#### CAMPBELL

# essential 6e biology

with physiology

GLOBAL EDITION

Eric J. Simon • Jean L. Dickey • Jane B. Reece

New England College

Clemson, South Carolina

Berkeley, California

with contributions from

Rebecca S. Burton
Alverno College



### **Detailed Contents**

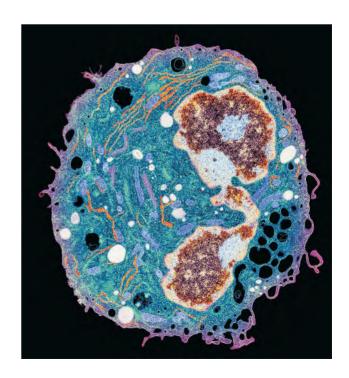
Learning About Life	36
CHAPTER THREAD  Swimming with the Turtles	37
BIOLOGY AND SOCIETY A Passion for Life	37
The Scientific Study of Life An Overview of the Process of Science Hypotheses, Theories, and Facts Controlled Experiments  THE PROCESS OF SCIENCE Do Baby Turtles Swim?	38 38 41 42
Evaluating Scientific Claims	43
The Properties of Life	44
Major Themes in Biology The Relationship of Structure to Function Information Flow Pathways That Transform Energy and Matter Interactions within Biological Systems Evolution  EVOLUTION CONNECTION Turtles in the Tree of Life	45 46 46 47 48 50

22	

Unit 1 Cells	55
Essential Chemistry	
for Biology	56
CHAPTER THREAD	
Helpful Radiation	57
BIOLOGY AND SOCIETY Nuclear Medicine	57
Some Basic Chemistry	58
Matter: Elements and Compounds	58
Atoms	59
THE PROCESS OF SCIENCE How Effective Is Radiation in Treating Prostate Cancer?	60
Chemical Bonding and Molecules	61
Chemical Reactions	62
Water and Life	63
Water Acids, Bases, and pH	63 65
EVOLUTION CONNECTION Radioactivity as an Evolutionary Clock	67
The Molecules of Life	70
CHAPTER THREAD	
Lactose Intolerance	71
BIOLOGY AND SOCIETY Got Lactose?	71
Organic Compounds	72
Carbon Chemistry	72
Giant Molecules from Smaller Building Blocks	73
Large Biological Molecules  Carbohydrates	74 74
Lipids	77
Proteins	80
Nucleic Acids  Does Lactose Intolerance Have	83
THE PROCESS OF SCIENCE a Genetic Basis?	85
EVOLUTION CONNECTION  The Evolution of Lactose Intolerance in Humans	85

A Tour of the Cell	88
CHAPTER THREAD Humans Versus Bacteria	89
BIOLOGY AND SOCIETY  Antibiotics: Drugs That Target Bacterial Cells	89
The Microscopic World of Cells The Two Major Categories of Cells An Overview of Eukaryotic Cells	90 91 92
Membrane Structure The Plasma Membrane Cell Surfaces	94 94 95
THE PROCESS OF SCIENCE How Was the First 21st-Century Antibiotic Discovered?	95
The Nucleus and Ribosomes: Genetic Control of the Cell The Nucleus Ribosomes How DNA Directs Protein Production	96 96 97 97
The Endomembrane System: Manufacturing and Distributing Cellular Products The Endoplasmic Reticulum The Golgi Apparatus Lysosomes Vacuoles	98 98 99 100 101
Chloroplasts and Mitochondria: Providing Cellular Energy Chloroplasts Mitochondria	102 102 102
The Cytoskeleton: Cell Shape and Movement  Maintaining Cell Shape  Flagella and Cilia	103 103 104
EVOLUTION CONNECTION The Evolution of Bacterial Resistance in Humans	105

The Working Cell	108
CHAPTER THREAD Nanotechnology	109
BIOLOGY AND SOCIETY Harnessing Cellular Structures	109
Some Basic Energy Concepts  Conservation of Energy  Heat  Chemical Energy  Food Calories	110 110 111 111 112
ATP and Cellular Work The Structure of ATP Phosphate Transfer The ATP Cycle	113 113 113 114
Enzymes Activation Energy	114 114
THE PROCESS OF SCIENCE Can Enzymes Be Engineered? Enzyme Activity Enzyme Inhibitors	115 116 116
Membrane Function Passive Transport: Diffusion across Membranes Osmosis and Water Balance Active Transport: The Pumping of Molecules across Membranes Exocytosis and Endocytosis: Traffic of Large Molecules  EVOLUTION CONNECTION The Origin of Membranes	117 117 118 120 120



Cellular Respiration: Obtaining Energy from Food	124
CHAPTER THREAD Exercise Science	125
BIOLOGY AND SOCIETY Getting the Most Out of Your Muscles	125
Energy Flow and Chemical Cycling in the Biosphere Producers and Consumers Chemical Cycling between Photosynthesis and Cellular Respiration	126 126 126
Cellular Respiration: Aerobic Harvest of Food Energy An Overview of Cellular Respiration The Three Stages of Cellular Respiration The Results of Cellular Respiration	128 128 130 134
Fermentation: Anaerobic Harvest of Food Energy Fermentation in Human Muscle Cells	135 135
THE PROCESS OF SCIENCE What Causes Muscle Burn? Fermentation in Microorganisms	136 136
EVOLUTION CONNECTION The Importance of Oxygen	137

Photosynthesis: Using Light	
to Make Food	140
CHAPTER THREAD  Solar Energy	141
BIOLOGY AND SOCIETY A Solar Revolution	141
The Basics of Photosynthesis	142
Chloroplasts: Sites of Photosynthesis	142
An Overview of Photosynthesis	143
The Light Reactions: Converting Solar Energy	
to Chemical Energy	144
The Nature of Sunlight	144
THE PROCESS OF SCIENCE What Colors of Light Drive Photosynthesis?	145
Chloroplast Pigments	145
How Photosystems Harvest Light Energy	146
How the Light Reactions Generate ATP and NADPH	147
The Calvin Cycle: Making Sugar from Carbon Dioxide	149
EVOLUTION CONNECTION Creating a Better Biofuel Factory	149





Unit 2 Genetics	153
Cellular Reproduction: Cells from Cells CHAPTER THREAD Life with and without Sex	<b>154</b>
BIOLOGY AND SOCIETY Virgin Birth of a Shark	155
What Cell Reproduction Accomplishes	156
The Cell Cycle and Mitosis  Eukaryotic Chromosomes  Duplicating Chromosomes  The Cell Cycle  Mitosis and Cytokinesis  Cancer Cells: Dividing Out of Control	157 157 159 159 160 162
Meiosis, the Basis of Sexual Reproduction Homologous Chromosomes Gametes and the Life Cycle of a Sexual Organism The Process of Meiosis Review: Comparing Mitosis and Meiosis The Origins of Genetic Variation	164 164 165 166 168 169
THE PROCESS OF SCIENCE Do All Animals Have Sex?	171
When Meiosis Goes Wrong  EVOLUTION CONNECTION The Advantages of Sex	172 174
The Advantages of Sex	174

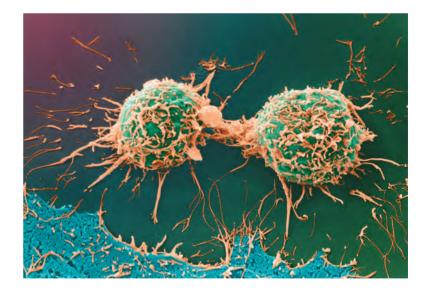
Patterns of Inheritance	178
CHAPTER THREAD  Dog Breeding	179
BIOLOGY AND SOCIETY Darwin's Dogs	179
Genetics and Heredity In an Abbey Garden Mendel's Law of Segregation Mendel's Law of Independent Assortment Using a Testcross to Determine an Unknown Genotype The Rules of Probability Family Pedigrees Human Traits Controlled by a Single Gene	180 180 181 184 186 186 187
THE PROCESS OF SCIENCE What Is the Genetic Basis of Short Legs in Dogs?	190
Variations on Mendel's Laws Incomplete Dominance in Plants and People ABO Blood Groups: An Example of Multiple Alleles and Codominance Pleiotropy and Sickle-Cell Disease Polygenic Inheritance Epigenetics and the Role of Environment	192 192 193 194 194 195
The Chromosomal Basis of Inheritance Linked Genes Sex Determination in Humans Sex-Linked Genes  EVOLUTION CONNECTION Barking Up the Evolutionary Tree	196 196 197 197



The Structure and Function of DNA  CHAPTER THREAD Deadly Viruses	204
BIOLOGY AND SOCIETY The Global Threat of Zika Virus	205
DNA: Structure and Replication  DNA and RNA Structure  Watson and Crick's Discovery of the Double Helix  DNA Replication	206 206 207 209
From DNA to RNA to Protein  How an Organism's Genotype Determines Its Phenotype From Nucleotides to Amino Acids: An Overview The Genetic Code Transcription: From DNA to RNA The Processing of Eukaryotic RNA Translation: The Players Translation: The Process Review: DNA → RNA → Protein Mutations	210 210 211 212 213 214 214 216 217 218
Viruses and Other Noncellular Infectious Agents Bacteriophages Plant Viruses Animal Viruses	220 220 222 222
THE PROCESS OF SCIENCE Can DNA and RNA Vaccines Protect Against Viruses?	224
HIV, the AIDS Virus Prions	224 226
EVOLUTION CONNECTION Emerging Viruses	226

7	

11	How Genes Are Controlled	230
	CHAPTER THREAD  Cancer	231
BIOLOGY A	ND SOCIETY Breast Cancer and Chemotherapy	231
How and	Why Genes Are Regulated	232
Gene Regu	ulation in Bacteria	232
Gene Regu	ulation in Eukaryotic Cells	234
Cell Signal	ing	237
Homeotic	Genes	238
Visualizing	g Gene Expression	238
Cloning P	lants and Animals	239
The Genet	tic Potential of Cells	239
Reproduct	tive Cloning of Animals	240
Therapeut	ic Cloning and Stem Cells	242
The Gene	tic Basis of Cancer	243
Genes Tha	at Cause Cancer	243
THE PROCE	SS OF SCIENCE Can Avatars Improve Cancer Treatment?	244
Cancer Ris	k and Prevention	246
EVOLUTION	CONNECTION The Evolution of Cancer in the Body	247



1	DNA Technology	250
	CHAPTER THREAD  DNA Profiling	251

BIOLOGY AND SOCIETY Using DNA to Establish Guilt and Innocend	e 251
Genetic Engineering Recombinant DNA Techniques Gene Editing Medical Applications Genetically Modified Organisms in Agriculture Human Gene Therapy	252 252 254 255 256 258
DNA Profiling and Forensic Science  DNA Profiling Techniques Investigating Murder, Paternity, and Ancient DNA	259 259 262
Bioinformatics  DNA Sequencing Genomics Genome-Mapping Techniques The Human Genome	263 263 264 265 265
THE PROCESS OF SCIENCE Did Nic Have a Deadly Gene?  Applied Genomics Systems Biology	267 267 268
Safety and Ethical Issues The Controversy over Genetically Modified Foods Ethical Questions Raised by Human DNA Technologies	269 269 270
The Y Chromosome as a Window on History	271



# Unit 3 Evolution and Diversity 275

How Populations Evolve	276
CHAPTER THREAD Evolution in Action	277
BIOLOGY AND SOCIETY Mosquitoes and Evolution	277
The Diversity of Life  Naming and Classifying the Diversity of Life  Explaining the Diversity of Life	278 278 279
Charles Darwin and The Origin of Species Darwin's Journey Darwin's Theory	280 280 282
Evidence of Evolution Evidence from Fossils Evidence from Homologies Evolutionary Trees	282 282 284 285
Natural Selection as the Mechanism for Evolution Natural Selection in Action Key Points about Natural Selection	286 287 288
The Evolution of Populations Sources of Genetic Variation Populations as the Units of Evolution Analyzing Gene Pools Population Genetics and Health Science Microevolution as Change in a Gene Pool	288 288 289 290 29
Mechanisms of Evolution  Natural Selection Genetic Drift Gene Flow Natural Selection: A Closer Look	292 292 292 294 295
THE PROCESS OF SCIENCE Did Natural Selection Shape the Beaks of Darwin's Finches?	296

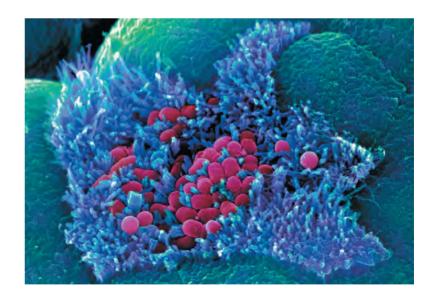


299

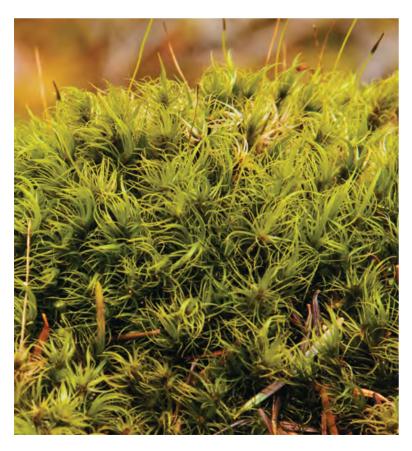
1/1	How Biological Diversity Evolves	302
14	CHAPTER THREAD  Evolution in the  Human-Dominated World	303
BIOLOGY AND SOCIE	TY Humanity's Footprint	303
The Origin of Spe What Is a Species? Reproductive Barrie Mechanisms of Spec	rs between Species	304 305 306 308
THE PROCESS OF SCI	Do Human Activities Facilitate Speciation?	310
Earth History and The Fossil Record Plate Tectonics and I Mass Extinctions and		313 313 315 317
Mechanisms of M Large Effects from S The Evolution of Bio	mall Genetic Changes	317 317 318
Classifying the Div Classification and Ph Classification: A Wor	nylogeny rk in Progress	320 320 322
EVOLUTION CONNEC	TION Evolution in the Anthropocene	323

Classification and Phylogeny Classification: A Work in Progress	320 322
EVOLUTION CONNECTION Evolution in the Anthropocene	323
	_

The Evolution of Microbial Life	326
CHAPTER THREAD  Human Microbiota	327
BIOLOGY AND SOCIETY Our Invisible Inhabitants	327
Major Episodes in the History of Life	328
The Origin of Life A Four-Stage Hypothesis for the Origin of Life From Chemical Evolution to Darwinian Evolution	330 330 332
Prokaryotes They're Everywhere! The Structure and Function of Prokaryotes The Ecological Impact of Prokaryotes The Two Main Branches of Prokaryotic Evolution: Bacteria and Archaea	333 333 334 337 338
THE PROCESS OF SCIENCE Are Intestinal Microbiota to Blame for Obesity?	340
Protists Protozoans Slime Molds Unicellular and Colonial Algae Seaweeds	341 342 343 344 344
<b>EVOLUTION CONNECTION</b> The Sweet Life of Streptococcus mutans	345



The Evolution of Plants and Fungi	348
CHAPTER THREAD  Plant-Fungus Interactions	349
BIOLOGY AND SOCIETY The Diamond of the Kitchen	349
Colonizing Land Terrestrial Adaptations of Plants The Origin of Plants from Green Algae	350 350 352
Plant Diversity Highlights of Plant Evolution Bryophytes Ferns Gymnosperms Angiosperms Plant Diversity as a Nonrenewable Resource	352 352 353 355 356 358 361
Fungi Characteristics of Fungi	362 363
THE PROCESS OF SCIENCE What Killed the Pines? The Ecological Impact of Fungi Commercial Uses of Fungi	364 365 365
EVOLUTION CONNECTION A Pioneering Partnership	366



The Evolution of Animals  CHAPTER THREAD  Human Evolution	370 <sub>371</sub>
PIOLOGY AND SOCIETY. For bing Alberta bility	271
The Origins of Animal Diversity What Is an Animal? Early Animals and the Cambrian Explosion Animal Phylogeny	371 372 372 373 374
Major Invertebrate Phyla Sponges Cnidarians Molluscs Flatworms Annelids Roundworms Arthropods Echinoderms	375 375 376 377 378 379 380 381 387
Vertebrate Evolution and Diversity Characteristics of Chordates Fishes Amphibians Reptiles Mammals	388 388 390 391 392 394
The Human Ancestry The Evolution of Primates The Emergence of Humankind	395 395 397
THE PROCESS OF SCIENCE What Can Lice Tell Us About Ancient Humans?	400
EVOLUTION CONNECTION Are We Still Evolving?	401



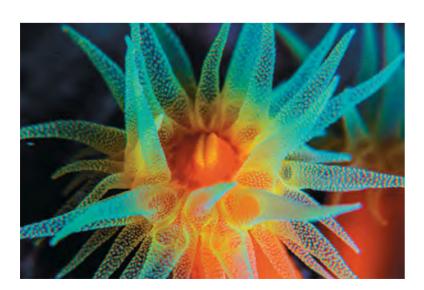
Unit 4 Ecology	405
An Introduction to Ecology and the Biosphere	<b>/</b> 406
CHAPTER THREAD Climate Change	407
BIOLOGY AND SOCIETY Penguins, Polar Bears, and People in Per	<b>il</b> 407
An Overview of Ecology  Ecology and Environmentalism  A Hierarchy of Interactions	408 408 409
Living in Earth's Diverse Environments Abiotic Factors of the Biosphere The Evolutionary Adaptations of Organisms Adjusting to Environmental Variability	410 410 412 412
Biomes Freshwater Biomes Marine Biomes How Climate Affects Terrestrial Biome Distribution Terrestrial Biomes The Water Cycle Human Impact on Biomes	414 416 418 419 425 426
Climate Change The Greenhouse Effect and Global Warming The Accumulation of Greenhouse Gases Effects of Climate Change on Ecosystems	428 428 429 430
THE PROCESS OF SCIENCE How Does Climate Change Affect Species Distribution?	431
Looking to Our Future	432
EVOLUTION CONNECTION  Climate Change as an Agent of Natural Selection	433



Population Ecology	436
CHAPTER THREAD Biological Invasions	437
BIOLOGY AND SOCIETY Invasion of the Lionfish	437
An Overview of Population Ecology Population Density Population Age Structure Life Tables and Survivorship Curves Life History Traits as Adaptations	438 439 439 440 440
Population Growth Models  The Exponential Population Growth Model: The Ideal of an Unlimited Environment  The Logistic Population Growth Model: The Reality of a Limited Environment  Regulation of Population Growth	442 442 443 444
Applications of Population Ecology Conservation of Endangered Species Sustainable Resource Management Invasive Species Biological Control of Pests	446 446 446 447 448
THE PROCESS OF SCIENCE Can Fences Stop Cane Toads? Integrated Pest Management	449 450
Human Population Growth The History of Human Population Growth Age Structures Our Ecological Footprint  EVOLUTION CONNECTION Humans as an Invasive Species	451 451 452 453 455
- voluntary contribute frumans as an invasive Species	455



	Communities	450
	and Ecosystems	458
	CHAPTER THREAD  Importance of Biodiversity	459
BIOLOGY AND SOCIETY	Why Biodiversity Matters	459
Biodiversity Genetic Diversity Species Diversity Ecosystem Diversity Causes of Declining Bio	diversity	460 460 460 461 461
Community Ecology Interspecific Interaction Trophic Structure Species Diversity in Col Disturbances and Succe Ecological Succession	ns mmunities	462 462 466 469 470 470
Ecosystem Ecology Energy Flow in Ecosyste Chemical Cycling in Eco		471 472 474
Conservation and Ro Biodiversity "Hot Spots Conservation at the Eco	"	478 478 479
THE PROCESS OF SCIENCE	Does Biodiversity Protect Human Health?	480
Restoring Ecosystems The Goal of Sustainable	e Development	481 482
EVOLUTION CONNECTION	ON Saving the Hot Spots	483



## Unit 5 Animal Structure and Function 487

Unifying Concepts of Anima Structure and Function	<b>l</b> 488
5tractare and ranction	100
CHAPTER THREAD  Controlling Body Temperature	489
BIOLOGY AND SOCIETY An Avoidable Tragedy	489
The Structural Organization of Animals	490
Anatomy and Physiology	491
Tissues	491
Organs and Organ Systems	495
Exchanges with the External Environment	498
Regulating the Internal Environment	499
Homeostasis	499
Negative and Positive Feedback	500
Thermoregulation	501
THE PROCESS OF SCIENCE How Does a Python Warm Her Eggs?	502
Osmoregulation	502
Homeostasis in the Urinary System	503
EVOLUTION CONNECTION Adaptations for Thermoregulation	505



	Nutrition and Digestion	508
77	CHAPTER THREAD  Controlling Your Weight	509

BIOLOGY AND SOCIETY The "Secret" to Shedding Pounds	509
An Overview of Animal Nutrition Animal Diets The Four Stages of Food Processing Digestive Compartments	510 510 510 512
A Tour of the Human Digestive System  System Map The Mouth The Pharynx The Esophagus The Stomach The Small Intestine The Human Microbiome The Large Intestine	513 513 514 514 514 516 517
Human Nutritional Requirements Food as Fuel Food as Building Material Decoding Food Labels	519 519 519 522
Nutritional Disorders  Malnutrition Eating Disorders Obesity	523 523 523 524
THE PROCESS OF SCIENCE Can a Gene Make You Fat?	524
EVOLUTION CONNECTION Fat and Sugar Cravings	525

Circulation and Respiration	528
CHAPTER THREAD Athletic Endurance	529
BIOLOGY AND SOCIETY Avoiding "The Wall"	529
Unifying Concepts of Animal Circulation	530
The Human Cardiovascular System The Path of Blood How the Heart Works Blood Vessels Blood	532 532 533 534 537
THE PROCESS OF SCIENCE Live High, Train Low?  Cardiovascular Disease	538 540
Unifying Concepts of Animal Respiration	541
The Human Respiratory System The Path of Air The Brain's Control over Breathing The Role of Hemoglobin in Gas Transport The Toll of Smoking on the Lungs	543 544 545 546 547
EVOLUTION CONNECTION Evolving Endurance	547



The Body's Defenses	550
CHAPTER THREAD  Vaccines	551
BIOLOGY AND SOCIETY Herd Immunity	551
An Overview of the Immune System	552
Innate Immunity External Innate Defenses Internal Innate Defenses	553 553 553
The Lymphatic System Circulatory Function Immune Function	554 555 555
Adaptive Immunity Step 1: Recognizing the Invaders Step 2: Cloning the Responders Step 3: Responding to Invaders Step 4: Remembering Invaders	556 556 557 558 560
THE PROCESS OF SCIENCE How Do We Know Vaccines Work?	561
Immune Disorders Allergies Autoimmune Diseases Immunodeficiency Diseases AIDS	561 563 563 563



EVOLUTION CONNECTION Viral Evolution versus the Flu Vaccine

#### Hormones 568 CHAPTER THREAD Steroid Abuse 569 BIOLOGY AND SOCIETY Baseball's Ongoing Steroid Problem 569 Hormones: An Overview 570 The Human Endocrine System 572 The Hypothalamus and Pituitary Gland 573 The Thyroid and Metabolism 574 The Pancreas and Blood Glucose 575 The Adrenal Glands and Stress 577 The Gonads and Sex Hormones 579 Mimicking Sex Hormones 579 THE PROCESS OF SCIENCE Do 'Roids Cause Rage? 580 EVOLUTION CONNECTION Steroids and Male Aggression 581



CHAPTER THREAD   High-Tech Babies   585		Reproduction nd Development	584
Unifying Concepts of Animal Reproduction  Asexual Reproduction  Sexual Reproduction  Sexual Reproduction  Human Reproductive Onation  Male Reproductive Anatomy  Female Reproductive Anatomy  Gametogenesis  The Female Reproductive Cycle  Reproductive Health  Contraception  Sexually Transmitted Infections  594  Human Development  Fertilization by Sperm  Basic Concepts of Embryonic Development  Ferganncy and Early Development  The Stages of Pregnancy Childbirth  Reproductive Technologies  Infertility In Vitro Fertilization  Are Babies Conceived through In Vitro Fertilization as Healthy as Babies Conceived Naturally?  603			585
Asexual Reproduction Sexual Reproduction Sexual Reproduction Sexual Reproduction Sexual Reproduction Sexual Reproductive Anatomy Sexual Reproductive Healtmy Sexual Reproductive Healthy Sexual Reprod	BIOLOGY AND SOCIETY N	ew Ways of Making Babies	585
Male Reproductive Anatomy Female Reproductive Anatomy Gametogenesis The Female Reproductive Cycle  Reproductive Health Contraception Sexually Transmitted Infections  Human Development Fertilization by Sperm Basic Concepts of Embryonic Development Fregnancy and Early Development The Stages of Pregnancy Childbirth  Are Babies Conceived through In Vitro Fertilization as Healthy as Babies Conceived Naturally?  589 589 589 589 589 589 589 589 589 58	Asexual Reproduction	nimal Reproduction	586
Contraception 593 Sexually Transmitted Infections 594  Human Development 596 Fertilization by Sperm 596 Basic Concepts of Embryonic Development 597 Pregnancy and Early Development 598 The Stages of Pregnancy 600 Childbirth 602  Reproductive Technologies 602 Infertility 602 In Vitro Fertilization 603  Are Babies Conceived through In Vitro Fertilization as Healthy as Babies Conceived Naturally? 603	Male Reproductive Anatom Female Reproductive Anatom Gametogenesis	рту	588 589 590
Fertilization by Sperm 596 Basic Concepts of Embryonic Development 597 Pregnancy and Early Development 598 The Stages of Pregnancy 600 Childbirth 602  Reproductive Technologies 602 Infertility 602 In Vitro Fertilization 603  Are Babies Conceived through In Vitro Fertilization as Healthy as Babies Conceived Naturally? 603	Contraception	ions	593
Infertility 602 In Vitro Fertilization 603 Are Babies Conceived through In Vitro Fertilization as Healthy as Babies Conceived Naturally? 603	Fertilization by Sperm Basic Concepts of Embryor Pregnancy and Early Develo The Stages of Pregnancy		596 597 598 600
The Ethics of IVF 604	Infertility In Vitro Fertilization	Are Babies Conceived through In Vitro Fertilization as Healthy as Babies	602
	The Ethics of IVF		604

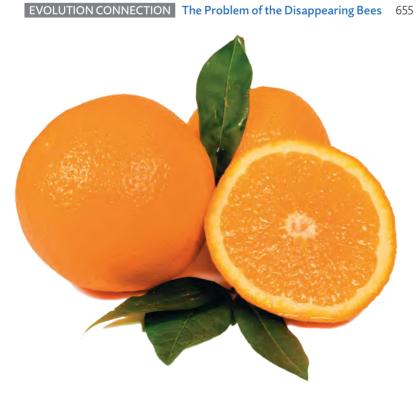
Nervous, Ser	_
and Locomot	<b>or Systems</b> 608
CHAPTER THREAD Neurotoxins	609
BIOLOGY AND SOCIETY Medicinal Poisons	609
An Overview of Animal Nervous System Neurons Organization of Nervous Systems Sending a Signal through a Neuron Passing a Signal from a Neuron to a Receiving 6	610 610 61
The Human Nervous System: A Closer The Central Nervous System The Peripheral Nervous System The Human Brain	<b>Look</b> 615 616 616
The Senses Sensory Input Vision Hearing	62' 62' 626 626
Locomotor Systems The Skeletal System The Muscular System	627 627 629
THE PROCESS OF SCIENCE Can Botulism Toxi Headaches?	n Prevent 632
Stimulus and Response: Putting It All Together	633
EVOLUTION CONNECTION A Neurotoxin Arm	ns Race 633





Unit 6	Plant Structure	
	and Function	637

The Life of a Flowering Plant	638
CHAPTER THREAD Agriculture	639
BIOLOGY AND SOCIETY The Buzz on Coffee Plants	639
The Structure and Function of a Flowering Plant Monocots and Eudicots Roots, Stems, and Leaves Plant Tissues and Tissue Systems Plant Cells	640 640 641 644 645
Plant Growth Primary Growth: Lengthening Secondary Growth: Thickening	
THE PROCESS OF SCIENCE What Happened to the Lost Colony of Roanoke?	650
The Life Cycle of a Flowering Plant The Flower Overview of the Flowering Plant Life Cycle Pollination and Fertilization Seed Formation Fruit Formation Seed Germination	651 651 652 652 653 654 654



The Working Plant	658
CHAPTER THREAD The Interdependence of Organisms	659
BIOLOGY AND SOCIETY Planting Hope in the Wake of Disaster	659
How Plants Acquire and Transport Nutrients Plant Nutrition From the Soil into the Roots The Role of Bacteria in Nitrogen Nutrition The Transport of Water The Transport of Sugars	660 662 662 663 664
THE PROCESS OF SCIENCE  Can the Pressure Flow Mechanism Be Directly Measured?	666
Economic Uses of Plant Transport Products	667
Plant Hormones Auxins Cytokinins Ethylene Gibberellins Abscisic Acid	667 668 668 669 669
Response to Stimuli Tropisms Photoperiodism  EVOLUTION CONNECTION Plants, Bugs, and People	670 670 671 672
Appendices	
A Metric Conversion Table B The Periodic Table C Credits D Selected Answers	A-1 A-3 A-5 A-13
Glossary	G-1
Index	I <b>-</b> 1

