

# Contents

Preface	xi
Acknowledgments	xv
Supplements	xvii

## CHAPTER 1

### Introduction to Physical Anthropology 3

The Human Connection	6
Biocultural Evolution	6
What Is Anthropology?	10

Cultural Anthropology	11
Linguistic Anthropology	11
Archaeology	12
Physical Anthropology	12
Applied Anthropology	18

Physical Anthropology and the Scientific Method	19
The Anthropological Perspective	21

<b>A Closer Look</b> Forensic Anthropology in Practice	22
Summary of Main Topics	23
Critical Thinking Questions	23

## Heredity and Evolution

## CHAPTER 2

### The Development of Evolutionary Theory 25

A Brief History of Evolutionary Thought	26
The Scientific Revolution	28
Precursors of the Theory of Evolution	29
The Discovery of Natural Selection	33
In Darwin's Shadow	38
Natural Selection	39
Natural Selection in Action	39
Natural Selection and Reproductive Success	41
Constraints on Nineteenth-Century Evolutionary Theory	42
Opposition to Evolution Today	43
A Brief History of Opposition to Evolution in the United States	44
<b>At a Glance</b> The Mechanism of Natural Selection	45
How Do We Know?	46

Summary of Main Topics	47
Critical Thinking Questions	47

## CHAPTER 3

### The Biological Basis of Life 49

Cells	50
From DNA to Protein	52
DNA Structure	52
<b>A Closer Look</b> Rosalind Franklin: The Fourth (but Invisible) Member of the Double Helix Team	53
DNA Replication	53
Protein Synthesis	54
What Is a Gene?	57
<b>A Closer Look</b> Noncoding DNA—Not Junk After All	59
Regulatory Genes	60
<b>At a Glance</b> Coding and Noncoding DNA	61
Mutation: When Genes Change	62



Cell Division	64
Chromosomes	64
Karyotyping Chromosomes	66
Mitosis	67
Meiosis	69
New Frontiers	72
How Do We Know?	77
Summary of Main Topics	78
Critical Thinking Questions	78

## CHAPTER 4

### Heredity and Evolution 81

The Genetic Principles Discovered by Mendel	83
Segregation	84
Dominance and Recessiveness	85
Independent Assortment	86
Mendelian Inheritance in Humans	87
Misconceptions about Dominance and Recessiveness	89
Patterns of Mendelian Inheritance	90
Non-Mendelian Inheritance	94
Polygenic Inheritance	94
<b>At a Glance</b> Mendelian vs. Polygenic Traits	96
Mitochondrial Inheritance	97
Pleiotropy	97
Genetic and Environmental Factors	98
Modern Evolutionary Theory	98
The Modern Synthesis	98
A Current Definition of Evolution	99
Factors That Produce and Redistribute Variation	100
Mutation	100
Gene Flow	100
Genetic Drift and Founder Effect	102
Natural Selection Is Directional and Acts on Variation	105
Review of Genetics and Evolutionary Factors	108
How Do We Know?	109
Summary of Main Topics	109
Critical Thinking Questions	110

## CHAPTER 5

### Macroevolution: Processes of Vertebrate and Mammalian Evolution 113

How We Connect: Discovering the Place of Humans in the Natural World	114
Principles of Classification	116
Making Connections: Constructing Classifications and Interpreting Evolutionary Relationships	117
Comparing Evolutionary Systematics with Cladistics	117
<b>A Closer Look</b> Evo-Devo: The Evolution Revolution	118
An Example of Cladistic Analysis: The Evolutionary History of Cars and Trucks	120
Using Cladistics to Interpret Organisms	121
Definition of Species	123
<b>At a Glance</b> Comparing Two Approaches to Interpretation of Evolutionary Relationships	124
Interpreting Species and Other Groups in the Fossil Record	126
Recognition of Fossil Species	126
Recognition of Fossil Genera	127
What Are Fossils and How Do They Form?	128
Humans Are Vertebrates: Distant Connections through Geological Time	130
<b>A Closer Look</b> Deep Time	132
Humans Are Also Mammals: Closer Connections	134
Processes of Macroevolution	136
Adaptive Radiation	136
Generalized and Specialized Characteristics	137
Working Together: Microevolution and Macroevolution	138
How Do We Know?	138
Summary of Main Topics	139
Critical Thinking Questions	140



## CHAPTER 6

### Survey of the Living Primates 143

Primate Characteristics	144
Limbs and Locomotion	146
Dentition and Diet	146
The Senses and the Brain	146
Maturation, Learning, and Behavior	147
<b>A Closer Look</b> Primate Cranial Anatomy	148
Primate Adaptations	148
Evolutionary Factors	149
Geographical Distribution and Habitats	150
Diet and Teeth	150
Locomotion	151
Primate Classification	155
A Survey of the Living Nonhuman Primates	157
Lemurs and Lorises	157
Tarsiers	159
Anthropoids: Monkeys, Apes, and Humans	160
Hominoids: Apes and Humans	166
Endangered Primates	174
<b>A Closer Look</b> Aye-Ayes: Victims of Derived Traits and Superstition	175
The Bushmeat Trade	179
How Do We Know?	181
Summary of Main Topics	182
Critical Thinking Questions	182

## CHAPTER 7

### Primate Behavior 185

The Evolution of Behavior	186
Some Factors That Influence Social Structure	188
<b>A Closer Look</b> Types of Nonhuman Primate Social Groups	190
Why Be Social?	191
Primate Social Behavior	192
Dominance	192
<b>At a Glance</b> Primate Social Strategies	193
Communication	194

Aggressive and Affiliative Behaviors within Groups 196

Reproduction and Reproductive Behaviors 198

Reproductive Strategies 198

Sexual Selection 199

Is Infanticide a Reproductive Strategy? 200

Mothers, Fathers, and Infants 201

Nonhuman Primate Models for the Evolution of Human Behavior 203

Brain and Body Size 204

Language 206

The Evolution of Language 209

Primate Cultural Behavior 211

**At a Glance** Evolution of Human Language 212

Conflict between Groups 216

Prosocial Behaviors: Affiliation, Altruism, and Cooperation 218

Altruism 219

The Primate Continuum 221

How Do We Know? 222

Summary of Main Topics 222

Critical Thinking Questions 223

## CHAPTER 8

### Overview of the Fossil Primates 225

Background to Primate Evolution: Late Mesozoic 226

Primate Origins 227

**A Closer Look** Building Family Trees from Genes 228

Made to Order: Archaic Primates 229

Eocene Euprimates 231

Lemur Connections? The Adapoids 233

Closer Connections to Living Primates:  
The Evolution of True Lemurs and Lorises 234

**At a Glance** Key Early Primate Names 234

Tarsier Connections? The Omomyoids 236

Evolution of True Tarsiers 237

Eocene and Oligocene Early Anthropoids 237

**A Closer Look** Primate Diversity in the Fayum 239

Oligocene Primates 240

True Anthropoids 240



Early Platyrrhines: New World  
Anthropoids 242

**A Closer Look** Island Hopping and Primate  
Evolution 244

Miocene Primates 245

Monkeying Around 245

Aping Monkeys 248

**At a Glance** Key Early Anthropoid Names 250

True Apes 253

**At a Glance** Key Fossil Ape Names 253

Evolution of Extant Hominoids 258

Hylobatids: The Lesser Apes 258

The African Great Apes 258

Asia's Lone Great Ape 259

How Do We Know? 260

Summary of Main Topics 261

Critical Thinking Questions 261

# Hominin Evolution

## CHAPTER 9

### Paleoanthropology: Reconstructing Early Hominin Behavior and Ecology 263

Understanding Our Direct Evolutionary Connections:  
What's a Hominin? 264

What's in a Name? 265

Biocultural Evolution: The Human Capacity  
for Culture 266

Discovering Human Evolution: The Science  
of Paleoanthropology 267

**A Closer Look** What Were Early Hominins Doing,  
and How Do We Know? 268

Connecting the Dots through Time:  
Paleoanthropological Dating Methods 272

**A Closer Look** Chronometric Dating Estimates 275

Experimental Archaeology 276

Stone Tool (Lithic) Technology 277

Analysis of Bone 278

Reconstruction of Early Hominin Environments  
and Behavior 279

Why Did Hominins Become Bipedal? 279

How Do We Know? 283

Summary of Main Topics 284

Critical Thinking Questions 284

## CHAPTER 10

### Hominin Origins in Africa 287

Walking the Walk: The Bipedal Adaptation 288

The Mechanics of Walking on Two Legs 288

**A Closer Look** Major Features of Bipedal  
Locomotion 290

Digging for Connections:

Early Hominins from Africa 293

Pre-Australopiths (6.0+ to 4.4 mya) 293

Australopiths (4.2 to 1.2 mya) 297

**At a Glance** Key Pre-Australopith Discoveries 298

**A Closer Look** Cranial Capacity 302

A Contemporaneous and Very Different  
Kind of Hominin 303

Later More Derived Australopiths (3.0 to  
1.2 mya) 304

New Connections: A Transitional  
Australopith? 307

Closer Connections: Early *Homo* (2.0 to 1.4 mya) 310

Interpretations: What Does It All Mean? 311

Seeing the Big Picture: Adaptive  
Patterns of Early African Hominins 313

How Do We Know? 315

Summary of Main Topics 316

Critical Thinking Questions 316

## CHAPTER 11

### The First Dispersal of the Genus *Homo: Homo erectus* and Contemporaries 319

A New Kind of Hominin 320

The Morphology of *Homo erectus* 321

Body Size 321

Brain Size 321

Cranial Shape 324



The Geographic Range of <i>Homo erectus</i>	325
The First <i>Homo erectus</i> : <i>Homo erectus</i> from Africa	325
<b>At a Glance</b> Key <i>Homo erectus</i> Discoveries from Africa	327
A New Hominin Discovery in South Africa	327
Who Were the Earliest African Emigrants?	328
<i>Homo erectus</i> from Indonesia	330
<i>Homo erectus</i> from China	331
<b>A Closer Look</b> In Search of Ancient Human Ancestors—and a Little Shade	332
<b>A Closer Look</b> Dragon Bone Hill: Cave Home or Hyena Den?	336
Asian and African <i>Homo erectus</i> : A Comparison	336
<b>At a Glance</b> Key <i>Homo erectus</i> Discoveries from Asia	338
Later <i>Homo erectus</i> from Europe	338
<b>At a Glance</b> Key <i>Homo erectus</i> and Contemporaneous Discoveries from Europe and Western Asia	340
Technological Trends During the Time of <i>Homo erectus</i>	340
Seeing the Connections: Interpretations of <i>Homo erectus</i>	341
Something New and Different: The “Little People”	342
How Do We Know?	344
Summary of Main Topics	345
Critical Thinking Questions	345

## CHAPTER 12

### Premodern Humans 347

When, Where, and What	348
The Pleistocene	348
Dispersal of Middle Pleistocene Hominins	349
Middle Pleistocene Hominins: Terminology	350
Premodern Humans of the Middle Pleistocene	351
Africa	351
<b>At a Glance</b> Key Premodern Human ( <i>H. heidelbergensis</i> ) Fossils from Africa	352
Europe	352
Asia	353
<b>At a Glance</b> Key Premodern Human ( <i>H. heidelbergensis</i> ) Fossils from Europe	353
A Review of Middle Pleistocene Evolution	356

<b>At a Glance</b> Key Premodern Human ( <i>H. heidelbergensis</i> ) Fossils from Asia	356
Middle Pleistocene Culture	357
Neandertals: Premodern Humans of the Late Pleistocene	358
Western Europe	360
Central Europe	363
Western Asia	365
Central Asia	366
Surprising Connections: Another Contemporary Hominin?	366
<b>At a Glance</b> Key Neandertal Fossil Discoveries	367
Culture of Neandertals	367
Technology	368
Subsistence	368
Speech and Symbolic Behavior	369
<b>A Closer Look</b> The Evolution of Language	370
Burials	370
Molecular Connections: The Genetic Evidence	372
Neandertal DNA	373
<b>A Closer Look</b> Are They Human?	374
Seeing Close Human Connections: Understanding Diversity among Premodern Humans	376
How Do We Know?	379
Summary of Main Topics	379
Critical Thinking Questions	380

## CHAPTER 13

### The Origin and Dispersal of Modern Humans 383

Approaches to Understanding Modern Human Origins	385
The Regional Continuity Model: Multiregional Evolution	385
Replacement Models	385
<b>At a Glance</b> Scenarios of Modern Human Origins	387
<b>At a Glance</b> Genetic Relationships among Modern Humans, Denisovans, and Neandertals	388
The Earliest Discoveries of Modern Humans	389
Africa	389
The Near East	392



**At a Glance** Key Early Modern *Homo sapiens*  
Discoveries from Africa and the Near East 394

Asia 394

Australia 396

Central Europe 396

Western Europe 397

**At a Glance** Key Early Modern *Homo sapiens*

Discoveries from Europe and Asia 400

Technology and Art in the Upper Paleolithic 400

Europe 400

Africa 405

**A Closer Look** Maybe You *Can* Take It with  
You 406

Summary of Upper Paleolithic Culture 407

How Do We Know? 408

Summary of Main Topics 409

Critical Thinking Questions 409

## Contemporary Human Evolution

### CHAPTER 14

#### Modern Human Biology: Patterns of Variation 411

Historical Views of Human Variation 412

The Concept of Race 413

**A Closer Look** Racial Purity: A False and Dangerous  
Ideology 414

Contemporary Interpretations of Human  
Variation 418

Human Polymorphisms 419

Polymorphisms at the DNA Level 421

**At a Glance** Genetic Polymorphisms Used to Study  
Human Variation 421

**A Closer Look** What DNA Tells Us about Ancient  
Human Migrations 422

Population Genetics 425

**At a Glance** Population Genetics Research 427

Calculating Allele Frequencies 428

**A Closer Look** Calculating Allele Frequencies:  
PTC Tasting in a Hypothetical Population 429

Evolution in Action: Modern Human  
Populations 430

Human Biocultural Evolution 431

How Do We Know? 434

Summary of Main Topics 435

Critical Thinking Questions 435

### CHAPTER 15

#### Modern Human Biology: Patterns of Adaptation 437

The Adaptive Significance of Human Variation 438

Solar Radiation and Skin Color 439

The Thermal Environment 444

**A Closer Look** Skin Cancer and UV Radiation 446

High Altitude 449

Infectious Disease 451

**At a Glance** Zoonoses and Human Infectious  
Disease 452

The Continuing Impact of Infectious Disease 454

Human Skeletal Biology: What Bones Can Tell Us  
about Ancient Diseases, Trauma, and Lifestyles 458

Evidence of Prehistoric Diseases 458

Reconstruction of Prehistoric Behavioral  
Patterns 461

How Do We Know? 463

Summary of Main Topics 463

Critical Thinking Questions 464

### CHAPTER 16

#### Legacies of Human Evolutionary History: Effects on the Life Course 467

Evolved Biology and Contemporary Lifestyles—Is  
There a Mismatch? 468



Biocultural Evolution and the Life Course	469	Public Perceptions of Climate Change	495
Diet and Nutrition through the Life Course	469	Earth's Shrinking Polar Ice	496
Too Much and Too Little	472	Impact on Biodiversity	500
<b>At a Glance</b> Diet, Lifestyle, and Consequences	473	Acceleration of Evolutionary Processes	502
Other Factors Influencing Growth and Development: Genes, Environment, and Hormones	475	Looking for Solutions	503
Life History Theory and the Human Life Course	477	Is There Any Good News?	505
Pregnancy, Birth, Infancy, and Childhood	478	How Do We Know?	506
Onset of Reproductive Function in Humans	481	Summary of Main Topics	506
Decline in Reproductive Function	482	Critical Thinking Questions	506
Aging and Longevity	483		
Are We Still Evolving?	487	<b>APPENDIX A</b>	
How Do We Know?	488	Atlas of Primate Skeletal Anatomy	507
Summary of Main Topics	488	<b>APPENDIX B</b>	
Critical Thinking Questions	489	Sexing and Aging the Skeleton	515
		Glossary	520
		References	531
		Index	557
<b>CHAPTER 17</b>			
<b>The Human Disconnection</b>	491		
Human Impacts on the Planet and on Other Life-Forms	492		
Humans and the Impact of Culture	493		
Global Climate Change	494		