



contents

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