



c o n t e n t s

Preface, xiii

chapter one

Science of Zoology and Evolution of Animal Diversity, I

- Principles of Science 2
- Origins of Darwinian Evolutionary Theory, 4
- Darwin's Theory of Evolution, 9
- Evidence for Darwin's Five Theories of Evolution, 12
- Revisions of Darwinian Evolutionary Theory, 23
- Microevolution: Genetic Variation and Change within Species, 24
- Macroevolution: Major Evolutionary Events, 28

Summary, 31

Online Learning Center, 32

chapter two

Animal Ecology, 33

- The Hierarchy of Ecology, 34

Summary, 49

Online Learning Center, 50

chapter three

Animal Architecture, 51

- The Hierarchical Organization of Animal Complexity, 52
- Complexity and Body Size, 52
- Extracellular Components of the Metazoan Body, 52
- Types of Tissues, 54
- Animal Body Plans, 57

Summary, 66

Online Learning Center, 67

chapter four

Classification and Phylogeny of Animals, 68

- Linnaeus and the Development of Classification, 69
- Taxonomic Characters and Reconstruction of Phylogeny, 70
- Theories of Taxonomy, 72
- Species, 77
- Major Divisions of Life, 79
- Major Subdivisions of the Animal Kingdom, 80

Summary, 82

Online Learning Center, 83

chapter five

Protozoan Groups, 84

- Form and Function, 86
- Phyla Retortamonada and Axostylata, 92
- Phylum Chlorophyta, 92
- Phylum Euglenozoa, 94
- Superphylum Alveolata, 94
- Phylum Apicomplexa, 94
- Phylum Ciliophora, 95
- Phylum Dinoflagellata, 98
- Amebas, 99
- Phylogeny and Adaptive Radiation, 100

Summary, 102

Online Learning Center, 104

chapter six

Sponges: Phylum Porifera, 105

- Ecological Relationships, 106
- Form and Function, 107
- Brief Survey of Sponges, 112
- Phylogeny and Adaptive Radiation, 113

Summary, 114

Online Learning Center, 115

chapter seven**Radiate Animals:
Cnidarians and Ctenophores, 116**

Phylum Cnidaria, 117
 Phylum Ctenophora, 134
 Phylogeny and Adaptive Radiation, 135

Summary, 137

Online Learning Center, 138

chapter eight**Acoelomate Bilateral Animals: Flatworms,
Ribbon Worms, and Jaw Worms, 139**

Phylum Platyhelminthes, 140
 Phylum Nemertea (Rhynchocoela), 150
 Phylum Gnathostomulida, 152
 Phylogeny and Adaptive Radiation, 152

Summary, 154

Online Learning Center, 155

chapter nine**Pseudocoelomate Animals, 156**

Phylum Rotifera, 157
 Phylum Acanthocephala, 158
 Phylum Gastrotricha, 159
 Phylum Entoprocta, 159
 Phylum Nematoda: Roundworms, 160
 Phylum Nematomorpha, 165
 Phylum Kinorhyncha, 166
 Phylum Priapulida, 166
 Phylum Loricifera, 167
 Phylogeny and Adaptive Radiation, 167

Summary, 169

Online Learning Center, 170

chapter ten**Molluscs, 171**

Form and Function, 173
 Classes Caudofoveata and Solenogastres, 176
 Class Monoplacophora, 176
 Class Polyplacophora: Chitons, 176
 Class Scaphopoda, 178
 Class Gastropoda, 178
 Class Bivalvia (Pelecypoda), 183
 Class Cephalopoda, 188
 Phylogeny and Adaptive Radiation, 191

Summary, 194

Online Learning Center, 196

chapter eleven**Segmented Worms, 197**

Body Plan, 198
 Class Polychaeta, 199
 Class Oligochaeta, 202
 Class Hirudinea, 206
 Phylogeny and Adaptive Radiation, 208

Summary, 210

Online Learning Center, 211

chapter twelve**Arthropods, 212**

Subphylum Trilobita, 214
 Subphylum Chelicerata, 215
 Subphylum Crustacea, 220
 Subphylum Uniramia, 228
 Phylogeny and Adaptive Radiation, 248

Summary, 250

Online Learning Center, 252

chapter thirteen**Lesser Protostomes, 253**

Phylum Sipuncula, 254
 Phylum Echiura, 254
 Phylum Pogonophora, 255
 Lophophorates, 256
 Phylum Phoronida, 256
 Phylum Ectoprocta, 256
 Phylum Brachiopoda, 258
 Phylum Pentastomida, 259
 Phylum Onychophora, 260
 Phylum Tardigrada, 260
 Phylum Chaetognatha: Arrowworms, 261
 Phylogeny, 261

Summary, 263

Online Learning Center, 264

chapter fourteen**Echinoderms and Hemichordates, 265**

Phylum Echinodermata, 266
 Phylum Hemichordata: Acorn Worms, 278

Summary, 282

Online Learning Center, 284

chapter fifteen

Vertebrate Beginnings: The Chordates, 285

Four Chordate Hallmarks, 287
Ancestry and Evolution of the Chordates, 291
Subphylum Urochordata (Tunicata), 291
Subphylum Cephalochordata, 292
Subphylum Vertebrata, 293

Summary, 300
Online Learning Center, 301

chapter sixteen

Fishes, 302

Ancestry and Relationships of Major Groups of Fishes, 303
Superclass Agnatha: Jawless Fishes, 303
Cartilaginous Fishes: Class Chondrichthyes, 308
Bony Fishes: The Osteichthyes Origin, Evolution, and Diversity, 311
Structural and Functional Adaptations of Fishes, 315

Summary, 323
Online Learning Center, 324

chapter seventeen

The Early Tetrapods and Modern Amphibians, 325

Movement onto Land, 326
Early Evolution of Terrestrial Vertebrates, 326
The Modern Amphibians, 329

Summary, 338
Online Learning Center, 339

chapter eighteen

Reptiles, 340

Origin and Adaptive Radiation of Reptilian Groups, 341
Characteristics of Reptiles That Distinguish Them
from Amphibians, 344
Characteristics and Natural History of Reptilian Orders, 346

Summary, 356
Online Learning Center, 357

chapter nineteen

Birds, 358

Origin and Relationships, 359
Adaptations of Bird Structure and Function for Flight, 363
Flight, 369
Migration and Navigation, 371
Social Behavior and Reproduction, 373
Bird Populations, 376

Summary, 380
Online Learning Center, 381

chapter twenty

Mammals, 382

Origin and Evolution of Mammals, 383
Structural and Functional Adaptations of Mammals, 386
Mammalian Populations, 396
Human Evolution, 397

Summary, 404
Online Learning Center, 405

General References, 406
Glossary, 407
Credits, 428
Index, 431