Des Moines Area Community College
Course Competency Information
Effective Date: Fall 2007

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<tr>
<th>Acronym/Number:</th>
<th>BIO 112</th>
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<tr>
<td>Course Title:</td>
<td>GENERAL Biology I</td>
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<td>Credit Breakout:</td>
<td>4.00 3.00 1.00 0 0</td>
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<tr>
<td>(Total Credits: Lecture 1hr/crdt Lab 2hrs/crdt Practicum 3hrs/crdt Work Experience 4hrs/crdt(unsupervised))</td>
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Prerequisite/Co-Requisite
Prerequisite: H.S. Biology & H.S. Chemistry or equivalent

Description
First semester of Biology for majors. Topics covered include chemistry of life, cells, bioenergetics, genetics, evolution, viruses, prokaryotes and protists.

Course Competencies

1. Use the scientific method
   1. Explain how use of the scientific method brought about the current understanding of the structure and functions of living organisms
   2. Describe contributions of significant researchers in biology.
   3. Describe how methods used by researchers in biology enables them to make major contributions to the field
2. Describe characteristics of life and the study of biology
   1. Characterize organisms
   2. Classify organisms
   3. Name organisms
3. Summarize the characteristics of life molecules
   1. Use chemical terminology
   2. Describe atoms, molecules, chemical bonds, and chemical reactions
   3. Describe characteristics of water
   4. Use the pH scale
   5. Summarize basics of carbon chemistry
   6. Identify functional groups of organic molecules
   7. Identify characteristics of carbohydrates, lipids, proteins, and nucleic acids.
   8. Identify amino acids
   9. Identify levels of protein structure
   10. Identify characteristics of nucleic acids
   11. Investigate biological molecule in the laboratory
4. Summarize metabolism
   1. Use terminology of metabolism
   2. Characterize metabolic pathways
   3. Classify forms of energy
   4. Explain the laws of thermodynamics
   5. Apply concepts of free-energy
   6. Describe cellular work
   7. Summarize ways ATP serves as the energy currency of life.
   8. Characterize enzymes
9. Relate energy of activation to enzyme activity
10. Describe enzyme function and regulation
11. Describe control of metabolism
12. Investigate enzymes in the laboratory

5. Summarize microscopy
   1. Use terminology of microscopy
   2. Use a light microscope
   3. Describe electron microscopes and their use

6. Summarize characteristics of cells
   1. Use current terminology to describe cells and cellular constituents.
   2. Distinguish between prokaryotic and eukaryotic cells.
   3. Describe features and functions of the nucleus and its contents
   4. Describe ribosomes and their function
   5. Describe features and functions of the endomembrane system of cells
   6. Describe functions of cell vesicles and vacuoles
   7. Explain how the structures of the mitochondrion and the chloroplast relate to their functions
   8. Distinguish between plastids of plant cells
   9. Describe features and functions of the cytoskeleton
10. Explain how the structures of cilia and flagella provide for their functions.
11. Describe development and structure of plant cell walls
12. Explain how the glycocalyx of animal cells provides for cellular functions.
13. Differentiate between types of intercellular junctions
14. Identify cellular components in the laboratory

7. Summarize cell membrane structure and function
   1. Use current terminology to describe cell membranes and membrane transport.
   2. Summarize functions of the cell membrane
   3. Explain how membrane composition determines membrane fluidity and structure
   4. Classify transport proteins
   5. Describe diffusion and its relation to potential energy.
   6. Explain osmosis
   7. Explain the generation of membrane potential
   8. Describe endocytosis
   9. Investigate membrane transport in the laboratory

8. Summarize cellular respiration
   1. Use current terminology to describe harvest of chemical energy in cells.
   2. Diagram energy flow through the biosphere
   3. Summarize chemical reactions of cellular respiration of glucose
   4. Distinguish between substrate-level and oxidative phosphorylation
   5. Distinguish between oxidation and reduction
   6. Name coenzymes used in cellular respiration
   7. Specify the cellular sites of the processes of cellular respiration
   8. Explain chemosmotic phosphorylation
   9. Describe fermentation and why it is necessary
10. Relate how cells get energy from glucose to how they get energy from other molecules.
11. Explain how ATP production is controlled in cells
12. Explain the evolutionary significance of glycolysis
13. Investigate respiration in the laboratory

9. Summarize photosynthesis
   1. Use current terminology to describe photosynthetic events and structures.
   2. Distinguish between autotrophic and heterotrophic nutrition
   3. Distinguish between photosynthetic autotrophs and chemosynthetic autotrophs.
   4. Relate chloroplast structure to function
   5. Summarize chemical reactions of photosynthesis
   6. Describe features of light
   7. Relate the absorption spectrum of chlorophyll to its action spectrum.
   8. Explain of light absorption cause the electron flow of photosystems I and II.
10. Describe the roles of ATP and NADPH in the Calvin-Benson cycle.
11. Describe photorespiration.
12. Describe evolutionary adaptations that minimize photorespiration.
13. Describe the chemical fates of the products of photosynthesis.

10. Summarize cellular reproduction
   1. Use current terminology to describe cellular reproduction.
   2. Describe binary fission in prokaroyes.
   3. Describe chromosomes and their structural forms.
   4. Summarize cell chromosome number changes in the sexual life cycles.
   5. Describe events of the periods of the cell cycle.
   6. Identify characteristics and events of the phases of mitosis.
   7. Describe structures and events required for chromosomal movement in mitosis.
   8. Compare cytokinesis of plant and animal cells.
   9. Describe control of the cell cycle and the consequences of lack of this control.
10. Explain the relationship of chromosomes to heredity.
11. Distinguish between sexual and asexual reproduction of organisms.
12. Identify characteristics and events of the phases of meiosis.
13. Differentiate between mitosis and meiosis.
14. Distinguish between mitotic interphase and meiotic interkinesis.
15. Explain how independent assortment, crossing over, and random fertilization contribute to genetic variability in sexually reproducing organisms.
16. Explain how genetic variation in populations of organisms is crucial to Darwin's theory of evolution.
17. Identify stages of mitosis and meiosis in the laboratory.

11. Summarize Mendelian genetics
   1. Use current terminology of Mendelian genetics.
   2. Summarize Mendel's laws of segregation and independent assortment.
   3. Use Punnett squares and the laws of probability to predict the genotype and phenotype ratios of F1 and F2 generations of mono-, di-, and tri-hybrid crosses.
   4. Differentiate between complete dominance, recessiveness, incomplete dominance, and codominance.
   5. Explain how sex-linkage may affect genotype and phenotype ratios.
   6. Use pedigrees to determine patterns of inheritance.
   7. Explain the presence of lethal genes in the population.
   8. Explain methods used in genetic screening.
   9. Relate chromosomal inheritance to independent assortment and sex determination.
10. Describe processes and results of crossing-over.
11. Describe how changes in chromosome number can occur and the results of these changes.
12. Explain the theory of genomic imprinting.
13. Explain examples of extra nuclear inheritance.
14. Perform mendelian crosses in the laboratory.

12. Summarize molecular genetics
   1. Describe the processes used to determine that DNA is the genetic material.
   2. Identify chemical characteristics of DNA replication.
   3. Identify characteristics of DNA replication.
   4. Explain the one gene-one polypeptide hypothesis.
   5. Differentiate between RNA and DNA.
   6. Differentiate between types of RNA.
   7. Distinguish between transcription and translation by processes and the location of these processes in cells.
   8. Use the universal genetic code to work problems involving transcription and translation.
   9. Describe characteristics of the genetic code.
10. Explain the processes and cellular structures that are involved in translation.
11. Explain processes involved translation in the cytoplasm and on the rough endoplasmic reticulum.
12. Explain how protein targeting in cells relates to the site of translation.
13. Describe differences between prokaryotic and eukaryotic mRNA.
14. Explain eukaryotic mRNA nuclear processing.
15. Describe functions of introns and gene splicing
16. Differentiate between types of base-sequence mutations and their effects.
17. Investigate molecular genetics in the laboratory

13. Summarize viral and bacterial genetics
   1. Summarize viral composition and function
   2. Describe processes of viral genome replication
   3. Distinguish between lytic and lysogenic reproductive cycles in a bacteriophage
   4. Describe cellular processes used to defend against viral infection.
   5. Describe how viruses may cause cancers
   6. Describe means of virus transmission
   7. Relate hypotheses explaining viral evolution
   8. Differentiate between viruses and living organisms
   9. Describe the bacterial chromosome and binary fission
   10. Describe bacterial genetic recombination
   11. Describe roles of plasmids in bacterial life
   12. Describe natural and laboratory bacterial transformation and transduction.
   13. Explain how operons function in metabolic control

14. Summarize genome organization and expression in eukaryotes
   1. Compare genomic organization in eukaryotes to prokaryotes.
   2. Describe DNA packing
   3. Distinguish between types of chromatin and the functions.
   4. Describe hypothesized functions and origins of repetitive sequences and multigene families
   5. Describe examples of genome plasticity
   6. Describe the molecular basis of gene expression control

15. Summarize the processes, applications, and ethics of genetic engineering
   1. Describe functions and uses of restriction enzymes
   2. Describe uses of gel electrophoresis in DNA technology
   3. Describe vectors used in recombinant DNA technology
   4. Describe source of genes for cloning
   5. Outline procedures used for gene cloning and transformation of bacteria and other cells.
   6. Outline procedures used to sequence DNA
   7. Describe applications of recombinant DNA technology
   8. Describe procedures and processes that comprise the Human Genome project.
   9. Discuss safety and ethical considerations of recombinant DNA research.

16. Summarize elements of evolution
   1. Describe development of evolutionary theory
   2. Summarize the Hardy-Weinberg theorem
   3. Use terminology of evolution
   4. Apply knowledge of molecular genetics to evolutionary theory.
   5. Relate sexual dimorphism and diploidy to evolution
   6. Summarize speciation
   7. Outline phylogeny
   8. Describe views of the origin of life
   9. Investigate evolution in the laboratory

17. Examine the prokaryotes
   1. Use appropriate terminology to describe prokaryotes
   2. Classify prokaryotes
   3. Describe prokaryotic metabolism, motility, gene exchange, and survival mechanisms
   4. Describe prokaryotic interactions with ecosystems
   5. Describe factor that allow prokaryotes to cause disease
   6. List Koch's postulates
   7. Classify toxins
   8. Observe prokaryotes in the laboratory

18. Examine the protists
   1. Point out the major groups of protists
   2. Compare the major groups of protists
3. Explain protoplasmic level of development
4. Discuss principles of parasitism
5. Describe life cycles and pathology of parasitic protozoans.
6. Point out the economic importance of the protozoans
7. Observe protists in the laboratory