

Contents

Preface	vii
Exercise 1 Introduction to the Scientific Method	1
Activity 1: Forming Hypotheses to Solve Problems	2
Activity 2: Testing Hypotheses	4
Activity 3: Interpreting Data	6
Activity 4: Performing an Experiment and Collecting Data	8
Activity 5: Graphing Your Results	11
Activity 6: Interpreting Data Using Simple Statistics	16
Exercise 2 Windows to a Microscopic World	25
Activity 1: Learning to Use the Dissecting Microscope	26
Activity 2: Making Observations with the Dissecting Microscope	28
Activity 3: Getting Familiar with the Compound Microscope	30
Activity 4: Parts of the Compound Microscope	33
Activity 5: Learning to Use the Compound Microscope	34
Activity 6: Preparing Temporary Slides—Wet Mounts	37
Activity 7: Using the Microscope to Answer a Question: What Do Aquarium Snails Eat?	40
Exercise 3 Functions and Properties of Cells	47
Activity 1: Cellular Organelles	48
Activity 2: Observing Living Cells	51
Activity 3: Amyloplasts in Potato Tubers	56
Activity 4: Stem Cells	58
Exercise 4 Movement of Molecules Across Cell Membranes	61
Activity 1: Water Molecules in Motion	62
Activity 2: Diffusion and Osmosis	64
Activity 3: Controls for the Diffusion and Osmosis Experiment	67
Activity 4: Completing the Diffusion and Osmosis Experiment	70
Activity 5: Osmosis in Elodea Cells	72
Exercise 5 Investigating Cellular Respiration	77
Activity 1: Do Microorganisms Perform Cellular Respiration?	78
Activity 2: Comparison of Classroom Air with Exhaled Air	80
Activity 3: Effect of Exercise on Carbon Dioxide Production	81
Activity 4: Alternatives to Aerobic Respiration	85
Activity 5: Anaerobic Respiration	86

Exercise 6	Photosynthesis	93
Activity 1: Absorption of Carbon Dioxide During Photosynthesis		94
Activity 2: Testing Leaves for Starch		98
Activity 3: Cells of the Leaf Epidermis		103
Exercise 7	Organic Molecules and Nutrition	107
Activity 1: Positive and Negative Indicator Tests		108
Activity 2: Testing Food Samples		112
Activity 3: An Embryo in a Peanut Seed		114
Activity 4: Dietary Intake and Good Health		116
Exercise 8	Factors That Affect Enzyme Activity	121
Activity 1: Demonstration of Enzyme Activity		122
Activity 2: Enzyme Activity in Food Vacuoles		126
Activity 3: Effect of Environmental Conditions on Protein Structure		130
Exercise 9	Introduction to Molecular Genetics	137
Activity 1: Removing DNA from Cells		138
Activity 2: The Basics of DNA Structure		142
Activity 3: Building a Model of DNA		144
Activity 4: Steps of Protein Synthesis		146
Activity 5: Building a Real Protein		148
Exercise 10	Mitosis and Asexual Reproduction	159
Activity 1: How Mitosis Works		160
Activity 2: Recognizing the Stages of Mitosis		162
Activity 3: Mitosis—The Real Thing!		165
Activity 4: Estimate the Duration of the Cell Cycle		167
Activity 5: Regeneration		170
Activity 6: Asexual Reproduction: Growing a Plant from a Cutting		171
Exercise 11	Connecting Meiosis and Genetics	175
Activity 1: Getting Started: Build a Pair of Chromosomes		177
Activity 2: Homologous Chromosomes Separate in Meiosis to Form Gametes		180
Activity 3: Fertilization: Nature's Equivalent to Rolling the Dice		184
Activity 4: What's Your Baby's Genotype?		185
Activity 5: Genotype Determines Phenotype		186
Activity 6: Passing on Traits		189
Activity 7: Practicing Genetics Problems		190
Exercise 12	Human Genetics	195
Activity 1: PTC Tasting		196
Activity 2: X-Linked Traits		199
Activity 3: Codominance and Sickle-Cell Disease		201
Activity 4: A Family History of Sickle-Cell Disease		203
Activity 5: Codominance and Multiple Alleles		208
Exercise 13	Evolution	213
Activity 1: Determining the Age of Rock Layers and Fossils		214
Activity 2: Reconstructing Fossil Evidence		219
Activity 3: Natural Selection		223

Exercise 14	Functions of Tissues and Organs	229
Activity 1: Skin: The Outer Protective Layer		230
Activity 2: The Epidermis		231
Activity 3: The Dermis		233
Activity 4: Hair Today, Gone Tomorrow		234
Activity 5: Below the Skin (The Hypodermis)		236
Activity 6: Touch Sensitivity		238
Activity 7: Muscle Fatigue		244
Exercise 15	The Cardiovascular System	251
Activity 1: Circulation of Blood Around the Body		252
Activity 2: A Closer Look at the Heart		256
Activity 3: Understanding Blood Pressure and Pulse Rate		259
Activity 4: Cardiovascular Disease		261
Exercise 16	Introduction to Anatomy: Dissecting the Fetal Pig	271
Activity 1: Getting Started		272
Activity 2: Following Anatomical Directions		272
Activity 3: External Anatomy of the Fetal Pig		273
Activity 4: Dissection of the Mouth		276
Activity 5: Dissection of the Neck		279
Activity 6: Dissection of the Thoracic Cavity		283
Activity 7: Measuring Lung Capacity		285
Exercise 17	Organs of the Abdominal Cavity	291
Activity 1: Dissection of the Abdominal Cavity		291
Activity 2: The Urinary System		296
Activity 3: Internal Structure of the Stomach		299
Activity 4: Examining the Small Intestine		302
Activity 5: The Importance of Surface Area		303
Activity 6: A Closer Look at the Inside of the Small Intestine		306
Activity 7: Earthworm Locomotion		308
Exercise 18	Introduction to Forensic Biology	315
Activity 1: Getting Started		316
Activity 2: Classifying Fingerprint Patterns		321
Activity 3: Analyzing Fingerprint Evidence		324
Activity 4: Blood Typing		327
Exercise 19	Biotechnology: DNA Analysis	335
Activity 1: Sources of DNA Evidence		336
Activity 2: Solving a Crime Using RFLP Fingerprints		337
Activity 3: The Use of PCR for STR Analysis		342
Activity 4: Solving a Criminal Case Using STR Evidence		346
Activity 5: Deciding a Paternity Suit Involving STR Analysis		353
Activity 6: DNA Barcodes		355
Exercise 20	Using Biotechnology to Assess Ecosystem Damage	361
Activity 1: Exploring Bioluminescence		362
Activity 2: Getting Started		365
Activity 3: Making Accurate Serial Dilutions		366
Activity 4: Preparing Bacterial Samples		369
Activity 5: Testing the Toxicity of Your Chemical		369

Exercise 21	Ecosystems	377
Activity 1: Food Chains		379
Activity 2: Loss of Energy in Food Chains		381
Activity 3: Food Chains Interact to Form Food Webs		383
Activity 4: Ecosystem Jenga®		386
Exercise 22	Population Ecology	395
Activity 1: Introduction to Sampling—An Ecological Tool		396
Activity 2: Sampling Quadrats to Estimate Population		399
Activity 3: The Mark and Recapture Technique for Estimating Population Size		406
Appendix 1	Game Cards for Exercise 21	415
Appendix 2	Self Test Answers	423
	Photo/Illustration Credits	445