

YOSEMITE HIGH SCHOOL
50200 ROAD 427 - OAKHURST, CA 93644
(559)683-4667

COURSE TITLE: AGRICULTURAL BIOLOGY
DEPARTMENT: VOCATIONAL EDUCATION/AGRICULTURE

<u>REQUIREMENT SATISFIED:</u>			
High School:	X	Model Curriculum Standards:	
State College:		Frameworks:	
UC Approved:	X		

GRADE LEVEL: *9-12 LENGTH OF COURSE: Year CREDITS: 10

PREREQUISITE: Successful completion of Ag. Science 1 or Earth Science with a grade of "B" or better. Successful completion of Algebra 1 or Algebra C/D (or concurrently enrolled).

*Incoming 9th grade students must have recommendation of 8th grade teacher.

TEXTBOOKS: Biology: Dynamics of Life, Biggs, Etal; Glencoe McGraw-Hill or equivalent Ag texts

COURSE DESCRIPTION:

This course is intended to provide the student with a College preparatory level introduction to cellular, molecular, plant, and animal biology; human and animal anatomy and physiology; classification and diversity of organisms; ecology; evolutionary trends; and scientific investigation. The course will consist of discussions, lectures and laboratory investigations.

Students who are successful in this class will have good study skills and the ability to manage and average of 30 minutes of Ag Biology homework/study time each school day.

COURSE OUTLINE/ALIGNMENT TO CALIFORNIA STATE STANDARDS AND EXPECTED SCHOOLWIDE LEARNING RESULTS:

<u>Assignment</u>		<u>Standards</u>	
<u>Course Content/Objectives:</u>		<u>Addressed:</u>	<u>ESLRS:</u>
ECOLOGY	Bio/Life	6a, 6b, 6c, 6d 6e, 6f	1,3,4
CELL BIOLOGY	Bio/LifeSci	1a, 1c, 1d, 1e 1,h	1,3,4
GENETICS	Bio/LifeSci	2a, 2b, 2c, 2e 2f, 2g, 4a, 4b 4c, 4d, 4e	1,3,4
EVOLUTION	Bio/Life	8a-f 7a-f	1,3,4
ANATOMY AND PHYSIOLOGY OF HUMAN AND ANIMAL BODIES	Bio/Life	2a,3a,9a-h,10a-f	1,3,4

DISTRICT/STATE CONTENT STANDARDS ADDRESSED:

Agriculture (Grades 9-12):

Basic Core Career Path Cluster: Agriculture & Society

1. Students will develop an awareness of the interrelationship of California agriculture and society on the local, state, national, and international levels, and will discuss the economic impact of leading commodities.
 - 1.1 Students will be able to list five agricultural commodities exported from California and the U.S. and explain the economic importance of each.
 - 1.2 Students will be able to list five agricultural commodities imported to California and the U.S. and explain the economic importance of each.
 - 1.3 Students will be able to identify and explain the importance of five agricultural commodities produced in their county, in California, and in the U.S.
 - 1.4 Students will be able to explain the relationship of the development of agriculture to the development of civilization and modern society in the U.S. (i.e., diversification of labor, development of trade, mechanization, and land use).

Agriculture and the Environment

2. Students will understand the interrelationship of modern agriculture and the environment, focusing on water, land, and other natural resources in California. Students will explain how natural resource availability affects agriculture.
 - 2.1 Students will be able to describe the environmental impacts of agriculture on water, soil, and air.
 - 2.2 Students will be able to describe the environmental challenges of urban sprawl, decline in water quality, and concerns over chemical use for agriculture.
 - 2.3 Students will be able to explain the importance of agriculturists as stewards of our natural resources.

Agriculture Business and Technology

3. Students will understand the importance of agriculture firms and technology with regard to the production, processing, servicing, purchasing, and marketing of agriculture products.
 - 3.1 Students will be able to explain the flow of an agricultural commodity from the producer to the consumer.
 - 3.2 Students will be able to explain the effect technology has had on agriculture (i.e. labor, production efficiency, product diversity and availability, mechanization, and communication).
 - 3.3 Students will be able to explain the functions of production, processing, servicing and marketing in agriculture.

Record Keeping

4. Students will understand the importance of keeping accurate records and explain the consequences of inaccurate records. Students will maintain and complete the California Agricultural Record Book which pertains to their Supervised Occupational Experience (SOE) Program.
 - 4.1 Students will be able to explain reasons for keeping accurate records and consequences of inaccurate records.
 - 4.2 Students will be able to develop a budget and a business agreement for a project.
 - 4.3 Students will be able to complete journal entries for two enterprises and carry entries forward to the next month.
 - 4.4 Students will be able to prepare a financial statement and next income summary.
 - 4.5 Students will complete non-depreciable and depreciable property inventories.
 - 4.6 Use the straight-line method for determining depreciation.

Computer Literacy

5. Students will understand the importance of computer literacy as it pertains to agriculture.
 - 5.1 Students will be able to describe three examples of computer applications in agriculture.

Interpersonal Leadership Development

6. Students will develop a basic understanding of the FFA, recognize the traits of effective leaders and participate in leadership training activities associated with FFA, which may include public speaking, leading group discussions, working within a committee, conducting business meetings, and problem solving.
 - 6.1 Students will be able to explain the benefits of FFA membership.
 - 6.2 Students will be able to describe and explain leadership skills developed by participating in FFA.
 - 6.3 Students will be able to demonstrate the use of five parliamentary procedure skills.
 - 6.4 Students will be able to demonstrate the ability to cooperate and collaborate by serving on a committee.
 - 6.5 Students will be able to make an oral presentation.
 - 6.6 Students will be able to demonstrate the process of solving a problem by identifying the problem, proposing solution, gathering information, testing and evaluating solutions.

Projects

7. Students will understand the relationship between a supervised occupational experience (SOE) and their preparation for a career in agriculture. Students will actively engage in and manage a SOE which enables them to develop occupational skills.
 - 7.1 Students will be able to develop an agricultural SOE plan (student data sheet).
 - 7.2 Students will be able to demonstrate responsibility, commitment, and time management skills by conducting and maintaining and SOE.

Careers and Employability in Agriculture

8. Students will be aware of existing and future employment opportunities in the field of agriculture and will develop an understanding of how to conduct a job search, write a resume, and interview for a job.
 - 8.1 Students will be able to describe the six agriculture career clusters and give examples of entry, technical, and professional careers in each cluster.
 - 8.2 Students will be able to develop a resume and participate in a mock job interview.
 - 8.3 Students will be able to utilize resources to learn about an agriculture occupation of their choice.

Measurement

9. Students will be able to read and use measuring equipment, and perform calculations for problem solving.
 - 9.1 Students will be able to measure to within $1/16^{\text{th}}$ of an inch.
 - 9.2 Students will be able to calculate area and volume when given dimensions.

Tool Use and Safety

10. Students will understand the operating principles of common tools used in agriculture and will understand the principles of safety that apply to them.
 - 10.1 Students will be able to identify commonly used tools.
 - 10.2 Students will be able to select and justify the tools appropriate for a given project.
 - 10.3 Students will be able to explain safety procedures in the use of hand and power tools.

Domestic Animals and Society

11. Students will understand the importance of animals, their domestication, and role in modern society. Students will explain the care and uses of domesticated livestock in society.

- 11.1 *Students will be able to explain the difference between domesticated and non-domesticated animals.*
- 11.2 *Students will be able to describe proper care of domesticated animals to ensure their welfare and productivity.*
- 11.3 *Students will be able to compare and contrast the evolution and uses of domestic animals.*

Major Body Systems

- 12. *Students will understand the anatomy of the major body systems. Students will explain the major functions of the digestive, reproductive, circulatory, nervous, muscular, skeletal, respiratory, and endocrine systems.*
 - 12.1 *Students will be able to compare and contrast the basic parts and functions of monogastric and ruminant digestive systems.*
 - 12.2 *Students will be able to label the basic parts and describe the functions of male and female reproductive systems.*
 - 12.3 *Students will be able to identify the major body systems that compose the vertebrate: digestive, reproductive, circulatory, nervous, muscular, skeletal, respiratory, and endocrine.*
 - 12.4 *Students will be able to give an example of the major components of each system.*
 - 12.5 *Students will be able to compare and contrast the structures of plant and animal cells.*
 - 12.6 *Students will be able to compare and contrast the major external body parts of a bovine, porcine, and avian animal.*

Animal Genetics

- 13. *Students will understand the basic theory of inheritance, the genetic basis for animal selection, the process of fertilization, and the processes of meiosis and mitosis. Students will explain and/or diagram these concepts and processes.*
 - 13.1 *Students will be able to describe the difference between genotype and phenotype and dominant and recessive genes with the assistance of the Punit Square.*
 - 13.2 *Students will be able to describe the process of fertilization.*
 - 13.3 *Students will be able to diagram and label and process of meiosis to form sperm and ova, and the process of mitosis.*

Animal Nutrition

- 14. *Students will understand the factors influencing animal nutrition and feeding. Students will identify common feed ingredients and will explain the uses of different feeds for particular animal species.*
 - 14.1 *Students will be able to list six classes of nutrients and their functions.*

- 14.2 Students will be able to choose and justify the type of feeds suitable for the digestive system of ruminant, monogastric and avian species.
- 14.3 Students will be able to explain how production processes, stage of development, costs and availability of feeds dictate their selection.
- 14.4 Students will be able to describe basic guidelines for animal feeding.

Animal Health

- 15. Students will identify general symptoms of animal health problems and will understand the causes of disease in domestic animals. Students will recognize a sick animal, describe its symptoms and recommend treatment.
 - 15.1 Students will be able to describe the appearance and behavior of a normal, healthy animal.
 - 15.2 Students will be able to list the major factors affecting animal health (housing, sanitation, nutrition).

Soil Science and Principles

- 16. Students will understand the role of soil, water, and fertilizer in plant production.
 - 16.1 Students will be able to describe the major components of soil (air, water, organic material, and minerals).
 - 16.2 Students will be able to explain the relationship of soil characteristics to plant growth (soil, texture, structure, pH, and salinity).

Plant Physiology and Functions

- 17. Students will understand the requirements for plant growth and development. Students will identify and explain the functions of plant systems and structures.
 - 17.1 Students will be able to identify the major components for plant growth (air, water, heat, light, soil).
 - 17.2 Students will be able to explain the process of photosynthesis and its importance to life.
 - 17.3 Students will be able to describe the life cycles of annual, biennial, and perennial plants.
 - 17.4 Students will be able to compare and contrast the structures of plant and animal cells.

Pest Management in Plant Production

- 18. Students will understand the importance of pest management in plant production. Students will explain the major principles of integrated pest management.
 - 18.1 Students will be able to explain how insects, weeds, disease and vertebrate pests affect plant production.

- 18.2 Students will be able to define IPM, discuss its advantages and disadvantages.
- 18.3 Students will be able to describe chemical, mechanical, cultural and biological methods of controlling insects, weeds, and disease.

Natural Resources

19. Students will be aware of the major natural resources used in agriculture. Students will discuss major issues related to the use of these natural resources.
 - 19.1 Students will be able to describe how natural resources are used in agriculture.
 - 19.2 Students will be able to describe major issues related to water sources and water quality.
 - 19.3 Students will be able to compare and contrast practices for conserving renewable and non-renewable resources.

Animal Science Career Path Cluster (Grades 9-12): Animal Facilities, Equipment, and Handling

1. Students will understand the correct and safe uses and selection of animal facilities and housing, restraint equipment, and tools.
 - 1.1 Given a site, climate and species, students design and explain an animal housing facility.
 - 1.2 Students will be able to demonstrate the safe and appropriate use of restraint equipment for an animal species.

Animal Nutrition

2. Students will understand principles of animal nutrition. Students will understand the interrelationship between the digestive, endocrine, and circulatory systems.
 - 2.1 Students will be able to trace the pathway of food through the digestive systems (ruminant, monogastric, avian, equine) and explain the digestive processes occurring in each species.

Animal Physiology

3. Students will understand the structure, function, and maintenance of the major organ systems of animals.
 - 3.1 Students will be able to explain the interrelationship between the circulatory, respiratory, excretory, endocrine, digestive, reproductive, skeletal, and muscle systems.
 - 3.2 Students will be able to suggest management practices that enhance the function of the body systems.

Animal Reproduction

4. Students will understand the structure and function of the endocrine and reproductive systems and how they relate to reproductive management practices and fetal development.

- 4.1 Given a scenario for the production of a species, students describe reproductive management practices and their effect on fetal development.
- 4.2 Students will be able to explain the application of artificial insemination and embryo transfer in animal agriculture.
- 4.3 Students will be able to describe breeding systems commonly used in animal reproduction.

Animal Genetics

5. Students will understand the basic theory of inheritance, the genetic basis for animal selection, the process of fertilization, the role(s) of DNA and RNA, and the process of meiotic division to form sperm and ova.
 - 5.1 The students will be able to use probability to predict the phenotypic and genotypic results of a dominant/recessive gene pair to the F₂ generation.
 - 5.2 The students will be able to identify natural and artificially induced mutations and hybrids and discuss their value to agriculture.

Animal Health

6. Students will understand the cause of disease as it applies to animal health problems.
 - 6.1 Students will be able to demonstrate the ability to identify normal behavioral characteristics of a healthy animal.
 - 6.2 Students will be able to describe sound management practices that can prevent disease.

Animal Parasites and Pests

7. Students will understand the life cycle of internal and external parasites.
 - 7.1 Students will be able to explain control measures for these pests and parasites.
 - 7.2 Students will be able to describe a parasite prevention program and describe symptoms of a parasite problem
 - 7.3 Students will be able to trace the life cycle of a given pest or parasite and indicate the best stage for control.

Large and Small Animal Production

8. Students will understand the different principles of animal production, marketing, and production record keeping.
 - 8.1 Students will be able to describe different production and marketing strategies and their economic importance.
 - 8.2 Students will be able to select an animal to raise or follow from selection through marketing, keeping records of growth and production decisions and with financial considerations.

Range Management

9. Students will understand range management practices.
 - 9.1 Students will be able to explain how range management practices affect pasture production, erosion control, and the overall balance of the ecosystem.

Waste Management

10. Students will understand the challenges associated with animal waste management.
 - 10.1 Students will be able to analyze different methods for the use of animal waste including consideration of environmental impacts.

Record Keeping

11. Students will understand the principles of record keeping.
 - 11.1 Students will be able to demonstrate record keeping utilizing a variety of methods and systems including the California FFA record book.
 - 11.2 Students will be able to explain the differences between production and financial records.

Interpersonal Leadership Development

12. Students will recognize the traits of effective leaders.
 - 12.1 Students will participate in leadership training activities associated with the FFA including public speaking, leading group discussions, working within a committee, conducting business meetings and problem solving.

Supervised Practical Experience Project

13. Students will understand the relationship between a Supervised Occupational Experience project (SOE) and their preparation for a career in agriculture.
 - 13.1 Students will participate in a Supervised Occupational Experience that employs skills and knowledge learned in the classroom.
 - 13.2 Students will be able to maintain an ongoing record book on their SOE.

Production and Management

14. Students will demonstrate an understanding of the process of evaluation and selection of livestock based on current industry standards.
 - 14.1 Students will be able to demonstrate the use of critical thinking, problem solving, communications skills, and available technology in evaluating livestock.

Animal Welfare

15. Students will develop an appreciation of the public's perception of animal welfare issues.

- 15.1 Students will be able to communicate the rationale for various animal management practices.

Feeds and Feeding

16. Students will understand the principles of feeds and feeding.
 - 16.1 Students will be able to explain the function of feed components in animal rations for various species.

Plant and Soil Science Career Path Cluster (Grades 9-12): Plant Classification

1. Students will understand the principles of plant classification and identify plants using a simple dichotomous key.
 - 1.1 Give a selection of plants, students will be able to identify the plants using a dichotomous key.

Plant Cell Components

2. Students will understand cell functions and will identify and describe cell components. They will understand the principles of plant inheritance, which will include the structure and role of DNA.
 - 2.1 Given a series of plants grown under different conditions, students will be able to describe the plants reaction in terms of cellular function.

Plant Physiology and Growth

3. Students will understand the principles of plant physiology and growth.
 - 3.1 Students will be able to describe the factors which influence plant growth including water, nutrients, light, soil, air, and climate.
 - 3.2 Students will be able to modify the factors affecting plant growth and predict plant response.

Plant Reproduction

4. Students will understand the difference between sexual and asexual reproduction in plants.
 - 4.1 Students will be able to demonstrate techniques for successful plant propagation (including budding, grafting, cuttings, and seeds).

Plant Pathology and Pests

5. Students will understand basic pest problems and their respective economic impacts.
 - 5.1 Students will be able to identify pests that affect plants.
 - 5.2 Students will be able to describe symptoms of disease and the methods of management (i.e. conventional, sustainable, organic systems).
 - 5.3 Students will be able to demonstrate proper handling of hazardous materials.

Soil Properties

6. Students will understand the relationship between soils and plant production.
 - 6.1 Students will be able to identify the basics of soil texture and structure, the types of soil, the rating procedure used.
 - 6.2 Students will be able to identify properties of soil that are necessary for successful crop production.

Soil Biology

7. Students will understand what a soil food chain is (soil biology).
 - 7.1 Students will be able to describe the impact of soil biology on the environment.

Soil Management

8. Students will understand the effective management practices used in tillage and soil conservation.
 - 8.1 Students will be able to describe practices necessary to effectively manage and conserve soil through irrigation, drainage, and tillage practices.

Water Management

9. Students will understand the effective management practices used in irrigation, drainage, watersheds, and water conservation.
 - 9.1 Students will be able to describe the practices necessary to effectively manage and conserve water.

Agrosystem

10. Students will understand the concept of "agrosystem" approach to production.
 - 10.1 Students will be able to identify the components of "whole system management".

Cultural and Harvest Practices

11. Students will understand crop management and production practices.
 - 11.1 Students will be able to demonstrate an understanding of local cultural techniques including monitoring, pruning, fertilization, planting, irrigation, harvest treatments, processing, packaging, and marketing practices.

Post Harvest Physiology and Marketing Practices

12. Students will understand post harvest plant physiology and marketing practices.
 - 12.1 Students will be able to identify post harvest treatments, processing, packaging, and marketing practices used on local crops.

Equipment Management and Safety

13. Students will know how to maintain tools and equipment used in plant production operations. Students will understand occupational safety issues including the avoidance of physical hazards in the work environment.
 - 13.1 Students will demonstrate the skills necessary to service and maintain equipment and tools.
 - 13.2 Students will operate equipment safely as not to endanger themselves or others.
 - 13.3 Students will demonstrate proper handling of hazardous materials.

Biotechnology

14. Students will understand the principles of biotechnology in relation to plant protection and improvement.
 - 14.1 Students will be able to demonstrate an understanding of micro propagation, biological pest controls, and genetic engineering.

Technology

15. Students will understand the use of technology in plant production.
 - 15.1 Students will be able to describe how changes in technology affect plant production and management.
 - 15.2 Students will be able to describe ways to keep informed about advancements in technology that affect plant and soil science.

Record Keeping

16. Students will demonstrate an understanding of the principles of record keeping utilizing a variety of methods and systems.
 - 16.1 Students will be able to explain the differences between production and financial records.

Interpersonal Leadership Development

17. Students will recognize the traits of effective leaders.
 - 17.1 Students will participate in leadership training activities associated with the FFA, including public speaking , leading group discussions, working within a committee, conducting business meetings, and problem solving.

Supervised Agriculture Experience Project

18. Students will understand the relationship between a Supervised Occupational Experience (SOE) and their preparation for a career in agriculture.
 - 18.1 Students will participate in a Supervised Occupational Experience employing skills and knowledge learned in the classroom.
 - 18.2 Students will maintain an ongoing record book.

Ornamental Horticulture Career Path Cluster: Plant Classification

1. Students will understand plant classification and identification.
 - 1.1 Students will be able to classify and identify plants using botanical growth habits, landscape uses, cultural requirements, and a simple botanical key.
 - 1.2 Students will be able to demonstrate plant selection and identification for local landscape applications.

Plant Physiology

2. Students will understand the basic principles of plant physiology and growth, including photosynthesis, osmosis, transpiration, respiration, plant structure, and cell structure.
 - 2.1 Students will be able to raise various plant materials under a variety of conditions and identify the factors affecting plant growth.

Plant Reproduction

3. Students will understand the methods of asexual plant reproduction as well as the factors affecting them.
 - 3.1 Students will be able to safely demonstrate propagation practices and monitor plant development.

Integrated Pest Management

4. Students will understand basic principles of integrated pest management. They will identify pest and disease damage and learn methods of control.
 - 4.1 Students will be able to read and interpret pesticide labels and understand safe pesticide management practices.

Soil and Water

5. Students will understand water and soil (media) management practices.
 - 5.1 Students will be able to demonstrate an understanding of water and soil and how they affect plant growth.
 - 5.2 Students will be able to prepare and amend soils, implement methods of soil conservation, and evaluate results.

Plant Nutrition

6. Students will understand plant nutrition practices for ornamental plants as it relates to plant growth and health.
 - 6.1 Students will be able to read and interpret fertilizer labels and use proper application practices.

Ornamental Horticulture Equipment

9. Students will understand the safe use, repair, and maintenance of tools, equipment, and facilities found in the horticulture industry.

- 9.1 Students will be able to safely operate and maintain selected hand and power equipment.

Horticulture Record Keeping

13. Students will understand the importance of keeping records of business transactions and production records.

- 13.1 Students will be able to maintain and complete record books, production records, and other records as needed.

Interpersonal Leadership Development

14. Students will recognize the traits of effective leaders.

- 14.1 Students will participate in leadership training activities associated with the FFA including public speaking, leading group discussions, working within a committee, conducting business meetings, and problem solving.

Supervised Occupational Experience Project

15. Students will understand the relationship between a Supervised Occupational Experience project (SOE) and their preparation for a career in agriculture.

- 15.1 Students will participate in a Supervised Occupational Experience project employing skills and knowledge learned in the classroom.

- 15.2 Students will be able to maintain an ongoing record book.

- 10.2 Students will be able to use basic concrete/masonry, plumbing, and/or electrical wiring skills.

Natural Resources/Forestry Career Path Cluster (Grades 9-12): Energy and Nutrient Cycles

1. Students will understand the cycling of energy, water, and basic elements in the ecosystem.

- 1.1 Students will be able to observe and analyze the roles energy, water, and basic elements play in various ecosystems and describe the influence of human activities on these systems.

Energy

2. Students will understand the importance of energy, including sources, conservation, and future needs.

- 2.1 Students will be able to compare the effects of using different kinds of energy and energy sources on air and water pollution.

Water and Water Pollution

3. Students will understand water use issues, cycles, management practices, conservation, pollution, and water quality.

- 3.1 Students will be able to analyze the role of water management in maintaining a healthy environment and lifestyle.

Soil

4. *Students will understand soil composition and the factors which affect the use of different types of soil.*
 - 4.1 *Students will be able to explain or demonstrate practices used to manage and conserve soil resources.*

Wildlife and Waterfowl

6. *Students will understand the importance of wildlife including indigenous and migratory species, their physical and behavioral characteristics, habitat, and management.*
 - 6.1 *Students will be able to compare habitat requirements for different species and identify factors that influence population dynamics.*
 - 6.2 *Students will be able to identify the major species of migratory waterfowl, their characteristics, and migratory flyways, and explain the importance of maintaining waterfowl habitats.*

Wetland and Aquatic Resources

7. *Students will understand the principles of fisheries and marine resource management.*
 - 7.1 *Students will be able to explain how water quality affects aquatic animals and their habitats.*

Plant Physiology

9. *Students will understand the basic principles of plant physiology.*
 - 9.1 *Students will be able to describe the factors which influence plant growth.*
 - 9.2 *Students will be able to explain or diagram the process of photosynthesis and describe its importance to life.*

Taxonomy

10. *Students will understand the classification of plants and animals.*
 - 10.1 *Students will be able to utilize a dichotomous key to identify plants and animals.*
 - 10.2 *Students will be able to describe the scientific method of animal classification including: order, family, genus, and species.*

Record Keeping

15. *Students will understand the principles of record keeping.*
 - 15.1 *Students will be able to demonstrate record keeping utilizing a variety of methods and systems.*
 - 15.2 *Students will be able to explain the differences between production and financial records.*

Interpersonal Leadership Development

16. Students will recognize the traits of effective leaders.
- 16.1 Students will participate in leadership training activities associated with the FFA including public speaking, leading group discussions, working within a committee, conducting business meetings, and problem solving.

Supervised Practical Experience Project

17. Students will understand the relationship between a Supervised Occupational Experience (SOE) project and their preparation for a career in agriculture.
- 17.1 Students will participate in a supervised practice experience employing skill and knowledge learned in the classroom.
- 17.2 Students will be able to maintain an ongoing record book.

SCIENCE: BIOLOGY/LIFE SCIENCES (Grades 9-12):

Cell Biology

1. The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. As a basis for understanding this concept:
- a. Students know cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.
 - b. Students know enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions, and the pH of the surroundings.
 - c. Students know how prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.
 - d. Students know the central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.
 - e. Students know the role of the endoplasmic reticulum and Golgi apparatus in the secretion of proteins.
 - f. Students know usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.
 - g. Students know the role of the mitochondria in making stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.
 - h. Students know most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.
 - i. Students know how chemiosmotic gradients in the mitochondria and chloroplast store energy for ATP production.

- j* Students know how eukaryotic cells are given shape and internal organization by a cytoskeleton or cell wall or both.

Genetics

2. Mutation and sexual reproduction lead to genetic variation in a population. As a basis for understanding this concept:
 - a. Students know meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.
 - b. Students know only certain cells in a multicellular organism undergo meiosis.
 - c. Students know how random chromosome segregation explains the probability that a particular allele will be in a gamete.
 - d. Students know new combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).
 - e. Students know why approximately half of an individual's DNA sequence comes from each parent.
 - f. Students know the role of chromosomes in determining an individual's sex.
 - g. Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents.
3. A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization. As a basis for understanding this concept:
 - a. Students know how to predict the probable outcome of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive).
 - b. Students know the genetic basis for Mendel's laws of segregation and independent assortment.
 - c. Students know how to predict the probable mode of inheritance from a pedigree diagram showing phenotypes.
 - d. Students know how to use data on frequency of recombination at meiosis to estimate genetic distances between loci and to interpret genetic maps of chromosomes.
4. Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism. As a basis for understanding this concept:
 - a. Students know the general pathway by which ribosomes synthesize proteins, using tRNAs to translate genetic information in mRNA.
 - b. Students know how to apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.
 - c. Students know how mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.

- d. *Students know specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.*
 - e. *Students know proteins can differ from one another in the number and sequence of amino acids.*
 - f. *Students know why proteins having different amino acid sequences typically have different shapes and chemical properties.*
5. *The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells. As a basis for understanding this concept:*
- a. *Students know the general structures and functions of DNA, RNA, and protein.*
 - b. *Students know how to apply base-pairing rules to explain precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA.*
 - c. *Students know how genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.*
 - d.* *Students know how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation, and transformation) is used to construct recombinant DNA molecules.*
 - e. *Students know how exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.*

Ecology

6. *Stability in an ecosystem is a balance between competing effects. As a basis for understanding this concept:*
- a. *Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.*
 - b. *Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.*
 - c. *Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.*
 - d. *Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.*
 - e. *Students know a vital part of an ecosystem is the stability of its producers and decomposers.*
 - f. *Students know at each link in a food web some energy is stored in newly made structures but much energy is dissipated into the environment as heat. This dissipation may be represented in an energy pyramid.*
 - g. *Students know how to distinguish between the accommodation of an individual organism to its environment and the gradual adaptation of a lineage of organisms through genetic change.*

Evolution

7. *The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time. As a basis for understanding this concept:*
 - a. *Students know why natural selection acts on the phenotype rather than the genotype of an organism.*
 - b. *Students know why alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.*
 - c. *Students know new mutations are constantly being generated in a gene pool.*
 - d. *Students know variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.*
 - e. *Students know the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature.*
 - f. *Students know how to solve the Hardy-Weinberg equation to predict the frequency of genotypes in a population, given the frequency of phenotypes.*

8. *Evolution is the result of genetic changes that occur in constantly changing environments. As a basis for understanding this concept:*
 - a. *Students know how natural selection determines the differential survival of groups of organisms.*
 - b. *Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.*
 - c. *Students know the effects of genetic drift on the diversity of organisms in a population.*
 - d. *Students know reproductive or geographic isolation affects speciation.*
 - e. *Students know how to analyze fossil evidence with regard to biological diversity, episodic speciation, and mass extinction.*
 - f. *Students know how to use comparative embryology, DNA or protein sequence comparisons, and other independent sources of data to create a branching diagram (cladogram) that shows probable evolutionary relationships.*
 - g. *Students know how several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another.*

Physiology

9. *As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment. As a basis for understanding this concept:*
 - a. *Students know how the complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.*

- b. *Students know how the nervous system mediates communication between different parts of the body and the body's interactions with the environment.*
 - c. *Students know how feedback loops in the nervous and endocrine systems regulate conditions in the body.*
 - d. *Students know the functions of the nervous system and the role of neurons in transmitting electrochemical impulses.*
 - e. *Students know the roles of sensory neurons, interneurons, and motor neurons in sensation, thought, and response.*
 - f. *Students know the individual functions and sites of secretion of digestive enzymes (amylases, proteases, nucleases, lipases), stomach acid, and bile salts.*
 - g. *Students know the homeostatic role of the kidneys in the removal of nitrogenous wastes and the role of the liver in blood detoxification and glucose balance.*
 - h. *Students know the cellular and molecular basis of muscle contraction, including the roles of actin, myosin, Ca^{+2} , and ATP.*
 - i. *Students know how hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms.*
10. *Organisms have a variety of mechanisms to combat disease. As a basis for understanding the human immune response:*
- a. *Students know the role of the skin in providing nonspecific defenses against infection.*
 - b. *Students know the role of antibodies in the body's response to infection.*
 - c. *Students know how vaccination protects an individual from infectious diseases.*
 - d. *Students know there are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.*
 - e. *Students know why an individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign.*
 - f. *Students know the roles of phagocytes, B-lymphocytes, and T-lymphocytes in the immune system.*

OUTCOME STATEMENT:

Students will demonstrate:

- 1 *An ability to outline basic principles of ecology such as biotic and abiotic factors.*
- 2 *State the differences between organisms, populations, communities, ecosystems, and the biosphere.*

- 3 Compare and contrast the cycles in nature.
- 4 Show how, where and why energy is lost in a food chain, pyramid or web.
- 5 Explain how immigration, emigration, birth and death effect populations.
- 6 Define biodiversity and explain why a large biodiversity is healthy for the ecosystem.
- 7 Explain how a single cell fulfills all the basic requirements for life, including use of energy, growth, reproduction, and response to stimulus.
- 8 Outline the basic function of all cell organelles.
- 9 Explain the process of transcription and translation.
- 10 Compare and contrast respiration and photosynthesis.
- 11 Make a Punnett square to determine the possible outcomes of monohybrid and dihybrid crosses including complete dominance, codominance, incomplete dominance and sex linked traits.
- 12 Explain the process of meiosis and which cells undergo meiosis and why.
- 13 Explain how independent assortment affects zygote outcomes.
- 14 Explain how mutations in DNA affect protein expression.
- 15 Explain how number and sequence of amino acids affect protein shape and function.
- 16 Draw the basic structure of a DNA molecule including proper base pairing and hydrogen bonding.
- 17 Compare and contrast the theories of natural selection and punctuated equilibrium, including genetic drift and its effect on biodiversity.
- 18 Explain how the major organ systems operate and interact with each other. Define Homeostasis and how it relates to balance in bodily systems.
- 19 Explain the function of the immune system and how vaccinations help protect against disease.

INSTRUCTIONAL STRATEGIES:

Student learning will involve reading of texts, outlining techniques, note taking, classroom discussions, demonstrations, labs, video viewing and class projects.

ASSESSMENT:

Student assessment will be done by observation by instructor of student participation, notebook assessment, writing assignments, worksheets, projects, lab write ups, group activities, chapter outlines, chapter review assignments, quizzes, tests, mid-term tests, and final tests.

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