

Inquiring Minds Want to Know Module 1

Module 1 Description:

Participants will be introduced to the philosophy, the website and resources of National Math and Science Initiative. Lessons will be explored that incorporate inquiry activities and teaching strategies. Each lesson for this day was chosen because it covers content related to each of the four Big Ideas outlined in the AP Biology Curriculum Framework.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- explore deeper content-based knowledge about evolution, photosynthesis, DNA, and biochemistry.
- participate in an activity illustrating natural selection using a simulation.
- create an experiment to illustrate another factor that may affect photosynthesis in leaf discs.
- describe the chemical processes behind extracting DNA and participate in a competition to extract a larger amount of DNA.
- model a teaching strategy for enzymes.
- design an experiment to increase the reaction rate of enzymatic reactions in catalase.
- Use confirmation tests to find various biomolecules within a food specimen.

Bringing Math to Life Module 2

Module 2 Description:

Participants will see how math is integrated in lessons that stem from each Big Idea in AP Biology. These lessons require high levels of math skills and incorporate many concepts at once.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- explore deeper content-based knowledge about Hardy-Weinberg equation, surface area to volume ratios, chi-square, population equations, and rates of diffusion.
- participate in an activity using notecards to illustrate random mating, genetic drift, and mutations calculating allelic and genotypic frequencies using the Hardy-Weinberg equations.
- calculate surface area to volume ratios in various shapes of agar and perform an inquiry-based experiment to increase surface area to volume ratios.
- perform a chi-square analysis on an ear of maize.
- simulate population growth on a theoretical deer population and a bacterial population and compare the two population growths.
- collect data on the effect of various percentages of corn syrup on raw potato pieces and determine the percentage of corn syrup that is isotonic to a raw potato piece.



Oh What a Conceptual Web We Weave Module 3

Module 3 Description:

In this module participants will see the connections teachers should be making between concepts and Big Ideas in the classroom. Many of the lessons span across several concepts at once.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- explore deeper content-based knowledge about variation in populations, meiosis, spermatogenesis and oogenesis, stomatal density, and transpiration.
- construct acceptable outline for free response essays.
- take measurements on plant and hand traits and perform statistics to examine the dispersion of the data.
- model meiosis and participate in a sperm race to an oocyte with pool noodles to determine genotypes and phenotypes.
- calculate stomatal density on monocots and dicots.
- calculate the differences in transpiration rates between monocots and dicots.
- be able to make connections across all the concepts in these lessons.

Lures for Learning Module 4

Module 4 Description:

This is the fourth module of any science training series. Unlike the other training modules, it is presented to a mixed audience of middle school and high school teachers. Participants will explore various types and levels of inquiry through hands-on, minds-on activities. The importance of carefully and strategically aligning both content and science process skills and practices is stressed by highlighting the connections in each of the activities. Building successful students starts in the middle grades and progresses throughout the high school years. This vertical emphasis is accomplished by allowing the participants to have the opportunity to explore the process of inquiry, together, through selected activities from middle grades through physics. This also allows participants to examine their own curriculum and determine the best way to integrate lessons obtained at training within their various grade levels or subjects.

Learner Outcomes:

Participants will

- describe what the Science and Engineering Practices look like within the context of a lesson.
- identify and relate each lesson to Common Core State Standards and Next Generation Science Standards.
- review and make connections to the Big Ideas of AP when applicable.
- demonstrate an understanding of the importance of inquiry strategies that allow students to investigate, explore, discover, and reach conclusions about scientific phenomena.
- perform relevant activities and participate with in-depth discussions that illustrate and promote rigor in the science classroom.
- analyze their curriculum and identify areas in which inquiry could be used to better challenge students and improve their critical thinking skills.
- demonstrate an understanding of the need to align both content and science process skills to the learning of science.
- develop a rich understanding of the philosophy of rigorous instruction in the classroom.



Breathing Diversity into Life Module 5

Module 5 Description:

In this module participants will explore lessons that relate to the idea that the process of evolution drives the diversity and unity of life. The lessons presented also incorporate math, simulations, and models.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- explore deeper content-based knowledge about radioactive isotopes, cladograms, geologic time scales and animal development.
- simulate a model of exponential decay of an isotope, measure percentages of decayed isotopes over known periods of time and determine half-life.
- participate in a radioactive dating simulation to analyze fossils among different strata.
- create a cladogram based on external characteristics and compare it to a cladogram based on BLAST information using the same organisms.
- simulate a geologic time scale.
- complete a phylogenetic tree given embryologic information and create a model of body cavities.

The More Things Change, the More They Stay the Same

Module 6

Module 6 Description:

In this module participants will engage in lessons that relate to the idea that biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis. The lessons presented also incorporate the use of probes, live organisms and microscopes.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- explore deeper content-based knowledge about cell membranes, cellular respiration, alternation of generations, plasmolysis and taxis.
- create models of cell membranes and use them to illustrate hypertonic, hypotonic and isotonic.
- demonstrate the fluidity of a lipid bilayer with bubbles.
- model cellular respiration and measure the respiration rate for crickets in different temperatures.
- create various conditions to measure taxis in planarians.
- create a model of alternation of generations in ferns and draw the sori that are observed under the microscope.
- investigate factors that affect plasmolysis of Elodea and onion cells, identify the tonicity of unknown solutions and design an experiment to determine the solute concentration of Elodea leaves.

The Incredible Inheritable Gene Module 7

Module 7 Description:

In this module participants will engage in lessons that relate to the idea that living systems store, retrieve, transmit and respond to information essential to life processes. These lessons look predominately at the expression of genetic material using models, simulations and statistics.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- explore deeper content-based knowledge about DNA replication and DNA to RNA transcription, genetic crosses, chi-square analysis, karyotypes and cell division.
- create and use models to simulate DNA replication and DNA to RNA transcription.
- simulate the production of gametes and fertilization by using the random number generator.
- count mitotic stages in onion root tips and calculate the percentage of cells in each of the stages.
- analyze simulated karyotypes to determine genetic syndromes.

The Ties that Bind Module 8

Module 8 Description:

In this module participants will engage in lessons that relate to the idea that biological systems interact, and these systems and their interactions possess complex properties. The participants will experience engaging lessons on population ecology, community ecology, and ecosystem ecology.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- explore deeper content-based knowledge about predator/prey dynamics, ecology, ecosystems, and biodiversity.
- evaluate changes in population size and distribution due to density-dependent and density-independent limiting factors by using chi-square analysis.
- measure population growth changes in wolves and elk populations and use the generated graph to analyze predator/prey relationships.
- simulate a predator/prey relationship in populations of wolves and sheep.
- participate in a hands-on activity involving food chains; food webs and energy flow through an ecosystem.
- participate in a hands-on activity involving biodiversity in the Everglades.

Mitosis, Passive Transport and Genetics Module 9

Module 9 Description:

In this module participants will discuss and develop student skills related to mitosis and karyotypes using manipulatives. Passive transport will be explored in two labs using microscopes and graphing calculators.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- perform relevant labs and activities, and participate in in-depth discussions that illustrate and promote rigor in the science classroom.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about mitosis, passive transport, and genetics.

Bacteria, Viruses, and Paramecia

Module 10

Module 10 Description:

In this module participants will discuss common misconceptions in the Biology classroom. Participants will also investigate bacterial transformation, viral transmission, and the trp operon using modeling strategies. Participants will use microscopes to observe a Paramecium feeding process in a traditional wet lab.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about bacterial transformation, transmission of viral diseases, paramecia's response to food and environment, and the operon model of gene expression in prokaryotes.

Plants, Ecology and Evolution Module 11

Module 11 Description:

In this module participants will look at plants, ecology and evolution, and explore lessons related to adaptations and alternation of generations in plants. Participants will demonstrate evolution in the animal kingdom with an in-depth look at the different forms of body cavities and symmetries.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about the light-independent reactions of photosynthesis, the alternation of generations in plants, specific adaptations in plants, and classification of animals.

Enzymes and Body Systems

Module 12

Module 12 Description:

In this module participants will explore strategies for teaching about enzymes and conduct a lab designed to illustrate enzyme-substrate specificity using technology. The body system activities include the endocrine system, respiratory system and the excretory system.

Learner Outcomes:

Participants will

- develop a rich understanding of the philosophy of rigorous instruction in the classroom.
- review and make connections to the Big Ideas of AP Biology.
- examine the Science Practices used with each lesson.
- identify and relate each lesson to Common Core State Standards, Next Generation Science Standards, and AP Biology Curriculum Framework.
- analyze the objectives of the AP exam.
- analyze the attributes of rigorous assessments.
- demonstrate an understanding of the science process skills and how they relate to classroom activities.
- demonstrate a deeper content-based knowledge about enzymes and human body systems.