Advanced Placement Biology
2007/2008

Teaching Philosophy:

I have loved Biology for as long as I can remember, and I teach because I want students to love biology as much as I do. Teaching AP Biology allows me the opportunity to instill that love of biology as well as guide and direct students as they prepare for college. I believe that as a teacher, not only is it my job to teach biology, but perhaps more importantly to teach life lessons. The goals/ lessons I have set for my AP Biology students are…

1) To be critical thinkers and life long learners.
2) To be responsible for their actions, ideas and for their knowledge.
3) To be aware of how advances in science apply to their lives
4) To develop a sound knowledge base and participate in a full laboratory experience.

Text and Resources

1. Campbell, Neil and Jane Reece. Biology. 6th. San Francisco: Benjamin Cummings, 2002.
2. AP Biology Lab Manual. College Board, 2001.
3. Taylor, Martha. Biology Student Study Guide. Benjamin Cummings, 2002.
4. Vodopich, Darrell, and Randy Moore. Biology laboratory Manual. 6th. Boston: McGraw Hill, 2002.
5. Hartman, Glenn, and Jennifer Pfannerstill. Multiple Choice and Free Response Questions in Preparation for the AP Biology Examination. 5th. Brooklyn: 2007,
6. Labs and activities from many varied resources

Course Overview:

AP Biology is a rigorous course which demands personal responsibility from the student. In order for students to plan effectively, they are provided with due dates for all major projects/labs and tests at the beginning of each nine weeks. They are strongly encouraged to complete nightly readings and study each days lecture notes on their own time. Students are required to take the AP Biology test.

- AP biology meets 90 minutes a day for 180 days. However, I plan the course based on 160 days since we take the AP test approximately 10 days before the end of the school year and I allow 5 days prior to the AP Exam for review, additionally, in high school, there are always those days that teaching is impossible due to other distractions, I have 5 such days built into the schedule so I don't fall behind schedule when those days occur. We spend approximately 50 days in lab which exceeds the College Board requirement of 25%.
- Students are responsible for completing reading and written assignments out of class
- All due dates will be strictly enforced. Work that is turned in 1 day late will receive ½ credit, while work 2 days late will not be accepted

- The following is what a typical week looks like. However, this may be modified occasionally to accommodate longer labs or time in the computer lab to work on student projects.
    - Monday: Tests/quizzes over previous weeks work/lecture
    - Tuesday: Lecture
    - Wednesday: Lecture/Prepare for lab
    - Thursday: lab
    - Friday: lab/student work day
- Pop quizzes are given 2-3 times per week as deemed necessary by the instructor. These are over the previous day notes or reading assignment.
- Each unit is tested with 50-100 M.C. questions, many of which are pulled from previously released AP exams. In addition each test has 1 essay from released AP exams, scored using AP scoring guidelines. As the course progresses, I expect the students to become faster on completing their essays. In order to prepare them for the stress of writing timed essays on the AP test, during the last 2-3 months students will be timed on completion of their essay
- Students will complete weekly practice AP essays. Which are assigned on Monday and are due the following Monday.
- Students are required to keep a sketch notebook.

Student projects

- Lab report for each of the 12 AP labs. The lab report will consist of the following sections, corresponding to the steps in the scientific method. These reports may later be used as evidence of completion of the lab component as required for exemption out of the lab section of introductory college biology.
    - Title
    - Abstract
    - Problem statement
    - Research summary
    - Hypothesis
    - Materials list
    - Procedure
    - Data collection
    - Data analysis
    - Conclusion
- Each 9 weeks (4 times a year): Read a scientific journal article and complete an analysis of the article, which emphasizes the potential impact the research could have on society.
- Three nine week projects (one each for the first 3 nine weeks):
    - 1st nine weeks: Select one of the following topics which focuses on the process of science
        - Biologist biography: research the life and times of a biologist (modern or historical), read some of their work and present a biography to the class.
        - Complete a science fair project

- 2nd nine weeks: Read a nonfiction book containing biology content. Analyze and report on the accuracy of the biological content.
- 3rd nine weeks: Select one of the following topics focusing on the environment. Each of these projects will consist of research into methods and techniques used in field studies, completion of the field study, a written report and visual presentation for the community on the field study.
    - Stream/watershed analysis of the creek behind the school
    - Biodiversity survey on the grounds of our school
    - School conservation project

o There is no project for the 4th nine weeks so that we may concentrate our efforts on reviewing for the AP exam.

Grading:

The course will be graded using accumulated points. Points are assigned in the following manner

Assignment	Points
Tests	50-100
9 week projects	100
Scientific Journal Article Analysis	50
Lab reports	50
Quizzes/homework/other assignments	10-50

- At the end of 1st semester students take a semester exam which is cumulative and counts 15% of the semester average
- At the end of 2nd semester students take the state mandated End of Course Test which counts 15% of the semester average

Units:

The units in AP biology are designed around the 9 units described by the College Board in the Biology course requirements. In addition, there will be an emphasis on the 8 major themes of Biology throughout each unit.

8 Major Themes of Biology

A) Science as a process
B) Evolution
C) Energy transfer
D) Continuity and Change
E) Relationship of Structure to Function
F) Regulation
G) Interdependence In Nature
H) Science, Technology and Society

Introduction:

Time line: 3 days

Readings:

1. Campbell Biology chapters 1, 2
2. Internet/journal articles on the Nature of Science—selections vary year to year

Topics:

1. Course overview
2. Major themes in Biology
3. Nature of Science
4. Review Scientific Method

Labs:

1. Scientific Method: Students will review the steps of the Scientific method through a simple controlled experiment

Unit 1: Chemistry of Life: 7 % of course

Time Line: 12 days

Readings:

1. Campbell Biology chapters 3, 4, 5, 6

Topics:

1. Properties of water, specifically as related to its necessity for living organisms' survival
2. pH scale:
    a. adaptations for living organisms to maintain pH of their body fluids
3. Carbon structure
    a. Bonding properties
4. Organic Molecules: structure and function in living organisms
    a. Carbohydrates
    b. Lipids
    c. Nucleic Acids
    d. Proteins
5. Enzyme structure and function
    a. Primary, secondary, tertiary and quaternary bonding
    b. Substrate specificity
    c. Denaturizing
6. ATP—ADP Cycle
7. Metabolic pathways
8. Transformation of energy in living organisms
9. Regulation of metabolic energy

Student activities:

1. Analysis of and written paper regarding the students carbon footprint
2. Student nutrition analysis
3. Polypeptide sequence analysis as evidence for evolution

Labs:

1. Properties of water: Students will conduct inquiry learning to determine the properties of water
2. pH: Students will determine the pH of various substances and fluids from living organisms. They will determine what constitutes an acid and a base
3. AP lab # 2 Enzyme Catalysis

Unit 2: Cells: 10% of course

Time Line: 16 days

Readings:

1. Campbell biology chapters 7, 8, 11, 12

Topics:

1. Compare and contrast prokaryotic and eukaryotic cells
2. Endosymbiotic theory and supporting evidence
3. Cellular organelles: emphasizing relationship between structure and function
    a. A cell is the sum of its parts
    b. Nucleus
    c. Ribosomes
    d. Endomembrane system
        i. ER
        ii. Golgi
        iii. Lysosomes
        iv. Vacuole
        v. Mitochondria
        vi. Chloroplasts
    e. Protein structures
        i. Cytoskeleton
        ii. Cilia
        iii. Flagella
        iv. Spindle apparatus
    f. Cell surfaces
        i. Cell membrane
            1. fluid mosaic model
            2. cell-cell recognition via carbohydrates
        ii. cell wall
        iii. intercellular junctions
4. Cellular transport
    a. Selective permeability
    b. Passive transport
        i. Osmosis
            1. Homeostasis: maintenance of water balance
    c. Transport via membrane proteins:
        i. Facilitated diffusion

ii. Active transport and regulation of transport in terms of maintenance of homeostasis, and effects of failure of active transport mechanisms
    1. ion pumps
    2. co-transport
    3. endocytosis
    4. exocytosis

5. Cell Cycle and Regulation
    a. Function of cell division
        i. Reproduction
        ii. Growth
        iii. Repair
        iv. Distribution of chromosomes to daughter cells
    b. Mitosis
        i. Steps
        ii. Mitotic spindle
    c. Cytokinesis
    d. Binary fission in prokaryotes
    e. Regulation of cell cycle
        i. Molecular controls
        ii. Internal and external cues for instigation of cell division
        iii. Failure of regulation (cancer)

Student Activities

1. Student Essays
    a. Endosymbiotic theory
    b. Compare and contrast prokaryotes and eukaryotes
    c. Homeostasis maintenance via active transport
    d. Cell cycle regulation and failure of
2. 3-dimensional cell cycle model
3. Create a cell structure/function tutorial for publication on the internet

Labs:

1. AP Lab #1: Diffusion and Osmosis
2. Cell structure and function: Students will compare and contrast animal and plant cells using microscopy.
3. AP lab # 3 part A: Mitosis

Unit 3: Cellular Energetics: 8 % of course

Time Line: 12 days

Readings:

1. Campbell Biology chapters 9, 10

Topics:

1. Biochemical pathways
    a. The evolution of biochemical pathways
2. Review ATP-ADP cycle

3. Cellular respiration: Emphasize the role of enzymes and cellular regulation of respiration
    a. Mitochondria structure
    b. Glycolysis
    c. Krebs cycle
    d. Electron Transport Chain
4. Summarize products of cellular respiration
5. Fermentation: Pathways, which organisms under which circumstances
    a. Lactic acid
    b. Alcoholic
6. Chloroplast structure
7. Photosynthetic pathways
    a. Electron transport chain
    b. Light reactions
    c. Calvin cycle
    d. Alternative pathways---CAM, C_3 and C_4
8. Recycling and reuse of compounds between respiration and photosynthesis as an example of interdependence in nature and energy transfer between and within organisms.

Student Activities:

1. Create simple stick and ball models of molecules involved in respiration and photosynthesis to follow changes that occur to these molecules at each step in these processes
2. Student essays
    a. Regulation of biochemical pathways
    b. Alternate photosynthetic methods as adaptations for survival in different environments
    c. The interdependence of organisms as illustrated by photosynthesis/respiration…recycling of molecules.

Labs:

1. AP Lab # 4: Plant Pigments and Photosynthesis
2. AP Lab # 5: Cell respiration

Unit 4: Heredity: 8% of course

Time Line: 12 days

Readings:

1. Campbell Biology chapters 13, 14, 15, p. 354-356
2. Experiments in Plant Hybridization by Gregor Mendel

Topics:

1. Comparison of sexual and asexual reproduction in terms of genetic variation within a species and their relationship to evolution
2. Meiosis and its relationship to sexual reproduction in terms of genetic variation and gametogenesis
    a. Steps of Meiosis
    b. Independent assortment
    c. Crossing over

3. Probability as it relates to expected offspring outcomes
4. Mendelian Genetics
    a. Summarize Mendel's work
    b. Complete monohybrid, dihybrid and trihybrid crosses
    c. Relationship between genotype and phenotype
    d. Sex linkages
    e. Co-dominance and Incomplete dominance
    f. Multiple genes
5. Eukaryotic chromosome structure
6. Chromosomal mutations and their effects (mutations as a vessel for evolution)
7. Reading and analyzing a pedigree
8. Sex determination in sexual reproducing organisms

Student Activities:

1. Construct and analyze karyotypes.
2. Student essays
    a. Summary of Mendel's work
    b. Sources and effects of genetic variation in meiosis
3. Pedigree construction
4. Chromosome modeling

Labs:

1. AP Lab # 3: Part B: Meiosis
2. AP Lab # 4: Genetics of Organisms

Unit 5: Molecular Genetics: 9% of the course

Time Line: 14 days

Readings:

1. Campbell Biology chapters 16, 17, 20, p. 328-340, p. 356-371
2. Excerpt from Double Helix by J. Watson
3. "Molecular Structure Of Nucleic Acids A Structure for Deoxyribose Nucleic Acid" by J. Watson & F. Crick

Topics:

1. History of DNA study and identification of DNA as genetic material
    a. Griffith's experiments
    b. Hershey-Chase experiment
    c. Erwin Chargaff
    d. Watson & Crick
    e. Role of R. Franklin and M. Wilkins
2. DNA
    a. Structure
    b. Replication
3. RNA
    a. 3 unique structures each matched to its specific role in protein synthesis

4. Protein synthesis: Emphasize the relationship between each step and the final product
    a. Transcription
    b. Translation
5. Point mutations on DNA and their role in evolution
6. DNA technology and its implications
    a. Cloning
    b. Recombinant DNA
    c. Genomics
    d. Genetic engineering
7. Control of gene expression occurs in all stages of protein synthesis

Student Activities:

1. Watch Double Helix and complete an analysis
2. Analysis of bioethical issues associated with DNA technology (problem based learning)
3. Create 3-dimensional model of protein synthesis
4. Student essays
    a. Protein synthesis (specifically relate structure of molecules involved to their function)
    b. Summary of the history of DNA research

Labs:

1. AP lab # 6: Molecular Biology
2. Electrophoresis lab: Students will complete electrophoresis on a variety of DNA samples to gain experience in using electrophoresis equipment
3. Forensics lab (if time permits): Student will solve a crime using DNA technology

Unit 6: Evolutionary Biology: 8 % of course

Time Line: 12 days

Readings:

1. Campbell Biology chapters 22, 23, 24, 26
2. Excerpt from On the Origin of Species by C. Darwin
3. Excerpt from Lamarck

Topics:

1. History of evolutionary theory
    a. Evidence of geologic processes sets time frame for evolution
    b. Lamarck
    c. Darwin
        i. Field research
        ii. Origin of species
        iii. Natural selection = evolution
2. Origin of species
        i. Definition of species (and limitations on species)
        ii. Modes of speciation
        iii. How speciation leads to macroevolution

3. Mechanics of Evolution
    a. Population genetics
        i. Emphasize the relationship between Mendelian genetics, individual selection and population evolution
        ii. Hardy-Weinberg theorem
    b. Microevolution
        i. Changes in gene frequency occur from one generation to the next
        ii. Genetic drift
        iii. Natural selection
    c. Causes of genetic variation in an individual and in a population
        i. Mutations
        ii. Sexual recombination
        iii. Diploidy
        iv. Polymorphism
    d. Selection of the fittest
    e. Selection effects
    f. Maintenance of sexual reproduction
    g. "Perfect" organisms
4. Origin of Life
    a. Outline the steps to early life formation
    b. The timeline of history of early life and major adaptive changes

Student Activities:

1. Student essays
    a. Compare and contrast Darwin and Lamarck's theories
    b. Discuss the concept of "Survival of the fittest" and how that relates to natural selection
    c. Explain the connection between Mendelian genetics, genetic variation in an individual and natural selection in a population
2. As a class, create a museum exhibit depicting the origin of life

Labs:

1. Natural selection lab: Students will assess the effects of a changing environment on natural selection
2. AP Lab #8: Population genetics and evolution

Unit 7: Diversity of Organisms: 8% of course

Time line: 12 days

Readings:

1. Campbell Biology chapters 27-34

Topics:

1. This unit will focus on the diversity within the kingdoms as well as the evolutionary relationships between the organisms.
2. Prokaryotes
    a. Bacteria and Archae
    b. Survey of Prokaryotic diversity
        i. Nutritional diversity

c. Structure and function of prokaryotes
    i. Cell wall/capsule
    ii. Motility
    iii. Cellular organization
    iv. Genome
d. Ecological importance of prokaryotes
    i. Nutrient recyclers
    ii. Symbiotic relationships
    iii. Pathogenic prokaryotes
    iv. Uses in research and technology

3. Protists
    a. Survey of Protozoan diversity
        i. nutrition and metabolic functions
        ii. reproduction
        iii. motility
        iv. habitat
    b. Survey of Algae
        i. Photosynthetic pigment
        ii. Reproductive methods
        iii. Habitat
4. Fungi
    a. Fungal lifestyle
        i. Absorptive nutrition
        ii. Reproductive methods
    b. Survey of Fungal diversity (emphasis on different methods of reproduction)
    c. Ecological importance of Fungi
5. Plants
    a. Plant evolution
        i. Necessary adaptations for terrestrial life
    b. Alternation of generation
        i. Steps and significance
    c. Phylum Bryophyta
        i. Characteristics, life cycle, ecological and economic necessity
    d. Vascular Plants
        i. Adaptations of vascular plants
        ii. Seedless plants
            1. examples, life cycle, “coal forests”
        iii. Seed Plants
            1. Reduction of the gametophyte
            2. Evolution of the seed
            3. Pollen
            4. Gymnosperms
                a. Examples, life cycle

5. Angiosperms
    a. Reproductive advantages of the flower
    b. Reproductive advantages of the fruit
    c. Life cycle of angiosperms
    d. Co-evolution of angiosperms and pollinator

6. Animals
    a. Evolution of Animals
    b. Classification
        i. Traditional method: based on body plans
        ii. Modern method: based on molecular systematics
    c. Invertebrate diversity: nutrition, habitat, reproduction, body plan and specialized modifications for survival for each phylum.
        i. Porifera
        ii. Cnidaria
        iii. Ctenophora
        iv. Platyhelminthes
        v. Rotifera
        vi. Lophophorate
        vii. Nemertea
        viii. Mollusca
        ix. Annelida
        x. Nematoda
        xi. Arthropoda
        xii. Echinodermata
    d. Evolutionary relationships between each of the phyla
    e. Vertebrate diversity
        i. Relationship between invertebrate chordates and evolution on vertebrate
        ii. Anatomical features unique to chordates
        iii. Agnathans
        iv. Jawed fish
            1. Class Chondrichthyes
            2. Class Osteichthyes
        v. Tetrapods
            1. Class Amphibia
        vi. Amniotes
            1. Structure of amniotic egg and importance to evolution to land by animals
            2. Class Reptilia
            3. Class Aves (specialized modification for flight)
            4. Class Mammalia
                a. Characteristics
                b. Variations in reproduction
                c. Overview orders of Mammals

f. Hominid evolution
    i. Outline steps of human evolution
    ii. Summarize characteristics of major hominids

Student Activities:

1. Independent study portfolio over the Kingdoms of living organisms. Each Kingdom will have its own section in the portfolio and will consist of specific activities that are required about each Kingdom
2. Leaf collection
3. Analysis/creation of phylogenetic trees
4. Field study and collection of representatives from all Kingdoms
5. Student essays
    a. Describe the importance of bacteria to our world today. Be sure to include bacteria's role in emerging technology (DNA technologies)
    b. Explain the adaptation that were necessary for plants to become successful on land
    c. Describe the co-evolution of plants and pollinators
    d. Compare and contrast the classification of animals based on morphology and using molecular data
    e. Discuss the evolution of humans as overlapping, not linear and elaborate on the contrasting Multiregional and Out of Africa theories.

Labs

1. Survey labs for each of the Kingdoms
    a. Bacteria (collection, colony analysis and identification)
    b. Protists (identification and pond water analysis)
    c. Fungi (diversity survey)
    d. Plants (diversity survey)
    e. Invertebrate animals (diversity survey and comparative anatomy)
2. Hominid skull identification lab: Students will determine and compare the characteristics of various hominid skulls in an attempt to identify human lineage

Unit 8: Structure of Plants and Animals: 32% of course (divided into two subunits)

Unit 8a: Plant Structure and Function:

Time Line: 15 days

Readings:

1. Campbell Biology chapter 35, 36, 38, 39

Topics: All the topics in this unit will emphasize the relationship between structure and function

1. Plant organs
    a. Roots
    b. Stems
    c. Leaves

2. Plant tissues and cell types: Where located in the plant and its function
    a. Ground
    b. Dermal
    c. Vascular
    d. Schlerenchyma
    e. Collenchyma
    f. Parenchyma
3. Meristems and their role in lateral and secondary growth
4. Transport Mechanisms in plants
    a. Cellular transport
    b. Bulk flow
        i. Xylem transport
        ii. Phloem transport
    c. Transpiration regulation
5. Alternation of generation
    a. Evolutionary advantages
    b. Steps involved
    c. Co-evolution of plants and pollinators
6. Signal transduction and plant responses
    a. Hormones
    b. Light
    c. Environmental stimuli
    d. Herbivores and pathogens

Student Activities:

1. Create models of roots, stems and leaves
2. Student essays
    a. Description of the relationship between structure of roots, stems and leaves and their functions. Include specific examples of unique adaptations of each for survival in different conditions.
    b. Explain alternation of generation and the concept of co-evolution. Give specific examples
    c. Describe several specific tropisms and the role each plays in a plants ability to survive its unique environmental conditions

Labs:

1. AP lab # 9: Transpiration
2. Plant tropisms lab: Students will, through a controlled experiment, investigate how light, hormones, and various other stimuli affect plant growth and health
3. Analysis of plant structures (microscope): Students will describe roots, stems and leaves using microscopy
4. Regulation of osmosis through stomata: Students will determine the effects of various solutions on stomata

Unit 8b: Animal Structure and Function:
Time Line: 36 days
Readings:

Campbell Biology Chapter 40-49

Topics: All the topics in this unit will emphasize the relationship between structure and function

1. Overview of animal tissue types
2. Bioenergetics of animals
   a. Ectothermic animal
   b. Inverse relationship between animal size and metabolic activity
3. Dependence of each organ system on all the other organ systems
4. Nutrition
   a. Variations in feeding mechanisms & adaptation in digestive systems for different food sources
   b. Overview of digestive processes:
      i. Organs
      ii. Enzymes
5. Circulation
   a. Comparison of different transport systems across the Animal kingdom
   b. Vertebrate heart structure, arteries, veins and capillaries
      i. Transport mechanisms vary in arteries, veins and capillaries
   c. Blood (connective tissue with a liquid matrix)
      i. Blood components
   d. Cardiovascular disease
6. Gas Exchange
   a. Comparison of different gas exchange mechanisms
   b. Lung structure and function
7. Immunity
   a. Nonspecific defenses
   b. Immune response
   c. Failures and diseases of the immune system
8. Regulation
   a. Regulation of body temperature
   b. Water balance
   c. Excretory system
   d. Endocrine system
9. Nervous system
   a. Functions of the nervous system
   b. Membrane potential (rest, during, and after a nervous impulse)
   c. Brain structure and functions of the different areas of the brain (concentrate on human)

d. Sensory and motor pathways
    i. Eye structure and photoreceptors
    ii. Ear structure and hearing
    iii. Lateral line system
    iv. Equilibrium
    v. Chemoreception
        1. taste
        2. olfaction

10. Reproduction
    a. Asexual and sexual in animal kingdom
        i. Advantages of each (sexual to provide genetic variation, asexual to produce large amounts of offspring)
    b. Mechanisms to ensure reproductive success in Animal kingdom
        i. Internal fertilization (few offspring, greater time investment)
        ii. External fertilization (more offspring, less time investment)

    c. Stages of development in placental mammals
        i. Regulation of development

<u>Student Activities</u>

1. Student essays
    a. Describe bioenergetics and compare the energy requirements of ectotherms, small endotherms and large endotherms
    b. Determine which organ system you believe to be most important and justify your choice
    c. Discuss the relationship between structure and function in animal tissues, give specific examples
    d. Describe the stages of embryological development and the meaning of the statement “embryology recapitulates phylogeny”
2. Disease paper
3. Measure lung capacity
4. 3-dimensional model of digestive system
5. Immune system cartoon

<u>Labs:</u>

1. AP Lab # 10: Physiology of the Circulatory system
2. AP Lab # 11: Animal Behavior
3. Chicken embryology lab: Students will describe the stages of embryological development using fertilized chicken eggs
4. Five senses lab: Students will evaluate the strengths and weaknesses of their five senses
5. Dissections (comparative anatomy): Students will use representative organs from various species to compare determine structure and function of organs
    a. Heart
    b. Brain
    c. Fetal pig

Unit 9: Ecology: 10% of course

Time Line: 16 days

Readings

1. Campbell Biology chapters 50, 52-55
2. Excerpt from Silent Spring by R. Carson

Topics:

1. Distribution of organisms
   a. Biotic factors
   b. Abiotic factors
   c. Climatic factors
2. Biomes: Describe typical climate conditions and organisms present in each
   a. Aquatic
      i. Lakes: Vertical stratification
      ii. Rivers
      iii. Wetlands
      iv. Estuaries
      v. Intertidal
      vi. Coral reef
      vii. Ocean Pelagic
      viii. Benthos
   b. Terrestrial: Identify geographic location, typical climatic conditions, typical flora and fauna.
      i. Tundra
      ii. Coniferous forest
      iii. Temperate deciduous forest
      iv. Temperate grasslands
      v. Chaparral
      vi. Polar and high mountain ice
      vii. Desert
      viii. Savanna
      ix. Tropical Forest
   c. Factors affecting species distribution
3. Population Ecology
   a. Density and spacing of populations
   b. Population growth models
      i. Exponential
      ii. Logistic
   c. Population limiting factors
      i. Density dependent
      ii. Density independent
   d. Human population growth
      i. Exponential
      ii. Human carrying capacity

e. Communities
    i. Species interactions
    ii. Trophic structure
        1. Dominant and keystone species
        2. Top down predator control vs. bottom up nutrients
    iii. Community succession
        1. Human effects on communities
    iv. Biodiversity
        1. species richness: factors affecting
        2. genetic diversity
        3. species diversity
        4. ecosystem diversity

4. Ecosystems
    a. Energy flow determined by trophic structure
    b. Importance of decomposition in an ecosystem
    c. Food webs/food chains
    d. Primary productivity
        i. Ecosystems depend on primary productivity
        ii. Limiting factors on primary productivity in aquatic and terrestrial ecosystems
    e. Secondary productivity
        i. Low energy transfer between levels
    f. Nutrient cycling
        i. Water cycle
        ii. Oxygen/Carbon dioxide cycle
        iii. Nitrogen cycle
        iv. Importance of decomposition to nutrient cycles
    g. Human impact
        i. Disruption of nutrient cycles
            1. Fossil fuel combustion
            2. Toxin concentration in food webs
            3. Climate change
            4. Ozone depletion

5. Conservation Biology
    a. Threats to biodiversity
        i. Habitat destruction
        ii. Introduced species
        iii. Overexploitation
        iv. Food chain disruptions
    b. Conservation methods
        i. Population and species
            1. declining population approach
            2. small population approach
        ii. Community, Ecosystem
            1. Conservation
            2. Restoration

Student Activities:

1. Student report and presentation on a global environmental issue. Include specific information on how this issue is affecting our local community.
2. Create a classroom biosphere
3. Biome travel brochure
4. Work in groups to prepare and carry out a debate on global warming
5. Study population dynamics (assess the effects of adding or removing a species from an ecosystem)
6. Student essays
    a. Discuss the 4 major threats to biodiversity and analyze the role humans play in destruction/conservation
    b. Explain the difference between density dependent and density independent limiting factors. Give specific examples
    c. Describe the major forms of species interactions, give specific examples

Labs:

1. AP Lab # 12: Dissolved oxygen and aquatic primary productivity
2. Population sampling in local forest: Students will assess the validity and accuracy of different sampling techniques by sampling populations in our local forest
3. Population dynamics lab: Students will assess the affects of various species interactions through direct observation.