


Hazelwood School District



High Expectations For All!

Advanced Placement (AP)

Biology

Grades 11-12

Dr. Christina Hughes, Science Curriculum Coordinator

Approved by the Hazelwood School District Board of Education on June 19, 2018

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Hazelwood School District

Mission Statement

We are a collaborative learning community guided by a relentless focus to ensure each student achieves maximum growth

Vision Statement

HSD will foster lifelong learners, productive citizens, and responsible leaders for an ever-evolving society.

Board of Education on January 5, 2010

Goals

Goal #1: Hazelwood students will meet or exceed state standards in all curricular area with emphasis in reading, writing, mathematics, science and social studies.

Goal #2: Hazelwood staff will acquire and apply skills necessary for improving student achievement.

Goal #3: Hazelwood School District, the community, and all families will support the learning of all children.

Curriculum Overview

AP Biology is an introductory college-level biology course. Students cultivate their understanding of biology through inquiry-based investigations as they explore the following topics: evolution, cellular processes — energy and communication, genetics, information transfer, ecology, and interactions.

The revised AP[®] Biology course addresses this challenge by shifting from a traditional “content coverage” model of instruction to one that focuses on enduring, conceptual understandings and the content that supports them. This approach will enable students to spend less time on factual recall and more time on inquiry-based learning of essential concepts, and will help them develop the reasoning skills necessary to engage in the science practices used throughout their study of AP Biology.

To foster this deeper level of learning, the breadth of content coverage in AP Biology is defined in a way that distinguishes content essential to support the enduring understandings from the many examples or applications that can overburden the course. Illustrative examples are provided that offer teachers a variety of optional instructional contexts to help their students achieve deeper understanding. Additionally, content that is outside the scope of the course and exam is also identified.

Students who take an AP Biology course using this curriculum framework as its foundation will also develop advanced inquiry and reasoning skills, such as designing a plan for collecting data, analyzing data, applying mathematical routines, and connecting concepts in and across domains. The result will be readiness for the study of advanced topics in subsequent college courses — a goal of every AP course.

The revised AP Biology course is equivalent to a two-semester college introductory biology course and has been endorsed enthusiastically by higher education officials. The prerequisites for AP Biology are high school courses in biology and chemistry.

Twenty-five percent of instructional time is devoted to hands-on laboratory work with an emphasis on inquiry-based investigations. Investigations require students to ask questions, make observations and predictions, design experiments, analyze data, and construct arguments in a collaborative setting, where they direct and monitor their progress.

Hands-on laboratory work will emphasize inquiry based investigations that provide students with opportunities to apply the science practices.

The course is based on four Big Ideas, which encompass core scientific principles, theories, and processes that cut across traditional boundaries and provide a broad way of thinking about living organisms and biological systems. The following are the Big Ideas:

- Big Idea 1: Evolution
- Big Idea 2: Cellular Processes
- Big Idea 3: Cell Cycle, Mitosis, and Meiosis
- Big Idea 4: Ecology

Taken from AP Central

<https://apcentral.collegeboard.org/pdf/ap-biology-course-and-exam-description.pdf?course=ap-biology>

COURSE TITLE: Advanced Placement (AP) Biology

GRADE LEVEL: 11-12

CONTENT AREA: Science

Course Description:

Students will study the scientific method, biochemistry, and cell structure and function from a standpoint of application to scientific research. The scientific method of problem solving, laboratory experience, essay writing, and independent projects will be emphasized. This course is designed to prepare students for the Biology Advanced Placement exam. During the second semester, students will study cell processes, reproduction and development, and heredity from a standpoint of application to scientific research. Methods of problem solving, laboratory experience, essay writing, and independent projects will be emphasized. Students taking this course are strongly encouraged to take the Advanced Placement exam. Students taking the Advanced Placement exam may receive college credit if they receive a qualifying score.

Course Rationale:

The Advanced Placement Program enables willing and academically prepared students to pursue college-level studies - with the opportunity to earn college credit, advanced placement, or both - while still in high school. AP Biology uses scientific inquiry for investigation throughout the course. This requires students to reason scientifically about scientific principles, theories and processes in order to establish their own understanding of relevant biological information.

Course Scope and Sequence

Big Idea 1: Evolution 10 weeks	Big Idea 2: Cellular Processes –Energy and Communication 8 weeks
Big Idea 3: The Cell Cycle, Mitosis, and Meiosis 10 weeks	Big Idea 4: Ecology 10 weeks

Approved Course Materials and Resources:

Urry, L., Cain, M., Wasserman, S., Minorsky, P., Reece, J. (2018). Campbell: Biology in Focus. Pearson, 11th Edition.

Essential Terminology/Vocabulary

Big Idea 1: Evolution

adaptation, adaptive radiation, allele, allopatric, analogous structure, Ancestor, artificial selection, background extinction rate, biogeography, biological species, cladogenesis, coevolution, common ancestor, comparative anatomy, convergent evolution, Darwin, differential survival, directional selection, disruptive selection, divergent evolution, endosymbiosis, epoch, evo-devo, evolution, evolutionary fitness, extinction, fixation (of alleles), fossil, fossil record, founder effect, gene flow, gene pool, genetic bottleneck, genetic drift, genetic equilibrium, genetic variation, genotype, geologic time scale, geology, gradualism (aka anagenesis), Hardy-Weinberg equation, homologous structures, homology, hybrid, Last Universal Common, mass extinction, migration, Miller-Urey experiments, modern synthesis, molecular clock, mutation, natural selection, paleontology, panspermia, parallel evolution, phenotype, phylogeny, polymorphism, polyploidy, population, postzygotic isolating mechanism, prezygotic isolating mechanism, primordial environment, radiometric dating, random mating, relative dating, reproductive isolation, RNA world, rock strata, speciation, species, stromatolite, sympatric, transitional fossil, and vestigial organ.

Big Idea 2: Cellular Processes: Energy & Communication

absorption spectrum, accessory pigment, acetyl coA, action spectrum, activation energy, active site, allosteric regulation, anabolism, anaerobic metabolism, ATP, autotroph, Calvin cycle, catabolism, catalyst, cellular respiration, chemiosmosis, chemoautotroph, chlorophyll, chloroplast, citric acid cycle, coenzyme, cofactor, compartmentalization, consumer, cyclic electron flow, denaturation, electron transport chain, endergonic reaction, entropy, enzyme, exergonic reaction, feedback inhibition, fermentation, glycolysis, heterotroph, induced fit model, light dependent reactions, light independent reactions, metabolic pathway, mitochondrion, NAD, NADP, negative feedback, non-cyclic electron flow, oxidative phosphorylation, photolysis, photosynthesis, positive feedback, ribulose biphosphate, substrate-level phosphorylation, and thylakoid membrane.

Big Idea 3: The Cell Cycle, Mitosis, and Meiosis

activator, allele, amino acids, anaphase, anticodon, autosome, back cross, base-pairing rules, cancer, cell cycle, cell differentiation, cell division, cellular differentiation, centrioles, chromosome, line, coding strand, codominance, codon, constitutive gene, continuous

variation, cross, crossing over, crossover frequency, cyclin-dependent kinase, cytokinesis, differentiation, dihybrid cross, diploid (2N), discontinuous variation, DNA, DNA ligase, DNA polymerase, DNA replication, dominant, embryonic induction, exons, F1/F2 Generation, fertilization, gamete, gel electrophoresis, gene expression, gene induction, gene repression, genetic code, genetic counseling, genetic engineering, genetic transplantation, genomic imprinting, genotype, haploid (1N), helicase, heterozygous, homeotic genes, homologous chromosomes, homozygous, HOX genes, hydrogen bonding, incomplete dominance, independent assortment, inducible genes, interphase, introns, lac operon, lagging strand, leading strand, lethal allele, linkage, maternal chromosome, meiosis, metaphase, micro RNA (miRNA), mitosis, monohybrid cross, morphogenesis, morphogens, multiple alleles, mutation, non-disjunction, non-nuclear inheritance, nuclear division, nucleic acids, nucleotides, Okazaki fragments, p53, paternal chromosome, pedigree analysis, phenotype, phenotypic plasticity, polygenetic inheritance, polymerase chain reaction, potency, prophase, protein, Punnett square, pure-breeding, recessive, recombination, regulatory sequence, replication fork, repressor, restriction enzyme, reverse transcriptase, RNA (mRNA, rRNA, tRNA, RNAi), segregation, sex-limited traits, sex chromosome, sex linked gene, small interfering RNA (siRNA), small regulatory RNA, somatic cell, specialized cell, start codon/stop codon, synapsis, telophase, template strand, test cross, trait, transcription, transcription factors, transgenic organism, translation, and true-breeding.

Big Idea 4: Ecology

abiotic factor, abundance, active transport, adaptation, age structure, amphipathic, apoptosis, aquaporin, biodiversity, biome, biotic factor, carbon cycle, carrier protein, carrying capacity, cell-mediated immunity, cell wall, centrioles, channel protein, chloroplast, circadian rhythm, climate change, clonal selection, closed circulatory system, communication, community, companion cell, concentration gradient, conservation, cortex, countercurrent exchange, courtship, cyclic AMP (cAMP), cytoplasm, cytoskeleton, decomposer, demography, density dependent factor, dentition, detritovore, diabetes, diastole, diffusion, digestive enzymes, digestive tract, disease, distribution, dopamine, double circulatory system, ecological niche, ecological pyramid, ecological succession, ecosystem, ecosystem stability, ectothermic, electrochemical gradient, electron microscope, endangered species, endocrine signaling, endocytosis, endodermis, endoplasmic reticulum, endothermic, estivation, excretion, exponential growth, extracellular digestion, fibrin, food chain, food web, G-protein linked receptor, gas exchange, gastrovascular cavity, gills, global warming, glucagon, glycolipid, glycoprotein, Golgi apparatus, greenhouse effect, greenhouse gas, gross primary productivity, guard cells, habitat, heart, heart valves, hibernation, HIV, homeostasis, hormone, humoral immunity, hydrologic cycle, hypertonic, hypothalamus, hypotonic, immune response, imprinting, inflammation, inhibition, insulin, integration, interspecific competition, intracellular digestion, intraspecific competition, introduced species, ion pump, isotonic, K-selection, keystone species, kidney, leaf, learning, leukocyte, life history, life tables, ligand, light microscope, limiting factor, logistic growth, loop of henle, lungs, lymphocyte, lysosome, magnification, mark and recapture, membrane, memory cells,

mesophyll, metabolism, migration, mitochondrion, mortality, motor neuron, mutualism, myelin, myosin, necrosis, net primary productivity, neuromuscular junction, neuron, neurotransmitter, nitrogen cycle, nitrogenous waste, nodes of Ranvier, non-specific defense, nuclear envelope, nuclear pore, nutrient cycle, open circulatory system, osmoregulation, page 4, page 5, parasite, passive immunity, pathogen, phagocyte, phagocytosis, phloem, phospholipid, phosphorylation cascade, photoautotroph, photoperiodism, phytochrome, pinocytosis, plasma membrane, plasmolysis, pollution, population, population growth, population size, postsynaptic, predator, pressure-flow hypothesis, presynaptic, primary consumer, primary immune response, prokaryotic cell, protein kinase, pulmonary circulation, quadrat, quorum sensing, rate of increase, receptor, reflex, refractory period, reproductive strategy, resiliency, resolution, respiratory surface, resting potential, ribosome, root, root hair, root pressure, rough ER, r selection, saltatory conduction, saprophyte, Schwann cells, secondary consumer, secondary immune response, second messenger, selectively permeable, sensory neuron, sensory receptor, serotonin, signal cascade, signal transduction, signal transduction pathway, sinoatrial node, skeletal muscle, smooth ER, species diversity, specific defense, stem, stimulus, stomata, survivorship curve, symbiosis, symplast, synapse, T-cell, ten percent rule, threatened species, transpiration, transpirational pull, trophic efficiency, trophic level, urbanization, vaccination, vein, ventricle, villi, xerophyte, and xylem.

Unit Objectives: (Students will...)

Big Idea 1: Evolution

1. Convert a data set from a table of numbers that reflect a change in the genetic makeup of a population over time and apply mathematical methods and conceptual understandings to investigate the cause(s) and effect(s) of this change.
2. Evaluate evidence provided by data to qualitatively and quantitatively investigate role of natural selection in evolution.
3. Analyze data to support the claim that responses to information and communication of information affect natural selection.
4. Apply mathematical methods to data from a real or simulated population to predict what will happen to the population in the future.
5. Evaluate data-based evidence that describes evolutionary changes in the genetic makeup of a population over time.
6. Evaluate evidence provided by data from many scientific disciplines that support biological evolution.
7. Refine evidence based on data from many scientific disciplines that support biological evolution.
8. Design a plan to answer scientific questions regarding how organisms have changed over time using information from morphology, biochemistry, and geology.
9. Connect scientific evidence from many scientific disciplines to support the modern concept of evolution.

10. Construct and/or justify mathematical models, diagrams, or simulations that represent processes of biological evolution.
11. Pose scientific questions about a group of organisms whose relatedness is described by a phylogenetic tree or cladogram in order to (1) identify shared characteristics, (2) make inferences about the evolutionary history of the group, and (3) identify character data that could extend or improve the phylogenetic tree.
12. Construct explanations based on scientific evidence that homeostatic mechanisms reflect continuity due to common ancestry and/or divergence due to adaptation in different environments.

Origin of Species

13. Analyze data related to questions of speciation and extinction throughout Earth's history.
14. Design a plan for collecting data to investigate the scientific claim that speciation and extinction have occurred throughout the Earth's history.
15. Use data from a real or simulated population(s), based on graphs or models and types of selection, to predict what will happen to the population in the future.
16. Justify the selection of data that addresses questions related to reproductive isolation and speciation.
17. Describe speciation in an isolated population and connect it to a change in gene frequency, change in environment, natural selection, and/or genetic drift.
18. Describe a model that represents evolution within a population.
19. Evaluate given data sets that illustrate evolution as an ongoing process.

Big Idea 2: Cellular Processes: Energy & Communication

1. Explain how internal membranes and organelles contribute to cell functions.
2. Make a prediction about the interactions of subcellular organelles.
3. Construct explanations based on scientific evidence as to how interactions of subcellular structures provide essential functions.
4. Use representations and models to analyze situations qualitatively to describe how interactions of subcellular structures, which possess specialized functions, provide essential functions.
5. Use representations and models to pose scientific questions about the properties of cell membranes and selective permeability based on molecular structure.
6. Construct models that connect the movement of molecules across membranes with membrane structure and function.
7. Use representations and models to analyze situations or solve problems qualitatively or quantitatively to investigate whether dynamic homeostasis is maintained by the active movement of molecules across membranes.
8. Use calculated surface area-to-volume ratios to predict which cell(s) might eliminate wastes or procure nutrients faster by diffusion.
9. Explain how cell size and shape affect the overall rate of nutrient intake and the rate of waste elimination.

10. Justify the selection of data regarding the types of molecules that an animal, plant, or bacterium will take up as necessary building blocks and excrete as waste products.
11. Explain the connection between the sequence and the subcomponents of a biological polymer and its properties.
12. Represent graphically or model quantitatively the exchange of molecules between an organism and its environment, and the subsequent use of these molecules to build new molecules that facilitate dynamic homeostasis, growth, and reproduction.
13. Construct explanations based on evidence of how variation in molecular units provides cells with a wider range of functions.
14. Refine representations and models to explain how the subcomponents of a biological polymer and their sequence determine the properties of that polymer.
15. Use models to predict and justify that change in the subcomponents of a biological polymer affect the functionality of the molecule.
16. Analyze data to identify how molecular interactions affect structure and function.
17. Justify the scientific claim that organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.
18. Pose scientific questions that correctly identify essential properties of shared, core life processes that provide insights into the history of life on Earth.
19. Explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization, to grow, and to reproduce.
20. Justify a scientific claim that free energy is required for living systems to maintain organization, to grow, or to reproduce, but that multiple strategies exist in different living systems.
21. Predict how changes in free energy availability affect organisms, populations, and ecosystems.
22. Use representations and models to analyze how cooperative interactions within organisms promote efficiency in the use of energy and matter.
23. Use representations to pose scientific questions about what mechanisms and structural features allow organisms to capture, store, and use free energy.
24. Construct explanations of the mechanisms and structural features of cells that allow organisms to capture, store, or use free energy.
25. Describe specific examples of conserved core biological processes and features shared by all domains or within one domain of life, and how these shared, conserved core processes and features support the concept of common ancestry for all organisms.

Cell Communication/Signaling

26. Describe basic chemical processes for cell communication shared across evolutionary lines of descent.
27. Generate scientific questions involving cell communication as it relates to the process of evolution.
28. Use representation(s) and appropriate and models to describe features of a cell signaling pathway.

29. Construct explanations of cell communication through cell-to-cell direct contact or through chemical signaling.
30. Create representation(s) that depict how cell-to-cell communication occurs by direct contact or from a distance through chemical signaling.
31. Describe a model that expresses the key elements of signal transduction pathways by which a signal is converted to a cellular response.
32. Justify claims based on scientific evidence that changes in signal transduction pathways can alter cellular response.
33. Describe a model that expresses key elements to show how change in signal transduction can alter cellular response.
34. Construct an explanation of how certain drugs affect signal reception and, consequently, signal transduction pathways.

Big Idea 3: The Cell Cycle, Mitosis & Meiosis

1. Make predictions about natural phenomena occurring during the cell cycle.
2. Describe events that occur in the cell cycle.
3. Construct an explanation, using visual representations or narratives, is to how DNA in chromosomes is transmitted to the next generation via mitosis, or meiosis followed by fertilization.
4. Represent the connection between meiosis and increased genetic diversity necessary for evolution.
5. Evaluate evidence provided by data sets to support the claim that heritable information is passed from one generation to another through mitosis, or meiosis followed by fertilization.
6. Construct a representation that connects the process of meiosis to the passage of traits from parent to offspring.
7. Pose questions about the ethical, social, or medical issues surrounding human genetic disorders.
8. Apply mathematical routines to determine Mendelian patterns of inheritance provided by data sets.
9. Explain deviations from Mendel's model of the inheritance of traits.
10. Explain how the inheritance patterns of many traits cannot be accounted for by Mendelian genetics.
11. Describe representations of an appropriate example of inheritance patterns that cannot be explained by Mendel's model of the inheritance of traits.
12. Construct explanations of the influence of environmental factors on the phenotype of an organism.
13. Use evidence to justify a claim that a variety of phenotypic responses to a single environmental factor can result from different genotypes within the population.

Gene to Protein

14. Construct scientific explanations that use the structures and mechanisms of DNA and RNA to support the claim that DNA and, in some cases, that RNA are the primary

sources of heritable information.

15. Justify the selection of data from historical investigations that support the claim that DNA is the source of heritable information.
16. Describe representations and models that illustrate how genetic information is copied for transmission between generations.
17. Describe representations and models illustrating how genetic information is translated into polypeptides.
18. Create a visual representation to illustrate how changes in a DNA nucleotide sequence can result in a change in the polypeptide produced.
19. Predict how a change in a specific DNA or RNA sequence can result in changes in gene expression.

Gene Expression

20. Describe the connection between the regulation of gene expression and observed differences between different kinds of organisms.
21. Explain how the regulation of gene expression is essential for the processes and structures that support efficient cell function.
22. Use representations to describe how gene regulation influences cell products and function.
23. Refine representations to illustrate how interactions between external stimuli and gene expression result in specialization of cells, tissues, and organs.
24. Justify a claim made about the effect(s) on a biological system at the molecular, physiological, or organismal level when given a scenario in which one or more components within a negative regulatory system is altered.
25. Explain how signal pathways mediate gene expression, including how this process can affect protein production.
26. Use representations to describe mechanisms of the regulation of gene expression.
27. Connect concepts in and across domains to show that timing and coordination of specific events are necessary for normal development in an organism and that these events are regulated by multiple mechanisms.
28. Use a graph or diagram to analyze situations or solve problems (quantitatively or qualitatively) that involve timing and coordination of events necessary for normal development in an organism.
29. Justify scientific claims with scientific evidence to show that timing and coordination of several events are necessary for normal development in an organism and that these events are regulated by multiple mechanisms.
30. Describe the role of programmed cell death in development and differentiation, the reuse of molecules, and the maintenance of dynamic homeostasis.

Genetic Engineering

31. Justify the claim that humans can manipulate heritable information by identifying at least two commonly used technologies.
32. Predict how a change in genotype, when expressed as a phenotype, provides a

variation that can be subject to natural selection.

33. Explain the connection between genetic variations in organisms and phenotypic variations in populations.
34. Predict the effects of a change in an environmental factor on the genotypic expression of the phenotype.

Big Idea 4: Ecology

Origin of Life

1. Describe a scientific hypothesis about the origin of life on Earth.
2. Evaluate scientific questions based on hypotheses about the origin of life on Earth.
3. Describe the reasons for revisions of scientific hypotheses of the origin of life on Earth.
4. Evaluate scientific hypotheses about the origin of life on Earth.
5. Evaluate the accuracy and legitimacy of data to answer scientific questions about the origin of life on Earth.
6. Justify the selection of geological, physical, and chemical data that reveal early Earth conditions.

Viruses vs. Cells

7. Construct an explanation of how viruses introduce genetic variation in host organisms.
8. Use representations and appropriate models to describe how viral replication introduces genetic variation in the viral population.

Maintaining Homeostasis

9. Connect how organisms use negative feedback to maintain their internal environments.
10. Evaluate data that show the effect(s) of changes in concentrations of key molecules on negative feedback mechanisms.
11. Make predictions about how organisms use negative feedback mechanisms to maintain their internal environments.
12. Make predictions about how positive feedback mechanisms amplify activities and processes in organisms based on scientific theories and models.
13. Justify that positive feedback mechanisms amplify responses in organisms.
14. Justify the selection of the kind of data needed to answer scientific questions about the relevant mechanism that organisms use to respond to changes in their external environment.
15. Design a plan for collecting data to support the scientific claim that the timing and coordination of physiological events involve regulation.
16. Justify scientific claims with evidence to show how timing and coordination of physiological events involve regulation.
17. Use representations or models to analyze quantitatively and qualitatively the effects of disruptions to dynamic homeostasis in biological systems.
18. Explain how the distribution of ecosystems changes over time by identifying large-scale events that have resulted in these changes in the past.

19. Analyze data to identify phylogenetic patterns or relationships, showing that homeostatic mechanisms reflect both continuity due to common ancestry and change due to evolution in different environments.
20. Connect differences in the environment with the evolution of homeostatic mechanisms.

Interactions with Environment

21. Refine scientific models and questions about the effect of complex biotic and abiotic interactions on all biological systems, from cells and organisms to populations, communities, and ecosystems.
22. Design a plan for collecting data to show that all biological systems (cells, organisms, populations, communities, and ecosystems) are affected by complex biotic and abiotic interactions.
23. Analyze data to identify possible patterns and relationships between a biotic or abiotic factor and a biological system (cells, organisms, populations, communities, or ecosystems).

Behavior

24. Justify scientific claims, using evidence, to describe how timing and coordination of behavioral events in organisms are regulated by several mechanisms. [6.1]
25. Connect concepts in and across domain(s) to predict how environmental factors affect responses to information and change behavior.
26. Analyze data that indicate how organisms exchange information in response to internal changes and external cues, and which can change behavior.
27. Create a representation that describes how organisms exchange information in response to internal changes and external cues, and which can result in changes in behavior.
28. Describe how organisms exchange information in response to internal changes or environmental cues.

Responses and Defenses

29. Create representations and models to describe immune responses. Create representations or models to describe nonspecific immune defenses in plants and animals.
30. Construct an explanation, based on scientific theories and models, about how nervous systems detect external and internal signals, transmit and integrate information, and produce responses.
31. Describe how nervous systems detect external and internal signals.
32. Describe how nervous systems transmit information.
33. Describe how the vertebrate brain integrates information to produce a response. Create a visual representation of complex nervous systems to describe/explain how these systems detect external and internal signals, transmit and integrate information, and produce responses.

34. Create a visual representation to describe how nervous systems detect external and internal signals.
35. Create a visual representation to describe how nervous systems transmit information.
36. Create a visual representation to describe how the vertebrate brain integrates information to produce a response.

Living Together

37. Evaluate scientific questions concerning organisms that exhibit complex properties due to the interaction of their constituent parts.
38. Predict the effects of a change in a component(s) of a biological system on the functionality of an organism(s).
39. Refine representations and models to illustrate bio complexity due to interactions of the constituent parts.
40. Justify the selection of the kind of data needed to answer scientific questions about the interaction of populations within communities.
41. Apply mathematical routines to quantities that describe communities composed of populations of organisms that interact in complex ways.
42. Predict the effects of a change in the community's populations on the community.
43. Predict the effects of a change of matter or energy availability on communities.
44. Use data analysis to refine observations and measurements regarding the effect of population interactions on patterns of species distribution and abundance.
45. Predict consequences of human actions on both local and global ecosystems.
46. Make scientific claims and predictions about how species diversity within an ecosystem influences ecosystem stability.