Course #: BIOL 115,116

NAME OF COURSE: General Biology I and Lab, BIOL 115,116

NAME OF ORIGINATOR / REVISOR: Eileen Walsh, Ph.D.

CURRENT DATE: 9/09

Please indicate whether this is a NEW COURSE or a REVISION: REV

DATE OF PRIOR REVISION: Spring 06

NUMBER OF CREDITS 4

NUMBER OF CONTACT HOURS PER WEEK 5
(3 lecture hrs; 2 lab hrs)

APPROXIMATE FREQUENCY OF OFFERING THIS COURSE: Every Semester
[Every semester, fall, spring, or not offered every semester]

PREREQUISITES OR ENTRY LEVEL SKILLS: High School biology, chemistry or equivalent

COREQUISITES: None

PLACE OF THIS COURSE IN CURRICULUM:

Required for Curriculum (name) ____________ College Core _X_ Elective

Part of Required/Recommended Sequence with (Number of Course) BIOL 117/118

IS THIS COURSE DESIGNED FOR TRANSFER TOWARD A SPECIFIC MAJOR? __X_ Yes ___ No

MAJOR(S) Biology

COURSE OUTCOMES:
List the course’s learning outcomes and describe how each outcome will be measured.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Lecture</th>
<th>Description</th>
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<tbody>
<tr>
<td></td>
<td>Discuss the chemical composition of living matter from the atomic to molecular level.</td>
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<td></td>
<td>Describe the structure and function of the parts of a typical plant and animal cell including the cell membrane, organelles and nucleus as well as cell division.</td>
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</table>

Knowledge, understanding, and application of the material will be tested in the form of multiple choice, completion, matching, true/false, and essay questions, labeling of diagrams; interpretation of figures and graphs.
<table>
<thead>
<tr>
<th>Course # BIOL 115,116</th>
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<tbody>
<tr>
<td><strong>Discuss the flow of energy in living organisms including a detailed explanation of photosynthesis and cellular respiration.</strong></td>
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<tr>
<td><strong>Discuss Mendelian genetics, its variations, and other patterns of inheritance.</strong></td>
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<tr>
<td><strong>Discuss the molecular biology of the gene and the flow of genetic information from DNA to RNA to protein synthesis and DNA technology.</strong></td>
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<td><strong>Describe the basic structure and function of the male and female reproductive systems.</strong></td>
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<tr>
<td><strong>Discuss the theories and evidences of evolution along with the evolution of populations and the origin of species.</strong></td>
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</table>
| **Lab Objectives –**  
Perform laboratory exercises using appropriate equipment to illustrate biological topics of basic chemistry, study of the cell, genetics and evolution. | Lab reports; written and practical tests evaluating knowledge and interpretation and application of results. |
| **Record, analyze and interpret results of laboratory experiments.** | Design an experiment using the steps in the Scientific Method. |
| **Understand the Scientific Method.** |  |
12. COURSE GRADE
Based on the above measures, how will the final course grade be calculated?
Lecture = 75%
  5 tests and comprehensive final
Lab = 25%
  4 tests = 90%
  Lab Reports = 10%

13. INSTRUCTIONAL METHODS: List the different instructional methods you might use, in the course of the semester. List supplementary learning options, if any.

- Traditional lecture with use of chalkboard
- Learning objectives
- Overhead transparencies
- Power point presentations
- Computer assisted learning in the form of tutorials
- Computer practice testing
- Variety of CD ROMS
- Internet
- Models, slides
- Working in groups in lab
- Written and practical tests
- Films and tapes
- Learning Option – On-Line course is offered

14. CROSS-CURRICULAR OPPORTUNITIES:

A. General Education Enrichment:
Does this course provide opportunities to draw upon examples or concepts from outside the main objectives of this area of study? If yes, please briefly describe the content, activities or assignments.

B. Information Management:
Does this course provide opportunities to teach and/or require the students to apply information management skills? If yes, please briefly describe the content, activities or assignments.

C. Critical Thinking:
Are there components of this course which teach and/or require students to demonstrate Critical Thinking? If yes, please briefly describe the content, activities or assignments.

D. Student Engagement:
Does this course provide opportunities for students to participate in individual or group presentations or interactions? If yes, please briefly describe the content, activities or assignments.
### Opportunities

<table>
<thead>
<tr>
<th>General Education</th>
<th>Activities or Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Relating course objectives to experiences outside the classroom, i.e., application of methods of transport; news; internet information.</td>
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</table>

<table>
<thead>
<tr>
<th>Information Management</th>
<th>Activities or Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students access power point presentations and supplementary material on Blackboard and utilize the website accompanying text. Honors option students submit internet assignments.</td>
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<table>
<thead>
<tr>
<th>Critical Thinking</th>
<th>Activities or Assignments</th>
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<tr>
<td></td>
<td>Test questions and lab reports require critical thinking. Lab on Scientific Method demonstrates the need. Students are encouraged to analyze information and draw conclusions. Certain topics lend to their expression of opinion, i.e., stem cell research, medical ethics, biotechnology.</td>
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</table>

<table>
<thead>
<tr>
<th>Student Engagement</th>
<th>Activities or Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students work as individuals and as a group in lab. Group activities require interaction and cooperation among members. Students are urged to participate and engage in discussions. Group study is encouraged.</td>
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</table>

### Topic Outline
Attached

### Unique Aspects of Course
Honors option and online course requiring computer access.

### Appendix I: Required Texts and/or Materials Required by the Student

**Text:**

**Lab Manual:**

### Appendix II: Catalog Description
(Approximately 65 words or less)

**BIOL 115,116 General Biology I and Lab**

4 credits

A first course in a two-semester sequence designed to fulfill the science requirement for the college degree as well as for a science major. Covers basic chemistry, the cell, energetics, genetics and evolution. May be taken for Honors or online. Prerequisite: High school biology, chemistry or equivalent. Class hrs, 3; Lab hrs. 2. Offered every semester.
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
</table>
| 1    | I. Introduction  
|      | A. What is biology?  
|      | B. What is life?  
|      | 1. characteristics of life  
|      | 2. forms of life  
|      | II. Chemistry of life  
|      | A. Chemistry of Life  
|      | 1. definition of element and atom  
|      | 2. Periodic Table  
|      | 3. elements in living organisms  
|      | B. Atomic Structure  
|      | 1. sub atomic particles  
|      | 1. charge  
|      | 2. mass  
|      | 3. location  
|      | C. Chemical Bonds  
|      | 1. formation  
|      | 1. stability  
|      | 2. valence  
|      | 2. types  
|      | 1. ionic  
|      | 2. covalent  
|      | 3. hydrogen  
|      | 3. compounds vs. molecules  
|      | D. pH and Buffers  
|      | 1. definition of acid, base and salt  
|      | 2. hydrogen and hydroxyl ions  
|      | 3. interpretation of pH scale  
|      | 4. strong and weak acids and bases  
|      | 5. buffers and their significance  
|      | E. Inorganic Compounds  
|      | 1. inorganic vs. organic compounds  
|      | 2. water and its significance to life  
|      | 3. properties of water  
| 2    |
F. Organic Compounds

1. Carbohydrates
   a. chemical composition
   b. dehydration synthesis and hydrolysis
   c. isomers
   d. classes
      1) monosaccharides
      2) disaccharides
      3) polysaccharides
   e. function

2. Protein
   a. chemical composition
   b. amino acids
      1) amino group
      2) carboxyl group
   c. peptide bond formation
   d. formation of polypeptide and protein
   e. functions
   f. proteins as enzymes
      1) definition of enzyme
      2) properties of enzyme
      3) action of enzyme
         a) activation energy
         b) induced fit theory
      4) factors that affect enzyme activity

3. Lipids
   a. chemical composition
   b. fats
      1) composition
      2) function
   c. other subgroups

4. Nucleic Acids
   a. DNA
      1) composition of nucleotide
      2) double helix
      3) base pairing
      4) self-replicating molecule
      5) function
   b. RNA
      1) structure
      2) function
      3) contrast with DNA

5. ATP
   a. structure and formation
   b. function
III. Cellular Basis of Life
A. Introduction
1. definition of cell
2. general description
3. cell size and shape
B. Cell Membrane
1. structure
   a. fluid mosaic model
   b. properties and permeability
2. functions
   a. cell transport
      1) passive processes
         a) diffusion
         b) osmosis – isotonic, hypotonic, and isotonic solutions
         c) facilitated diffusion
         d) filtration
         e) dialysis
      2) active transport
         a) active processes
         b) phagocytosis
         c) pinocytosis
   b. other functions
C. Nature of Cytoplasm
1. composition
2. consistency
D. Organelles and Inclusions
1. microtubules and microfilaments
2. endoplasmic reticulum
3. ribosome
4. Golgi body
5. lysosome
6. peroxisome
7. mitochondrion
8. plastids
   a. chromoplast (chloroplast)
   b. leucoplast (amyloplast)
9. cilia and flagella
10. basal body
11. centriole
12. vacuole
   a. food
   b. contractile
   c. central
13. others
E. Cell Wall
1. structure
2. composition
3. function

F. Cell Types
1. eukaryotic vs. prokaryotic
   a. classification of living organisms into kingdoms
   b. comparison
2. plant vs. animal
   a. similarities
   b. differences

G. Nucleus
1. structure
2. function

H. Cell Cycle and Cell Division
1. stages of cell cycle
2. definition of cell division
   a. mitotic division process in plants and animals
   b. cytokinesis in plants and animals
   c. meiotic division
      1) spermatogenesis
      2) oogenesis
3. biological significance of mitotic and meiotic division

IV. Cellular Energetics
A. Introduction
1. energy
   a. definition
   b. forms of energy
      1) potential
      2) kinetic
   c. thermodynamics
      1) Law of Conservation of Energy
      2) Law of Entropy
   d. energy flow in living organisms
   e. types of reactions
      1) endergonic
      2) exergonic

B. Photosynthesis
1. balanced equation for photosynthesis
2. photosynthetic reaction described as a series of oxidation-reduction reactions
   a. oxidation and reduction defined
   b. mechanisms of oxidation and reduction
3. overall summary of photosynthesis
4. main phases of photosynthesis
   a. light dependent phase
      1) structure and role of the chloroplast
      2) description and role of photosystems
      3) role of light
         a) propagation of light
         b) absorption spectrum of chlorophyll
         c) action spectrum for photosynthesis
         d) role of accessory pigments
         e) excitation of electrons
      4) cyclic electron flow
      5) non-cyclic electron flow
      6) summary of light dependent phase
         a) comparison of cyclic and non-cyclic electron flow
         b) relationship to light independent phase
   b. light independent phase
      1) site
      2) C02 or Calvin cycle
         a) reduction of C02 to sugar
         b) description of the reactions
      3) Hatch-Slack pathway
      4) possible fates of the synthesized sugar
   c. C4 plants

C. Cellular Respiration
   1. definition
   2. raw materials for cellular respiration and their sources
   3. balanced equation for cellular respiration
   4. common features
      a. stepwise series of reactions
         1) energy released into the cell gradually
         2) formation of biologically important intermediates
         3) specificity of enzymes
         4) role of coenzymes and cofactors
         5) oxidation-reduction reactions
   5. glycolysis
      a. site
      b. reaction sequence
         1) enzymatic breakdown of glucose
         2) exergonic vs. endergonic phase
         3) net energy gain
6. anaerobic respiration – alcoholic and lactic acid formation  
a. site  
b. reaction sequence  
   1) net energy gain  
   2) products  
7. aerobic respiration  
a. site  
b. reaction sequence  
   1) Kreb’s cycle  
   2) electron transport system and oxidative phosphorylation  
8. overall efficiency of cellular respiration  
a. number of ATP’s produced  
b. site of ATP formation  
9. structure of the mitochondria and its relationship to the reactions of cellular respiration  
10. oxidation of lipids and proteins  
a. outline of reaction sequences  
b. comparison of energy yields of each major food type  
D. Chemiosmotic Theory of ATP Synthesis  
1. occurrence in chloroplast  
2. occurrence in mitochondria  

V. Genetics  
A. Concept of Genetics  
1. transmission of hereditary information  
2. translation of inherited information to visible traits  
B. Mendelian Genetics  
1. success of Mendel  
2. Mendel’s laws of inheritance  
C. Patterns of Inheritance  
1. definition of basic terms  
   a. gene and allele  
   b. dominant and recessive  
   c. homozygous and heterozygous  
   d. genotype and phenotype  
2. monohybrid cross  
   a. principle of segregation  
   b. complete dominance  
   c. incomplete dominance  
3. dihybrid cross and principle of independent assortment
4. linked genes
   a. definition
   b. crossing over
   c. chromosome map

5. genic interactions
   a. complimentary
   b. collaboration
   c. epistasis
   d. modifier genes
   e. multiple gene inheritance

6. multiple alleles – ABO blood groups

7. sex-linked inheritance
   a. sex chromosomes vs. autosomes
   b. sex determination
   c. sex-linked genes
      1) colorblindness
      2) hemophilia
   d. sex limited genes
   e. sex influenced genes

D. Nucleic acids as the genetic material
   1. molecular structure of DNA and RNA
   2. properties of DNA
   3. replication of DNA
      a. outline of process
         1) semi conservative replication
         2) enzymes involved

E. Protein Synthesis
   1. relationship between gene and protein
   2. genetic code
   3. outline of major events
   4. m-RNA
      a. role
      b. transcription
      c. codons
   5. ribosomes
      a. function
      b. chemical composition
      c. general structure
      d. location
   6. t-RNA
      a. function
      b. structure
      c. linkage of amino acid to t-RNA
      d. anti-codons
      e. specificity of action
7. polypeptide chain formation
   a. chain initiation
   b. chain elongation
   c. chain termination

F. Slit genes and RNA splicing

G. Alteration in genetic material
   1. genic mutation
      a. definition
      b. types
      c. effects on protein synthesis
   2. chromosomal mutation
      a. definition
      b. change in chromosome number
      c. change in chromosome structure
      d. effect on inheritance

H. Biotechnology
   1. DNA cloning
   2. DNA technology
   3. application

VI. Reproduction
A. Asexual vs. Sexual
B. Human Reproduction
   1. male
      a. anatomy
      b. physiology
   2. female
      a. anatomy
      b. physiology

14 VII. Evolution
A. Introduction
   1. similarity and diversity of life
   2. definition of evolution and natural selection
   3. Lamarck’s theory
   4. contributions of Wells and Wallace
   5. Darwin’s theory and natural selection
B. Mechanism of Evolution
   1. sources of variation
      a. recombination and mutation
      b. isogenes and polymorphic genes
      c. circumstances that can lead to extinction
   2. natural selection acting upon genetic variations
C. Population
   1. definition of population
   2. gene pool
      a. define gene pool, gene flow, genetic equilibrium, and genetic drift
      b. Hardy-Weinberg Law
      c. factors affecting genetic equilibrium

D. Speciation
   1. define species
   2. reproduction isolation
      a. prezygotic mechanisms
      b. postzygotic mechanisms
   3. geographical isolation
      a. allopatric speciation
      b. sympatric speciation
   4. adaptive radiation

E. Adaptation
   1. definition
   2. types of adaptations and examples
      a. structural
      b. behavioral
      c. physiological

F. Patterns of Evolution
   1. divergent
   2. convergent
   3. parallel

G. Evidence for Evolution
<table>
<thead>
<tr>
<th>Week</th>
<th>Laboratory Exercise</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>(1) Introduction to the Laboratory</td>
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<tr>
<td>2</td>
<td>(2) The Microscope</td>
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<tr>
<td>3</td>
<td>(3) Introduction to the Scientific Method</td>
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<tr>
<td>4</td>
<td>(4) Enzymes and Factors That Affect Their Activity</td>
</tr>
<tr>
<td>5</td>
<td>(5) Diffusion and Osmosis (begin)</td>
</tr>
<tr>
<td>6</td>
<td>(5) Diffusion and Osmosis (complete)</td>
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<tr>
<td>7</td>
<td>(6) Examining the Cell</td>
</tr>
<tr>
<td>8</td>
<td>(8) Demonstration of Factors Influencing Photosynthesis (begin)</td>
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<tr>
<td>9</td>
<td>(8) Photosynthesis (complete)</td>
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<tr>
<td></td>
<td>(10) A Demonstration of Cellular Respiration</td>
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<td>10</td>
<td>(11) Experimental Genetics (begin)</td>
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<td>11</td>
<td>(14) Genetic Problems (begin)</td>
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<td>12</td>
<td>(11) Experimental Genetics (complete)</td>
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<td>(14) Genetic Problems</td>
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<tr>
<td>13</td>
<td>(12) Genetic Fingerprinting</td>
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<tr>
<td>14</td>
<td>Test</td>
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