

Biology
(2008-2009 ACADEMIC YEAR)
Scope and Sequence

Organizing Topic	Essential Knowledge and Skill <i>The student will be able to:</i>	Strategies	Assessment Methods	Resources
The Science of Life	Define <i>truth</i> . Describe several ways to determine truth, and analyze the value of these methods.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activities -Scientific method -Light microscope Demonstration -How to use a light microscope	Test Laboratory Checks	BJ LINC video clips -Leeuwenhoek Test and Quiz Masters
	List, describe, and explain the significance of the steps of the scientific method.			
	Evaluate the limitations of science.			
	Describe a scriptural philosophy of science, explaining the relationship between science and Scripture.			
	List and describe the attributes of life.			
	Identify the parts of the compound light microscope. Demonstrate an ability to use the microscope.			
	Analyze the problems inherent in the scientific study of life.			
	Explain the relationship between science and scientific models.			
The Chemistry of Life	Differentiate between a chemical change and a physical change.	Lecture PowerPoint® slides Question/Answer Homework Demonstrations -Solutions, suspensions, and colloids -Diffusion -Osmosis	Test	Video - <i>Organic Molecules</i> Test and Quiz Masters
	List and describe two types of energy.			
	Describe the properties of solutions, suspensions, and colloids, and apply these properties to living things.			
	Describe diffusion and osmosis.			
	Describe the properties and functions of enzymes.			
	Compare and contrast the major kinds of organic compounds, describing their basic structure and discussing several functions each has in living structures.			
Cell Biology	List and describe the concepts of the cell theory.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activity -Basic cytology Demonstrations	Quizzes Tests Laboratory Check	BJ LINC video clips -Tour of the Cell -Joseph Priestley -Photosynthesis -Protein Synthesis Microscope video clips -Onion skin cells
	List and define the processes carried on by cells.			
	List the levels of cellular organization of living things.			
	Describe the various boundaries of cells.			

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Cell Biology <i>(continued)</i>	Describe cellular membranes.	-How to prepare a wet mount slide -Cellular organelles & processes -Solutions and cells -Photosynthesis		-Human cheek cells - <i>Elodea</i> cells -Banana cells Test and Quiz Masters
	List and describe the functions of the basic cellular organelles.			
	Discuss the effects of hypotonic and hypertonic solutions on cells. List and describe some ways cells that must live in these conditions are able to do so.			
	Compare and contrast passive and active transport of substances into cells.			
	Analyze the significance of ATP and ADP in cellular energy systems.			
	Analyze the significance of photosynthesis and cellular respiration to the processes of life.			
	Write a simple chemical equation for photosynthesis and for aerobic cellular respiration.			
	Describe the light-dependent and light-independent phases of photosynthesis.			
	Note the efficiency of cellular respiration compared with lactic acid fermentation and alcoholic fermentation.			
	Describe the origin and function of messenger RNA, transfer RNA, and ribosomal RNA.			
	List and describe the steps in the process of protein synthesis.			
	Compare and contrast various cellular metabolic processes. Discuss how the various cellular processes are interrelated and interdependent when it comes to maintaining life.			
	Genetics			
Explain the nature of cell division, listing and describing the phases of the cell cycle.				
Discuss the significance of mitosis in asexual reproduction and in the growth of multicellular organisms.				

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Organizing Topic	Essential Knowledge and Skill <i>The student will be able to:</i>	Strategies	Assessment Methods	Resources
Genetics <i>(continued)</i>	Analyze the major differences between mitosis and meiosis. Evaluate the limited significance of meiosis in genetic variation. Describe Mendel's work with peas, and apply the relationship of his findings to observations of chromosomes during mitosis and meiosis. Solve monohybrid crosses on Punnett squares, and interpret the results. Figure simple pedigree problems. Explain modifications of Mendel's principles such as incomplete dominance, codominance, pleiotropy, multiple gene interaction, and multiple alleles. List and describe the inheritance of several human traits and genetic disorders. Solve simple problems dealing with sex-linked traits. Describe changes that affect the number of chromosomes in an organism. Describe mutations and discuss their effects. Explain the relationship between gene expression and cancer. Discuss basic principles of population genetics, including the Hardy-Weinberg Principle. Discuss biblical principles that apply to eugenics.	Laboratory activities -Mitosis and meiosis -Genetics problems Demonstrations -Mitosis -Genetics problems -Chromosome and gene changes		
Biotechnology	Describe the dominion mandate, and discuss its significance for a Christian's response to science. Describe cloning, and give a biblical perspective on human cloning. Describe genetic engineering, and give examples of the use of the technique. Describe the major controversies surrounding stem cell research, and discuss a biblical approach to this technology.	Lecture PowerPoint® slides Question/Answer Homework Demonstration -DNA extraction	Test	Test and Quiz Masters

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Biotechnology <i>(continued)</i>	Describe some practical uses of biotechnology, such as gene therapy, DNA fingerprints, and genetically modified plants.			
Creation & Evolution	Contrast the creationists' position and the evolutionists' position using the arguments of both.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activity -Creationism: My beliefs and defense	Quiz Test Laboratory Check	Video - <i>A Question of Origins</i> Guest Lecturers -Ken Ham -Dr. Bill Lovegrove Test and Quiz Masters
	Explain the results of believing evolutionary theory.			
	Define <i>scientism</i> , and explain how evolutionary theory supports it.			
	Differentiate between and give biblical support for the long-day theory and the short-day theory and for the gap theory and the non-gap theory.			
	Describe several methods of fossilization, and discuss their natural occurrence in today's world.			
	List several logical reasons for believing that the Genesis flood was universal.			
	Explain the flood theory of fossil formation.			
	Describe several methods scientists use to date the age of the earth, and identify the potential problems with these methods.			
	Evaluate the limitations of dating methods using carbon-14 and other compositional substances.			
	Discuss Lamarck's and Darwin's evolutionary theories, and present the creationist arguments against them.			
	Evaluate whether mutations are capable of supplying the variation needed for evolution.			
Define and explain each of the following: <i>common ancestor, phylogenetic tree, missing links, punctuated equilibrium, natural selection, survival of the fittest, descent with modification, homologous structures, vestigial structure, the theory of recapitulation, and anthropology.</i>				

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The Classification System	Analyze the difference between a natural and an artificial system of classification.	Lecture PowerPoint® slides Question/Answer Laboratory activity -The use of biological keys	Quiz Laboratory Check	BJ LINC video clip -Carolus Linnaeus Test and Quiz Masters
	List the seven main levels in the current biological classification hierarchy, and explain the descending hierarchy of the system.			
	Explain how scientific names are written, and discuss the reasons scientific names are important.			
	List some problems involved in classifying living organisms.			
	Describe the problems with the species concept, and define the term <i>biblical kind</i> .			
Microbiology	Describe the cellular structure of bacteria.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activities -Protozoans -Algae Demonstrations -Bacterial cultures -Microbiology laboratory techniques -Antibiotic susceptibility testing -Live protozoans -Live algae	Quizzes Tests Laboratory Check	BJ LINC video clips -Louis Pasteur Moody Science video clip -Protozoans and algae Microscope video clips -Bacteria - <i>Amoeba</i> - <i>Paramecium</i> - <i>Plasmodium</i> - <i>Euglena</i> - <i>Spirogyra</i> - <i>Volvox</i> - <i>Ulothrix</i> -Desmids -Diatoms -Dinoflagellates Test and Quiz Masters
	List various methods bacteria use to obtain energy, the basic requirements for bacterial growth, methods for controlling bacterial growth, and several uses of bacteria.			
	Describe the relationships of bacteria to oxygen and the reproduction of bacteria.			
	Describe methods bacteria have for transferring genetic material.			
	Describe the physical properties of a virus when it is not in contact with a cell.			
	Explain the lytic cycle of a virus.			
	Compare and contrast ways different viruses affect cells, including the lysogenic cycle, transforming viruses, tumors, and persistent infections.			
	Evaluate viruses as living versus nonliving things.			
	Discuss the germ (pathogen) theory of disease. Contrast the germ theory to some historical theories of the cause of disease.			
	List and describe the methods by which pathogens are spread.			
	List the structural, nonspecific, and specific defenses of the human body against disease, and explain how they affect the pathogen.			

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Microbiology <i>(continued)</i>	List several human diseases. Describe their causes, symptoms, and methods of transmission.			
	Describe and give examples of the four protozoan phyla.			
	Compare and contrast the various methods of locomotion, reproduction, and food acquisition in the amoeba and paramecium.			
	List several economic effects of protozoans.			
	Discuss the economic and ecological significance of algae.			
	Describe and give examples of the eukaryotic algal phyla.			
	Identify and describe the following algae: <i>Euglena</i> , <i>Spirogyra</i> , diatoms, desmids, dinoflagellates, and <i>Fucus</i> .			
Discuss the methods of sexual and asexual reproduction in algae.				
Kingdom Fungi	List and describe some fungi that are beneficial and others that are both directly and indirectly harmful to man.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activity -Fungi & lichens Demonstration -Live fungi	Test Laboratory Check	Microscope video clips - <i>Rhizopus</i> - <i>Penicillium</i> - <i>Coprinus</i> -Lichen Test and Quiz Masters
	Describe and give examples of the major fungal phyla.			
	Discuss the methods of sexual and asexual reproduction in fungi.			
	Describe the methods by which fungi obtain food.			
	Describe the life cycle of a mushroom.			
Describe the gross anatomy, microanatomy, and symbiotic relationship of lichens.				
Botany	Describe the structure and life cycle of a moss, fern, pine tree, and flowering plant.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activities -Plant organs -Flowers, fruits, & seeds Demonstrations -Plant classification -Ferns, fiddleheads, & sori	Quiz Test Laboratory Checks	Moody Science video clips -Sprouts -Flowers opening Video clips -Moss -Ferns -Flower dissection Microscope video clips -Leaf -Stem -Root Test and Quiz Masters
	Compare and contrast monocots and dicots.			
	Contrast annual, biennial, and perennial plants.			
	Describe the functions and structures of a plant's vegetative and reproductive organs.			
	Draw and label a cross section of a leaf, and give the functions of the structures shown.			
	Explain the opening and closing of stomata.			
Distinguish between the primary and secondary tissues of both roots and stems.				

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Botany <i>(continued)</i>	<p>Describe how roots absorb water and minerals.</p> <p>Explain the transportation of water, minerals, and food in a plant.</p> <p>Describe how hormones affect a plant. List several plant hormones, and tell their specific function in a plant.</p> <p>Distinguish between tropisms and nastic movements.</p> <p>Distinguish between natural and artificial methods of vegetative propagation. List and describe several examples of each method.</p> <p>Draw, label, and give the functions of the structures in a complete flower.</p> <p>Describe pollination and fertilization in a flower.</p> <p>Define <i>fruit</i>, giving names and examples of various types.</p> <p>Discuss seed germination requirements and their significance.</p>	<p>-Leaf margins, shapes, & venations</p> <p>-Transpiration & capillarity</p> <p>-Dissection of a flower</p>		
Invertebrate Zoology	<p>Define the basic terms of animal anatomy and symmetry.</p> <p>List and define the various life processes of all animals.</p> <p>Describe the structure of a typical sponge, a hydra, and a planarian.</p> <p>Give the function of each type of cell found in a simple sponge, a hydra, and a planarian.</p> <p>List the characteristics and give examples of the following phyla: Porifera, Cnidaria, Platyhelminthes, Nematoda, Annelida, Mollusca, Echinodermata, and Arthropoda.</p> <p>Trace the life cycle of a fluke, a tapeworm, an <i>Ascaris</i>, and a trichina worm.</p> <p>Distinguish between free-living and parasitic forms of worms.</p> <p>Give the functions of the major organs and organ systems of the earthworm.</p> <p>Evaluate the advantages and disadvantages of an exoskeleton.</p> <p>Compare and contrast the five major classes of phylum Arthropoda.</p>	<p>Lecture</p> <p>PowerPoint® slides</p> <p>Question/Answer</p> <p>Homework</p> <p>Laboratory activities</p> <p>-Phylum Porifera</p> <p>-Phylum Cnidaria</p> <p>-Earthworm dissection</p> <p>-Crayfish dissection</p> <p>Demonstrations</p> <p>-Phyla Platyhelminthes & Nematoda</p> <p>-External anatomy of the grasshopper</p> <p>-Insect orders</p>	<p>Quizzes</p> <p>Test</p> <p>Laboratory Checks</p>	<p>BJ LINC video clips</p> <p>-Earthworm Dissection</p> <p>-Riverbanks Zoo</p> <p>-Charleston Aquarium</p> <p>-Crayfish Dissection</p> <p>Microscope video clips</p> <p>-<i>Hydra</i></p> <p>-Planaria</p> <p>-<i>Daphnia</i></p> <p>-Vinegar eels</p> <p>Moody Science video clips</p> <p>-Fly trap</p> <p>-Caterpillar—butterfly</p> <p>-Spider & web</p> <p>Test and Quiz Masters</p>

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Organizing Topic	Essential Knowledge and Skill <i>The student will be able to:</i>	Strategies	Assessment Methods	Resources
Invertebrate Zoology <i>(continued)</i>	Describe and give the functions of the main structures of the crayfish, a typical malacostracan; the spider, a typical arachnid; and the grasshopper, a typical insect.			
	Describe several methods humans use to control insects, and evaluate the environmental significance of each.			
	List the characteristics that separate insects from other classes of arthropods.			
	Contrast complete and incomplete metamorphosis.			
	Describe and give examples of the following orders of insects: Orthoptera, Coleoptera, Lepidoptera, Hymenoptera, and Diptera.			
Vertebrate Zoology	Describe the characteristics of the phylum Chordata and subphylum Vertebrata.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activities -Perch dissection -Frog dissection	Quizzes Test Laboratory Checks	BJ LINC video clips -Riverbanks Zoo -Greenville Zoo -Hollywild Animal Park -Charleston Aquarium -Perch Dissection -Frog Dissection Test and Quiz Masters
	Discuss the three basic forms of reproduction common among vertebrates.			
	Describe the vertebrate nervous system, and identify the lobes of a vertebrate brain.			
	Explain the three main levels of vertebrate behavior, and give examples of each.			
	List and describe the characteristics of the following classes: Osteichthyes, Amphibia, Reptilia, Aves, and Mammalia.			
	Compare the circulatory, respiratory, nervous, and reproductive systems of a fish, frog, reptile, bird, and mammal.			
	Identify two groups of organisms in the class Amphibia and four living groups of organisms in the class Reptilia.			
	Describe the metamorphosis of amphibians. Give details regarding respiration, circulation, feeding, and habitat.			
	Describe the ectothermic state, and give examples of frog and reptile behavior which result from their being ectothermic.			
	Describe and give the functions of the parts of an amniotic egg.			

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Vertebrate Zoology (continued)	Analyze the attributes that specially suit a bird's body for flight.			
	Evaluate the advantages of being endothermic, and give bird-related examples of each.			
	Compare bird and mammal instincts, learned behavior, and intelligence.			
	Explain the value of a bird's instincts of migration, courting, and nest building.			
	List characteristics and give examples of the following mammalian groups: rodents, carnivores, aquatic mammals, primates, odd-toed and even-toed ungulates, marsupials, and monotremes.			
Ecology	Define and describe <i>ecology</i> and <i>ecosystem</i> .	Lecture PowerPoint® slides Question/Answer Homework Demonstrations -Succession and pollution -Recycling	Quiz Test	Test and Quiz Masters
	List the various components of the physical environment, and discuss how they work together to create different habitats.			
	Trace the water cycle. Identify the physical environmental factors that keep the water cycle going.			
	Identify producers and consumers in a food chain/food web.			
	List, define, and give examples of several possible nutritional relationships between populations in an ecosystem.			
	Distinguish between <i>niche</i> and <i>habitat</i> .			
	Trace the oxygen, carbon, and nitrogen cycles.			
	Compare and contrast the pioneer stages of succession and the climax stage of succession.			
	List and describe the major biomes. Discuss what factors contribute to an area having one biome rather than another.			
	Identify man's role in the biosphere as a consumer and a manager. Discuss man's limits as a consumer and a manager in an ecosystem and the biosphere.			
	Define and give examples of a natural resource. Identify several approaches people take toward natural resources.			

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Ecology <i>(continued)</i>	Identify which approaches would be acceptable to a Christian philosophy and which would not. Explain why.			
	Give criteria for deciding what is a legitimate ecological concern and what is environmentalism or hype.			
	Differentiate between substance and energy pollutants and between biodegradable and nonbiodegradable pollutants.			
	List and describe appropriate limits for animal rights and for scientific experimentation with animals. Discuss the current animal rights movement, and compare it with an appropriate Christian philosophy.			
Human Anatomy and Physiology: Integumentary, Skeletal, and Muscular Systems	Describe and give examples of the basic levels of human behavior, and discuss the significance of man being created in the image of God.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activities -The human body & the skeletal system -The human muscular & integumentary systems	Quizzes Test Laboratory Checks	Microscope video clips -Muscle cells -Bone cells -Skin cells Test and Quiz Masters
	Identify the major body areas, cavities, and terms of direction used in human anatomy.			
	List and describe the four basic human tissues.			
	Explain the functions of the human integumentary system.			
	List and describe the various layers of the human skin.			
	Describe human hair and hair follicles, nails, sweat glands, and sebaceous glands.			
	Identify the major bones of the human body.			
	Describe the structure of a typical long bone.			
	Explain how a bone grows in length and diameter.			
	List the major kinds of joints found in the human body, and give examples of each.			
	Describe different types of muscle tissue, the structures of a typical muscle, and muscle physiology (how a muscle contracts).			
	Explain what happens as a muscle fatigues.			
Identify the major muscles of the human body.				

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Organizing Topic	Essential Knowledge and Skill <i>The student will be able to:</i>	Strategies	Assessment Methods	Resources
	Describe several diseases and disorders of the integumentary, skeletal, and muscular systems.			
Human Anatomy and Physiology: Respiratory and Digestive Systems	Describe and give the functions of the structures of the respiratory and digestive systems.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activity -The human digestive system Demonstration -Lung volume	Quizzes Test Laboratory Check	Guest Lecturer -Linda Haight, fitness and nutrition Test and Quiz Masters
	Describe the process of breathing.			
	Explain gas exchange between lungs and blood and between blood and body tissues.			
	List several factors that influence the respiration rate, and explain how they operate.			
	List and describe the basic organic and inorganic food substances, giving their sources and their uses in the human body.			
	Compare and contrast physical and chemical digestion.			
	Describe several diseases and disorders of the respiratory and digestive systems.			
Human Anatomy and Physiology: Circulatory, Lymphatic, and Excretory Systems	Describe the components of blood, and discuss their functions.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activity -The blood Demonstrations -Blood typing -Heart rate & pressure	Quizzes Test Laboratory Check	Video - <i>The Virtual Heart Surgery</i> Microscope video clips -Blood cells -Sickle cell anemia blood cells Test and Quiz Masters
	Discuss the clinical significance of blood typing.			
	Label the structures of the heart, and explain their functions.			
	Trace the circulation of blood through the heart and several of the major arteries and veins of the body, outlining its function in each area.			
	Describe the structure of arteries, veins, and capillaries.			
	Describe the functions and structures of the lymphatic and excretory systems.			
	Compare and contrast cell-mediated and humoral immunity.			
	Differentiate between active immunity and passive immunity.			

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	Describe several diseases and disorders of the circulatory, lymphatic, and excretory systems.			
Human Anatomy and Physiology: Nervous System, Sensory Organs, and Endocrine System	Describe and list the functions of the structures of a neuron.	Lecture PowerPoint® slides Question/Answer Homework Laboratory activity -The minor senses Demonstrations -Reflexes -Vision & hearing	Quizzes Test Laboratory Check	Test and Quiz Masters
	Describe a nerve impulse.			
	Explain the significance of a reflex arc.			
	Label and explain the functions of the parts of the brain.			
	List and describe the minor senses.			
	Identify the structures of the ear and of the eye, and tell the function of each structure.			
	Describe several disorders of the ear and the eye.			
	Define <i>hormone</i> and describe how hormones affect the body.			
	List the major hormones produced by the endocrine glands, and describe their functions.			
	Identify the causes of the secondary sex characteristics.			
Describe several diseases and disorders of the nervous system, sensory organs, and endocrine system.				
Human Anatomy and Physiology: Reproductive System	Describe and give the functions of the male and female reproductive systems.	Lecture PowerPoint® slides Question/Answer Homework	Quiz Test	Test and Quiz Masters
	Explain the process of fertilization, implantation of the embryo, the basic steps of embryological development and pregnancy, and the process of birth.			