School: Rolla High School
Class: Biology II
Classroom Sets:
Additional source materials utilized in the Ecology quarter will be pulled from Applied Biology/Chemistry (CORD), Project WET and Missouri Stream Team.

1st Quarter – Microscope Basics & Botany

Week One: Microscope Basics
Day 1 - Class introductions, expectations, curriculum overview & lab safety.
Day 2 - Finish lab safety & intro. lab equipment. Go over microscope parts and focusing techniques (letter “e” and security on $ and checks).
Day 3 - Field-of-view and -depth activities (colored thread lab). Measuring objects with microscope (lecture, practice, and worksheet).
Day 4 - Review over safety, lab equipment, and measuring live pond water specimens (using “proto-slow”).
Day 5 - Written and lab test over microscope, lab equipment, and safety. (8-20-07)

Botany (Chapters 21, 22, 23 & 24)

Chapter 21 (2 weeks) – What is a plant? (8-31-07)
Objectives:
- Compare and contrast characteristics of algae and plants.
- Identify and evaluate structural adaptations of plants to their land environments.
- Describe the alternation of generations in land plants.
- Describe the phylogenetic relationships among divisions of plants.
- Identify the plant kingdom divisions.
Activities:
- Quarter-long take-home activity for students to attempt to sprout and grow a Kentucky coffee-bean seed.
- Mini-lab over plant cuticle (peeled vs. reg. carrots under osmotic conditions).
- Mini-lab on living or preserved sample of Marchantia (liverwort) structures.
- Examine preserved specimens of non-seed plants.
- Utilize dichotomous key to identify conifers.
- Internet search over medicines derived from plants.

Chapter 22 (2 weeks) – The Diversity of Plants (9-14-07)
Objectives:
- Identify the structures of nonvascular plants.
- Compare and contrast characteristics of the different groups of nonvascular plants.
- Evaluate the significance of plant vascular tissue to life on land.
- Identify and analyze the characteristics of the non-seed vascular plant divisions.
- Identify and analyze the characteristics of seed plants.
- Analyze the advantages of seed and fruit production.

**Activities:**
- Evaluate water absorption capabilities of peat moss.
- Examine preserved mosses, liverworts & hornworts.
- Students will observe the release of spores from a sporangium.
- Students will determine how to tell if a seed is from a monocot or dicot plant and test for the presence of starch in seeds.
- Walk around Ber Juan Park (city park) and identify various species of trees.
- Speaker from MO Dept. of Conservation (Forestry) or National Park Service (Mark Twain National Forest) speaking on “plant adaptations of local species”.

**Chapter 23 (2 weeks) – Plant Structure and Function (9-28-07)**

**Objectives:**
- Identify the major types of plant cells.
- Distinguish among the functions of the different types of plant tissues.
- Identify and compare the structures of roots, stems, and leaves.
- Describe and compare the functions of roots, stems, and leaves.
- Identify the major types of plant hormones.
- Identify and analyze the different types of plant responses.

**Activities:**
- Examine preserved slides of parenchyma, collenchyma, and sclerenchyma cells.
- Examine student-prepared slides of “Wandering Jew” to observe stomata and guard cells and trichomes from local plant samples.
- Mini-lab where students prepare, observe, and determine the function of two plant tissue types (celery tissue).
- Examine preserved slides of monocot and dicot roots and stems and identify the components of the vascular tissue.
- Examine leaves and compare and contrast the leaf type, venation, and arrangement for each leaf.
- Explore effect of auxins and gibberellins on bean sprouts.
- Explore tropisms (photo-, gravi- & thigmo-) on germinated bean seeds.

**Chapter 24 (2 weeks) – Reproduction in Plants (10-12-07)**

**Objectives:**
- Review the steps of alternation of generations.
- Survey and identify methods of reproduction and life cycles of mosses, ferns, and conifers.
- Identify the organs of a flower.
- Examine how photoperiodism influences flowering.
- Survey and identify the methods of reproduction, growth, and development in flowering plants.
- Outline the processes in which cells differentiate during the formation of seeds and fruits during seed germination.

**Activities:**
- Students will use different plant parts (garlic bulb, carrot & potato) to demonstrate asexual reproduction.
- Identify and draw flower anatomy from an assortment of real flowers.
- Students will study and interpret diagrams of flower cross sections.
- Fruit lab where students identify the different types of fruit and seed dispersal methods.
- Compare dormant and germinating monocot and dicot seed embryos.

2nd Quarter – Genetics
(Chapters 10-11(review), 12, 13 & 15)

Chapters 10-11 Quick review over these two chapters (was covered in Biology I): (1 week) – Mendel and Meiosis / DNA and Genes (Quiz on 10-19-07)

Objectives:
- Relate Mendel’s two laws to the results he obtained in his experiments with garden peas.
- Predict the possible offspring of a genetic cross by using a Punnett square.
- Analyze how meiosis maintains a constant number of chromosomes within a species.
- Infer how meiosis leads to variation in a species.
- Relate Mendel’s laws of heredity to the events of meiosis.
- Analyze structure of DNA and how it reproduces itself accurately.
- Relate the concept of the gene to the sequence of nucleotides in DNA.
- Sequence the steps involved in protein synthesis.
- Categorize the different kinds of mutations that can occur in DNA.
- Compare the effects of different kinds of mutations on cells and organisms.

Activities:
- Quarter-long research projects using fruit flies to show various crosses (mono- and dihybrid, sex-linked, etc. crosses over three generations). We will use real fly cultures and Drosophila sciencemuseum.org to model different genetic crosses.
- Perform mono- and dihybrid crosses using Punnett squares to show predicted genotypes and phenotypes.
- Compare alleles on homologous chromosomes.

Chapters 12 (2 weeks) – Mendelian Inheritance of Human Traits (11-2-07)

Objectives:
- Interpret a pedigree.
- Identify human genetic disorders caused by inherited recessive alleles.
- Predict how a human trait can be determined by a simple dominant allele.
- Distinguish between alleles for incomplete dominance and codominance.
- Analyze the pattern of sex-linked inheritance.
- Summarize how internal and external environments affect gene expression.
- Identify codominance, multiple allelic, sex-linked, and polygenic patterns of inheritance in humans.
- Distinguish among conditions that result from extra autosomal or sex chromosomes.

Activities:
- Students will observe a specific human trait and prepare a pedigree.
- Students will use Punnett squares to determine the chance of offspring receiving certain traits.
- Students will work with problems that deal with multiple alleles.
- “Blue-bottle” lab to model the low level of the enzyme “diaphorase” in the Fugates of Troublesome Creek that results in their disorder.
- Research blue people of Troublesome Creek and construct a pedigree from their research.
- Blood typing lab using simulate blood (actual blood typing for those with parent
Students will explore why hemophilia has been called the royal disease. Interpret a karyotype for type of nondisjunction it shows.

**Chapters 13** (3.5 weeks) – Genetic Technology *(11-30-07)*

**Objectives:**
- Predict the outcome of a test cross.
- Evaluate the importance of plant and animal breeding to humans.
- Summarize the steps used to engineer transgenic organisms.
- Give examples of applications and benefits of genetic engineering.
- Analyze how the effect to completely map and sequence the human genome will advance human knowledge.
- Predict future applications of the human genome project.

**Activities:**
- Quarter-long research experiments with fruit flies where they will be performing test crosses.
- Analysis of Eco RI cleavage patterns of Lamda Phage DNA in electrophoresis lab to illustrate restrictive enzymes (EDVO-Kit 112).
- Transformation of E. coli cells with a plasmid containing the green and blue fluorescent protein (EDVO-Kit 222).
- Interpret a pedigree and electrophoresis gel of an Old Order Mennonite family with Maple Syrup Urine Disease.
- VAN Program from University of MO-Columbia with DNA analysis of students’ DNA (Alu-25 and D17S5).

**Chapters 15** (2 weeks) – Natural Selection and the Evidence for Evolution *(12-14-07)*

**Objectives:**
- Summarize Darwin’s theory of natural selection.
- Explain how the structural and physiological adaptations of organisms related to natural selection.
- Distinguish among the types of evidence for evolution.
- Summarize the effects of the different types of natural selection on gene pools.
- Relate changes in genetic equilibrium to mechanisms of speciation.
- Explain the role of natural selection in convergent and divergent evolution.

**Activities:**
- Perform and analyze data from a peppered moth activity modeling natural selection through camouflage.
- Use Internet and GenBank to analyze similarities in protein between various life forms.
- Students will measure and determine that peanut shells vary in length.
- Students will analyze data of allelic frequency using Hardy-Weinberg equation and will simulate natural selection on a population to see how allelic frequency changes.
3rd Quarter – Zoology
(Chapters 26, 27, 28, 29, 30 & 32)

Chapter 26 (2 weeks) – Sponges, Cnidarians, Flatworms, and Roundworms (1/16/08)

Objectives:
- Relate the sessile life of sponges to their food-gathering adaptations.
- Describe the reproductive adaptations of sponges.
- Analyze the relationships among the classes of cnidarians.
- Sequence the stages in the life cycle of a cnidarian.
- Evaluate the adaptations of cnidarians for obtaining food.
- Distinguish between the structural adaptations of parasitic flatworms and free-living planarians.
- Explain how parasitic flatworms are adapted to their way of life.
- Compare and contrast the structural adaptations of roundworms and flatworms.
- Identify the characteristics of four roundworm parasites.

Activities:
- Observe prepared slides of sponge gemmules with a microscope.
- Compare water-holding capacity of grass, yellow, sheep’s wool, and hard head sea sponges against synthetic sponges of equal volume.
- Observe prepared slides of sponge spicules with a microscope.
- Examine prepared slides of budding hydra.
- Students will observe the feeding behavior of live hydra.
- Examine skeletons of various coral types.
- Students will examine live planarians and preserved specimens of flatworms and roundworms.

Chapter 27 (1.5 weeks) – Mollusks and Segmented Worms (1-25-08)

Objectives:
- Identify the characteristics of mollusks.
- Compare the adaptations of gastropod, bivalve, and cephalopod mollusks in their biomes.
- Describe the characteristics of segmented worms and their importance to the survival of these organisms.
- Compare and contrast the classes of segmented worms.

Activities:
- Dissect injected squid to study internal and external anatomy.
- Students will study the life cycle of larval development in a freshwater mussel (examine glochidia (snail larval) encysted in a fish’s fins if available from local stream).
- Students will use a dichotomus key to identify mollusks based on their shells.
- Observe live earthworms to evaluate coordination between its setae, longitudinal, and circular muscles to create movement.
- Dissect injected earthworm to study internal anatomy.
- Examine preserved specimens of different classes mollusks and annelids.

Chapter 28 (1 week) – Arthropods (Lab Test on 2-4-08 & Reg. Test 2-5-08)
Objectives:
- Relate the structural and behavioral adaptations of arthropods to their ability to live in different habitats.
- Analyze the adaptations that make arthropods an evolutionarily successful phylum.
- Compare and contrast the similarities and differences among the major groups of arthropods.
- Explain the adaptations of insects that contribute to their success.

Activities:
- Dissect preserved specimen of crayfish to study external and internal anatomy.
- Students set up an experiment to explore optimum salt concentration for hatching brine shrimp eggs.

Chapter 29 (1 week) – Echinoderms and Invertebrate Chordates (2-13-08)

Objectives:
- Compare similarities and differences among the classes of echinoderms.
- Interpret the evidence biologists have for determining that echinoderms are close relatives of chordates.
- Summarize the characteristics of chordates.
- Explain how invertebrate chordates are related to vertebrates.
- Distinguish between sea squirts and lancelets.

Activities:
- Students will observe the pincher-like structures of pedicellariae.
- Observe, compare and contrast various echinoderms (preserved sea star, sea urchin, sand dollar and sea cucumber).
- Students will study external and internal anatomy of a preserved sea star.
- Students will observe the external appearance of lancelets.

Chapter 30 (1.5 weeks) – Fishes and Amphibians (2-22-08)

Objectives:
- Relate the structural adaptations of fishes to their environments.
- Compare and contrast the characteristics of the different groups of fishes.
- Interpret the phylogeny of fishes.
- Relate the demands of a terrestrial environment to the adaptations of amphibians.
- Relate the evolution of the three-chambered heart to the amphibian lifestyle.

Activities:
- Students will examine the microscopic structure of a fish’s gills and analyze how structure is related to function.
- Students will examine mounts of fish scales to determine ages of various fish.
- Research via the Internet on which species of poison arrow frogs are the most deadly and report on how the toxin affects the physiology of the inflicted individual.

Chapter 32 (1.5 weeks) – Mammals (3-7-08)

Objectives:
- Distinguish mammalian characteristics.
- Explain how the characteristics of mammals enable them to adapt to most habitats on Earth.
- Distinguish among the three groups of living mammals.
- Compare reproduction in egg-laying, pouched, and placental mammals.
Activities:
- Students compare the length of herbivore and carnivore digestive systems.
- Students examine the disarticulated skeletons of small mammals in an owl pellet and determine species based on skull features.
- Dissect and study the external and internal anatomy of preserved white rat.

4th Quarter – Ecology
This quarter is going to be centered around field lab activities. We will be doing bi-weekly water sampling at Ber Juan Lake (testing water quality and zooplankton tows) showing abiotic and biotic trends from mid-March until mid-May. Testing will take one day/2 weeks and analysis of the plankton tows one day/2 weeks. The major areas of study will be water, air, soil, and population dynamics.

Water & Soil Ecology (5 weeks) (4-18-08)
Texts: ChemCom & Natural Resources (CORD), Subunit 5

Objectives:
- Describe the hydrological cycle and distribution of world’s water supply.
- Identify the physical and chemical properties of water.
- Explain how water is a polar molecule and why ionic compounds dissolve in a water solution.
- Solubility of solid and gas solutes in water solvent at various temperatures.
- Identify the biotic and abiotic components of a watershed.
- Identify point and non-point pollution sites.
- Describe how soil is formed from organic and inorganic materials.
- Evaluate how soil layers and soil composition affect soil’s ability to support life.
- Describe how plants are affected by soils lacking in nitrogen, phosphorus or potassium.
- Explain how minerals are cycled through the environment.
- Identify three major soil-related problems and their causes.

Activities:
- “A Drop in the Bucket” from Project WET to highlight that the available fresh water on Earth is limited.
- Fisheries Biologist with Missouri Department of Conservation as guest speaker.
- Use of sling psychrometer to measure relative humidity.
- Explore surface tension and density of water compared to other fluids.
- Explore how to test for abiotic water quality parameters (phosphate, temperature, pH, alkalinity, turbidity, dissolved oxygen, and nitrate-nitrogen).
- Use of a salinity refractometer to measure salinity level.
- Determine the soil texture through relative percentage of sand, silt, and clay particles.
- Determine the pH, nitrogen, phosphorus, and potassium levels of a soil sample through analysis.
- Determine how much nutrient supplements and pH buffers must be added to adjust a given soil plot to grow a particular plant species.
**Tools /Techniques & Man’s Impact** (3 ½ weeks) (5-16-08)
Texts: Watershed Dynamics & Community of Life (CORD), Subunit 4

**Objectives:**
- Students will be able to interpret data on topographic maps related to watersheds.
- Learn techniques to managing aquatic ecology and understanding watershed dynamics.
- Explain how temperatures cycles in a lake may lead to the water overturning in the Spring and Fall.
- Students will be able to do stream-ordering, identification of major tributaries and lakes, elevations of selected sites, and gradient drop of streams using topographic maps.
- Understanding water treatment systems and their impact on the water cycle.
- Students will explore nonrenewable vs. renewable energies utilized by humans and their impact on planet Earth.
- Describe sampling methods for animal populations.
- Explain demographics of biological populations.
- Interpret population growth models.
- Investigate human growth impact on natural ecosystems.

**Activities:**
- Rolla / Dillon quad. topographic map assignment.
- Foul Water Lab to explore techniques utilized at human waste water treatment facilities.
- Use pH indicator (bromothomol blue) to detect relative levels of CO$_2$ dissolved in water after cellular respiration.
- Explore thermoclines and circulation in small-scale models.
- Analyze field testing data from Ber Juan Lake of dissolved oxygen / biochemical oxygen demand related to water temperature.
- Use mark and recapture techniques to estimate a population size.
- Interpret graphs and tables containing demographic information to answer questions about population trends. (Lab 7 in Com. of Life; pg. 146)
- Chart the growth of a population in a more versus less developed countries.
- Internet research on renewable energies.