

CLARK SPENCER LARSEN

ESSENTIALS
of

**PHYSICAL
ANTHROPOLOGY**



3rd
EDITION

ESSENTIALS OF PHYSICAL ANTHROPOLOGY



THIRD EDITION

ESSENTIALS OF PHYSICAL ANTHROPOLOGY

DISCOVERING OUR ORIGINS

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**

ABOUT THE AUTHOR



CLARK SPENCER LARSEN heads the Department of Anthropology at The Ohio State University, Columbus. 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. 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 Ohio State, 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*. In addition to *Our Origins*, he has authored or edited 30 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*.

BASIC TABLE OF CONTENTS

To the Instructor xx
To the Student xxviii

CHAPTER 1 What Is Physical Anthropology? 2

PART I The Present: Foundation for the Past 19

CHAPTER 2 Evolution: Constructing a Fundamental Scientific Theory 20

CHAPTER 3 Genetics: Reproducing Life and Producing Variation 42

CHAPTER 4 Genes and Their Evolution: Population Genetics 70

CHAPTER 5 Biology in the Present: Living People 100

CHAPTER 6 Biology in the Present: The Other Living Primates 132

CHAPTER 7 Primate Sociality, Social Behavior, and Culture 164

PART II The Past: Evidence for the Present 183

CHAPTER 8 Fossils and Their Place in Time and Nature 184

CHAPTER 9 Primate Origins and Evolution: The First 50 Million Years 216

CHAPTER 10 Early Hominin Origins and Evolution: The Roots of Humanity 244

CHAPTER 11 The Origins and Evolution of Early *Homo* 282

CHAPTER 12 The Origins, Evolution, and Dispersal of Modern People 306

CHAPTER 13 Our Last 10,000 Years: Agriculture, Population, Biology 350

TABLE OF CONTENTS



Two-Page Spreads xix

To the Instructor xx

Tools for Teaching and Learning xxiii

Who Helped xxv

To the Student xxviii

CHAPTER 1 WHAT IS PHYSICAL ANTHROPOLOGY? 2

Big Questions 3

What Is Anthropology? 5

What Is Physical Anthropology? 7

What Do Physical Anthropologists Do? 7

What Makes Humans So Different from Other Animals?: The Six Steps to Humanness 8

How We Know What We Know: The Scientific Method 14

Answering the Big Questions 16

Key Terms 17

Evolution Review 17

Additional Readings 17



PART I THE PRESENT: FOUNDATION FOR THE PAST 19

CHAPTER 2 EVOLUTION: CONSTRUCTING A FUNDAMENTAL SCIENTIFIC THEORY 20

Big Questions 21

The Theory of Evolution: The Context for Darwin 23

Geology: Reconstructing Earth's Dynamic History 24

Paleontology: Reconstructing the History of Life on Earth 25

Taxonomy and Systematics: Classifying Living Organisms and Identifying Their Biological Relationships 26

Concept Check Pre-Darwinian Theory and Ideas: Groundwork for Evolution 27

Demography: Influences on Population Size and Competition for Limited Resources 28

Evolutionary Biology: Explaining the Transformation of Earlier Life-Forms into Later Life-Forms 28

Concept Check Darwin Borrows from Malthus 30

The Theory of Evolution: Darwin's Contribution 31

Since Darwin: Mechanisms of Inheritance, the Evolutionary Synthesis, and the Discovery of DNA 33

Mechanisms of Inheritance 33

The Evolutionary Synthesis, the Study of Populations, and the Causes of Evolution 36

DNA: Discovery of the Molecular Basis of Evolution 37

Answering the Big Questions 39

Key Terms 39

Evolution Review: Past, Present, and Future of a Fundamental Scientific Theory 40

Additional Readings 41

CHAPTER 3 GENETICS: REPRODUCING LIFE AND PRODUCING VARIATION 42

Big Questions 43

The Cell: Its Role in Reproducing Life and Producing Variation 44

The DNA Molecule: The Genetic Code 46

DNA: The Blueprint of Life 48

The DNA Molecule: Replicating the Code 48

How Do We Know? Ancient DNA Opens New Windows on the Past 50

Concept Check The Two Steps of DNA Replication 51

Chromosome Types 51

Mitosis: Production of Identical Somatic Cells 52

Meiosis: Production of Gametes (Sex Cells) 54

Producing Proteins: The Other Function of DNA 56

Concept Check The Two Steps of Protein Synthesis 60

Genes: Structural and Regulatory 61

Polymorphisms: Variations in Specific Genes 61

Genotypes and Phenotypes: Genes and Their Expression 63

The Complexity of Genetics 65

Answering the Big Questions 67

Key Terms 68

Evolution Review: Insights from Genetics 68

Additional Readings 69

CHAPTER 4 GENES AND THEIR EVOLUTION: POPULATION GENETICS 70

Big Questions 71

Demes, Reproductive Isolation, and Species 72

Hardy-Weinberg Law: Testing the Conditions of Genetic Equilibrium 76

Mutation: The Only Source of New Alleles 77

Natural Selection: Advantageous Characteristics, Survival, and
Reproduction 80

Patterns of Natural Selection 81

*Natural Selection in Animals: The Case of the Peppered Moth and Industrial
 Melanism* 82

*Natural Selection in Humans: Abnormal Hemoglobins and Resistance to
 Malaria* 84

The Geography of Sickle-Cell Anemia and the Association with Malaria 86

The Biology of Sickle-Cell Anemia and Malarial Infection 87

The History of Sickle-Cell Anemia and Malaria 87

Other Hemoglobin and Enzyme Abnormalities 89

Genetic Drift: Genetic Change due to Chance 90

Founder Effect: A Special Kind of Genetic Drift 93

Gene Flow: Spread of Genes across Population Boundaries 93

Concept Check What Causes Evolution? 97

Answering the Big Questions 97

Key Terms 98

Evolution Review: The Four Forces of Evolution 99

Additional Readings 99

CHAPTER 5 BIOLOGY IN THE PRESENT: LIVING PEOPLE 100

Big Questions 101

Is Race a Valid, Biologically Meaningful Concept? 102

Brief History of the Race Concept 102

*Debunking the Race Concept: Franz Boas Shows that Human Biology Is Not
 Static* 103



So-Called Racial Traits Are Not Concordant 103
Human Variation: Geographic Clines, Not Racial Categories 103

Life History: Growth and Development 104

The Growth Cycle: Conception through Adulthood 105
Prenatal Stage: Sensitive to Environmental Stress, Predictive of Adult Health 105
Postnatal Stage: The Maturing Brain, Preparing for Adulthood 106
Adult Stage: Aging and Senescence 109
Evolution of Human Life History: Food, Sex, and Strategies for Survival and Reproduction 111

Concept Check Life History Stages in Humans: Prenatal, Postnatal, and Adult 111

Prolonged Childhood: Fat-Bodied Moms and Their Big-Brained Babies 112
Grandmothering: Part of Human Adaptive Success 112

Adaptation: Meeting the Challenges of Living 113

Climate Adaptation: Living on the Margins 114
Heat Stress and Thermoregulation 114
Body Shape and Adaptation to Heat Stress 114
Cold Stress and Thermoregulation 115
Solar Radiation and Skin Color 116
Solar Radiation and Vitamin D Synthesis 117
Solar Radiation and Folate Protection 118
High Altitude and Access to Oxygen 118

Concept Check Adaptation: Heat, Cold, Solar Radiation, High Altitude 119

Nutritional Adaptation: Energy, Nutrients, and Function 120
Macronutrients and Micronutrients 120
Human Nutrition Today 121
Overnutrition and the Consequences of Dietary Excess 123

Concept Check Nutritional Adaptation 126

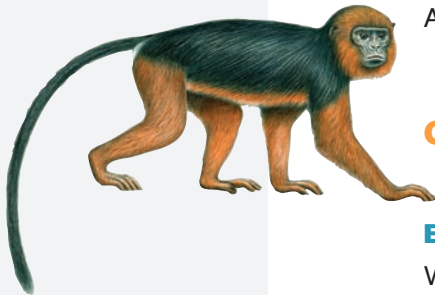
Workload Adaptation: Skeletal Homeostasis and Function 126
Excessive Activity and Reproductive Ecology 128

Answering the Big Questions 129

Key Terms 130

Evolution Review: Human Variation Today 130

Additional Readings 131



**CHAPTER 6 BIOLOGY IN THE PRESENT:
THE OTHER LIVING PRIMATES** 132

Big Questions 133

What Is a Primate? 135

Arboreal Adaptation—Primates Live in Trees and Are Good at It 138
Primates Have a Versatile Skeletal Structure 138
Primates Have an Enhanced Sense of Touch 140

Primates Have an Enhanced Sense of Vision 141
Primates Have a Reduced Reliance on Senses of Smell and Hearing 141

Concept Check What Makes Primates Good at Living in Trees? 142
Dietary Plasticity—Primates Eat a Highly Varied Diet, and Their Teeth Reflect This Adaptive Versatility 142
Primates Have Retained Primitive Characteristics in Their Teeth 142
Primates Have a Reduced Number of Teeth 142
Primates Have Evolved Different Dental Specializations and Functional Emphases 143

Concept Check What Gives Primates Their Dietary Flexibility? 143
Parental Investment—Primate Parents Provide Prolonged Care for Fewer but Smarter, More Socially Complex, and Longer-Lived Offspring 146

Concept Check Primate Parenting 148

What Are the Kinds of Primates? 148

The Strepsirhines 153

Concept Check Monkey or Ape? Differences Matter 154

The Haplorhines 155

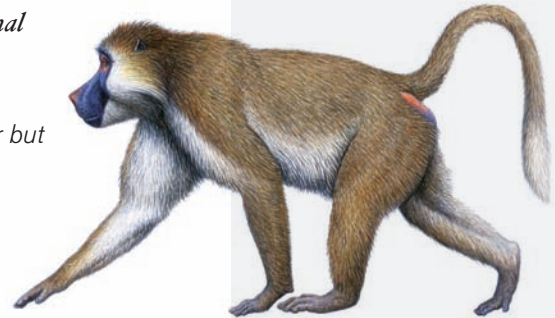
Concept Check Strepsirhines and Haplorhines Differ in Their Anatomy and Senses 161

Answering the Big Questions 162

Key Terms 162

Evolution Review: Our Closest Living Relatives 163

Additional Readings 163



CHAPTER 7 PRIMATE SOCIALITY, SOCIAL BEHAVIOR, AND CULTURE 164

Big Questions 165

Primate Societies: Diverse, Complex, Long-Lasting 166

Diversity of Primate Societies 166

Primate Social Behavior: Enhancing Survival and Reproduction 167

Primate Residence Patterns 168

Primate Reproductive Strategies: Males' Differ from Females' 169

Concept Check Male and Female Reproductive Strategies 170

The Other Side of Competition: Cooperation in Primates 170

Getting Food: Everybody Needs It, but the Burden Is on Mom 172

Acquiring Resources and Transmitting Knowledge: Got Culture? 173

Vocal Communication Is Fundamental Behavior in Primate Societies 175

Answering the Big Questions 181

Key Terms 181

Evolution Review: Primate Social Organization and Behavior 182

Additional Readings 182

PART II THE PAST: EVIDENCE FOR THE PRESENT 183

CHAPTER 8 FOSSILS AND THEIR PLACE IN TIME AND NATURE 184

Big Questions 185

Fossils: Memories of the Biological Past 188

What Are Fossils? 188

Taphonomy and Fossilization 188

Types of Fossils 188

Limitations of the Fossil Record: Representation Is Important 191

Just How Old Is the Past? 192

Time in Perspective 192

Geologic Time: Earth History 193

Relative and Numerical Age 195

Relative Methods of Dating: Which Is Older, Younger, the Same Age? 196

Stratigraphic Correlation 196

Chemical Dating 196

Biostratigraphic (Faunal) Dating 197

Cultural Dating 198

Absolute Methods of Dating: What Is the Numerical Age? 198

The Radiometric Revolution and the Dating Clock 198

The Revolution Continues: Radiopotassium Dating 203

Non-Radiometric Absolute Dating Methods 205

Genetic Dating: The Molecular Clock 207

Concept Check How Old Is It? 208

Reconstruction of Ancient Environments and Landscapes 209

The Driving Force in Shaping Environment: Temperature 210

Chemistry of Animal Remains and Ancient Soils: Windows onto Diets and Habitats 211

Answering the Big Questions 213

Key Terms 214

Evolution Review: The Fossil Record 214

Additional Readings 215

CHAPTER 9 PRIMATE ORIGINS AND EVOLUTION: THE FIRST 50 MILLION YEARS 216

Big Questions 217

Why Did Primates Emerge? 218

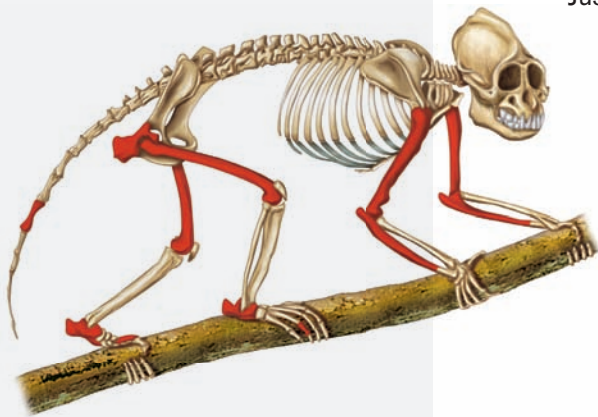
The First True Primate: Visual, Tree-Dwelling, Agile, Smart 220

Primates in the Paleocene? 220

Eocene Euprimates: The First True Primates 220

The Anthropoid Ancestor: Euprimate Contenders 224

The First Anthropoids 225



Early Anthropoids Evolve and Thrive 227

Concept Check When Were They Primates?: Anatomy through Time 227

Coming to America: Origin of New World Higher Primates 230

How Anthropoids Got to South America 230

Apes Begin in Africa and Dominate the Miocene Primate World 231

Apes Leave Africa: On to New Habitats and New Adaptations 234

Apes in Europe: The Dryopithecids 234

Apes in Asia: The Sivapithecids 235

Dead End in Ape Evolution: The Oreopithecids 235

Climate Shifts and Habitat Changes 238

Miocene Ape Survivors Give Rise to Modern Apes 238

Apes Return to Africa? 238

Concept Check The First Apes: A Remarkable Radiation 239

Monkeys on the Move 239

Answering the Big Questions 241

Key Terms 242

Evolution Review: Primate Social Organization and Behavior:

The Deep Roots of the Order Primates 242

Additional Readings 243

CHAPTER 10 EARLY HOMININ ORIGINS AND EVOLUTION: THE ROOTS OF HUMANITY 244

Big Questions 245

What Is a Hominin? 246

Bipedal Locomotion: Getting Around on Two Feet 248

Nonhoning Chewing: No Slicing, Mainly Grinding 248

Why Did Hominins Emerge? 251

Charles Darwin's Hunting Hypothesis 251

Concept Check What Makes a Hominin a Hominin? 252

Peter Rodman and Henry McHenry's Patchy Forest Hypothesis 254

Owen Lovejoy's Provisioning Hypothesis 254

Sexual Dimorphism and Human Behavior 255

Bipedality Had Its Benefits and Costs: An Evolutionary Trade-Off 255

What Were the First Hominins? 256

The Pre-Australopithecines 256

Sahelanthropus tchadensis (7–6 mya) 257

Orrorin tugenensis (6 mya) 257

Ardipithecus kadabba and Ardipithecus ramidus (5.8–4.4 mya) 258

Concept Check The Pre-Australopithecines 263

The Australopithecines (4–1 mya) 264

Australopithecus anamensis (4 mya) 265

Australopithecus afarensis (3.6–3.0 mya) 266

Australopithecus (Kenyanthropus) platyops (3.5 mya) 269





Diversification of the Homininae: Emergence of Multiple Evolutionary Lineages from One (3–1 mya) 269

Australopithecus garhi (2.5 mya) 270

The First Tool Makers and Users: Australopithecus or Homo? 270

Evolution and Extinction of the Australopithecines 273

Concept Check The Australopithecines 276

Answering the Big Questions 280

Key Terms 280

Evolution Review: The First Hominins 281

Additional Readings 281

CHAPTER 11 THE ORIGINS AND EVOLUTION OF EARLY HOMO 282

Big Questions 283

Homo habilis: The First Species of the Genus Homo 285

The Path to Humanness: Bigger Brains, Tool Use, and Adaptive Flexibility 285

Homo habilis and Australopithecus: Similar in Body Plan 287

Homo habilis's Adaptation: Intelligence and Tool Use Become Important 287

Habitat Changes and Increasing Adaptive Flexibility 288

Concept Check *Homo habilis: The First Member of Our Lineage* 288

Homo erectus: Early Homo Goes Global 289

Homo erectus in Africa (1.8–.3 mya) 290

Homo erectus in Asia (1.8–.3 mya) 293

Homo erectus in Europe (1.2 million–400,000 yBP) 296

Evolution of Homo erectus: Biological Change, Adaptation, and Improved Nutrition 297

Patterns of Evolution in Homo erectus 302

Concept Check *Homo erectus: Beginning Globalization* 303

Answering the Big Questions 304

Key Terms 305

Evolution Review: The Origins of *Homo* 305

Additional Readings 305

CHAPTER 12 THE ORIGINS, EVOLUTION, AND DISPERSAL OF MODERN PEOPLE 306

Big Questions 307

What Is So Modern about Modern Humans? 309

Modern *Homo sapiens*: Single Origin and Global Dispersal or Regional Continuity? 309

What Do *Homo sapiens* Fossils Tell Us about Modern Human Origins? 311

Early Archaic Homo sapiens 311

Archaic Homo sapiens in Africa (350,000–200,000 yBP) 312

Early Archaic Homo sapiens in Asia (350,000–130,000 yBP) 312
Early Archaic Homo sapiens in Europe (500,000–130,000 yBP) 313
Early Archaic Homo sapiens' Dietary Adaptations 313

Late Archaic Homo sapiens 314

Late Archaic Homo sapiens in Asia (60,000–40,000 yBP) 315
Late Archaic Homo sapiens in Europe (130,000–30,000 yBP) 316
The Neandertal Body Plan: Aberrant or Adapted? 319
Neandertal Hunting: Inefficient or Successful? 321
Neandertals Buried Their Dead 324
Neandertals Talked 325
Neandertals Used Symbols 327

Early Modern Homo sapiens 327

Concept Check Archaic *Homo sapiens* 328

Early Modern Homo sapiens in Africa (200,000–6,000 yBP) 329
Early Modern Homo sapiens in Asia (90,000–18,000 yBP) 331
Early Modern Homo sapiens in Europe (35,000–15,000 yBP) 332

Modern Behavioral and Cultural Transitions 334

How Has the Biological Variation in Fossil *Homo sapiens* Been Interpreted? 335

Ancient DNA: Interbreeding between Neandertals and Early Modern People? 336

Concept Check Early Modern *Homo sapiens* 337

Living People's Genetic Record: Settling the Debate on Modern Human Origins 338

Assimilation Model for Modern Human Variation: Neandertals Are Still with Us 339

Concept Check Models for Explaining Modern *Homo sapiens'* Origins 340

Modern Humans' Other Migrations: Colonization of Australia, the Pacific, and the Americas 340

Down Under and Beyond: The Australian and Pacific Migrations 342

Arrival in the Western Hemisphere: The First Americans 344

Answering the Big Questions 348

Key Terms 349

Evolution Review: The Origins of Modern People 349

Additional Readings 349

CHAPTER 13 OUR LAST 10,000 YEARS: AGRICULTURE, POPULATION, BIOLOGY 350

Big Questions 351

The Agricultural Revolution: New Foods and New Adaptations 353

Population Pressure 354

Regional Variation 355

Survival and Growth 359

Agriculture: An Adaptive Trade-Off 360

Population Growth 360

Environmental Degradation 361

Concept Check The Good and Bad of Agriculture 362

How Did Agriculture Affect Human Biology? 362

The Changing Face of Humanity 363

Two Hypotheses 363

Implications for Teeth 365

Concept Check Soft Food and Biological Change 365

Building a New Physique: Agriculture's Changes to Workload/Activity 366

Health and the Agricultural Revolution 369

Population Crowding and Infectious Disease 369

Concept Check Labor, Lifestyle, and Adaptation in the Skeleton 370

The Consequences of Declining Nutrition: Tooth Decay 371

Nutritional Consequences Due to Missing Nutrients: Reduced Growth and Abnormal Development 371

Nutritional Consequences of Iron Deficiency 373

Concept Check Health Costs of Agriculture 374

Nutritional Consequences: Heights on the Decline 375

If It Is So Bad for You, Why Farm? 375

The Past Is Our Future 375

Our Ongoing Evolution 376

Answering the Big Questions 378

Key Terms 379

Evolution Review: Setting the Stage for the Present and Future 379

Additional Readings 380

Appendix: The Skeleton A1

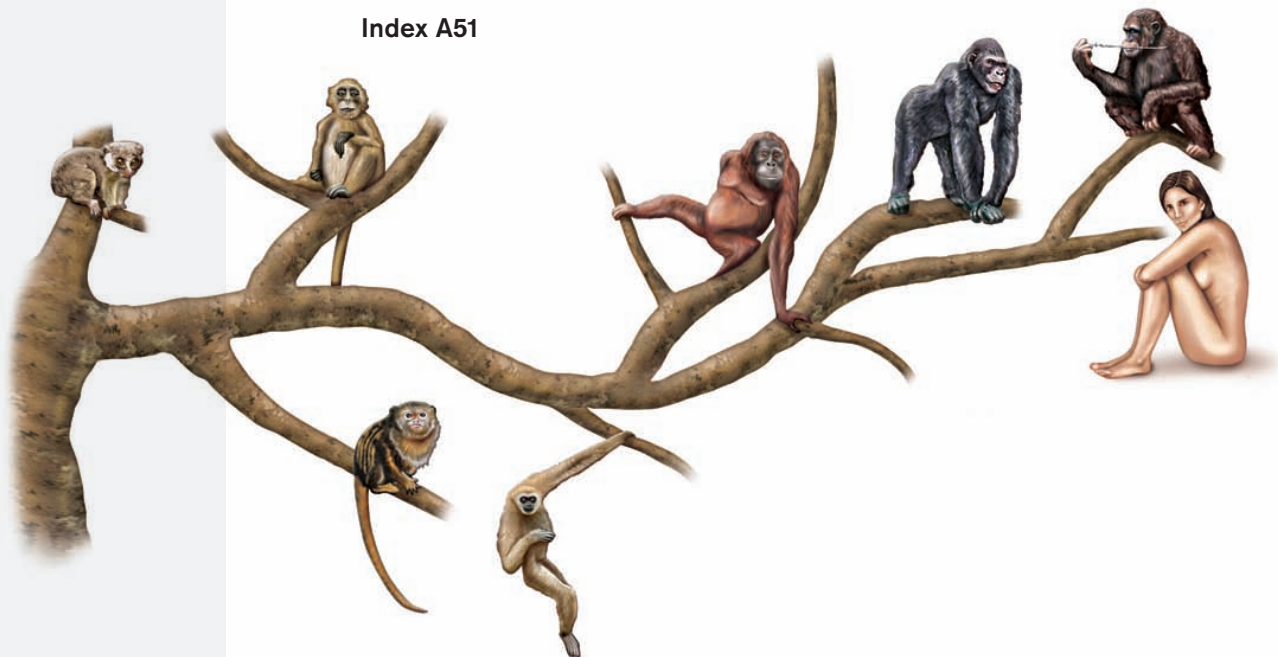
Glossary A11

Glossary of Place Names A19

Bibliography A21

Permissions Acknowledgments A47

Index A51



TWO-PAGE SPREADS

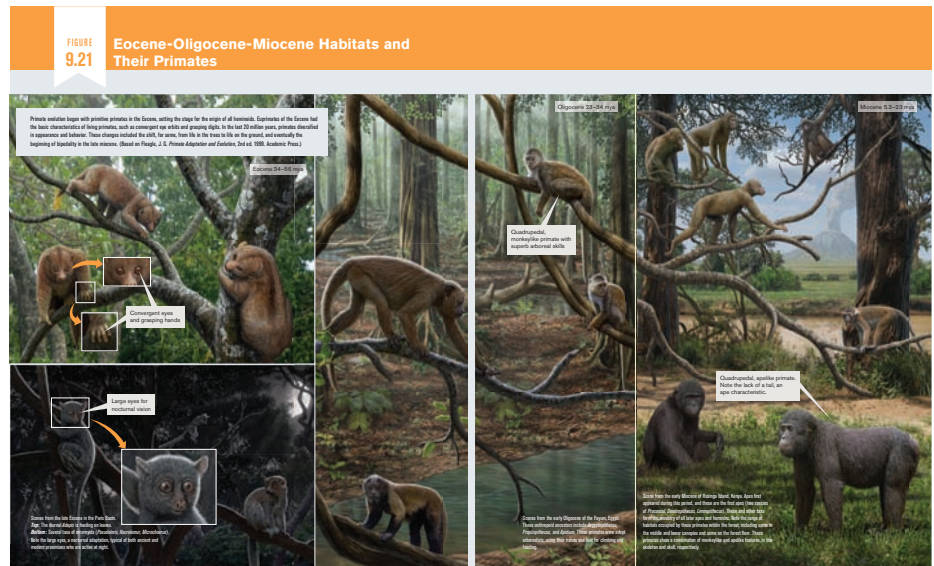
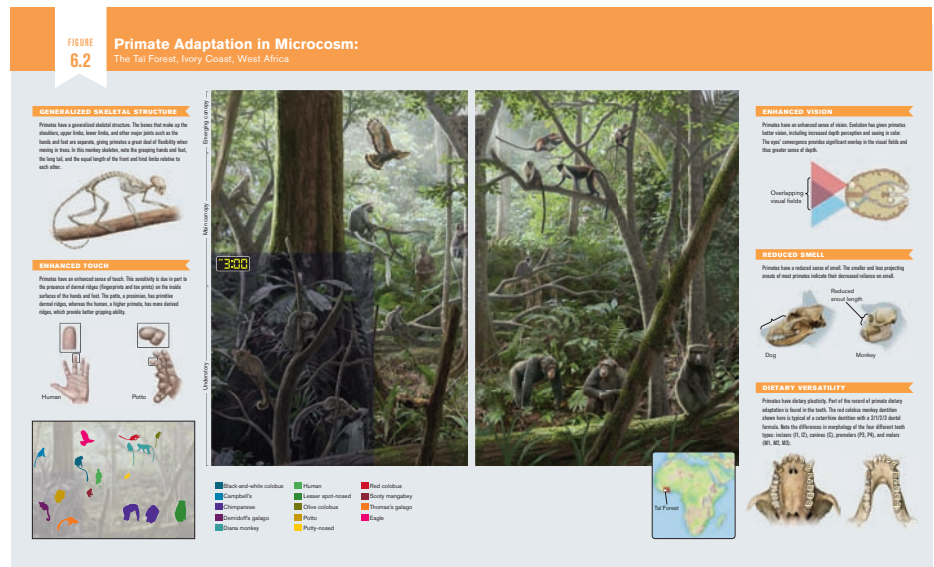
Figure 1.3
The Six Big Events of Human Evolution: Bipedalism, Nonhoning Chewing, Dependence on Material Culture, Speech, Hunting, and Domestication of Plants and Animals pp. 10–11

Figure 3.17
Protein Synthesis pp. 58–59

Figure 6.2
Primate Adaptation in Microcosm: The Tai Forest, Ivory Coast, West Africa pp. 136–137

Figure 9.21
Eocene–Oligocene–Miocene Habitats and Their Primates pp. 236–237

Figure 10.16
From Discovery to Understanding: *Ardipithecus* of Aramis pp. 260–261



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. *Essentials of 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 last 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 field-work 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, *Essentials of 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 two parts. Following 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

into what came before—the present contextualizes and informs our understanding of the past. It is no mistake, then, that *Discovering Our Origins* is the subtitle 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 (bone, 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 last 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 last 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, including 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.

CHANGES IN THE THIRD EDITION

Reflecting the dynamic nature of physical anthropology, there are numerous revisions and updates throughout this new, third edition of *Essentials of Physical Anthropology*. These updates provide content on the cutting-edge developments in the discipline, give new ways of looking at older findings, and keep the book engaging and timely for both you and your students. Although the core principle of the book remains 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 biocultural adaptation.* Anthropologists provide important insights into how humans' remarkable intelligence is related to their evolutionary success. This third edition presents new research on the role of social learning and the retention of knowledge—the accumulation of information—over many generations.
- *New primate taxonomy.* In order to inform students about the latest developments in primate classification, the third edition has shifted from the traditional, grade-based approach used in the previous editions to the cladistics, or phylogenetic, approach. This approach provides students with a classification based on ancestor-descendant evolutionary relationships.
- *New content on developments in genetics that are altering our understanding of phenotype.* We are learning that non-protein coding DNA, often considered “junk” DNA, has important implications for various other instructions in the genome. Similarly, the rapidly expanding field of epigenetics is revealing evolutionary change without alteration of DNA.
- *New content on race and human variation in Chapter 5.*
- *New content on maladaptive human behavior and health outcomes such as obesity.* The role of environment is fundamental in understanding patterns of health in very recent human evolution, including the impacts of the creation of obesogenic environments, the alarming rise in obesity globally, and the causes and consequences of these changing circumstances and outcomes.
- *New content on fossil primate and hominin discoveries.* Exciting new discoveries in early primate evolution from Africa and Asia are revealing the enormous variety and complexity of species. New discoveries from East Africa reveal that although all australopithecines were bipedal, some retained arboreal behavior relatively late in the evolution of these early hominins. New discovery of stone tools dating to 3.3 million years ago—700,000 years earlier than previously known—from East Africa shows the beginnings of humankind's reliance on material culture. Once thought to be the domain of *Homo*, these early dates show use of tools by earlier australopithecines, long before the origins of our genus. These discoveries continue to illustrate the complexity of early hominin evolution. New evidence from chemical and tooth wear analyses reveals that at least some later australopithecines were eating significant quantities of low-quality vegetation, including grasses on the African savanna, confirming the long-held notion that some had highly specialized diets.
- *New findings on the origins of cooking and its importance in human evolution.* Controlled use of fire dates to as early as 1 mya in South Africa. This innovation provided a means for cooking meats and starches, thereby increasing the digestibility of these foods. New research suggests that cooking and nutritional changes associated with cooking may have “fueled” the increase in brain and body size in early hominins.
- *New content on the appearance and evolution of modern Homo sapiens and the Neandertal genome.* Analysis of the direction and pattern of scratches on the incisors of Neandertals reveals that they were predominantly right-handed. In addition to showing this modern characteristic, this finding reveals that this earlier form of *H. sapiens* had brain laterality, a feature linked to speech. Neandertals talked. New genetic evidence reveals the presence of Neandertal genes in modern humans, consistent with the hypothesis that modern *H. sapiens* interbred with Neandertals. Newly discovered hominin fossils from Denisova, Siberia, dating to the late Pleistocene represent a genome that is different from Neandertals' and modern *H. sapiens*'. This newly discovered “Denisovan” genome is also found in people living today in East Asia, suggesting that modern *H. sapiens* encountered Neandertals as well as other populations once in Europe.
- *New findings on the future of humankind.* The study of melting ice caps and glaciers around the world today reveals a dramatic warming trend. As temperatures rise, habitats are in the process of changing. These environmental changes will provide a context for evolution, both in plants and in animals. These factors, coupled with reduction in species diversity, are creating new health challenges for humans today and for the foreseeable future.
- *Revision of content to enhance clarity.* I have continued to focus on helping students understand core concepts, with considerable attention given to cell biology, genetics, DNA, race and human variation, primate taxonomy, locomotion, and dating methods. As in previous editions, I paid careful attention to the clarity of figure captions. The captions do not simply repeat text. Instead, they 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 over 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 conveying past life through wonderful visual presentations.
- *“Evolution Review” sections.* At the end of each chapter, an “Evolution Review” section summarizes material on evolution in that chapter and includes assignable questions about concepts and content. Suggested answers appear in the Instructor’s Manual.
- *InQuizitive.* Norton’s new formative and adaptive online learning resource improves student understanding of the big picture concepts of physical anthropology. Students receive personalized quiz questions on the topics they need the most help with. Engaging, game-like elements motivate students as they learn. These are intended for use in teaching face-to-face, blended, or online class formats.
- *New lab manual.* This text now has a new lab manual, the *Lab Manual for Biological Anthropology—Engaging with Human Evolution* by K. Elizabeth Soluri and Sabrina C. Agarwal. This flexible and richly illustrated manual is designed to support or enhance your current labs and collections, or work on its own. Attractively priced, discount bundles can be purchased including this text.

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 about.

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 generally in addition to its use in the associated text. For convenient reference, defined terms are signaled with bold-face page numbers in the index.

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.

The study of evolution is the central core concept of physical anthropology. The newly introduced 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 game-like, formative, adaptive assessment program featuring visual and conceptual questions keyed to each chapter’s learning objectives from the text. InQuizitive helps you track and report on your students’ progress to 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 *Essentials of Physical Anthropology* 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

InQuizitive

New InQuizitive online formative and adaptive assessment is available for use with *Essentials of Physical Anthropology*, Third Edition, featuring interactive and engaging questions with answer-specific feedback. InQuizitive features questions designed to help students better understand the core objectives of each chapter. Built to be intuitive and easy to use, InQuizitive makes it a snap to assign, assess, and report on student performance and help keep your class on track. Options are available to integrate InQuizitive into your LMS or Coursepack. Contact your local W. W. Norton representative for details.

Lab Manual and Workbook for Biological Anthropology—Engaging with Human Evolution by K. Elizabeth Soluri and Sabrina C. Agarwal.

This new manual captures student interest and illustrates the discipline with the vivid images—every chapter contains large detailed figures, photographs that are properly scaled, and drawings of bones and fossils with an almost three-dimensional appearance. The labs are grouped into four units of four chapters each: 1) genetics/evolutionary theory; 2) human osteology and forensics; 3) primatology; and 4) paleoanthropology. No topic is over- or underemphasized, and the manual is flexibly designed to be used as a whole, or as individual labs, and with a school's cast and photo collection or with the sample photos provided. Each lab has unique Critical Thinking Questions to go with Chapter Review and Lab Exercises. This manual is available at student friendly prices, either as a stand-alone volume or bundled with this text, or as a custom volume.

Coursepacks

Available at no cost to professors or students, Norton Coursepacks for online or hybrid courses are available in a variety of formats, including all versions of Blackboard and WebCT. Content includes review quizzes, flash cards, and links to animations and videos. Coursepacks are available from wwnorton.com/instructors.

New Animations

These new animations of key concepts from each chapter are available in either the Coursepacks, or from wwnorton.com/instructors. Animations are brief, easy to use, and great for explaining concepts either in class or in a distance-learning environment.

New Videos

This new streaming video service is now available through Norton Coursepacks and at wwnorton.com/instructors. These one- to seven-minute educational film clips from across the discipline but with an emphasis on paleoanthropology and primatology help students see and think like anthropologists and make it easy for instructors to illustrate key concepts and spark classroom discussion.

Update PowerPoint Service

To help cover what is new in the discipline, each semester we will provide a new set of supplemental lectures, notes, and assessment material covering current and breaking research. Prepared by Laurie Reitsema (University of Georgia) and with previous updates from Kathy Droesch (Suffolk County Community College), this material is available for download at wwnorton.com/instructors.

PowerPoint Slides and Art JPEGs

Designed for instant classroom use, these slides prepared by Jeremy DeSilva (Boston University) 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.

Instructor's Manual

Prepared by Nancy Tatarek (Ohio University) and Greg Laden, this innovative resource provides chapter summaries, chapter outlines, lecture ideas, discussion topics, suggested reading lists for instructors and students, a guide to “Writing about Anthropology,” suggested answers to Evolution Matters questions, and teaching materials for each video.

Test Bank

Prepared by Renee Garcia (Saddleback College) and Greg Laden, this Test Bank contains multiple-choice and essay questions for each chapter. It is downloadable from Norton's Instructor's Website and available in Word, PDF, and *ExamView*® *Assessment Suite* formats. Visit wwnorton.com/instructors.

Ebook

An affordable and convenient alternative, Norton ebooks retain the content and design of the print book and allow students to highlight and take notes with ease, print chapters as needed, and search the text.

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Columbus, Ohio
August 10, 2015

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 for 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

The book is divided into two parts. Following 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 last 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.

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.



Gorilla meets hominin and author of *Essentials of Physical Anthropology* Clark Larsen.

ESSENTIALS OF PHYSICAL ANTHROPOLOGY



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?

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 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. 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 questions about the biology of modern people. Native Americans had lived in this area of the world for most of the last 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

BIG QUESTIONS?

- 1 **What is anthropology?**
- 2 **What is physical anthropology?**
- 3 **What makes us human and different from other animals?**
- 4 **How do physical anthropologists know what they know?**

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 consequences and behavioral consequences of European contact on native peoples. In setting up the research project, I had envisioned that our findings would provide 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 proven fundamental to human beings' understanding of their 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, dating from before the arrival of 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 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 hard, they 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 southeastern United States Atlantic coast, but physical anthropologists explore and study *everywhere* how humans and their ancestors lived. This enterprise covers a lot of ground and a lot of time, basically the entire world and the last 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 Mountains, 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.

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 subdisciplines: **cultural anthropology**, **archaeology**, **linguistic anthropology**, and **physical anthropology**, also called **biological anthropology** (**Figure 1.1**).

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

anthropology The study of humankind, viewed from the perspectives of all people and all times.

cultural anthropology The study of modern human societies through the analysis of the origins, evolution, and variation of culture.

archaeology The study of historic of prehistoric human populations through the analysis of material remains.

linguistic anthropology The study of the construction, use, and form of language in human populations.

physical anthropology The original term for biological anthropology.

biological (physical) anthropology The study of the evolution, variation, and adaptation of humans and their past and present relatives.

culture Learned behavior that is transmitted from person to person.

artifacts Material objects from past cultures.

language A set of written or spoken symbols that refer to things (people, places, concepts, etc.) other than themselves.

sociolinguistics The science of investigating language's social contexts.

The Four Branches of Anthropology

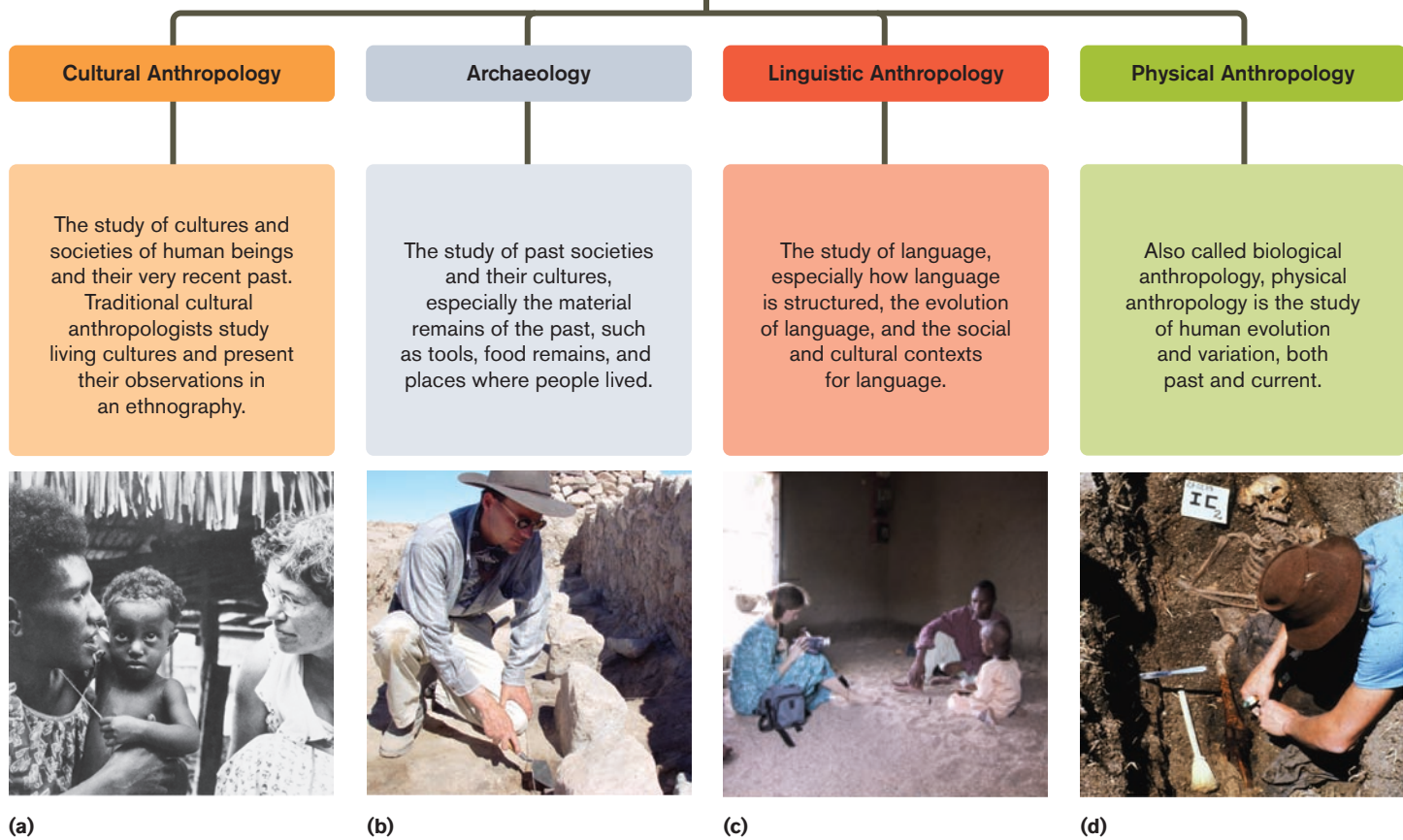


FIGURE 1.1 The Four Branches of Anthropology (a) *Cultural anthropologists*, who study living populations, often spend time living with cultural groups to gain more intimate perspectives on those cultures. The American anthropologist Margaret Mead (1901–1978), one of the most recognizable names in cultural 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. In the Peruvian Andes, this archaeologist examines the remnants of a brewery used by the Wari Empire (ca. AD 750–1000). (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.

forensic anthropology The scientific examination of skeletons in hope of identifying the people whose bodies they came from.

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

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. Anthropologists 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.

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 present 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 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 important, 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.

hominin Humans and humanlike ancestors.

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.

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; 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 examine molecular structure, bones and teeth, blood types, breathing capacity and lung volume, genetics and genetic history, infectious and other types of disease, origins of language and speech, nutrition, reproduction, growth and development, aging, primate origins, primate social behavior, brain biology, and many other topics dealing with variation in both the living and the dead—sometimes the very long dead (**Figure 1.2**)!

In dealing with such topics, physical anthropologists apply methods and theories developed in other disciplines as well as in their own as they answer questions that help us understand who we are, a point that I will raise over and over again throughout this book. The very nature of their discipline and their constant borrowing from other disciplines mean that physical anthropologists practice an *interdisciplinary science*. For example, they might draw on the work of geologists who study the landforms and layering of deposits of soil and rock that tell us when earlier humans lived. Or they might obtain information from paleontologists, who study the evolution of life-forms in the distant past and thus provide the essential context for understanding the world in which earlier humans lived. Some physical anthropologists are trained in chemistry, so they can analyze the chemical properties of bones and teeth to determine what kinds of foods were eaten by those earlier humans. Or to learn how living humans adapt to reduced-oxygen settings, such as in the high altitudes of the Peruvian Andes Mountains, physical anthropologists might work with physiologists who study the lungs' ability to absorb oxygen. The firm yet flexible identity of their science allows physical anthropologists to gather data from other disciplines in order to address key questions. Questions drive what they do.

What Makes Humans So Different from Other Animals?: The Six Steps to Humanness

Human beings clearly differ from other animals. From humanity's earliest origin—about 6–8 mya, when an apelike primate began walking on two feet—to the period beginning about 10,000 years ago, when modern climates and environments emerged following what is commonly known as the Ice Age, six key attributes developed that make us unique. These attributes are bipedalism, nonhoning chewing, complex material culture and tool use, hunting, speech, and dependence on domesticated foods (**Figure 1.3, pp. 10–11**). The first development represents



(a)



(b)



(c)



(d)



(e)



(f)

FIGURE 1.2 A Sample of What Physical Anthropologists Do (a) Human remains excavated at Bactia Pozzeveri, a medieval church cemetery in Tuscany, Italy, provide a window onto health and living conditions in Europe. (b) Geneticists analyze samples of human DNA for various anthropological purposes. DNA studies are used to determine how closely related humans are to other primate species, to examine human origins, and to determine individual identities. (c) A human biologist records the physical activities of a lactating woman (right, weaving basket) living in a rural community in the eastern Amazon, Brazil. These data will be used to calculate the woman's energy expenditure and to understand how she copes with reproduction's great energy demands. (d) In a lab, a forensic anthropologist measures and assesses human bones. If the bones came from a contemporary grave, this forensic information might help to identify the victim. If the bones belonged to a past population, physical anthropologists might use these data to gain insight into the population's health and lifestyle. (e) Laboratory investigations of human ancestors' bones help paleoanthropologists to determine where these ancestors fit in the human family tree. (f) Primatologists, such as the British researcher Jane Goodall (b. 1934), study our closest living relatives, nonhuman primates. The behavior and lifestyle of chimpanzees, for example, help physical anthropologists to understand our evolutionary past.