

Contents

Preface xv

Prologue xix

PART ONE: How Evolution Works

Chapter 1: Adaption by Natural Selection 3

Explaining Adaptation before Darwin 3

Darwin's Theory of Adaptation 5

Darwin's Postulates 6

An Example of Adaptation by Natural Selection 7

READING: STUDYING EVOLUTION IN DARWIN'S FINCHES 9-10

Individual Selection 13

The Evolution of Complex Adaptations 14

Why Small Variations Are Important 14

Why Intermediate Steps Are Favored by Selection 16

Rates of Evolutionary Change 19

Darwin's Difficulties Explaining Variation 22

Chapter 2: Genetics 25

Mendelian Genetics 25

Cell Division and the Role of Chromosomes in Inheritance 27

Mitosis and Meiosis 28

Chromosomes and Mendel's Experimental Results 29

Linkage and Recombination 33

BOX 2.1: MORE ON RECOMBINATION 34-36

Molecular Genetics 37

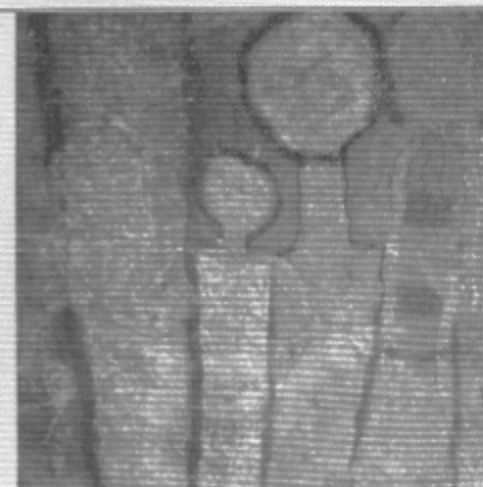
Genes Are DNA 38

The Chemical Basis of Life 40

DNA Codes for Protein 43

Not All DNA Codes for Proteins 47

READING: DECIPHERING DNA 48-49



Chapter 3: The Modern Synthesis 52

Population Genetics 52

Genes in Populations 53

How Random Mating and Sexual Reproduction Change

Genotypic Frequencies 54

BOX 3.1: GENOTYPIC FREQUENCIES AFTER TWO GENERATIONS OF RANDOM MATING 58

How Natural Selection Changes Gene Frequencies 58

The Modern Synthesis 59

The Genetics of Continuous Variation 59

How Variation Is Maintained 63

READING: DNA IS DIGITAL 64–65

Natural Selection and Behavior 68

Constraints on Adaptation 72

Correlated Characters 72

Disequilibrium 74

Genetic Drift 76

Local versus Optimal Adaptations 80

Other Constraints on Evolution 81

BOX 3.2: THE GEOMETRY OF AREA-VOLUME RATIOS 82

Chapter 4: Speciation and Phylogeny 86

What Are Species? 86

The Biological Species Concept 88

The Ecological Species Concept 89

The Origin of Species 91

Allopatric Speciation 91

Parapatric and Sympatric Speciation 94

READING: EVOLUTION IS NOT ALWAYS SO SLOW 97–98

The Tree of Life 99

Why Reconstruct Phylogenies? 102

BOX 4.1: THE ROLE OF PHYLOGENY IN THE COMPARATIVE METHOD 104

How to Reconstruct Phylogenies 105

Problems due to Convergence 106

Problems due to Ancestral Characters 107

Reconstructing Phylogenies Using Genetic Distance Data 110

BOX 4.2: PHYLOGENY RECONSTRUCTION USING GENETIC DISTANCE 112–13

Taxonomy—Naming Names 114

PART TWO: Primate Ecology and Behavior

Chapter 5: Introduction to the Primates 121

Two Reasons to Study Primates 121

Primates Are Our Closest Relatives 122

Primates Are a Diverse Order 122

Features That Define the Primates 123

BOX 5.1: WHAT'S IN A TOOTH? 127

Primate Biogeography 128



A Taxonomy of Living Primates 129

The Prosimians 129

READING: ORANGUTAN CONSERVATION 131-32

The Anthropoids 133

Primate Conservation 140

Chapter 6: Primate Ecology 145

The Distribution of Food 146

READING: MONKEYS CAN BE PICKY EATERS 148-49

BOX 6.1: DIETARY ADAPTATIONS OF PRIMATES 152-53

Activity Patterns 154

Ranging Behavior 157

Predation 159

Primate Sociality 161

BOX 6.2: FORMS OF SOCIAL GROUPS AMONG PRIMATES 163-64

The Distribution of Females 166

BOX 6.3: DOMINANCE HIERARCHIES 168

The Distribution of Males 170

Chapter 7: Primate Mating Systems 173

The Language of Adaptive Explanations 174

The Evolution of Reproductive Strategies 175

Reproductive Strategies of Females 177

Sources of Variation in Female Reproductive Performance 179

Reproductive Tradeoffs 182

Sexual Selection and Male Mating Strategies 184

Intrasexual Selection 186

Intersexual Selection 188

Male Reproductive Tactics 190

Investing Males 190

Male-Male Competition in Nonmonogamous Groups 192

READING: DANGERS OF DISPERSAL 193-96

Infanticide 198

Paternal Care in Nonmonogamous Groups 203

Female Mate Choice 203

Chapter 8: The Evolution of Social Behavior 206

Kinds of Social Interactions 206

Altruism: A Conundrum 208

Kin Selection 210

BOX 8.1: GROUP SELECTION 211

Hamilton's Rule 212

Evidence of Kin Selection in Primates 214

BOX 8.2: HOW RELATIONSHIPS ARE MAINTAINED 218-19

Reciprocal Altruism 222

READING: HOW DO WE STUDY PRIMATES? 223-25

Chapter 9: Primate Intelligence 229

What Is Intelligence? 229

Why Are Primates So Smart? 231

Hypotheses Explaining Primate Intelligence 231

Testing Models of the Evolution of Intelligence 233

Knowledge about the Ecological and Social Domains 235

The Ecological Domain 236

Social Knowledge 238

BOX 9.1: EXAMPLES OF DECEPTION IN NONHUMAN PRIMATES 241

READING: WHAT DO CHIMPANZEES THINK ABOUT SEEING? 243–45

Theory of Mind 245

BOX 9.2: EXAMINING THEORY OF MIND IN CHILDREN, MONKEYS, AND APES 246

The Great Ape Problem 247

The Value of Studying Primate Behavior 249

PART THREE: The History of the Human Lineage



Chapter 10: From Tree Shrew to Ape 253

Continental Drift and Climate Change 256

The Methods of Paleontology 258

The Evolution of the Early Primates 260

The First Anthropoids 264

BOX 10.1: FACTS THAT TEETH CAN REVEAL 267

BOX 10.2: MISSING LINKS 270–71

The Emergence of the Hominoids 272

READING: THE WORLD OF THE ANCIENT APES 274–76

Chapter 11: From Hominoid to Hominid 280

At the Beginning 280

Ardipithecus ramidus 280

READING: TOUMAI, CHILD OF A DRY SEASON 281

Orrorin tugenensis 282

The Hominid Community Diversifies 282

Australopithecus 284

A. anamensis 284

A. afarensis 285

A. africanus 291

A. garhi 293

A. habilis/rudolfensis 294

Paranthropus 297

BOX 11.1: CHEMICAL CLUES ABOUT THE DIET OF PARANTHROPINES 300–301

Kenyanthropus 301

Hominid Phylogenies 302

Evolution of Early Hominid Morphology and Behavior 304

The Evolution of Bipedality 304

Early Hominid Subsistence 306

Early Hominid Social Organization 309

READING: WALKING THROUGH TIME 310-12

Chapter 12: Oldowan Toolmakers and the Origin of Human Life History 315

The Oldowan Toolmakers 315

BOX 12.1: ANCIENT TOOLMAKING AND TOOL USE 317-18

Complex Foraging Shapes Human Life History 319

BOX 12.2: WHY MEAT EATING FAVORS FOOD SHARING 322

Evidence for Complex Foraging by Oldowan Toolmakers 325

Archaeological Evidence for Meat Eating 327

READING: AN OLDOWAN CHALLENGE 331-32

Hunters or Scavengers? 332

Domestic Lives of Oldowan Toolmakers 335

Back to the Future: The Transition to Modern Human Life Histories 337

Chapter 13: From Hominid to Homo 339

Hominids of the Lower Pleistocene: *Homo ergaster* 340

Morphology 341

Tools and Subsistence 343

Hominids of the Early Middle Pleistocene (900 to 300 kya) 347

BOX 13.1: RECONSTRUCTING ANCIENT CLIMATES USING DEEP-SEA CORES 349-50

Eastern Asia: *Homo erectus* 351

READING: THE STORY OF THE FIRST MISSING LINK 353-54

Africa and Western Eurasia: *Homo heidelbergensis* 356

Hominids of the Later Pleistocene (300 to 50 kya) 358

Eastern Eurasia: *H. erectus* and *H. heidelbergensis* 359

Western Eurasia: The Neanderthals 360

Africa: The Road to *Homo sapiens*? 367

The Sources of Change 369

The Muddle in the Middle 370

Chapter 14: *Homo sapiens* and the Evolution of Modern Human Behavior 373

Modern *Homo sapiens* 374

Archaeological Evidence for Modern Human Behavior 375

Upper Paleolithic Technology and Culture 377

READING: WHEN LIONS RULED FRANCE 384-86

Origin and Spread of Modern Humans 387

BOX 14.1: THE MULTIREGIONAL HYPOTHESIS 388-89

Genetic Data 389

BOX 14.2: MITOCHONDRIAL EVE 394-95

Evidence from Fossils and Tool Kits 399

Modern Human Behavior: Revolution or Evolution? 401

The African Archaeological Record during the Later Pleistocene 401

How Modern Human Behavior Evolved 405

BOX 14.3: ARCY-SUR-CURE AND THE CAUSES OF MODERN HUMAN BEHAVIOR 407-08

Chapter 15: The Evolution of Language 410

Language Is an Adaptation 411

Speech Production and Perception 412

Grammar 415

READING: HAPPILY BLINKERED HUMANS 418-19

Language Capacities Are Derived 420

How Language Evolved 422

When Language Evolved 425

Did Language Arise Early? 425

Did Language Arise Late? 429

PART FOUR: Evolution and Modern Humans**Chapter 16: Human Genetic Diversity 435**

Explaining Human Variation 435

Variation in Traits Influenced by Single Genes 439

Causes of Genetic Variation within Groups 441

BOX 16.1: CALCULATING GENE FREQUENCIES FOR A BALANCED POLYMORPHISM 443

Causes of Genetic Variation among Groups 444

Variation in Complex Phenotypic Traits 451

Genetic Variation within Groups 452

Genetic Variation among Groups 453

The Race Concept 456

READING: HUMAN DIVERSITY 461-63

Chapter 17: Evolution and the Human Life Cycle 465

Maternal-Fetal Conflict during Pregnancy 465

Why There Is Parent-Offspring Conflict 466

Spontaneous Abortion 467

Blood Sugar 469

The Evolution of Senescence 470

Two Evolutionary Theories of Senescence 470

Evidence for the Theories 474

READING: GOT MILK? 476-79

The Evolution of Menopause 479

BOX 17.1: THE EVOLUTION OF MENSTRUATION 481-82

Chapter 18: Evolution and Human Behavior 489

Why Evolution Is Relevant to Human Behavior 489

Evolutionary Psychology 492

The Logic of Evolutionary Psychology 492

Reasoning about Reciprocity 493

BOX 18.1: CLERICAL PROBLEM 495

BOX 18.2: BARTENDER'S PROBLEM I 496

BOX 18.3: BARTENDER'S PROBLEM II 497

Evolutionary Psychology and Human Universals 497

Inbreeding Avoidance 498



BOX 18.4: WHY INBRED MATINGS ARE BAD	500
Evolution and Human Culture	504
Culture Is a Derived Trait in Humans	504
READING: CULTURAL DIVERSITY AND HUMAN UNIVERSALS	506-07
BOX 18.5: EXAMPLES OF CULTURE IN OTHER ANIMALS	508-09
Culture Is an Adaptation	510
Human Behavioral Ecology	513
 Chapter 19: Human Mate Choice and Parenting	519
The Psychology of Human Mate Preferences	520
Some Social Consequences of Mate Preferences	525
Kipsigis Bridewealth	525
Nyinba Polyandry	527
Raising Children	529
Child Abuse and Infanticide	530
Adoption	534
Family Size	537
Is Human Evolution Over?	540
READING: THE RELATIONSHIP BETWEEN SCIENCE AND MORALITY	541-42
 Epilogue	544
 Appendix	A1
 Glossary	A3
 Credits	A17
 Permissions Acknowledgments	A21
 Index	A22