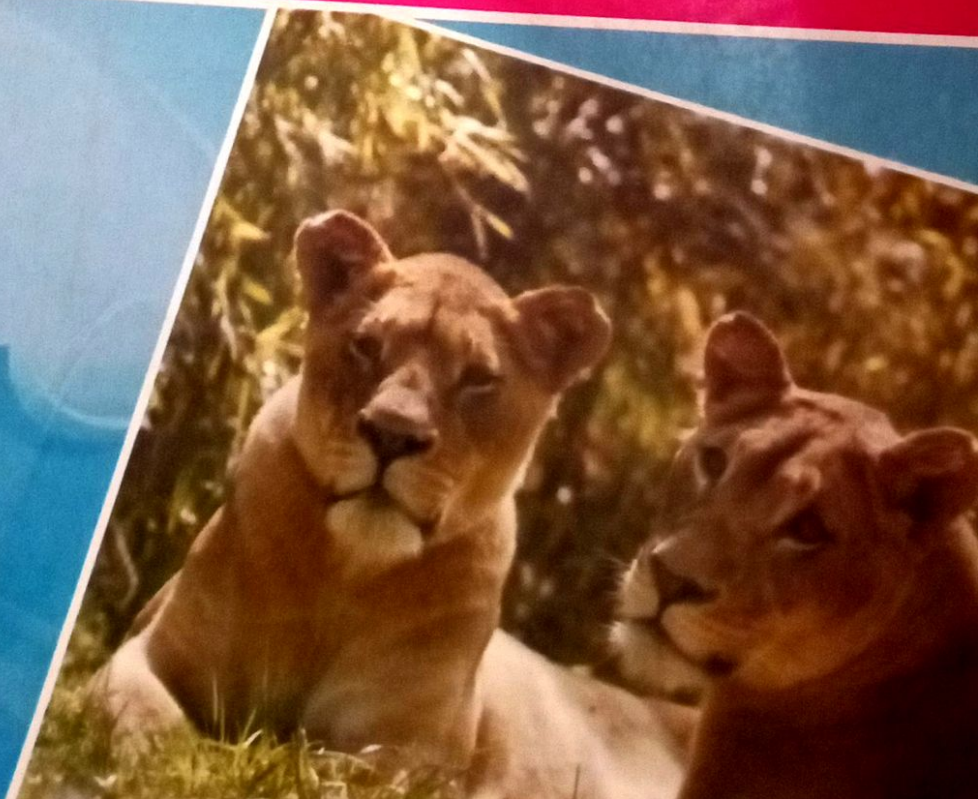
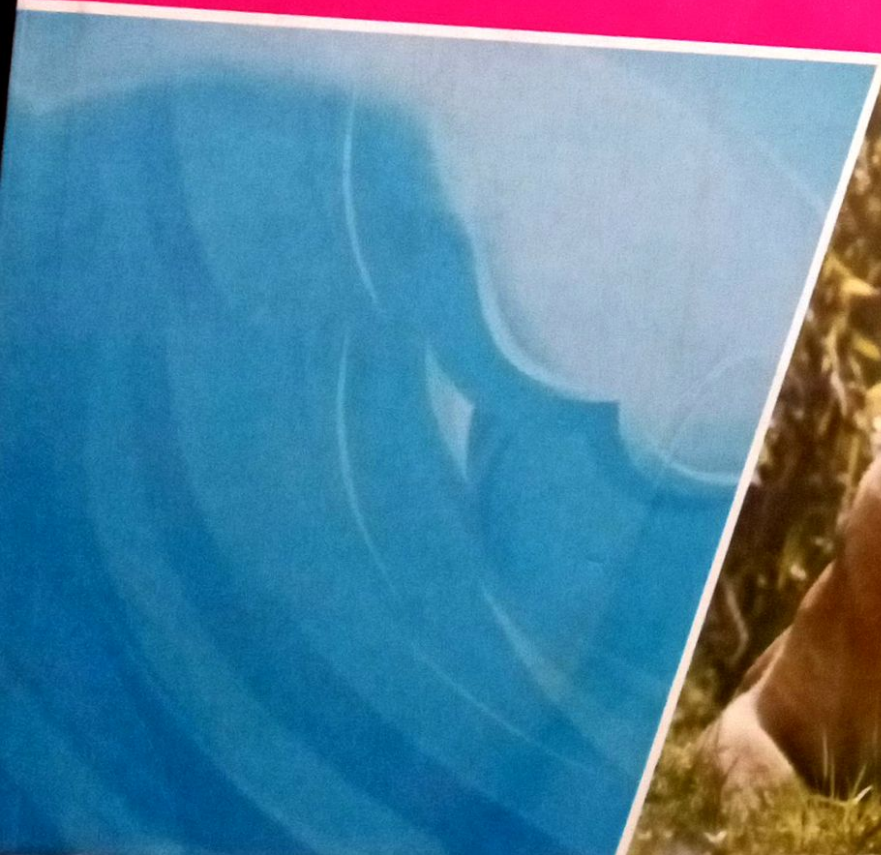


8th Edition

Zoology



CONTENTS

CHAPTER 1
CELLS: AN EVOLUTIONARY AND BIOLOGICAL PERSPECTIVE 1

- Outline 1
- Concepts 1
- Evolution: An Evolutionary Perspective 2
- Biological: An Evolutionary Perspective 5
- Structure 8
- Cells and Area 9
- Concept Review Questions 9
- Analysis and Application Questions 9

CHAPTER 2
CELLS, TISSUES, ORGANS, AND ORGAN SYSTEMS OF ANIMALS 10

- Outline 10
- Concepts 10
- What Are Cells? 10
- Why Are Most Cells Small? 12
- Cell Membranes 12
- Movement across Membranes 14
- Cytoplasm, Organelles, and Cellular Components 16
- The Nucleus: Information Center 17
- Levels of Organization in Various Animals 18
- Human 18
- Organ 18
- Organ Systems 18
- Summary 18
- Selected Key Terms 18
- Concept Review Questions 18
- Analysis and Application Questions 18

CHAPTER 3
CELL REPRODUCTION AND DEVELOPMENT 19

- Outline 19
- Concepts 19
- Cellular Reproduction 19
- Development 19
- Summary 19
- Selected Key Terms 19
- Concept Review Questions 19
- Analysis and Application Questions 19

- Summary 52
- Selected Key Terms 53
- Concept Review Questions 53
- Analysis and Application Questions 54

CHAPTER 4
EVOLUTION: HISTORY AND EVIDENCE 55

- Outline 55
- Concepts 55
- Pre-Darwinian Theories of Change 56
- Darwin's Early Years and His Journey 56
- Early Development of Darwin's Ideas of Evolution 57
- The Theory of Evolution by Natural Selection 58
- Microevolution, Macroevolution, and Evidence of Macroevolutionary Change 61
- Summary 71
- Selected Key Terms 71
- Concept Review Questions 71
- Analysis and Application Questions 71

CHAPTER 5
EVOLUTION AND GENE FREQUENCIES 72

- Outline 72
- Concepts 72
- Evolutionary Processes 72
- Microevolution 72
- Macroevolution 72
- Summary 72
- Selected Key Terms 72
- Concept Review Questions 72
- Analysis and Application Questions 72

CHAPTER 6
EVOLUTION AND THE HISTORY OF LIFE 73

- Outline 73
- Concepts 73
- Evolutionary Processes 73
- Microevolution 73
- Macroevolution 73
- Summary 73
- Selected Key Terms 73
- Concept Review Questions 73
- Analysis and Application Questions 73

- Communities 92
- Trophic Structure of Ecosystems 94
- Cycling within Ecosystems 95
- Ecological Problems 96
- Summary 101
- Selected Key Terms 101
- Concept Review Questions 101
- Analysis and Application Questions 101

CHAPTER 7

ANIMAL CLASSIFICATION, PHYLOGENY, AND ORGANIZATION 102

- Outline 102
- Concepts 102
- Classification of Organisms 102
- Evolutionary Relationships and Tree Diagrams 109
- Patterns of Organization 109
- Higher Animal Taxonomy 113
- Summary 116
- Selected Key Terms 116
- Concept Review Questions 117
- Analysis and Application Questions 117

CHAPTER 8

ANIMAL-LIKE PROTISTS: THE PROTOZOA 118

- Outline 118
- Concepts 118
- Evolutionary Perspective of the Protists 118
- Life within a Single Plasma Membrane 119
- Symbiotic Lifestyles 121
- Protists and Protozoan Taxonomy 121
- Further Phylogenetic Considerations 132
- Summary 133
- Selected Key Terms 134
- Concept Review Questions 134
- Analysis and Application Questions 134

CHAPTER 9

MULTICELLULAR AND TISSUE LEVELS OF ORGANIZATION 135

- Outline 135
- Concepts 135
- Evolutionary Perspective 135
- Phylum Porifera 137
- Phylum Cnidaria 142
- Phylum Ctenophora 150
- Further Phylogenetic Considerations 152
- Summary 154
- Selected Key Terms 155

- Concept Review Questions 155
- Analysis and Application Questions 155

CHAPTER 10

THE TRIPLOBLASTIC, ACOELOMATE BODY PLAN 156

- Outline 156
- Concepts 156
- Evolutionary Perspective 156
- Phylum Acoelomorpha 158
- Phylum Platyhelminthes: Flatworms Are Acoelomate with Gastrovascular Cavities 158
- Phylum Nemertea: Proboscis Worms Are Named for Their Prey-Capturing Apparatus 170
- Phylum Gastrotricha 171
- Phylum Cyclophora: A Relatively New Phylum 172
- Further Phylogenetic Considerations 172
- Summary 173
- Selected Key Terms 174
- Concept Review Questions 174
- Analysis and Application Questions 174

CHAPTER 11

MOLLUSCAN SUCCESS 175

- Outline 175
- Concepts 175
- Evolutionary Perspective 175
- Molluscan Characteristics 176
- Class Gastropoda 178
- Class Bivalvia 181
- Class Cephalopoda 185
- Class Polyplacophora 189
- Class Scaphopoda 190
- Class Monoplacophora 190
- Class Aplacophora 190
- Further Phylogenetic Considerations 191
- Summary 193
- Selected Key Terms 194
- Concept Review Questions 194
- Analysis and Application Questions 194

CHAPTER 12

ANNELIDA: THE METAMERIC BODY FORM 195

- Outline 195
- Concepts 195
- Evolutionary Perspective 195
- Class Polychaeta 198
- Class Clitellata 203

Further Phylogenetic Considerations	207
Summary	209
Selected Key Terms	210
Concept Review Questions	210
Analysis and Application Questions	210

CHAPTER 13

THE PSEUDOCOELOMATE BODY PLAN: ASCHELMINTHES (LOPHOTROCHOZOAN AND ECDYSOZOAN PHYLA) 211

Outline	211
Concepts	211
Evolutionary Perspective	211
General Characteristics	212
Aschelminthes That Do Not Molt (Lophotrochozoan Phyla)	212
Aschelminthes That Molt (Ecdysozoan Phyla)	217
Further Phylogenetic Considerations	226
Summary	226
Selected Key Terms	226
Concept Review Questions	226
Analysis and Application Questions	227

CHAPTER 14

THE ARTHROPODS: BLUEPRINT FOR SUCCESS 228

Outline	228
Concepts	228
Evolutionary Perspective	228
Metamerism and Tagmatization	229
The Exoskeleton	230
The Hemocoel	231
Metamorphosis	232
Subphylum Trilobitomorpha	232
Subphylum Chelicerata	232
Subphylum Crustacea	240
Further Phylogenetic Considerations	247
Summary	248
Selected Key Terms	248
Concept Review Questions	248
Analysis and Application Questions	248

CHAPTER 15

THE HEXAPODS AND MYRIAPODS: TERRESTRIAL TRIUMPHS 250

Outline	250
Concepts	250
Evolutionary Perspective	250

Subphylum Myriapoda	251
Subphylum Hexapoda	254
Further Phylogenetic Considerations	255
Summary	269
Selected Key Terms	270
Concept Review Questions	270
Analysis and Application Questions	270

CHAPTER 16

THE ECHINODERMS 271

Outline	271
Concepts	271
Evolutionary Perspective	271
Echinoderm Characteristics	272
Class Asterozoa	274
Class Ophiurozoa	276
Class Echinozoa	278
Class Holothurozoa	279
Class Crinozoa	280
Further Phylogenetic Considerations	281
Summary	283
Selected Key Terms	284
Concept Review Questions	284
Analysis and Application Questions	284

CHAPTER 17

HEMICHORDATA AND INVERTEBRATE CHORDATES 285

Outline	285
Concepts	285
Evolutionary Perspective	285
Phylum Hemichordata	286
Phylum Chordata	289
Further Phylogenetic Considerations	293
Summary	295
Selected Key Terms	295
Concept Review Questions	295
Analysis and Application Questions	295

CHAPTER 18

THE FISHES: VERTEBRATE SUCCESS IN WATER 296

Outline	296
Concepts	296
Evolutionary Perspective	296
Survey of Fishes	299
Evolutionary Pressures	305
Further Phylogenetic Considerations	313

Summary 315
Selected Key Terms 316
Concept Review Questions 316
Analysis and Application Questions 316

CHAPTER 19

AMPHIBIANS: THE FIRST TERRESTRIAL VERTEBRATES 317

Outline 317
Concepts 317
Evolutionary Perspective 317
Survey of Amphibians 318
Evolutionary Pressures 321
Amphibians in Peril 331
Further Phylogenetic Considerations 332
Summary 332
Selected Key Terms 333
Concept Review Questions 333
Analysis and Application Questions 333

CHAPTER 20

REPTILES: NONAVIAN DIAPSID AMNIOTES 334

Outline 334
Concepts 334
Evolutionary Perspective 334
Survey of the Reptiles 336
Evolutionary Pressures 340
Further Phylogenetic Considerations 347
Summary 348
Selected Key Terms 348
Concept Review Questions 348
Analysis and Application Questions 349

CHAPTER 21

BIRDS: REPTILES BY ANOTHER NAME 350

Outline 350
Concepts 350
Evolutionary Perspective 350
Evolutionary Pressures 353
Summary 367
Selected Key Terms 367
Concept Review Questions 367
Analysis and Application Questions 367

CHAPTER 22

MAMMALS: SYNAPSID AMNIOTES 368

Outline 368
Concepts 368

Evolutionary Perspective 368
Diversity of Mammals 370
Evolutionary Pressures 373
Human Evolution 385
Summary 392
Selected Key Terms 392
Concept Review Questions 392
Analysis and Application Questions 393

CHAPTER 23

PROTECTION, SUPPORT, AND MOVEMENT 394

Outline 394
Concepts 394
Protection: Integumentary Systems 394
Movement and Support: Skeletal Systems 399
Movement: Nonmuscular Movement
and Muscular Systems 403
Summary 412
Selected Key Terms 412
Concept Review Questions 412
Analysis and Application Questions 413

CHAPTER 24

COMMUNICATION I: NERVOUS AND SENSORY SYSTEMS 414

Outline 414
Concepts 414
Neurons: The Basic Functional Units
of the Nervous System 415
Neuron Communication 416
Invertebrate Nervous Systems 419
Vertebrate Nervous Systems 421
Sensory Reception 426
Invertebrate Sensory Receptors 427
Vertebrate Sensory Receptors 431
Summary 439
Selected Key Terms 440
Concept Review Questions 441
Analysis and Application Questions 441

CHAPTER 25

COMMUNICATION II: THE ENDOCRINE SYSTEM AND CHEMICAL MESSENGERS 442

Outline 442
Concepts 442
Chemical Messengers 443
Hormones and Their Feedback Systems 443
Mechanisms of Hormone Action 444
Some Hormones of Invertebrates 445

Overview of the Vertebrate Endocrine System	448
Endocrine Systems of Vertebrates Other Than Birds or Mammals	449
Endocrine Systems of Birds and Mammals	451
Some Hormones Are Not Produced by Endocrine Glands	458
Evolution of Endocrine Systems	459
Summary	459
Selected Key Terms	459
Concept Review Questions	459
Analysis and Application Questions	460

CHAPTER 26

CIRCULATION AND GAS EXCHANGE 461

Outline	461
Concepts	461
Internal Transport and Circulatory Systems	461
Gas Exchange	470
Summary	479
Selected Key Terms	479
Concept Review Questions	479
Analysis and Application Questions	480

CHAPTER 27

NUTRITION AND DIGESTION 481

Outline	481
Concepts	481
Evolution of Nutrition	481
The Metabolic Fates of Nutrients in Heterotrophs	482
Digestion	485
Animal Strategies for Getting and Using Food	486
Diversity in Digestive Structures: Invertebrates	489
Diversity in Digestive Structures: Vertebrates	490
The Mammalian Digestive System	495
Summary	502
Selected Key Terms	502
Concept Review Questions	502
Analysis and Application Questions	502

CHAPTER 28

TEMPERATURE AND BODY FLUID REGULATION 503

Outline	503
Concepts	503
Homeostasis and Temperature Regulation	503
Control of Water and Solutes (Osmoregulation and Excretion)	510
Invertebrate Excretory Systems	511
Vertebrate Excretory Systems	514
Summary	522

Selected Key Terms	522
Concept Review Questions	523
Analysis and Application Questions	523

CHAPTER 29

REPRODUCTION AND DEVELOPMENT 524

Outline	524
Concepts	524
Asexual Reproduction in Invertebrates	524
Sexual Reproduction in Invertebrates	527
Sexual Reproduction in Vertebrates	528
Examples of Reproduction among Various Vertebrate Classes	528
The Human Male Reproductive System Is Typical of Male Mammals	530
The Human Female Reproductive System Is Typical of Female Mammals	533
Prenatal Development and Birth in a Human	539
Summary	542
Selected Key Terms	543
Concept Review Questions	543
Analysis and Application Questions	543

CHAPTER 30*

THE CHEMICAL BASIS OF ANIMAL LIFE

Outline
Concepts
Atoms and Elements: Building Blocks of All Matter
Compounds and Molecules: Aggregates of Atoms
Acids, Bases, and Buffers
The Molecules of Animals
Summary
Selected Key Terms
Concept Review Questions
Analysis and Application Questions

CHAPTER 31*

ENERGY AND ENZYMES: LIFE'S DRIVING AND CONTROLLING FORCES

Outline
Concepts
What Is Energy?
The Laws of Energy Transformations
Activation Energy
Enzymes: Biological Catalysts
Cofactors and Coenzymes
ATP: The Cell's Energy Currency
Summary

Selected Key Terms
Concept Review Questions
Analysis and Application Questions

CHAPTER 32*

HOW ANIMALS HARVEST ENERGY STORED IN NUTRIENTS

Outline
Concepts
Glycolysis: The First Phase of Nutrient Metabolism
Aerobic Respiration: The Major Source of ATP
Metabolism of Fats and Proteins: Alternative Food Molecules
Control of Metabolism
The Metabolic Pool
Summary
Selected Key Terms
Concept Review Questions
Analysis and Application Questions

CHAPTER 33*

EMBRYOLOGY

Outline
Concepts
Fertilization
Embryonic Development, Cleavage, and Egg Types
The Primary Germ Layers and Their Derivatives
Echinoderm Embryology

Vertebrate Embryology
Summary
Selected Key Terms
Concept Review Questions
Analysis and Application Questions

CHAPTER 34*

ANIMAL BEHAVIOR

Outline
Concepts
Four Approaches to Animal Behavior
Proximate and Ultimate Causes
Anthropomorphism
Development of Behavior
Learning
Control of Behavior
Communication
Behavioral Ecology
Social Behavior
Summary
Selected Key Terms
Concept Review Questions
Analysis and Application Questions

Glossary 544

Credits 573

Index 576