

SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

**ACADEMIC AFFAIRS**

Course Number: BIOL 106 Department: Biological Sciences

Course Title: General Biology 1 Semester: Spring Year: 1997

**Objectives/Competencies**

<b>Course Objective</b>	<b>Competencies</b>
1. Major themes in the study of life.	<ol style="list-style-type: none"><li>1. Describe the unifying themes of life.</li><li>2. Diagram the hierarchy of structural levels in biology.</li><li>3. Describe emergent properties associated with life.</li><li>4. Identify the major kingdoms of life.</li><li>5. Outline the steps of the scientific method.</li><li>6. Distinguish between inductive and deductive reasoning.</li></ol>
2. Basic chemistry of life.	<ol style="list-style-type: none"><li>1. Define atom, molecule, compound, element.</li><li>2. Identify major elements comprising life.</li><li>3. Explain the structure of atom.</li><li>4. Differentiate between atomic number, mass number, atomic weight, valence.</li><li>5. Explain why radioactive isotopes are important to biologists.</li><li>6. Explain how electron configuration influences chemical behavior of atoms.</li><li>7. Distinguish among the types of bonds.</li><li>8. Describe how hydrogen bond differs from ionic, and</li></ol>

Course Objective	Competencies
3. Properties of Water.	covalent. <ol style="list-style-type: none"><li>1. Describe structure of water and explain what properties emerge as a result.</li><li>2. Explain the ways that water supports life.</li><li>3. Describe the dissociation of water.</li><li>4. Explain the basis of pH scale.</li><li>5. Explain how acids and bases differ in hydrogen ion concentration.</li><li>6. Explain how buffers work.</li></ol>
4. Organic Macromolecules.	<ol style="list-style-type: none"><li>1. Explain condensation and hydrolysis reactions.</li><li>2. Describe characteristics of carbohydrates and how they are classified.</li><li>3. Describe major polysaccharides and major functions that they provide.</li><li>4. Explain what distinguishes lipids.</li><li>5. Summarize the unique properties of fats, phospholipids, and steroids.</li><li>6. Distinguish between saturated and unsaturated fats and list emergent properties that result from differences.</li><li>7. Identify ester linkage.</li><li>8. Describe importance and properties of proteins.</li><li>9. Explain structure of amino acids and how they are categorized.</li><li>10. Describe levels of organization in proteins.</li><li>11. Summarize structure and function of nucleic acids and nucleotides.</li></ol>

Course Objective	Competencies
5. Enzymes and Energy Transformations.	<ol style="list-style-type: none"><li>12. Distinguish between purine and pyrimidin.</li><li>13. Describe the three-dimensional structure of DNA.</li><li>1. Explain the role of catabolic and anabolic pathways in cell metabolism.</li><li>2. Distinguish between exergonic and endergonic reactions.</li><li>3. Distinguish between kinetic and potential.</li><li>4. Describe the function of ATP in cells.</li><li>5. List the components of ATP.</li><li>6. Describe the energy profile of a chemical reaction including activation energy.</li><li>7. Describe the function of enzymes.</li><li>8. Explain relationship between enzyme structure and specificity.</li><li>9. Explain regulation by cofactors, inhibitors, allosteric regulators.</li><li>10. Explain how metabolic pathways are regulated.</li></ol>
6. Cell Structure and Function.	<ol style="list-style-type: none"><li>1. Describe techniques used in cytology.</li><li>2. Distinguish between resolving power and magnification.</li><li>3. Compare the light, electron and scanning microscopes.</li><li>4. Describe the process of cell fractionation.</li><li>5. Explain importance of compartmentalization in eukaryotic cells.</li><li>6. Describe the structure and function of cell organelles.</li><li>7. Describe the functioning of cilia and flagella.</li><li>8. Compare the intercellular junctions.</li><li>9. Outline the development of plant cell wall.</li></ol>

Course Objective	Competencies
<p>7. Membrane Structure.</p> <p>8. Cellular Respiration.</p> <p>9. Photosynthesis.</p>	<p>10. List the components of cytoskelton.</p> <ol style="list-style-type: none"> <li>1. Explain function of plasma membrane.</li> <li>2. Outline early investigations of membrane.</li> <li>3. Compare contributions of Robertson, Singer, and Nicolson.</li> <li>4. Describe how membrane fluidity is influenced by membrane composition.</li> <li>5. Identify how proteins are spatially arranged.</li> <li>6. Explain the role of hydrophobic interaction.</li> <li>7. Describe factors affecting permeability.</li> <li>8. Compare mechanisms of transport through membranes.</li> <li>9. List example of receptor-mediated endocytosis.</li> </ol> <ol style="list-style-type: none"> <li>1. Summarize overall equation of cell respiration.</li> <li>2. Differentiate between substrate-level and oxidative phosphorylation.</li> <li>3. Explain coupling of endergonic and exergonic processes.</li> <li>4. Define oxidation and reduction.</li> <li>5. List and describe coenzymes involved in cell respiration.</li> <li>6. Outline steps of glycolysis</li> <li>7. Describe location, molecules in and out of the Krebs cycle.</li> <li>8. Describe the process of chemiosmosis.</li> <li>9. Explain the process of fermentation.</li> <li>10. Show how other food molecules can be metabolized to make ATP.</li> </ol>

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<p>10. Cellular Reproduction</p> <p>11. Meiosis and Life Cycles.</p>	<ol style="list-style-type: none"> <li>1. Distinguish between modes of nutrition.</li> <li>2. Differentiate between chemosynthetic and photosynthetic autotrophs.</li> <li>3. Explain role of REDOX reactions in photosynthesis.</li> <li>4. Summarize equation for photosynthesis.</li> <li>5. Show relationship between action spectrum and absorption spectrum.</li> <li>6. List components of photosystems.</li> <li>7. Trace electron flow through photosystems I and II.</li> <li>8. Compare cyclic and noncyclic flow of electrons in light reaction.</li> <li>9. Summarize major events of light and dark reactions.</li> <li>10. Describe role of ATP and NADPH in Calvin cycle.</li> </ol> <ol style="list-style-type: none"> <li>1. Describe process of binary fission.</li> <li>2. List phases of cell cycle and describe the events in each phase.</li> <li>3. Distinguish between interphase and mitosis proper.</li> <li>4. List phases of mitosis and events occurring.</li> <li>5. Compare cytokinesis in plants and animal.</li> <li>6. Describe changes in spindle apparatus.</li> <li>7. List several factors stimulating and inhibiting cell growth.</li> <li>8. Explain the role of MPF in regulation of cell cycle.</li> <li>9. Describe how abnormal cancerous cell division differs from mitosis.</li> </ol> <ol style="list-style-type: none"> <li>1. Distinguish between asexual and sexual reproduction.</li> <li>2. Distinguish among the life cycle patterns of animals,</li> </ol>

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12. Classical Genetics.	<p>fungi, and plants.</p> <ol style="list-style-type: none"><li>3. List the phases of meiosis I and meiosis II and characteristics of each phase.</li><li>4. Describe process of synapsis and how recombination occurs.</li><li>5. Point out key differences between mitosis and meiosis.</li><li>6. Distinguish between interphase and interkinesis.</li><li>7. Describe all the factors contributing to genetic variation in sexually reproducing organisms.</li></ol> <ol style="list-style-type: none"><li>1. Describe early theories of heredity.</li><li>2. Tell how Mendel's hypothesis differed from the blending theory.</li><li>3. State Mendel's laws.</li><li>4. Solve monohybrid, dihybrid problems.</li><li>5. Explain the applicability of testcrosses.</li><li>6. Give example of incomplete dominance.</li><li>7. Explain factors that affect the phenotypic expression of genotype.</li><li>8. Describe the inheritance of the ABO system.</li><li>9. Define and give examples of pleiotrophy.</li><li>10. Explain how epistasis affects the phenotypic ratio.</li><li>11. Describe how environmental conditions can influence phenotypic expression.</li></ol>
13. Chromosomal Basis of Inheritance.	<ol style="list-style-type: none"><li>1. Describe contributions of Morgan, Sutton, Sturtevant to field.</li><li>2. Explain why Drosophila is a good experimental</li></ol>

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<p>14. Molecular Basis of Inheritance.</p>	<p>organism.</p> <ol style="list-style-type: none"> <li>3. Define linkage and explain why it interferes with independent assortment.</li> <li>4. Distinguish between parental and recombinant phenotypes.</li> <li>5. Describe mechanisms of sex determination in different animals.</li> <li>6. Solve sex-linkage problems.</li> <li>7. Differentiate between nondisjunction, aneuploidy, polyploidy.</li> <li>8. Distinguish between deletions, duplication translocations, and inversions.</li> <li>9. Describe the common chromosomal alterations implicated in human disorders.</li> </ol> <ol style="list-style-type: none"> <li>1. Describe why earlier scientists believed that protein was the genetic material.</li> <li>2. Summarize experiments of Griffith, Hershey &amp; Chase, and Chargaff.</li> <li>3. Identify the three components of a nucleotide.</li> <li>4. Distinguish between ribose and deoxyribose.</li> <li>5. List the bases found in DNA and distinguish between pyrimidine and purine.</li> <li>6. Describe how Watson and Crick determined the structure of DNA and the evidence that they used.</li> <li>7. Explain the base-pairing rule and its significance.</li> <li>8. Explain the Meselson-Stahl experiment and semi-conservative replication.</li> </ol>

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15. Protein Synthesis.	<ol style="list-style-type: none"><li>9. Describe the process of DNA replication noting the role of helicase, single-strand binding protein, DNA polymerase ligase and primase.</li><li>10. Explain antiparallel and why continuous replication of both DNA strands is not possible.</li><li>11. Explain the role of repair enzymes in DNA proofreading and repair.</li></ol> <ol style="list-style-type: none"><li>1. Describe Beadle and Tatum's experiments with Neurospora.</li><li>2. Summarize how information flows from genes to proteins.</li><li>3. Explain the "one gene-one enzyme" theory.</li><li>4. Indicate how RNA differs from DNA.</li><li>5. Distinguish between transcription and translation.</li><li>6. Compare transcription and translation in eukaryotes and prokaryotes.</li><li>7. Explain what a codon is and the association between mRNA codons and the linear sequence of amino acids in protein.</li><li>8. Describe the significance of a universal genetic code.</li><li>9. Explain the process of transcription including the three major steps of initiation, elongation, and termination.</li><li>10. Describe the role of RNA polymerase in transcription.</li><li>11. Differentiate between mRNA, tRNA, and rRNA.</li><li>12. Describe the wobble effect.</li><li>13. Explain how aminoacyl-tRNA synthetase functions.</li><li>14. Describe ribosomal structure.</li></ol>



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	15. Explain how proteins can be targeted for specific sites in cells.