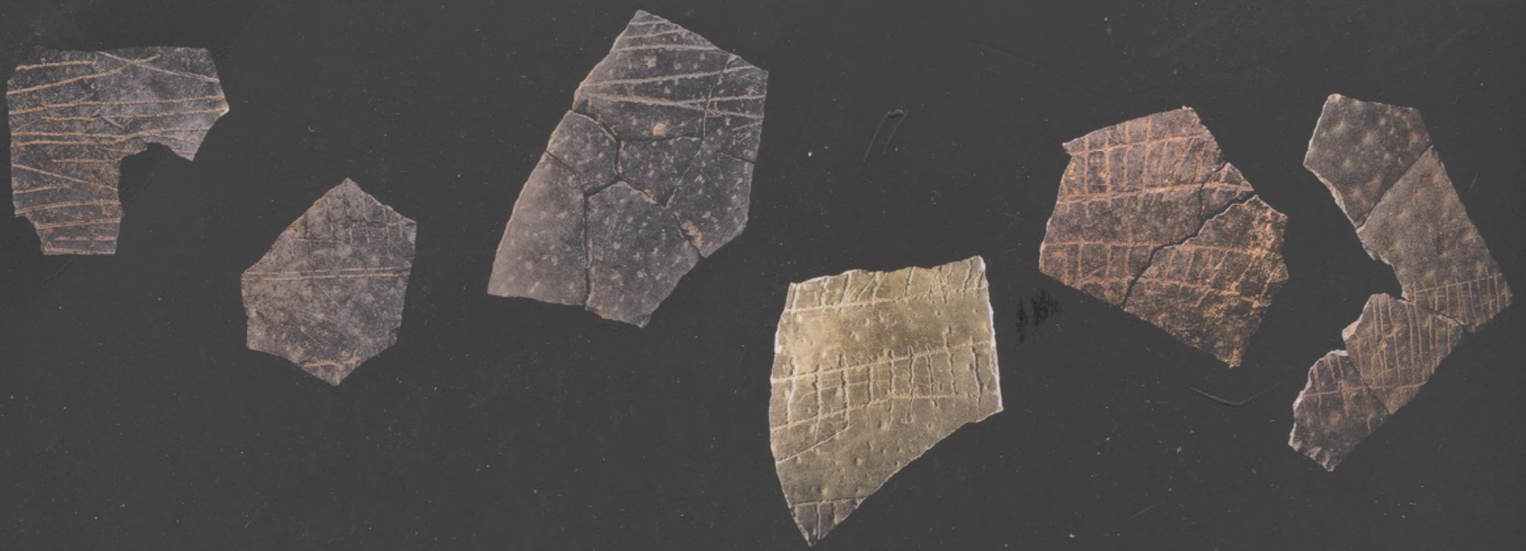




The front cover of this text features fragments of engraved ostrich eggshells found in the Howiesons Poort of Diepkloof Rock Shelter in Western Cape, South Africa. Anthropologists believe these artifacts may have symbolized group identity in the same way that pottery and basket decoration do today. As an example of early material culture, these artifacts help tell the larger story of how we evolved from our earliest ancestors into the complex species we are today.

INQUIZITIVE

InQuizitive is an easy-to-use and award-winning adaptive learning tool that strengthens student understanding of key concepts in physical and biological anthropology. Offering a wide variety of question types featuring visuals, animations, and answer-specific feedback, InQuizitive gives students a personalized path of quiz questions on the topics they need help with most. Engaging, gamelike elements motivate students as they learn. Try out InQuizitive at [DIGITAL.WWNORTON.COM/HOWHUMANS8](https://digital.wwnorton.com/howhumans8).

Additional student resources that can be found at [DIGITAL.WWNORTON.COM/HOWHUMANS8](https://digital.wwnorton.com/howhumans8) include:

- ▶ Real-world video clips, including primate behavior footage
- ▶ Animations demonstrating key anthropology concepts
- ▶ Ebook, with on- or offline reading options

Cover design: Lissi Sigillo

Cover art: Fragments of engraved ostrich eggshells found in the Howiesons Poort of Diepkloof Rock Shelter (Western Cape, South Africa). From Texier, P. J., G. Porraz, J. Parkington, et al. 2010. "A Howiesons Poort Tradition of Engraving Ostrich Eggshell Containers Dated to 60,000 Years Ago at Diepkloof Rock Shelter, South Africa." *Proceedings of the National Academy of Sciences of the United States of America* 107(14): 6180–6185, doi: 10.1073/pnas.0913047107.



W. W. NORTON New York * London
www.wwnorton.com

ISBN 978-0-393-60345-3



9 0000

Preface xiii

Prologue: Why Study Human Evolution? xviii

Part One: How Evolution Works

CHAPTER 1: Adaptation by Natural Selection 2

Explaining Adaptation before Darwin 3

Darwin's Theory of Adaptation 5

 Darwin's Postulates 6

 An Example of Adaptation by Natural Selection 7

 Individual Selection 11

The Evolution of Complex Adaptations 12

 Why Small Variations Are Important 12

 Why Intermediate Steps Are Favored by Selection 14

Rates of Evolutionary Change 17

Darwin's Difficulties Explaining Variation 21

CHAPTER 2: Genetics 24

Mendelian Genetics 25

Cell Division and the Role of Chromosomes in Inheritance 26

 Mitosis and Meiosis 28

 Chromosomes and Mendel's Experimental Results 29

 Linkage and Recombination 32

A CLOSER LOOK 2.1 More on Recombination 34

Molecular Genetics 37

 Genes Are DNA 38

 Some Genes Code for Proteins 40

 Regulatory Sequences Control Gene Expression 47

 Not All DNA Codes for Protein 49

CHAPTER 3: The Modern Synthesis 52

Population Genetics 53

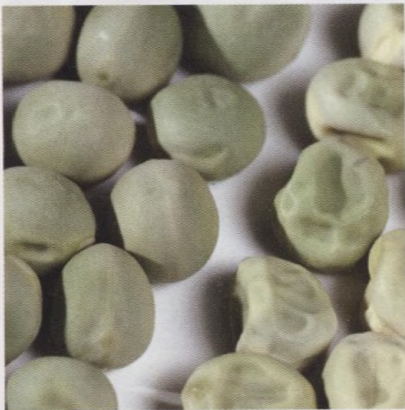
 Genes in Populations 54

 How Random Mating and Sexual Reproduction Change Genotypic Frequencies 55

A CLOSER LOOK 3.1 Genotypic Frequencies after Two Generations of

 Random Mating 59

 How Natural Selection Changes Gene Frequencies 59



The Modern Synthesis	60
The Genetics of Continuous Variation	60
How Variation Is Maintained	63
Natural Selection and Behavior	65
Constraints on Adaptation	68
Correlated Characters	68
Disequilibrium	70
Genetic Drift	71
Local versus Optimal Adaptations	74
A CLOSER LOOK 3.2 The Geometry of Area/Volume Ratios	76
Other Constraints on Evolution	76

CHAPTER 4: Speciation and Phylogeny 80

What Are Species?	81
The Biological Species Concept	83
The Ecological Species Concept	84
The Origin of Species	86
Allopatric Speciation	86
Parapatric and Sympatric Speciation	89
The Tree of Life	91
Why Reconstruct Phylogenies?	93
How to Reconstruct Phylogenies	95
A CLOSER LOOK 4.1 The Role of Phylogeny in the Comparative Method	96
Problems Due to Convergence	97
Problems Due to Ancestral Characters	98
Using Genetic-Distance Data to Date Phylogenetic Events	101
Taxonomy: Naming Names	103

Part Two: Primate Ecology and Behavior

CHAPTER 5: Primate Diversity and Ecology 108

Two Reasons to Study Primates	109
Primates Are Our Closest Relatives	110
Primates Are a Diverse Order	110
Features That Define the Primates	111
Primate Biogeography	114
A Taxonomy of Living Primates	115
A CLOSER LOOK 5.1 Teeth and Guts: You Are What You Can Chew	116
Primate Diversity	118
The Strepsirrhines	118
The Haplorrhines	119
Primate Ecology	125
The Distribution of Food	125
Activity Patterns	130



Ranging Behavior	131
Predation	132
Primate Sociality	134
Primate Conservation	135
A CLOSER LOOK 5.2 Forms of Social Groups among Primates	136

CHAPTER 6: Primate Mating Systems 142

The Language of Adaptive Explanations	144
The Evolution of Reproductive Strategies	145
Reproductive Strategies of Females.....	147
Sources of Variation in Female Reproductive Performance	148
A CLOSER LOOK 6.1 Dominance Hierarchies.....	151
Reproductive Trade-offs	154
Sexual Selection and Male Mating Strategies	155
Intrasexual Selection.....	156
Male Reproductive Tactics	159
Investing Males	159
Male–Male Competition in Groups without Pair Bonds	160
Infanticide.....	163

CHAPTER 7: The Evolution of Cooperation..... 168

Altruism: A Puzzle.....	169
Mutualism	170
The Problem with Group-Level Explanations	171
Kin Selection	172
A CLOSER LOOK 7.1 Group Selection.....	173
Hamilton's Rule	174
Kin Recognition	176
Kin Biases in Behavior.....	179
A CLOSER LOOK 7.2 How Relationships Are Maintained.....	180
Parent–Offspring Conflict.....	184
Reciprocal Altruism.....	184

CHAPTER 8: Primate Life Histories and the Evolution of Intelligence 188

Big Brains and Long Lives	189
Life History Theory.....	190
Selective Pressures Favoring Large Brains in Monkeys and Apes.....	193
What Do Monkeys Know about One Another?.....	197
The Value of Studying Primate Behavior	202



Part Three: The History of the Human Lineage

CHAPTER 9: From Tree Shrew to Ape 206

Continental Drift and Climate Change	209
The Methods of Paleontology.....	211
A CLOSER LOOK 9.1 Using Deep-Sea Cores to Reconstruct Ancient Climates	212
The Evolution of the Early Primates	214
The First Haplorrhines	218
A CLOSER LOOK 9.2 Facts That Teeth Can Reveal.....	220
The Emergence of the Apes	223
A CLOSER LOOK 9.3 Missing Links.....	224

CHAPTER 10: The Earliest Hominins..... 232

At the Beginning	234
<i>Sahelanthropus tchadensis</i>	235
<i>Orrorin tugenensis</i>	235
A CLOSER LOOK 10.1 What It Takes to Be a Biped	236
<i>Ardipithecus</i>	238
The Adaptive Advantages of Bipedalism	242
The Hominin Community Diversifies	244
<i>Australopithecus</i>	245
<i>Paranthropus</i>	253
<i>Kenyanthropus</i>	257
Hominin Phylogenies	257

CHAPTER 11: Early *Homo* and *H. erectus* (2.6–1 Ma) 260

Early <i>Homo</i>	262
<i>Homo erectus</i>	264
Stone Tools	269
A CLOSER LOOK 11.1 Ancient Toolmaking and Tool Use.....	272
Complex Foraging Shapes Human Life History.....	275
A CLOSER LOOK 11.2 Why Meat Eating Favors Food Sharing.....	279
Evidence for Complex Foraging by Early Toolmakers	283
Archaeological Evidence for Meat Eating.....	284
Hunters or Scavengers?	288
Home Bases of Early Toolmakers	292

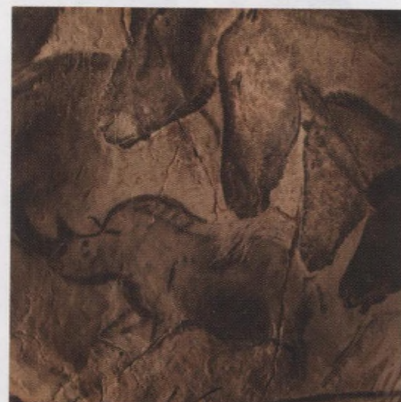
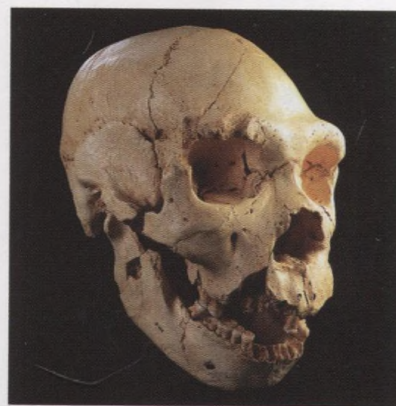


CHAPTER 12: The Neanderthals and Their Contemporaries 296

Climate Change during the Middle Pleistocene (900 ka to 130 ka).....	298
<i>Homo heidelbergensis</i>	300
Hominins of the Later Pleistocene (300 ka to 50 ka).....	303
The Neanderthals and the Denisovans	305
A CLOSER LOOK 12.1 The Origins of Language	312
Africa: The Road to <i>Homo sapiens</i> ?.....	316
A CLOSER LOOK 12.2 <i>Homo naledi</i>: Mysteries of the Rising Star Cave	317
The Sources of Change	318
The Muddle in the Middle	320

CHAPTER 13: *Homo sapiens* and the Evolution of Modern Human Behavior 322

Modern Humans in Africa before 60 ka.....	324
The African Archaeological Record for the Later Pleistocene.....	326
Out of Africa.....	330
Fossil Evidence.....	331
Genetic Evidence.....	331
Archaeological Evidence	341
One Expansion out of Africa or Two?.....	343
Life in the European Upper Paleolithic	344
The End of History?	351



Part Four: Evolution and Modern Humans

CHAPTER 14: Human Genetics and Variation..... 354

Explaining Genetic Variation	355
How Humans Are Different from Other Apes	356
The Dimensions of Human Variation	360
Variation in Traits Influenced by Single Genes	361
Causes of Genetic Variation within Groups.....	363
A CLOSER LOOK 14.1 Calculating Gene Frequencies for a Balanced Polymorphism	365
Causes of Genetic Variation among Groups	366
Variation in Complex Phenotypic Traits	373
Genetic Variation within Groups	374
Genetic Variation among Groups	376
The Race Concept.....	379





CHAPTER 15: Evolution and Human Behavior 386

Why Evolution Is Relevant to Human Behavior	387
Understanding How We Think	390
Inbreeding Avoidance	391
Human Mate Preferences	395
Social Consequences of Mate Preferences	401
Kipsigis Bridewealth	402
How Much Does Evolution Explain about Human Behavior?	403

CHAPTER 16: Culture, Cooperation, and Human Uniqueness 406

Evolution and Human Culture	408
Culture Is an Adaptation	414
Cooperation	417
Is Human Evolution Over?	425

Epilogue: There Is Grandeur in This View of Life.....	427
Appendix: The Skeletal Anatomy of Primates	A-1
Glossary	G-1
Credits	C-1
Index	I-1