and cancer, which are usually diseases of later life.

Once a country joins the developed economies and moves through the health transition, additional increases in affluence do not, by themselves, translate into further improvements in longevity. Partly this is explicable by limits on maximum life span of *Homo sapiens*, that is, the ways that physical wear and tear, oxidation, and other processes of aging set natural limits to life span. But many people do not live to the maximum life span characteristic of the species; there are disparities within and between developed countries that we will explore in this section. Consider, for example, the average life expectancy at birth of two infants born in the eastern United States: an Asian-American female living in wealthy Westchester County, New York, who has a life expectancy of 90.3 years, and an African American male in Washington, DC, with a life expectancy of 57.9 years, less than that of a male in Ghana, Bangladesh, or Bolivia (Kawachi and Kennedy 2002:201). In broad terms, the disparity between them reflects differences of gender, wealth, ethnicity, and geography.

### Income Inequality and Health

By several different measures of development, and particularly of health status, the United States does not do as well as other industrialized countries. In child mortality under age five, the measure used by UNICEF for child well-being, the United States ranks thirty-ninth among all countries, tied with Latvia, Lithuania, Serbia, Slovakia, Thailand, and the United Arab Emirates. The United States has greater wealth than most of the thirty-eight countries with better child survival. Factors that may account for poorer child health and lower life expectancy in the United States are the lack of universal primary health care and the high numbers of medically uninsured, unique among the developed countries. Health resources in the United States are concentrated on end-of-life care and high technology interventions rather than prevention.

According to a World Health Organization study, the United States has the highest health care expenditures per person of any country, but its health care system ranks only thirty-seventh in overall performance. France and Italy have the best-performing health care systems by this broad measure, which takes account of distribution of services and fairness of funding. Japan and Australia have the top rank in terms of health outcomes (WHO 2000). Australia's successful health outcomes are especially interesting to Americans, who see Australia as much like America in language and culture, facing similar challenges in providing services to immigrants and indigenous people. One difference is

that Australia provides universal access to primary care, and there are no financial barriers to access to hospital care (Duckett 2001).

Although there are substantial differences in access to health care among industrialized countries, it is not health care by itself that explains the differences in life expectancy between these countries. Inequality in income affects health through many pathways in addition to the ability to buy access to private medical care and medicines. Higher income translates into many opportunities to enhance family health: better food, less crowded housing, outdoor play space for children, and recreational sports for all ages.

The degree of inequality in income within several countries is shown in Table 9.2. There are several ways to measure economic inequality, but the one used here is fairly simple to understand. If a society were completely equal, each 20 percent of the population would get 20 percent of the income. There would be no difference between rich and poor. But in the real world, even in the countries with the most equality (those toward the bottom of the chart), the richest 20 percent receive more than 20 percent of the income. It is frequently true that low-income developing countries are very unequal, with a small wealthy elite at the top of society and a large impoverished lower class at the bottom. But this is not always the case, and some poor countries (for

TABLE 9.2 Income Inequality in Selected Countries

	Percent of Income Received by	
Country	Poorest 20% of Population	Richest 20% of Population
South Africa	3.5	62.2
Brazil	2.8	61.1
Ecuador	3.3	58.0
Costa Rica	3.5	54.1
China	4.3	51.9
Nigeria	5.0	49.2
United States	5.4	45.8
Australia	5.9	41.3
Russian Federation	6.1	46.6
Canada	7.2	39.9
Sweden	9.1	36.6
Japan	10.6	35.7

Source: World Bank, World Development Indicators, 2007. Washington, DC.

example, Nepal) are not as unequal as others. The United States, among the most unequal of the industrialized countries, is near the top of this chart. It lacks many of the programs and tax structures by which other industrialized countries redistribute income among their citizens. In recent years, income inequality has been increasing in most countries, including the United States.

Social scientists hypothesize that income inequality is destructive of social cohesion or "social capital" and reduces overall health. The classic demonstration of this argument used data from England, where there actually is less inequality in income and access to health care than in the United States (Wilkinson 1973). Studies in the United States that relate ill health and mortality directly to income are more difficult, because the United States does not keep health statistics according to income. Even in the absence of detailed data on income, simply comparing regional data shows a strong relationship between income inequality and mortality. The metropolitan areas and states that have the most inequality of income (such as Louisiana and Mississippi) have higher death rates, and states that have more equal incomes (such as New Hampshire, Vermont, and Wisconsin) have lower death rates (Kawachi and Kennedy 2002:102). Simply comparing rates in this way does not give us any insight into mechanisms that might bring about these disparities, but from the research on stress and the lack of social support discussed in Chapter 7, such results are not surprising. The point is that inequality itself, difference in relative wealth, is harmful to health.

Poverty, at least in its extreme form, is not good for health. That much is obvious, but what is more surprising is that the effect of inequality on health is as strong as it is. This has suggested to some policy analysts that, especially in the United States, the best health policy might be a simple change in the tax structure to transfer more income from the rich to the pockets of the poor.

# Ethnicity and Health Disparities

Within a multicultural society such as the United States, although there is a great deal of similarity among ethnic groups, there are still distinctive patterns of mortality and morbidity associated with different ethnic groups. Among American Indians, about half of deaths are due to cardiovascular disease and cancer, which are also the two leading causes of death in the rest of the American population. American Indian health and life expectancy have improved substantially over recent years, particularly through reducing infectious diseases such as tuberculosis and pneumonia. Even so, mortality from certain causes has been much higher than among non-Indians; among these were al-

coholism, tuberculosis, diabetes, accidental injuries, suicide, and homicide. Some other causes of death, including AIDS, were less frequent among American Indians than the rest of the population during the 1990s (Brenneman et al. 2000).

There are clearly some *differences* in health associated with ethnicity. For example, a child with northern European ancestry is more likely to be diagnosed with cystic fibrosis, whereas a child with African ancestry is more likely to be diagnosed with sickle cell anemia. Both of these are diseases with a significant genetic component. But difference is not the same as *disparity*. Health disparities are inequities that arise not from biology but from a pattern of discrimination. Health disparities go beyond differences in health status to disparities in the health care that people of different races or ethnicity receive for the same condition.

Across a large number of studies of different diseases and medical procedures throughout the United States, disparities have been shown in health care for minorities, even after adjusting for income and insurance coverage. African Americans are less likely to receive appropriate diagnostic tests, treatments, and pain medications for cancer. They are less likely to receive coronary bypass surgery, kidney transplant, or certain HIV therapies, even when the diagnosis and severity are identical. The Institute of Medicine (an entity comparable to the National Academy of Science) and a wide variety of other organizations are working on gaining a better understanding of how such disparities are maintained (Smedley et al. 2002). This is an area of research and practice where medical anthropologists have been asked to participate at several levels. By mentioning several different kinds of involvement, we can illustrate the variety of professional roles played by medical anthropologists in working toward solving a problem, once it has been accorded high priority, in this case by the U.S. Congress.

The Institute of Medicine (IOM) study *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care* was directed by a multidisciplinary committee of researchers, including a medical anthropologist, Jennie Joe. She is a professor in the Department of Family and Community Medicine and director of the Native American Research and Training Center at the University of Arizona. Her research there concentrates on diabetes among American Indian children (Joe and Frishkopf 2006). (See Fig. 9.7.) The purpose of the IOM study was to review what was already known and, on the basis of these findings, to make recommendations, not only for further data collection and research but for changes in legislation, health systems, and health education.



FIGURE 9.7 University of Arizona medical anthropologist Jennie Joe with the medical team volunteers of Wellness Camp, a summer camp for Indian children with type 2 diabetes. As childhood obesity has increased, type 2 diabetes, once called "adult onset" diabetes, has emerged at younger ages. Photo courtesy of James Justice, M.D.

The IOM study relied in part on work done by consultants, researchers who tackled special assignments to review one or more aspects of the problem. One of these reports was produced by a team of four medical anthropologists at Harvard University, Mary-Jo DelVecchio-Good, Cara James, Byron Good, and Anne Becker (DelVecchio-Good et al. 2002). Their task was to look at the culture of medicine, particularly at the way that culture is transmitted to new doctors in medical school. They asked how there might be covert racism built into the medical institutions themselves.

At a different level of participation from the university-based researcher and more directly involved with policy makers is the medical anthropologist working within the government, such as Suzanne Heurtin-Roberts, who works at the National Cancer Institute in the Behavioral Research Program of the Division of Cancer Control and Population Sciences. Before entering government work, she had already done research, particularly on African American health. At the National Institutes of Health (NIH), she is coordi-

nator of research on health disparities, one of those issues that cross-cuts the disease-based lines of organization (cancer, stroke, alcoholism, mental health, and so on) around which the NIH is structured.

The level of participation that engages the most medical anthropologists in work on health disparities is the nitty-gritty of small research projects at the local level. As representative of this work, take Eric Bailey's consultant work on African American access to health care in two counties in Indiana. He studied two counties where about 10 percent of the population were African Americans (compared with 13 percent nationally). Trained facilitators conducted focus group discussions in the cities of South Bend and Fort Wayne as well as additional individual interviews. Participants were concerned about lack of access to health services by poor single males who receive neither work-related insurance coverage nor Medicaid. They also expressed a preference for African-American physicians (Bailey 2000).

Understanding and improving access to health care are important because African Americans tend to be diagnosed at a late stage with various diseases, including breast cancer and prostate cancer. Late diagnosis leads to a higher fatality rate. Some of the diseases for which African Americans have high prevalence rates, such as asthma and lupus, may be related to differential exposure to environmental pollution. In the following section we consider health disparities that arise from geographic/environmental differences.

# Spatial Disparities in Health

Living in certain places is clearly dangerous to your health—prison, for example. The United States has the largest penal system in the world and the highest incarceration rate, with 2.3 million people incarcerated in 2007. Although a high proportion of these are young males, who should be one of the healthiest groups, they are nonetheless at risk of acquiring AIDS and other diseases (Kane and Mason 2001). Russia is another country with a large penal population, among whom multidrug-resistant tuberculosis is rampant (Farmer 1999). Prisons are a special population with special risks, but other institutions also present their own pattern of risk: antibiotic-resistant strains of bacteria in hospitals, meningitis and mononucleosis in college dormitories.

Certain kinds of neighborhoods present obvious risks. Children playing outdoors in neighborhoods near the sites of old metal smelters in mining towns may be at double jeopardy of lead poisoning, from the lead paint in old housing and the lead deposited in the soil in their yards by smelter

smokestacks. Other neighborhood risks that show up in statistical analysis are more subtle. For example, the distribution of childhood asthma across New York City is very uneven. This kind of problem begs for close biocultural analysis, taking into account income, ethnicity, housing, and even the density of trees lining urban streets (Lovasi et al. 2008). Adult health also reflects spatial disparities. The incidence of coronary heart disease, for example, has been shown to vary with the neighborhood of residence, even when income and ethnicity are held constant (Diez Roux et al. 2001).

## Paying the Costs of Industrial Development

The urban poor are likely to pay more than their share of the health costs of industrial development, though hardly anyone in the world today can escape taking into his or her body air or water containing the toxic by-products of industry. When a disease is increasing rapidly in incidence, particularly among children and young adults, we have to suspect that there may be a link to some relatively recent industrial development. A cluster of rare congenital defects of the heart in Silicon Valley in California was very directly related to pollution of the water supply by chemical by-products of computer production.

Long after an industrial plant, a mine, or a dump site closes, it may leave behind a toxic legacy that continues to affect health in unknown ways. The most famous example is probably Love Canal, a neighborhood in Niagara Falls, New York, where houses and schools were built unknowingly on a site contaminated by chemical wastes. The exact dimensions of the health effects of Love Canal are not knowable because it is not possible to establish with any certainty who was exposed to what amounts of which chemicals, but low birthweight, miscarriages, and congenital defects seem to be the statistically most readily demonstrable outcomes (New York State Department of Health 2006).

What we do know is that Love Canal and its residents who struggled for answers to those questions played a key role in history through the establishment of the Superfund programs of the federal and state governments for the cleaning up of hazardous waste sites. The following profile discusses another area in upstate New York where both state and federal Superfund sites are undergoing cleanup after industrial development contaminated a region of great natural beauty and threatened the health of Native Americans living there. (See Fig. 9.8.)



FIGURE 9.8 Akwesasne is a region of great natural beauty, as is evident in this photograph of Stanley Island. Because of threats to the environment, the tribal government developed an active Environmental Department. Photo courtesy of Lawrence Schell.

# ROFILE: HAZARDOUS WASTE AND THE MOHAWKS AT AKWESASNE \_\_\_\_\_

In making any law, our chiefs must consider three things: the effect of their decisions on peace; the effect on the natural world; and the effect on seven generations in the future.

(Source: Carol Jacobs, Cayuga Clan Mother, as quoted by the Akwesasne Task Force on the Environment Research Advisory Committee 1997)

Along the St. Lawrence River in northern New York State and Ontario and Quebec in Canada lies the territory of the Mohawk Nation, Akwesasne. (See Fig. 9.9.) Though Mohawks in urban areas have been famous for decades as ironworkers on skyscrapers, in Akwesasne the Mohawks retain a strong relationship with the beautiful natural environment of their homeland. The approximately 12,000-member community of Akwesasne continues to depend on the fish, wildlife, farmland, and plants of this territory.

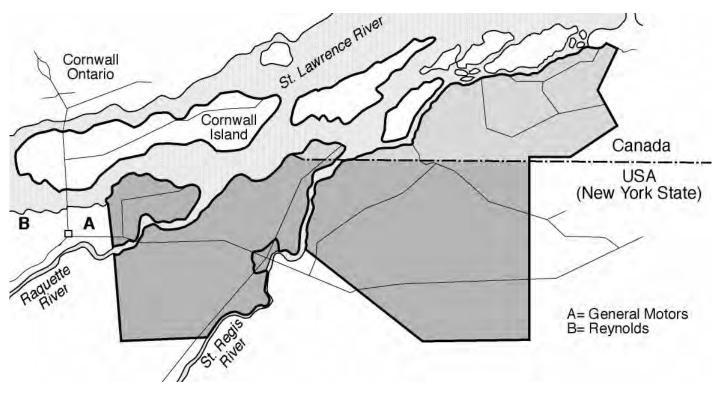


FIGURE 9.9 Akwesasne is located in northern New York State on the border with Canada.

The building of the St. Lawrence Seaway and a hydroelectric dam in the 1950s opened up ports in the Great Lakes to oceangoing vessels and fostered industrial development along the Seaway. Reynolds and ALCOA built aluminum plants to take advantage of the cheap electric power. General Motors (GM) opened a plant at Massena, New York, just upstream from Akwesasne. Together these industries contaminated a large area with polychlorinated biphenyls (PCBs) and other toxic chemicals. The Akwesasne community was engulfed by industrial pollution.

PCBs are a group of related organic chemicals that differ in the number and arrangement of ring chlorine substitutions. (Generally speaking, those forms with more chlorine are more toxic.) Until federal laws restricted the use of PCBs in the late 1970s, they were widely used in industry, especially in electric transformers. The GM plant, which was originally built to produce aluminum cylinder heads for the Corvair, an automobile produced from 1960 to 1969, had die-casting machines that used hydraulic fluids containing PCBs until 1980. As a result of careless disposal practices, GM contaminated four industrial lagoons, two disposal areas, and a landfill. Because the lagoons and landfills were not lined with a barrier that would keep them from leaking, ultimately the drainage from them polluted the adjacent wetlands and rivers and contaminated soil and sediment in Akwesasne territory located immediately downstream from the plant. (See Fig. 9.10.)

The United States Environmental Protection Agency (EPA) added the General Motors site to the National Priorities List in 1983, and General Motors was required to clean it up under the federal Superfund program. (The Reynolds and ALCOA sites became New York State Superfund sites.) Under this program the U.S. government negotiated with General Motors about the level of cleanup that would be required. Planning for remediation was conducted in two stages, dealing with two parts of the large site. The St. Regis Mohawk Tribe agreed to the first part of the plan in 1990. The second plan, first proposed in 1992, was not acceptable to them because it proposed capping the landfill rather than excavating and moving the contaminated material. To reduce their costs, GM also lobbied the EPA for relaxed standards on the amount of PCB contamination that would be tolerated. After strong public opposition to GM's proposals, the EPA finally reached an agreement to dispose of dredged sediments and excavated contaminated soils offsite. The final stages of the cleanup began in 2000. Meanwhile, for several decades the Mohawks had been exposed to unknown levels of contaminants, a classic case of environmental injustice.



FIGURE 9.10 Industrial development near Akwesasne. The locks along the St. Lawrence Seaway are shown. Photo courtesy of Lawrence Schell.

PCBs have a wide range of possible effects on human health, including neurotoxicity, disturbing endocrine pathways, impairing immune function, and reducing physical growth and maturation (Gallo et al. 2002). Infants are especially likely to be vulnerable to toxic chemicals. They can be exposed to them during development in utero and from breast milk. After tests indicated the presence of PCBs in fish and wildlife, the St. Regis Mohawk Environmental Health Department issued an advisory in July 1986 warning women of childbearing age and children under fifteen against eating any fish taken from the St. Lawrence River. Other persons were advised to eat no more than one meal per week of fish caught in any of the area waters. On behalf of concerned mothers, Mohawk midwife Katsi Cook worked with scientists to arrange testing of breast milk. The studies showed that at Akwesasne from 1986 to 1990 mothers' milk did indeed contain PCBs at significantly higher levels than levels in a control group.

Discovering that their local fish, wildlife, and vegetation—in other words, their whole subsistence system—might be contaminated was devastating.

People did respond to the health advisory and pregnant women reduced their consumption of local foods. The contamination of breast milk declined after 1990. Is this a health education success story? Not exactly. Diabetes and heart disease are on the increase. Low-fat, high-protein fish was replaced by less healthful foods from stores and fast food outlets. A whole set of activities promoting outdoor exercise was lost, along with the social, cultural, and religious meaning of these activities (Tarbell and Arquette 2000). Reflecting these changes in diet and activity, Akwesasne youth are overweight (Gallo et al. 2005).

Research has begun to document the effects on youth of low-level exposure to PCBs at Akwesasne, research that involves the people of Akwesasne as full partners with the scientists from the State University of New York at Albany. Goals for the research were set in partnership, the data are collected by research assistants who are members of the community, and results are presented at community meetings and published in partnership (Schell and Tarbell 1998; Schell et al. 2007). The biological anthropologist on the research team is Lawrence Schell, who was already well known for his work on the ecology of stress in urban environments. Schell argued that the physical anthropologist's traditional anthropometric toolkit for measuring the growth of children is especially useful for assessing the effects of exposure to toxic chemicals. Comparisons of growth patterns may detect community-wide effects of chemicals before they are detectable by statistically significant changes in patterns of disease or death (Schell 1997). Because the numbers of people affected at any one site are relatively small, the careful investigation and analysis of a reported cluster of childhood cancer or another disease is unlikely to reach statistical significance.

In the Mohawk youth study, a random sample of 117 Mohawk young people, ages ten to sixteen, was measured and weighed. Their blood was drawn to measure PCB levels, lead, other toxins, and thyroid hormones. The investigators found that there was an inverse relationship between growth and PCB levels that was statistically significant. The higher the concentration of PCBs in the blood serum, the lower the BMI (body mass index). Because these are adolescents, the effect of the PCBs can be seen as a delay in development. What is the mechanism by which PCBs affect development? The measurement of thyroid hormones suggests that PCBs alter the functioning of the thyroid gland (Gallo et al. 2002; Schell et al. 2002). A more recent finding is that a particular subgroup of PCBs mimics estrogen. Exposure to these PCBs leads to earlier onset of menstruation in Mohawk girls (Schell et al. 2007).

Larry Schell's work with Mohawk youth at the General Motors Superfund site is an excellent example of how a biological anthropologist can contribute to the study of the effects of hazardous waste. Cultural anthropologists and sociologists have also studied Superfund sites, usually documenting the struggles of local communities to understand the threats to their health and to organize at the grassroots level to seek solutions to the environmental damage.

There is a great deal of room for further work by medical anthropologists in communities affected by pollution. We need to understand better how people perceive environmental risk. We do know that people often overestimate the risks of industrial toxins while underestimating other risks, such as indoor air pollution from naturally occurring radon and cigarette smoking. Yet many hazardous waste sites would not have been identified or cleaned up without vigorous action from the grassroots. Neighborhood groups carried out their own studies of "popular epidemiology," to use a term coined by sociologist Phil Brown. Concerned residents went door-to-door collecting data about health problems in their neighborhood. Their work raised awareness of the issues but often also revealed fault lines of conflict within the neighborhood between those who denied and those who exaggerated the dangers. Such conflicts produce stress, but working together to solve problems also increases the social support and sense of mastery that are helpful in coping with the inevitable stress of living in a contaminated neighborhood.

In culturally diverse communities, different ethnic groups may perceive the health risks of pollution very differently as well as having different perceptions of resources available for preventing and treating illness. Among the anthropologists who have studied this kind of diversity is the Kenyan-born anthropologist Simeon Chilungu (1974). Chilungu compared two groups, African Americans and Yemeni Arabs, both of whom had migrated to the Lake Erie city of Lackawanna, New York, to work in the steel mills, and found that the two groups differed greatly in their perceptions of health problems. Blacks listed sexually transmitted disease, hypertension, drug addiction, and heart disease as the most important community health problems, while Arabs listed cancer, colds and flu, headaches, and STDs as most important. Both groups had access to county health clinics. The two groups also differed in perception of the urban environment's effect on their health. Arabs viewed life in the United States as better in many ways than in their

native country, while blacks perceived conditions more negatively, even prior to the closing of the steel plants in the mid-1980s.

### The Anthropology of Trouble

The pollution, closed industrial plants, and worries about threats to their health experienced by persons living in communities near hazardous waste sites, along with other modern ills such as substance abuse, homelessness, and teen pregnancies, are all encompassed by the expression "trouble" as used by Roy A. Rappaport (1993). Rappaport felt that anthropologists were ready to identify some of the deeper underlying social disorders, the maladaptations of modern society. These disorders afflict America, Europe, and Japan and are spreading globally.

One of the maladaptations identified by Rappaport is *overspecialization* of subsystems. We have seen this when small countries become dependent on a single export crop, increasing vulnerability to malnutrition. Yet another type of maladaptation is *hypercoherence*, defined as the increasingly tight integration of more inclusive systems. The improved transportation and communication networks that go along with economic development contribute to this. As a result, disruptions anywhere in the system spread very quickly, for example, viruses that are able to spread quickly because of urbanization and air travel.

The significance of Rappaport's effort is that it shows that anthropology, especially an anthropology taking an ecological perspective, can offer more than just a collection of narrowly applied studies attempting to shed light on specific problems one at a time. This approach is sometimes spoken of as **public anthropology**, to distinguish it from a narrower vision of an applied anthropology that tackles local problems one at a time in practical ways.

# Global Environmental Change

Major global environmental changes include climate change, acid rain, ozone depletion, loss of biodiversity, deforestation, and land degradation. While the existence of all of these changes is undisputed, people and governments differ on their perceptions of the pace of the change and the urgency of action to reverse them; that is, on the price they are willing to pay in the present to protect the future global environment. In this section we will consider some of the effects on human health of large-scale environmental changes.

One of the global processes that affects health is the *depletion of ozone* in the stratosphere, which allows ultraviolet radiation to reach the earth's surface

more readily. The ozone layer is an accumulation of the gas ozone, a molecule composed of three oxygen atoms  $(O_3$ , compared to the ordinary oxygen in the atmosphere,  $O_2$ ). Ozone is a very unstable gas, reacting readily with other gases in the atmosphere, especially chlorine. The rapid erosion of the ozone layer has in recent years been marked most dramatically by the opening of an "ozone hole" over Antarctica but is less spectacularly observable as a decrease in the concentration of ozone everywhere.

The ozone layer performs a protective function for living organisms, absorbing from sunlight the most harmful wavelength of ultraviolet radiation, UV-B. UV-B does most of its damage to organisms in the first few layers of cells. In humans, the damage of increased exposure to UV-B takes the form of skin cancer, suppression of the immune system, and damage to the eyes. Eye damage includes temporary "snow blindness," which can be thought of as sunburn of the cornea, as well as the gradual formation of cataracts, making the lens of the eye opaque.

The increase in chlorine in the atmosphere that depleted the ozone layer was largely the result of the sharp increase in the industrial production of chlorofluorocarbons (CFCs) between 1950 and 1989. After the damage from CFCs began to be recognized, in 1978 the United States passed a law prohibiting the use of CFCs as propellants in aerosol cans. This eliminated the largest source of CFCs at that time; nonetheless the total of CFC production continued to rise because of CFCs used in refrigerators and air conditioners. The ozone layer is not expected to recover for several decades.

Another global process of the industrial era is *climate change*. This is the effect of a blanket of carbon dioxide and other gases making up an increasing proportion of the atmosphere. A significant source of these gases is the burning of petroleum and coal. Even the brief heat waves that we experience from time to time show how seriously a rise in temperature affects health. For example, when temperatures in Chicago reached 108°F (42.5°C) in July 1995, more than 580 unprepared people, mostly elderly, died of heat-related illness. As global warming continues, it will be experienced less as a change in air temperature than as an increase in the number of severe weather events—storms, droughts, and floods—brought on by changes in ocean temperatures and currents. These events will lead to direct loss of life but also to instability in food supplies. Still another of the effects of long-term global climate change will be an increase in diseases spread by vectors as insects increase their range into areas where people have not developed resistance to these diseases (McMichael 2001).

A third global change that has accelerated in our lifetime is the *loss of biodiversity*. The rapid extinction of plant and animal species is due to human activities, especially the cutting of species-rich tropical forests. These extinctions affect human health in ways that are difficult to measure. In the past, people benefited from plants that had healing properties that could be used directly, for example, quinine for malaria from a plant growing in the tropical forest. Later, chemists who analyzed these traditional medicines were able to synthesize their active ingredients. We do not know what healing plants have been lost before their properties were known. This is, of course, only one small part of what is lost as we move toward an ecologically impoverished "planet of weeds."

### Violence and Terror

"Dirty war" is a graphic description for the use of terror and repression for maintaining control over civilian populations. Dirty war tactics are increasingly used in conflicts within countries by guerrillas as well as by statesponsored armies. "Disappearances" are a typical tactic, leaving families uncertain whether their relative has been kidnapped or killed. Civilians are raped, murdered, or mutilated publicly, as a spectacle to maximize terror in internal conflicts in places such as Bosnia.

Often refugees escaping regimes of terror have experienced torture, so that in any of the relatively peaceful places to which they escape they may continue to experience long-term consequences of torture. Treating the survivors of torture is challenging for the health professions. Like the victims of domestic violence and crime, survivors of torture suffer both physical and psychological trauma that are not always readily diagnosed. In contrast to domestic violence and crime, the law cannot be invoked for help because the violence was state-sponsored (Nordstrom 1992). The striking change in war has been the increasing extent to which arms are turned on civilians rather than being used between two sets of face-to-face combatants. Radioactive fallout does not discriminate between civilians and combatants, even when the nuclear device is aimed at a military target. Even with conventional bombs, the crew of a high-altitude bomber does not see the face of the enemy. Here we will focus on land mines, the modern weapon that most clearly typifies the impact of dirty wars on civilians.

Land mines are extremely cheap, costing a few dollars each. They can therefore be used in large numbers by underfinanced rebels as well as well-financed

armies. Many are made of plastic and cannot be located with a metal detector. Because they are incredibly expensive and difficult to remove, they remain in place for years after the conflict that put them there has been resolved. The countries in which landmines remain a serious hazard include Afghanistan, Angola, Bosnia, Cambodia, Croatia, Georgia, Iraq, Laos, Mozambique, Myanmar (Burma), Nicaragua, Somalia, Sri Lanka, and Sudan.

Some landmines are meant to be set off only by a heavy tank running over them, but most are the anti-personnel type that are set off by someone stepping on them—or by a child picking up a colorful plastic "butterfly" or "bottle cap." They are deliberately designed to maim rather than kill because injured soldiers will burden their comrades, weakening the enemy. But they ultimately injure far more civilians than military, and the numerous amputees place a tremendous burden on the health services, especially in small rural hospitals. (See Fig. 9.11.)

Land mines render agricultural land unusable. The farmers who are displaced often must turn to other economic activities that also expose them to danger from land mines. A large portion of those injured in Cambodia are young men who are opening up new parts of the forest for cutting wood, and others are women gathering bamboo shoots for the market.

Sdeng Phal was a twelve-year-old boy who stepped on a land mine near his village in Cambodia. He was herding his family's two cows when one of the cows ran into the line of trees along the field. Phal knew there were mines in that area, but he felt that he must go after the cow. Cattle were commonly killed by mines, and his family could not stand the financial loss. When Phal stepped on a mine, he lost his right foot, but inexpert use of a tourniquet cut off the blood supply to his leg. By the time he reached the hospital, it was necessary to amputate his leg above the knee. He was given an artificial leg, a solution that can be especially difficult for children because they are growing and the prosthesis needs to be changed frequently (Davies and Dunlop 1994:71–73).

Because their training and interests bridge the social causes and medical consequences of warfare and other forms of violence, medical anthropologists are moving forward to discuss these issues of violence and war. Maria Olujic, an American-educated anthropologist of Croatian ethnicity, went to Croatia at the height of the war in the early 1990s as an official in the Croatian government. After the war had officially ended in Croatia, she continued there and in Bosnia-Herzegovina working as a researcher on violence against women. She interviewed women who survived rape in the war and others, such as health workers and religious leaders, who had knowledge of such violence. Rape held



FIGURE 9.11 Double amputee works in a shop making prosthetic legs, Mozambique. Photo by C. Sattleberger/United Nations High Commission on Refugees.

special terror as a form of torture in that war because ethnic groups of the former Yugoslavia (Croats, Muslims, and Serbs) shared a culture that highly valued female chastity and family honor. Olujic regarded her interviews as testimonies, making hers the solemn task of witnessing to her readers about torture (Olujic 1998).

### Nuclear Dangers

Another medical anthropologist, Glenn Alcalay, quite literally gave testimony to another case of war-related violence against civilians, testifying before the U.S. Presidential Advisory Committee on Radiation Experiments in 1995. Alcalay conducted a thirteen-month health survey in the Marshall Islands, within the Trust Territory of the Pacific Islands. Before beginning the survey, Alcalay had worked there with the Peace Corps. Women told him of stillbirths and miscarriages, describing giving birth to "something resembling the eggs of a sea turtle" or "something like the intestines of a turtle." By conducting formal interviews he was able to establish that in the years since hydrogen bomb testing began in the Marshalls, women living in the northern atolls, closest to the testing on Bikini and Enewetak, had more miscarriages and stillbirths than those living in the southern atolls, farther from the tests (Alcalay 1995).

Much additional work on radiation in the Marshall Islands has been done by Holly Barker, another former Peace Corps volunteer,. Her work at the embassy of the Republic of the Marshall Islands in Washington, DC, has been concentrated on providing documentation for the efforts of the Marshallese population exposed to radiation to get adequate health care through the Nuclear Claims Tribunal. The United States governed the Marshall Islands as part of the UN Trust Territory of the Pacific Islands after World War II until 1986, when the Republic of the Marshall Islands (RMI) became independent. From 1946 to 1958 the U.S. government conducted sixty-seven atomic and thermonuclear tests in the atmosphere in the Marshall Islands. Only recently has fuller information become available about extent of damage from those tests, much of which was previously hidden as classified data (Barker 2007).

Barker has collaborated in her Marshall Islands work with Barbara Rose Johnston, who has been a strong advocate for anthropological work on the radioactive legacy of the Cold War on all its fronts (Johnston 2007). Anthropologists have done fieldwork at several of the sites where human health was threatened by the manufacture, testing, and use of nuclear weaponry. Some of these have become Superfund sites under remediation by the U.S. Department of Energy, such as the huge Hanford site in Washington State.

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Isolated areas of the former Soviet Union such as Chelyabinsk, in the Ural Mountains of Russia, and the Republic of Kazakhstan have an even more daunting legacy of nuclear weapons production and testing. They are hidden by denial and secrecy, and have even less prospect for cleanup than those in the United States.

The peaceful use of nuclear energy, like the manufacture of bombs, also leaves a legacy of wastes, the disposal of which has as yet no satisfactory solution. One less than satisfactory use for the depleted uranium (DU) that is a byproduct of producing enriched uranium is to produce other types of weaponry (David Bell, personal communication.). The extreme density and self-sharpening properties of DU make it suitable as a protective shielding for tanks and as a tip for artillery shells. Exposure to radiation at the lower level contained in DU is of particular concern not only for military personnel using the material but for children exposed at former battlefield sites. Tiny radioactive particles are spread through the dust of an explosion and may also be taken up into the food chain.

### **CONCLUSIONS**

On a global scale, the price of development along the lines followed by the Western industrial nations may be too great for the biosphere to bear. The idea that the finite natural resources of our planet cannot support the present rate of industrial growth, nor the rate of population growth in less-developed countries, has gained acceptance. Yet few countries are willing to give up industrial advances already won, despite the acknowledged health costs of that progress. The new industrialist of a developing nation is likely to respond to talk of limits to growth with the claim, "But now it is our turn to enjoy the earth's resources." The tremendous disparities in wealth and power among nations today mean that talk of constraints on growth is meaningless in the absence of just means of equalization and redistribution.

Yet the prospect of unlimited growth invites science fiction scenarios in which chronic shortages of food, water, and shelter affect humans in every country. But is this science fiction? What would a beggar in India say? Or squatter residents in Santo Domingo? Or families living near a chemical dump in the United States?

These are uncomfortable questions, but they are not to be ignored. Medical anthropology provides unique perspectives and methods for dealing with these problems, whether we choose to do so as social scientists, as health professionals, or as concerned volunteers. Medical anthropology serves as a bridge

for interdisciplinary study of the biological and the cultural needs of human beings, and it provides us with models for understanding the interconnections between those needs, the dynamics of ecological systems, and the processes of human adaptation. In the next chapter, we review roles that medical anthropologists have taken in trying to understand global as well as regional health problems, and we also look at opportunities for the next generation of medical anthropologists to make a difference in finding feasible solutions and effective change.

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# Chapter Ten

# MEDICAL ANTHROPOLOGISTS AT WORK

Meeting the Challenges of the Twenty-First Century



Medical anthropology graduate student Candace Graser at work in Kashmir.

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PHOTO BY PERMISSION OF CANDACE GRASER.

### **PREVIEW**

As the world moved into the twenty-first century, the human species faced many challenges to its survival, some of which were explored in Chapter 9. In this chapter we look in greater detail at careers in medical anthropology that respond to some of these challenges. In the first section we look at the work of *forensic anthropologists*, who use some of the techniques that are already familiar to you from the discussion of paleopathology in Chapter 4. Although most commonly working on the individual victims of homicide, increasingly they are engaged in identifying the multiple remains of victims of terrorist attacks or mass executions.

A second career path explored in this chapter is that of the medical anthropologist at work in understanding and mitigating the AIDS pandemic through work in *international public health*. Finally, we ask how medical anthropologists are beginning to expand their roles to make more effective contributions to the formation of *health policy* in developed countries.

# Violence and Terror: The Work of Forensic Anthropologists

September 11, 2001: Staff members from the New York City Medical Examiner's office were called to the site of the World Trade Center, where airliners had crashed into the Twin Towers. After they parked the car and approached, the South Tower collapsed and debris rained down around them. A young forensic anthropologist, Amy Zelson Mundorff, tried to run, but the force of the impact slammed her against a wall. After a day she was back at work with two black eyes, bruises, stitches, and indelible memories of the disaster. Over the following year, she and fellow staff at the city morgue, aided by anthropologists volunteering from other parts of the country, sorted through the more than 16,000 body parts, attempting to identify the remains of nearly 3,000 persons who died in the terrorist attack (CNN 2002).

Mundorff's undergraduate degree was in archaeology. After working as an archaeologist for a few years, she had gone back to school to get her master's degree in forensic anthropology. With this training in analyzing skeletal remains, prior to 9/11 she was most often assigned to identify the age, sex, and

other features of skeletons unearthed by construction workers in New York City. It must have been excruciatingly difficult to maintain a scientist's professional distance after 9/11, working on the remains from an event that came so close to taking her own life. Mundorff was near the beginning of a career in a field that has gained a great deal of attention, considering that it has relatively few practitioners.

Better known to the public than any medical anthropologists who deal with the living are those who deal with the dead. Forensic anthropologists study the human skeletal remains, the teeth and bones, from the scene of a crime. Medical examiners and pathologists study the soft tissues, though their work sometimes overlaps with that of forensic anthropologists, as decomposition is a continuous process (Burns 1999:4). Any reader of popular mysteries will have met characters who do this work, for example, Dr. Temperance Brennan, the fictional creation of a real forensic anthropologist, Kathy Reichs, a professor at the University of North Carolina at Charlotte. Like the author, the fictional character works on cases in Montreal and in North Carolina. When Dr. Brennan came to television as the lead character in *Bones*, her workplace was relocated to the fictional Jeffersonian Institute in Washington, DC.

Moviegoers who enjoy thrillers are also familiar with the "Body Farm" established at the University of Tennessee for research in forensic anthropology. This natural laboratory helps to improve the accuracy with which forensic scientists can determine how long it takes a body to decompose under different conditions. The effects of insects, larvae, and carnivores on the decaying bodies are vivid reminders of the interaction of the human species with other species in our environment.

Unlike most medical anthropologists, but like physicians, forensic anthropologists are board certified. Although many people have some basic training in the methods of forensic anthropology, at the specialist level it is not a large profession; as of 2007, there were only seventy who were certified by the American Board of Forensic Anthropology, Inc. The forensic anthropologist works on a team with other specialists in examining the physical evidence from crime scenes—experts in ballistics, drugs, and fingerprints—and forensic pathologists, who do autopsies of the recently dead.

The basic skills of the forensic anthropologist are the same as those introduced in Chapter 4 in the discussion of paleopathology and paleodemography. Faced with unfamiliar human skeletal material, the investigator must use teeth and bones to estimate age, identify sex and racial features, and estimate height and weight. Repetitive activities, muscular development, and left- or right-handedness all leave their mark on bone, as do disease and trauma.

Healed injuries can be separated from those that occurred at the time of death and from more recent damage to the dry bone by animals or people who disturbed the grave.

The forensic anthropologist is called in to provide information that will allow authorities to match a single skeleton with the database of missing persons and to determine the cause of death. Or there may be the remains of a large number of people to sort out and identify, such as those who died at the Branch Davidian Compound near Waco, Texas, in 1993. Several forensic anthropologists, including Douglas Ubelaker and Douglas Owsley of the Smithsonian Institution, worked on the recovery and analysis of the victims from the Branch Davidian Compound. Forty of the eighty-three individuals examined could be identified from dental records, fingerprints, or old X-rays; DNA typing was used for identifying the rest. Some of the bodies were badly burned; others had been killed and were buried around the compound before the fire. Many of the young children died huddling in a concrete bunker that had been used to store weapons and ammunition, making the recovery of their bodies dangerous and difficult. The challenge was to distinguish trauma related to the fire from that due to gunshot and shrapnel wounds (Ubelaker et al. 1995).

Identifying soldiers missing in action is another task for forensic anthropologists. New technologies have made it possible to identify remains that would once have been too fragmentary. The U.S. Army's Central Identification Laboratory in Hawaii does this work, continuing to identify remains recovered from Vietnam more than twenty-five years after that conflict ended in 1975. In addition to dental records, which provide the majority of identifications, along with age and stature, the lab can use DNA. Of the two types of DNA in human cells, one begins to break down immediately after death and is of little use in identifying remains that are decades old. This is the nuclear, or chromosomal, DNA, which is derived from both parents. Unlike the nuclear DNA, the mitochondrial DNA in bone is longer lasting. It is derived from the mother's line only. By comparing mitochondrial DNA from bone fragments with DNA sequences from maternal relatives of soldiers suspected to be missing in action, the labs have a powerful tool for confirming identity.

# Anthropologists and Human Rights

The techniques that are used to identify victims of accidents and crimes found a new application beginning in 1984, when a forensic anthropologist was invited to investigate mass graves in Argentina. From 1976 to 1983, dur-

ing Argentina's "Dirty War," more than 10,000 civilians disappeared, victims of its military regime. Clyde Snow, a forensic anthropologist from Oklahoma, directed the effort to excavate mass graves, identify the *desaparacedidos* (those who had disappeared), and document the torture and killing so that those responsible could be prosecuted. The Argentinean atrocities were only the first of a series of human rights investigations that Clyde Snow and other forensic anthropologists would carry out (Snow 1995).

Snow later investigated human rights abuses in Sri Lanka, Iraq, El Salvador, Guatemala, and Mexico. In Yugoslavia he testified before a war crimes tribunal about his examination of skeletons from a mass grave site near Vukovar. Yugoslav army officers were charged with taking more than 200 male patients and staff from a hospital and brutally murdering them in 1991 when Serb forces entered the city. In Guatemala, Snow worked with local teams exhuming many unmarked graves of young male Maya Indians, most of them victims of shooting at close range. Whether or not those responsible can be prosecuted, finding out what happened helps the families to finish their grieving and move on with life. (See Fig. 10.1.)



FIGURE 10.1 Forensic anthropologist Karen Ramey Burns explains physical evidence, a human jaw, to a Haitian jury at the Raboteau trial in the city of Gonaive, Haiti (2000). An international team of anthropologists was hired by the Haitian Truth Commission in 1995 to recover and identify skeletal remains from victims of massacres related to the military coup. It was the first time physical evidence had been presented in a Haitian court of law and resulted in convictions of sixteen of the twenty-two defendants. Courtroom testimony is part of the work of forensic anthropologists. Photo courtesy of Karen Ramey Burns.

Forensic anthropologists who become involved in international human rights work find that they cannot limit their work entirely to the physical evidence, as they would in working on the usual criminal investigation in their home country. In addition to the physical evidence that allows the victims to be identified and the evidence of trauma interpreted, they must also collect and analyze verbal evidence. For this they use skills typically associated with cultural anthropologists as they talk with family members and others who are present when the burials are exhumed. Sometimes they require an interpreter to do this. They also need cultural information, such as the usual burial customs, so that they can distinguish a normal burial from one done in haste or disrespect (Burns 1999:208).

Forensic specialists are not the only anthropologists who have become involved with questions of human rights. The American Anthropological Association (AAA) has an elected commission that deals with human rights. This commission works to raise the awareness of human rights by presenting programs at the annual meeting of the AAA and through the organization's newsletters and publications. It also conducts investigations and recommends actions in selected cases of violations of human rights. Some of the human rights issues that have engaged medical anthropologists include reproductive rights, gender issues such as female genital cutting and domestic violence, the right to food, and the right to basic medical care. An example of medical anthropologists becoming involved in advocacy in this area is the work of Paul Farmer and his colleagues at Partners in Health, who insist that impoverished persons, whether living in Boston or Lima, Peru, or Russian prisons, are entitled to the same access to treatment for multiple-drug resistant tuberculosis or for AIDS that wealthier persons receive. In his work on human rights, Farmer (2005) speaks of the structural violence that produces extreme suffering, most often among impoverished people suffering the added insults of racism and gender inequality.

The forensic anthropologists discussed in this chapter, like most of the medical anthropologists whose research has been discussed in this book, have found their primary employment in academic institutions, including universities and museums. Teaching and research is usually their main job, interrupted by occasional opportunities to serve as a consultant to a law enforcement agency or as an expert witness. Some of the work of academic medical anthropologists to solve practical problems of health care delivery is funded by work as temporary consultants to a government agency or a not-for-profit organization. Other anthropologists have made full-time careers in the field of applied medical anthropology. The next section of this chapter highlights work by applied

medical anthropologists in the area where their influence has perhaps been greatest: international public health.

# The AIDS Pandemic: Medical Anthropologists in International Health

Medical anthropologists have been engaged in international public health from the very beginning of the discipline. Indeed, in the 1950s and 1960s, that was essentially all that medical anthropology meant: the applied anthropology associated with health projects in developing countries. To gain a sense of what a career in this field might look like today, we consider two medical anthropologists who have worked in international public health on projects related to the AIDS pandemic.

An Anthropologist in International Public Health: The Career Path of Ted Green

Though he has worked as a public health consultant in more than thirty countries from Montenegro to Indonesia and is currently based at Harvard, Edward C. Green is best known for his work as an applied medical anthropologist on projects related to AIDS and other sexually transmitted diseases throughout Africa. Green began his research as a Ph.D. student of cultural anthropology studying religious change among the Maroons, African Americans of Suriname in South America. Shifting to southern Africa, he worked on public health projects in Swaziland between 1981 and 1992 and in Mozambique between 1990 and 1994, mostly funded by the U.S. Agency for International Development (USAID).

Despite their positive goals, many primary care programs encouraged by international agencies in developing countries had only limited success. This was the case in Mozambique, a southeast African country of about 17 million people that organized programs in the 1980s to train village health workers. Returning to the home village with basic medical kits after six months of training, the person received a small salary to give preventive and curative care. However, when economic conditions deteriorated and villages could no longer pay workers, the program almost ceased (Green 1994:123).

One strategy to deal with the problem of continuity of care in the villages is to enlist the support of indigenous healers, who often incorporate Western biomedicine into traditional curing practices. In some developing countries physicians and nurses are opposed to collaboration with traditional healers.

However, Mozambique has taken a different course, establishing a Department of Traditional Medicine in its health ministry and developing a policy of cooperation with traditional healers. Green was active in the research that supported this policy and the projects that implemented it. Surveys showed that 76 percent of doctors were in favor of collaboration with healers, in part because the country had high rates of infant mortality and could not provide adequate biomedical care to rural areas. Mozambique had only one physician per 50,000 people, in contrast to one traditional healer per 200 people (Green 1994).

As in other sub-Saharan African countries, containment of the AIDS epidemic was one of the highest priorities of the Mozambican traditional medicine project. Study of how healers diagnose, classify, and treat STDs is particularly important in the fight against AIDS in African nations for two reasons: (1) Syphilis, gonorrhea, and chlamydia may be major co-factors in AIDS transmissions in sub-Saharan Africa, where 80 percent of AIDS cases are contracted through heterosexual transmission; and (2) most Africans turn to traditional healers for treatment of STDs, and thus these healers could play a critical role in prevention or early detection of HIV infection.

All Mozambican indigenous healers interviewed in 1991 by a research team headed by Green had heard about AIDS, but most had not treated patients infected with HIV. However, all were familiar with other sexually transmitted diseases, not only treating STDs with herbal medicines with some success but also teaching preventive techniques such as limiting sexual contacts. Thus it was feasible to teach healers about AIDS transmission in terms they understood. Since they already classified most STDs as diseases transmitted by *khoma*, an "invisible, tiny causal agent" that carries disease, rather than by witchcraft or evil spirits, it was possible to teach them that AIDS was similar (Green 1994:142). Without having to explain specifically what a virus was, researchers described the human immunodeficiency virus as being like a *khoma*. They emphasized that nonsexual transmission was also possible, for example through multiple use of unsterilized razor blades in scarification, traditional vaccinations, or incisions to treat infections.

Promotion of condom use was a key strategy in this project, as well as in similar projects in other countries, including South Africa. Unfortunately, many Africans resist using condoms, which in Africa may be of poor quality to begin with and which deteriorate under improper storage conditions, leading to breakage during use. But the research team reasoned that if healers could be persuaded to recommend condoms to their patients, acceptance might increase. In workshops, demonstrations showed correct use of con-

doms. Ten months later, healers were reported to be distributing condoms to patients.

In Indigenous Theories of Contagious Disease (1999b), Green makes the theoretical argument that underlies his applied work. While ethnographers have rightly emphasized the prominence of witches, sorcerers, and spirits as supernatural explanations of many types of disease and misfortune throughout Africa, the various contagious diseases are most often explained by some type of pollution beliefs. Green contends that indigenous contagion theory (ICT) does not necessarily reflect the influence of Western biomedicine but is part of traditional ethnomedicine in many cultures, not only in Africa but also South America and Asia. He favors an adaptationist explanation for this. Green argues that, although these beliefs do not correspond exactly with biomedical theories of disease, they are naturalistic and they work: they lead to behaviors that serve to reduce the spread of sexually transmitted diseases and other infectious diseases. If a man avoids having sexual intercourse with many partners or with prostitutes to avoid mystical pollution, he reduces his exposure to sexually transmitted diseases even if he has no concept of viruses or bacteria. Green has found that ICT allows considerably more potential for collaboration between biomedicine and traditional healers than many earlier health workers in Africa had been willing to accept as possible (Green 1999a). (See Fig. 10.2.)

This work, combined with his observations of the relative success of the indigenous model developed in Uganda for AIDS prevention, led Green to campaign actively for a paradigm shift in HIV/AIDS prevention programs in Africa, doing this from his base at the Harvard School of Public Health, where he has held a position as research scientist since 2002. The Ugandan model was a program based on the ABC model of Abstinence First, Be Faithful, and, if not, use a Condom. All of these behavioral changes were promoted and change did occur in all three behaviors during a time when AIDS prevalence also decreased. Green's book Rethinking AIDS Prevention: Learning from Successes in Developing Countries (2003) lays out his approach in detail. Green's support for the Ugandan model put him at odds with most academic HIV/AIDS researchers and with the medical and pharmaceutical establishment. It did, however, gain him a hearing on Capitol Hill, where, beginning in 2003, he has regularly testified on AIDS policy for Africa. It led to an appointment to President Bush's Advisory Committee on HIV/AIDS. Unfortunately for Green, political and religious conservatives only wanted to hear the "A" for Abstinence, requiring Green to try to educate many of his supporters as well as his opponents (Nuti 2006).



FIGURE 10.2 A group of indigenous healers at Makurdi, Benue, Nigeria, meeting with Edward C. Green, who was serving as consultant to a family-planning project (1988). In a collaborative program, the indigenous healers and biomedical personnel shared ideas and "technology" about birth spacing and contraception. Photo Courtesy of Edward C. Green.

An Anthropologist in International Public Health: The Career Path of Carol Jenkins

Carol Jenkins is another medical anthropologist who, like Ted Green, worked to slow the global spread of HIV/AIDS, most recently as AIDS specialist for Asia and the Pacific in USAID. Reporting on the AIDS situation

in Papua New Guinea, she noted that it has the same pattern as AIDS in southern Africa, rather than either the North American or Asian patterns. Why should this be so? There are no historical or cultural connections between the continent of Africa and distant Papua New Guinea in the Pacific islands. The connection they share is poverty. While Papua New Guinea has mineral resources that placed it in the middle-income category among nations in recent years, it is in the nature of mineral income to be unequally distributed, unstable, and unsustainable. Therefore most Papua New Guineans continued to live in poverty despite the mineral exports that benefited a few. Impoverished people in both Papua New Guinea and southern Africa respond to poverty in ways that expose them to disease, particularly sexually transmitted disease. For example, they may live in crowded housing, and they may grant sexual favors to multiple partners in exchange for cash, food, or other gifts. In both areas HIV is primarily spread by heterosexual intercourse, not injection drugs or homosexual contact. AIDS occurs equally in males and females, and, increasingly, in newborns.

The career path that led Carol Jenkins to work on AIDS internationally was similar to that followed by Ted Green, with a few significant differences. Jenkins, like Green, was an American anthropologist, but she began not as a cultural anthropologist but as a physical anthropologist. She completed her doctoral research on malnutrition among children in the Central American country of Belize, measuring and weighing children of four ethnic groups: Maya, Garifuna (Black Carib), Mestizo, and Creole (Afro-Caribbean) (Jenkins 1981).

Shifting her research to Papua New Guinea, as a long-term staff member at the Institute of Medical Research, Jenkins continued working on child nutrition. In child health, nutrition is closely tied to infectious diseases, and therefore it was natural to move in that direction. Her ethnographic research on gastrointestinal disease in children in the Eastern Highlands, for example, found that the best predictor of diarrhea in children was sleeping in the same house with pigs. This was a common practice in Highlands communities, where women had heavy responsibilities for child care, worked in food gardens and cash crops of coffee, and needed to keep a close watch on the pigs, their main family investment, at the same time as they cared for the children, day and night (Jenkins and Howard 1992).

Jenkins also began research with the Hagahai, a newly contacted group of people on the remotest fringe of the Highlands (Jenkins 1988). There she was shocked to find that infant mortality was even higher among these newly contacted people, as Townsend had found among the Saniyo at a similar stage of

contact with outsiders more than twenty years earlier (detailed in the profile in Chapter 4).

In an effort to assure that the Hagahai might benefit from the possible development of vaccines for the infectious diseases that afflicted them, Jenkins and her colleagues discussed with the community the possibility of patenting the Hagahai cell line that contained a unique variant of the human t-lymphatic virus (HTLV–1). The community agreed that patenting was the best approach. When the U.S. National Institutes of Health (NIH) was issued the joint patent claim, the first based on a DNA fragment from an indigenous person, an international controversy erupted. The case became the centerpiece of a discussion about the human rights involved in patenting human genetic material. Although the Hagahai, the researchers, and the NIH all decided to disclaim the joint patent, the bioethical questions raised continue to require discussion and resolution, a debate that has involved many anthropologists (Lehrman 1996).

By the mid-1990s the infectious disease that was of most concern in Papua New Guinea was the emerging AIDS epidemic. Jenkins' research shifted toward the social factors that were critical to prevention of AIDS in the Papua New Guinea setting. Papua New Guinea is still largely rural, with 83 percent of the population living in rural areas and no really large cities. Jenkins found that especially in the towns and in commercialized rural areas such as mines and plantations, young women commonly have sex with multiple partners, exchanging sex for gifts and money and sharing the proceeds with friends and family who struggle with the high cost of living in Papua New Guinea towns. These women would not consider themselves sex workers, nor are there residential brothels, as is typical in Asia. But the women in Jenkins' studies who admitted to exchanging sex for gifts and money also reported having more partners than those who did not. Gang rape frequently occurs, especially in association with alcohol and marijuana. Men in positions of power, such as policemen, also take advantage of their ability to acquire multiple sexual partners. By 1998, in Port Moresby, the capital of Papua New Guinea, AIDS was the most frequent cause of hospital admission and the leading cause of death (Jenkins 2002).

As she continued to do research on HIV/AIDS, Jenkins moved from Papua New Guinea to a more internationally based career, working in Bangladesh, then back in the United States, and then in Southeast Asia. She continued to make regular trips to Papua New Guinea to keep abreast of the situation there. Truly, "she lived her life as a citizen of the world," as her death notice stated, when she died of cancer in Bangkok in 2008 (*Anthropology News*, March 2008, p. 38). (See Fig. 10.3.)



FIGURE 10.3 Cremation ceremony for Carol Jenkins, 2008, Bangkok, Thailand. Permission Courtesy of Aaron Jenkins.

Although Jenkins and Green are both American anthropologists who have done at least some of their work for U.S. aid agencies, it would be a mistake to conclude from this choice of examples that Americans dominate such career paths (or even that American aid is dominant in the health field). In her four years at the Papua New Guinea Institute of Applied Social and Economic Research, Pat Townsend met people from many countries doing research in applied medical anthropology. They came from Australia, England, Malaysia, the Philippines, Canada, the United States, Japan, Germany, and Switzerland, and they worked with Papua New Guinean counterparts and research assistants. Medical anthropology is a truly international discipline.

# Contemporary Medicine and Its Discontents

What do medical anthropologists see when they turn their attention from the desperately underfunded medical systems of countries like Swaziland to the United States, a country that spends more than a thousand times as many dollars per person each year on health care? As this text has already documented, they find some of the same problems of inequality of access to services and difficulty of communication between practitioners and patients that

they encounter overseas. In either setting, many of the same theoretical concepts and fieldwork methods are useful in approaching these issues.

## Practicing Anthropology

Having read this textbook, a student might conclude that most work in medical anthropology is done by people with doctoral degrees doing research in academic settings. That impression is probably unavoidable because textbooks rely on published research, and academics are the ones who tend to be rewarded for publishing the results of their work. Or at least they are punished for not doing so! (Only a few medical anthropologists are rewarded by writing books that become best-sellers like Sheila Kitzinger's guides for pregnancy and childbirth.) The impression that medical anthropology is entirely an academic activity is misleading, because for every academic medical anthropologist there are several practicing anthropologists employed outside the university. These are persons whose main professional training is a Ph.D. or master's degree in anthropology, but they may be working or volunteering in a nonprofit organization, business, or government agency. And for every practicing medical anthropologist there are many more people whose primary professional training and role are in some clinical field, but who have studied some medical anthropology and apply it on a daily basis in their work with individual patients or in making health policy.

The most visible career opportunities for medical anthropologists in developed countries have been as researchers and as educators training future health care providers, either in professional schools or in preprofessional education. Most often their research has been concerned with health care for the most vulnerable groups in society: ethnic minorities, refugees, elderly people, and people with disabilities.

Nurse-anthropologist Margarita Kay worked with Hispanic Americans in the Southwest and compiled a reference book that tells how plant medicines are used by Hispanic Americans and Native Americans throughout the American West. Some are common plants found at roadsides throughout the area. For example, the creosote bush, also called greasewood, is common in the Sonoran Desert. Native Americans and Mexican Americans use it as a tea for people with kidney problems, high blood pressure, uterine cancer, and other conditions. It has many active chemical constituents. One of these is a phenol, NDGA, which is indeed active against bacteria and has analgesic and antitumor activity. Kay is quite careful to avoid suggesting that her work should be used as a guide to self-medication with these plants, many of which have

adverse effects such as liver damage. Her chief purpose is to make health workers aware of plants their patients may be using at the same time that they are taking their prescribed drugs. The plant medicines may interact with the prescribed drugs, with negative effects on health. Kay gives the example of a nurse practitioner who discovered that her Hispanic diabetic patient was using both insulin and an herbal medicine, effectively giving herself a double dose (Kay 1996:5).

Kay's work on medicinal plants epitomizes the kind of contribution that has earned high regard for anthropologists: description that documents the richness of the traditional knowledge of minority or indigenous cultures. But complementary and alternative medicine (CAM) has now become a big business and has entered mainstream culture. In 2002 a national survey indicated that 62 percent of adults in the United States had used some form of CAM in the preceding twelve months, if prayer specifically for health reasons is included. If prayer is excluded from the definition, 36 percent used CAM in the preceding 12 months. Commonly used forms were natural products, deepbreathing exercises, chiropractic care, yoga, massage, and diet-based therapies. The most commonly used natural products were echinacea, ginseng, ginkgo biloba, and garlic supplements (Barnes et al. 2004).

In 1998 the U.S. government established a National Center for Complementary and Alternative Medicine, but anthropologists are not very visible there, even though ethnomedicine has been a long-term anthropological specialty (Marshall 2002). The institute is largely concerned with clinical trials, initially of St. John's Wort, a medicinal plant already used widely in treating depression in Europe. Many medical anthropologists would say that there is a great irony in this. The clinical trial approach is a form of biological reductionism that misses the main reasons that people may be attracted to alternative medicine, that is, they are searching for a "holism that makes mind-body-soul connections" (Baer 2002:405). In the long run, however, both biomedicine and medical anthropology cannot help but both be strengthened by further research to examine the empirical aspects of traditional medicine (Waldstein and Adams 2006). (See Fig. 10.4.)

# Anthropology and Public Policy

The topic of herbal medicines is one that anthropologists have been involved with for a very long time, as they have collected information about plant uses and healing rituals around the world. You might think that it would have been easy for them to have a voice in contemporary discussions of closely



FIGURE 10.4 Parthenium auriculatum B. Wild quinine roots and leaves were used by Native Americans as a medicinal plant for treating burns and dysentery. Drawing from U.S. Department of Agriculture.

related policy questions. Why did this apparently not happen, and how can this be changed? For one thing, most anthropologists had never thought of anthropology as a policy science. Rather than making clear-cut policy recommendations, they were more likely to collect and publish information and let the policy makers make whatever use of it they would.

Anthropologists have generally not been visible when working in policy-related settings at home to the same extent that they have in international positions of the sort held by Ted Green and Carol Jenkins, discussed in the preceding section. Anthropologists have been identified as purveyors of exotic information from remote places, and, even when working within the developed countries, many of them have specialized in ethnic minorities and seemingly esoteric topics. They were less likely to be viewed as authorities on middle-class Americans, who are currently the major users of complementary medicines (Adler 2002).

Determined to take a more active role in policy planning, more anthropologists are seeking to use their research skills to contribute to the solution

of broader social problems. As they succeed in doing so, they will open more opportunities for others to do the same. Medical anthropologists have been working to have an input into health policy in their home cultures, and they are asking how they can do this most effectively. They recognize that to have an effect on policy they need to plan ahead, involving the policy makers from the beginning of their research. They need to understand the way that policy is made, in a dynamic process that involves the people who provide funding, the service providers, and the public (whether defined as clients, patients, or consumers) (Gilbert 1989; Ervin 2005).

What can anthropologists provide that is distinctive from the contributions of disciplines that have historically been more involved with policy, such as economics and political science? Matters of long-standing anthropological research like herbal medicines are not the only ones where a policy-relevant anthropology could have an impact. Take as an example the issue of "managed care." Nothing less exotic could be imagined in the area of health care. HMOs (health maintenance organizations) emerged in the context of market-based medicine in the United States. By the mid-1990s this was the most common form of health care delivery in America and was being exported overseas. Touted as a method for containing costs, it did not seem, in fact, to be working out that way, as costs continued to rise, with more of the cost diverted to the paperwork involved in the administration of the system.

What could anthropologists distinctively contribute in the arena of policy concerning managed care? Our ethnographic methods would be useful, for one thing. There has been relatively little research on the patient's perspective and experience with managed care, particularly of the most vulnerable patients (Rylko-Bauer and Farmer 2002). The care provider's perspective and the culture of medicine could also be studied. Ethnographic research can reveal how health care providers negotiate their way through the managed care system (Horton et al. 2001).

At the Royal Women's Hospital in Melbourne, Australia, researchers in the Key Centre for Women's Health had already established a role for medical anthropologists in studying the health of immigrant and refugee women. They were charting new territory for medical anthropology when they took on a project that could potentially affect policy and practice for the hospital as a whole. They noted that the percentage of surgery that was done as "day surgery" (the Australian equivalent for "out-patient procedure") was steadily increasing. Yet no one had really explored the long-term outcomes of this for women's health. What kind of preoperative care is optimal? What kind of support do women need when they go home from day surgery? (Manderson

2001). Again, anthropologists are looking at the patients' perspective, but with an eye to the administrators and service providers who will need to implement policy change.

### CONCLUSIONS

The pandemic of HIV/AIDS should have been a humbling experience for biomedicine, although its implications do not seem to have been absorbed in the rush to develop new drug therapies and get them into use. Toward the end of the twentieth century, new infectious diseases were emerging each year: AIDS, Ebola, West Nile virus, hantavirus. Among the older diseases, many common bacterial pathogens have developed strains resistant to the antibiotics used to treat them. As medical anthropologist Peter Stephenson (2001:12) expressed it, "[E]very new generation of drugs increases pathogenic resistance in a downward spiral, spreading death and destruction in its wake—along with a generous bonus of increasing dividends for wealthy individuals and corporations." Terrorist attacks with anthrax seemed to forecast even more dangerous attacks to come, such as genetically modified forms of smallpox that would not be preventable by existing vaccinations (Preston 2002).

The image of biomedicine as "fighting," "curing," or "controlling" diseases persists, although it is now obsolete. Insofar as medical anthropology buys into this image of biomedicine, it is also in danger of being obsolete. This is true whether medical anthropology is a helpful handmaiden to biomedicine, assisting health care providers to serve minority populations more effectively, or a strong critic of biomedicine, proposing alternative "cures," whether these are in the form of political change or alternative therapies.

The ecological perspective proposed in this textbook, when followed out to its full implications, would lead to another image of medicine. In this view, humans, pathogens, plants, and animals are all part of complex ecosystems that are beyond the capacity of humans to manage or control. The degrading of ecosystems that has taken place with the spread of industrialization will inevitably lead to declining health, whatever temporary victories may be won by technology on behalf of those individuals who have access to the most up-to-date medical care. Patchwork solutions that provide a drug or other intervention to target a particular pathogen or bodily defect will never be sufficient to promote health for all, for the locus of health is not the individual body but the relationships. It is in the restoration and preservation of those relationships that there is hope for healing. The value of medical anthropology lies in its insistence on looking at human health in the broadest possible context, a

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context that includes the evolutionary history of the human species, the diversity of cultures and societies within which humans develop in body, mind, and spirit, and the ecosystems in which humans live.

### RESOURCES

### Readings

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### Videos

- Anthropologists at Work: Careers Making a Difference. 1993. Video. 36 minutes. National Association of Practicing Anthropologists. American Anthropological Association, Washington, DC.
- Anthropology: Real People, Real Careers. 2006. DVD. 42 minutes. Available from American Anthropological Association, Washington, DC.
- Body Detectives: Forensic Anthropology at the Body Farm. 2000. DVD. 52 minutes. Distributed by Films for the Humanities and Sciences.
- Following Antigone: Forensic Anthropology and Human Rights Investigations. 2002. DVD. 40 minutes. Produced by Witness and the Argentine Forensic Anthropology Team (EAAF). Available on line at www.archaeologychannnel .org. Accessed July 24, 2008.
- No Bone Unturned: Bioarchaeology and Forensic Anthropology. 2003. DVD. 14 minutes. Distributed by Films for the Humanities and Sciences.
- Slave Island: New York's Hidden History. 2002. DVD. 50 minutes. Distributed by Films for the Humanities and Sciences.
- The Talking Skull: Forensic Anthropology. 1999. 26 minutes. Video. Films for the Humanities & Sciences, Princeton, NJ.

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# APPENDIX: PROJECTS IN MEDICAL ANTHROPOLOGY

An excellent way to learn about medical anthropology is to design and carry out a research project, working individually or as a team. In this section we briefly describe projects our students have chosen and enjoyed, and we suggest ways to research various topics.

In most projects, the final paper should differ from a typical term paper. It may be an ethnographic account of volunteer work or a report on a current or past health problem. Often the most effective way to demonstrate and assess learning is to write a personal account of why the student chose the project, how she or he proceeded, the methods attempted, and an evaluation of what was learned.

Some class time should be devoted to discussion of research techniques as well as problems encountered in field situations. Issues of ethics and confidentiality are especially important to discuss. Students need to understand how to safeguard the rights of those they interview or observe. They should secure permission for participation-observation of semi-public settings such as church services. Anonymous surveys require information about the project and ways to contact the student's instructor or advisor printed at the top of the survey. Any projects involving one-on-one interactions with participants (interviews, life histories, linguistic studies) require informed consent.

The instructor should confer with an institutional review board (IRB) that oversees protection of human research participants at his or her institution to ensure that student projects are approved. Most projects will pose little or no risk to participants and may qualify for exempt status, but the IRB must make that decision, not the instructor or the student. The IRB may choose to classify the projects as teaching exercises rather than research.

### Suggested Project Topics

- 1. Ask several elderly people, preferably relatives or neighbors, to talk about their memories of health care in the early and mid-twentieth century. Ask about types of illness, kinds of treatment and practitioners, costs of treatment, communication with practitioners, over-the-counter medications, and home remedies. If appropriate, you may also ask about pregnancy and birth, management of stress and addictions, and how people dealt with terminal illness and death.
- 2. Interview fellow students whose families have cultural traditions different from your own about their family's management of minor health problems such as colds, upset stomach, sunburn, toothache, and so on. Ask about the recipes for home remedies and for special foods like chicken soup, rice and yogurt, and hot rum toddies that are given to sick people.
- 3. Interview people who practice yoga, tai chi, karate, or other disciplines to learn about the history, philosophy, and health benefits of the discipline. If possible, try the exercises or join a class or group to learn from participation.
- 4. Carry out volunteer work, observation, or shadowing in a health setting and keep a confidential journal about your experiences. Examples of health settings are Veterans Administration hospitals, dental clinics, care facilities for elderly, well-baby clinics, and prepared-childbirth classes.
- 5. Learn about programs and resources for people with disabilities by contacting your institution's Office for Disability Services or by contacting agencies in the phone book. By talking with people or by surveying your school's facilities, try to assess whether your college meets the accessibility needs of people with special challenges. Are restrooms handicapped accessible? Where there are stairs, are working elevators close by? Can students get help in reaching materials on library shelves? In your classes, are signlanguage interpreters available?
- 6. From newspapers, magazines, and television, choose a current health problem such as:
  - the early onset of hypertension and diabetes resulting from childhood obesity,
  - public health problems in areas hit by hurricanes,
  - pandemics of SARS or avian flu,
  - the marketing of chemically contaminated milk or bacterially contaminated fresh vegetables,
  - the use of anthrax as a biological weapon

- Study the problem as an anthropologist would, holistically, considering the medical, economic, sociocultural, and psychological components of the impact of this health problem. Also consider the role of media in alerting the public and possibly sensationalizing the problem.
- 7. Using the Human Relations Area Files (which may be housed in paper form at your university library or may be available online) or ethnographies suggested by your instructor, look comparatively at the ethnomedical practices and beliefs of several societies. (We suggest eight or more just to get some variation.) Note differences and similarities in beliefs about illness, use of herbs, nutritional rules and taboos, childbirth practices, care of elderly, ritual healing, and ways of handling death. If possible, compare several hunting-gathering societies with agricultural societies.
- 8. Study a disease that once had a great impact on human societies, such as smallpox, tuberculosis, or plague, and trace the history of the disease, including its social and ecologic impacts. What is the status of the disease today? Under what conditions is it likely to have a resurgence?
- 9. Choose a problem that affects a particular age group in your country, such as older persons with Alzheimer's, children with attention-deficit disorder, or sexually transmitted diseases among teens. You may find online information about these problems, but for historical perspective be sure to look for library books and articles as well. Look for research findings that link ecological, nutritional, or behavioral factors to these problems. If possible, compare recorded rates over time and in different regions. If you were to do research from an ecological perspective on this subject, how would you proceed?
- 10. Identify a problem related to health, think through possible solutions, and take actions that contribute to solving the problem or making people more aware of it. The issue may be local, such as need for a blood pressure screening program or the lack of nutritious snacks in dorm vending machines. Or it may be a world problem, such as the lack of self-sufficiency in food production (as addressed by organizations such as Bread for the World or Heifer Project International). After investigating the issue, you may wish to write letters to newspapers and legislators suggesting a course of action or form an organization on campus that will work toward disseminating information and advocating action.

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