

MODULE 1: Anthropology, Science, and Storytelling

"Things are similar: this makes science possible. Things are different: this makes science necessary" (Levins and Lewontin 1985, 141). Many anthropologists claim that their attempts to explain human nature, human society, and the human past are scientific. A scientific approach is what distinguishes the ethnographer from the tourist, the archaeologist from the treasure hunter. But scientists are clearly not the only people who offer explanations for the intriguing and often contradictory features of our world. People in all societies tell stories about why we are the way we are and why we live the way we do. What makes these nonscientific explanations different from the scientific explanations of an anthropologist?

Scientific and Nonscientific Explanations

In some respects, scientific and nonscientific explanations of the way the world works have much in common. For one thing, scientists today are more aware than ever before of the fact that scientific theorizing is a form of storytelling (Landau 1984). Like the tales collected by anthropologists from peoples all over the world, scientific theories offer narrative accounts of how things got to be the way they are.

Consider the following two extracts taken from longer narratives. The first is from the Amazon and is part of the creation story of the Desana (Tukano) people (Figure M1.1):

The sun created the Universe and for this reason he is called Sun Father (*pagé abé*). He is the father of all the Desana. The Sun created the Universe with the power of his yellow light and gave it life and stability. From his dwelling place, bathed in yellow reflections, the Sun made the earth, with its forests and rivers, with its animals and plants. The Sun planned his creation very well, and it was perfect.

The world we live in has the shape of a large disk, an immense round plate. It is the world of men and animals, the world of life. While the dwelling place of the Sun has a yellow color, the color of the power of the Sun, the dwelling place of men and animals is of a red color, the color of fecundity and of the blood of living beings. Our earth is *maria turí*, and is called the "upper level" (*vekámaha turí*) because below is another world, the "lower level" (*dohkámaha turí*). The world below is called *Ahpikondia*, Paradise. Its color is green, and the souls of those who were good Desana throughout their life go there. . . . Seen from below, from *Ahpikondia*, our earth looks like a large cobweb. It is transparent, and the Sun shines light through it. The threads of this web are like the rules that men should live by, and they are guided by these threads, seeking to live well, and the Sun sees them. . . .

The Sun created the animals and the plants. To each one he assigned the place he should live. He made all of the animals at once, except the fish and the snakes; these he made



FIGURE M1.1 Desana (Tukano) man playing panpipes.

afterward. Also, together with the animals, the Sun made the spirits and the demons of the forest and the waters.

The Sun created all of this when he had the yellow intention—when he caused the power of his yellow light to penetrate, in order to form the world from it. (Reichel-Dolmatoff 1971, 24–25)

The second extract comes from an American work on modern physics:

At the start of the lepton era the universe is one ten-thousandth of a second old, the temperature is 1 trillion Kelvin (10^{12} K) and each cubic centimeter of the cosmic quantum soup weighs about a thousand tons. The universe consists of a mixture of approximately equal numbers of photons, electrons, electron neutrinos, muons, muon neutrinos, some other particles like pions . . . and their antiparticles, plus a relatively small "contamination" of equal numbers of protons and neutrons which are no longer in equilibrium with the other particles. . . .

As the temperature falls from its value at the beginning of the lepton era, the production threshold for the muons is crossed. All the muons and antimuons now annihilate into electrons, positrons and muon and electron neutrinos. Any excess charge of the muons can be passed on to the electrons. . . . For this reason no muons survive the muon slaughter. . . .

At the end of the lepton era all the heavy leptons, muons and tauons have disappeared, while hordes of neutrinos flood the universe but no longer interact with anything. Photons, electrons and antielectrons are still in equilibria, creating and destroying one another. When the temperature falls below the production threshold to create electron-positron pairs, most of the pairs annihilate into photons. This temperature threshold marks the beginning of the photon era. . . .

At the first second (which marks the beginning of the photon era, which goes on to last for 300,000 years), the temperature of the photons was 10 billion Kelvin and the density of the radiation about 100 kilograms (about 220 pounds) per cubic centimeter—a very thick viscous fluid of light. . . . (Pagels 1985, 250–53)

Both the Desana story and the scientific story might be called **myths**—as long as we use this term the way anthropologists use it. For anthropologists, myths are stories that recount how various aspects of the world came to be the way they are. The power of myths comes from their ability to make life meaningful for those who accept them. The truth of myths seems self-evident because they effectively integrate personal experiences with a wider set of assumptions about the way society, or the world in general, operates. In everyday speech, by contrast, the term *myth* is used to refer to a story that is false. To be sure, origin myths like the Desana tale contain marvelous and fantastic elements that stretch the credulity of ordinary sensible folk. Still, the anthropological understanding of myth does not assume that myths are necessarily false. Stories that survive to become myths usually connect in important ways with everyday human experiences in a particular society. But what about stories that recount events that we could never experience personally, such as the origin of the universe? If we study a variety of origin myths from different cultural traditions, we learn that many of these stories differ substantially from one another. Since nobody

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science The invention of explanations about what things are, how they work, and how they came to be that can be tested against evidence in the world itself.

alive today was around when the world began or when our ancestors first walked its surface, how could we ever find out what actually happened?

For increasing numbers of people over the past few centuries, the answer to this question has lain with science. The growth of modern science in western Europe and its spread throughout the world are largely a result of scientists' belief that the answers to the history of the world could be found in the world itself if only people looked at the world in a new way. This new perspective claimed that "the world of phenomena is a consequence of the regular operation of repeatable causes and their repeatable effects, operating roughly along the lines of known physical law" (Lewontin 1983, xxvi). Scientists believed that remarkable new insights about the universe, the objects in it, and even ourselves could be gained if we carried out observations according to a new set of rules.

These rules were first set on a firm foundation by Isaac Newton (Figure M1.2). A pious Christian, Newton did not doubt that God had created the universe, yet he believed that the universe God had created was orderly, that the movements of objects within it were constrained by laws discoverable by human reason, and that those laws could be precisely described using the language of mathematics. Newton's approach gained followers because it was extremely successful at describing and predicting, exactly as it had promised. Moreover, different observers could independently test the descriptions and predictions, and scientific knowledge could grow as the verified predictions were retained and the unverified predictions were discarded. Most fatefully, the new, scientifically verified knowledge about nature's laws could be put to work to transform nature in unprecedented ways. It appeared that human desires could be satisfied through scientific mastery of the material world. For many people, the practical application of scientific discoveries in astronomy, navigation, and industry became the clinching proof of scientific superiority.

Niles Eldredge and Ian Tattersall (1982), two prominent evolutionary biologists, have written that science is "storytelling, albeit of a special kind. **Science** is the invention of explanations about what things are, how they work, and how they came to be. There are rules, to be sure: for a statement to be scientific, we must be able to go to nature and assess how well it actually fits our observations of the universe" (1). Indeed, these rules give science its particular dynamic because science is firmly and explicitly committed to open-ended self-correction. If ideas about the way the world works can be shown *not* to fit our observations of the universe, then the scientist must reject those ideas, regardless of the consequences, and invent better ones.

Scientists believe that the answers to questions about how the world works can be found by going to the world itself. Put another way, science is *empirical*, based on concrete experience and observation. Scientists have never been content to observe the world without getting their



FIGURE M1.2 One of the founders of the new worldview of science, Sir Isaac Newton (1642–1727), made major contributions to mathematics, optics, and experimental investigation.

hands dirty. Scientific theories must build on and be tested against direct physical contact with real objects in the world. Of course, scientists did not invent trial-and-error experimentation with the material world; that activity lies behind the technical achievements of all human societies. Nevertheless, scientific research has taken experimentation to a new level of complexity. Using elaborate tools that are themselves the product of previous scientific work, scientists have engaged in increasingly refined experimental manipulation of material objects and processes in the world. One result of this activity has been the production of more sophisticated stories about the way the world works. The success and persuasive power of evolutionary biology, for example, are due in no small measure to the fact that scientists have been able to generate new evidence about the living world, reinterpret old evidence, and produce a new story that remains richer, more comprehensive, and more fruitful than any of its rivals.

Some Key Scientific Concepts

The first step in understanding scientific stories is to master a few key concepts that are part of every scientist's vocabulary. In this section, we introduce some terms you will encounter

frequently as you read this book. Special attention must be paid to the way scientists define these terms because they are also often used in everyday speech with rather different meanings. Six terms are particularly important: assumptions, evidence, hypotheses, testability, theories, and objectivity.

Assumptions **Assumptions** are basic, unquestioned understandings about the way the world works. Under ordinary circumstances, most human beings do not question whether the sun will come up in the morning; it is taken for granted. If you want to go birdwatching tomorrow, you might be concerned about how cold it will be or whether it will rain, but you need not worry whether the sun will rise.

Everybody, scientist or not, operates on the basis of assumptions. Scientists are particularly concerned about the assumptions they bring to their observations of the natural world because the significance of what they see and measure is never obvious. If their observations are guided by incorrect assumptions about the way the world works, their measurements will be meaningless and the conclusions they draw from those measurements will be misleading.

Evidence In science, **evidence** refers to what we can see when we examine a particular part of the world with great care. The structures and processes of living cells as revealed under the microscope, the systematic distribution of related species of birds in neighboring geographical regions, the different kinds of bones found together again and again in the same geological strata—these are examples of the kinds of evidence scientists use to support theories of biological evolution. There are two different kinds of evidence: material and inferred.

Material evidence consists of things—material objects—themselves, information recorded about them, or scientific measurements made of them. In the study of human origins, for example, bones and stones are the most conspicuous forms of material evidence (Figure M1.3a) but so are careful records (including photographs) of other material objects recovered from the site of an excavation. The precise geological layering at a site is an important form of material evidence but so are objects at a site (e.g., certain kinds of rocks or baked clay) that can be subjected to forms of laboratory analysis that yield reliable information about the dates when they formed. For cultural anthropologists, ritual performances observed and transcribed in the field constitute

assumptions Basic, unquestioned understandings about the way the world works.

evidence What is seen when a particular part of the world is examined with great care. Scientists use two different kinds of evidence: material and inferred.



FIGURE M1.3 That particular material features, such as this pot (a), are found in an archaeological site and that the people of Bali perform a certain dance (b) are material facts, verifiable by inspection. How or why the pot came to be here and what it was used for or what this dance means may be far from obvious and must be inferred.

material evidence (Figure M1.3b). Material evidence is ordinarily what scientists mean when they refer to “the facts” or “the data.”

Material evidence has two striking attributes. First, “the facts” can be inspected by anyone who wants to examine them. Like cowpats in a pasture, the facts exist in their own right, and their existence, shape, and position cannot be ignored by people who wish to walk through the particular field and keep their shoes clean. Second, the facts cannot speak for themselves. That a particular accumulation of bones and stones was found at a certain place in an archaeological site and that certain people perform a particular ritual are material facts verifiable by inspection. How or why the bones and stones got there or what the ritual means may be far from obvious. This leads to the second kind of evidence used by scientists: the interpretation put on material evidence.

Inferred evidence is material evidence plus interpretation. As one paleoanthropologist observes, “We can all see a bone and know it is a bone, but what it is ‘evidence’ for depends upon one’s interpretation” (Clarke 1985, 176–77). Interpretation begins with the simple description of individual objects or events and is followed by the description of patterns of distribution of similar objects and events. The final stage of interpretation consists of elaborate explanatory frameworks that link many different objects or events to one another by drawing on findings from many different fields of knowledge. The

connection between material evidence and inferred evidence is an intimate one. Several scientists examining the same material evidence frequently emphasize different descriptions and construct different explanations of what it is and how it got there. Rather than the facts speaking for themselves, the observers speak to one another about the facts in an attempt to make sense of them.

For example, the discovery of ancient hominin bones on the Indonesian island of Flores in 2003 sparked much debate among paleontologists (Figure M1.4). The bones are tens of thousands of years old and look human but are unusually small. Some paleontologists have argued that the bones belonged to modern humans who suffered from a disease that reduced their stature. Other paleontologists insist that the bones show no morphological signs of such disease and that they most likely represent a previously undiscovered species of *Homo*. Further, they argue that this species evolved to have a small stature in response to selective pressures associated with living on an island, a phenomenon known as *insular dwarfing*. Others prefer to withhold judgment until more fossil evidence is available.

As you will see, scientific debate about evolution has long involved just this sort of interpretive dialogue. But it is important to remember that the debates about interpretation would be pointless without something to interpret. Science is more than just “the data,” but it can never get too far away from the data before it is not science anymore. The data are the pretext and the context for debate among observers.



FIGURE M1.4 Ancient hominin bones from the Indonesian island of Flores (the skull is pictured above, between a *Homo erectus* skull on the left and a modern human skull on the right) have been the subject of much debate among paleontologists.

The data, in their stubborn materiality, set limits to the kinds of interpretation that are scientifically plausible.

Hypotheses Scientists state their interpretations of data in the form of **hypotheses**, which are statements that assert a particular connection between fact and interpretation, such as “The bones found at the Hadar site in Ethiopia belonged to an extinct form of primate that appears ancestral to modern human beings.” Hypotheses are also predictions about future data based on data already in hand. On the basis of the Hadar findings, paleoanthropologists might hypothesize as follows: “Bones similar to those found at Hadar are likely to be found in geological strata of the same age elsewhere in eastern Africa.” Indeed, hypotheses of the latter kind have guided paleoanthropologists in their search for fossils of human ancestors. The impressive collections of fossils of all kinds that have been amassed over the past couple of centuries show just how successful such hypotheses have been in guiding scientific discovery.

Testability **Testability** is the scientific requirement that a hypothesis must be matched against evidence to see whether it is confirmed or refuted. That is, our assertion about the connection between fact and interpretation must be subject to testability if it is to be regarded as a scientific hypothesis.

How might we test the hypothesis about the bones from the Hadar site? The first step would be to make sure the bones were not simply those of a modern primate that had recently died. If examination of the bones revealed them to be permeated by mineral deposits, making them hard and stonelike, we would be justified in concluding that they were very old because such a process takes a long time. The next step might be to compare the fossil bones with the bones of living primates, human and nonhuman, to see how they

matched. If the bones from Hadar appeared more similar to the bones of humans than to the bones of monkeys or apes, we would be justified in concluding that we had found the bones of an organism ancestral to modern humans. Our confidence in the correctness of the original hypothesis would increase, especially if a number of experts in primate anatomy agreed.

Why would the experts not simply claim, however, that the fossils from Hadar belonged to a human being just like ourselves who happened to have lived and died millions of years ago? What would lead them to conclude that these fossils belonged to a primate *ancestral* to modern human beings? The answer to this question depends on just how similar to modern human bones the Hadar fossils appeared to be. Paleoanthropologists would be justified in assigning the bones from Hadar to an ancestor of modern humans if the bones, although clearly humanlike, nevertheless differed in some significant respect from the bones of modern human beings. If the bones were significantly smaller than those of modern human beings, if the teeth were significantly larger in proportion to the jaw, if the skull were significantly smaller, if the arm bones were relatively longer in proportion to the leg bones, if the finger and toe bones appeared curved—all these traits would suggest strongly that the bones from Hadar, although humanlike, did not belong to a modern human being.

In addition, if the same geological strata yielding the Hadar bones produced the fossils of other organisms that were equally unlike the bones of living animals, we might well conclude that we had discovered the remains of more than one extinct animal species. The plausibility of our original hypothesis about the bones from the Hadar site would be further strengthened.

Some hypotheses, however, may not be subject to testability. That is, there may be no way, even in principle, to find evidence in nature that could show a hypothesis to be false. As a result, even if such a hypothesis were correct, it could not be considered a scientific hypothesis. Suppose someone were to hypothesize that all of the fossils from the Hadar site (together with all the objects in every geological layer on the surface of the earth) had been placed in the ground 10,000 years ago by aliens from another planet. These aliens had the desire and the skill to trick us about the history of life on earth. Is such a hypothesis testable? What sort of evidence could nature give us that would either confirm or refute such a hypothesis?

Certainly, if we found the remains of sophisticated technological devices alongside the fossil bones, we would

hypotheses Statements that assert a particular connection between fact and interpretation.

testability The ability of scientific hypotheses to be matched against nature to see whether they are confirmed or refuted.

instantly suspect that the site was very odd. Our suspicion might be confirmed if laboratory analysis reported that these devices were constructed using materials and engineering principles unknown on earth. Our suspicion would deepen if the remains of similar devices began to appear regularly in paleontological digs, and it would become more than suspicion if datable remains from every site, analyzed by a variety of laboratory techniques, consistently turned out to be around 10,000 years old! But what if no such material evidence were ever found? What if nothing in any archaeological site suggested the presence of high technology, alien or otherwise? What if the objects recovered from digs turned out to vary in age in a manner consistent with the geological layers in which they were found? What if only a few sites could be reliably dated to 10,000 years ago and many more could be reliably dated to either older or more recent times?

Perhaps die-hard supporters of the alien story might offer a new hypothesis. They might claim that the aliens were so amazingly skilled that they were able to arrange the pattern of burial so as to trick us into thinking we were observing a series of deposits laid down over time. The aliens were so fiendishly clever that they were able to chemically treat the objects they buried in a way that would make them yield misleading dates—a pattern of misleading dates—whenever they were subjected to laboratory analysis!

We now have a new alien hypothesis to consider, but this time we cannot call it a scientific hypothesis. The first version of the alien hypothesis was not confirmed: it was tested against nature and did not match. But there is no way of testing the new hypothesis that aliens carried out this massive task of rearranging the layers in the earth's crust and tampering with its contents. If scientists objected that the bones and stones in their laboratories showed no evidence of chemical tampering, a defender of the new hypothesis could reply that this demonstrated how adept the aliens were at covering their tracks. Indeed, any evidence offered by a scientist to refute the new hypothesis would simply be interpreted by supporters as another part of the alien scheme to deceive earthlings.

In the absence of any evidence to support it and the presence of overwhelming evidence against it (all the patterned geological deposits with older or younger dates, cross-checked by more than one dating method), the new alien hypothesis holds no scientific interest. This does not mean that scientists have proved beyond question that aliens never visited our planet or buried fake fossils in our

soil; it does mean, however, that the alien hypothesis need not be taken seriously by scientists. Under these circumstances, to continue to support the alien hypothesis would be to leave the realm of science and enter the realm of science fiction.

Theories In everyday speech, we frequently use the word *theory* to refer to an explanation that is as likely to be false as it is to be true. Indeed, we tend to invent “theories” in the absence of evidence. This is why we often plead “It’s just a theory” to defend ourselves against critics who demand that we produce evidence to back up our claims. In science, the contrary is true. Scientists speak of a **scientific theory** only when they are able to link up a series of testable hypotheses in a coherent manner to explain a body of material evidence. Scientific theories are the combined result of sifting data, testing hypotheses, and imagining how all the resulting information might be put together in an enlightening way. Scientific theories are taken seriously because they account for a wide range of material evidence in a coherent, persuasive manner even though their hypotheses remain open to testing and possible falsification. The most powerful theories in science, such as the theory of relativity or the theory of evolution, are valued not just because they explain more of the material evidence than their competitors but also because their central hypotheses are open to testing and potential falsification—and yet, after repeated tests, they have never been disconfirmed.

It is often the case that the same body of material evidence, interpreted in different ways, gives rise to rival theories. Scientists have long been involved in a lively dialogue with one another about the meaning of material evidence, as well as about what should count as material evidence in the first place. This scientific give-and-take helps refine and strengthen some theories over time while exposing the weaknesses of others. Areas in which scientists agree at one period, however, may be reopened for debate at a later time, when new material evidence or a new hypothesis, or both, arises. As scientists compare their theories not only with nature but also with the theories of their rivals, their understanding is deepened and their theories are revised.

Objectivity One reason scientific findings are highly respected is that they are considered objective. But what do we mean when we speak of “objectivity”? The meaning of this concept in Western thought has varied over time, but by the nineteenth century **objectivity** had acquired the meaning many people associate with it today: a judgment about some feature of the world that is free of individual idiosyncrasies (Daston 1999, 111). Western science has traditionally emphasized the demands that objectivity places on individual scientists. From this point of view, objectivity can be defined as “the separation of observation and reporting from the researcher’s wishes” (Levins and Lewontin 1985,

scientific theory A coherently organized series of testable hypotheses used to explain a body of material evidence.

objectivity The separation of observation and reporting from the researcher’s wishes.

225). Because theories are rooted in material evidence, new material evidence can tip the balance in favor of one theory over its alternatives or expose all current theories as inadequate. Scientific researchers who faithfully report results even when these results undermine their own pet hypotheses would be viewed as objective in this individual sense.

But scientific objectivity may also be understood as an attribute of communities of scientists, not just of individual researchers. Most historians and philosophers of science recognize that science as it developed in western Europe has always been a social activity. The testability of scientific hypotheses, for example, makes sense only when we understand that an individual's work is carried out in a scientific community whose members share their work, in the form of public presentations or articles in professional journals. Members of the same scientific community scrutinize each other's stories about nature, testing to see if they are confirmed or disconfirmed, in a process called "peer review." Public evaluation of scientists' work ideally appeals to the same standards for everyone, and members of the community are expected to be responsive to the observations of all knowledgeable critics (Figure M1.5). As philosopher of science Helen Longino (1990) emphasizes, responsiveness to other members of a scientific community "does not require that individuals whose data and assumptions are criticized recant. . . . What is required is that community members pay attention to the critical discussion taking place and that the assumptions that govern their group activity remain logically sensitive to it" (78).

Longino (1990) adds that criticism cannot go on indefinitely if scientific research is to achieve its goals. Scientists become impatient if their detractors repeat the same criticisms over and over but never develop an alternative research program of their own that produces rich new evidence in support of their own views (Longino, 79). In part, this is because scientists are often unwilling to give up on even an inadequate research program until they find an alternative that somehow works better than what they already have. This unsatisfactory state of affairs regularly provokes the development of new approaches in science that produce new evidence, thus allowing critics to do more than merely point out the deficiencies of other scientists' work. The history of paleoanthropology is full of lively debates that have produced new theories, new evidence, and new research techniques (such as those associated with dating ancient fossils and artifacts or recovering ancient biomolecules such as DNA). These have enormously increased our understanding of the complex evolutionary history of our species and our closest relatives.

Scholars like Helen Longino and Lorraine Daston have been part of an important multidisciplinary effort over the past quarter century to rethink traditional assumptions about what science is and how it works. By the 1980s, these

theorists (anthropologists among them) had produced a large body of work known as **science studies**, which explores the interconnections among the sociocultural, political, economic, and historic conditions that make scientific research both possible and successful. As we observed in Chapter 1, science studies has provided a stronger, more nuanced account of how science is done and why it succeeds (or fails), primarily by drawing attention to people, technology, and institutions whose activity is essential for the success of science, but that are regularly downplayed or ignored in standard accounts of the scientific method.

One innovation of science studies that is important for anthropology was *laboratory ethnography*. One of the first laboratory ethnographers was Bruno Latour, who carried out fieldwork at the Salk Institute in Southern California in the 1970s (Latour and Woolgar 1986). Laboratory fieldwork involves following scientists as they go about their everyday laboratory activities and brings to light the range of embodied skills that scientists in certain fields must master if they are effectively to operate the often-elaborate technological apparatuses that make successful research possible. In addition, Latour and others revealed the significance of a range of "nonscientific" institutions and individuals *outside* the laboratory whose support was essential if "strictly scientific" research projects *inside* the laboratory were to continue (Latour and Woolgar 1986; Latour 1987). Successful directors of laboratories, for example, must wear many hats: Not only must they be able to secure proper working conditions for their scientific staff, but also they must cultivate good relationships with university administrators, laboratory instrument makers, government funding agencies, and, increasingly, private industry. These days, some scientists even run their own companies.

Recent successful laboratory ethnographies undertaken by anthropologists can be found in the 2014 volume *Mestizo Genomics: Race Mixture, Nation, and Science in Latin America*, edited by Peter Wade, Carlos López Beltrán, Eduardo Restrepo, and Ricardo Ventura Santos. Three of the four editors of this collection are anthropologists, and the fourth is a historian of science. The chapters in the volume are based on laboratory ethnographies carried out in genetics laboratories in Mexico, Brazil, and Colombia, countries whose populations have often been considered to be the product of "race mixture" between European conquistadors, enslaved Africans, and Indigenous peoples. In each country, ethnographers worked closely with scientists in different laboratories and were able to show (among other things) how scientists' relationships outside the laboratory

science studies Research that explores the interconnections among the sociocultural, political, economic, and historic conditions that make scientific research both possible and successful.

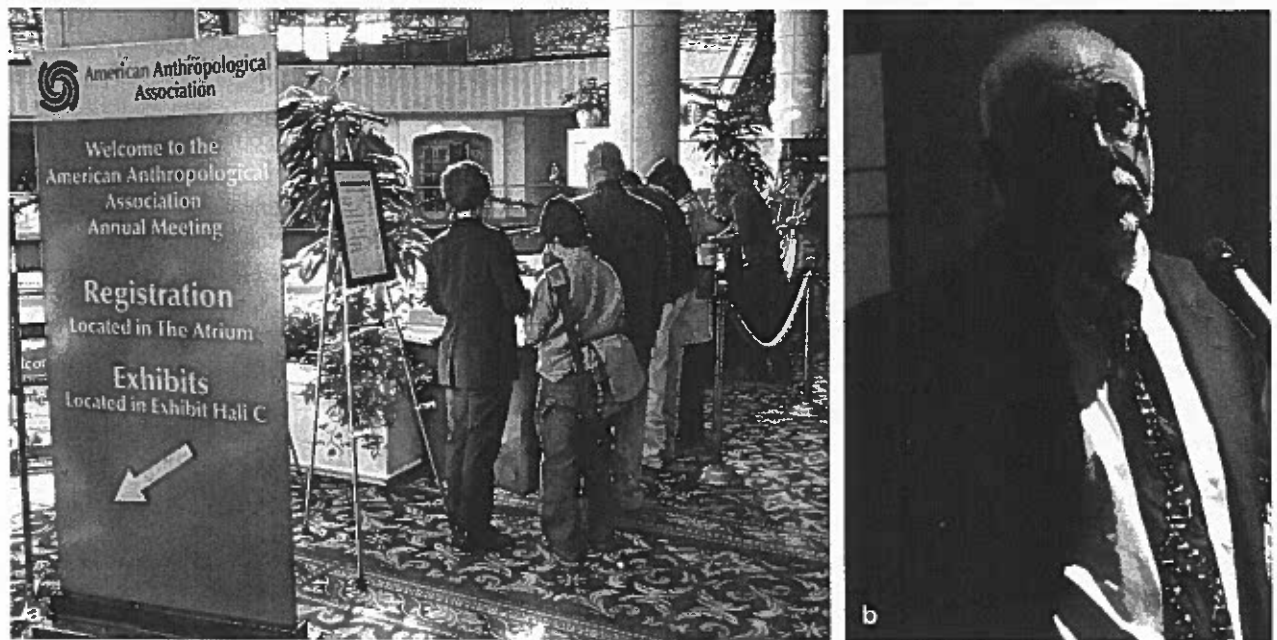


FIGURE M1.5 There is an important social aspect to science. It is not just that scientists work in teams, but they also meet regularly to discuss and debate their research, informally as conference goers seek food (a) or formally as bioanthropologist Jonathan Marks presents his research (b).

(for example, with members of local populations from which they desired to obtain genetic samples) affected the kind of science carried out inside the laboratory. The scientists' initial concern to identify genes that put different populations at risk for genetic diseases became aligned with the concern of national governments to accord official political recognition to different ethnic and racial groups within each country. Finally, the authors explore a paradox in the ways the results of this research were received by different audiences: "while [the patterns scientists discovered] appear nonracial to genetic experts, [they] might look a lot like race to nonexperts in genetics . . . reinforcing commonsense understandings of human diversity as divided up into continent-shaped groups" (2014a: 2).

Many anthropologists value science studies for having provided a more accurate, if less exalted, view of the complex alliances and entanglements that produce scientific outcomes. The legacy of science studies in anthropology has inspired anthropologists such as primatologists who work with other species (e.g., Fuentes 2012) as well as archaeologists and other anthropologists interested in material culture, from clothing to computers to art objects and ancient artifacts (e.g., Miller 2005; Hodder 2012). Historian of science Steven Shapin encapsulates the science studies perspective in the title of a recent collection of his essays: *Never Pure: Historical Studies of Science as If It Was Produced by People with*

Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority (2010). The title of Shapin's book also highlights the way science studies draws attention to the people with bodies who were involved with science and technology as researchers, as research subjects, or in other vital supporting roles. As we observed in Chapter 1, science studies scholarship has influenced work in all subfields of anthropology and suggests innovative ways to bring various subfields of anthropology into closer collaboration. We will present examples of such collaboration in subsequent chapters.

To evaluate the scientific stories told about human origins, people must become more knowledgeable about the kinds of material evidence and the interpretations of that evidence that scientists use. This book deals with both matters. The next two chapters provide an overview of the basic elements of modern evolutionary theory and the evidence that evolutionary biologists have collected to support their hypotheses. Subsequent chapters will discuss, step by step, the way scientific inquiry into the biology of living primates, the analysis of fossils, the interpretation of archaeological remains, and the study of a wide range of contemporary human societies has provided a vast body of evidence in support of an evolutionary story about human origins, the origin of culture, and the development of human cultural diversity.