



EXPLORING CREATION WITH

# BIOLOGY

3rd EDITION

## COURSE INTRODUCTION

Course Introduction (00:53)

## MODULE 1: THE SCIENCE OF LIFE

Introduction (01:52)

The Process of Science (01:41)

What Scientists Do (13:17)

Observations and Inferences

Hypotheses

Experiments

Scientific Theories and Laws

Scientific Method in Action (04:35)

The Limitations of Science (16:12)

Spontaneous Generation

Redi's Experiments Refute Spontaneous Generation

Discovering Microorganisms

Pasteur's Experiment

Why Study Science?

Spontaneous Generation: Some Still Cling to It!

The Study of Life (01:04)

Cells and Life (01:20)

Growth and Development (01:25)

Metabolism and Energy (08:12)

Homeostasis (01:41)

Sensing and Responding to Stimuli (01:45)

DNA and Reproduction (04:45)

Tools of Biology (01:07)

A Common Measurement System (01:53)

Tables and Graphs (01:46)

Microscopes (20:37)

Light Microscopes

Electron Microscopes

Experiment 1.1: Introduction to the Microscope

Safety in Biology (00:45)

## MODULE 2: THE CHEMISTRY OF LIFE

Introduction (01:25)  
The Composition of Matter (00:31)  
Atoms: the Basic Building Blocks of Matter (06:32)  
Atomic Structure  
Elements (03:02)  
Isotopes (03:05)  
Radioactive Isotopes  
Molecules and Compounds (07:01)  
Chemical Formulas  
Chemical Bonds (07:36)  
Ionic Bonds  
Covalent Bonds  
The Properties of Water (11:53)  
Experiment 2.1: Investigating Water's Properties  
The Structure of Water (03:18)  
Life-Supporting Properties of Water (11:10)  
The Universal Solvent  
Cohesion, Surface Tension, and Adhesion  
High Heat Capacity  
Density of Ice  
Carbon Compounds (34:05)  
Carbohydrates  
Functional Groups and Organic Acids and Bases  
Experiment 2.2: How Effective is Your Antacid?  
Lipids (04:34)  
Proteins and Enzymes (29:35)  
Protein Structure  
Enzymes  
Experiment 2.3: the Fragility of an Enzyme  
Nucleic Acids

## MODULE 3: THE FIRST FOUR KINGDOMS

Introduction (05:00)  
Energy and Life (00:39)  
Producers, Consumers, and Decomposers (03:44)  
Food Chains, Food Webs, and Trophic Levels (03:35)  
Energy Moves Through Trophic Levels (09:56)  
Ecological Pyramids  
Energy Pyramids  
Biomass Pyramids  
Pyramids of Numbers  
The Biosphere (02:24)  
The Water Cycle (04:30)

The Carbon Cycle (21:32)

Experiment 3.1: Carbon Dioxide and the Greenhouse Effect

Global Climate

The Oxygen Cycle (03:52)

The Nitrogen Cycle (05:07)

The Phosphorus Cycle (01:15)

Ecosystems and Biomes (03:29)

Factors that Affect Ecosystems (04:01)

Biotic and Abiotic Factors

Climate

Major Biomes (11:33)

Terrestrial Biomes

Aquatic Biomes

Marine Biomes—the Ocean Biome

Marine Biomes—Coral Reefs

Marine Biomes—Estuaries

Standing Freshwater Biomes—Lakes and Ponds

Running Freshwater Biomes—Rivers and Streams

Freshwater Biomes—Wetlands

Populations and Communities (00:32)

Community Interactions—Competition (07:51)

Intraspecific Competition

Interspecific Competition

Community Interactions—Predation (03:28)

Community Interactions—Symbiosis (02:22)

Community Disturbances (04:56)

Primary Succession

Secondary Succession

Characteristics of Populations (16:48)

Population Growth

Exponential Growth

Logistic Growth

Limits to Growth

Experiment 3.2: How Does Competition Affect Plant Growth?

## MODULE 4: CELL STRUCTURE AND FUNCTION

Introduction (02:17)

History of Cell Theory (03:03)

The Cell Theory (01:30)

Characteristics of Cells (04:24)

Cell Structure (03:01)

Structures That All Cells Have in Common (03:32)

The Plasma Membrane

The Cytoplasm

Ribosomes

Organelles of Eukaryotic Cells (47:41)  
Cell Wall  
The Nucleus  
The Endoplasmic Reticulum  
The Golgi Apparatus  
Vacuoles and Vesicles  
The Lysosome  
The Peroxisome  
The Mitochondrion  
The Plastids  
The Cytoskeleton  
Centrioles  
Experiment 4.1: Plant and Animal Cell Structure

A Closer Look at Membranes (07:54)  
Movement Through Membranes (21:16)  
Passive Transport: Diffusion  
Passive Transport: Osmosis  
Experiment 4.2: Osmosis in Animal Cells  
Osmosis in Living Cells (22:07)  
Experiment 4.3: Plasmolysis in Plant Cells  
Passive Transport: Facilitated Diffusion  
Active Transport

## MODULE 5: CELLULAR ENERGY

Introduction (03:08)  
ATP: the Energy Currency of Cells (04:53)  
Photosynthesis: Making Energy-Packed Food (18:05)  
Experiment 5.1: Pigments of Photosynthesis Paper Chromatography  
The Light Reactions (06:25)  
The Calvin Cycle (07:42)  
Cellular Respiration: Making ATP (04:43)  
Mitochondrial Design (01:03)  
The Stages of Cellular Respiration (30:42)  
Stage 1: Glycolysis  
Stage 2: The Link Reaction  
Stage 3: The Krebs Cycle  
Stage 4: The Electron Transport Chain  
Fermentation  
Experiment 5.2: Cellular Respiration and Fermentation in Yeast

## MODULE 6: DNA, PROTEINS, AND THE CELL CYCLE

Introduction (06:49)  
DNA, Genes, and Chromosomes (01:21)  
A Brief History of the Discovery of DNA (02:43)

Genes and Chromosomes (12:25)  
Experiment 6.1: DNA Extraction  
DNA Replication (04:46)  
Protein Synthesis (03:09)  
Protein Synthesis Part 1: Transcription—DNA to RNA (06:47)  
Editing RNA  
Protein Synthesis Part 2: Translation—RNA to Protein (12:15)  
Adding Amino Acids  
Summarizing Protein Synthesis  
Cell Cycle and Cellular Reproduction (04:27)  
Mitosis (15:17)  
Prophase  
Metaphase  
Anaphase  
Telophase and Cytokinesis  
Experiment 6.2: Mitosis  
Meiosis (18:59)  
Counting Chromosomes  
The Process of Meiosis  
Meiosis I: Prophase I  
Meiosis I: Metaphase I  
Anaphase I  
Telophase I and Cytokinesis  
Prophase II  
Metaphase II  
Anaphase II  
Telophase II and Cytokinesis

## MODULE 7: GENETICS

Introduction (10:34)  
Experiment 7.1: Environmental Factors and their Effect on Radish Leaf Color  
Mendelian Genetics (03:00)  
Mendel's Experiments (11:12)  
Modern Terminology (08:47)  
Inheritance and Meiosis  
Punnett Squares (07:09)  
Testcross (02:47)  
Pedigrees (12:52)  
Experiment 7.2: Making Your Own Pedigree  
More Complex Crosses (16:24)  
Meiosis and Dihybrid Crosses  
Inheritance Patterns (00:21)  
Sex-Linked Genetic Traits (09:32)  
Non-Mendelian Inheritance Patterns (14:45)  
Human Genetics (00:44)

- Autosomal Disorders (03:22)
- Sex-Linked Disorders (01:23)
- Disorders Caused by Damaged Genes (06:28)
- Disorders Caused by Damaged Chromosomes (02:09)
- Disorders Due to Change in Chromosome Number (02:27)
- Gene Technologies (02:38)
- Restriction Enzymes (02:14)
- Gel Electrophoresis and DNA Profiling (03:05)
- Polymerase Chain Reaction (01:21)
- Genetic Engineering and Recombinant DNA (07:01)
- Summing Up (00:35)

## MODULE 8: EVOLUTION

- Introduction (04:07)
- Charles Darwin (05:48)
- Darwin's Theory (10:25)
- Microevolution and Macroevolution (18:49)
- A Closer Look at Macroevolution
- Macroevolution Today
- The Geological Column and the Fossil Record (09:42)
- A Detailed Look at the Fossil Record Evidence (10:51)
- The Cambrian Explosion (04:55)
- Punctuated Equilibrium and Gradualism (04:01)
- Structural Homology (03:55)
- Molecular Biology (10:10)
- Why Do So Many Scientists Believe in Macroevolution? (03:51)

## MODULE 9: PROKARYOTES AND VIRUSES

- Introduction (02:15)
- Biological Classification (06:50)
- Five Kingdoms or Six Kingdoms? (06:25)
- Overview of Three Domains and Four Kingdoms (04:34)
- Classifying Phylum, Class, Order, Family, Genus, and Species using
- Biological Keys (11:37)
- Experiment 9.1: Using a Biological Key
- Archaea and Bacteria (01:10)
- Archaea (01:35)
- Bacteria (45:13)
- Bacterial Cell Structure (a review)
- Identifying Bacteria
- Shape
- Cell Wall Structure
- Movement
- Getting and Releasing Energy

Autotrophs  
Heterotrophs  
Cellular Respiration  
Conditions for Bacterial Growth  
Reproduction  
Genetic Variation in Bacteria  
Conjugation  
Transformation  
Transduction  
Bacteria in Nature  
Chemical Recyclers and Bioremediation  
Bacteria and Humans  
Bacteria and Disease  
Experiment 9.2: Bacterial Fermentation—Making Yogurt  
Viruses (01:53)  
Viral Structure (02:32)  
How Viruses Infect (05:29)  
The Lytic Cycle  
The Lysogenic Cycle  
Defenses Against Viruses (05:45)

## MODULE 10: PROTISTS AND FUNGI

Introduction (01:26)  
Introduction to Protists (08:10)  
Experiment 10.1: Pond Life—Part A  
General Characteristics of Protists (01:01)  
Classifying Protists (01:05)  
Animal-Like Protists—The Protozoans (14:50)  
Protozoans with Pseudopodia—Sarcodines  
Protozoans with Flagella—Zooflagellates  
Protozoans with Cilia—Ciliates  
Other Ciliates  
Nonmotile Protozoans—Sporozoans  
Fungus-Like Protists (04:55)  
Slime Molds  
Cellular Slime Molds  
Acellular Slime Molds  
Water Molds and Mildews  
Plant-Like Protists—Euglena and Algae (18:50)  
Euglena  
Flame-Colored Algae—Dinoflagellates  
Golden Algae—Diatoms  
Green Algae  
Other Members of Chrysophyta  
Red Algae

Brown Algae  
Experiment 10.2: Protozoans, Algae, and Pond Life—Part B  
Introduction to Fungi (01:25)  
General Characteristics of Fungi (01:41)  
Structure and Function (03:21)  
Reproduction in Fungi (02:37)  
How Fungi Spread (01:36)  
Classifying Fungi (01:51)  
The Common Molds—Zygote Fungi (18:30)  
Structure and Function of Zygote Fungi  
Life Cycle of Zygote Fungi  
Experiment 10.3: Molds  
Sac Fungi (23:06)  
Yeast  
Experiment 10.4: Yeast  
Other Sac Fungi  
Club Fungi (17:39)  
The Life Cycle of Club Fungi  
Diversity of Club Fungi  
Experiment 10.5: Club Fungi  
Chytrids (00:54)  
Imperfect Fungi (01:58)  
How Fungi Impact Life (00:29)  
Decomposers (00:44)  
Symbiotic Relationships (02:41)  
Pathogens (02:12)  
Summing Up (01:02)

## MODULE 11: PLANT DIVERSITY AND REPRODUCTION

Introduction (00:58)  
Introduction to Plants (03:05)  
Classifying Plants (01:43)  
Nonvascular Plants—Bryophytes (09:13)  
Designed to Live in Air  
Diversity of Bryophytes  
Reproductive Life Cycle of Bryophytes  
Uses of Mosses  
Seedless Vascular Plants—Pteridophytes (06:00)  
Designed for Height  
Diversity of Pteridophytes  
Reproductive Life Cycle of Ferns  
Seed Plants (12:19)  
Designed for Dry Land  
Cones



Pollen  
Seeds  
Reproductive Life Cycle of Gymnosperms  
Diversity of Gymnosperms  
Diversity of Angiosperms  
Monocots and Dicots  
Woody and Herbaceous Plants  
Annuals, Biennials, and Perennials  
A Closer Look at the Angiosperm Life Cycle (00:32)  
The Parts of a Flower (19:40)  
Experiment 11.1: Flower Anatomy  
Reproduction in Angiosperms—Part 1: Pollen and Embryo Sacs (01:53)  
Pollen Grain Formation  
Egg Cell Formation (02:20)  
Reproduction in Angiosperms—Part 2: Pollination (06:00)  
Reproduction in Angiosperms—Part 3: Fertilization (02:49)  
Seeds and Fruits (27:37)  
Experiment 11.2: Fruit Classification  
Germination and Early Growth (04:33)  
Vegetative Reproduction (08:38)

## MODULE 12: PLANT STRUCTURE AND FUNCTION

Introduction (01:21)  
Introduction to Plant Anatomy and Physiology (00:55)  
Plant Structure (01:08)  
Plant Tissue (04:52)  
Meristematic Tissue  
Ground Tissue  
Dermal Tissue  
Vascular Tissue  
Roots (08:27)  
Macroscopic View of Roots  
Microscopic View of Roots  
Stems (11:01)  
Herbaceous Stems  
Woody Stems  
Specialized Stems  
Leaves (23:19)  
Macroscopic View of Leaves  
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Experiment 12.1: Cross Sections of Roots, Stems, and a Leaf  
Leaf Color (17:29)  
Experiment 12.2: How Anthocyanins and pH Help Determine Leaf Color  
Transporting Water and Nutrients (00:34)  
How a Plant Depends on Water (05:11)

Water Absorption in Plants (03:45)

Water Transport in Plants (05:33)

Transpiration

Capillary Action

Root Pressure

Movement of Substances in Phloem (02:09)

Plant Growth, Hormones, and Responses (01:34)

Auxins and Plant Responses (06:25)

Phototropism

Gravitropism

Thigmotropism

Cytokinins (02:13)

Gibberellins (00:53)

Absciscic Acid (01:01)

Ethylene (00:47)

Florigen (02:07)

Unique Designs (00:30)

Freshwater Plants (00:24)

Saltwater Plants (00:26)

Desert Plants (01:41)

Insectivorous Plants (02:18)

## MODULE 13: ANIMALS—INVERTEBRATES PT1

Introduction (01:40)

Characteristics of Animals (01:19)

Invertebrates and Vertebrates (01:40)

Symmetry (03:40)

Diversity of Invertebrates (00:37)

Sponges—Phylum Porifera (15:16)

Sponge Anatomy

Feeding

Reproduction

Uses of Sponges

Experiment 13.1: Observation of the Spicules of a Sponge

Phylum Cnidaria (17:50)

Cnidarian Anatomy

Hydras

Reproduction in Hydras

Experiment 13.2: Observation of a Hydra

Sea Anemones

Corals

Jellyfish

Phylum Annelida (38:57)

Feeding Habits of the Earthworm

The Respiratory and Circulatory Systems in an Earthworm

The Earthworm's Reproductive System  
Other Segmented Worms  
Experiment 13.3: Earthworm Dissection  
Phylum Platyhelminthes: the Planarian (09:31)  
Experiment 13.4: Observation of a Planarian  
Other Members of Phylum Platyhelminthes (01:08)  
Phylum Nematoda (03:05)  
Phylum Mollusca (05:20)  
General Anatomy  
Gastropods  
Bivalves  
Cephalopods  
Summing Up the Invertebrates (00:46)

## MODULE 14: ANIMALS—INVERTEBRATES PT2

Introduction (01:49)  
A Closer Look at Arthropods (09:32)  
Common Characteristics  
An Exoskeleton  
Body Segmentation  
Jointed Appendages  
Ventral Nervous System  
An Open Circulatory System  
The Diversity of Arthropods (00:28)  
Class Crustacea: the Crayfish (37:47)  
The Crayfish's Respiratory System  
The Crayfish's Circulatory System  
The Crayfish's Digestive System  
The Crayfish's Nervous System  
The Crayfish's Reproductive System  
Other Crustaceans  
An Important Note  
Experiment 14.1: Crayfish Dissection  
Class Arachnida (08:54)  
Characteristics of Arachnids  
The Spider  
Catching Prey  
Spider Anatomy  
Classes Chilopoda and Diplopoda (02:01)  
Class Insecta (03:19)  
Insect Legs  
Insect Wings  
The Basic Anatomy of an Insect (07:49)  
Respiration and Circulation in Insects  
The Feeding Habits of Insects

## Reproduction and Development in Insects

A Few Orders in Class Insecta (12:02)

Order Lepidoptera: the Butterflies and Moths

Order Hymenoptera: Ants, Bees, and Wasps

Order Coleoptera: Beetles

Order Diptera: Flies, Gnats, and Mosquitoes

Order Orthoptera: Grasshoppers and Crickets

A Bit About Echinoderms (01:02)

The Unique Design of Echinoderms (03:18)

Diversity of Echinoderms (03:20)

Summing Up (00:37)

## MODULE 15: ANIMALS—CHORDATES PT1

Introduction (01:22)

General Characteristics of Chordates (03:34)

Nonvertebrate Chordates (00:38)

Tunicates (01:29)

Lancelets (00:43)

General Characteristics of Vertebrates (02:39)

Internal Support and Protection

Circulatory System (02:47)

Nervous System (05:31)

Reproduction (03:37)

Diversity of Vertebrates—Fishes (01:37)

Jawless Fishes (03:03)

Cartilaginous Fishes (10:34)

Sharks

Rays and Skates

Bony Fishes (45:06)

General Anatomy of Bony Fishes

Diversity of Bony Fishes

Experiment 15.1: Perch Dissection

Diversity of Vertebrates—Amphibians (01:31)

Characteristics of Amphibians (04:22)

Groups of Amphibians (23:49)

Experiment 15.2: Frog Dissection

Alternate Experiment for Module 15: Field Study II

Diversity of Vertebrates—Reptiles (00:36)

Characteristics of Reptiles (05:44)

Classification of Reptiles (10:21)

Lizards and Snakes

Turtles and Tortoises

Crocodylians

Tuataras

## MODULE 16: ANIMALS—CHORDATES PT2

Introduction (01:42)

Birds (00:30)

Characteristics of Birds (13:00)

Endothermic

Four-Chambered Heart

Toothless Bill

Reproduction

A Bird's Ability to Fly

Feathers

Wings

Skeletal Structure

Classification in Class Aves (07:44)

Experiment 16.1: Bird Identification

Mammals (00:39)

Characteristics of Mammals (06:28)

Hair

Reproduction

Caring for Young

Endothermic with a Four-Chambered Heart

Classification in Class Mammalia (14:20)

Monotremes

Marsupials

Placental Mammals

Animal Behavior (01:45)

Innate Behavior (07:40)

Fixed Action Pattern

Rhythmic Patterns of Behavior

Learned Behavior (06:00)

Habituation

Imprinting

Conditioning

Social Behaviors (08:50)

Competitive Behaviors

Aggressive Behavior

Territorial Behavior

Dominance Hierarchies

Courtship Behavior

Cooperation

Summing it All Up (01:22)