SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: BIOL 202 Department: Biological Sciences

Course Title: Principles of Biology 2 Semester: Spring Year: 1997

Objectives/Competencies

Course Objective	Competencies
1. Understand basic cell structure and function	1. Identify the constituent parts of a generalized cell. 2. Describe the function of the constituent parts of a generalized cell. 3. Summarize the basic interrelationships of the various parts of a generalized cell. 4. Describe the role of cell membranes in regulating the function of the parts of a generalized cell. 5. Describe how material is transferred across cell membranes.
2. Understand how energy is transferred within a cell.	1. Recognize the molecular structure of the adenosine triphosphate (ATP) molecule. 2. Draw a schematic of the molecular structure of the ATP molecule. 3. Define where in the ATP molecule energy is stored. 4. Explain how energy is released from the ATP molecule. 5. Provide examples of where ATP is used in a cell. 6. Define an oxidation/reduction (redox) reaction

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3. Understand metabolism, which releases energy from food molecules (particularly glucose) within a cell.	1. Explain where in the cell glycolysis takes place. 2. List the steps in the process of glycolysis. 3. List the products of the process of glycolysis. 4. Describe the significance of each of the products of glycolysis. 5. Describe the transfer of pyruvic acid across the mitochondrial membrane. 6. Describe conversion of pyruvic acid to acetyl-coenzyme A. 7. Describe the general features of the metabolism of acetyl-coenzyme A in the Kreb's cycle. 8. List the reactants that enter the Kreb's cycle 9. List the products produced by the Kreb's cycle. 10. Describe the significance of each of the products of the Kreb's cycle. 11. Describe the general features of electron transport and oxidative phosphorylation. 12. Describe how high-energy electrons are carried from glycolysis and the Kreb's cycle and delivered to the electron transport chain. 13. Describe the transfer of electrons in the electron transport chain. 14. Describe how energy is transferred from the high-energy electrons to molecules of ATP. 15. Metabolism converts glucose to other forms. Identify these forms, and describe how the atoms that were originally in the glucose leave the body.

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	16. Describe the basics of the metabolism of lipid and protein as compared to glucose.
4. Understand the process of photosynthesis.	1. Describe where in a plant cell photosynthesis takes place. 2. Summarize photosynthesis and list the reactants entering photosynthesis and the products that result. 3. Review the reactants and products of the light reaction of photosynthesis. 4. Summarize the events of the light reactions of photosynthesis. 5. Review the reactants and products of the dark reaction of photosynthesis. 6. Summarize the events of the dark reactions of photosynthesis. 7. Describe how the light and dark reactions of photosynthesis are linked. 8. Explain how photosynthesis is performed differently in plants that perform C4 photosynthesis. 9. Explain how photosynthesis is performed differently in plants that perform crassulean acid metabolism (CAM). 10. List the benefits and costs of C4 and CAM photosynthesis versus conventional photosynthesis.
5. Understand and explain the relationship between photosynthesis and metabolism.	1. Summarize the reactants and products of photosynthesis. 2. Summarize the reactants and products of glucose metabolism. 3. Explain how the reactants for metabolism are the products of photosynthesis.

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	4. Explain how the reactants for photosynthesis are the products of metabolism.
6. Comprehend the fundamentals of the mechanism of protein synthesis.	1. Interpret the key experiments that revealed that DNA is the genetic material. 2. Define DNA and RNA as polymers of nucleotides. 3. Describe the chemical interactions by which double stranded DNA forms a helix. 4. Describe the genetic code. 5. Describe the formation of an mRNA transcript of a gene. 6. Describe the formation of a protein through the translation of the mRNA transcript. 7. Summarize the complete process of through which a protein is formed from the information contained within a gene.
7. Know the fundamental concepts by which cells control gene expression.	1. Describe the structure and function of an operon. 2. Describe the structure and function of a stop codon. 3. Define the concepts of intron and exon as they pertain to gene transcripts. 4. Describe the process by which introns are removed from gene transcripts. 5. Understand basics of the mechanisms by which regulatory proteins control gene transcription. 6. Describe the most important mechanisms of post-translational processing of gene products. 7. Express comprehension of gene regulation by applying the above concepts to explaining events in cell

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	differentiation.
8. Review and evaluate the history of Darwin's theory of evolution.	1. Describe the historical context within which the theory of evolution was developed. 2. List the significant observations that led to the development of the theory of evolution. 3. Describe the importance of unique island floras and faunas in defining the theory of evolution. 4. Describe the influence of the fossil record on the development of evolutionary theory. 5. Describe the role of molecular biology in reconfirming the validity of the theory of evolution.
9. Understand and evaluate the mechanisms by which evolution occurs.	1. Define the concept of a biological species. 2. Define the term *natural selection.* 3. Present the Hardy-Weinberg equilibrium equation. 4. Calculate the Hardy-Weinberg equilibrium for a given allele. 5. Describe how the Hardy-Weinberg equilibrium expresses the stability of a given allele in a population. 6. Describe how mutation introduces variation into a population. 7. Describe how variation is introduced into a given population via sexual recombination. 8. Explain the concept of reproductive fitness. 9. Explain the factors determining reproductive fitness. 10. Explain the relationship between the reproductive fitness of an individual and the process of natural selection.

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	11. Provide examples of processes by which new species arise.
10. Knowledge of the unifying concepts of anatomy (structure) and physiology (function).	1. Explain that structure and function are interrelated in all species. 2. List the hierarchy of levels at which structure and function may be studied. 3. Define the term *tissue*, *organ*, and *organ system*. 4. List the four primary tissue types, and describe the basic function of each. 5. Explain the concept of homeostasis. 6. Review examples of typical homeostatic mechanisms.
11. Comprehension of unifying concepts of nutrition and digestion.	1. Define the term *digestion*. 2. Distinguish between the four stages of the digestive process: ingestion, digestion, absorption, and elimination. 3. Compare species that practice external versus internal digestion. 4. Review adaptations by which animals prepare food for digestion. 5. Explain that the diet provides: food molecules for energy, food molecules to build and repair tissues, and essential nutrients that the body can not make on its own.
12. Comprehension of unifying concepts of gas exchange.	1. Review the metabolic requirements of cells that require intake of oxygen and release of carbon dioxide. 2. Explain that respiration must take place over a moist tissue surface.

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13. Comprehension of unifying concepts of circulation.	3. Land animals have access to a higher concentration of oxygen, but must maintain a moist surface for respiration. 4. Summarize the four basic mechanisms by which animals achieve gas exchange: diffusion through a moist skin, diffusion across gills, diffusion across lungs, or diffusion via trachea as in insects. 5. Explain techniques by which animals increase the surface area of respiratory surfaces. 6. List techniques by which land animals reduce evaporative water loss across their respiratory surfaces. 7. Define the concept of a counter-current exchange mechanism. 8. Describe the mechanism of counter-current flow in ensuring efficient gas exchange in fish gills. 9. Compare unidirectional versus bi-directional flow of gases in mammalian versus avian lungs. 10. Explain the control of breathing by brain stem nuclei in mammals. 1. Summarize the role of the circulatory system in gas and nutrient exchange. 2. Explain how primitive animals with no circulatory system achieve gas exchange and distribute nutrients. 3. Compare and contrast an open versus a closed circulatory system. 4. Summarize the anatomy of a fish heart. 5. Summarize the anatomy of a reptilian heart. 6. Summarize the anatomy of a mammalian heart.

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14. Synthesize an understanding of the interrelationship of the digestive, respiratory, and circulatory systems.	7. Explain mechanisms by which the mammalian heart responds to increased demand. 1. Combine the individual function of each organ system and express their function as a coordinated whole.