MIDDLESEX COUNTY COLLEGE
EDISON, NEW JERSEY

Course Title: **Basic Biology** Catalog #: **Bio 010**

Class Hours: 3 Laboratory Hours: 3 Credit Hours: Q4

Department Chair: _____ Division Dean: _____ Date: 2007-2008

Prerequisite: None Corequisite: MAT 013

Textbooks for Course:

Author	Title	Publisher	Copyright
Krogh, David	**Biology: A Guide To the Natural World**	**Prentice Hall**	**2004**
Liberson, Fabiano	**Laboratory Manual for Basic Biology 2nd Edition**	**Burgess**	**1993**
Drewes, F.	**How to Study Science 4th Edition**	**Brown**	**2003**

Supplementary Materials: Charts, Films, Loops, Overhead Transparencies, Models, Handouts-Biology Review Sheets

Study Guide: ***A Guide to the Natural World* - 2004**

Catalog Description:
An introduction equivalent to one year of high school biology. The basic principles and terminology of biological sciences. Recommended for students with insufficient backgound in biology to prepare them for college level biology courses.

Course Goals:
1. To prepare students for college level biology courses.
2. To introduce scientific terminology.
3. To introduce the chemical principles which are necessary for an understanding of biology.
4. To develop the concept of the structural organization of living things.
5. To develop proper laboratory techniques.

Course Objectives:
The students shall learn:
1. Basic Laboratory skills such as measurement and microscope use.
2. To communicate effectively using the scientific terminology of the biological and chemical sciences.
3. Basic chemical and biological principles.

COURSE OUTLINE

I. Introduction to Science
   - A. Applied vs. theoretical science
   - B. Physical vs. biological sciences
     how are they related to each other
   - C. Major disciplines of Biology
     Botany, Zoology, Cytology, Microbiology, Genetics, Anatomy, Physiology, Histology

II. Characteristics of Life
   - A. Take in nutrients
     define autotrophs and heterotrophs
   - B. Gas exchange
   - C. Growth and maintenance
   - D. Reproduction
   - E. Respond to stimuli
   - F. Highly organized
   - G. Homeostasis

III. Scientific Method
   - A. The general processes of scientific inquiry
     1. observing
     2. questioning
     3. hypothesizing
     4. experimenting
     5. reasoning to form a conclusion
   - B. Historical examples of use of scientific method
     1. Fleming
     2. Mendel
     3. Koch
   - C. Students should be able to:
     1. write a hypothesis in "if.....then" format
     2. design controlled experiment to test hypothesis
     3. present data clearly in chart, table, or graph form
     4. read data tables etc. and draw conclusions about the hypothesis from the data

IV. Metrics (to be covered in lab)
   Students should know:
   - A. Metric units of measure (m, l, g, celsius)
   - B. Most commonly used prefixes and their numerical value
   - C. How to convert within the metric system by using conversion factors (noEnglish to metric conversions)

D. How to measure length, mass, volume, temperature correctly (using a meter stick, balance, graduated cylinder, thermometer, etc.)

V. Microscope (to be covered in lab)

Students should be able to:

A. Identify and locate the parts of the microscope
B. Know the functions of the parts of the microscope and be able to use them properly to focus
C. Demonstrate proper care of the microscope
D. Calculate total magnification
E. Define and use appropriately the terms:
field size
working distance
parafocal
resolution

VI. Inorganic Chemistry

A. Define:
element
compound
matter
atom
molecule
B. Use the periodic table to determine:
1. atomic mass
2. atomic number
3. number of electrons in outer shell
C. Use the periodic table to draw the structure of atoms (atomic #1-18)
1. calculate number of protons, neutrons, electrons
2. place correct number of subatomic particles in nucleus
3. correctly place electrons into first 3 energy levels (not orbitals)
4. memorize symbols for common elements found in living things
D. Define and give examples of isotopes
E. Describe how atoms react to form compounds
1. ionic bonds
2. covalent bonds (polar & non-polar)
3. hydrogen bonds
4. determine chemical formulae using periodic table
5. understand the meaning of a chemical formula (i.e. what coefficients & subscripts mean)
F. Ions
1. define anion and cation
2. understand how ions form
3. compare electrolytes vs. non-electrolytes

G. Chemical reactions

1. understand how to read a chemical equation
2. recognize whether the reaction is synthesis, decomposition, single or double replacement
3. determine if the equation is balanced (they do not need to know how to balance an equation)
4. relate balanced equations to the law of conservation of matter

H. Solutions
1. define solute and solvent
2. understand concentration
   %concentration
   saturated
   unsaturated
   supersaturated
3. distinguish between true solutions & colloids
4. pH (to be covered in lab)
   a. define acid, base, salt
   b. understand pH scale and be able to recognize the pH of an acid or base
   c. measure pH using litmus paper, pH paper, and pH meter
   d. define butter and understand their importance

I. Explain the properties of water (to be covered in lab)
1. polar molecule
2. hydrogen bonds
3. high specific heat=high boiling point
4. freezing point
5. density
6. surface tension
7. capillary action
8. abilities as a solvent

VII. Organic Chemistry

A. Organic and inorganic compounds
1. definition
2. recognizing formulae as being organic or inorganic

B. Characteristics of Carbon
1. draw the carbon atom
2. understand its ability to form single, double, and triple covalent bonds
3. know the importance of the arrangement of atoms in organic compounds
   a. structural formulae
   b. isomers

C. Distinguish carbohydrates, lipids, proteins, and nucleic acids in terms of:
1. major biological functions

2. formula (kinds of atoms only-no structural formulas)
3. building blocks
4. examples and their functions
    a. carbohydrates: glucose, fructose, sucrose, starch, glycogen, cellulose
    b. lipids: saturated & unsaturated fats, phospholipids, steroids, cholesterol
    c. proteins: fibrous and globular
    d. nucleic acids, ATP, DNA, RNA
5. biochemical tests a Benedict's, Biuret, etc-covered in late) and how to determine a positive reaction for each test

VIII. DNA Replication (Lab and Lec)
- A. Draw structure of DNA (ladder-like arrangement of sugar, phosphates, & N-bases - detailed structural formula)
- B. Describe the process of DNA replication in general terms (not enzymes involved in replication, direction of replication, or Okazaki fragments
- C. Correctly pair N-Bases in DNA
- D. Relate replication to mitosis & meiosis
- E. Know the location in the cell where replication occurs

IX. Protein Synthesis (Lab-Lec)
- A. Structure and function of RNA
- B. RNA synthesis
    1. web sites transcription occurs
    2. when transcription occurs
    3. major events of transcription
    4. make correct sequence of N-bases in RNA from a given strand of DNA
- C. Protein Synthesis
    1. where translation occurs and when it occurs
    2. general function of mRNA, rRNA
    3. significance of codens and anticodons
    4. be able to base fair codons to anticodons
    5. chose the amino acid based on the codons

X. Cells (Lab and Lec)
- A. Define cells - list the levels of organization from subatomicparticles to organism
- B. Describe how cells differ in size and shape

- C. Describe cell structure and function
    1. fluid mosaic model of the cell membrane
    2. nucleus

3. composition of cytoplasm
4. cellular organelles
    a. mitochondria
    b. plastids, eg. chloroplast
    c. lysosome
    d. peroxisomes
    e. vacuoles: food, storage, contractile, pigment
    f. ribosomes
    g. smooth and rough endoplasmic reticulum
    h. Golgi body
    i. centrioles
5. cellular inclusions
6. the cytoskeleton-microtubules and microfilaments
7. cilia and flagella
8. cells walls

XI. Compare animal and plant cell structure

XII. Compare prokaryotic and eukaryotic cells

XIII. Transport mechanisms (Lab and Lecture)
- A. define
    1. concentration
    2. % concentration
    3. concentration gradient
- B. Distinguish between active and passive transport
- C. Define diffusion and give examples
    1. describe the properties of membranes which allow diffusion
    2. list the factors which affect diffusion rate
- D. Define osmosis and give examples
    1. use terms hypotonic, hypertonic, isotonic properly
    2. use terms crenation, lysis, plasmolysis, and turgor properly
- E. Define filtration and give examples
- F. Define facilitated diffusion and describe how it differs from diffusion
- G. Define carrier-mediated active transport (Na-K pump)
- H. Define phagocytosis and pinocytosis and give examples

XIV. Enzymes
- A. Define enzyme and use the following terms properly
    1. catalyst
    2. substrate
    3. active site
- B. Describe enzyme activity in terms of the Lock & Key model
    1. how the model explains enzyme specificity and the effect of pH, temperature, & heavy metals on enzyme activity
    2. define denaturation and how this effects enzyme activity

XVI. ATP-The Energy Storing Compound
- A. Compare the structure of AMP, ADP, ATP
- B. Explain how energy is stored in chemical bonds
- C. Understand the cycle of synthesis and breakdown of ATP to meet energy requirements of the cell.

XVII. Photosynthesis
- A. Define photosynthesis
- B. Know the general equation for photosynthesis
- C. Historical perspectives (optional)
  Contributions of:
  1. Van Helmont
  2. Priestley
  3. Van Neil
- D. Requirements
  1. light
  2. pigments
  3. carbon dioxide
  4. water
  5. ATP
- E. Light Reactions
  1. describe the functions of the light reaction
  2. relate the location of the light reactions to the structures of the chloroplast
  3. understand basic processes
     a. light absorption
     b. function of NADP
     c. oxygen production
     d. ATP formation (brief-no details of chemiosmosis)
- F. Dark Reactions
  1. describe purpose of dark reactions
  2. relate location of dark reactions to structure of chloroplast
  3. describe major events of Calvin cycle
- G. Fate of glucose
  1. conversion to other sugars
  2. conversion to amino acids
  3. conversion to lipids
  4. immediate energy source
  5. storage

XVIII. Cellular Respiration
- A. Define cellular respiration
- B. Describe general equation for cellular respiration
- C. Glycolysis
  1. define

2. input and output
3. role of NAD as electron carrier
4. role of ATP
5. location of glycolysis in cell

D. Aerobic Respiration
1. define
2. relate location to structure of mitochondria
3. Krebs cycle
   a. basic function
   b. input-output

4. electron transport
   a. input-output
   b. role of oxygen as final electron acceptor
   c. ATP production

E. Fermentation (anaerobic respiration)
1. define
2. relate location to cell structure
3. Distinguish between lactic acid fermentation and alcohol fermentation

XIX. Genetics and Cellular Reproduction

XX. The Chromosome

XXI. Cell Cycle
A. Define
B. Distinguish between G1, G2, and S phases of interphase
C. Describe the relative amount of time a cell spends in each phase of cell cycle

XXII. Mitosis (Lab)
A. Diagram cell and recognize structures involved in mitosis
1. Centrioles
2. Spindles
3. Cell plate
4. Cleavage furrow
5. Equator
6. Poles
7. Asters
8. Microtubules

B. Describe the events of:
1. Prophase
2. Metaphase
3. Anaphase

4. Telophase

C. Recognize diagrams and slides of each stage of mitosis

D. Distinguish between mitosis in animals & plants

XXIII. Meiosis (Lab)

A. Distinguish differences between mitosis and meiosis in terms:
1. Purpose
2. Kinds of cells formed
3. Location in body of each process

B. Understand chromosome number
1. Define homologous chromosomes
2. Diploid
3. Haploid

C. Describe events of:
1. Meiosis I
2. Meiosis II
3. Synapses – tetrad formation
4. Crossing – over

XXIV. Genetics – Lab and Lecture

A. Define heredity and genetics

B. Historical Perspective
1. Mendel – describe experiments as they relate to concepts of
-Dominance
-Segregation
-Independent assortment

C. Define
1. Trait
2. Purebred – hybrid
3. Gene
4. Allele
5. Dominant – recessive
6. F1 cross
7. F2 cross
8. Punnett square
9. Gametes
10. Phenotype – genotype
11. Heterozygous – homozygous

D. Solve simple genetics problems
1. Monohybrid and dihybrid crosses involving complete dominance
2. Incomplete dominance
3. X-linkage (colorblindness and hemophilia)

4. Human blood types (multiple alleles and codominance)

E. Determine sex

F. Define and give examples of polygenic inheritance
   1. Height
   2. Skin color

G. Define and give example of sex-influenced traits – male baldness

H. Relate N-base sequence in gene to production of phenotype
   1. How changes in N-base sequence changes protein produced
   2. Types of mutations
      a. Point mutations
      b. Frameshift mutations
   3. Causes of mutations