Adapted from Syllabus #3

Course Overview

The course is designed around the AP Biology Curriculum Framework that focuses on the major concepts in biology and their connections. Additionally, the Curriculum Framework provides a basis for students to develop a deep conceptual understanding as well as opportunities to integrate biological knowledge and the science practices through inquiry-based activities and laboratory investigations without having to teach a textbook from cover to cover.

Textbooks/Resources

Reece, Urry, Cain, Wassermann, Minorsky, Jackson. *Campbell Biology AP Edition, 9th Edition*, San Francisco: Pearson/Benjamin Cummings, 2011 **[CR1]**
Each student has access to the investigations contained in *AP Biology Investigative Labs: an Inquiry Base Approach*, as well as other laboratory investigations as deemed necessary.

Teaching Strategies

AP Biology is structured around four Big ideas (Evolution, Energy Processes, Information, and Interactions) described in the Curriculum Framework, which encompass the core scientific principles, theories, and processes governing living organisms and biological systems. At least one of the Big ideas will be incorporated in every lesson throughout the course. **[CR2]** Because evolution is the foundation upon which the entire course is based, it will be referenced throughout the entire course, and science as a process will be woven throughout both the investigations and the class activities outside of the investigations.

Students begin each unit with a list of enduring understandings and big ideas to guide them throughout the main points of the unit and to frame students' class notes. Students are encouraged to add to these notes during class discussions, listing all of their questions that arise as the class discusses each topic. Class discussions may be based on animations from various sources (textbook, CDs, Internet, podcasts. etc.) to help the students visualize what they have read. Group quizzes are interspersed throughout the unit and inform how instruction may need to be adjusted to improve student learning.

To help students apply biological, scientific knowledge and critical thinking skills to major issues of social concern, they are offered the opportunity to read and report on (written) one novel that includes biology content in the story-line. For the novel, students must explain the science and science processes in the book, as well as describe the accuracy of their use and presentation in the book. In addition, students will need to be prepared to engage in bi- monthly current event discussions informed by readings from recent scientific journals, as well as develop a presentation on a topic of their choice after the AP exam. Through these activities, students are given the opportunity to see that biology is in their everyday lives and is not just a chapter in a textbook. **[CR5]**

Investigative Component

Laboratory investigations make up a minimum of 25% of instructional time. **[CR7]** Students will conduct a minimum of eight inquiry-based-Investigations (two per Big idea). **[CR6]** Supplemental labs and activities are also used to widen the range of topics covered in a hands-on, discovery mode. By undertaking a variety of investigations throughout the course, all seven science practice skills will be used by students on a regular basis with a goal of leading students toward open inquiry investigations. The science practice skills need to be honed over the entire course and reinforced through opportunities to make observations, ask questions based on those observations, and investigate their own questions both in and out of the designated lab times. It is critical for me, as an instructor, to help students discover how the biological world works as we know it--and to learn how to investigate the biological world that is still unknown. That is why the investigations are a key to this entire course.

Students will maintain a written record (lab notebook) of investigations conducted. In addition, they will be asked for the following throughout the course: **[CR8]**

- Formal lab report that emphasizes the development and testing of a hypothesis, the ability to organize collected data, and the ability to analyze and clearly discuss the results.
- Poster presentations (create poster with main investigation components; present to small groups or whole class; field questions).
- Self-assessments of their ability to work in group investigations that will often be conducted in teams of 2 or 3 in order for students to develop group skills and learn the importance of collaboration among scientists.

Course Schedule

The following table describes how the enduring understandings/essential knowledge statements, learning objectives and seven science practices are the focus of each unit within the course. Due to the reduction in required content for AP Biology, all sections of each chapter will not be covered and/or may be used for reference as needed. The outlined timeline is approximate. Assignments include many ways to meet the objectives (worksheets, readings, dry labs, wet labs, Free Response writing, projects, etc.), and a few of these activities have been elaborated upon in order to fully demonstrate the incorporation of curricular requirements. These assignments connect biological content across big ideas.

A.P. Biology Syllabus 2012- Text: Biology, 9th Edition, N. Campbell, 2011

MOLECULES, CELLS AND ENERGY: BIG IDEAS 1,2,3 & 4 (CR2)

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
A. ECOLOGY Ecological interactions- biotic vs abiotic Behavioral ecology- natural selection involvement Population dynamics- growth & its regulations Communities & Ecosystems energy levels & flows, cycles, symbiosis & impact on evolution Human influences positive & negative	Text chapters 50-55	Nature of Science and Statistics: Activity: Rocks, Ponds, and Boats [CR 8 and SP 4,6] (1 day) Biodiversity Arthropod Collection : teach spreadsheet, graphing, trend lines and r2 values activity [CR 4a and SP 2, 4] (2 days) M&M statistics lab T test activity [CR SP2, 5] (1 day) Relationship Graphing activity from Vernier's Chemistry with computers vernier.com for up to 5 data sets to fit what kind of curve. Evolution and threshold limits (1 day) Pop. Ecology Population Growth Activity Chi Square activity (SP2) 1 Day) , Prelab Animal Behavior Investigative LAB #12: Critter behavior (2 days) LAB FORMAT: OPEN [CR6] (SP 2, 3, 4, 6) Animal Behavior: Taxis, Kinesis, chi square analysis **LAB FORMAT: OPEN Dissolved Oxygen & Aquatic Primary Productivity (EU 4.A connects to Bl 1) [CR3d], [CR5] & [CR6] (SP 2, 3, 4, 5, 6, 7) (2 days)** The Wolf, The Moose and the Fir Tree: A case study of Trophic Interactions or Back to the Bay from Biological Inquiry	Group Reading quizzes Ecology (review questions) Unit test with FRQ's and follow up PEER GRADING Investigative Lab #11 questions, analysis and presentation [CR8] and PEER EDIT Lab Report on primary productivity Presentation: Students present lab results to class with ways to improve water quality of local streams, estuaries and bay[CR5]

Big Ideas and Science Practice Matrix for Units Activities

ECOLOGY and NATURE OF SCIENCE UNIT

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Rocks, Ponds, and Boats CR 8							x	x	x	x	x
Biodiversity Arthropod Collection CR 4a						x		x			
M&M statistics lab CR 5					x	x			x		
Relationship Graphing activity CR 4a (Connects Big Idea 1 to 4C)	x			x	x	x	x			x	
Pop. Ecology Population Growth Activity CR 4 Connects Big Idea 1 to 4C)	x			x	x	x	x		x	x	
OPEN FORMAT LAB #12 : Animal Behavior CR 6				x 4A.6	x	x	x	x	x	x	x
OPEN FORMAT LAB Aquatic Primary Productivity EU 4.A connects to BI 1) [CR3d], [CR5] & [CR6]		x		x		x	x	x	x	x	x
The Wolf, The Moose and the Fir Tree: A case study of Trophic Interactions CR3a	x			x	x	x	x			x	x

BIOCHEMSTRY: MACROMOLECULES, ENZYMES AND ENERGY BIG IDEAS 2 AND 4

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
Polarity of water & its importance to biological systems Carbon's role in the molecular diversity of life Monomers, polymers & reactions involved in building & breaking them down considering polar/ nonpolar interactions Various levels of structures in protein & carbohydrates Enzyme structure as a special protein Cycling of elements through ecosystem ATP structure & function Redox reactions in relation to cellular respiration DEMO Toothpickase Enzyme catalysis Activation energy & specificity	Chemistry of Life Chapters 2--5, 8 from textbook	Building Macromolecules demo with condensation reactions [CR4a] (SP 1) Milk lipids LAB FORMAT: STUDENT STRUCTURE and if time GUIDED INQUIRY Adhesion/ cohesion lab. Students do variations by adding different macro-molecules to solution to see effects adhesion etc. (EU4.A connects to BI 1) [CR3d] (SP 4) (1 day) Protein Demo: Pipe cleaner activity for 4 levels of protein folding. Discuss Sickle Cell folding ex. FOLD.IT protein online folding activity INORGANIC to ORGANIC DEMO: Using and understanding how different indicators are used to identify proteins, lipids, carbohydrates (incl. reducing sugars analysis) using Biuret, Benedict's, Sudan etc.. Also used to introduce the idea of origin of life [CR6] (SP 6) Natural Selection ensured the chemical properties in cells and polymers (Connects Big Idea 4 to 1 and 2) Toothpickase graphs & questions "Enzyme Catalysis" Prelab: Toothpickase Investigative lab #13: Enzyme Activity (EU 4.A connects to BI 2) [CR3d] & [CR6] Inquiry prompts: animal organs; parts of plants … research catalase. What is catalase? What does it do and where is it found? get a 3d picture and label the active site. does it have an allosteric site? Research the roles of kidney, heart and liver. Predict which would contain catalase and why? STRUCTURE=FUNCTION. What about plants (ex. potatoes) Why would plants have catalase. would you expect diff parts of plants to have diff amounts of catalase? Lastly, what are zymogens (what role do they play in digestion) take notes and then make into a clear concise background information that you wil end up putting into your journal. (2 days) Biorad BioFuel Cellobioase Enzyme/Mushroom Extension lab (2 days) Investigative Lab: Enzymes: Factors affecting the rate of activity [CR6] (SP 2, 5)	Group Reading quizzes Mini Posters on Macromolecules Mini Posters on recycling of the elements Unit test with free response practice Written lab reports [CR8] RAFT activity (atoms/molecules, world, mime, cycling) of different element cycles including relative amts. of transfer [CR4b], [CR4d] & [CR8] RAFT stands for: R= Role of the writer (character, famous person, inanimate object etc.) A= Audience (other characters, community members, parents, etc.) F= Format (letter, action plan, invitation, brochure, etc.) T= Topic (focus/ subject of the product) (Also, a strong verb such as persuade, demand, plead, etc .might be provided with the topic to help students express themselves.) Toothpickase graphs & questions Presentation of students group lab results to class [CR8] Presentations of lab data and results [CR8] Review Proteins and Enzyme

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for BIOCHEMSTRY: MACROMOLECULES, ENZYMES AND ENERGY BIG IDEAS 2 AND 4

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Building Macromolecules demo CR4d				x 4A.1, 2, 4B.1, 4C.1	x						x
Milk lipids LAB FORMAT: STRUCTURE ,GUIDED INQUIRY : CR3d				x connects 4A.1 to B1			x	x	x	x	x
Protein Demo CR4d				x A1,2	x						x
FOLD.IT CR4d				x A1,2	x						x
INORGANIC to ORGANIC DEMO: CR4d				x A1, B1 Connects to EU 2 and 1	x					x	x
Toothpickase : LAB FORMAT STRUCTURED, CR4d		x 2A1		x 4B1, 4C1	x	x	x	x	x	x	x
Investigative lab #13: Enzyme Activity OPEN LAB FORMAT [CR3d, 6]				x 4A connects to B1,2	x	x	x	x	x	x	x
Biorad BioFuel Cellobioase Enzyme/Mushroom Extension lab [CR6]				X		X			X		

CELLS, MEMBRANES AND TRANSPORT: BIG IDEA 2 AND 4 Connected to 1B

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
Theories of how macro-molecules joined to support origin of life Was RNA 1st genetic material? Age of earth (structure & function) Big idea 1 & 2 Explain similarities, differences & evolutionary relationships between prokaryotic & eukaryotic cells Cell membrane structure & function Cell communication (signals, receptors, responses hormones) Methods of transport across membranes	Text chapter 4.1 & 25 outline notes guided reading Text chapters 6,7,11 Outline notes Guided reading questions	Origin of Life Activity Clay catalyzed RNA polymerization activity with role playing focus on theories, redevelopment of theories over time (EU 1.B connects to BI 3) [CR3a] & [CR4c] (SP 6, 7) (1 day) Cell Campaigns include a component comparing structures of cells from 3 different cell types from 3 different kingdoms (EU 1.A connects to BI 3) [CR3a], [CR4a], [CR4c] & [CR8] Demo on internet: Normal vs Plasmolyzed Cells using Plant cells and red blood cells (teacher generated) [CR6] Cell size lab activity: all cells are ruled by the same chemical and physical laws: single cell to multicellular (2 days) Mini Electronic Poster Presentations, Animated claymation comparing 3 feedback mechanisms (Osmoregulation, Thermoregulation, Blood Sugar Regulation) [CR8] LAB FORMAT: OPEN Inquiry lab # 4 Diffusion and Osmosis [CR6] (SP 3, 4) link to excretion in the kidneys (3+ days) data must be graphed into journals, Calculate PSI for dialysis bag, russet potato, sweet potato and McIntosh apples.**Part 1:** Bring a plant you want to figure out Molarity for and some related questions **Part 2:** Find the PSI of saline solution. Show your work.)Calculate M from NaCl %)Cite source. **Part 3**: Discuss blood plasma. What is the molarity and PSI. What is in IV solution? Why? Cite source. [CR4b], [CR4c] & [CR6] (SP 2) Cystic Fibrosis Case Study or Sickle Cell Case study http://sciencecases.lib.buffalo.edu/cs/collection/detail.asp?case_id=484&id=484 Cystic Fibrosis Article in Scientific American 2011	group reading quizzes Unit test with Free Response practice Written lab reports [CR8] graph & calculations Cell Size lab calculations Formal Lab Write-up for Inquiry lab Diffusion & Osmosis [CR8] Analyze & Discuss a chart comparing different types of cells & their functions in the human body from the Cell Campaigns Discussion of the endosymbiont hypotheses of the evolution of eukaryotic cells [CR3b] Journal articles on organelle based health issues [CR5]

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for **CELLS, MEMBRANES AND TRANSPORT: BIG IDEA 2 AND 4 connected to 1B**

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Origin of Life Activity CR4d and CR3d	1B		x	4A.1, 4B1connects to 2a 3, B1 and 1B	x		x			x	x
Clay catalyzed RNA polymerization activity [CR3a] & [CR4c]	x 1B	2B								x	x
Cell Campaigns CR3a, 4a,c and 8	1A conects to B1,3									x	x
Cell size lab activity	1B	2A1,3		4A 6, 4B2	x	x	x	x	x	x	x
Mini Electronic Poster Presentations, Animated claymation comparing 3 feedback mechanisms [CR8]	1B	2A3, C2,3 D2, E2,3		4A and B			x			x	x
LAB FORMAT: OPEN Inquiry lab # 4 Diffusion and Osmosis CR 3b and 4d, 6 and 8	1B	2B.1 and D				x	x	x	x	x	x
Cystic Fibrosis Case Study or Sickle Cell Case study CR 3c 4d		2D		4B1,2						x	x
Cystic Fibrosis Article CR 5		2D								x	x

CELL ENERGY: RESPIRATION AND PHOTOSYNTHESIS Big Ideas 2 and 4 connect to 1B

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
Cellular respiration glycolysis, citric acid cycle, electron transport chain & chemiosmosis Mitochondria form & function Photosynthesis mechanisms; light/ dark Compare/contrast to respiration Alternative mechanisms Understanding light energy & the nano scale (the size of small things inside cells)	Text chpts 9, 10 Outline notes Guided reading questions	Investigative Lab #6 Cellular Respiration : research peas, crickets and organisms of choice [CR4b] LAB FORMAT IS OPEN: Students choose what organisms they wish to test and which procedure (3 days) Prelab Plant Pigments Photosynthesis [CR4b] Investigative Lab #5 Photosynthesis [CR6] LAB FORMAT: OPEN: students decide which factors relative to photosynthesis they wish to test. Ex. wavelengths (color0 of light, color of leaves, type of plant and types of conditions (3 days)	Reading quizzes Unit test with FRQ Presentation of students group lab results to class [CR8] chromatography calculations, graphs Lab writeup and analysis [CR8] Students make a chart comparing sizes of cellular parts & larger items to evaluate range of metric distance measurements down to the nano scale [CR4b]

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for **CELL ENERGY: REPSIRATION AND PHOTOSYNTHESIS Big Ideas 2 and 4 connect to 1B**

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Investigative Lab #6 Cellular Respiration :LAB FORMAT OPEN CR 3a, 4b, 7 and 8	1B				x	x	x	x	x	x	x
Investigative Lab #5 Photosynthesis LAB FORMAT: OPEN CR6, CR 8	x 1B	2B			x	x	x	x	x	x	x

CELL CYCLE, MITOSIS AND CELL SIGNALING Big Ideas 2 and 3

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
Mitosis Lecture/ activity Cell Cycle mechanism & control Stem Cells Cell Signaling connected to an intro to Embryology	Ch 11 & 12 & 13 (Nervous System & Endocrine Ch 48, 45)	Investigative Lab #7: Mitosis(EU 3.A connects to BI 1) [CR3c] & [CR6] [CR4c] with illustrative examples for nerve transmission, endocrine pathways (2 days) Planaria Regeneration Activity Fertilization Online tutorial Cell signaling and Disease Project with illustrative examples for nerve transmission, endocrine pathways Mitosis and Cancer TED Talk with mitosis handout and discuss ethics and being your own advocate in science Stem Cell Activity: Saving Superman Case Study	group quiz cell signaling article Review from Scientific American and class discussion TED talk: Bonnie Bassler: Quorum Sensing in Bacteria Unit Test with FRQ/short answer Cell signaling and Disease Project Presentations Class discussion abut stem Cells and Saving Superman

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for **CELL CYCLE, MITOSIS AND CELL SIGNALING Big Ideas 2 and 3**

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Investigative Lab #7: Mitosis CR3b, 4c 6 CONNECT EU 2 and 3		A, B and E	D				x	x	x	x	x
Planaria Regeneration Activity: CR 3b, 4b	1A.4, B1	2A4,E1 and 2					x			x	x
Fertilization Online tutorial CR 3b, 4b	1A.4, B1	2A4,E1 and 2					x			x	x
Cell signaling and Disease Project CR		x	x				x			x	x
Mitosis and Cancer TED CR 5		x					x			x	x
Stem Cell Activity: Saving Superman Case Study CR5		x	x				x			x	x

HEREDITY, GENETICS AND EVOLUTION BIG IDEAS 1 and 3 (CR2)

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
A. MEIOSIS Chromosomes Sexual vs asexual reproduction & evolutionary advantages Stages of meiosis Genetic variation in offspring, mechanisms & impact on evolution Investigating genetics: environmental influences	Text chapters 13	Investigative Lab #7: Meiosis (EU 3.A connects to BI 1) [CR3c] & [CR6] (2 days) Karyotyping exercise (teacher generated-- students will have to do this on their own time) [CR4c] Sumanas Inc website animations with Interactive Lecture/tutorial Fruit Loop/Alpha Bits Replication Activity or counting Nasonia or Flies	Group Reading quizzes Class discussions and working out problems on white boards Karyotyping results Students choose & research controversial topics and the arguments supporting their genetic and/or environmental basis. Ex. Obesity, alcoholism, etc. [CR5] Unit test with FRQ
B. MENDELIAN GENETICS MENDEL'S LAWS Patterns of inheritance Predicting genetic outcomes genetic counseling Gene linkage & mapping Mutations revisited	Text chapters 14, 15 Scientific American Article Reading	Prelab activity: Looking at corn crosses & analyzing results (2 days) Read Scientific American Article on Jumping Genes in the Brain, "The Neuroscience of Identity" March 2012 Prelab and LAB: Fruit fly genetics (4 days + student time for counting offspring) Ghost In Your Genes: Epigenetics Activity Cystic Fibrosis Article review in Scientific American for Pleiotropy	Class discussions and working out problems on white boards Reading quizzes Journal article discussions Unit test with FRQ

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for HEREDITY, GENETICS AND EVOLUTION BIG IDEAS 1 and 3 (CR2)

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Investigative Lab #7: Mitosis CR3c, 4c, 6 CONNECT EU 2 to 3		A, B and E	A, D				x			x	x
Karyotyping exercise CR4c, 5			A.4, c				x			x	x
Sumanas Inc website animations with Interactive Lecture CR5			x							x	x
Corn Crosses: Jumping Genes introduction (CR 3c, 6,8)			3 A, B 3C.1.2	4B 1. 2	x	x	x	x	x	x	x
Scientific American Article "The Neuroscience of Identity" March 2012 CR 3d, 5			3 A, B 3C.1.2	4B 1. 2 4C1.2						x	x
Genetics Lab (CR 6, 8)			x		x	x	x	x	x	x	x
Ghost In Your Genes: Epigenetics Activity CR 3d, 5			3 A, B 3C.1.2	4B 1. 2 4C1.2						x	x
Cystic Fibrosis Article review in Scientific American 2011 for Pleiotropy CR 3d, 5			3 A, B 3C.1.2	4B 1. 2 4C1.2						x	x

HEREDITY, GENETICS AND EVOLUTION BIG IDEAS 1 and 3 (CR2)

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
C. MOLECULAR BASIS OF INHERITANCE DNA structure & replication RNA structure Protein Synthesis transcription & translation Mutations - basis for natural selection	Text chapters 16 DNA STRUCTURE, 17 FROM GENE TO PROTEIN Journal Article Reading Watson and Crick's original Nature paper from 1953	Comparing DNA & protein sequences from an internet based computer database in discussing evolutionary implications of mutations (SP 7) 2 days Sumanas Inc website animations with Interactive Lecture/tutorial	Group Reading quizzes Journal article discussions Unit test with Free Response Bioinformatics results, Report on Bioinformatics activity
D. MOLECULAR GENETICS Regulation of gene expression Viruses Gene expression in bacteria Biotechnology DNA Technology, Recombinant DNA, PCR, Gel electrophoresis Applications of DNA technology Use of bioinformatics to analyze genomes Comparing & discussing genomic sequences in relation to evolution	Text chapters 18: Regulation of Gene Expression Ch 19: Viruses Ch 20: Biotech 21Genomes and Their Evolution	Investigative lab #9: Bio- technology I [CR6] Prelab Bacterial transformation: pGLO STRUCTURED LAB with illustrative extensions to Growth Hormone, Clotting Factor, Insulin etc. (3 days). Journal Article: Kary Mullis on PCR. Biotech Interactive Animations: Cell Differentiation video Regulating genes NOVA Switch genes on or off NOVA RNA flower example Prelab DNA Electrophoresis for PV92 Lab: Investigative lab #9: Biotechnology II. Restriction Enzyme Analysis of DNA [CR6] BioRad: Restriction Digest for Lambda OPEN INQUIRY lab when students are presented with a scenario where they need to gather evidence and analyze it in order to come up with a reasonable explanation for the scenario (2-3 days) TED: Emerging Viruses	Group reading quizzes Mini poster or white board presentations of gene regulation other than pGLO Journal article discussions Unit test with FRQ White board reviews of Technological processes Lab results for both transformation & electrophoresis labs Analysis and group presentation of Investigative lab Class discussion about the role of science in modern world and Developing Countries. What should our goals be? What challenges are there to succeed in getting information, funding and accessibility to be realized?

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for HEREDITY, GENETICS AND EVOLUTION BIG IDEAS 1 connected to EU 3

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Comparing DNA & protein sequences CR4c	1B.1.2.3 1C.2.3		3A								x
Sumanas Inc website animations with Interactive Lecture CR4c			3							x	x
Investigative lab #9: Bio-technology pGLO STRUCTURED LAB CR 5, 6 and 8	1B.1 D1.2		3 C, 3Dd		x		x	x	x	x	x
Restriction Digest Lab turned to OPEN FORMAT CR 6,7,8	1B.1 D1.2				x	x	x	x	x	x	
PV92 Lab: Investigative lab #9: Biotechnology II. Restriction Enzyme Analysis of DNA CR 6	1 B.1, C1.2.3.D1.2			4B 1.2.C.1	x	x	x	x	x	x	x
TED: Emerging Viruses CR 5	1 A, B C									x	x

EVOLUTION PROCESSES AND RELATIONSHIPS BIG IDEAS 1 and 3 (CR2)

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
E. EVOLUTIONARY BIOLOGY explorations and theory of descent with modification & natural selection Evidence for evolution (molecular analyses & morphological analyses) Phylogeny & systematics Evolution of populations Hardy-Weinberg Law	ext chapters 22-25, Ch 34/4-34.5 Human Evolution Journal Article Reading Beak of the Finch by Jonathan Weiner	How are We Evolving questions for Sci American Article: How Are We Evolving? POP GENETICS ACTIVITY as a review exercise Activity: Genetics Survey Project analyzing traits of those around us Lab Investigation "2 Mathematical Modeling: Hardy-Weinberg [CR6] (SP2, 4, 5, 7) (2 days, computer lab) Demo SWAMI site at NGBW or French site for Hominid Evolution and explain Phylogeny illustrations Activity: Hands on hominid analysis of skulls. If unavailable then use interactive lab with Smithsonian Museum website CR4a] (SP 6, 7) (2 days) Evolution of Skin Color TED HUMAN and CHIMP ACTIVITY Investigative LAB # 3: Analyzing Genes with BLAST (EU 1.B connects to BI 4) [CR3a] & [CR6] Aquatic Mammals from SWAMI at NGBW: turn into OPEN FORMAT where students create their own investigation (2 days, computer lab) Case in Biological inquiry: Picture Perfect (Campbell 9th ed.)	Group Reading quizzes Article discussions Unit test with FRQ Analysis and class discussion about findings from Phylogeny Labs: Fossils and Bioinformatics. Ask students to synthesis data and then make inferences about the relationships. What evolutionary connections can be made? Class discussion of race and the implications of race in politics and history. Human and Chimp Activity will assess whether students can go further with the DNA evolutionary patterns and connect them to patterns in embryology and HOX genes.

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for EVOLUTION PROCESSES AND RELATIONSHIPS BIG IDEAS 1 and 3 (CR2)

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Sci American Article: How Are We Evolving? CR 3a and 4a	1B.1.2.3 1C.2.3		3A and B				x			x	x
POP GENETICS ACTIVITY CR4A	1A					x		x	x	x	
Lab Investigation "2 Mathematical Modeling: Hardy-Weinberg CR6						x		x	x		x
Primate & Hominid Skull Analysis CR4a	A,B,C, D			4 B.4.5 and C						x	x
Evolution of Skin Color TED CR 4a , CR 5	ABCD			4 B.4.5 and C						x	x
HUMAN and CHIMP ACTIVITY	ABCD	E.1.2		4 B.4.5 and C						x	x
Investigative LAB # 3: Analyzing Genes with BLAST CR3a, 6 Aquatic Mammals OPEN FORMAT	1B ,C,D				x	x	x	x	x	x	x
Case in Biological inquiry: Picture Perfect CR4a	x									x	x

DIVERSITY OF DOMAINS (not animalia) and PLANT EVOLUTION BIG IDEAS 1,3 AND 4 (CR2)

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
A. BIOLOGICAL DIVERSITY & MICROBIOLOGY Early life on earth Revisit: Origin of Life Activity Explain the appropriateness of a change form the kingdom system of classification to the modern domain system. Evolution of prokaryotes & eukaryotes Investigate how molecular structure of the cells helps in classification. Focus on Gram -/+ bacteria differ in structure, disease and antibiotic effectiveness. Follow up with protista structure and roles in the ecosystem. How plants colonized land Evolution of seed plants Discuss female and male reproductive structures of plants and how the same trends in plant evolution occur in animals.	Text chapters 25, 26, 27, 28 29, 30, 31	OPEN LAB FORMAT: BIOINQUIRY Slime Mold : Students are challenged to pose a question they will create a procedure for about slime mold. (2 days) Bacteria and Protists activity #1 is an online activity in place of a lecture allowing students to see structural and microscopic changes between organisms. Discuss social and health implications of antibiotic resistance as an evolutionary mechanism (2 days) Plant Diversity lecture guide to accompany Biodiversity activity 2: Land plants with on school site Field Trip. Structure = Function will be connected to evolutionary adaptations. An emphasis will be placed on alteration of generations. Students are to find an article involving genetic recombination using prokaryotes and present to class [CR5] Investigative LAB # 3: Analyzing Genes with BLAST (EU 1.B connects to BI 4) [CR3a] & [CR6] (with plants, 1 day) Fungi Lecture and Activity TED talk: How Fungi can save the world: Students will discuss the potential implications of fungi roles in medicine and the opportunities in Tropical Forests. Look at microscope slides of Antheridia and Archegonia of *Marchantia* and other plants to highlight reproductive structures of plants and how the same trends in plant evolution occur in animals. (1 day)	Class discussion of the first round of Slime mold data will lead into a second round of questions and procedure to get more information about slime mold and make more sophisticated questions. Class discussions about labs Formal and Semi formal Lab Write ups Group Quizzes Article Reviews about Genetic recombination using prokaryotes Domain and Plant Evolution Practicum and FRQ

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for DIVERSITY OF DOMAINS (not animalia) and PLANT EVOLUTION BIG IDEAS 1 AND 4 (CR2)

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
OPEN LAB FORMAT: BIOINQUIRY Slime Mold CR 3B, 6,7,8	1B.1.2.3 1C.2.3	3,B, D, E		X			x		X	x	x
Bacteria and Protists activity #1 CR 3a, 4a, 5	x			x			x			x	x
Plant Diversity lecture guide to accompany Biodiversity activity 2: Land plants with Field Trip to nearby Creek. CR 4d	x			x						x	x
Article Review on genetic recombination using prokaryotes CR 4d, 5	x			x						x	x
Investigative LAB # 3: Analyzing Genes with BLAST CR3, CR6	1B					x	x	x	x	x	x
Fungi Lecture and Activity CR 7	x			B and C					x	x	x
TED talk: How Fungi can save the world CR 4A	x			B and C						x	x
Microscope slides of Antheridia and Archegonia of *Marchantia* CR 7				B						x	x

PLANT STRUCTURE AND FUNCTION RELATED TO EVOLUTIONARY REQUIREMENTS EU 1

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
PLANTS STRUCTURE and FUNCTION Structure, growth & development Plants responses to internal & external stimuli Plant nutrition Angiosperm Reproduction	Text 35, 36 Text 37, 38, 39	Transpiration Investigative LAB # 11: OPEN FORMAT. Students will choose what plants, parts of plants and procedures to measure the rate of water lost. C3,C4 CAM review (EU 1.B connects to BI 4) [CR3a] & [CR6] (SP 2, 3, 5) (4 days) LAB: Students conduct a long term (exp't) lab investigation plant growth from seeds under various conditions in our green- house. [CR6] (SP 3.5, 6, 7) LAB: Flower dissection and pollen tube Plant Hormone Commercial Activity: cartoon or video activity: BioRad GMO PCR with **GMO student worksheet** OPEN FORMAT (3 days)	Class discussion of setup and results for transpiration lab. Investigative labs analysis and formal lab writeup. Flower dissection and practical quiz. Animation created from pictures taken during the pollen tube growth Class discussion about themes observed in the Plant Hormone Commercials. Vote on which came first or which hormone is the most important and discuss why. Class discussion about GMOS. Ethical paper and lab writeup. Formal writeup for students' own plant lab [CR8] Group Reading Quizzes Unit Test with FRQ, practicum

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for PLANT STRUCTURE AND FUNCTION RELATED TO EVOLUTIONARY REQUIREMENTS EU1,2,4

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
OPEN LAB FORMAT:Transpiration Investigative LAB # 11: CR3a, 6	1B.1.2.3 1C.2.3	3 E		X		x	x	x	X	x	x
LAB: Flower dissection and pollen tube CR 7, 8		x		x						x	x
Plant Hormone Commercial Activity: cartoon or video activity: CR 4b, 5		x		x						x	x
BioRad GMO PCR with **GMO student worksheet** OPEN FORMAT CR 5, 6, 8	B and C			B	x	x	x	x	x	x	x

OPEN FORMAT: lab investigation plant growth from seeds under various conditions. CR6							x		x	x	x

ANIMAL DIVERSITY AND PHYSIOLOGY : Big Ideas 1,2, 3 and 4

TOPICS	READINGS	ACTIVITY/LABS	ASSESSMENT
ANIMAL DIVERSITY Embryology and Characteristics (body plans & systems) of invertebrates as you go up the phylogenetic tree Analysis of structure & function of body systems: Immune, Endocrine, Nervous (review Circulation, Excretory and respiration) Why do fish need gills? Why do fish have hemoglobin? Evolutionary relationships Case Studies for each System highlighting details from earlier in the year about transportation, cell signaling, genetics and evolution. IMMUNITY Big idea 2&3 Innate vs Acquired Response Humoral responses B cells vs T cells Self vs non--self Revisit Stem Cells	Text chapters 19 (Viruses), 32-34 and 40-49	Survey of animal phyla in bottles and microscope slides Embryology Development lecture/tutorial incorporating these sites: Cell Differentiation Video Animal Cloning interactive SIGNAL TRANS and APTOSIS ANIM Play Dough Embryology Lab Activity (1 day) OPEN FORMAT: Fish Evolution Proteomics Lab with SWAMI tutorial for proteinand HBB FISH list (3 days) Mammalian Diving Response: LAB FORMAT: CONFIRMATION Human Reflex lab (1 day) Endocrine lecture/ tutorial with online sites : INSULIN ANIM Control Breast STEM CELLS by HORMONES ANI My dog is broken activity on hormones HORMONE LEVELS ACTIVITY FOR MENSTRUATION from the Lesson locker Review: Water Balance print from 1st semester: be sure to get the hormonal control and all the things the kidneys regulate OPEN FORMAT: Urinalysis Lab. Students must decide how to diagnose a patient based on a protocol of their choosing (2 days) Lights, Camera, Action Lab…	Group Reading quizzes Unit test with FFRQ, practicum with actual animal specimens. Class discussion of FISH Lab results and formal lab write up Play Dough Embryology: discuss relationships pr patterns seen between reproduction and development of plants and animals Analyze Diving Response Lab Data and discuss significance of findings. What is the purpose of this crazy response? Diagram the Reflex response on white boards. Discuss patterns! Answer questions about the organization of the body from the Cat Dissection. Discuss Patterns between animal and plant hormones. OPEN Inquiry BLAST if desired. Mini Poster Presentation on Urinalysis Findings. Diagram the Evolution from the simplest nerve response mechanisms to humans. Groups of students with white boards or mini posters. Need to show evolution progression. Why do

		Immune Lecture/ tutorial with online sites such as : Natn'l geo : flu video CLONAL SELECTION ANIM and DENGUE FEVER Movie using HHMI lecture series Immune Cells in Action Stem Cells: A new hope? Video GENETICS OF ANTIBODIES ACTIVITY Theraputic Uses for Stem Cells HHMI interactive HHMI Immunology lab with Virtual Immunology worksheet or ELISA LAB: Immunoassays: Antibody purification BIOETHICS: Fishbowl activity involving Immortal Life of Henrietta Lacks	we still have nerve nets? The Immune System Play Flow chart for immunoassay labs Student generated creative reviews of a body system. Play, Poem, Song, Pantomime under 2 min that describes the relationship between Structure and Function and Evolution Advantages

MATRIX for BIG IDEAS and SCIENTIFIC PRACTICES for ANIMAL DIVERSITY AND PHYSIOLOGY : Big Ideas 1,2, 3 and 4

	EU 1. Evolution	EU 2. Energy processes	EU 3. Information	EU 4. Interactions	SP 1. use representations and models	SP 2. Use mathematics	SP 3 Engage in Scientific Questioning	SP 4. Plan and Impelement data collection strategies	SP 5. Perform data analysis and evalutaiton of evidence	@P 6. Work with sceintific explanation and theories	SP 7. Connect and relate knowledge
Survey of animal phyla in bottles and microscope slides CR 3a, 7	1B.1.2.3 1C.3, D			A4			x			x	x
Play Dough Embryology Lab Activity CR 3d, 4d	1B.1.2.3 1C.3, D	A4		A3, 4, B, C1			x			x	x
OPEN FORMAT: Fish Evolution Proteomics Lab with SWAMI tutorial for proteinand HBB FISH list CR 6	1B.1.2.3 1C.3, D			A3, 4, B, C1	x	x	x	x	x	x	x
Mammalian Diving Response: LAB FORMAT: CONFIRMATION CR4b		2C. 3 D2. 3, E		A4			x		x	x	x
Human Reflex lab CR4b		2C. 3 D2. 3, E		A4			x		x	x	x

My dog is broken activity on hormones CR 4b											
HORMONE LEVELS ACTIVITY FOR MENSTRUATION from the Lesson locker CR 4b, 5, 8		2C. 3 D2. 3, E		A3, 4, B, C1						x	x
OPEN FORMAT: Urinalysis Lab. CR 6		2 B, C, D E		A3, 4, B, C1		x			x	x	x
Lights, Camera, Action Lab...	1B.1	2 B, C, D E		A3, 4, B, C1		x	x	x	x	x	x
GENETICS OF ANTIBODIES ACTIVITY	1B.1	2 B, C, D E		A3, 4, B, C1						x	x
Theraputic Uses for Stem Cells HHMI interactive CR 5	1B.1	2 B, C, D E		A3, 4, B, C1			x			x	x
HHMI Immunology lab with Virtual Immunology worksheet or ELISA LAB: Immunoassays: Antibody purification CR7	1A.4, D	2A,B,C, D, E								x	x
BIOETHICS: Fishbowl activity : Immortal Life of Henrietta Lacks CR 4b	1B.1	2 B, C, D E		A3, 4, B, C1				x	x	x	x
		x								x	x