AP Biology
 Course Syllabus 2018-2019

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Introduction

Advanced Placement Biology affords students the opportunity to complete an introductory course at the college level. This course is focused on the building connections between biology at the cellular and molecular level though biology at the environmental level. It is important for students to understand the role biology has on society and the responsibility that students have to make informed decisions about issues raised by advancements and research in biology.

Course Overview

The curriculum is built around the four Big Ideas in AP Biology. They include the following:

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

The Big Ideas are interconnected and should not be taught in isolation. The students will develop concept maps within each instructional unit throughout the course which are documented as “Connecting Big Ideas” throughout this syllabus. The goal is for students to develop a deeper understanding as to how the Big Ideas connect to the Enduring Understandings.

In order to investigate the four Big Ideas, the curriculum will focus on developed enduring understandings with identified essential knowledge. The essential knowledge in conjunction with the seven science practices are the foundation for the learning objectives for the course. The learning objectives will also serve as the basis for formative and summative assessments.

Laboratory Component

The *AP Biology Lab Manual* will serve as the source for many of the labs. Some of these laboratory investigations are modified to meet the time restrictions of the course or modified to allow the incorporation of probe ware. The course devotes 25% of the instructional time to laboratory exercises. The majority of the laboratory investigations are inquiry based at a variety of levels, from guided to open inquiry. Students will be engaged in a number of additional investigations that supplement the curriculum for this course.

An emphasis is placed on integrating the use of mathematical analysis into the course. Basic, yet essential statistical tools will be utilized to analyze the data collected as laboratory investigations are performed. Example calculations include but are not limited to Chi-square, standard deviation, standard error and the T-test. Additionally, students need to understand the importance of identifying mathematic trends such as generating a line of best fit for appropriate data collected.

A variety of modes are used throughout the course that allows students to present the results of laboratory investigations. These include constructing and presenting mini-posters, developing PowerPoint presentations, conducting peer reviews, and developing traditional laboratory reports. Complete laboratory reports include an introduction, hypothesis, procedure, organized data, a complete statistical analysis of the data, a conclusion with both limitations and recommendations for further investigations.

The seven science practices are incorporated into varying laboratory investigations throughout the course.
The seven science practices are outlined below:

1. *The student can use representations and models to communicate scientific phenomena and solve scientific problems.*
2. *The student can use mathematics appropriately.*
3. *The student can engage in scientific questioning to extend thinking or guide investigations within the context of the AP course.*
4. *The student can plant and implement data collection strategies appropriate to a particular scientific question.*
5. *The student can perform data analysis and evaluation of evidence.*
6. *The student can work with scientific explanations and theories.*
7. *The student is able to connect and relate knowledge across various scales, concepts and representations in and across domains.*

LAB SAFETY AND REQUIRED SAFETY CONTRACT



***Student Expectations/Rules:***

1. There is absolutely **no eating or drinking in my classroom**. You are allowed to have a bottle of water only. Tervis Cups and Yeti or other types of personal lidded cups will be taken up and returned to the student through the front office.
2. Put your **PHONE AWAY** in your backpack or purse. Please see High School Phone Policy for consequences.
3. **Follow directions** the first time they are given.
4. Be in your seat **with all supplies** when the tardy bell rings.
5. Remain seated and attentive until the **teacher** dismisses the class.
6. Students will be respectful and courteous. Inappropriate language and insubordination will not be tolerated.
7. Respect the personal space of others. Keep hands, feet, and other objects to yourself.

***Classroom Materials:***

******Students will need to bring the following items to class **every day** in order to be prepared for class:

* + A willingness to succeed and a questioning mind
	+ Composition Notebook or 100 page Spiral Notebook. (this is for notetaking during lab and classroom lecture)
	+ #2 pencil for all assessments. **NO ASSESSMENT WILL BE ACCEPTED OR GRADED THAT IS WRITTEN IN PEN!**
	+ A scientific or graphing calculator is strongly recommended. Calculators, however, will be provided for each student during class time, but these calculators may not leave the classroom.

***Grades:***

The grades will be calculated by using the percentage you have earned of the total points available for each nine-weeks grading period. Tests will be worth significantly more points than homework or daily grades.

1. **Daily work** - Homework and daily class assignments represent **10%** of the nine week grade.
2. **Quizzes** – Quizzes may be **announced** or **unannounced** (Pop Quiz) and may cover any of the material covered in class. Quizzes represent **30%** of the nine week grade.
3. **Tests** - Tests are announced at least one week in advance and will be composed of multiple choice and free answer questions. Exams will represent **60%** of the final nine weeks grade for the course. There will three major assessments/exams per nine week period.
4. **Notebook** – A Digital Interactive Notebook grade will be taken each nine weeks based upon the student’s use of OneNote. The digital notebook will consist of notes and all work done each nine week including lab reports. The training and format will be covered in class. This grade will be equivalent to Quiz grade of **30%**.
5. **Lab activities/experiments** – Some activities may require some additional outside work. Students may be expected to report on their findings, draw conclusions, and determine mathematical relationships. Labs represent **30%** of the nine week grade.

**YOU MUST MAINTAIN A 75 TO REMAIN IN AP BIOLOGY**

***Lab and Safety****:*

 As with any science class, a portion of your grade will be derived from lab work. You will spend approximately 40% of your time doing hands on activities and experiments. Lab will account for 30% of your grade and full participation in group work is expected.

**ABSOLUTELY NO HORSEPLAY WILL BE TOLERATED**!

Anyone using unsafe lab practices will be excused from the lab and a **zero** will be assigned in the gradebook followed by a phone call home and possible office referral. SAFETY FIRST!

 ***Late work and all the Excuses:***

Homework and other assignments are due at the **beginning** of class. Late work will be accepted up to 3 days late for a 75. After 3 days the grade will become a “0” in the gradebook.

***Make-up Policy:***

EACH STUDENT IS RESPONSIBLE ON THE DAY THEY RETURN TO FIND OUT ABOUT ANY MISSED WORK. The request for missing work should be done before class or after class. Once the tardy bell has sounded, class has begun and all requests for work will be postponed.

STUDENTS WILL BE GIVEN THE SAME AMOUNT OF TIME THAT THEY WERE ABSENT IN ORDER TO COMPLETE MISSED ASSIGNMENTS. Ex: If a student misses 2 days of school they are allowed 2 days to make up any missing work.

* **Work assigned prior to a student’s absence is due upon their return.**
* **Tests and Quizzes missed while absent can only be made up during tutorial times, advisory or after school. You must arrange with me when you would like to schedule your missed test.**
* Students absent the **class day before** a quiz or test **will** take that quiz or test on the scheduled day – tests will be announced at least **one week** in advance; most quizzes will be announced at least **one to two days in advance.**
* This policy applies only to **EXCUSED** absences. Under no circumstances will this apply to truancy in which case the student could receive a zero for missed work and/or exams.

***Test Corrections and Retakes:***

 One retest is allowed per nine weeks period for no more than a 70 and will consist of a different test of the same difficulty. Corrections may be made to any test the student made below a 70 and will provide up to 10 points for recapture up to a new grade of a 70.

***Cheating:***

******Cheating of any form will not be tolerated. Examples of **cheating** include:

* + - copying from another student homework or assignments (ie. labs)
		- allowing another student to copy homework or assignments
		- **plagiarizing** (copying from the internet)
		- using cheat notes
		- talking during an exam or quiz

Any offense in cheating (even just one question) will result in a **zero** for that particular assignment or exam followed by an Office Referral and a phone call home.

In the end, it is you that gets hurt if you cheat. The homework is designed to give you practice solving questions similar to those on the test. Short term gain by turning in a homework assignment that has been copied impacts your long term goals of passing this class….

***Restroom Passes:***

You may obtain the hall pass only if you **surrender your cell phone**. Abuse of the Restroom Policy will by asking to go daily will result in a phone call home and placement on the No Fly List.

TUTORIAL TIMES

AFTER SCHOOL: MONDAY – THURSDAY 2:35 to 3:20

TUTORIALS ALSO AVAILABLE DURING ADVISORY TRAVEL DAYS

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**Unit 1 Microevolution**

Essential Knowledge

* 1.A.1-4; 1.B.2; 1.C.3; 1.D1-2
* 3.D.1

Topics

* Evolution sources of mutation; point mutations substitutions (neutral mutations), frame shift mutations (deletions and additions), chromosomal mutations deletions, translocation, transductions, replications, meiosis recombination, crossing over, random fertilization, mate selection
* Gene pool and allele frequency
* Hardy-Weinberg Equilibrium
* Changes in allele frequency, impact of environment, adaptations, selection pressure
* Genetic drift, founder effect, bottle neck populations
* Sexual selection, directional selection, disruptive selection and stabilizing selections
* Maintaining genetic variability, balanced polymorphism and heterozygote advantage

Labs and Activities

* AP Lab 1 Artificial Selection: Modified using brine shrimp and selecting for a variable.
(SP 1.5, SP 2.2, SP 5.3, SP 7.1)
* AP Lab 2 Mathematical Modeling: Using a spreadsheet to analyze data
(SP 2.1-3; SP 5.1-3; SP 6.1-5)
* Hardy-Weinberg Equilibrium problem set
* Analyzing amino acid sequences to determine relatedness

Connecting Big Ideas

* A discussion of how microevolution is impacted by the environment (Big Idea#1).
* A discussion of how molecular changes (DNA and protein) is ultimately the basis for evolution (Big Idea #2)
* A discussion of how DNA is the blue print for life and provides for the continuity of life through the process of transcription and translation. Changes in the DNA results in changes in phenotypic expression upon which natural selection can act. (Big Idea #3)

**Macroevolution Unit 2**

Essential Knowledge

* 1.A.1-4; 1.B1-2; C.1-3; 1.D1-2
* 2.E.3
* 3.D.1

Topics

* Definition of a species
* Allopatric speciation and geographic isolation (3 reasons why speciation occurs)
* How speciation occurs on a temporal versus spatial scale
* Sympatric speciation
* Rate of evolution gradual versus punctuated
* Origin of life
* Classification and relatedness
* Comparison of three domains of life
* Construction and analysis of cladograms and phylogenetic trees
* Trends in evolution

Labs and Activities

* AP Lab 3 Comparing DNA sequences to understand evolutionary relationships utilizing the BLAST lab to compare genomes and to determine evolutionary history
(SP 4.1-4; SP 5.1-3)
* The Great Clade Race-Used to aid in the understanding of cladograms and phylogenetic trees
(SP 1.1, 1.5, SP 6.2, 6.4)
* Cladogram Problem set for analysis of cladograms and data tables
(SP 1.1, 1.5, SP 6.2, 6.4)

Connecting Big Ideas

* A discussion of how the environment impacts evolution (Big Idea#1)
* A discussion of how timing and coordination of behavior are regulated by various mechanisms and are important in natural selection (Big Idea #2)
* A discussion of how interactions between and within populations influence patterns of species distribution and abundance (Big Idea #4)

**Unit 3 Ecology**

Essential Knowledge

* 1.A.1-4; 1.B1
* 2.A.1-3; 2.C.2;2.D1-4
* 3.E.1-2
* 4.A.5-6; 4.B.2-4; 4.C.3-4

Topics

* Population structure and growth, human population and growth*, K*-strategies versus *r*-strategies
* Energy and the environment, energy pyramids, population pyramids, food webs
* Community ecology, concept of a niche, intra-and interspecific competition resource partitioning
* Biogeochemical cycles: carbon cycle, water cycle, nitrogen cycle, phosphorous cycle, and eutrophication
* Investigation of behavior, learned behavior, innate behavior and other pertinent examples

Labs and Activities

* AP Lab 12: Animal behavior: Open inquiry lab to investigate the behavior of pill bugs
(SP 3.1-3; SP 4.1-4; SP 5.1-3)
* AP Lab 10: Energy Dynamics: Modified to use pill bugs and cabbage leaves
(SP 2.1-2; SP 4.1, 4.3; SP 5.1, 5.3; SP 7.1-2)
* Lab Exponential Population Growth (SP 1.1, 1.4, SP 2.1, 2.3)
* Lab Predator/Prey Lab (SP 1.1, 1.4, SP 2.1, 2.3)
* Math Problem Set for population growth problems
* Current Events Activity-Investigating environmental issues and human impact (3 minutes presentation).

Connecting Big Ideas

* A discussion of how the environment impacts evolution (Big Idea#1)
* A discussion of free energy and its flow through the ecosystem affects different trophic levels (Big Idea #2)
* A discussion how communities are regulated by both biotic and abiotic factors (Big Idea #2)

**Biochemistry Unit 4**

Essential Knowledge

* 1.D.1-2
* 2.B1-3; 2.C.2; 2.D.1
* 3.A.1
* 4.A.1-3; 4.B 1-2; 4.C.1

Topics

* Properties of carbon and its unique role in the process of life
* Survey of functional groups important in biology
* Survey of carbohydrates at both the monomer and polymer level
* Survey of various lipids and phospholipids
* Survey of proteins at both the monomer and polymer level
* Survey of nucleic acids at both the monomer and polymer level
* Discussion of free energy and biological reactions
* Explanation of enzymes and their role in metabolism

Labs and Activities.

* Constructing models of various organic compounds
(SP 1.1-3)
* AP Lab 13: Enzyme Activity: modified enzyme lab using catalase to capture oxygen directly. Students use a guided inquiry approach to investigate variables of their choosing and determine their effects on reactions rates.
(SP 2.1, 2.2, 2.3; SP 4.1, 4.2, 4.3, 4.4; SP 5.1, 5.2, 5.3; SP 7.2)
* Constructing models to illustrate the various levels of proteins structure.
(SP 1.1-3)
* Examining models of enzymes and demonstrating competitive and noncompetitive inhibition.
(SP 1.1-3)

Connecting Big Ideas

* A discussion of how evolution impacts changes in DNA structure which ultimately alters the structure of a protein (Big Ideas #1 and #2)
* A discussion of how monomers combine to form polymers and how this affects the properties of the polymer (Big Idea #4)

**Botany Unit 5**

Essential Knowledge

* 1.B.1-2; 1.C.1-3
* 2.C.1-2, 2.D.2; 2.E.3
* 3.C.1-2; 3.D.1
* 4.C.1-3

Topics

* Evolution of the plant kingdom and evolutionary trends
* Alternation of generations and how it relates to evolutionary trends
* Basic angiosperm structure including xylem and phloem
* Basic plant physiology emphasis on water regulation and nutrition absorption

Labs and Activities

* AP Lab 9: Modified to do whole plant transpiration. Students design an experiment to measure the effect of different variables on the rate of transpiration
(SP 2.1-3; SP 4.1-4, SP 5.1-3, SP 6.1-2, 6.4)
* Flower Reproduction Lab: Students dissect a variety of flowers identifying parts and adaptations for each type of flower
(SP 3.1)
* Seed Germination Lab: Student investigate factors that might affect the rate of germination
(SP 3.1; SP 4.1-3)

Connecting Big Ideas

* A discussion of how organisms must exchange matter with the environment to grow, reproduce and maintain organization (Big Idea 2)
* A discussion of organisms use of feedback mechanisms to maintain their internal environments and respond to external environmental changes (Big Idea 2)
* A discussion of populations continuing to evolve which are reflected in the adaptations of plants (Big Idea #1)

 **Nervous System Unit 6**

Essential Knowledge

* 2.A.1-3; 2.B.1-3; 2.C.1-2; 2.D.1-3; 2.E.1-2
* 3.D.1-4; 3.E.1-2
* 4.A.4, 4.A.6; 4.B.1-3

Topics

* Basic anatomy of neurons, nerves and the nervous system including detail regarding the CNS and PNS
* Physiology of a nervous impulse and transmission with a reflex arc
* Explanation of how a nervous impulse is an example of cell communication
* Discussion of sensory perception and sensory organs (ears, nose, tactile, eyes)
* Coordination and homeostasis of the nervous system

Labs and Activities

* Response time lab
(SP 1.1,1.2-3)

Connecting Big Ideas

* A discussion of how the structure of the cell membrane makes it selectively permeable (Big Idea #2)
* A discussion of how organisms use feedback mechanisms to maintain their internal environment and respond to external environmental changes (Big Idea #2)
* A discussion of how the interactions between molecules affect their structure and function (Big Ideas #2 and 4 )

**Endocrine System Unit 7**

Essential Knowledge

* 2.A.1-3; 2.B.1-3; 2.C.1-2; 2.D.1-3; 2.E.1-2
* 3.D.1-4.
* 4.A.4, 4.A.6; 4.B.1-2

Reading

* Endocrine System, chapters 45-46

Topics

* Explanation the role of signaling molecules involved in cell communications
* Comparison of the structures and mechanisms of different classes of hormones
* Survey of endocrine glands and the production of various hormones
* Discussion of feedback mechanisms between antagonistic hormones in the maintenance of homeostasis
* Role of endocrine glands in regulating metabolism, homeostasis, development and behavior

Labs and Activities.

* Termite and pheromone Lab: Students will design an investigation to explore the phenomenon in which termites follow a trail of a certain ball point pen ink containing a pheromone-like substance
 (SP 3.1-3.2; SP 4.1-4.4, SP 5.2; SP 6.1)
* Use of manipulative models in simulating hormonal action.

Connecting Big Ideas

* A discussion that growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes (Big Idea #2)
* A discussion of how organisms maintain their internal environment and respond to external environmental changes using feedback mechanisms (Big Idea #2)
* A discussion of multiple mechanisms that regulate the timing and coordination of physiological events (Big Idea #3)
* A discussion of the interaction between molecules affect their structure (Big Idea #4 )

**Immune System Unit 8**

Essential Knowledge

* 2.A.1-3; 2.B.1-3; 2.C.1-2; 2.D.1-4; 2.E.1-2
* 3.D.1-4.
* 4.A.4, 4.A.6; 4.B.1-2
* 4.A.1-3; 4.B 1-2; 4.C.1

Topics

* Description of the innate immune system to include both chemical and cellular aspects of the system
* Description of the acquired immune system to include the humoral response and the cell mediated response
* Survey of the function and structure of various antibodies
* Discussion of active versus passive immunity and natural versus artificial immunity
* Survey of autoimmune diseases and AIDS

Labs and Activities.

* ELISA Lab: <http://www.hhmi.org/biointeractive/vlabs/>
(SP 3.1-3.2; SP 4.1-4.4, SP 5.2; SP 6.1)
* Use of paper plate models to illustrate the immune system
(SP 1.1-1.3)

Connecting Big Ideas

* A discussion that growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes (Big Idea #2 and #4)
* A discussion of how organisms use feedback mechanisms to maintain their internal environments and respond to external environmental changes (Big Idea #2)
* A discussion of the interaction between molecules affect their structure (Big Idea #4 and #2)

**Cells and Cell Communication Unit 9**

Essential Knowledge

* 1.B, 11.B2
* 2.A.1-3; 2.B.1-3; 2.C.1; 2.D.13
* 3.A.1-3
* 4.A.2-3; 4.C.1

Reading

* Cell, chapters 6,7 and 27
* Cell Communication, chapter 26

Topics

* Survey of cellular anatomy from different domains with emphasis on prokaryotes, eukaryotic plant and animal cells
* Evolution of prokaryotes and eukaryotes (folding membranes and endosymbiosis)
* Explanation of cell membrane and cell wall structure
* Explanation of the limits of cell size with emphasis on surface area to volume ratio
* Examination of transport across the membrane to include osmosis, passive diffusion, active transport, facilitated transport, endocytosis and exocytosis
* Survey of proteins at both the monomer and polymer level
* Survey of nucleic acids at both the monomer and polymer level
* Detailed explanation of cell communication

Labs and Activities.

* Constructing models of various types of transport
(SP 1.1-3)
* Constructing a model of the cell membrane. Students will compare and contrast their membrane with other students’ membrane.
(SP 1.1-3)
* Making models of various types of cell communication
(SP 1.1-3)
* Cell Type Survey- Student inquiry into a survey of various cells and proper staining technique
(SP 1.1.-4)
* AP Lab 4 Diffusion and Osmosis: Examination of semi-permeable membranes, passive diffusion and osmosis, cell size, plasmolysis, calculations of water potential of different types of tissues
(SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)

Connecting Big Ideas

* A discussion of evolution of various cell types (Big Ideas #1 and #3)
* A discussion of how polymers are part of cell membrane structure (Big Ideas #2 and #3)
* A discussion of the role of the nucleus and ribosome in transmitting inheritance (Big Ideas #2 and #3)

**Cell Respiration Unit 10**

Essential Knowledge

* 1.B, 11.B2
* 2.A.1-3; 2.B.1-3; 2.C.1; 2.D.13
* 3.A.1-3
* 4.A.2-3; 4.C.1

Topics

* Discussion of mitochondrion evolution and cell respiration in prokaryotes
* Comparison of aerobic and anaerobic respiration
* Function of fermentation and its role in respiration
* Krebs cycle and modifications to respire nutrients other than glucose
* Chemiosmosis
* The role of respiration in global warming

Labs and Activities.

* Constructing a model of the mitochondrion and the pathway for respiration
(SP 1.1-3)
* AP Lab 6: Cellular Respiration
(SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)
* Current events on man’s impact and global warming (also addressed in Unit 10)

Connecting Big Ideas

* A discussion of the evolution of respiration (Big Ideas #1 and #2)
* A discussion of the evolution of mitochondrion (Big Ideas #1 and #2)

**Photosynthesis Unit 11**

Essential Knowledge

* 1.B, 11.B2
* 2.A.1-3; 2.B.1-3; 2.C.1; 2.D.13
* 3.A.1-3
* 4.A.2-3; 4.C.1

Topics

* Survey of leaf anatomy and various adaptations that have evolved
* Discussion of chloroplasts evolution and photosynthesis in prokaryotes
* Examination of structure and function of chlorophyll and chloroplasts
* Light reaction of photosynthesis with cyclic and noncyclic photophosphorylation
* Chemiosmosis
* Calvin cycle and its modification of C3, C4 and CAM photosynthesis
* The role of photosynthesis in global warming

Labs and Activities.

* Constructing a model of the chloroplast
(SP 1.1-3)
* Inquiry lab for plant pigments
(SP 2.1-3, SP 3.2-3, SP 4.1, 4.3-4; SP 5.1-2; SP 7.1)
* AP Lab 5 Photosynthesis
(SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)
* Student poster presentations involving current event activities aimed at investigating global warming data and man’s impact on the environment

Connecting Big Ideas

* A discussion of the evolution of photosynthesis (Big Ideas #1 and #2)
* A discussion of the evolution of chloroplasts (Big Ideas #1 and #2)

**Cell Reproduction and DNA replication Unit 12**

Essential Knowledge

* 1.A.3-4; 1.B.1
* 2.C.1-2; 2.E1-3
* 3.A.1-2; 3.C.3, 3.D.1
* 4.A.1-2; 4.B.1-2

Reading

* Cell Reproduction, chapters 13 and 14 & DNA Structure and replication, chapters 15 and 16

Topics

* Discussion of sexual versus asexual reproduction
* Examination of binary fission, mitosis and meiosis and cytokinesis
* Comparison of mitosis with meiosis
* Examination of the historical background of DNA with experimental evidence
* Identifying the structure of DNA
* Discussion of the process of DNA replication
* Discussion of various DNA replication errors or mutations

Labs and Activities.

* Constructing chromosome models as well as modeling mitosis and meiosis
(SP 1.1-3)
* AP Lab 7: Cellular Division: Mitosis and Meiosis (including statistical analysis)
(SP .1.-5; SP 2.1-3, SP 4.3; SP 5.1-3, SP 6.2, 6.4; SP 7.1-2)
* Problem set involving chromosomal mapping
(SP 5.1-3)

Connecting Big Ideas

* A discussion of how nucleotide monomers form the DNA polymer (Big Ideas #1 and #2).

**Protein Synthesis Unit 13**

Essential Knowledge

* 2.A.3; 2.B.3; 2.D.1; 2.E.1
* 3.A.1; 3.B.3.1-2;3.C.1-3
* 4.A.1-2; 4.B.1

Reading

* Protein synthesis, chapter 17

Topics

* Defining the gene
* Examination of codons and the genetic code with emphasis on its universality and redundancy
* Identifying the structure of RNA
* Discussion of transcription and modifications of various RNA molecules
* Discussion of translation and modifications of various post-translation proteins
* Comparison of gene expression among the three different domains

Labs and Activities.

* Construct a model that simulates the process of protein synthesis
(SP 1.1-3)
* Protein Gel Electrophoresis Lab separating proteins based on their chemical properties
(SP 3.1; SP 5.1; SP 6.1)

Connecting Big Ideas

* A discussion of building RNA as a polymer constructed of nucleotides (Big Ideas #1 and #2)
* A discussion of how organisms obtain nucleotides to construct RNA molecules and how environmental factors can influence gene expression (Big Ideas # 2 and #3)

**Gene Regulation and Development Unit 14**

Essential Knowledge

* 2.A.3; 2.B.3; 2.D.1; 2.E.1
* 3.A.1; 3.B.3.1-2;3.C.1-3
* 4.A.1-2; 4.B.1

Reading

* Gene Regulation and Development, chapter 18

Topics

* Discussion of the regulation of bacterial genes with inducible and repressible operons
* Examination of

DNA packaging

methylation or acetylation

transcription factors

RNA processing

degrading of the mRNA

protein post-translational modifications

* Examination of cell differentiation to include

genetic programing for embryonic development

cytoplasmic determinants

sequential regulation of gene expression during development

* Discussion of pattern formation
* Discussion of axis establishment
* Examination of gene regulation
* Examination of cancer and its relationship to gene regulation

Labs and Activities.

* Using a model to simulate the role of an operon in gene regulation
(SP 1.1-3)
* Using a model to simulate the process of eukaryotic gene regulation

Connecting Big Ideas

* A discussion of how organisms must exchange matter with the environment in order to grow and reproduce and that these exchanges can have an effect on cell specialization (Big Ideas #2 and #3)
* A discussion of the subcomponents of biological molecules and their sequence determine the properties of that molecule which can have an effect on cell specialization. (Big Ideas # 3 and #4)

**Biotechnology Unit 15**

Essential Knowledge

* 1.A.2-4; 1.B.1-2
* 3.A.3-4
* 4.A.1-2; 4.B.1-2

Topics

* Exposure to biotechnology laboratory techniques including electrophoresis, micropipetting, extraction and recombination of plasmids using restriction enzymes and PCR
* Analysis of electrophoretic gels, cloning, RFLP analysis and genomic libraries
* Examining basic virus structure and viral replication (lytic and lysogenic cycles and retroviruses)
* Discussion of viroids, prions, and emerging viruses

Labs and Activities.

* AP Lab 8 Biotechnology: Bacterial Transformation
(S2.1-3; SP 3.1-3; SP 4.1-4; SP 1-3; SP 6.1-5; SP 7.1-2)
* AP Lab 9 Biotechnology : Restriction Enzyme Analysis of DNA
(S2.1-3; SP 3.1-3; SP 4.1-4; SP 1-3; SP 6.1-5; SP 7.1-2)
* Analysis of Harris Hawks Gels to determine parentage and investigate behavior
(SP3.1-3, SP 5.1-3)
* DNA Technology current events assignment: Students will independently research topics relating to recent biotechnology discoveries and discuss the resulting societal implications.

Connecting Big Ideas

* A discussion of the origin and evolution of restriction enzymes and how they function (Big Ideas #1 and #2)

**Genetics Unit 16**

Essential Knowledge

* 1.A.2-4; 1.B.1-2;1. C.3
* 3.A.1-4; 3.B.2; 3.C.1-2
* 4.A.3; 4.C.2-3

Topics

* Explanation of Mendelian genetics including probability calculations, 1st Law of Segregation and 2nd Law of Independent Assortment with regard to meiosis
* Explanation of dominant versus recessive traits along with incomplete dominance and co-dominance
* Explanation of non-Mendelian patterns of inheritance such as polygenic inheritance, epistasis, complementary genes, linked genes, and multiple alleles
* Discussion of sex-linked genes
* Examination of karyotyping
* Analyzing of pedigrees

Labs and Activities.

* Performing simulated *Drosophila* crosses with subsequent Chi-square analysis <http://www.sciencecourseware.org/vcise/drosophila/>
(SP 2.1-3; SP 4.1, 4.3-4; SP 5.1-3; SP 6.1-5)
* Students will solve Mendelian and non-Mendelian genetic problems
(SP 2.1; SP 4.1, 4.3-4; SP 5.1-3; SP 6.1-5)
* Analysis of karyotypes from HIPS biology
(SP 1.1, 1.3-4; SP 4.1, 4.3-4; SP 5.1-3; SP 61-5)
* Analysis of Harris Hawks Gels to determine parentage and investigate behavior
(SP3.1-3, SP 5.1-3)

Connecting Big Ideas

* A discussion of how organisms must exchange matter with the environment in order to grow and reproduce and that these exchanges can effect on phenotypic expression (Big Ideas #2 and #3)