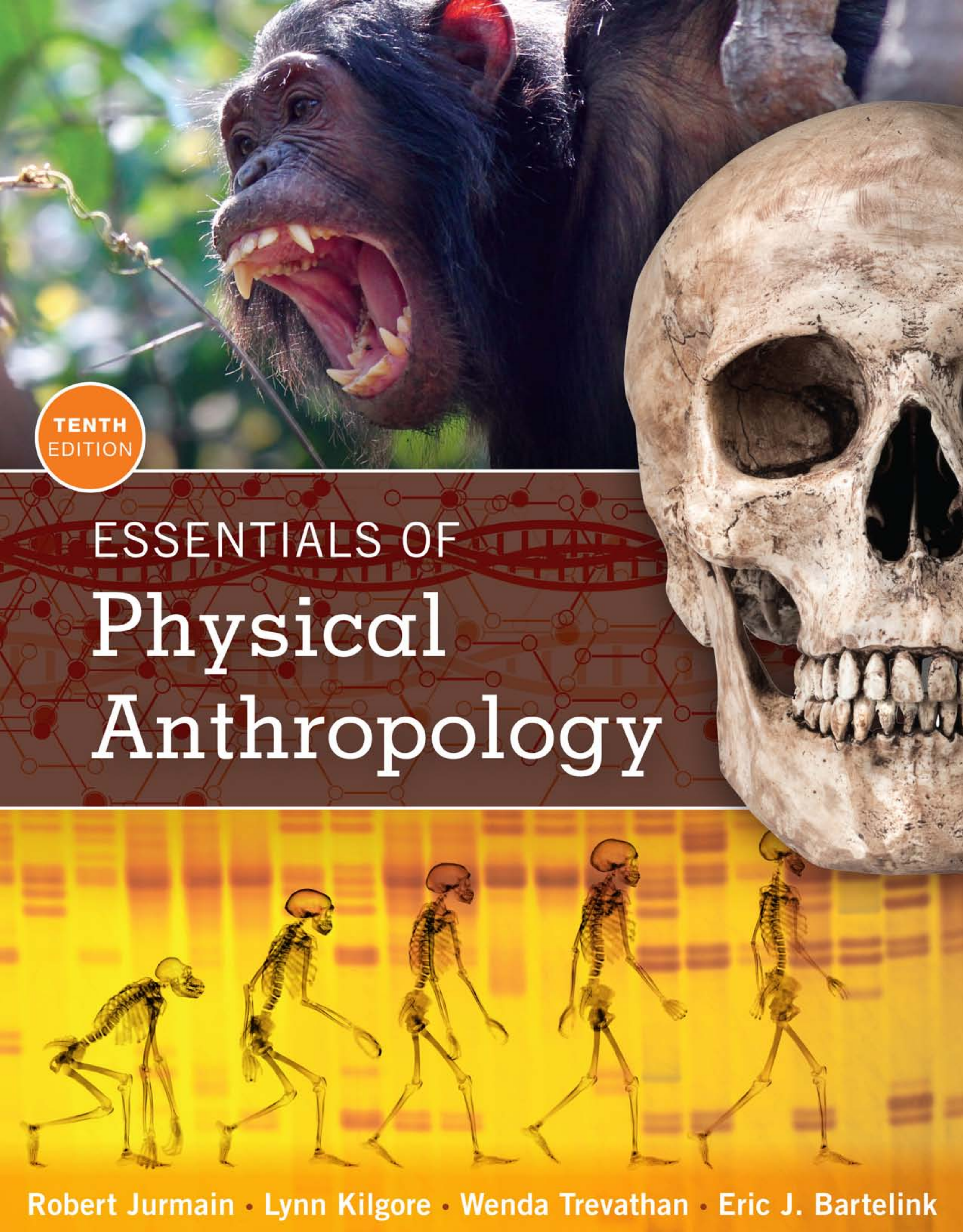

TENTH EDITION

ESSENTIALS OF Physical Anthropology

Robert Jurmain · Lynn Kilgore · Wenda Trevathan · Eric J. Bartelink

Major Fossil Hominin Sites


30°E
60°E
90°E
120°E
150°E
ARCTIC
OCEAN
75°N
Circle
NORWAY
SWEDEN
FINLAND
RUSSIA
60°N
Sungir
Neander
Valley
Spy
Heidelberg (Mauer)
Mladeč, Předmostí, Dolní Věstonice
Krapina
Oase
Arago
Ceprano
Petralona
Tighenif
KAZAKHSTAN
MONGOLIA
Okladnikov Cave/Denisova Cave
45°N
Dmanisi
Teshik-Tash
Jinniushan
Zhoukoudian
Ordos
Lantian
Dali
NORTH KOREA
SOUTH KOREA
JAPAN
CHINA
Hexian
30°N
TURKEY
IRAN
Amud
Jebel
Qafzeh
Skhul/Tabun
Shanidar
AFGHANISTAN
PAKISTAN
NEPAL
BHUTAN
ALGERIA
LIBYA
EGYPT
SAUDI ARABIA
KUWAIT
QATAR
INDIA
Liujiang
Maba
HONG KONG
MACAU
TAIWAN
PACIFIC
Tropic of Cancer
Toros-Menalla
NIGER
CHAD
SUDAN
ERITREA
YEMEN
OMAN
BANGLADESH
MYANMAR
(BURMA)
LAOS
VIETNAM
THAILAND
CAMBODIA
NORTHERN
MARIANA
ISLANDS
OCEAN
15°N
PHILIPPINES
Hadar
DJIBOUTI
Middle Awash (Aramis, Bouri,
Herto, Dikika)
Bodo
ETHIOPIA
SOMALIA
NIGERIA
BENIN
CENTRAL AFRICAN
REPUBLIC
CAMEROON
SRI LANKA
MALDIVES
BRUNEI
REPUBLIC OF THE
MARSHALL ISLANDS
FEDERATED STATES
OF MICRONESIA
Omo
East and West Turkana
Kanapoi
Tugen Hills
KENYA
UGANDA
RWANDA
TOGO
EQUAT.
GUINEA
GABON
CONGO
SAO TOME
& PRINCIPE
DEMOCRATIC
REPUBLIC
OF THE CONGO
BURUNDI
TANZANIA
Olduvai/Laetoli
MALAYSIA
Niah Cave
SINGAPORE
BORNEO
Equator
0°
CABINDA
(Angola)
SEYCHELLES
INDIAN
Ngandong
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Trinil
Flores
INDONESIA
PAPUA
NEW GUINEA
SOLOMON ISLANDS
TUVALU
COMOROS ISLANDS
ANGOLA
ZAMBIA
Kabwe
15°S
VANUATU
FIJI
MALAWI
ZIMBABWE
NAMIBIA
BOTSWANA
MADAGASCAR
MAURITIUS
OCEAN
MOZAMBIQUE
NEW CALEDONIA
AUSTRALIA
WALVIS BAY
(Status to be
determined)
Sterkfontein/Swartkrans/Drimolen/Malapa
Tropic of Capricorn
Taung
SWAZILAND
Florisbad
Border Cave
SOUTH
AFRICA
LESOTHO
30°S
Lake Mungo
Klasies River Mouth
Kow Swamp
1. SLOVENIA
2. CROATIA
3. BOSNIA AND HERZEGOVINA
4. ALBANIA
5. MACEDONIA
6. SERBIA AND MONTENEGRO
NEW ZEALAND
45°S
60°S
75°S
30°E
60°E
90°E
120°E
150°E

ESSENTIALS OF

Physical Anthropology

ESSENTIALS OF Physical Anthropology

TENTH EDITION

Robert Jurmain
Professor Emeritus, San Jose State University

Lynn Kilgore
University of Colorado, Boulder

Wenda Trevathan
Professor Emerita, New Mexico State University

Eric J. Bartelink
California State University, Chico

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Robert Jurmain, Lynn Kilgore, Wenda Trevathan, Eric J. Bartelink

Product Director: Marta Lee-Perriard

Product Manager: Elizabeth Beiting-Lipps

Content Developer: Kate Scheinman

Content Development Manager: Trudy Brown

Product Assistant: Chelsea Meredith

Content Project Manager: Rita Jaramillo

Art Director: Michael Cook

Manufacturing Planner: Judy Inouye

Production Service/Compositor: Hespenheide Design

Text Designer: Diane Beasley

Cover Designer: Michael Cook

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Preface

This book is about human evolution and how our species is biologically connected to all life on earth. At its foundation, our topic is a part of human biology and, more generally, directly linked to all the biological sciences.

Biology is a field that is changing dramatically as new methods are developed and major discoveries are made almost daily. Much of the most crucial, and certainly the most exciting, breakthroughs come from molecular studies of DNA.

The academic discipline that studies human evolution specifically is called physical (or biological) anthropology. In this field, too, there have been major advances within the last few years. Perhaps most significantly, this very new knowledge has revealed how complicated are the genetic mechanisms that build and regulate all organisms on earth, including humans. What's more, as new fossils relating to the evolution of the human lineage are found, the picture of our evolutionary history becomes all the more complicated.

These exciting developments pose a challenge for students, instructors, and textbook authors alike, but they also provide the opportunity for a deeper understanding of our subject. Each of the authors of this textbook has taught the introductory physical anthropology course for many years. From this long experience, we realize that many of the students taking this course had limited biological or anthropological instruction in high school and may find much of the material in this book entirely new. To help students more easily grasp this new subject area, we provide clear explanations and examples enhanced by many visual aids.

Within these pages, there are many opportunities for students to seek help in learning about topics, ideas, and developments encountered for the first time. The addition of Eric Bartelink as a coauthor for the tenth edition also brings a fresh perspective to this edition. To provide even greater assistance than in previous editions, we have added new photos and have expanded the scope of the text. All these changes reflect our long-term commitment to our textbook as an effective teaching and learning instrument. Because genetic mechanisms lie at the heart of understanding evolution, we address the basic aspects of life, cells, DNA, and the ways species change in the early chapters of this text (Chapters 2 through 5). We next turn (in Chapters 6 and 7) to an exploration of our evolutionary cousins, the nonhuman primates, and how they relate to us both physically and behaviorally. In Chapters 8 through 11, we briefly discuss the evolutionary history of early primates and then turn to a more detailed exploration of our specific human evolutionary history over the past 6 million years. This evolutionary journey takes us back to our small-brained ancestors in Africa and follows the development of their descendants through time and over their expanding ranges into Asia and Europe and much later into Australia and the Americas.

In the last section of this book (Chapters 12 through 14), we cover the most recent part of our journey through human evolution with a discussion of modern human biology and trace the ongoing evolution of our species. Major topics include the nature of human variation (including the social construct of "race"), patterns of adaptation in recent human populations, and the developmental changes experienced by humans through the life course. In the concluding chapter, "The Human Disconnection," we discuss how humans now adapt to and alter the planet and compare these recent developments with our species' long evolutionary past, when humans were not so numerous or so dependent on nonrenewable resources. These dramatic alterations to our world will pose enormous challenges to people throughout the twenty-first century and beyond. We hope that this book will better prepare all of you for what lies ahead.

In-Chapter Learning Aids

Connections graphic at the beginning of each chapter shows the biological relationships emphasized in the chapter in the context of topics in other chapters.

A running glossary in the margins provides definitions of terms immediately adjacent to the text where the term is first introduced. A full glossary is provided at the back of the book.

Quick Review boxes found throughout the book briefly summarize complex or controversial material in a visually simple fashion.

Why it Matters sections (with "Your Turn" scenarios) at the end of chapters make the case for the importance of studying the material presented in the chapters by relating that material to students' lives.

Physical Anthropology in Practice sections (with "What Do You Think?" questions) at the end of chapters are designed to highlight case studies and applications within physical anthropology to provide students a broader perspective on various topics covered in the chapter.

What's Important tables summarize the most significant fossil discoveries discussed in relevant chapters to help students as they review the chapter material.

Figures, including numerous photographs, line drawings, and maps, most in full color, are carefully selected to clarify text materials and directly support the discussion in the text.

Critical Thinking Questions at the end of each chapter reinforce key concepts and encourage students to think critically about what they have read.

Full bibliographical citations throughout the book provide sources from which the materials are drawn. This type of documentation guides students to published, peer-reviewed source materials and illustrates for students the proper use of references. All cited sources are listed in the comprehensive bibliography at the back of the book.

What's New in the Tenth Edition?

At the start of every chapter, we have added student learning objectives (linked to the main chapter headings) and a short chapter outline; these tools provide a preview of the upcoming chapter content. Toward the end of each chapter, we have extended the "Why It Matters" boxes by incorporating a "Your Turn" activity that allows students to decide what to do next. We have also added a new feature box ("Physical Anthropology in Practice") highlighting important discoveries, controversies, and contributions by physical anthropologists, while engaging students with critical thinking questions.

We have updated much of the book, reflecting recent discoveries and advances in virtually every aspect of physical anthropology:

In Chapter 1, we have added information on forensic anthropology as a growing area of physical anthropology. In Chapter 2, we have expanded the discussion of creationism and have contextualized the public debate on evolutionary theory between scientists and creationists. We also provide additional examples of natural selection in action.

There is no area of biological research today that advances more rapidly than the study of genetics. Because genetics underlies evolution and thus nearly every topic in this book, we strived to keep our coverage as up to date as possible. At the same time, it's important to make this complicated topic understandable and (we hope) enjoyable to college students, whose lives are impacted by genetic research every day.

As genetic technology continues to grow at an unprecedented pace, it is our task to present the most relevant new discoveries in as simple a manner as possible. In Chapter 3, we discuss the basis for genetic typing of biological materials used in forensic science and in Chapter 4 provide a discussion of what information can be learned about a person's genetic heritage through DNA typing.

Primatologists are regularly reporting on new discoveries about our closest relatives, the nonhuman primates, revealing our continuity with them. Since many of our primate cousins are unfamiliar to our readers, we've updated several photos to provide new examples of primates in the wild or to highlight specific behaviors. In Chapter 6, we added a discussion of the genetic relationship between humans and our closest living relatives, the chimpanzees. Today, most nonhuman primates are endangered, and we hope to raise awareness of them among students who read this book. Also in this chapter, we've significantly updated the statistics on threatened primate species and provide a discussion of recent efforts in primate conservation. Chapter 7 provides an expanded discussion of evidence of culture among nonhuman primates.

Remarkable new discoveries of fossil hominins are discussed in Chapters 8 through 11. Chapter 8 covers the fossil primates and earliest hominins. It presents on the earliest known primate group to which monkeys, apes, and humans belong, recently found in China, as well as a new fossil discovery from Tanzania that shows the earliest evidence for the divergence between Old World monkeys and apes. Also in Chapter 8, we discuss evidence for the earliest known stone tools (tentatively dated to 3.3 million years ago), a possible new hominin species discovered in Ethiopia (dated to 3.4 million years ago), and expand the discussion of *Australopithecus sediba* based on the most recent research.

Chapter 9 has updates relating to the study of *Homo erectus* growth rates and estimation of body size, a new *Homo erectus* discovery from Dmanisi, Georgia, that represents the most complete skull of an early hominin, the earliest probable evidence for the systematic use of fire based on studies from Wonderwerk Cave in South Africa, new dating on a *Homo erectus* fossil from China, and an expanded discussion of the role of meat consumption in hominin evolution.

Chapter 10 has been extensively revised to include the most recent genetic discoveries on Middle Pleistocene premodern humans, Neandertals, and Denisovans. These molecular discoveries show that Neandertals and Denisovans interbred with modern humans, and their genes can still be found in many contemporary human populations! A new discussion of Neandertal diets is provided based on analyses of stable isotopes of Neandertal bones and plant starch grains from dental calculus.

Chapter 11 expands on the origins of modern human populations and highlights new genetic findings regarding Late Pleistocene migration events. The discussion on the unusual Indonesian hominins, *Homo floresiensis* (popularly called “hobbits”), has also been expanded. We have also updated the chapter to discuss early evidence for complex behaviors among early modern humans from Border Cave, South Africa.

In Chapters 12 and 13, our focus turns to modern human biology. We have updated information on the global issues of HIV and tuberculosis infection, the reemergence of infectious diseases due to the overuse of antibiotics and the anti-vaccination movement, and perspectives on human variation used in forensic anthropology.

One theme that we emphasize throughout the book is that we are the result of not only biological but also cultural evolutionary factors. In other words, we are a *biocultural* species. In Chapter 13, now titled “Legacies of Human Evolutionary History: Effects on the Life Course,” we focus on ways in which biology and culture act on the human life course from conception, through reproduction, to the end of life. There are a number of ways in which our biology, resulting from millions of years of evolution, seems to be mismatched with the lives we lead today, leading in some cases to compromised health. For example, the biology of women may not be well suited to the highly frequent menstrual cycling that results from the use of modern forms of birth control. Some health disorders that we are dealing with today may stem from the dramatic differences between the diets of our ancestors and the foods we eat today. In this chapter, there’s a new discussion of recent research on the human gut microbiome, human brain growth rates, infant dependency, menopause, pleiotropic genes, factors influencing cancer risk, and the Paleolithic diet trend.

Finally, in Chapter 14, we focus on another theme that runs through the book—*why it matters* that we know and understand human evolutionary history, its impact on the world today, and how we have distanced ourselves from other living species with which we share so many connections. We humans and the consequences of our activities are probably the most important influences on evolution today, causing the extinction or near-extinction of thousands of other life-forms and threatening the very planet on which we live. Our disconnection from other life-forms and from our own evolutionary past pose the biggest challenges our species has ever faced. Only by understanding how we got to this point can we begin to respond to the challenges that are in our future and the futures of our children and grandchildren.

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Robert Jurmain
Lynn Kilgore
Wenda Trevathan
Eric J. Bartelink

January 2016

In memory of Dr. Turhon Murad (1944–2015)

Brian Brazeal

Supplements

Essentials of Physical Anthropology, Tenth Edition, comes with an outstanding supplements program to help instructors create an effective learning environment so that students can more easily master the latest discoveries and interpretations in the field of physical anthropology.

Supplements for the Instructor

Online Instructor's Manual for *Essentials of Physical Anthropology*, Tenth Edition
This online resource includes a sample syllabus showing how to integrate MindTap with the text, as well as chapter outlines, learning objectives, key terms and concepts, lecture suggestions, and enrichment topics.

Online Test Bank for *Essentials of Physical Anthropology*, Tenth Edition
Organize your course and capture your students' attention with the resources found in the Test Bank, including multiple-choice, true/false, short-answer, and essay questions—most with answers and page references for each chapter of the text.

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These vibrant Microsoft PowerPoint lecture slides for each chapter assist you with your lecture by providing concept coverage using images, figures, and tables directly from the textbook.

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- Import, edit, and manipulate test bank content from the *Essentials of Physical Anthropology* test bank or elsewhere, including your own favorite test questions
- Create multiple test versions in an instant
- Deliver tests from your LMS, your classroom, or wherever you want

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MindTap engages and empowers students to produce their best work—consistently. By seamlessly integrating course material with activities, apps, and much more, MindTap creates a unique learning path that fosters increased comprehension and efficiency.

For students:

- MindTap delivers real-world relevance with activities and assignments that help students build critical thinking and analytical skills that will transfer to other courses and their professional lives.

- MindTap helps students stay organized and efficient with a single destination that reflects what's important to the instructor, along with the tools students need to master the content.
- MindTap empowers and motivates students with information that shows where they stand at all times—both individually and compared with the highest performers in class.

Additionally, for instructors, MindTap allows you to:

- Control what content students see and when they see it with a learning path that can be used as is or matched to your syllabus exactly.
- Create a unique learning path of relevant readings and multimedia and activities that move students up the learning taxonomy from basic knowledge and comprehension to analysis, application, and critical thinking.
- Integrate your own content into the MindTap Reader using your own documents or pulling from sources like RSS feeds, YouTube videos, websites, Googledocs, and more.
- Use powerful analytics and reports that provide a snapshot of class progress, time in course, engagement, and completion.

ESSENTIALS OF

Physical Anthropology

CONNECTIONS

1

Introduction to Physical Anthropology

This illustration emphasizes the fact that all life-forms on earth, including humans, are ultimately connected by DNA.

NASA (map); iStockphoto.com/Jgroup (DNA)

Student Learning Objectives

After studying the material in this chapter, you should be able to:

- Describe how all life-forms are interconnected through evolution.
- Define biocultural evolution and explain its relevance to human evolution.
- Describe the discipline of anthropology as it is practiced in the United States, including its four subfields.
- Articulate the fundamentals of the scientific method and the importance of hypothesis testing within physical anthropology.
- Explain how an anthropological perspective provides a holistic perspective on the human experience.

One day, perhaps during the rainy season some 3.7 million years ago, two or three animals walked across a grassland **savanna** (see next page for definitions of terms on this page) in what is now northern Tanzania, in East Africa. These individuals were early **hominins**, members of the evolutionary lineage that also includes our own **species**, *Homo sapiens*. Fortunately for us, a record of their passage on that long-forgotten day remains in the form of fossilized footprints, preserved in hardened volcanic deposits. As chance would have it, shortly after heels and toes were pressed into the damp soil, a nearby volcano erupted. The ensuing ashfall

▲ **Figure 1-1**
Early hominin footprints at Laetoli, Tanzania. The tracks to the left were made by one individual, while those to the right appear to have been made by two individuals, the second stepping in the tracks of the first.

blanketed everything on the ground. In time, the ash layer hardened into a deposit that remarkably preserved the tracks of numerous animals, including those early hominins, for nearly 4 million years (Fig. 1-1).

These now famous prints indicate that two individuals, one smaller than the other and perhaps walking side by side, left parallel sets of tracks. But because the larger individual's prints are obscured, possibly by those of a third, it's unclear how many actually made that journey so long ago. What is clear is that the prints were made by an animal that habitually walked **bipedally** (on two feet), and that fact tells us that those ancient travelers were hominins.

In addition to the footprints, scientists working at this site (called Laetoli) and at other locations have discovered many fossilized parts of skeletons of an animal we call *Australopithecus afarensis*. Because the remains have been extensively studied, we know that these hominins were anatomically similar to ourselves, although their brains were only about one-third the size of ours. They may have used stones and sticks as simple tools, but there is no evidence that they actually made stone tools. In fact, they were very much at the mercy of nature's whims. They certainly could not outrun most predators, and their canine teeth were fairly small, so compared with many other animals, they were pretty much defenseless.

We've asked numerous questions about the Laetoli hominins, but we will never be able to answer them all. These early human ancestors left a fossilized trail for us to follow. So it remains for us to learn as much as we can about them, and as we continue to do this, their greater journey continues.

On July 20, 1969, a television audience numbering in the hundreds of millions watched as two human beings stepped out of a spacecraft onto the surface of the moon. People born after that date have always lived in an age of space exploration; therefore, many may now take that first moon landing for granted. But the significance of that first moonwalk can't be overstated, because it represents humankind's presumed mastery over the natural forces that govern our presence on earth. For the first time ever, people actually walked upon the surface of a celestial body that, as far as we know, has never had biological life.

As the astronauts gathered geological specimens and frolicked in near weightlessness, they left traces of their fleeting presence in the form of footprints in the lunar dust (Fig. 1-2). On the surface of the moon, where no rain falls and no wind blows, the footprints remain undisturbed to this day. They survive as silent testimony to a brief visit by a medium-sized, big-brained creature that presumed to challenge the very forces that created it.

You may wonder why anyone would care about early hominin footprints and how they can possibly be relevant to your life. You may also wonder why a physical **anthropology** textbook would begin by discussing two such seemingly unrelated events as ancient hominins walking across an African savanna and a moonwalk. But the fact is, these two events are very closely connected.

Physical (or biological) anthropology is a scientific discipline concerned with the biological and behavioral characteristics of human beings, as well as those of our closest relatives, the nonhuman **primates** (apes, monkeys, tarsiers, lemurs,

savanna (also spelled savannah) A large flat grassland with scattered trees and shrubs. Savannas are found in many regions of the world with dry and warm-to-hot climates.

hominins Colloquial term for members of the evolutionary group that includes modern humans and all extinct bipedal relatives.

species A group of organisms that can interbreed to produce fertile offspring. Members of one species are reproductively isolated from members of all other species (i.e., they cannot mate with them to produce fertile offspring).

and lorises), and their ancestors. This kind of research helps us explain what it means to be human and how we came to be the way we are. This is an ambitious goal, and it probably isn't fully attainable, but it's certainly worth pursuing. We're the only species to ponder our own existence and question how we fit into the spectrum of life on earth. Most people view humanity as quite separate from the rest of the animal kingdom. But at the same time, many are curious about the similarities we share with other species. Maybe, as a child, you looked at your dog and tried to figure out how her front legs might correspond to your arms. Or perhaps during a visit to the zoo, you recognized the similarities between a chimpanzee's hands or facial expressions and your own. Maybe you wondered if he also shared your thoughts and feelings. If you've ever had thoughts and questions like these, then you've indeed been curious about humankind's place in nature.

NASA Images

Figure 1-2
Human footprints left on the lunar surface during the *Apollo* mission.

We humans, who can barely comprehend a century, can't begin to grasp the enormity of nearly 4 million years. But we still want to know more about those creatures who walked across the savanna that day. We want to know how an insignificant but clever bipedal primate such as *Australopithecus afarensis*, or perhaps a close relative, gave rise to a species that would eventually walk on the surface of the moon, some 239,000 miles from earth.

How did *Homo sapiens*, a result of the same evolutionary forces that produced all other forms of life on this planet, gain the power to control the flow of rivers and even alter the climate on a global scale? As tropical animals, how were we able to leave the tropics and eventually occupy most of the earth's land surfaces? How did we adjust to different environmental conditions as we dispersed? How could our species, which numbered fewer than 1 billion until the mid-nineteenth century, come to number more than 7.3 billion worldwide today and, as we now do, add another billion people every 12 or 13 years?

These are some of the many questions that physical anthropologists try to answer through the study of human **evolution**, variation, and **adaptation**. These issues, and many others, are covered in this textbook, because physical anthropology is, in large part, human biology seen from an evolutionary perspective. On hearing the term *evolution*, most people think of the appearance of new species. Certainly, new species are one important consequence of evolution; but it isn't the only one, because evolution is an ongoing biological process with more than one outcome. Simply stated, evolution is a change in the **genetic** makeup of a population from one generation to the next, and it can be defined and studied at two levels. Over time, some genetic changes in populations do result in the appearance of a new species (or *speciation*), especially when those populations are isolated from one another. Change at this level is called *macroevolution*. At the other level, there are genetic alterations *within* populations; and though this type of change may not lead to speciation, it does cause populations of a species to differ from one another in the frequency of certain traits. Evolution at this level is referred to as *microevolution*. Evolution at both these levels will be discussed in this book.

bipedally On two feet; walking habitually on two legs.

anthropology The field of inquiry that studies human culture and evolutionary aspects of human biology; includes cultural anthropology, archaeology, linguistics, and physical, or biological, anthropology.

primates Members of the mammalian order Primates (pronounced "pry-may´-tees"), which includes lemurs, lorises, tarsiers, monkeys, apes, and humans.

evolution A change in the genetic structure of a population. The term is also frequently used to refer to the appearance of a new species.

adaptation An anatomical, physiological, or behavioral response of organisms or populations to the environment. Adaptations result from evolutionary change (specifically, as a result of natural selection).

genetic Having to do with the study of gene structure and action and the patterns of inheritance of traits from parent to offspring. Genetic mechanisms are the foundation for evolutionary change.

The Human Connection

The unifying theme of this textbook is how human beings are linked to all other life on earth. We are all connected to other organisms in countless ways, as you will learn throughout this book. For example, most of our DNA is structurally identical to that of every living thing. Indeed, we share genes that are involved in the most fundamental life processes with even the simplest of animals, such as sponges. These genes have changed very little over the course of several hundred million years of evolution. Our cells have the same structure and work the same way as in all life-forms, with few exceptions. Anatomically, we have the same muscles and bones as many other animals. What's more, many aspects of our **behavior** have direct connections to nonhuman species, especially other primates.

The countless connections we share with other organisms show that humans are a product of the same evolutionary forces that produced all living things. But clearly we aren't identical to any other species. In fact, all species are unique in some ways. Humans are one contemporary component of a vast biological **continuum** at a particular point in time; and in this regard, we aren't really all that special. Stating that humans are part of a continuum doesn't imply that we're at the peak of development on that continuum. Depending on the criteria used, humans can be seen to exist at one end of the spectrum or the other or somewhere in between, but we don't necessarily occupy a position of inherent superiority over other species (Fig. 1-4 on pp. 8–9).

However, human beings are truly unique in one significant dimension, and that is intellect. After all, humans are the only species, born of earth, to stir the lunar dust. We're the only species to develop language and complex culture as a means of buffering nature's challenges, and by doing so, we have gained the power to shape the planet's very destiny.

Biocultural Evolution

Biological anthropologists don't just study physiological and biological systems. When these topics are considered within the broader context of human evolution, another factor must be considered, and that factor is **culture**. Culture is an extremely important concept, not only as it relates to modern humans but also because of its critical role in human evolution. Quite simply, and in a very broad sense, culture can be seen as the strategy by which humans adapt to the natural environment. In fact, culture has so altered and dominated our world that it's become the environment in which we live. Culture includes technologies ranging from stone tools to computers; subsistence patterns, from hunting and gathering to global agribusiness; housing types, from thatched huts to skyscrapers; and clothing, from animal skins to high-tech synthetic fibers (Fig. 1-3). Technology, religion, values, social organization, language, kinship, marriage rules, gender roles, dietary practices, inheritance of property, and so on, are all aspects of culture. Each culture shapes people's perceptions of the external environment, or their **worldview**, in particular ways that distinguish that society from all others.

One important point to remember is that culture isn't genetically passed from one generation to the next. We aren't born with innate knowledge that leads us to behave in ways appropriate to our own culture. Culture is transmitted from generation to generation through the process of *learning*, a process that begins, quite literally, at birth. We are all products of the culture in which we are raised, and since most human behavior is learned, it follows that most human behaviors, perceptions, values, and reactions are shaped by culture.

At the same time, however, it's important to emphasize that even though culture isn't genetically determined, the human predisposition to assimilate culture and function within it is very much influenced by biological factors. Most nonhuman

behavior Anything organisms do that involves action in response to internal or external stimuli; the response of an individual, group, or species to its environment. Such responses may or may not be deliberate, and they aren't necessarily the result of conscious decision making (which is absent in single-celled organisms, insects, and many other species).

continuum A set of relationships in which all components fall along a single integrated spectrum (for example, color). All life reflects a single biological continuum.

culture Behavioral aspects of human adaptation, including technology, traditions, language, religion, marriage patterns, and social roles. Culture is a set of learned behaviors transmitted from one generation to the next by nonbiological (i.e., nongenetic) means.

worldview General cultural orientation or perspective shared by members of a society.

Figure 1-3
Traditional and recent technologies. **(a)** An early stone tool from East Africa. This artifact represents one of the oldest types of stone tools found anywhere. **(b)** The Hubble Space Telescope, a late twentieth-century tool, orbits the earth every 96 minutes at an altitude of 360 miles. Because it is above the earth's atmosphere, it provides distortion-free images of objects in deep space. **(c)** A cuneiform tablet. Cuneiform, the earliest form of writing, involved pressing symbols into clay tablets. It originated in southern Iraq some 5,000 years ago. **(d)** Text messaging, a fairly recent innovation in satellite communication, has generated a new language of sorts. Today, more than 500 million text messages are sent every day worldwide. **(e)** A Samburu woman in East Africa building a traditional but complicated dwelling of stems, small branches, and mud. **(f)** These Hong Kong skyscrapers are typical of cities in industrialized countries today.


a

Lynn Kilgore


b

NASA Images


c

Museum of Primitive Art and Culture, Peace Dale, RI.


d

iStockphoto.com/DrRave


e

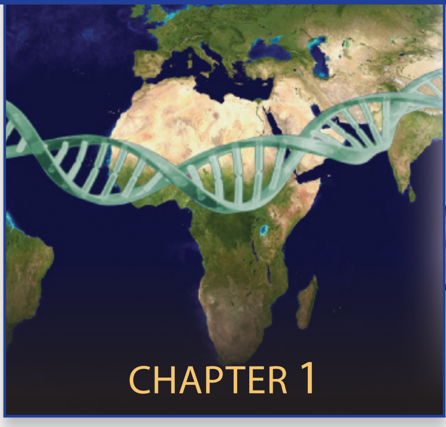
Lynn Kilgore


f

iStockphoto.com/Justin Horrocks

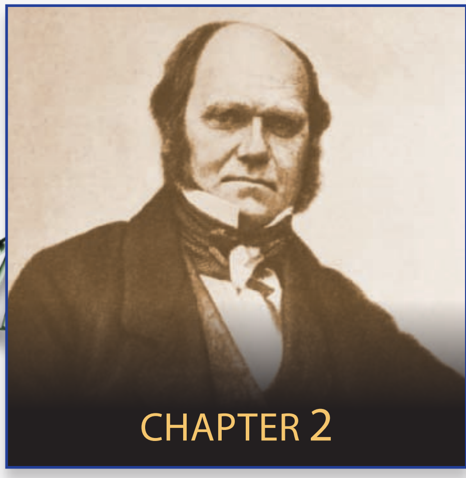
CONNECTIONS

Figure 1-4
Connections: Humans are biologically connected to all life. This central theme will be addressed in every chapter of the text, as shown in this figure.



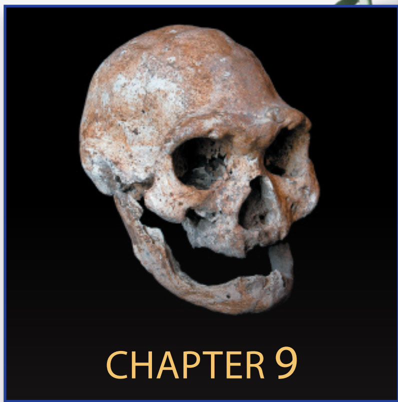
NASA (map); iStockphoto.com/Jgroup (DNA)

Physical anthropology is a biological science that investigates how humans have evolved and continue to do so.



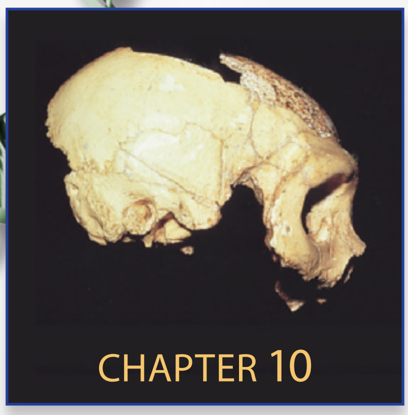
Bettmann/Corbis

Evolutionary theory, particularly natural selection, explains how life forms have changed over time and how new species are produced.



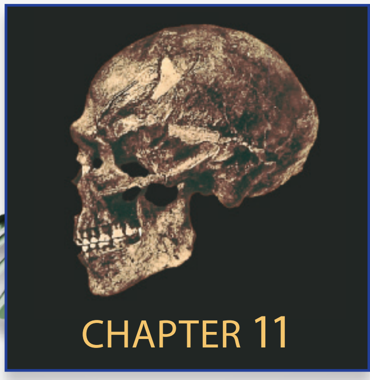
David Lordkipanidze

Hominins began to disperse out of Africa around 2 million years ago, and during the next 1 million years inhabited much of Eurasia.



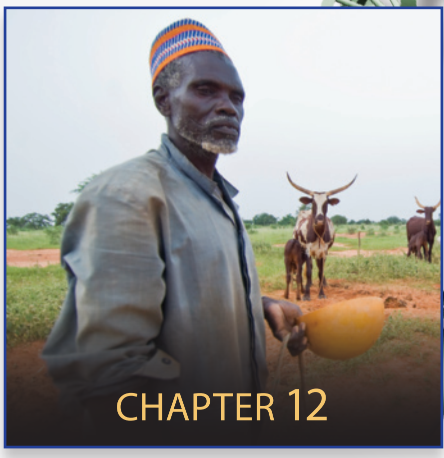
Fred Smith

The immediate predecessors of modern humans, including the Neandertals, were much like us, but had some anatomical and behavioral differences.



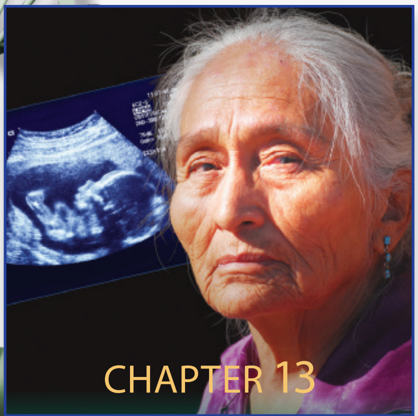
Harry Nelson

Modern humans first evolved in Africa and later spread to other areas of the world, where they occasionally interbred with Neandertals and other pre-modern humans.



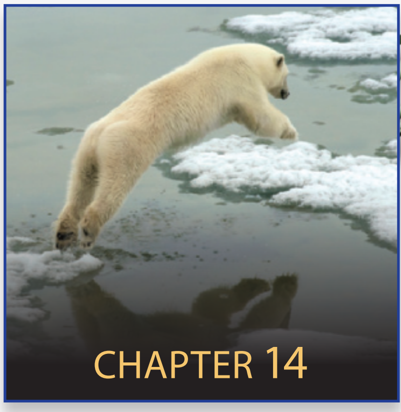
Guido Cozzi/Terra/Atlantide Phototravel/Corbis

Modern human variation is best understood by looking at patterns of DNA in different populations.



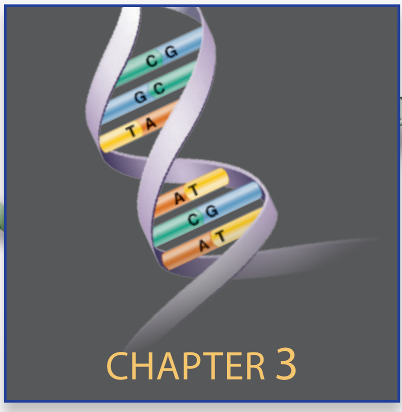
Darren Brode, 2010/Used under license from Shutterstock.com (ultrasound)
David P. Smith/Shutterstock.com (Navajo woman)

Human development and adaptation is best understood from an evolutionary perspective.



Keenpress/National Geographic/Getty Images

Humans have recently become disconnected from other life and are rapidly altering the planet.



DNA molecule is the basis of all life.

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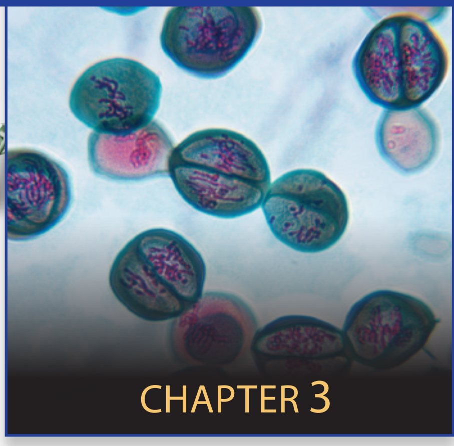
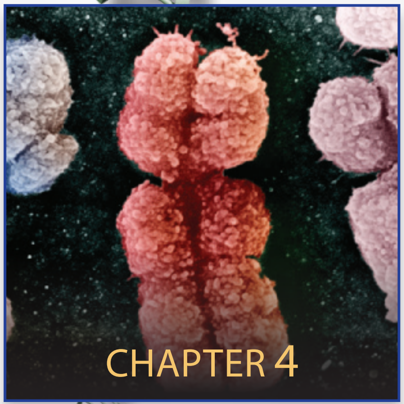


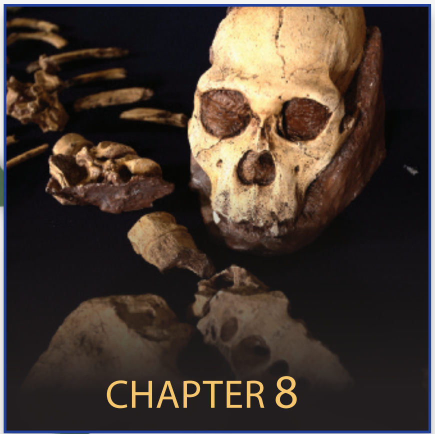
All forms of life are made up of cells.

Biodisc/Encyclopedia/Visuals Unlimited/Corbis



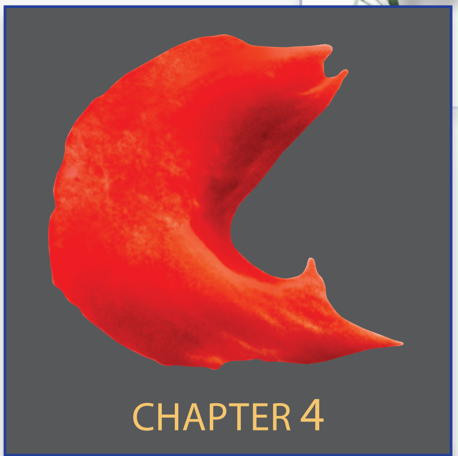
Heredity is based on the transmission of DNA from one generation to the next.

Biophoto Associates/Science Source



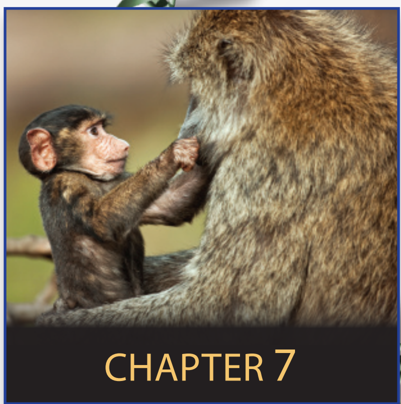
The first more human-like animals (hominins) appeared in Africa more than 6 million years ago and evolved into a variety of different species.

Raj Wong/FeatureChina/Newscom



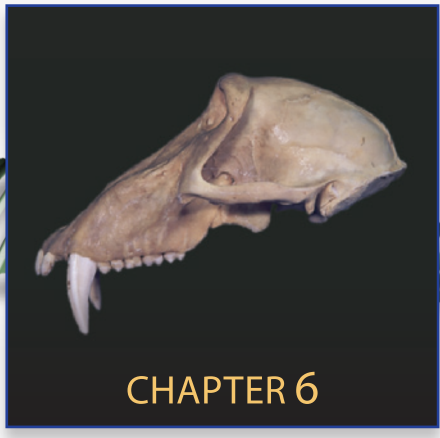
Evolution occurs when DNA changes, and genetic variation is further influenced by natural selection and other factors.

Dr. Stanley Flegler/Visuals Unlimited, Inc.



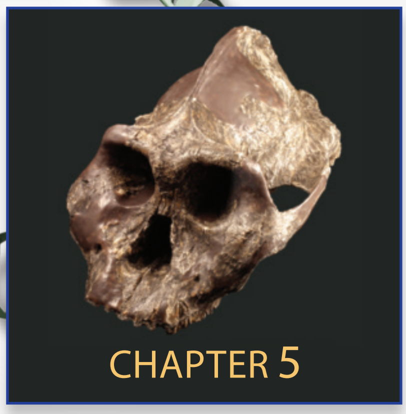
Partly because of common evolutionary history, many human behaviors are also seen in other primates.

Anup Shah/The Image Bank/Getty Images



Humans are primates and share many biological characteristics with other primates.

Lynn Kilgore



Humans are both vertebrates and mammals, and their evolutionary history over many millions of years explains our early roots.

Russell L. Ciochon