01 Introduction

01-01 Exploring Life on its Many Levels

- 01-02 Evolution, Unity and Diversity
- 01-03 The Process of Science
- 01-99 Associated problems in Chapter 01
- 02 The Chemical Context of Life
- 02-01 Chemical Elements and Compounds
- 02-02 Atoms and Molecules
- 02-99 Associated problems in Chapter 02

03 Water and the Fitness of the Environment

- 03-01 The Effects of Water's Polarity
- 03-02 The Dissociation of Water Molecules
- 03-99 Associated problems in Chapter 03

04 Carbon and the Molecular Diversity of Life

- 04-01 The Importance of Carbon
- 04-02 Functional Groups
- 04-99 Associated problems in Chapter 04

05 The Structure and Function of Macromolecules

- 05-01 **Polymer Principles**
- 05-02 Carbohydrates Fuel and Building Material
- 05-03 Lipids Diverse Hydrophobic Molecules
- 05-04 Proteins Many Structures, Many Functions
- 05-05 Nucleic Acids Informational Polymers
- 05-99 Associated problems in Chapter 05

06 An Introduction to Metabolism

- 06-01 Metabolism, Energy, and Life
- 06-02 Enzymes
- 06-03 The Control of Metabolism
- 06-99 Associated problems in Chapter 06
- 07 A Tour of the Cell
- 07-01 How We Study Cells
- 07-02 A Panoramic View of the Cell
- 07-03 The Nucleus and Ribosomes
- 07-04 The Endomembrane System
- 07-05 Other Membranous Organelles
- 07-06 The Cytoskeleton
- 07-07 Cell Surfaces and Junctions
- 07-99 Associated problems in Chapter 07

08 Membrane Structure and Function

- 08-01 Membrane Structure
- 08-02 Traffic Across Membranes
- $08\mathchar`-99$ Associated problems in Chapter 08

- 09 Cellular Respiration
- 09-01 Principles of Energy Harvest
- 09-02 Glycolysis
- 09-03 Krebs Cycle
- 09-04 Oxidative Phosphorylation
- 09-05 Fermentation
- 09-99 Associated problems in Chapter 09
- 10 Photosynthesis
- 10-01 Basic Concept of Photosynthesis
- 10-02 Light Dependent Reaction
- 10-03 Calvin Cycle
- 10-04 C3, C4 and CAM Plants
- 10-99 Associated problems in Chapter 10
- 11 Cell Communication
- 11-01 An Overview of Cell Signaling
- 11-02 Signal Reception: the Initiation of Transduction
- 11-03 Signal-Transduction Pathways
- 11-04 Cellular Responses to Signals
- 11-99 Associated problems in Chapter 11
- 12 The Cell Cycle
- 12-01 The Key Roles of Cell Division
- 12-02 Bacterial Cell Division
- 12-03 The Mitotic Cell Cycle
- 12-04 Regulation of the Cell Cycle
- 12-99 Associated problems in Chapter 12
- 13 Meiosis and Sexual Life Cycles
- 13-01 An Introduction to Heredity
- 13-02 Meiotic Process and its Role in Sexual Life Cycles
- 13-03 Origins of Genetic Variation
- 13-99 Associated problems in Chapter 13

14 Mendel and the Gene Idea

- 14-01 Gregor Mendel's Discoveries
- 14-02 Variation in Mendelian Genetics
- 14-03 Mendelian Inheritance in Humans
- 14-99 Associated problems in Chapter 14

15 The Chromosomal Basis of Inheritance

- 15-01 Relating Mendelism to Chromosomes
- 15-02 Linkage
- 15-03 Sex Chromosomes
- 15-04 Chromosomal Aberrations
- 15-05 Cytoplasmic Inheritance
- 15-99 Associated problems in Chapter 15

- 16 The Molecular Basis of Inheritance
- 16-01 DNA as the Genetic Material
- 16-02 DNA Replication and Repair
- 16-99 Associated problems in Chapter 16
- 17 From Gene to Protein
- 17-01 The Connection Between Genes and Proteins
- 17-02 The Synthesis and Processing of RNA
- 17-03 The Synthesis of Protein
- 17-99 Associated problems in Chapter 17

18 Microbial Models: Viruses and Bacteria

- 18-01 The Genetics of Viruses
- 18-02 The Genetics of Bacteria
- 18-99 Associated problems in Chapter 18

19 Organization, Control of Eukaryotic Genomes

19-01 Eukaryotic Chromatin Structure

- 19-02 Genome Organization at the DNA Level
- 19-03 The Control of Gene Expression
- 19-04 The Molecular Biology of Cancer
- 19-99 Associated problems in Chapter 19

20 DNA Technology and Genomics

- 20-01 DNA Cloning
- 20-02 DNA Analysis and Genomics
- 20-03 Practical Applications of DNA Technology
- 20-99 Associated problems in Chapter 20

21 The Genetic Basis of Development

- 21-01 From Single Cell to Multicellular Organism
- 21-02 Differential Gene Expression
- 21-03 Pattern Formation: Genetic, Cellular
- 21-99 Associated problems in Chapter 21

22 Modification: Darwinian View of Life

22-01 Historical Context for Evolutionary Theory

22-02 The Darwinian Revolution

22-99 Associated problems in Chapter 22

23 The Evolution of Populations

- 23-01 **Population Genetics**
- 23-02 Causes of Microevolution
- 23-03 Genetic Variation: Natural Selection
- 23-04 Adaptive Evolution: Natural Selection
- 23-99 Associated problems in Chapter 23
- 24 The Origin of Species

- 24-01 What Is a Species?
- 24-02 Modes of Speciation
- 24-03 From Speciation to Macroevolution
- 24-99 Associated problems in Chapter 24
- 25 Phylogeny and Systematics
- 25-01 The Fossil Record and Geologic Time
- 25-02 Systematics: Classification, Phylogeny
- $25\text{-}99\,$ Associated problems in Chapter $25\,$
- 26 Early Earth and the Origin of Life
- 26-01 Introduction to the History of Life
- 26-02 The Origin of Life
- 26-03 The Major Lineages of Life
- 26-99 Associated problems in Chapter 26

27 Prokaryotes: Origins of Metabolic Diversity

- 27-01 The World of Prokaryotes
- 27-02 Prykaryotes: Structure, Function, Reproduction
- 27-03 Nutritional and Metabolic Diversity
- 27-04 A Survey of Prokaryotic Diversity
- 27-05 The Ecological Impact of Prokaryotes
- 27-99 Associated problems in Chapter 27

28 The Origins of Eukaryotic Diversity

- 28-01 Introduction to the Protists
- 28-02 Origin and Early Diversification of Eukaryotes
- 28-03 Protistan Diversity
- 28-99 Associated problems in Chapter 28

29 Plant Diversity I: How Plants Colonized Land

- 29-01 An Overview of Land Plant Evolution
- 29-02 The Origin of Land Plants
- 29-03 Bryophytes
- 29-04 The Origin of Vascular Plants
- 29-05 Pteridophytes: Seedless Vascular Plants
- 29-99 Associated problems in Chapter 29

30 Plant Diversity II: Evolution of Seed Plants

- 30-01 Overview of Seed Plant Evolution
- 30-02 Gymnosperms
- 30-03 Angiosperms (Flowering Plants)
- 30-04 Plants and Human Welfare
- 30-99 Associated problems in Chapter 30

31 Fungi

- 31-01 Introduction to the Fungi
- 31-02 Diversity of Fungi
- 31-03 Ecological Impacts of Fungi

- 31-04 Evolution of Fungi
- $31\mathchar`-99$ Associated problems in Chapter 31

32 Introduction to Animal Evolution

32-01 What Is an Animal?

32-02 Two Views of Animal Diversity

- 32-03 The Origins of Animal Diversity
- 32-99 Associated problems in Chapter 32

33 Invertebrates

- 33-01 **Parazoa**
- 33-02 Radiata
- 33-03 Protostomia: Lophotrochozoa
- 33-04 Protostomia: Ecdysozoa
- 33-05 Deuterostomia
- 33-99 Associated problems in Chapter 33

34 Vertebrate Evolution and Diversity

- 34-01 Origin of Vertebrates: Invertebrate Chordates
- 34-02 Introduction to the Vertebrates
- 34-03 Jawless Vertebrates
- 34-04 Fishes and Amphibians
- 34-05 Amniotes
- 34-06 Primates, Evolution of Homo sapiens
- $34\mathchar`-99$ Associated problems in Chapter 34

35 Plant Structure and Growth

- 35-01 The Plant Body
- 35-02 The Process of Plant Growth and Development
- 35-03 Mechanisms of Plant Growth and Development
- $35\text{-}99\,$ Associated problems in Chapter $35\,$
- 36 Transport in Plants
- 36-01 An Overview of Transport Mechanisms in Plants
- 36-02 Absorption of Water and Minerals by Roots
- 36-03 Transport of Xylem Sap
- 36-04 The Control of Transpiration
- 36-05 Translocation of Phloem Sap
- 36-99 Associated problems in Chapter 36

37 Plant Nutrition

- 37-01 Nutritional Requirements of Plants
- 37-02 The Role of Soil in Plant Nutrition
- 37-03 Special Case of Nitrogen as a Plant Nutrient
- 37-04 Nutritional Adaptations: Symbiosis
- 37-05 Nutritional Adaptations: Parasitism, Predation
- $37\mathchar`-99$ Associated problems in Chapter 37

38 Plant Reproduction and Biotechnology

- 38-01 Sexual Reproduction
- 38-02 Asexual Reproduction
- 38-03 Plant Biotechnology
- 38-99 Associated problems in Chapter 38

39 Plant Responses to Signals

- 39-01 Signal Transduction and Plant Responses
- 39-02 Plant Responses to Hormones
- 39-03 Plant Responses to Light
- 39-04 Plant Responses to Other Environmental Stimuli
- 39-05 Plant Defenses: Herbivore, Pathogen Responses
- 39-99 Associated problems in Chapter 39

40 Animal Structure and Function

- 40-01 An Overview to Funtional Anatomy
- 40-02 Body Plans and the External Environment
- 40-03 Regulating the Internal Environment
- 40-04 Introduction to the Bioenergetics of Animals
- 40-99 Associated problems in Chapter 40
- 41 Animal Nutrition
- 41-01 Nutritional Requirements
- 41-02 Food Types and Feeding Mechanisms
- 41-03 Overview of Food Processing
- 41-04 The Mammalian Digestive System
- 41-05 Adaptations of Vertebrate Digestive Systems
- 41-99 Associated problems in Chapter 41

42 Circulation and Gas Exchange

- 42-01 Circulation in Animals
- 42-02 Gas Exchange in Animals
- 42-99 Associated problems in Chapter 42
- 43 The Body's Defenses
- 43-01 Nonspecific Defenses Against Infection
- 43-02 How Specific Immunity Arises
- 43-03 Immune Responses
- 43-04 Immunity in Health and Disease
- 43-99 Associated problems in Chapter 43
- 44 Regulating the Internal Environment
- 44-01 An Overview of Homeostasis
- 44-02 Regulation of Body Temperature
- 44-03 Water Balance and Waste Disposal
- 44-04 Excretory Systems
- 44-99 Associated problems in Chapter 44
- 45 Chemical Signals in Animals
- 45-01 An Introduction to Regulatory Systems

- 45-02 Chemical Signals and Their Modes of Action
- 45-03 The Vertebrate Endocrine System
- 45-99 Associated problems in Chapter 45
- 46 Animal Reproduction
- 46-01 Overview of Animal Reproduction
- 46-02 Mechanisms of Sexual Reproduction
- 46-03 Mammalian Reproduction
- 46-99 Associated problems in Chapter 46
- 47 Animal Development
- 47-01 The Stages of Early Embryonic Development
- 47-02 Cellular, Molecular Basis of Morphogenesis
- 47-99 Associated problems in Chapter 47
- 48 Nervous Systems
- 48-01 An Overview of Nervous Systems
- 48-02 The Nature of Nerve Signals
- 48-03 Evolution and Diversity of Nervous Systems
- 48-04 Vertebrate Nervous Systems
- 48-99 Associated problems in Chapter 48
- 49 Sensory and Motor Mechanisms
- 49-01 Sensing, Acting, and Brains
- 49-02 Introduction to Sensory Reception
- 49-03 Photoreceptors and Vision
- 49-04 Hearing and Equilibrium
- 49-05 Chemoreception Taste and Smell
- 49-06 Movement and Locomotion
- 49-99 Associated problems in Chapter 49
- 50 An Introduction to Ecology and the Biosphere
- 50-01 The Scope of Ecology
- 50-02 Factors Affecting Distribution of Organisms
- 50-03 Aquatic and Terrestrial Biomes
- 50-04 The Spatial Scale of Distributions
- $50\mathchar`-99$ Associated problems in Chapter 50
- 51 Behavioral Biology
- 51-01 Introduction to Behavior, Behavioral Ecology
- 51-02 Learning
- 51-03 Animal Cognition
- 51-04 Social Behavior and Sociobiology
- $51\mathchar`-99$ Associated problems in Chapter 51
- 52 Population Ecology
- 52-01 Characteriatics of Populations
- 52-02 Life Histories
- 52-03 Population Growth

- 52-04 Population-Limiting Factors
- 52-05 Human Population Growth
- 52-99 Associated problems in Chapter 52
- 53 Community Ecology
- 53-01 What Is a Community?
- 53-02 Interactions, Community Structure
- 53-03 Disturbance and Community Structure
- 53-04 Biogeographical Factors Affecting Biodiversity
- 53-99 Associated problems in Chapter 53
- 54 Ecosystems
- 54-01 Ecosystem Approach to Ecology
- 54-02 Primary Production in Ecosystems
- 54-03 Secondary Production in Ecosystems
- 54-04 Chemical Element Cycling in Ecosystems
- 54-05 Human Impact on Ecosystems, Biosphere
- 54-99 Associated problems in Chapter 54
- 55 Conservation Biology
- 55-01 The Biodiversity Crisis
- 55-02 Conservation: Population, Species Levels
- 55-03 Conservation: Community, Ecosystem, Landscape
- 55-99 Associated problems in Chapter 55
- 56 Evolution of Genomes
- 56-01 Comparative Genomics
- 56-02 Evolution of Development
- 56-99 Associated problems in Chapter 56
- 57 Chemistry for Biologists
- 57-01 Atoms and Molecules
- 57-02 Chemical Bonds
- 57-03 Water and Aqueous Solutions
- 57-04 Carbon Compounds
- 57-99 Associated problems in Chapter 57