

**CLARK SPENCER LARSEN**

**OUR** DISCOVERING  
PHYSICAL ANTHROPOLOGY  
FOURTH EDITION  
**ORIGINS**



FOURTH EDITION

# OUR ORIGINS





EDITION

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DISCOVERING PHYSICAL ANTHROPOLOGY

**CLARK SPENCER LARSEN**

THE OHIO STATE UNIVERSITY



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**To Chris and Spencer,  
with my deepest thanks for their help,  
encouragement, and (unwavering) patience**

**In memory of Jack Repcheck  
(January 13, 1957–October 14, 2015)  
Editor, writing mentor, and friend**

# ABOUT THE AUTHOR

**CLARK SPENCER LARSEN** is a native of Nebraska. He received his B.A. from Kansas State University and M.A. and Ph.D. from the University of Michigan. Clark's research is in bioarchaeology, skeletal biology, and paleoanthropology. He has worked in North America, Europe, and Asia. His current fieldwork is in Turkey, Italy, and the United States. He has taught at the University of Massachusetts, Northern Illinois University, Purdue University, and the University of North Carolina. Since 2001, he has been a member of the faculty at The Ohio State University, where he is Distinguished Professor of Social and Behavioral Sciences. He teaches introductory physical anthropology, osteology, bioarchaeology, and paleoanthropology. Clark has served as president of the American Association of Physical Anthropologists and as editor-in-chief of the *American Journal of Physical Anthropology*. He is a member of the National Academy of Sciences and a Fellow of the American Association for the Advancement of Science. In addition to *Our Origins*, he has authored or edited 35 books and monographs, including *Bioarchaeology: Interpreting Behavior from the Human Skeleton*, *Skeletons in Our Closet*, *Advances in Dental Anthropology*, and *A Companion to Biological Anthropology*.



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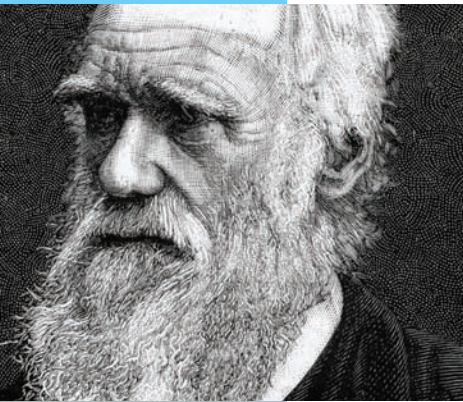
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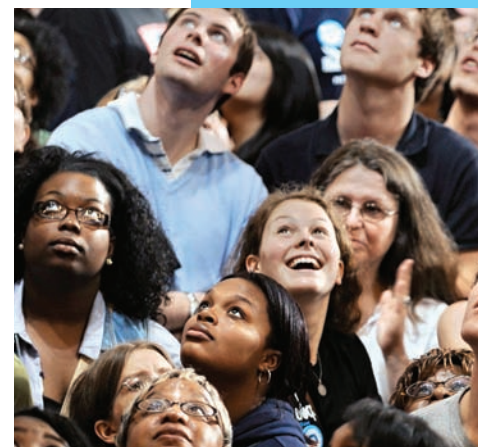
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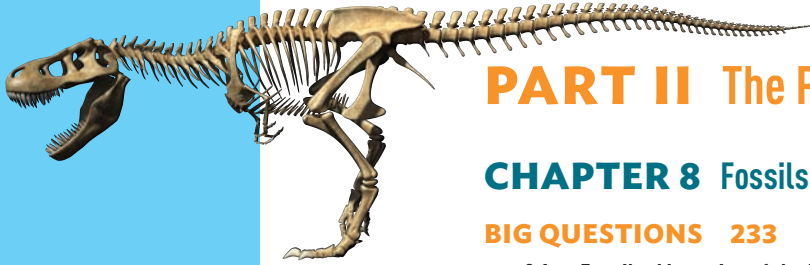
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**ANTHROPOLOGY MATTERS**

# IS RACE REAL?

If you asked the question "Is race real?" as part of an on-campus poll, nearly all would say with certainty that yes, race is real. Some might even go so far as to say, of course race is real. If those polled were then asked in what ways race is real, they would probably mention skin pigmentation as the lead diagnostic characteristic of one's racial identity. They would also probably tell you that all humans can be racially categorized, such as "white," "black," or "Asian." If pressed further, the majority in your poll would say that race as a biological category is very real indeed. But does this popular consensus mean that racial categories do, in fact, exist?

Physical anthropologists have long argued just the opposite: race as a biological concept is not real. In fact, the disagreement between your poll and what anthropologists say about race is the answer to the question that is the focus of this video. The final study of race and its strongly typological focus—that is, placing humans into discrete categories—has a long history in Western thought. Much of the discussion surrounding race can be traced to the German anatomist Johann Friedrich Blumenbach, who developed the four-race taxonomy (see page 127). In his classification scheme, first published in 1775, humans were "racialized" as "red," "white," "yellow," or "black" on the basis of their visible phenotypic characteristics. Blumenbach's main criterion was skin pigmentation, racial forms, and geography, although other characteristics were considered. The racialized categories were regularly adopted throughout the 19th century, and they have remained a mainstay of human classification ever since. Even today, as we live in an increasingly globalized world, the concept of race is still taught to schoolchildren worldwide (see the opening comments in this chapter about my experience). The notion of race as biology is well entrenched

in American society. Like most societies around the world, our society is highly racialized, meaning that most Americans view differences in skin pigmentation and other phenotypic variation as representing fundamental differences between people. Physical anthropologist Robin Dunbar argues that the typological thinking introduced by Blumenbach had only positive impacts on modern society but remains a wide range of opinions. Current research suggests that racial or typological thinking may be a natural human thought pattern, a natural result of recognizing variations that is hard-wired into all of our brains. In fact, Americans create categorizations of humans from observed traits in similar ways in other cultures and associate racism because of at least strongly influenced by their "race," including but not limited to economic disparities, discrimination, and inequality that limits access to health care, nutrition, education, and other essential factors, such as why there is drought and the world is so unequal. The trend is quite clear: in the United States, individuals belonging from certain descent groups have elevated death rates, more chronic diseases and require care, and an increased risk of injury. Considerable evidence also

connects environmental discrimination with low birth weight, infant mortality, tuberculosis, HIV infection, obesity, and cardiovascular disease. Unfortunately, these differences are typically biological, influenced on the assumption that these differences come from underlying genetic patterns (which they do). In fact, these differences are environmental, but have strongly influenced by living conditions and not due to one's "race." Think of racialized interpretations of society in general, and by a large swath of the health sciences in particular, as the treatment and view of individuals assumed to have innate (genetic) attributes. For much of the general public and the medical community, social inequality and poor health are unfairly dismissed as outcomes of typically biological differences.

Today, considerable research is funding a revolution for the study of population disparities in the social and medical sciences, which is moving to a radical development for society. However, the dependence on old, racialized, categorical taxonomic models of race makes the path toward addressing social inequality a rough one. We are responsible as a society to understand that human biological variation cannot be reduced to types and to understand the social and historical context of population stratification. "Race" once was used to describe genetic differences between newly constructed boundaries that have no basis in biology in particular and even in general. There isn't a "race" that you can identify someone that they are past toward improving the human condition.

Some scientists in the field of genetics, anthropology, and related fields are skeptical of racialized biological types.

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**4 UNDERSTANDING ARI: HEAD TO TOE**

**Skull and teeth** The skull is very similar to those of other pre-walking apes, such as *Sahelanthropus* (see p. 342), with its low brain (200 cc) and highly projecting face. It is probably the skull of the earliest common ancestor of apes and humans. The teeth show some of the specializations seen in being apes, such as the big incisors and canines and sectorial cusps of premolars and molars. When we see the teeth, we suggest that the hominid was omnivorous, eating tough fibrous foods and some hard foods. The canines show no functional honing, and so these hominids possessed their food like lower hominids.

**Upper limb and hand** Especially striking about the upper limb and hand are their proportions. Compared with those of living humans, the forearm (radius and ulna) is extraordinarily long in relation to the upper arm. The elbow joint shows evidence that these arms were used for suspension, however. The size and morphology of the hand indicate that the hominid did not knuckle-walk. The knuckle-walking posture is seen in apes. The finger was quite long, which would have given good grip. And, while we can't see the palm, it was quite flat.

**Lower limb** The lower limb has an adaptation for bipedalism, but there are several characteristics that indicate significant differences from the lower limb of apes. For example, the foot has greatly elongated toes and a fully developed big toe for grasping. The knee has the particular combination of features. While remaining in the ground, the hominid was able to swing from branch to branch by pulling the body forward when walking or running on the ground. In the other parts of the skeleton, it is a mixture of primitive and derived characteristics.

**5 IMPLICATIONS FOR HUMAN EVOLUTION**

The remarkable hominid skeleton, along with the other fossils found at Ardi, provides us with a new understanding of the origin and evolution of humans and our kin. This new understanding is made possible by the exceptionally complete fossil record and the unprecedented amount of multidisciplinary study, ranging from habitat reconstruction to the analysis of function and behavior of early hominids. The very primitive nature of this skeleton indicates that the descent of the chimpanzee lineage from human reconstruction is the result of behavior and adaptation soon after the divergence. This fossil is the closest yet found to the common ancestor of chimpanzees and humans. Most important, all of the models suggesting a three-phase model for hominid evolution—first hominid, then hominid, and finally hominid—are not supported.

# TO THE INSTRUCTOR

## How This Book Can Help Your Students Discover Physical Anthropology

### It Is about Engagement

Teaching is about engagement—connecting the student with knowledge, making it real to the student, and having the student come away from the course with an understanding of core concepts. *Our Origins: Discovering Physical Anthropology* seeks to engage the student in the learning process. Engaging the student is perhaps more of a challenge in the study of physical anthropology than in the study of other sciences, mainly because the student has likely never heard of the subject. The average student has probably taken a precollege course in chemistry, physics, or biology. Physical anthropology, though, is rarely mentioned or taught in precollege settings. Commonly, the student first finds out about the subject when an academic advisor explains that physical anthropology is a popular course that fulfills the college's natural science requirement.

Once taking the course, however, that same student usually connects quickly with the subject because so many of the topics are familiar—fossils, evolution, race, genetics, DNA, monkeys, forensic investigations, and origins of speech, to name a few. The student simply had not realized that these separately engaging topics come under the umbrella of one discipline, the subject of which is the study of human evolution and human variability.

Perhaps drawn to physical anthropology because it focuses on our past and our present as a species, the student quickly sees the fundamental importance of the discipline. In *Discover* magazine's 100 top stories of 2009, 18 were from physical anthropology. Three topics from the field were in the top 10, including the remarkable new discovery of our earliest human ancestor, *Ardipithecus*. So important was this discovery that *Science*, the leading international

professional science journal, called it the “Breakthrough of the Year” for 2009. The discussions in this textbook of topics familiar and unfamiliar give the student stepping-stones to science and to the centrality of physical anthropology as a window into understanding our world. Whether the students find the material familiar or unfamiliar, they will see that the book relates the discipline to human life: real concerns about human bodies and human identity. They will see themselves from an entirely different point of view and gain new awareness.

In writing this book, I made no assumptions about what the reader knows, except to assume that the reader—the student attending your physical anthropology class—has very little or no background in physical anthropology. As I wrote the book, I constantly reflected on the core concepts of physical anthropology and how to make them understandable. I combined this quest for both accuracy and clarity with my philosophy of teaching; namely, engage the student to help the student learn. Simply, teaching is about engagement. While most students in an introductory physical anthropology class do not intend to become professional physical anthropologists, some of these students become interested enough to take more courses. So this book is written for students who will not continue their study of physical anthropology, those who get “hooked” by this fascinating subject (a common occurrence!), and those who now or eventually decide to become professionals in the field.

The book is unified by the subject of physical anthropology. But equally important is the central theme of science—what it is, how it is done, and how scientists (in our case, anthropologists) learn about the natural world. I wrote the book so as to create a picture of who humans are as organisms, how we got to where we are over the past millions of years of evolution, and where we are going in the future in light of current conditions. In regard to physical anthropology, the student should finish the book understanding human evolution and how it is studied, how the present helps us understand

the past, the diversity of organisms living and past, and the nature of biological change over time and across geography. Such knowledge should help the student answer questions about the world. For example, How did primates emerge as a unique group of mammals? Why do people look different from place to place around the world? Why is it important to gain exposure to sunlight yet unsafe to prolong that exposure? Why is it unhealthy to be excessively overweight? Throughout their history, what have humans eaten, and why is it important to know?

I have presented such topics so that the student can come to understand the central concepts and build from them a fuller understanding of physical anthropology. Throughout the book, I emphasize hypothesis testing, the core of the scientific method, and focus on that process and the excitement of discovery. The narrative style is personalized. Often I draw on my own experiences and those of scientists I know or am familiar with through their teaching and writing, to show the student how problems are addressed through fieldwork or through laboratory investigations.

Scientists do not just collect facts. Rather, they collect data and make observations that help them answer questions about the complex natural world we all inhabit. Reflecting this practice, *Our Origins: Discovering Physical Anthropology* is a collection not of facts for the student to learn but of answers to questions that help all of us understand who we are as living organisms and our place in the world. Science is a way of knowing, it is a learning process, and it connects our lives with our world. In these ways, it is liberating.

## How the Book Is Organized

The book is divided into three parts. After an introductory overview of anthropology and physical anthropology, part I presents the key principles and concepts in biology, especially from an evolutionary perspective. This material draws largely on the study of living organisms, including humans and nonhuman primates. Because much of our understanding of the past is drawn from what we have learned from the present, this part lays the foundation for the presentation in part II—the past record of primate and human evolution. In putting the record of the living up front, this book departs from the style of most other introductory physical anthropology textbooks, which start out with the earliest record and end with the living. This book takes the position that most of what we learn about the past is based on theory and principles learned from the living record. Just as all of Charles Darwin’s ideas were first derived from seeing living plants and animals, much of our understanding of function and adaptation comes from living organisms as models. Therefore, this book views the living as the window onto what came before—the present contextualizes and informs our understanding of the past. It is no mistake, then, that *Our Origins* is the title of the book. The origins of who we are today do not just lie in the record of the past, but are very much embodied in the living. Our origins are expressed in our physical makeup (bones, teeth, and muscles), in our behavior, and in so many other ways that the student taking this course will learn about from this book and from you. You can teach individual chapters in any order, and that is partly because each

chapter reinforces the central point: we understand our past via what we see in the living.

Part II presents evidence of the past, covering more than 50 million years of primate and human evolution. Most textbooks of this kind end the record of human evolution at about 25,000 years ago, when modern *Homo sapiens* evolved worldwide. This textbook also provides the record since the appearance of modern humans, showing that important biological changes occurred in just the past 10,000 years, largely relating to the shift from hunting and gathering to the domestication of plants and animals. Food production was a revolutionary development in the human story, and part II presents this remarkable record, including changes in health and well-being that continue today. A new subdiscipline of physical anthropology, bioarchaeology, is contributing profound insights into the past 10,000 years, one of the most dynamic periods of human evolution. During this period, a fundamental change occurred in how humans obtained food. This change set the stage for our current environmental disruptions and modern living conditions.

Part III explores the record of continued evolution and discusses the impact of new developments, such as global warming, the alarming global increase in obesity, and the rise of health threats such as newly emerging infectious diseases, of which there is little understanding and for which scientists are far from finding cures. This part looks at the implications of these developments for evolution and for humans’ future on Earth.

## Changes in the Fourth Edition

Reflecting the dynamic nature of physical anthropology, there are numerous revisions and updates throughout this new, fourth edition of *Our Origins: Discovering Physical Anthropology*. These updates serve to provide content on the new and cutting-edge developments in the discipline, to give new ways of looking at older findings, and to keep the book engaging and timely for both you and your students. Although the core principles of the book remain the same, namely the focus on evolution, the revisions throughout the book present new insights, new discoveries, and new perspectives. Other changes are intended to give added focus and clarity and to increase the visual appeal that supports the pedagogy of engagement and learning:

- **New content on race and human variation.** The new edition provides answers to fundamental questions about race in America. This fourth edition explains that while race is a social reality, there is no meaningful biological basis for categorizing human variation. Therefore, while governmental and other institutions use categories to describe “race,” the categories are not biologically informed.
- **New content on the globalization of diet.** The traditional low-fat, high-protein diet in many settings around the world is rapidly shifting to a high-fat, high-carbohydrate diet, resulting in an epidemic of obesity globally. This has important consequences for world health in the twenty-first century.
- **New content on rapidly emerging infectious diseases.** New infectious diseases—such as those caused by Ebola, bird flu, and, most recently, Zika—are emerging owing to the evolutionary



changes taking place in the viruses and in the human hosts. We are learning how that evolution occurs, and how understanding this evolution offers a very practical foundation for mitigating these life-threatening events.

- **New content on epigenetics.** The new edition explores the remarkable advances in our understanding of the human genome and the role of environment in modifying the way that DNA is regulated and expressed (but without modifying the DNA itself). Some of these modifications taking place well before birth can have long-term health consequences.
- **New content on primate social behavior.** Anthropologists are learning much more about social interactions between members of primate groups, and just how critical social behavior is for the well-being and functioning of social units.
- **New content on the genomes of hominins.** Analysis of ancient DNA of Neandertals reveals the presence of alleles for modern human disease. New analysis of ancient DNA from Kennewick Man and other Paleoamericans reveals a clear genetic link between the earliest humans in the Western Hemisphere with modern Native Americans.
- **New content on fossil primate discoveries.** A newly discovered fossil New World monkey pre-dates the earliest known fossil New World monkey by as much as 10 million years.
- **New content on fossil hominin discoveries.** New discoveries of *Ardipithecus* extend the lineage back to more than 6 million years ago, taking us closer to the divergence of the great apes and hominins. In South Africa, cavers exploring the Rising Star Cave system discovered hundreds of skulls, teeth, and bones, all representing at least 15 early hominins. Named *Homo naledi*, this species is represented by the largest assemblage of early hominins in a single site in Africa. Its study is full of surprises and is expanding the scope of our understanding of human origins and human evolution. Excavations on Flores Island, where the famous “Hobbit” (*Homo floresiensis*) fossils were found, landed a new surprise: a dwarf hominin that may be the ancestor of *H. floresiensis*. Re-dating of *H. floresiensis* takes it back in time to at least 60,000 yBP.
- **Anthropology Matters and How Do We Know? boxes.** New boxes highlight exciting and relevant new developments in physical anthropology, including work at the “Body Farm” for developing the field of forensic anthropology; the Ebola virus and how knowledge of its evolution helps us combat the disease; new findings from genomics and the origins and evolution of modern humans and their migrations; the meaning of race and what anthropology brings to the discussion of this controversial topic; new developments in primate conservation; the exciting discovery and study of *Homo naledi*; bone chemistry and its application to the study of diets in past human populations, both long extinct and recent; and the earliest evidence of warfare and what human skeletons tell us about violence and conflict.
- **New content on dramatic changes in the world’s climate today.** We are living at a time of rapidly changing climate, involving global warming. New content in this edition makes the case that we may be living in a wholly new epoch, what many scientists

are calling the “Anthropocene.” New content in the final chapter of *Our Origins* focuses on the effects of climate change happening in the world around us today.

- **Revision of content to enhance clarity.** There is a continued focus on understanding core concepts, with considerable attention given to cell biology, genetics, DNA, race and human variation, primate taxonomy, locomotion, and dating methods. Like previous editions, I paid careful attention to the clarity of figure captions. The figure captions do not simply repeat text but rather offer the student additional details relevant to the topic and occasional questions about concepts that the figures convey.
- **Greatly enhanced art program.** The new edition contains more than 100 new or revised figures, often using a new “photorealistic” style. The book adds several full-color two-page spreads developed by Mauricio Antón, a world-renowned artist with expertise in representing past life in wonderful visual presentations.
- **InQuizitive.** InQuizitive is a new online formative and adaptive learning tool that includes a variety of question types featuring the vibrant, detailed, and photorealistic art from the text, as well as the accompanying suite of animations. Answer-specific feedback for every question helps students work through their mistakes, and InQuizitive personalizes students’ quizzing experience to target the areas they need help with most.
- **Updated Evolution Review sections.** At the end of each chapter, an Evolution Review section summarizes material on evolution in each chapter and includes assignable questions about concepts and content. Suggested answers appear in the Instructor’s Manual and the Interactive Instructor’s Guide.
- **New teaching and learning tools.** Consistent with the highly visual nature of physical anthropology, the instructor media package has been greatly expanded. Please see the complete listing that starts on page xxv. The Update PowerPoint Service features a new minilecture that will be posted to the Norton Instructor’s site each semester on the latest discoveries in the discipline.

## Aids to the Learning Process

Each chapter opens with a *vignette* telling the story of one person’s discovery that relates directly to the central theme of the chapter. This vignette is intended to draw your students into the excitement of the topic and to set the stage for the Big Questions that the chapter addresses.

**Big Question** learning objectives are introduced early in the chapter to help your students organize their reading and understand the topic.

**Concept Checks** are scattered throughout each chapter and immediately follow a major section. These aids are intended to help your students briefly revisit the key points they have been reading.

**Locator Maps** are placed liberally throughout the book. College-level instructors tend to hope that students have a good sense of geography, but like a lot of people who do not look at places

around the world on a daily basis, students often need reminders about geography. In recognition of this, locator maps in the book's margins show the names and locations of places that are likely not common knowledge.

**Photorealistic Art You Can “Touch”:** Designed to give students an even better appreciation for the feel of the discipline, the art program has been substantially reworked. Now most illustrations of bones and skeletons have an almost photorealistic feel, and most primates were redrawn for a high degree of realism. This book helps your students visualize what they are reading about by including hundreds of images, many specially prepared for the book. These illustrations tell the story of physical anthropology, including key processes, central players, and important concepts. As much thought went into the pedagogy behind the illustration program as into the writing of the text.

**Definitions** are also presented in the text's margins, giving your students ready access to what a term means in addition to its use in the associated text. For convenient reference, defined terms are signaled with boldface page numbers in the index.

A **How Do We Know?** box in each chapter discusses in more detail how a particular scientist went about the process of discovery.

An **Anthropology Matters** box in each chapter makes the important point that what we learn from this discipline has practical applications of broader significance in the “real” world. Students will come away from each box with a sense of how the material affects them.

At the end of each chapter, **Answering the Big Questions** presents a summary of the chapter's central points organized along the lines of the Big Questions presented at the beginning of the chapter. In addition, I have added to the Chapter Review at the end of each chapter a new Study Quiz, asking a handful of key questions that I ask my own students.

The study of evolution is the central core concept of physical anthropology. The **Evolution Review** section at the end of each chapter discusses topics on evolution featured in the chapter and asks questions that will help the student develop a focused understanding of content and ideas.

**InQuizitive** is our new online assessment service featuring visual, conceptual, and reading assessments keyed to the Big Question learning objectives, several of which are highlighted for your convenience at the end of each chapter. InQuizitive helps you track and report on your students' progress and make sure they are better prepared for class.

Join me now in engaging your students in the excitement of discovering physical anthropology.

## Tools for Teaching and Learning

The *Our Origins* teaching and learning package provides instructors and students with all the tools they need to visualize anthropological concepts, learn key vocabulary, and test knowledge.

## For Instructors

**New InQuizitive** New InQuizitive online assessment is available for use with *Our Origins*, Fourth Edition, featuring engaging assignments with focused feedback. InQuizitive includes drag-and-drop and other image-based questions designed to help students better understand the core objectives of each chapter. Further questions on the reading help you check if students have worked through the chapter material. Designed to be intuitive, accessible, and easy to use, InQuizitive makes it a snap to assign, assess, and report on student performance and help keep your class on track.

Chapter 9. Primate Origins and Evolution

Page 229 9.3 What were the first higher primates?

Question Confidence I think I know it  
You gained 80 points on this question.

Activity Score  
120

Current Grade  
0%  
You must answer at least 8 more questions to receive a grade.

Next Question  
Show Feedback  
Challenge This Question

Complete the following sentence by dragging the correct word to the blank.

Aegyptopithecus was one of the most common **propliopithecids**.

oligopithecids parapithecids

**Correct!** You earned 80 points.

Because Aegyptopithecus were larger and more catarrhine-like than the other parapithecids, they are a likely contender for the common ancestor of all later catarrhines. This makes them the best-known Fayum primate. Just take a look at the picture below!

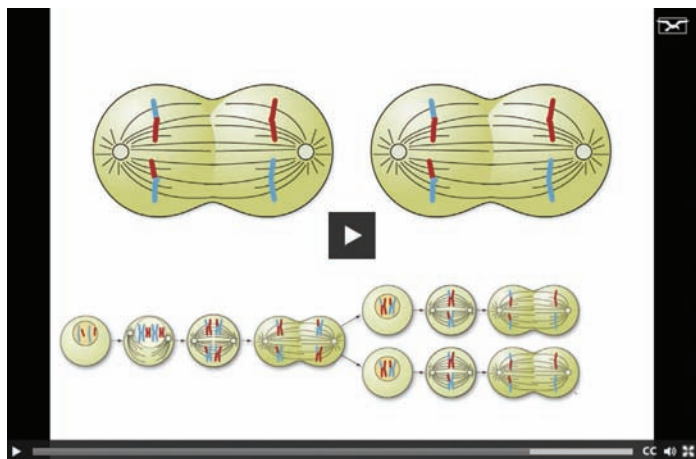
Next Question Close Feedback

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**New Animations** Animations of key concepts from the text are available to instructors and students in several ways, including via the Coursepack, the Interactive Instructor’s Guide, and at [wwnorton.com/instructors](http://wwnorton.com/instructors) and [digital.wwnorton.com/ourorigins4](http://digital.wwnorton.com/ourorigins4). These are brief, easy to use, and great for explaining concepts either in class or as a self-study tool.



**New Anthropology Matters and How Do We Know? Videos** New original videos accompany a selection of Anthropology Matters and How Do We Know? features from the text. An icon indicates when a video is available. Each two- to three-minute video further enhances the content while inspiring students to learn more and understand the significance of what they are studying. Instructors can obtain the videos through the Interactive Instructor’s Guide, [wwnorton.com/instructors](http://wwnorton.com/instructors), or via the Coursepack. Students can view the videos via the Coursepack or [digital.wwnorton.com/ourorigins4](http://digital.wwnorton.com/ourorigins4).

**Update PowerPoint Service** To help cover what is new in the discipline, each semester Norton will provide a new set of supplemental lectures, notes, and assessment material covering current and breaking research. Prepared by Laurie Reitsema (University of Georgia), this material will be available for download at [wwnorton.com/instructors](http://wwnorton.com/instructors) and in the Interactive Instructor’s Guide.



**Lecture PowerPoint Slides and Art Slides** Designed for instant classroom use, these slides prepared by Melissa Torpey (University of North Carolina Wilmington) using art from the text are a great resource for your lectures. All art from the book is also available in PowerPoint and JPEG formats. Download these resources from [wwnorton.com/instructors](http://wwnorton.com/instructors) or from the Interactive Instructor’s Guide.

**Prepare for Class with the Our Origins Instructor’s Manual** Prepared by Susan Kirkpatrick Smith (Kennesaw State University), this resource provides lecture ideas, discussion topics, suggested reading lists for instructors and students, and suggested answers to Evolution Review questions.

**Quickly and Easily Create Tests with the Our Origins Test Bank** Prepared by Greg Laden, this test bank contains multiple-choice and essay questions for each chapter. It is downloadable from Norton’s Instructor’s site and available in Word, PDF, and ExamView® Assessment Suite formats. Visit [wwnorton.com/instructors](http://wwnorton.com/instructors).

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## Who Helped

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Columbus, Ohio  
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# TO THE STUDENT

## Physical Anthropology Is about Discovering Who We Are

### Thinking Like an Anthropologist

Who are we? Where do we come from? Why do we look and act the way we do? This book is a journey that addresses these and other big questions about us, *Homo sapiens*. This journey emphasizes humans' discovery of the fascinating record of our diversity and of our evolution, a record that serves as a collective memory of our shared biological presence on Earth. From here to the end of the book, I will share with you all kinds of ideas that add up to our current understanding of human beings as living organisms. Along the way, you will experience scientific breakthroughs such as the Human Genome Project and forensics (you might even watch *CSI* and *Bones* in a whole new way). You will gain new understandings of phenomena such as race and human diversity, global warming and its impact on our evolution and our well-being, the origins of human violence, global disease, and the growing worldwide obesity epidemic. Like an anthropologist tackling important questions, you will discover places on nearly every continent and come to see what life was like millions of years before the present, before the emergence and evolution of humans.

Neither your instructor nor I can expect you as an introductory student to understand all the developments in physical anthropology. Both of us can, however, present you with a clear and concise framework of the field. By the time you are finished reading this book and completing this course, you will have a solid background in the basic tenets of the discipline. This knowledge will help you understand your place in nature and the world that we—more than 7 billion of us and growing—live in. The framework for developing your understanding of physical anthropology is the scientific

method, a universal approach to understanding the very complex natural world. You should not assume that this book and this course are about only knowing the right answers, the “facts” of physical anthropology. Rather, they are also about seeing how physical anthropologists know what they know—understanding the scientific method. So as you read, keep in mind the key questions that scientists try to answer, their processes and methods for finding the answers, and the answers themselves.

In writing this book, I have focused on the big questions in physical anthropology, how scientists have tackled them, and what key discoveries have been made. I have not shied away from identifying the scientists who made these discoveries—real people, young and old, from all over the world. Whether you need to learn all these individuals' names and what they contributed to the growth of physical anthropology and to our knowledge of human evolution and variation is up to your instructor. But in the introductory physical anthropology class that I teach, I encourage my students to learn about the people behind the ideas. By seeing the field through these people's eyes, you can start thinking like an anthropologist.

### Seeing Like an Anthropologist

Thinking like an anthropologist includes seeing what anthropologists see. We anthropologists are constantly looking at things—fossilized human teeth, ancient DNA, excavated stone tools, primate skeletons, and much more—and using what we see to understand biology in the past and in the present. The photos and drawn art throughout this book have been chosen to help you see what anthropologists see. I strongly encourage you to pay close attention to the visuals in the book and their captions because much of our anthropological understanding is in the art program.

## The Structure of the Book and Resources

The book is divided into three parts. After an overview of anthropology and physical anthropology (chapter 1), part I provides the basic context for how we understand human (and our nonhuman primate relatives') biology in the present (and how that helps us understand the past). From this section of the book you should come away with an understanding of evolution and the biology associated with it. Evolution as an idea has a long history (chapter 2). You will need to fully grasp the meaning and power of this theory, which explains humans' biological variation today and in the past. Part I also has the important job of providing you with an understanding of genetics (chapters 3 and 4). This information is a central part of the evidence for evolution, from the level of the molecule to the level of the population.

Part I also looks at the biology of living people, that of the other living primates, and the variation among primate species. I am keen on debunking the common notion that there are discrete categories—races—of human beings (chapter 5). In fact, nothing about the biology of people, present or past, indicates that we can be divided into distinct groups. After looking at how environment and culture help shape the way humans look and behave, I will look similarly at nonhuman primates (chapters 6 and 7). Because nonhuman primates' appearances are much more categorical than humans' are, nonhuman primate appearance lends itself to classification or taxonomy. In these chapters, we will look at what nonhuman primates do in the wild, what they are adapted to, and especially the environment's role in shaping their behavior and biology. By looking at living people and living nonhuman primates, we will be better equipped to understand the biological evidence drawn from the past.

Part II examines the processes and evidence physical anthropologists and other scientists use to understand the past (chapter 8), the evolution of prehuman primate ancestors that lived more than 50 million years ago (chapter 9), and both the emergence of our humanlike ancestors and their evolution into modern humans (chapters 10, 11, and 12). Contrary to popular (and some scientific) opinion, human evolution did not stop when anatomically modern people first made their appearance in various corners of the globe. Rather, even into the past 10,000 years a considerable amount of biological change has occurred. Anthropologists have learned that agriculture, which began some 10,000 years ago, has been a fundamental force behind population increase. The downside of this shift to new kinds of food and the resulting population increase was a general decline in health. The later section of part II (chapter 13) explores the nature and cause of biological change, including the changes associated with health and well-being that led to the biological and environmental conditions we face today.

Part III (chapter 14) looks at the future of our species. Humans continue to undergo biological change—some of it genetic, some not. To understand nongenetic biological change, we will look closely at how modern technologies and diets are profoundly

affecting human appearance and contributing to behavioral change. Technologies and diets are helping produce new diseases, new threats to animal and plant diversity, and a planet that is in some ways becoming a less desirable place to live. In particular, global warming's evolving threat is among the most important issues of our day and will prove even more important in the future. Chapters 1–13 will enable us to consider how humans can cope and thrive when faced with such daunting challenges.

For every chapter, we have developed additional, helpful online tools so you can further study and understand the concepts. Visit [digital.wwnorton.com/ourorigins4](http://digital.wwnorton.com/ourorigins4) to access animations and videos, free of charge. You can also access InQuizitive here for engaging, game-like, online questions with answer-specific feedback. InQuizitive personalizes the questions you receive, based on how you answer and express confidence along the way, to ensure that you understand all of the Big Questions.

With this book in hand and our goals—thinking and seeing like anthropologists—in mind, let us set off on this exciting journey. Consider it a voyage of discovery, on which our shipmates include your instructor and your fellow students. If we work hard and work together, we will find perhaps the most interesting thing on Earth: ourselves.



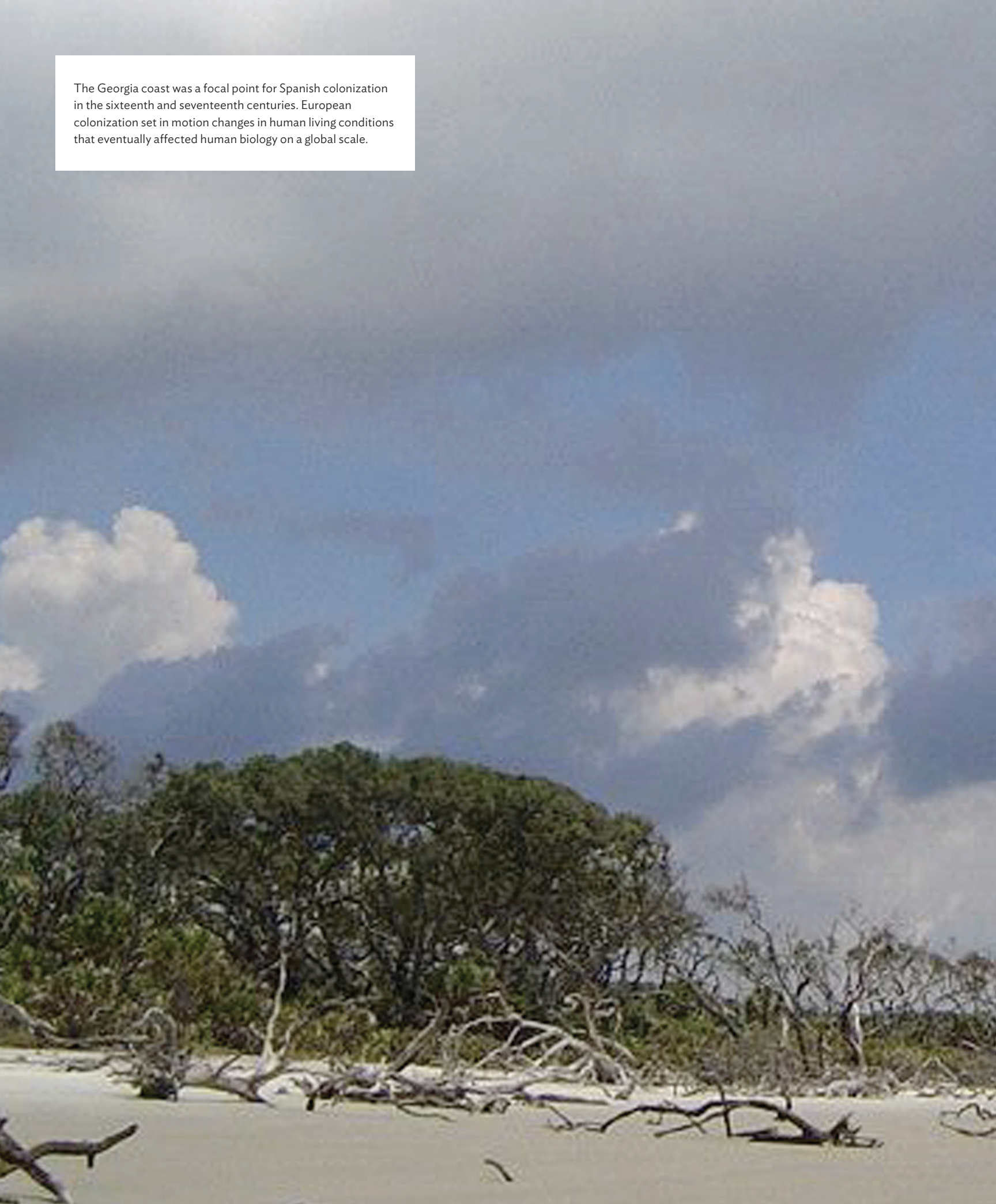




FOURTH EDITION

# OUR ORIGINS

The Georgia coast was a focal point for Spanish colonization in the sixteenth and seventeenth centuries. European colonization set in motion changes in human living conditions that eventually affected human biology on a global scale.



# 1

## What Is Physical Anthropology?

### BIG QUESTIONS

1. **What is anthropology?**
2. **What is physical anthropology?**
3. **What makes humans so different from other animals?**
4. **How do physical anthropologists know what they know?**

In the heat of the midday summer sun, our boat slowly made its way across the five miles of water that separate mainland Georgia from St. Catherines Island, one of a series of barrier islands dotting the Atlantic seaboard. Today, the island is covered by dense vegetation typical of the subtropical American South—palmettos and other palm trees, pines, hickories, and live oaks—and is infested with a wide array of stinging, burrowing, and biting insects. It is hard to imagine that this setting was once a focal point of the Spanish colonial “New World,” representing the northernmost extension of Spain’s claim on eastern North America (**Figure 1.1**). This was the location of the Roman Catholic church and mission Santa Catalina de Guale, where several hundred Indians and a dozen Spaniards lived and worked during the late 1500s and most of the 1600s.

What could possibly have motivated my field team and me to work for months under a blazing sun, fighting insects? Like any scientific investigation, our fieldwork was motivated by specific questions that we keenly wanted to answer. Buried in the sands of St. Catherines were the mortal remains—skeletons—of the native people who had lived at this long-abandoned place. These remains held answers to



**FIGURE 1.1**

**Spanish Mission Sites** Spanish colonization relied on the establishment of missions north and west of St. Augustine, Florida, along the coast of Georgia and the panhandle of northern Florida. These sites, such as Mission Santa Catalina de Guale (on St. Catherines Island), provide insight into what the missions might have looked like (inset). Researchers have reconstructed the lifestyles of the Indians and the Spanish colonizers who inhabited the sites: by studying their skeletons, the researchers assessed how the inhabitants changed biologically after colonization.

questions about the biology of modern people. Native Americans had lived in this area of the world for most of the past 10,000 years. We wanted to know about their biological evolution and variation: How had these people changed biologically over this time span? What caused these changes? What circumstances led to the changes that we hoped to identify and interpret?

When we first set foot on St. Catherines Island in the summer of 1982 to begin our work at Mission Santa Catalina, we were excited about our project, but little did we realize just what a spectacular scientific journey we were undertaking. The skeletons we sought turned out to provide wonderfully rich biological details about a little-understood region of the world, especially relating to the health and behavioral consequences of European contact on native peoples. In setting up the research project, I had envisioned that our findings would prove to be a microcosm of what had unfolded globally—in the Americas, Asia, Africa, and Australia—during the previous 500 years of human history. During this period, significant biological changes had taken place in humans. Some of these changes were evolutionary—they resulted in genetic change. Other biological changes, nonevolutionary ones, reflected significant alterations in health and lifestyle, alterations that had left impressions on the skeletons we studied. Such study—of genetic and nongenetic changes—here and elsewhere in the world has proved fundamental to understanding human biology in the early twenty-first century.

Like any scientific investigation, the research project at Mission Santa Catalina did not develop in a vacuum. Prior to our work there, my team and I had devoted nearly a decade to studying hundreds of skeletons we had excavated from the region that predated the arrival of the Spaniards. We had learned from archaeological evidence that before AD 1000 or so, the people there ate exclusively wild animals, fish, and wild plants—they were hunters and gatherers. Never settling into one place for any period of time, they moved from place to place over the year, hunting animals, fishing on the coastline, and collecting plants. Then, their descendants—the later prehistoric ancestors of the mission Indians—acquired corn agriculture, becoming the first farmers in the region. These people did lots of fishing, but farming produced the mainstay of their diet. This major shift in lifestyle led to the establishment of semipermanent villages. In comparison with the hunter-gatherers living before AD 1000, the later agricultural people were shorter, their skulls and limb bones were smaller, and they had more dental disease and more infections. All of this information—scientific discoveries about the prehistoric people, their biological changes, and their adaptations—set the stage for our return to the island to study the people who lived at Santa Catalina, the descendants of the prehistoric hunter-gatherers and later farmers. From our study of their remains, we learned that after the Spaniards' arrival, the native people worked harder, became more focused on producing and eating corn, and their health declined. The combination of declining quality of life and new diseases introduced by the Spaniards led to the native people's extinction in this area of North America.

The research just described is one small part of the broader discipline known as *physical anthropology*. My work concerns life on the Atlantic coast of the southeastern United States, but physical anthropologists explore and study *everywhere* humans and their ancestors lived. This enterprise covers a lot of ground and a lot of time, basically the entire world and the past 50 million years or so! The territorial coverage of physical anthropology is so widespread and so diverse because the field addresses broad issues, seeking to understand human evolution—*what we were* in the past, *who we are* today, and *where we will go* in the future. Physical anthropologists seek answers to questions about *why* we are what we are as biological organisms. How we answer these questions is oftentimes difficult. The questions, though, motivate physical anthropologists to spend months in the subtropics of coastal Georgia, learning about an extinct native people; in the deserts of central Ethiopia, finding and studying the remains of people who lived hundreds, thousands, or even millions of years ago; or at the high altitudes of the Andes, studying living people and their responses and long-term adaptation to low oxygen and extreme cold, to name just a few of the settings you will learn about in this book. In this chapter, we will explore in more detail the nature of physical anthropology and its subject matter.

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## 1.1 What Is Anthropology?

When European explorers first undertook transcontinental travel (for example, Marco Polo into Asia in the late 1200s) or transoceanic voyages to faraway lands (for example, Christopher Columbus to the Americas in the late 1400s and early 1500s), they encountered people that looked, talked, dressed, and behaved very differently from themselves. When these travelers returned to their home countries, they described the peoples and cultures they saw. Building on these accounts, early scholars speculated on the relationships between humans living in Europe and those encountered in distant places. Eventually, later scholars developed new ideas about other cultures, resulting in the development of the discipline of anthropology.

**Anthropology** is the study of humankind, viewed from the perspective of all people and all times. As it is practiced in the United States, it includes four branches or sub-disciplines: **cultural anthropology**, **archaeology**, **linguistic anthropology**, and **physical anthropology**, also called **biological anthropology** (Figure 1.2).

Cultural anthropologists typically study present-day societies in non-Western settings, such as in Africa, South America, or Australia. Culture—defined as learned behavior that is transmitted from person to person—is the unifying theme of study in cultural anthropology.

Archaeologists study past human societies, focusing mostly on their material remains—such as animal and plant remains and places where people lived in the past. Archaeologists are best known for their study of material objects—**artifacts**—from past cultures, such as weaponry and ceramics. Archaeologists study the processes behind past human behaviors; for example, why people lived where they did, why some societies were simple and others complex, and why people shifted from hunting and gathering to agriculture beginning more than 10,000 years ago. Archaeologists are the cultural anthropologists of the past—they seek to reassemble cultures of the past as though those cultures were alive today.

Linguistic anthropologists study the construction and use of language by human societies. **Language**—defined as a set of written or spoken symbols that refer to things (people, places, concepts, etc.) other than themselves—makes possible the transfer of knowledge from one person to the next and from one generation to the next. Popular among linguistic anthropologists is a subfield called **sociolinguistics**, the investigation of language's social contexts.

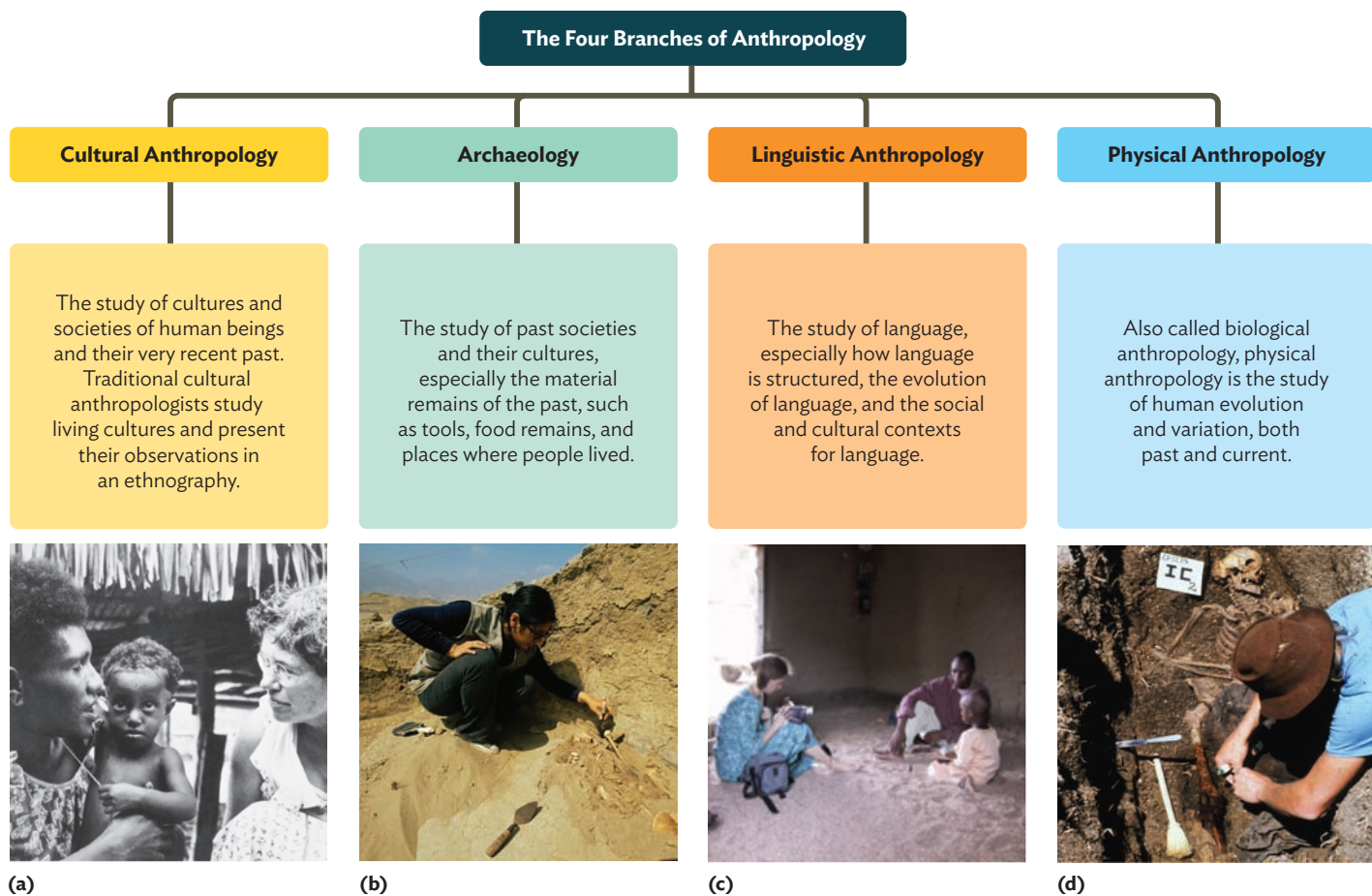
Physical (or biological) anthropologists study all aspects of present and past human biology. As we will explore in the next section, physical anthropology deals with the evolution of and variation among human beings and their living and past relatives.

No anthropologist is expected to be an expert in all four branches. Anthropologists in all four areas and with very different interests, however, acknowledge the diversity of humankind in all contexts. No other discipline embraces the breadth of the human condition in this manner. In fact, this remarkably diverse discipline differs from other disciplines in its commitment to the notion that, unlike other animals, humans are biocultural—both biological and cultural beings. Anthropologists are interested in the interrelationship between biology and culture. Anthropologists call this focus the **biocultural approach**. Anthropology also differs from other disciplines in emphasizing a broad comparative approach to the study of biology and culture, looking at all people (and their ancestors) and all cultures in all times and all places. They are interested in people and their ancestors, wherever or whenever they lived. Simply, you are studying a field that is holistic, unlike any you have studied before.

**artifacts** Material objects from past cultures.

**sociolinguistics** The science of investigating language's social contexts.

**biocultural approach** The scientific study of the interrelationship between what humans have inherited genetically and culture.



**FIGURE 1.2**

**The Four Branches of Anthropology** (a) Cultural anthropologists, who study living populations, often spend time living with cultural groups to gain more intimate perspectives on those cultures. The American anthropologist Margaret Mead (1901–1978), one of the most recognizable names in cultural anthropology, studied the peoples of the Admiralty Islands, near Papua New Guinea. (b) Archaeologists study past human behaviors by investigating material remains that humans leave behind, such as buildings and other structures. This archaeologist examines remnants from a pyramid in the ancient sacred city of Caral, Peru. (c) Linguistic anthropologists study all aspects of language and language use. Here, Leslie Moore, a linguistic anthropologist working in a Fulbe community in northern Cameroon, records as a teacher guides a boy in memorizing Koranic verses. (d) Physical anthropologists study human evolution and variation. Some physical anthropologists study skeletons from the past to investigate evolution and variation throughout human history. Those working in **forensic anthropology**, a specialty within physical anthropology, examine skeletons to identify who they were in life. Such an identification may be of a single person or of thousands. For example, the forensic anthropologist pictured here was called on to help identify the estimated 30,000 victims of Argentina’s “Dirty War,” which followed the country’s 1976 coup.

## 1.2 What Is Physical Anthropology?

The short answer to this question is, *Physical anthropology is the study of human biological evolution and human biocultural variation.* Two key concepts underlie this definition.

Number one, every person is a product of evolutionary history, or all the biological changes that have brought humanity to its current form. The remains of humanlike beings, or **hominins**, indicate that the earliest human ancestors, in Africa, date to sometime around 6–8 million years ago (mya). Since that time, the physical appearance of hominins and their descendants, including modern humans, has changed dramatically. Our physical appearance, our intelligence, and everything else that makes us

**hominins** Humans and humanlike ancestors.

distinctive biological organisms evolved in our predecessors, whose genes led to the species we are today. (Genes and species are among the subjects of chapters 3 and 4.)

Number two, each of us is the product of his or her own individual life history. From the moment you were conceived, your biological makeup has been determined mostly by your genes. (The human **genome**—that is, all the genetic material in a person—includes some 20,000–25,000 genes.) Your biological makeup is also strongly influenced by your environment. *Environment* here refers not just to the obvious factors such as climate but to everything that has affected you—the physical activities you have engaged in (which have placed stress on your muscles and bones), the food you have eaten, and many other factors that affect overall health and well-being. Environment also includes social and cultural factors. A disadvantaged social environment, such as one in which infants and children receive poor-quality nutrition, can result in negative consequences such as poor health, reduced height, and shortened life expectancy. The Indian child who lived after the shift from foraging to farming on the Georgia coast ate more corn than did the Indian child who lived in the same place before AD 1000. Because of the corn-rich diet, the later child's teeth had more cavities. Each child's condition reflects millions of years of evolution as well as more immediate circumstances, such as diet, exposure to disease, and the stresses of day-to-day living.

## WHAT DO PHYSICAL ANTHROPOLOGISTS DO?

Physical anthropologists routinely travel to places throughout the United States and around the world to investigate populations. Some physical anthropologists study living people, while others study extinct and living species of our nearest biological relatives, **primates** such as lemurs, monkeys, and apes. I am among the physical anthropologists who travel to museum collections and archaeological localities to study past societies. When I tell people outside the field what I do for a living, they often think physical anthropology is quite odd, bizarre even. Frequently they ask, “Why would anyone want to study dead people and old bones and teeth?” Everyone has heard of physics, chemistry, and biology; but the average person has never heard of this field. Compared to other areas of science, physical anthropology is small. But smallness does not make it unimportant. It is practical and significant, providing answers to fundamental questions that have been asked by scholars and scientists for centuries, such as *Who are we as a species? What does it mean to be human? Where did we come from?* Moreover, physical anthropology plays a vital role in addressing questions that are central to our society, sometimes involving circumstances that all of us wish had never come about. For example, the tragedy that Americans identify as 9/11 called immediately for the assistance of specialists from forensic anthropology.

The discipline as practiced in the United States began in the first half of the twentieth century, especially under the guidance of three key figures: Franz Boas for American anthropology generally (see “How Do We Know: Franz Boas Invents Anthropology, American Style”); Czech-born Aleš Hrdlička, who started the professional scientific journal and professional society devoted to the field; and Earnest Hooton, who trained most of the first generation of physical anthropologists. While the theory and methods of physical anthropologists today have changed greatly since the early 1900s, the same basic topics first envisioned by these founders form what we do.

Physical anthropologists study all aspects of human biology, specifically looking at the evolution and variation of human beings and their living and past relatives. This focus on biology means that physical anthropologists practice a *biological science*. But they also practice a *social science*, in that they study biology within the context of culture and behavior. Depending on their areas of interest, physical anthropologists might

**genome** The complete set of genetic information—chromosomal and mitochondrial DNA—for an organism or species that represents all of the inheritable traits.

**primates** A group of mammals in the order Primates that have complex behavior, varied forms of locomotion, and a unique suite of traits, including large brains, forward-facing eyes, fingernails, and reduced snouts.



# FRANZ BOAS INVENTS ANTHR

The origins of academic anthropology in the United States go back to the late 1800s. More than anyone else, Franz Boas (1858–1942) pulled together the various scholarly themes that give the discipline its distinctive identity in the United States.

German by birth and by education, Boas attended graduate school, majoring in physics and geography. He was expected to know a lot about a lot of different things. By the time he received his Ph.D. from the University of Kiel in 1881, he had developed a passionate interest in studying other cultures, drawing the conclusion that human societies were best understood from as many angles as possible, including the cultural side (culture, technology, and society) and the biological side (variation, physical characteristics, and adaptation). He was also trained to observe the natural world and to record it in detail, not just to collect facts but to answer questions. This perspective grew from his exposure to senior scholars with interdisciplinary approaches and to scientists who focused on empirical, measurable evidence. Among his teachers was the leading European anthropologist of the nineteenth century, Rudolf Virchow (1821–1902).

In the late spring of 1883, Boas left his hometown of Minden, Germany, for his first anthropological expedition, to spend a year observing the Inuit (Eskimos) living on Baffin Island in the eastern Arctic of North America. His education and training had convinced him that he needed to find out as much as he could on the cultural and biological sides of the human condition, in this case as they applied to the Inuit. This endeavor was a central element of the birth of anthropology in the United States.



Franz Boas aboard the *Germania* in 1883 on his expedition to Baffin Island.

Boas's objective in his fieldwork was simple. In his own words, he wanted to research "the simple relationships between the land and the people." His work represented a fundamental development in the history of anthropology because it brought together different perspectives, seeking to understand the Inuit's living and past cultures, language, and biology. Today, these emphases comprise the four main branches of anthropology: cultural anthropology, archaeology, linguistic anthropology, and physical anthropology.

# ANTHROPOLOGY, AMERICAN STYLE



Boas, here dressed and equipped for Arctic exploration, sought to learn how the Inuit people interacted with their environment and how the environment affected their biology. He also studied their language and material culture during this yearlong, physically and emotionally taxing expedition.

After Boas moved to the United States, he served as one of the first scientific curators of anthropology at the American Museum of Natural History in New York City during the 1890s. Over the next half-century, he taught full-time at Columbia University, instilling in his students a central tenet of anthropology: we learn about cultures, societies, and peoples' biology via *direct* observation and *careful*

attention to detail. Boas trained the first generation of American academic anthropologists, all leaders in the field: Ruth Benedict, Margaret Mead, Edward Sapir, Alfred Kroeber, Robert Lowie, and Melville Herskovits, to name a few. He was also an important force in founding one of the primary professional organizations, American Anthropological Association, and its journal, *American Anthropologist*, and played leading roles in the founding of other anthropological organizations, including the American Association of Physical Anthropologists, the professional organization of physical anthropologists in the United States. By basing his research and his teaching on questions such as *How do we know?*, Boas laid the foundation for scientific anthropology: reliance on the scientific method, with its focus on the collection of evidence, for addressing hypotheses and answering questions about past and living people.

Boas has left a lasting legacy, and his approach to understanding the human condition continues to influence anthropology today. For physical anthropology, he was a strong proponent of the idea of the plasticity of human biology, observing physical changes from one generation to the next. His most important legacy is his commitment to the idea of cultural relativism, namely that we must look at the values, behaviors, and beliefs from the point of view of the people and the culture being studied. All anthropologists today can look back on when they were first exposed to the idea. I well recall my own “ah ha” moment in the introduction to cultural anthropology course I took when I was an undergraduate, realizing that it isn't just other cultures that have different perspectives; others in my own culture may have different points of view as well. Boas celebrated human diversity in all ways—culturally, socially, and biologically.