AP Biology

Overview of AP Biology

Course Times:

The AP Biology course meets 5 days a week. Four days are 42-minute periods devoted to lecture, discussion, activities and testing. The fifth day is an 88-minute double period for lab work. Therefore, this course meets for 6 periods a week for a total of 256 minutes a week, of which at least 88 are devoted to lab work. Total lab time will be a minimum of 25% of instructional time.

Course Summary:

The AP Biology course is built around the four Big Ideas in Biology, which will be integrated throughout the course.

Big Idea #1: The process of evolution drives the diversity and unity of life.
Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
Big Idea #3: Living systems store, retrieve, transmit and respond to information essential to life processes.
Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.

In AP Biology, the students will perform at least 2 labs that relate to the Big Ideas. These labs can be found in the AP Biology Lab Manual for Students, and other labs will be added in as determined by the instructor. The time spent on lab work will allow the students to directly observe biological phenomena, while developing observation and data analysis skills.

Lab activities are hands-on so that students can experience the process of science, not just the results. During lab activities, students will develop and test hypotheses, collect, analyze and present data and clearly present their results. Lab reports will include discussion of the aforementioned areas and also clearly presented tables and graphs.

Students will maintain a laboratory notebook in which they will record lab procedures, data, graphs and analysis.

Textbook:

Biology
Seventh Edition, AP Edition, 2005
Campbell, Neil A., and Jane B. Reece
Prentice Hall
Upper Saddle River, NJ

Lab Manual:

AP Biology Investigative Labs
College Board

Timeline:

Summer Homework

- Read Chapters 1 & 2, Test will be given on the second day of school
- Read Chapter 22 in preparation for the first week of school
- A "Collection" of biological terms will be prepared over the summer. The collection will consist of definitions of biological terms and photographs taken by the students to illustrate other biological terms. Student photos are posted to the class blog where they can be viewed by the entire class: www.michaelsSHSbiology.blogspot.com
    - This assignment was modified from Kim Foglia's summer assignment found at www.explorebiology.com

Article Summaries – ongoing throughout the school year

Throughout the year, students are required to turn in monthly article summaries. I have saved recent issues of *Discover* and *Popular Science* magazines, and indicated articles that are related to the Big Ideas and Enduring Understandings. Each month, each student checks out a magazine and reads at least two articles. They must write up a summary of each article which includes how it is related to topics we have studied in class and to the Big Ideas/Enduring Understandings.

- ***These articles often focus on the human impact on the natural world, or on the societal impact of scientific discoveries. Students are exposed to the ethical dilemmas that go along with scientific progress. This activity requires students to regularly connect their biological and scientific knowledge to social and ethical issues.***

Popular Respresentations of Genetic Technology – at the end of the school year

I have the students read *Jurassic Park* by Michael Crichton. We also watch the movie *GATTACA* in class. Students then write a paper in which they address the implications of our advancements in genetic technology on society. We address the question – "Just because we *can* manipulate DNA, does that mean that we *should*? And, if so, under what circumstances?" This activity makes students examine their own feelings towards genetic technology.

- ***These works focus on the human impact on the natural world, and on the societal impact of scientific discoveries. Students are exposed to the ethical dilemmas that go along with scientific progress. This activity requires students to connect their biological and scientific knowledge to social and ethical issues.***

Unit 1 – Evolution – 3.5 weeks

- Textbook Readings:
  - Chapter 22 – *Descent with Modification: A Darwinian View of Life*
  - Chapter 23 – *Evolution of Populations*
  - Chapter 24 – *The Origin of Species*
  - Chapter 25 – *Phylogeny and Systematics*

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #1: The process of evolution drives the diversity and unity of life.
    - EU 1.A: Change in the genetic makeup of a population over time is evolution.
    - EU 1.B: Organisms are linked by lines of descent from common ancestry.
    - EU 1.C: Life continues to evolve within a changing environment.
    - EU 1.D: The origin of living systems in explained by natural processes.
  - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.
    - EU 4.B: Competition and cooperation are important aspects of biological systems.
    - EU 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

- Labs & Activities
  - Watch Scientific American Frontiers presentation – "Voyage to the Galapagos" – this video presentation exposes students to many of the organisms Darwin encounters, and explains his ideas on natural selection. After viewing the video, students will write a paper explaining the examples of evolution detailed in the video.
  - AP Investigation 1 – *Artificial Selection*
  - AP Investigation 2 – *Mathematical Modeling: Hardy-Weinberg*
  - AP Investigation 3 – *Comparing DNA Sequences to Understand Evolutionary Relationships with BLAST*
  - Population Genetics I: The Hardy-Weinberg Theorem *(Investigating Biology Laboratory Manual, 5th Edition; Judith G. Morgan & M. Eloise Brown Carter)* – students simulate the gene pool of a population over several generations, and under varying conditions. This lab simulates equilibrium, genetic drift and natural selection.
    - ***This lab will allow students to connect Big Idea #1 (Evolution), Enduring Understanding 1.A (change over time) with Big Idea #4 (Interactions), as it connects interactions between an population and its environment with changes in that population over time.***
    - ***As students analyze data from this activity, they will construct graphs of the allele frequencies vs. time for each simulation. These graphs will be analyzed to determine trends in allele frequencies, and predict future changes in the population. This meets Learning Objective 1.1.***
  - "Classification and Phylogenetic Trees" activity, purchased from Flinn Scientific – students sort the "caminalcules" into a phylogenetic tree.

Unit 2 – Cells and Biological Structures – 1 week

- Textbook Readings:
  - Chapter 29 – *Plant Diversity I: How Plants Colonized Land*
    - Section 29.1 – Land plants evolved from green algae
    - Section 29.2 – Land plants possess a set of derived terrestrial adaptations
  - Chapter 32 – *An Introduction to Animal Diversity*
    - Section 32.1 – Animals are multicellular, heterotrophic eukaryotes with tissues that develop from embryonic layers
    - Section 32.3 – Animals can be characterized by "body plans"
  - Chapter 40 – *Basic Principles of Animal Form and Function*
    - Section 40.1 – Physical laws and the environment constrain animal size and shape
    - Section 40.2 – Animal form and function are correlated at all levels of organization
  - Chapter 35 – *Plant Structure, Growth, and Development*
    - Section 35.1 – The plant body has a hierarchy of organs, tissues and cells
    - Section 35.2 – Meristems generate cells for new organs
    - Section 35.3 – Primary growth lengthens roots and shoots
    - Section 35.4 – Secondary growth adds girth to stems and roots in woody plants
  - Chapter 6 – A Tour of the Cell

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #1: The process of evolution drives the diversity and unity of life.
    - EU 1.B: Organisms are linked by lines of descent from common ancestry.
    - EU 1.C: Life continues to evolve within a changing environment.
  - Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
    - EU 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
    - EU 2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.
  - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.

- Labs & Activities
  - Microscopes and Cells *(Investigating Biology Laboratory Manual, 5th Edition; Judith G. Morgan & M. Eloise Brown Carter)* – This lab will re-acquaint students with microscope use and allow them to view typical plant and animal cells.
  - Plant Anatomy *(Investigating Biology Laboratory Manual, 5th Edition; Judith G. Morgan & M. Eloise Brown Carter)* – This lab will allow students to investigate plant tissues, and to identify familiar grocery items as specific plant organs (Grocery Store Botany).

Unit 3 – Water and Biochemistry – 2 weeks

- Textbook Readings:
  - Chapter 3 – *Water and the Fitness of the Environment*
  - Chapter 4 - *Carbon and the Molecular Diversity of Life*
  - Chapter 5 – *The Structure and Function of Macromolecules*

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
    - EU 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
  - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.
    - EU 4.B: Competition and cooperation are important aspects of biological systems.
    - EU 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

- Labs & Activities
  - Molecular Models – Teacher-generated lab in which students use model kits to assemble various organic molecules. This activity helps students to understand molecular structure, the diversity of organic molecules, and isomers.
  - Protein Model Kits – This activity allows students to effectively visualize the four levels of protein structure and how a protein's native conformation is determined via interactions of the amino acid side chains.

    I use the kits made by 3D Molecular Design, and have modified a handout originally created by the Center for BioMolecular Modeling at the Milwaukee School of Engineering.

    - ***During this activity, the students first construct the primary structure of a protein. Then, based on the amino acid sequence they fold their protein into its native conformation, and take a photo. Students then unfold their protein, and mutate one hydrophobic amino acid into a hydrophilic amino acid. They re-fold the protein and compare its conformation to the original one in the photo. This activity meets Learning Objectives 4.2 and 4.3.***

Unit 4 – Cellular Energetics and Metabolism – 4 weeks

- Textbook Readings:
  - Chapter 8 – *An Introduction to Metabolism*
  - Chapter 9 – *Cellular Respiration: Harvesting Chemical Energy*
  - Chapter 10 – *Photosynthesis*
  - Chapter 40 – *Basic Principles of Animal Form and Function*
    - Section 40.3 – Animals use the chemical energy in food to sustain form and function

        - Section 40.4 – Many animals regulate their internal environment within relatively narrow limits
        - Section 40.5 – Thermoregulation contributes to homeostasis and involves anatomy, physiology, and behavior
    - Chatper 41 – *Animal Nutrition*

- Big Ideas and Enduring Understandings to be Addressed:
    - Big Idea #1: The process of evolution drives the diversity and unity of life.
        - EU 1.B: Organisms are linked by lines of descent from common ancestry.
    - Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
        - EU 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
        - EU 2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.
        - EU 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain homeostasis.
        - EU 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
        - EU 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
    - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
        - EU 4.A: Interactions within biological systems lead to complex properties.
        - EU 4.B: Competition and cooperation are important aspects of biological systems.
        - EU 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

- Labs & Activities
    - Enzymes Everywhere – this simulation of enzyme action will demonstrate the factors affecting enzymes and will serve as an introduction the Enzyme Catalysis lab

      I have combined several enzyme simulations into this activity. This activity includes information and diagrams from the *Biology Coloring Workbook* by I. Edward Alcamo, Ph.D., Princeton Review Publishing, 1998. I also have modified the "Toothpickase" lab found at http://www.usask.ca/education/coursework/mcvittiej/bio30unit1/handouts/toothpickase.htm, which in turn was modified from *Toothpickase Biochemistry: Experiments with Enzyme Kinetics* found at http://www.flinnsci.com/index.
    - AP Investigation 13 – *Enzyme Activity*
    - AP Investigation 6 – *Cellular Respiration*
    - AP Investigation 5 – *Photosynthesis*

Unit 5 – Transport – 2.5 weeks

- Textbook Readings:
  - Chapter 7 – *Membrane Structure and Function*
  - Chapter 36 – *Transport in Vascular Plants*
  - Chapter 42 – *Circulation and Gas Exchange*
  - Chapter 44 – *Osmoregulation and Excretion*

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #1: The process of evolution drives the diversity and unity of life.
    - EU 1.B: Organisms are linked by lines of descent from common ancestry.
  - Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
    - EU 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
    - EU 2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.
    - EU 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain homeostasis.
    - EU 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
    - EU 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
  - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.
    - EU 4.B: Competition and cooperation are important aspects of biological systems.

- Labs & Activities
  - Construction of models of the cell membrane and use of those models to demonstrate the transport mechanisms used by cells.
    - ***Construction of these models and demonstrating them to the other students in the class will meet Learning Objective 2.11.***
  - AP Investigation 4 – *Diffusion and Osmosis*
  - AP Investigation 11 – *Transpiration*
  - Sheep Heart Dissection – This lab will allow the students to directly observe the structures of the mammalian heart.
  - Cardiovascular Physiology Lab (AP Lab Manual, Lab #10) – This lab will allow the students to determine the effects of various scenarios on human blood pressure.

Unit 6 – Communication – 4 weeks

- Textbook Readings:
  - Chapter 11 – *Cell Communication*
  - Chapter 39 – *Plant Responses to Internal and External Signals*
    - Section 39.2 – Plant hormones help coordinate growth, development, and responses to stimuli
    - Section 39.3 – Responses to light are critical for plant success
    - Section 39.4 – Plants respond to a wide variety of stimuli other than light
  - Chapter 45 – *Hormones and the Endocrine System*
  - Chapter 48 – *Nervous Systems*
    - Section 48.1 – Nervous systems consist of circuits of neurons and supporting cells
    - Section 48.2 – Ion pumps and ion channels maintain the resting potential of a neuron
    - Section 48.3 – Action potentials are the signals conducted by axons
    - Section 48.4 – Neurons communicate with other cells at synapses
    - Section 48.5 – The vertebrate nervous system is regionally specialized
  - Chapter 49 – *Sensory and Motor Mechanisms*
  - Chapter 43 – *The Immune System*
  - Chapter 39 – *Plant Responses to Internal and External Signals*
    - Section 39.5 – Plants defend themselves against herbivores and pathogens

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #1: The process of evolution drives the diversity and unity of life.
    - EU 1.B: Organisms are linked by lines of descent from common ancestry.
  - Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
    - EU 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain homeostasis.
    - EU 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
    - EU 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
  - Big Idea #3: Living Systems store, retrieve, transmit and respond to information essential to life processes.
    - EU 3.B: Expression of genetic information involves cellular and molecular mechanisms.
    - EU 3.D: Cells communicate by generating, transmitting and receiving chemical signals.
    - EU 3.E: Transmission of information results in changes within and between biological systems.
  - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.

        - EU 4.B: Competition and cooperation are important aspects of biological systems.

- Labs & Activities
    - Germination/Tropism Activity – Teacher-generated lab in which students will germinate seeds in various positions in order to observe gravitropism.
    - Sheep Brain Dissection – This activity will allow students to directly observe the structures of the mammalian brain.
    - Disease Transmission Simulation – This activity will allow students to simulate the spread of disease through a population, and also incorporates organisms' behaviors into the simulation.
    - SimGerm 1.0 – This is an online simulation of immune function. It is found at http://ldt.stanford.edu/~johnwong/masters/prototype.html#
    - Video - http://www.youtube.com/watch?v=vMG-LWyNcAs Video of a caterpillar that has been parasitized by wasp larvae – plants release volatile chemicals to attract the wasps, which then lay eggs in the caterpillars that are eating the plant's leaves.

Unit 7 – DNA/Protein Synthesis/Gene Expression – 2 weeks

- Textbook Readings:
    - Chapter 16 – *The Molecular Basis of Inheritance*
    - Chapter 17 – *From Gene to Protein*
    - Chapter 18 – *The Genetics of Viruses and Bacteria*
        - Section 18.3 – Rapid reproduction, mutation, and genetic recombination contribute to the genetic diversity of bacteria
        - Section 18.4 – Individual bacteria respond to environmental change by regulating their gene expression
    - Chapter 19 – *Eukaryotic Genomes: Organization, Regulation, and Evolution*
        - Section 19.1 – Chromatin structure is based on successive levels of DNA packing
        - Section 19.2 – Gene expression can be regulated at any stage, but the key stage is transcription
        - Section 19.4 – Eukaryotic genomes can have many noncoding DNA sequences in addition to genes
        - Section 19.5 – Duplications, rearrangements, and mutations of DNA contribute to genome evolution
    - Chapter 21 – *The Genetic Basis of Development*
        - Section 21.2 – Different cell types result from differential gene expression in cells with the same DNA

- Big Ideas and Enduring Understandings to be Addressed:
    - Big Idea #1: The process of evolution drives the diversity and unity of life.
        - EU 1.A: Change in the genetic makeup of a population over time is evolution.
        - EU 1.B: Organisms are linked by lines of descent from common ancestry.

- Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
  - EU 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
- Big Idea #3: Living Systems store, retrieve, transmit and respond to information essential to life processes.
  - EU 3.A: Heritable information provides for continuity of life.
  - EU 3.B: Expression of genetic information involves cellular and molecular mechanisms.
  - EU 3.C: The processing of genetic information is imperfect and is a source of genetic variation.
- Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
  - EU 4.A: Interactions within biological systems lead to complex properties.

- Labs & Activities
  - Protein Synthesis Modeling – Students will model the processes of transcription and translation, allowing them to visualize protein synthesis

    This activity combines information and diagrams from the *Biology Coloring Workbook* by I. Edward Alcamo, Ph.D., Princeton Review Publishing, 1998, with a simulation of protein synthesis that I designed.

<u>Unit 8 – DNA Technology – 1 week</u>

- Textbook Readings:
  - Chapter 20 – *DNA Technology and Genomics*
  - Chapter 38 – *Angiosperm Reproduction and Biotechnology*
    - Section 38.4 – Plant biotechnology is transforming agriculture

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #3: Living Systems store, retrieve, transmit and respond to information essential to life processes.
    - EU 3.A: Heritable information provides for continuity of life.
    - EU 3.B: Expression of genetic information involves cellular and molecular mechanisms.
    - EU 3.C: The processing of genetic information is imperfect and is a source of genetic variation.
  - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.

- Labs & Activities
  - Virtual Transgenic Flylab – online activity from the Howard Hughes Medical Institute – Students create virtual transgenic fruit flies and use them in virtual experiments on circadian rhythms. It can be found at http://www.hhmi.org/biointeractive/vlabs/transgenic_fly/

- AP Investigation 8 – Biotechnology: Bacterial Transformation
  - ***This lab will allow students to connect Big Idea #3 (Information), Enduring Understanding 3.B (gene expression) with Big Idea #1 (Evolution) as it utilizes the universal genetic code shared by all organisms.***
- AP Investigation 9 – Biotechnology: Restriction Enzyme Analysis of DNA

<u>Unit 9 – Cell Division & Reproduction – 2 weeks</u>

- Textbook Readings:
  - Chapter 12 – *The Cell Cycle*
  - Chapter 13 – *Meiosis and Sexual Life Cycles*
  - Chapter 29 – *Plant Diversity I: How Plants Colonized Earth*
    - Section 29.3 – The life cycles of mosses and other bryophytes are dominated by the gametophyte stage
    - Section 29.4 – Ferns and other seedless vascular plants formed the first forests
  - Chapter 30 – *Plant Diversity II: The Evolution of Seed Plants*
    - Section 30.1 – The reduced gametophytes of seed plants are protected in ovules and pollen grains
    - Section 30.2 – Gymnosperms bear "naked" seeds, typically on cones
    - Section 30.3 – The reproductive adaptations of angiosperms include flowers and fruits
  - Chapter 38 – *Angiosperm Reproduction and Biotechnology*
    - Section 38.1 – Pollination allows gametes to come together within a flower
    - Section 38.2 – After fertilization, ovules develop into seeds and ovaries into fruits
    - Section 38.3 – Many flowering plants clone themselves by asexual reproduction
  - Chapter 46 – *Animal Reproduction*
  - Chapter 47 – *Animal Development*
  - Chapter 21 – *The Genetic Basis of Development*
    - Section 21.3 – Pattern formation in animals and plants results from similar genetic and cellular mechanisms

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #1: The process of evolution drives the diversity and unity of life.
    - EU 1.A: Change in the genetic makeup of a population over time is evolution.
    - EU 1.B: Organisms are linked by lines of descent from common ancestry.
  - Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
    - EU 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
    - EU 2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.

        - EU 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain homeostasis.
        - EU 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
        - EU 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
    - Big Idea #3: Living Systems store, retrieve, transmit and respond to information essential to life processes.
        - EU 3.A: Heritable information provides for continuity of life.
        - EU 3.B: Expression of genetic information involves cellular and molecular mechanisms.
    - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
        - EU 4.A: Interactions within biological systems lead to complex properties.
        - EU 4.B: Competition and cooperation are important aspects of biological systems.

- Labs & Activities
    - AP Investigation 7 – Cell Division: Mitosis and Meiosis
    - Plant Diversity II: Seed Plants *(Investigating Biology Laboratory Manual, 5th Edition; Judith G. Morgan & M. Eloise Brown Carter)* – This lab will allow students to investigate and dissect flowers. They will also determine the likely pollination mechanism used by each plant.
        - ***This lab will allow students to connect Big Idea #4 (Interactions), Enduring Understanding 4.A (Interactions lead to complex properties) with Big Ideas #3 (Genetic Information/Reproduction) and #1 (Evolution). Students will observe heritable traits in the plants and relate that to each plant's interactions with its pollinators, and how those interactions confer a survival advantage.***

<u>Unit 10 – Genetics – 2.5 weeks</u>

- Textbook Readings:
    - Chapter 14 – *Mendel and the Gene Idea*
    - Chapter 15 – *The Chromosomal Basis of Inheritance*

- Big Ideas and Enduring Understandings to be Addressed:
    - Big Idea #1: The process of evolution drives the diversity and unity of life.
        - EU 1.A: Change in the genetic makeup of a population over time is evolution.
        - EU 1.B: Organisms are linked by lines of descent from common ancestry.
    - Big Idea #3: Living Systems store, retrieve, transmit and respond to information essential to life processes.
        - EU 3.A: Heritable information provides for continuity of life.
        - EU 3.C: The processing of genetic information is imperfect and is a source of genetic variation.

- Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.

- Labs & Activities
    - Human Genetic Traits – Students will survey traits found in the class, construct and analyze a karyotype and perform pedigree analysis

      This is Lab 15 in *Biology in the Laboratory, 3rd edition;* Helms, Doris R., Carl W. Helms, Robert J. Kosinski, John R. Cummings; W.H. Freeman and Company, New York, NY, 1998
        - ***As students work through this activity, they will construct a karyotype and analyze it for chromosomal abnormalities. They will evaluate a case study, and describe how they would counsel the family. They will construct and analyze a pedigree based on the case study. They will solve genetics problems involving Mendelian inheritance, sex-linked inheritance, and the inheritance of human blood types. This will serve to meet Learning Objectives 3.14 and 3.16.***
    - BioLab Fly – purchased from Carolina. This is a CD-ROM simulation that allows students to perform F_1 and F_2 crosses with *Drosophila* and analyze the results.

<u>Unit 11 – Diversity of Life – 2 weeks</u>

- Textbook Readings:
    - Chapter 26 – *The Tree of Life: An Introduction to Biological Diversity*
    - Chapter 18 – *The Genetics of Viruses and Bacteria*
        - Section 18.1 – A virus has a genome but can reproduce only inside a host cell
        - Section 18.2 – Viruses, viroids, and prions are formidable pathogens in plants and animals
    - Chapter 27 – *Prokaryotes*
        - Section 27.1 – Structural, functional, and genetic adaptations contribute to prokaryote success
        - Section 27.2 – A great diversity of nutritional and metabolic adaptations have evolved in prokaryotes
    - Chapter 28 – *Protists*
        - Section 28.1 – Protists are an extremely diverse assortment of eukaryotes
    - Chapter 31 – *Fungi*
        - Section 31.1 – Fungi are heterotrophs that feed by absorption
        - Section 31.2 – Fungi produce spores through sexual or asexual life cycles
    - Chapter 33 – *Invertebrates*
    - Chapter 34 – *Vertebrates*

- Big Ideas and Enduring Understandings to be Addressed:
    - Big Idea #1: The process of evolution drives the diversity and unity of life.
        - EU 1.A: Change in the genetic makeup of a population over time is evolution.
        - EU 1.B: Organisms are linked by lines of descent from common ancestry.
        - EU 1.C: Life continues to evolve within a changing environment.
        - EU 1.D: The origin of living systems in explained by natural processes.

- Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
    - EU 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
    - EU 2.B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.
    - EU 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain homeostasis.
    - EU 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
    - EU 2.E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.
- Big Idea #3: Living Systems store, retrieve, transmit and respond to information essential to life processes.
    - EU 3.A: Heritable information provides for continuity of life.
- Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.
    - EU 4.B: Competition and cooperation are important aspects of biological systems.
    - EU 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

- Labs & Activities
    - Fetal Pig Dissection – This activity will allow students to bring together their understanding of mammalian organ systems and animal evolution as they examine the internal anatomy of the fetal pig.

<u>Unit 12 – Ecology – 2 weeks</u>

- Textbook Readings:
    - Chapter 50 – *An Introduction to Ecology and the Biosphere*
    - Chapter 52 – *Population Ecology*
    - Chapter 27 – *Prokaryotes*
        - Section 27.4 – Prokaryotes play crucial roles in the biosphere
        - Section 27.5 – Prokaryotes have both harmful and beneficial impacts on humans
    - Chapter 30 – *Plant Diversity II: The Evolution of Seed Plants*
        - Section 30.4 – Human welfare depends greatly on seed plants
    - Chapter 37 – *Plant Nutrition*
        - Section 37.4 – Plant nutritional adaptations often involve interactions with other organisms
    - Chapter 53 – *Community Ecology*
    - Chapter 54 – *Ecosystems*
    - Chapter 51 – *Behavioral Ecology*

- Chapter 55 – *Conservation Biology and Restoration Ecology*

- Big Ideas and Enduring Understandings to be Addressed:
  - Big Idea #1: The process of evolution drives the diversity and unity of life.
    - EU 1.A: Change in the genetic makeup of a population over time is evolution.
    - EU 1.B: Organisms are linked by lines of descent from common ancestry.
    - EU 1.C: Life continues to evolve within a changing environment.
  - Big Idea #2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
    - EU 2.A: Growth, reproduction and maintenance of the organization of living systems require free energy and matter.
    - EU 2.C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain homeostasis.
    - EU 2.D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.
  - Big Idea #3: Living Systems store, retrieve, transmit and respond to information essential to life processes.
    - EU 3.E: Transmission of information results in changes within and between biological systems.
  - Big Idea #4: Biological systems interact, and these systems and their interactions possess complex properties.
    - EU 4.A: Interactions within biological systems lead to complex properties.
    - EU 4.B: Competition and cooperation are important aspects of biological systems.
    - EU 4.C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

- Labs & Activities
  - AP Investigation 10 – Energy Dynamics
    - ***This lab will allow students to connect Big Idea #2 (Metabolism/Energy), Enduring Understanding 2.D (homeostasis is affected by the environment) with Big Idea #4 (Interactions), as they observe how the interactions between the organisms affect each organism's biomass.***
  - AP Investigation 12 – Fruit Fly Behavior

Summary of the Lab Experience in AP Biology

Big Idea	***Labs***	***Science Practices***
1	AP Investigation 1 – *Artificial Selection*	2 – Mathematics 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 2 – *Mathematical Modeling: Hardy-Weinberg*	2 – Mathematics 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 3 – *Comparing DNA Sequences to Understand Evolutionary Relationships with BLAST*	2 – Mathematics 3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	Population Genetics I: The Hardy-Weinberg Theorem	1 – Representations and Models 2 – Mathematics 3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	Classification and Phylogenetic Trees	1 – Representations and Models 3 – Scientific Questioning 6 – Scientific Explanations and Theories
2	Protein Model Kits	1 – Representations and Models 6 – Scientific Explanations and Theories 7 – Making Connections
	Enzymes Everywhere	1 – Representations and Models 4 – Data Collection 5 – Data Analysis 7 – Making Connections
	AP Investigation 13 – *Enzyme Activity*	1 – Representations and Models 2 – Mathematics 3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 6 – *Cellular Respiration*	1 – Representations and Models 3 – Scientific Questioning 4 – Data Collection

		5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 5 – *Photosynthesis*	1 – Representations and Models 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 4 – *Diffusion and Osmosis*	1 – Representations and Models 3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 11 - *Transpiration*	1 – Representations and Models 3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
3	AP Investigation 8 – *Biotechnology: Bacterial Transformation*	3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 9 – *Biotechnology: Restriction Enzyme Analysis of DNA*	4 – Data Collection 5 – Data Analysis
	AP Investigation 7 – *Cell Division: Mitosis and Meiosis*	4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	Human Genetic Traits	2 – Mathematics 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories
4	Cardiovascular Physiology Lab	4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	Germination/Tropism Activity	3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	Disease Transmission Simulation	3 – Scientific Questioning 5 – Data Analysis

		7 – Making Connections
	Plant Diversity II: Seed Plants	7 – Making Connections
	AP Investigation 10 – Energy Dynamics	2 – Mathematics 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	AP Investigation 12 – Fruit Fly Behavior	3 – Scientific Questioning 4 – Data Collection 5 – Data Analysis 6 – Scientific Explanations and Theories 7 – Making Connections
	Fetal Pig Dissection	7 – Making Connections