EXPLORATIONS: AN OPEN INVITATION TO BIOLOGICAL ANTHROPOLOGY

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Chapter 1: Introduction to Biological Anthropology

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Learning Objectives

- Define anthropology and the main anthropological approaches.
- Describe the origins and early development of anthropology.
- Identify the four subdisciplines of anthropology and specify the focus of each one.
- Define biological anthropology, describe its key questions, and identify major subfields.
- Explain key components of the scientific method.
- Differentiate between hypotheses, theories, and laws.
- Differentiate science from other ways of knowing.

The first time one of the authors [Katie Nelson] heard of biological anthropology, she was a first-year college student at Macalester College in Saint Paul, Minnesota, taking her first-ever anthropology course. Before she enrolled in the class she didn't really know what *anthropology* meant. She knew it had something to do with people, but didn't know how it all fit together. The course description appealed to her, so she signed up. She quickly learned that anthropology was the study of humans and that it was an incredibly broad discipline that included explorations of cultural diversity, human origins, past human societies, and human languages, among a great many other subjects. She had always been interested in learning about people. She enjoyed observing the different ways people interacted in public spaces, like the mall or the zoo. She enjoyed learning Spanish in high school and loved listening to how people who spoke different languages produced different sounds. She was curious about how people inherited unique characteristics from their parents and was especially intrigued by immigration and migration and what caused people to uproot themselves and move to another part of the world. During the second week of class she began to learn about biological anthropology and some of the leading theories for how and why ancient humans left Africa and migrated throughout the world. As she sat in class, she vividly remembers imagining a small group of ancient humans walking barefoot together through the African savannah. She imagined what they wore, what their language sounded like, how they held hands, how they shared food, and so on. She wondered why they were migrating and what they would miss about their homeland. She was hooked on anthropology!

WHAT IS ANTHROPOLOGY?

Why are people so diverse? Some people live in the frigid Arctic tundra, others in the arid deserts of sub-Saharan Africa, and still others in the dense forests of Papua New Guinea. Human beings speak more than 6,000 distinct languages. Some people are barely five feet tall while others stoop to fit through a standard door frame. In some places,

people generally have very dark skin, in other places, people are generally pale. In some societies, eating pig is strictly prohibited; in others, pork is a rather ordinary food. What makes people differ from one another? What do we all share in common? How are humans different from other primates? How have primates adapted to different places? How and why did humans develop in the first place? These are some of the questions anthropologists try to answer.

Figure 1.1 Despite the many evident differences among people, humans are among the most genetically similar species.

Derived from Greek, the word "anthropos" means "human" and "logy" refers to the "study of." Therefore anthropology, by definition, is the study of humans. Anthropologists are not the only scholars to focus on the human condition; biologists, sociologists, psychologists, and others also examine human nature and societies. However, anthropologists uniquely draw on four key approaches to do their research: **holism**, comparison, dynamism, and fieldwork. Anthropology is an incredibly broad and dynamic discipline. It studies humanity by exploring our past and our present and all of our biological and cultural complexity.

Holism

Anthropologists are interested in the *whole* of humanity, in how various aspects of biological or cultural life intersect. One cannot fully understand what it means to be human by studying a single aspect of our complex bodies or societies. By using a holistic approach, anthropologists ask how different aspects interact with and influence one another. For example, a biological anthropologist studying monkeys in South America might consider the species' physical adaptations, foraging patterns, ecological conditions, and interactions with humans in order to answer questions about their social behaviors. By understanding how nonhuman primates behave, we discover more about ourselves: after all, as you will learn in this book, humans *are* primates! A cultural anthropologist studying marriage in a small village in India might consider local gender norms, existing family networks, laws regarding marriage, religious rules, and economic requisites in order to understand the particular meanings of marriage in that context. By using a holistic approach, anthropologists appreciate the complexity of any biological, social, or cultural phenomenon.

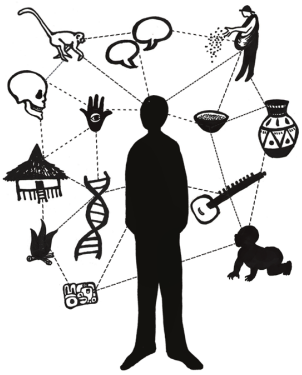

Figure 1.2 By using a holistic approach, anthropologists learn how different aspects of humanity interact with and influence one another.

As we will discuss in more detail, anthropology itself is a holistic discipline, comprised (in the United States) of four major areas of study called **subdisciplines**: cultural anthropology, biological anthropology, linguistic anthropology, and archaeology. We need all four subdisciplines in order to understand the human experience, which involves culture, language, and biological and social adaptations, as well as our history, evolution, and relationship to our closest living relatives: nonhuman primates.

Comparison

Anthropology is a comparative discipline: anthropologists compare and contrast data in order to understand what all humans have in common, how we differ, and how we have changed over time. The comparative approach can be historical: How do humans today differ from ancient *Homo sapiens*? How has Egyptian society changed since the building of the great pyramids? How is the English language adapting to

new modes of communication like smartphones? The comparative approach is also applied to sociocultural phenomena. We can compare the roles of men and women in different societies or different religious traditions within a given society. Some anthropologists compare different primate species, investigating traits shared by all primates (including humans!) or identifying traits that distinguish one primate group from another. Unlike some other disciplines that also use comparative approaches, anthropologists do not just consider our own species or society. Our comparisons span societies, cultures, time, place, and species.

Dynamism

Humans are one of the most dynamic species. Our ability to change, both biologically and culturally, has enabled us to persist over the course of millions of years, and to thrive in many different environments.

Depending on their research focus, anthropologists ask about all kinds of changes: short-term or long-term, temporary or permanent, cultural or biological. For example, a cultural anthropologist might look at how people in a relatively isolated society change in the context of globalization, the process of interaction and interdependence among different nations and cultures of the world. A linguistic anthropologist might ask how a new form of language, like Spanglish, emerges. An archaeologist might ask how climate change influenced the emergence of agriculture. A biological anthropologist might consider how diseases affecting our ancestors led to changes in their bodies. All these examples highlight the dynamic nature of human bodies and societies. While we differ from our ancestors who lived hundreds of thousands of years ago, we share with them this capacity for change.

Fieldwork

Throughout this book, you will read examples of anthropological research that will take you around the world. Anthropologists do not only work in laboratories, libraries, or offices. To collect data, they go to where their data lives, whether it is a city, village, cave, tropical forest, or desert. At their field sites, anthropologists collect data which, depending on subdiscipline, may be interviews with local peoples, examples of language in use, skeletal remains, or human cultural remains like potsherds or stone tools. While anthropologists ask an array of questions and use diverse methods to answer their research questions, they share this commitment to conducting their research out of their offices and in the field.

Figure 1.3 Anthropologist Katie Nelson conducting fieldwork among undocumented Mexican immigrant college students.

A Brief History of Anthropology

Imagine only interacting with people who looked, spoke, and acted like you. Now, how would you begin to understand a seemingly new group of people? As people first began to explore the world, they grappled with how to make sense of human differences. Many were adventurers, missionaries, or traders, motivated by a desire to explore, spread their religion, or acquire wealth. All of them were familiar with only one way of life—their own. It was, therefore, through the lens of their own culture that they viewed people they met during their travels.

Figure 1.4 Caption: Statue of Zhang Qian in Chenggu, China. Zhang Qian is still celebrated today in China as an important diplomat and pioneer of the silk road.

One of the first examples of someone who attempted to systematically study and document cultural differences among different peoples is Zhang Qian (Chang Ch'ien 164 BC – 113 BC). Born in the second century BCE in Hanzhong, China, Zhang was a military officer who was assigned by Emperor Wu of Han to travel through Central Asia, going as far as what is today Uzbekistan. He spent more than 25 years traveling and recording his observations of the peoples and cultures of Central Asia (Wood 2004). The Emperor used this information to establish new relationships and cultural connections with China's neighbors to the West. Zhang discovered many of the trade routes used in the Silk Road and introduced many new cultural ideas, including Buddhism, into Chinese culture.

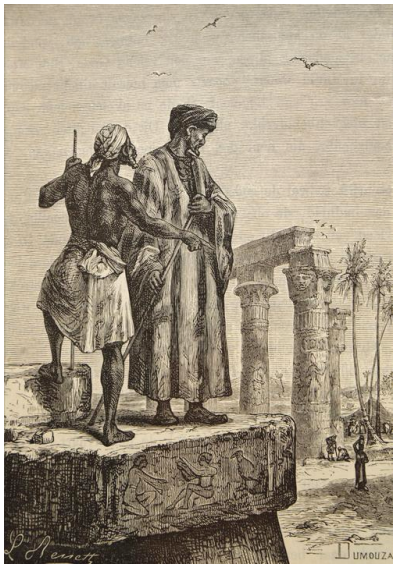

Figure 1.5 An illustration of Abu Abdullah Muhammad Ibn Battuta in Egypt from Jules Verne's book Discovery of the Earth.

Another early traveler of note was Abu Abdullah Muhammad Ibn Battuta (known most widely as *Ibn Battuta*) (1304-1369). Ibn Battuta was an Amazigh (Berber) Moroccan Muslim scholar. Over a period of nearly 30 years during the fourteenth century, Ibn Battuta's travels covered nearly the whole of the Islamic world, including parts of Europe, sub-Saharan Africa, India, and China. Upon his return to the Kingdom of Morocco, he documented the customs and traditions of the people he encountered in a book called *Tuhfat al-anzar fi gharaaib al-amsar wa ajaaib al-asfar* (A Gift to those who Contemplate the Wonders of Cities and the Marvels of Traveling), but became commonly known as *Al Rihla*, which means "travels" in Arabic (McIntosh-Smith 2003: ix). This book became part of a genre of Arabic literature that included descriptions of the people and places visited along with commentary about the cultures encountered. Some scholars consider *Rihla* to be among the first examples of early pre-anthropological writing.

Later, from the 1400s through 1700s, during the so-called "Age of Discovery," Europeans began to not only explore the world but also colonize it. Europeans exploited natural resources and human labor, exerting social and political control over people they encountered. New trade routes, along with the slave trade, fueled a growing European empire, while forever disrupting previously independent cultures in the Old World. European **ethnocentrism**—the belief that one's own culture is better than others—was used to justify the subjugation of non-European societies.

As European empires expanded, new ways of understanding the world and its people arose. Beginning in the eighteenth century in Europe, the Age of Enlightenment was a social and philosophical movement that privileged science, rationality, and empiricism while critiquing religious authority. This crucial period of intellectual development planted the seeds for many academic disciplines, including anthropology. It gave ordinary people the capacity to learn through observation and experience: *Anyone* could ask questions and use rational thought to discover things about the natural and social world.

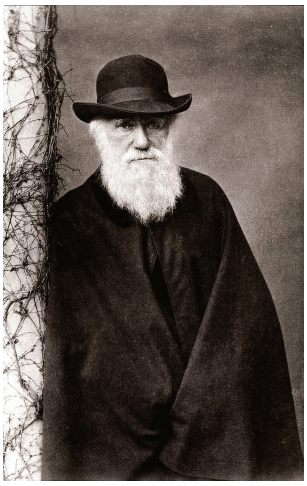

Figure 1.6 Caption: Charles Darwin, circa 1881.

For example, Charles Lyell (1797–1875), a geologist, would observe layers of rock and argue that Earth's surface must have changed gradually over long periods of time, such that it could not be only 6,000 years old (as the Young Earth interpretation in the Bible contends). Charles Darwin (1809–1882), a naturalist and biologist, would observe similarities between fossils and living specimens, leading him to argue that all life is descended from a common ancestor. Philosopher John Locke (1632–1704) would contemplate the origins of society itself. He wrote that people lived in relative isolation until they agreed to form a society in which the government would protect their personal property.

These radical ideas about the earth, evolution, and society influenced early social scientists into the nineteenth century. For example, Herbert Spencer (1820–1903), inspired by scientific principles, used biological evolution as a model to understand social evolution: just as biological life evolved from simple to complex multicellular organisms, he postulated that societies "evolve" to become larger and more complex. Lewis Henry Morgan (1818–1881) argued that all societies "progress" through the same stages of development: savagery–barbarism–civilization. Societies were classified into these stages based on their kinship patterns, technologies, subsistence patterns, and so forth. So-called savage societies, ones that used rudimentary tools and foraged for food, were said to be stalled in their mental and moral development.

Ethnocentric ideas, like those of Morgan, were challenged by anthropologists in the early twentieth century in both Europe and the United States. During World War I, Bronislaw Malinowski (1884–1942), a Polish anthropologist, became stranded on the Trobriand Islands, where he started to do **participant-observation** fieldwork: the method of immersive, long-term fieldwork that cultural anthropologists use today. By living with and observing the Trobrianders, he realized that their culture was not "savage," but rather fulfilled the needs of the people. He developed a theory to explain human cultural diversity: Each culture functions to satisfy the specific biological and psychological needs of its people. While this theory has been critiqued for overemphasizing individuals apart from culture, it was an early attempt to view other cultures in more relativistic ways.

Around the same time in the United States, Franz Boas (1858–1942), widely regarded as the founder of American anthropology, developed the cultural relativistic approach: the view that cultures differ but are not better or worse than one another. In his critique of ethnocentric views, Boas insisted that physical and behavioral differences among so-called racial groups in the United States were shaped by environmental and social conditions, not biology. In fact, he argued, culture and biology are distinct realms of experience: Human behaviors are socially learned, contextual, and flexible, not innate. Further, Boas worked to transform anthropology into a professional and **empirical** academic discipline that integrated the four subdisciplines: cultural anthropology, linguistic anthropology, archaeology, and biological anthropology.

Figure 1.7 Franz Boas, circa 1915.

THE SUBDISCIPLINES

Because human experiences are varied and complex, we need a diversified tool kit to study them. Anthropology therefore comprises four subdisciplines: Some are more scientific (like biological anthropology), while others are more humanistic (like cultural anthropology). The scientific subdisciplines tend to use the scientific method to develop theories that explain human origins, evolution, material remains, or behaviors. The humanistic subdisciplines tend to use observational methods and interpretive approaches to understand human beliefs, languages, behaviors, cultures,

and social organization. Findings from all four subdisciplines contribute to a multifaceted appreciation of human bio-cultural experiences, past and present.

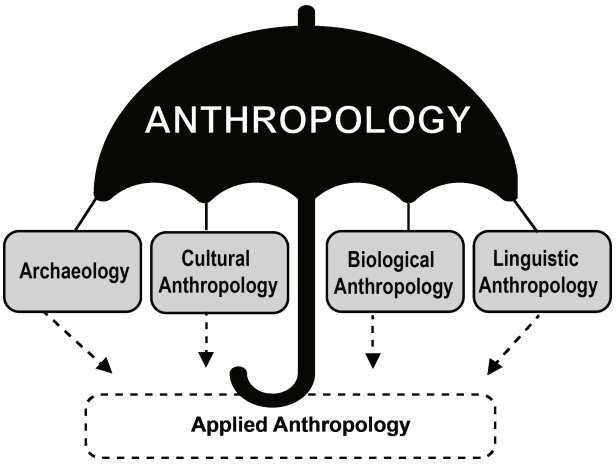

Figure 1.8 The discipline of anthropology has four subdisciplines as well as an applied dimension.

Cultural Anthropology

Cultural anthropologists focus on similarities and differences among living societies. They suspend their own sense of what is "normal" in order to understand the perspectives of the people they study (**cultural relativism**). They learn these perspectives through participant-observation fieldwork: a method that involves living with, observing, and learning from the people one studies. Beyond describing another way of life, cultural anthropologists ask broader questions about humankind: Are human emotions universal or culturally specific? Does globalization make us all the same or do we maintain cultural differences? For cultural anthropologists, no aspect of human life is outside their purview: They study art, religion, healing, natural disasters, video gaming, even pet cemeteries. While many cultural anthropologists are intrigued by human diversity, they realize that people around the world share much in common.

One famous American cultural anthropologist, Margaret Mead (1901–1978), conducted several cross-cultural studies of gender and socialization practices. In the early twentieth century in the United States, people wondered if the emotional turbulence of American adolescence was caused by the biology of puberty (and thus natural and universal) or something else. To find out, Mead set off for the Samoan Islands, where she lived for several months getting to know Samoan teenagers. She learned that Samoan adolescence was not angst-ridden (like it was in the United States), but rather a relatively tranquil and happy life stage. Upon returning to the United States, Mead wrote *Coming of Age in Samoa*, a best-selling book that was both sensational and scandalous (Mead 1928). In it, she critiqued U.S. parenting as overly restrictive, and contrasted it to Samoan parenting, which allowed teenagers to freely explore their community and even their sexuality. Ultimately, she argued that nurture (i.e., socialization) more than nature played a key role in the experience of child development.


Figure 1.9 Margaret Mead, circa 1948.

Cultural anthropologists do not always travel far to provide insight into human experience. In the 1980s, American anthropologist Philippe Bourgois (1956–) wanted to understand how pockets of extreme poverty persist amid the wealth and overall high quality of life in the United States. To answer this question, he lived with Puerto Rican crack dealers in East Harlem, contextualizing their experiences both historically (in terms of socioeconomic dynamics in Puerto Rico and in the United States) and presently (in terms of social marginalization and institutional racism). Rather than blame crack dealers for their poor choices or blame our society for perpetuating inequality, he argued that both individual choices and social inequality can trap people in the overlapping worlds of drugs and poverty (Bourgois 2003).

Linguistic Anthropology

Language is a defining trait of human beings. While other animals have communication systems, only humans have complex, symbolic languages—more than 6,000 of them! Human language makes it possible to teach and learn, to plan

and think abstractly, to coordinate our efforts, and to contemplate even our own demise. Linguistic anthropologists ask questions like: How did language first emerge? How has it evolved and diversified over time? How has language helped us succeed as a species? How does language indicate social identity? How does language influence our views of the world? If you speak two or more languages, you may experience how language affects you. For example, in English, we say: "I love you." But Spanish speakers use different terms—"te amo," "te adoro," "te quiero," and so on—to convey different kinds of love: romantic love, platonic love, maternal love, etc. The Spanish language arguably expresses more nuanced versions of love than the English language

Figure 1.10 From the moment they are born, children learn through language and nonverbal forms of communication.

One intriguing line of linguistic anthropological research focuses on the relationships between language, thought, and culture. It may seem intuitive that our thoughts come first; after all, we like to say, "Think before you speak." However, according to the **Sapir-Whorf hypothesis** (also known as linguistic relativity), the language you speak allows you to think about some things and not other things. When Benjamin Whorf (1897–1941) studied the Hopi language, he not only found word-level differences, but also grammatical differences between Hopi and English tenses. He wrote that Hopi has no grammatical tenses to convey the passage of time. Rather, Hopi language only indicates whether or not something has "manifested." Whorf argued that English grammatical tenses (past, present, future) inspire a linear sense of time, while Hopi language inspires a cyclical experience of time (Whorf 1956). Some critics, like German American linguist Ekkehart Malotki (1938–), refute Whorf's theory, arguing that Hopi do have linguistic terms for time and that a linear sense of time is natural and perhaps universal. At the same time, Malotki recognized that English and Hopi tenses differ, albeit in ways less pronounced than Whorf proposed (Malotki 1983).

Other linguistic anthropologists track the emergence and diversification of languages, while others focus on language use in today's social contexts. Still others explore how language is crucial to socialization: children learn their culture and social identities through language and nonverbal forms of communication (Ochs and Schieffelin 2012).

Archaeology

Archaeologists focus on the material past: the tools, food, pottery, art, shelters, seeds, and other objects left behind by people. **Prehistoric archaeologists** recover and analyze these materials to reconstruct the lifeways of past societies that lacked writing. They ask specific questions like: How did people in a particular area live? What did they eat? What happened to them? They ask general questions about humankind: When and why did humans first develop agriculture? How did cities first develop? What type of interactions did prehistoric people have with their neighbors?

One key method that archaeologists use to answer their questions is excavation—a method of careful digging and removing of dirt and stones to uncover material remains while recording their context. Archaeological research spans millions of years from human origins to the present. For example, Kathleen Kenyon (1906–1978), a British archaeologist, was one of few women working in this field in the 1940s. While excavating at Jericho (which dates back to 10,000 BCE), she discovered city structures and cemeteries built during the Early Bronze Age (3,200 yBP in Europe). Based on her findings, she argued that Jericho is the oldest city continuously occupied by different groups of people (Kenyon 1979).

Figure 1.11 Archaeologists, including Kathleen Kenyon, have helped unearth the foundations of ancient dwellings at Jericho.

Historical archaeologists study recent societies using material remains to complement the written record. For example, the Garbage Project, which began in the 1970s, is an archaeological project based in Tucson, Arizona. It involves excavating a contemporary landfill as if it were a conventional dig site. Archaeologists found a difference between what people say they throw out and what is actually in their trash. In fact, many landfills hold large amounts of paper products and construction debris (Rathje and Murphy 1992). This finding has practical implications for creating more environmentally sustainable waste-disposal practices.

Biological Anthropology

Biological anthropology, which will be thoroughly introduced later in this chapter, is the study of human origins, evolution, and variation. Some biological anthropologists focus on our closest living relatives: monkeys and apes. They examine the biological and behavioral similarities and differences between nonhuman primates and human primates (us!). Other biological anthropologists focus on extinct human species, asking questions like: What did our ancestors look like? What did they eat? When did they start to speak? And, how did they adapt to new environments?

Figure 1.12 Chimpanzees are the nonhuman primate that is most closely related to humans.

Many biological anthropologists explore how human genetic and phenotypic (observable) traits vary in response to environmental conditions. For instance, Nina Jablonski (1953–) asks why darker skin pigmentation is more prevalent in high ultraviolet (UV) contexts (like Central Africa), while lighter skin pigmentation is more prevalent in low UV contexts (like Nordic countries). She explains this pattern in terms of the interplay among skin pigmentation, UV radiation, folic acid, and vitamin D. In brief, UV radiation breaks down folic acid, which is essential to DNA and cell production. Dark skin helps to block UV, thereby protecting the body's folic acid reserves in high-UV contexts. Light skin evolved when humans migrated out of Africa to low-UV contexts, where dark skin blocks too much UV radiation, compromising the body's ability to absorb vitamin D from the sun (vitamin D is essential to calcium absorption and a healthy skeleton). Jablonski shows that the spectrum of skin pigmentation that we see today evolved to balance UV exposure with the bodily need for vitamin D and folic acid (Jablonski 2012).

Figure 1.13 Human skin color ranges from dark brown to light pink.

While some biological anthropologists study **hominins** (modern-day humans and human ancestors), others focus on nonhuman primates. For example, Jane Goodall (1934–) has devoted her life to studying wild chimpanzees (Goodall 1996). Beginning in the 1960s when she began her research in Tanzania, Goodall challenged widely held assumptions about the inherent differences between humans and apes. At the time, it was assumed that monkeys and apes lacked the social and emotional traits that made human beings such exceptional creatures. However, Goodall discovered that, like humans, chimpanzees also make tools, socialize their young, have intense emotional lives, and form strong maternal-infant bonds. Her work highlights the value of field-based research in natural settings as it can reveal the complex lives of nonhuman primates. Throughout this book, we will learn about many examples of biological anthropological research that explores our earliest ancestors, our evolution, and our nonhuman primate cousins.

Applied Anthropology

Sometimes considered a fifth subdiscipline, applied anthropology involves the practical application of anthropological theories, methods, and findings to solve real-world problems. Applied anthropologists are employed outside of academic settings, in both the public and private sectors, including business or consulting firms, advertising companies, city government, law enforcement, the medical field, nongovernmental organizations, and even the military.

Applied anthropologists span the subdisciplines. An applied archaeologist might work in cultural resource management to assess a potentially significant archaeological site unearthed during a construction project. An applied cultural anthropologist could work for a technology company that seeks to understand the human-technology interface in order to design better tools.

Medical anthropology is an example of both an applied and theoretical area of study that draws on all four subdisciplines to understand the interrelationship of health, illness, and culture. Rather than assume that disease resides only within the individual body, medical anthropologists explore the environmental, social, and cultural conditions that impact the *experience* of illness. For example, in some cultures, people believe that illness is caused by an imbalance within the community. Therefore, a communal response, such as a group healing ceremony, is necessary to restore the health of the person *and* the group. In other cultures, like mainstream U.S. society, people typically go to a doctor to find the biological cause of an illness and then take medicine to restore the individual body.

Figure 1.14 Paul Farmer in Haiti (right).

Trained as both a physician and medical anthropologist, Paul Farmer (1959–) demonstrates the potential of applied anthropology. During his college years in North Carolina, Farmer's interest in the Haitian migrants working on nearby farms inspired him to visit Haiti. There, he was struck by the poor living conditions and lack of health care facilities. Eventually, as a physician, he would return to Haiti to treat diseases, like tuberculosis and cholera, that were rarely seen in the United States. As an anthropologist, he would contextualize the suffering of his Haitian patients in relation to the historical, social, and political forces that impact Haiti, the poorest country in the Western Hemisphere (Farmer 2006). Today, he not only writes academic books about human suffering, he also takes action. Through the work of Partners in Health, a nonprofit organization that he cofounded, he has opened health clinics in many resource-poor countries and trained local staff to administer care. In this way, he applies his medical and anthropological training to improve people's lives.

WHAT IS BIOLOGICAL ANTHROPOLOGY?

The focus of this book is the anthropological subdiscipline of biological anthropology, which is the study of the human species from a biological perspective. Biological anthropology uses a scientific and evolutionary approach to answer many of the same questions all anthropologists are concerned with: What does it mean to be human? Where do we come from? Who are we today? Biological anthropologists are concerned with exploring how humans vary biologically, how humans adapt to their changing environments, and how humans have evolved over time and continue to evolve today. Some biological anthropologists also study nonhuman primates to learn about what we have in common and how we differ.

You may have heard biological anthropology referred to by another name—physical anthropology. Physical anthropology is an area of research that dates to as far back as the eighteenth century, when it focused mostly on physical variation among humans. Some early physical anthropologists were also physicians interested in comparing and contrasting human skeletons. These researchers dedicated themselves to measuring bodies and skulls (anthropometry and craniometry) in great detail. Many also acted under the misguided and oftentimes racist belief that human biological races existed and it was possible to differentiate between, or even rank, such races by measuring differences in human anatomy. Most anthropologists today agree that there are no biological human races and that all humans alive today are members of the same species and subspecies, *Homo sapiens sapiens*. We recognize that the differences we can see between peoples' bodies are due to a wide variety of factors, including our environment, our diet, the activities we engage in, and our genetic makeup.

Figure 1.15 An anthropometric device used to measure a subject's head, circa 1913.

The subdiscipline has changed a great deal since these early years. Biological anthropologists no longer set out to identify human differences in order to assign people to groups, like races. The focus is instead understanding how and why human and primate variation developed through evolutionary processes. The name for the subdiscipline has transitioned in recent years to reflect these changes. Many believe the term biological anthropology better reflects the subdiscipline's focus today, which includes genetic and molecular research. Nevertheless, the term physical anthropology is still common.

The Scope of Biological Anthropology

Just as anthropology as a discipline is wide ranging and holistic, so too is the subdiscipline of biological anthropology. There are at least six **subfields** within biological anthropology. Each subfield focuses on a different dimension of what it means to be human from a biological perspective. Through their varied research in these subfields, biological anthropologists try to answer the following key questions:

- What is our place in nature? How are we related to other organisms? What makes us unique?
- What are our origins? What influenced our evolution?
- How and when did we move/migrate across the globe?
- How are humans around the world today different from and similar to each other? What influences these patterns of variation? What are the patterns of our recent evolution and how do we continue to evolve?

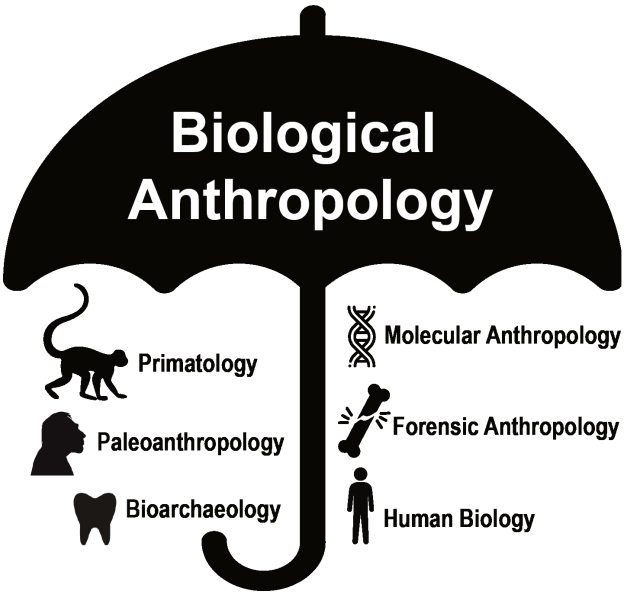

Figure 1.16 Biological anthropology has at least six subfields.

The terms *subfield* and *subdiscipline* are very similar and can be confusing because they are often used interchangeably. In this book we use *subdiscipline* to refer to the four major areas of focus that make up the discipline of anthropology: biological anthropology, cultural anthropology, archaeological anthropology, and linguistic anthropology. When we use the term *subfield* we are referring to the different specializations within biological anthropology. These subfields include primatology, paleoanthropology, molecular anthropology, bioarchaeology, forensic anthropology, and human biology.

Primatology

Primatologists study the anatomy, behavior, ecology and genetics of living and extinct nonhuman primates, including apes, monkeys, tarsiers, lemurs, and lorises, because nonhuman primates are our closest living biological relatives. The research done by primatologists gives us insights into how evolution has shaped our species and primates in general. Through such studies we have learned that all primates share a suite of traits. Primates, for instance, have nails instead of claws, have hands that can grasp and manipulate objects, invest great amounts of time and energy in raising just a few offspring, and have complex social behaviors.

Similar to Jane Goodall's studies of wild chimpanzees, Dian Fossey's research among mountain gorillas provided scientists with some illuminating insights into our primate cousins. She learned, for instance, that gorillas are like humans in that they have families and form strong maternal-infant relationships. Gorillas mourn the death of their group members, and also exhibit behaviors similar to humans such as playing and tickling. Importantly, the work of Dian Fossey, Jane Goodall, Karen B. Strier (see Appendix B), and others focus on primate conservation: They have brought attention to the fact that 60% of primates are currently threatened with extinction (Estrada et al. 2017).

Figure 1.17 Adult male mountain gorillas feeding on insects. Notice how similar his fingers are to your own fingers.

Paleoanthropology

Paleoanthropologists study human ancestors from the distant past to learn how, why, and where they evolved. Because these ancestors lived before there were written records, paleoanthropologists have to rely on various types of physical evidence to come to their conclusions. This evidence includes fossilized remains (particularly fossilized bones), artifacts such as stone tools, and the contexts in which these items are found. Paleoanthropologists have made some monumental discoveries that have shaped the way we understand **hominin** evolution (hominin refers to humans and fossil relatives that are more similar to us than chimpanzees).

Figure 1.18 Donald Johanson and an Australopithicus fossil skull.

One such discovery was made in Ethiopia in 1974 by paleoanthropologist Donald C. Johanson. He found the remains of a 3.2-million-year-old fossilized skeleton he named Lucy (she was named after the Beatles song "Lucy in the Sky with Diamonds," which the archaeologists played repeatedly at the celebration the evening after her discovery). Lucy was a remarkable find because she represented a new hominin species, *Australopithecus afarensis*, and the skeleton was over 40% complete. Like humans, she was **bipedal** (walked on two legs) and likely used tools. However she had a much smaller brain than humans, larger teeth and likely spent time in trees and on the ground. She was, in many ways, a transitional species between humans and earlier primates.

Since the discovery of Lucy, several hundred more *Australopithicus* fossils have been found in Africa, as you will learn more about in chapter nine. From these finds, we know that many *Australopithicus* species flourished for millions of years. Some of these species likely led to our genus (*Homo*), while others appear to have died off. These findings helped us learn that human evolution did not occur in a simple, straight line, but branched out in many directions. Most branches were evolutionary "dead ends." Humans are now the only hominins left living on planet Earth. Paleoanthropologists frequently work together with other scientists such as archaeologists, geologists, and paleontologists to interpret and understand the evidence they find. Paleoanthropology is a dynamic subfield of biological anthropology that contributes significantly to our understanding of human origins and evolution.

Molecular Anthropology

Molecular anthropologists use molecular techniques (primarily genetics) to compare ancient and modern populations and to study living populations of humans and nonhuman primates. By examining DNA sequences in different populations, molecular anthropologists can estimate how closely related two populations are, as well as identify population events, like a population decline, that explain the observed genetic patterns. This information helps scientists trace patterns of migration or identify how people have adapted to different environments over time.

Some exciting work that molecular anthropologists are doing today is studying the genetic material they find in ancient specimens. From this work we have learned, for instance, that many people in the world today have inherited some DNA from Neanderthals and/or a newly discovered species known as Denisovans. This tells us that at some point in our ancient past our modern human ancestors mated with Neanderthals and Denisovans and their genes were passed down to us. Moreover, it is now believed some of these genes helped our human ancestors survive.

From the work of molecular anthropologists we have also learned which genes distinguish us genetically from our closest living relatives: chimpanzees, bonobos, and gorillas. In the case of chimpanzees, our genomes are somewhere between 96% and 99% identical (Prufer et al. 2012; Relethford and Bolnick 2018). Yet that 2-4% contributes to a lot of physical (morphological) and behavioral differences! Molecular anthropology is a field changing quickly as new techniques and discoveries shape our understanding of ourselves and our nonhuman primate cousins.

Bioarchaeology

Bioarchaeologists study human skeletal remains and the soils and other materials found in and around the remains. They use the research methods of skeletal biology, mortuary studies, osteology, and archaeology to answer questions about

the lives and lifeways of past populations. Through studying the bones and burials of past peoples, bioarchaeologists search for answers to how people lived and died. For example, bioarchaeologists can estimate the sex, height, and age at which someone died. They can also gather clues about their lifestyle based on the skeleton, since bones respond to muscle use and developed muscle attachments may indicate extensive muscle use. Most bioarchaeologists study not just individuals, but populations, to reveal biological and cultural patterns.

Bioarchaeologists are also interested in learning about ancient people's health and nutrition, the diseases they suffered from and injuries they suffered. They may also look for clues to what people ate by examining the wear and condition of teeth or, in the case of well-preserved specimens, the residue from their last meals. Chemical studies of bones and teeth can also provide information about people's diets as well as where people lived and moved during their lives. Bioarchaeologists can reconstruct human migration and track the growth or decline of populations by looking for patterns of malnutrition, disease, and activities.

Figure 1.19 A model of what Ötzi may have looked like in life.

Not all places are ideal for finding well-preserved human remains. Environments that are very cold, very dry, or devoid of oxygen can preserve corpses for many years, sometimes centuries. In 1991, a group of hikers found the body of a man frozen in the Italian Alps. Because of how well-preserved the body was, the discoverers initially thought he might be a hiker who had died several years prior. However, once bioarchaeologists had a chance to study the body, they discovered the man had died around 5,300 years ago! Nicknamed Őtzi, or the Iceman, bioarchaeologists determined he was wearing leggings, a coat, and shoes made of leather and fur when he died. They also discovered he had an arrow embedded in his left shoulder, suffered from osteoporosis, had multiple tattoo patterns throughout his body and was infected by the bacterium *H. pylori*, a common human stomach pathogen that likely gave him significant stomach pain. Researchers later found similarities between the strain of *H. plyori* bacterium that plagued Őtzi and the strains seen today in parts of Central and Southern Asia. Modern-day Europeans have strains of the bacterium that reflect mixtures of both African and Asian strains. This research helped scientists demonstrate that for thousands of years after Őtzi died human groups were migrating all over the world, even returning to Africa and then moving back north again. Research within the subfield of bioarchaeology is continually providing important insights into humanity's past.

Forensic Anthropology

Forensic anthropologists use many of the same techniques as bioarchaeologists to develop a biological profile for unidentified individuals including estimating sex, age at death, height, ancestry, diseases they had, or other unique identifying features. They may also go to a crime or accident scene to assist in the search and recovery of human remains, and/or identify trauma, like fractures, on bones. The popular television program *Bones* told the fictional story of a forensic anthropologist, Dr. Temperance Brennan, who brilliantly interpreted clues from victims' bones and helped solve crimes. While the show includes forensic anthropology techniques and responsibilities, it also includes many inaccuracies. For example, forensic anthropologists generally do not collect trace evidence like hair or fibers, run DNA tests, carry weapons, or solve criminal cases. These researchers play an important role in aiding law enforcement to identify human remains.

Some forensic anthropologists have been called on to interpret the remains of victims of mass murders, such as the case of the town of El Mozote in El Salvador. In December of 1981, during the country's intense civil war, over 1,000 people were brutally killed by the Salvadoran right-wing military in and around a church in the town of El Mozote. Researchers later discovered that the U.S. government, under President Reagan, funded and trained the Special Forces of the Salvadoran Army who perpetrated the massacre. Starting in the mid-1990s, human rights organizations began to investigate the incident as a war crime, and finally, in 2015, a team of forensic anthropologists were called upon to study the bones of the deceased and try to reconstruct what happened at El Mozote and how the victims died (Binford 2016). Their work provided important clues that helped bring some closure to the families and survivors of this horrible incident. It also provided answers to investigators looking to bring accountability to those responsible.

Figure 1.20 A remembrance of the victims of El Mozote Massacre in El Salvador.

Forensic anthropology is considered an "applied" area of biological anthropology, since it is a practical application of anthropological theories, methods, and findings to solve real-world problems. While many forensic anthropologists are also academics and work for colleges and universities, some are employed by other agencies. Forensic anthropology is an active area of applied biological anthropology and a career that is useful all over the world.

Human Biology

Many biological anthropologists do work that falls under the label human biology. This type of research is varied, but tends to explore how the human body is impacted by different physical environments, cultural influences, and nutrition. These include studies of **human variation** or the physiological differences among humans around the world. For instance, some humans have the ability to digest lactase in milk into adulthood, and others lack this ability. Some humans have an enhanced ability to resist malarial infections. Some humans tend to be very tall and lean while others are short and stocky. Still others tend to have dark skin and others lighter brown and even pale skin colors.

Some of these anthropologists study **human adaptations** to extreme environments, which includes individual physiological responses and genetic advantages populations develop to help them live there. For example, people born at very high elevations adapt to life in an environment with decreased oxygen. Research has shown that populations that have lived for many generations at very high elevations, such as those in parts of Tibet, Peru, and Ethiopia, have developed long-term physiological adaptations. These include large lungs and chests and enhanced oxygen respiration and blood circulation systems that help them survive in an environment that otherwise might cause life-threatening hypoxia (oxygen deprivation) (Bigham 2016). Some anthropologists believe Tibetans' adaptation to living in high altitudes, estimated to have occurred in less than 3,000 years, is one of the fastest cases of human evolution in the scientific record!

In addition to studying how humans adapt to their physical environments and vary biologically, some biological anthropologists are interested in how nutrition and disease affect human growth and development. The modern Western diet that is high in processed starches, refined carbohydrates, saturated fats, sugar, and salt is increasingly causing a number of metabolic conditions. As cultural groups around the world begin to replace their traditional diets with these processed food products, they begin to experience a rise in diseases that plague Western societies, such as diabetes, heart disease, and hormonal imbalances. Other biological anthropologists have asked why girls in Western societies have begun to menstruate earlier (sometimes as young as seven years of age). A definitive explanation is still unresolved. Some speculate this may have to do with changes in our diet, while others believe it may also have to do

with exposure to chemicals in the environment or other factors. Biological anthropologists engage in a wide range of research that span the breadth of human biological diversity.

The six subfields of biological anthropology—primatology, paleoanthropology, bioarchaeology, molecular anthropology, forensic anthropology, and human biology—all help us understand what it means to be biologically human. From molecular analyses of our cells, to studies of our changing skeleton, to research on our nonhuman primate cousins, biological anthropology helps answer the central question of the larger discipline of anthropology: What does it mean to be human? Despite their different foci, all biological anthropologists share a commitment to using a scientific approach to study how we became the complex, adaptable species we are today.

ANTHROPOLOGISTS AS SCIENTISTS

Biological anthropologists use the scientific method as a way of learning about the world around them. Many people think of science as taking place in a sterile laboratory, and sometimes it does, but in biological anthropology it also occurs many other places, such as at a research station in Ethiopia, a field site in Tanzania, and a town in El Salvador. To understand how information in this field is established, it is important to recognize what science is (and is not) as well as understand how the scientific method actually works.

Recognizing Science

Science combines our natural curiosity with our ability to experiment so we can understand the world around us and address needs in our communities. Thanks to science, meteorologists can predict the weather, it takes only a relatively small number of farmers to grow enough food to feed our large population, our medicine continues to improve, and over 90% of Americans have a cell phone.

Anyone can participate in science—not just academics. In fact, children are often some of the best scientists. An early, well-known psychologist, Jean Piaget (1896–1980), argued that a child is a "little scientist," internally motivated to experiment and explore their world. This can be seen when an infant repeatedly drops a toy to see if the parent will pick it up, or when a four-year-old sincerely asks "why" again and again. Maria Montessori (1870–1952), an Italian doctor and educator, was interested in how children learn. Through her research, she also recognized that children have natural scientific tendencies. Children have a desire to explore their environment, ask questions, use their imaginations, and learn by doing. In 1907, Montessori opened a school to foster children's natural desire to learn this way. This developed a child-centered teaching method that has spread around the world and is being used in over 22,000 schools today. In anthropology and other scientific fields, the process of learning is more formalized, but scientists still benefit from the curiosity that motivates children and still experience the thrill of discovery.

Science represents both a body of knowledge and the process for learning that knowledge (the scientific method). Scientific claims can, at times, be difficult to distinguish from other information. Science also incorporates a broad range of methods to collect data, adding to the difficulty of knowing what science really is. This section of the chapter will address four key characteristics that help define and recognize science: (1) science studies the physical and natural world and how it works, (2) scientific explanations must be testable and refutable, (3) science relies on empirical evidence, and (4) science involves the scientific community.

Figure 1.21 Children are true scientists as they explore and test the world around them through sight and touch.

Science Studies the Physical and Natural World and How It Works

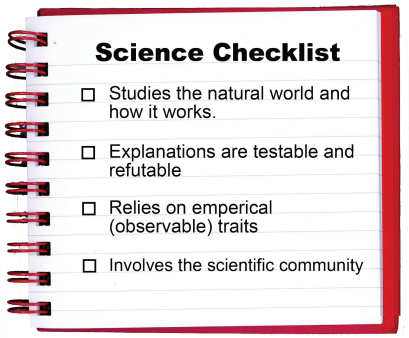

Figure 1.22 Science checklist.

Our physical and natural universe ranges from very small (e.g., electrons) to the very large (e.g., Earth itself and galaxies beyond it). Scientists often design their research to address how and why natural forces influence our physical and natural word. In biological anthropology, we focus our questions on humans as well as primate species, both living and extinct. We ask questions like: What influences a primate's diet? Why do humans walk bipedally? And did Neanderthals and modern humans interbreed?

There are very few questions that are considered off-limits in science. That being said, the scope of scientific investigation is generally focused on natural phenomena and natural processes and excludes the supernatural. People often regard the supernatural, whether it be a ghost, luck, or god, as working outside the laws of the universe, which makes it difficult to study with a scientific approach. Science neither supports nor contradicts the existence of supernatural powers—it simply does not include the supernatural in its explanations.

Scientific Explanations Must Be Testable and Refutable

The goal of scientists is to identify a research question and then identify the best answer(s) to that question. For example, an excavation of a prehistoric cemetery may reveal that many of the people buried there had unhealed fractures when they died, and the lead anthropologist may ask, "Why did this population experience more broken bones than their neighbors?" There might be multiple explanations to address this question, such as a lack of calcium in their diets, participation in dangerous work, or violent conflict with neighbors; these explanations are considered hypotheses. In the past, you might have learned that a hypothesis is an "educated guess," but in science, hypotheses are much more than that. A scientific hypothesis reflects a scientist's knowledge-based experiences and background research. A **hypothesis** is better defined as an explanation of observed facts; hypotheses explain how and why observed phenomena are the way they are.

Scientific hypotheses should generate expectations that are testable. For example, if the best explanation regarding our prehistoric population was that they were experiencing violent conflict with their neighbors, we should expect to find clues, like weapons or protective walls around their homes, in the anthropological record to support this. Alternatively, if this population did not experience violent conflict with their neighbors, we may eventually be able to gather enough evidence to rule out (refute) this explanation. An important part of science is rigorous testing. Science

does not prove any hypothesis. However, a strong hypothesis is one that has strong supporting evidence and has not yet been disproven.

Science Relies on Empirical Evidence

The word "empirical" refers to experience that is verified by observation (rather than evidence that derives primarily from logic or theory). In anthropology, much evidence about our world is collected by observation through fieldwork or in a laboratory. The most reliable studies are based on accurately and precisely recorded observations. Scientists value studies that explain exactly what methods were used, so their data collection and analysis processes are reproducible. This allows for other scientists to expand the study or provide new insights into the observations.

Science Involves the Scientific Community

Contrary to many Hollywood science fiction films, good science is not carried out in isolation in a secret basement laboratory but rather is done as part of a community. Scientists pay attention to what others have done before them, present new ideas to each other, and publish in scientific journals. Most scientific research is collaborative, bringing together researchers with different types of specialized knowledge to work on a shared project. Today, thanks to technology, scientific projects can bring together researchers from different backgrounds, experiences, locations, and perspectives. Most big anthropological questions—"Where did modern humans develop?" "What genetic changes make us uniquely human?" "How did cooperative behavior evolve?"—cannot be addressed with one simple study, but are tested with different lines of evidence and by different scientists over time.

Working within a scientific community supports one of the most valuable aspects of science: that science is self-correcting. Science that is openly communicated with others allows for a system with checks and balances: competing explanations can be proposed and questionable studies can be reevaluated. Ultimately, the belief is that through science the best explanations will stand the test of time.

How Science Works: The Scientific Method

Most students have learned the scientific method as a simple linear, or perhaps circular, process. Textbooks may phrase each step differently, but students usually recognize that the process begins with making observations about the natural world. Another important step is the selection or development of a scientific hypothesis. From the hypothesis a set of predictions can be made, which are then tested by experimentation or by making additional observations. Scientific predictions are often phrased as "if… then…" statements, such as "If hypothesis A is true, then this experiment will show outcome B." The results of a scientific study should then either support or reject the hypothesis.

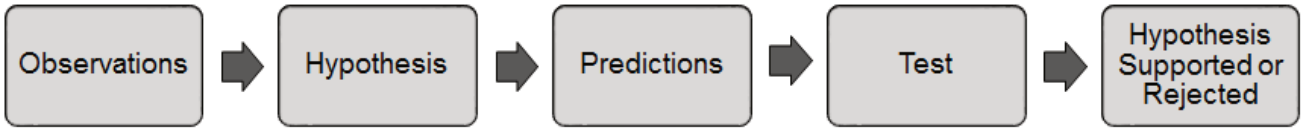

Figure 1.23 Simple depiction of the scientific method.

This relatively simple version of the scientific method is valuable as it highlights the key aspects that should be present in any scientific research experiment or scientific paper. However, this simplistic view of the scientific method does not accurately represent the dynamic and creative side of science, nor does it highlight the complex steps that are incorporated into a scientist's routine.

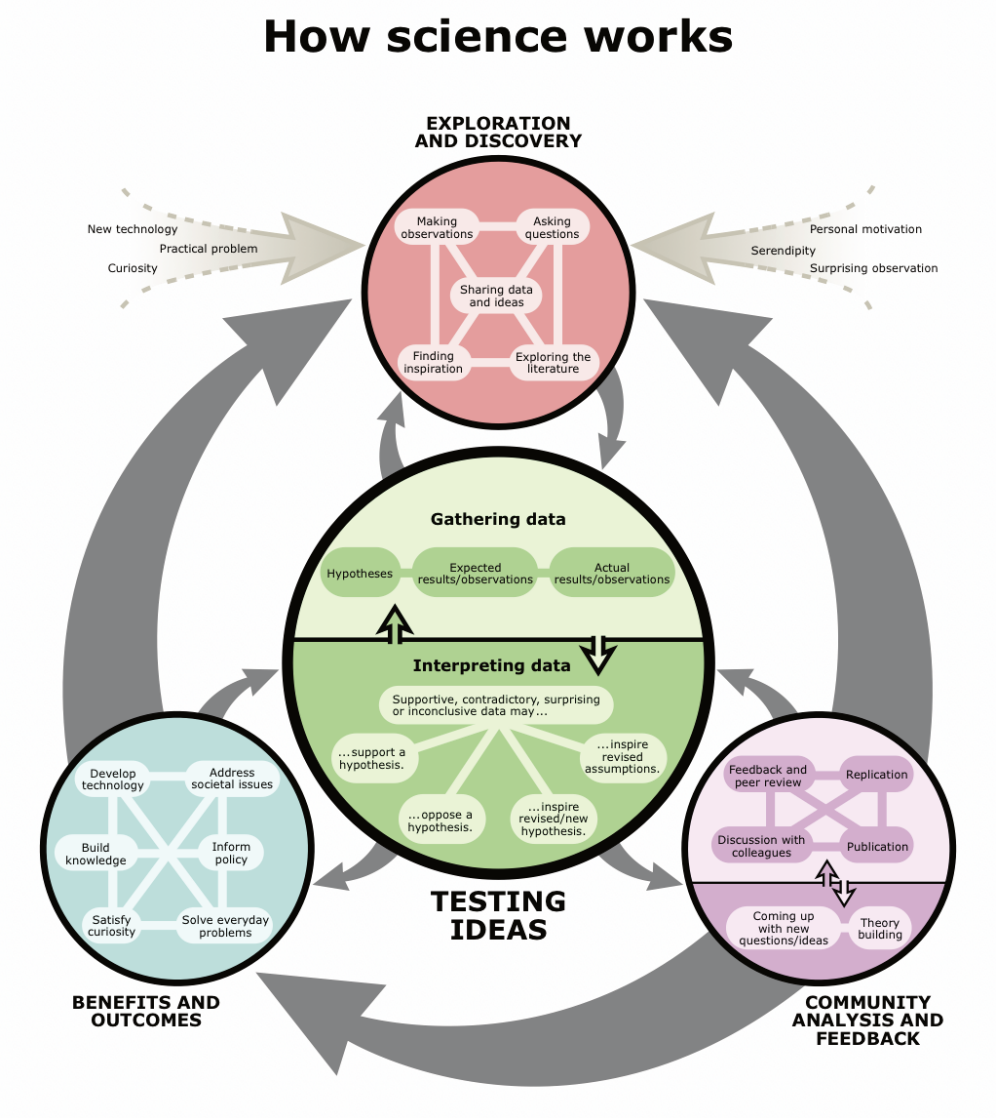

Figure 1.24 Complex flow of the scientific method.

Figure 1.24 provides an alternative representation of the scientific method that emphasizes the many paths to scientific discovery. While still incorporating the key components of making observations, testing ideas, and interpreting results, this chart shows that scientific ideas have many possible starting points and influences, and scientists often repeat steps and circle back around. Gathering evidence does not always rest on experiments in the laboratory. Evaluating data is not always clear-cut, and results are sometimes surprising or inconclusive. Many important discoveries were in fact made by mistake. For example, engineer Percy Spencer accidentally melted a chocolate bar in his pocket with a magnetron, which became the first microwave, and Spencer Silver invented the adhesive for 3M Post-it ® notes while trying to develop a strong glue. The real scientific process is more similar to the philosophy of the animated television character Ms. Frizzle from *The Magic School Bus*, "Take chances, make mistakes, get messy."

Two key components lacking in the simple version of the scientific method are exploration and discovery. There are many reasons that a scientist might choose a particular research question: they may be motivated by personal experience, struck by something they read about, or inspired by a student's question in class. Often scientific research reveals more questions than answers, so experienced researchers rarely lack problems to solve. But identifying a research question is just part of the process; most scientists spend more time exploring the literature, sharing ideas, asking questions, and planning their research project than conducting the test itself.

Science itself is a social enterprise that is influenced by cultural issues and values, as well as funding priorities. For example, corporations are the biggest funders of scientific research, followed next by government agencies like the National Science Foundation (which often fund research done by academics at colleges and universities). Those organizations have great influence on what is considered valuable research at any given time. For example, there are many diseases that the World Health Organization (WHO) has classified as "neglected tropical diseases," including dengue, leprosy, rabies, and hookworm, that affect an estimated 1 billion people, mostly in impoverished areas. These debilitating diseases can be as deadly as diseases that receive more attention, like AIDS and tuberculosis, but these tropical diseases receive comparatively little funding when it comes to research, drug development, and health care development (Farmer et al. 2013).

Also very important to the scientific process are interactions within the scientific community. Scientific collaboration can take place through informal discussion over a cup of coffee, but also includes more formal interactions, such as presenting at conferences and engaging in **scholarly peer review**. Scholarly peer review is the process where an author's work must pass the scrutiny of other experts in the field before being published in a journal or book. This helps keep scientists accountable for ethically responsible research projects and papers. Additionally, presenting data at conferences and in articles and books allows researchers to potentially receive critical feedback from academic peers and others to test these ideas and further the field of science toward identifying the best explanations.

Hypotheses, Theories, and Laws

Scientific investigation occurs at many levels, from investigating individual cases (for example, "What is causing this child's mysterious illness?") to understanding processes that affect most of us ("What is the ideal amount of sleep for an adult?"). All of these questions are important and will generate different types of testable scientific explanations. So far, we have used the term "hypothesis" to describe these scientific explanations for why observed phenomena are the way they are. Hypotheses are typically explanations that address a narrow set of phenomena, such as (in anthropology), a particular population or primate species.

In science, a **theory** is an explanation of observations that addresses a *wide* range of phenomena. Like hypotheses, theories also explain how or why something occurs, rely on empirical evidence, and are testable and able to be refuted. Because the term theory is often used casually outside of science, you may hear people try to dismiss a scientific claim as "just a theory." In science there are often multiple competing theories, but over time some are eliminated, leaving the theory or theories that best explain the most evidence. Scientific theories that have stood the test of time are thus supported by many lines of evidence and are usually reliable. Some well-tested theories accepted by most scientists include the theory of general relativity, which explains the law of gravitation and its relation to other forces, and evolutionary theory, which describes how heritable traits can change in a population over time.

While scientific hypotheses and theories share many characteristics, laws are quite different. A **law** is a prediction about what will happen given certain conditions, *not* an explanation for how or why it happens. A law is not a "mature" version of a theory. For example, Newton's universal law of gravity allows us to predict the gravitational force (F) between any two objects using the equation F = G(m1m2)/r2, but it does not explain *why* gravity works. Laws are often mathematical,

and some well-known laws include Newton's three laws of motion and laws of genetic inheritance. Laws are important, and their discovery often promotes the development of theories.

To demonstrate how important laws can be—and show how unusual things can inspire scientific discoveries—we can use the story of the ancient Greek mathematician and inventor Archimedes. Archimedes' buoyancy principle is a law that is useful for many things, including density calculations and designing ships. Purportedly, he made this discovery when he noticed the water level rise in the bathtub when he climbed in it. Realizing its importance, he is said to have shouted "Eureka" and proceeded to run naked through the city of Syracuse. While this is a fun story (that may or may not be true), it does remain that scientific laws, alongside scientific hypotheses and theories, do have a very important role in the scientific process and in generating scientific explanations about our natural world.

Figure 1.25 Archimedes is portrayed here having just discovered his Principle of Buoyancy. The vignette is by Count Giammaria Mazzuchelli (1707–1765).

WAYS OF KNOWING: SCIENCE, FAITH, AND ANTHROPOLOGY

In anthropology, we recognize that there are many ways people have of knowing things. Human knowledge is very diverse. For instance, you might know that fingernails are softer than metal because as a child you accidentally stapled through your fingernail while doing an art project (a coauthor of this chapter once experienced this). This would be an example of knowledge you gained through experience. You might also know that inserting a knife into an electrical outlet is dangerous and could harm your health. Hopefully you know this not from personal experience, but through instruction from parents, teachers, and others in your social group. The degree to which humans rely on and benefit from the experiential knowledge of others is an important characteristic of what makes us human!

A unified way of knowing that is shared by a group of people and is used to explain and predict phenomena is called a **knowledge system**. Human knowledge systems are diverse and reflect the wide range of cultures and societies throughout the world and through time.

Science and religion are both knowledge systems and it is useful to understand how they differ. The type of knowledge gained from science is oftentimes called scientific **understanding**. As we have explored in the previous section, scientific understanding can change and relies on evidence and rigorous, repeated testing. Religious ways of knowing are called **belief**, which is different from scientific understanding because it does not require repeated testing or validation (although it can rely on observations and experiences). Instead, religious belief relies on trust and **faith**.

Since the beginning of the discipline, anthropologists have been interested in understanding religion because it can be important to understanding human cultures. However, religion (as well as magic, witchcraft, and other faith-based traditions) has proven notoriously difficult to define from an anthropological perspective, partly because there are so many religious practices and beliefs throughout the world that play different roles in people's lives. For instance, some religions have multiple supernatural deities or gods, such as Hinduism, while others have hardly any supernatural elements, such as Buddhism. Some have beliefs that relate to energies and powers found in certain objects, animals, and people, while others place faith in ancestors and collective cultural heritage. Some religions provide instruction on nearly every day-to-day activity a person does, while others provide merely a rough framework for how one should act and behave. Emile Durkheim (1858-1917), an early social scientist, offered a definition of religion as "a unified set of

beliefs and practices relative to sacred things, that is to say, things set apart and forbidden—beliefs and practices which unite [into] one single moral community, all those who adhere to them" (Durkheim 2008).

Different individuals, cultures and societies may place more value on one type of knowing than another, although most use a combination that includes science and religion. In fact, in the early twentieth century, Bronisław Malinowski (1884-1942), an important early anthropologist, concluded that all societies use religion and science in some way or another. These are common ways that humans have of knowing our world.

In contemporary societies such as the United States, science and (some) religions conflict on the topic of human origins. Nearly every culture and society has a unique origin story that explains where they came from and how they came to be who they are today. These stories are often integrated into the culture's religious belief system. Many anthropologists are interested in faith-based origin stories and other beliefs because they show us how a particular group of people explain the world and their place in it. Anthropologists also value scientific understanding as the basis for how humans vary biologically and change over time. In other words, anthropologists value the multiple knowledge systems of different groups and use them to understand the human condition in a broad and inclusive way.

It is also important to note that scientists often depend on the local knowledge of the people they work with to help them understand elements of the natural or physical world that science has not yet investigated. Many groups, including **indigenous** peoples, know about the world through prolonged relationships with the environment. Indigenous knowledge systems—those ways of knowing about and explaining the world that are specific to an indigenous community or group—are informed by their own empirical observation of a specific environment and passed down over generations.

While religion and indigenous knowledge systems may play a complementary role in helping anthropologists understand the human condition, they are distinct from science. The anthropological subdiscipline of biological anthropology is based on scientific ways of knowing about humans and human origins. In this text we will exclusively explore what science tells us about how humans came to be and why we are the way we are today. Therefore, you do not need to *believe* in evolution to master this material, because belief is not a scientific way of knowing. For this textbook, you only need to *understand* the scientific perspective(s) of evolution.

Throughout our lives, each of us work to reconcile and integrate into our worldview the different ways we have of knowing things. This is part of our lifelong intellectual journey. It is also, in our opinion, one of the most exciting parts of learning. We are pleased you have joined us on this journey of knowledge about humanity and yourself! Welcome!

Review Questions

- What are some key approaches to anthropological research?
- How has the discipline of anthropology changed over time?
- What are some similarities and differences between the subdisciplines? How does the "fifth subdiscipline" of applied anthropology fit within the larger discipline of anthropology?
- What are some subfields of biological anthropology and what do those anthropologists study?
- What is science? What is the scientific method? How does science compare to other ways of knowing?

Key Terms

Belief (religious): A firmly held opinion or conviction typically based on spiritual apprehension rather than empirical proof.

Bipedal: Habitually using only two legs to walk.

Cultural relativism: The anthropological practice of suspending judgment and seeking to understand another culture on its own terms sympathetically enough so that the culture appears to be a coherent and meaningful design for living.

Empirical: Evidence that is verifiable by observation or experience instead of relying primarily on logic or theory.

Ethnocentrism: The opinion that one's own way of life is natural or correct and the only true way of being fully human.

Faith (religious): Complete trust or confidence in the doctrines of a religion, typically based on spiritual apprehension rather than empirical proof.

Historical archaeologists: Archaeologists who excavate and analyze material remains to supplement a society's written records.

Holism: The idea that the parts of a system interconnect and interact to make up the whole.

Hominins: Species that are regarded as human, directly ancestral to humans, or very closely related to humans.

Human variation: The range of forms of any human characteristic, such as body shape or skin color.

Human adaptation: The ways in which human bodies, people, or cultures change, often in ways better suited to the environment or social context.

Hypothesis: Explanation of observed facts; explains how and why observed phenomena are the way they are. Scientific hypotheses rely on empirical evidence, are testable, and are able to be refuted.

Indigenous: Refers to people who are the original settlers of a given region and have deep ties to that place. Also known as First Peoples, Aboriginal Peoples, or Native Peoples, these populations are in contrast to other groups who have settled, occupied, or colonized the area more recently.

Knowledge system: A unified way of knowing that is shared by a group of people and is used to explain and predict phenomena.

Law: A prediction about what will happen given certain conditions; typically mathematical.

Participant observation: A research method common in cultural anthropology that involves living with, observing, and participating in the same activities as the people one studies.

Prehistoric archaeologists: Archaeologists who survey, excavate, and analyze material remains to study civilizations that lacked written records.

Sapir-Whorf hypothesis: The principle that the language you speak allows you to think about some things and not other things. This is also known as the linguistic relativity hypothesis.

Scholarly peer review: The process where an author's work must pass the scrutiny of other experts in the field before being published in a journal or book.

Subdiscipline: These refer to the four major areas that make up the discipline of anthropology: biological anthropology, cultural anthropology, archaeology, and linguistic anthropology.

Subfield: In this book, subfield refers to the different specializations within biological anthropology, including primatology, paleoanthropology, molecular anthropology, bioarchaeology, forensic anthropology, and human biology.

Theory: An explanation of observations that typically addresses a wide range of phenomena.

Understanding (scientific): Knowledge accumulated by systematic scientific study, supported by rigorous testing and organized by general principles.

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Katie views teaching and learning as central to her practice as an anthropologist and as mutually reinforcing elements of her professional life. She is the former chair of the Teaching Anthropology Interest Group (2016–2018) of the General Anthropology Division of the American Anthropological Association and currently serves as the online content editor for theTeaching and Learning Anthropology Journal. She has contributed to several open access textbook projects, both as an author and an editor, and views the affordability of quality learning materials as an important piece of the equity and inclusion puzzle in higher education.

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Lara's concerns about the social ramifications of inequality have guided her research projects, teaching practices, and involvement with open access projects like this textbook. Recently, motivated by the desire to make college more affordable and accessible to all students, she has been serving as co-coordinator of Grossmont College's Open Educational Resources (OER) and Zero Textbook Cost (ZTC) degree initiatives.

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Beth enjoys teaching courses in multiple subdisciplines, as well as mentoring graduate students in teaching. Additionally, she coleads Chico State's Affordable Learning Solutions (CAL$) program, is committed to programs that prioritize diversity, and serves on the Society for Anthropology in Community Colleges (SACC) Executive Board as vice president for Membership and Development & Regional Networks chair.

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Kelsie Aguilera

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For Further Exploration

American Anthropological Association website: https://www.americananthro.org/

Partners in Health: https://www.pih.org/

Understanding Science. 2018. University of California Museum of Paleontology. 3 January. http://www.understandingscience.org.

Anticole, Matt. What's the difference between a scientific law and theory? TedEd Lesson. https://ed.ted.com/lessons/what-s-the-difference-between-a-scientific-law-and-theory-matt-anticole#watch

References

Bigham, Abigail W. 2016. "Genetics of Human Origin and Evolution: High-Altitude Adaptations." Current Opinion in Genetics & Development 41: 8–13.

Binford, Leigh. 2016. The El Mozote Massacre: Human Rights and Global Implications. Tucson: University of Arizona Press.

Bourgois, Phillippe. 2003. In Search of Respect. Cambridge: Cambridge University Press.

Durkheim, Emile. 2008. The Elementary Forms of Religious Life. Translated by Carol Cosman and Edited by Mark S. Cladis. New York: Oxford University Press.

Farmer, Paul. 2006. AIDS and Accusation: Haiti and the Geography of Blame. Berkeley: University of California Press.

Farmer, Paul, Matthew Basilico, Vanessa Kerry, Madeleine Ballard, Anne Becker, Gene Bukhman, Ophelia Dahl, et al. "Global Health Priorities for the Early Twenty-first Century." In Reimagining Global Health: An Introduction, edited by Paul Farmer, Jim Yong Kim, Arthur Kleinman, and Matthew Basilico, 302–339. Berkeley: University of California Press.

Goodall, Jane. 1996. My Life With the Chimpanzees. Aladdin Press.

Jablonski, Nina. 2012. Living Color: The Biological and Social Meaning of Skin Color. Berkeley: University of California Press.

Kenyon, Kathleen. 1979. Archaeology in the Holy Land. New York: W.W. Norton & Co. Malotki, Ekkehart. 1983. Hopi Time. The Hague: Mouton.

McIntosh-Smith, Tim. 2002. The Travels of Ibn Battutah. London: Picador.

Mead, Margaret. 1928. Coming of Age in Samoa. Oxford: Morrow.

Ochs, Elinor, and Bambi B. Schieffelin. 2012. "The theory of language socialization." In The Handbook of Language Socialization. Edited by Alessandro Duranti, Elinor Ochs, and Bambi Schieffelin, 1–21. Malden, MA: Wiley-Blackwell.

Prüfer, Kay, Kasper Munch, Ines Hellmann, Keiko Akagi, Jason R. Miller, Brian Walenz, Sergey Koren, et al. 2012. "The Bonobo Genome Compared with the Chimpanzee and Human Genomes." Nature 486 (June): 527–531.

Rathje, William, and Cullen Murphy. 1992. Rubbish!: The Archaeology of Garbage. New York: HarperCollins.

Relethford, John, and Deborah Bolnick. 2018. Reflections of our Past: How Human History Is Revealed in our Genes. 2nd ed. New York: Routledge.

Whorf, Benjamin. 1956. Language, Thought, and Reality. Cambridge: MIT Press.

Wood, Frances. 2004. The Silk Road: Two Thousand Years in the Heart of Asia. Berkeley: University of California Press.

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