AP Biology Syllabus

	Curricular Requirements	PAGES
CR1	Students and teachers use a recently published (within the last 10 years) college-level biology textbook.	2
CR2	The course is structured around the enduring understandings within the big ideas as described in the AP® Biology Curriculum Framework.	2,6,7,8,9
CR3A	Students connect the enduring understandings within Big Idea 1 (the process of evolution drives the diversity and unity of life) to at least one other big idea.	2,6,7,8
CR3B	Students connect the enduring understandings within Big Idea 2 (biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis) to at least one other big idea.	2,7,8,9
CR3C	Students connect the enduring understandings within Big Idea 3(living systems store, retrieve, transmit, and respond to information essential to life processes) to at least one other big idea.	2,7,8,9
CR3D	Students connect the enduring understandings within Big Idea 4 (biological systems interact and these systems and their interactions possess complex properties) to at least one other big idea.	2,7,8
CR4A	The course provides students with opportunities outside of thelaboratory investigations to meet the learning objectives within Big Idea 1.	2,6
CR4B	The course provides students with opportunities outside of thelaboratory investigations to meet the learning objectives within Big Idea 2.	2,6,8,9
CR4C	The course provides students with opportunities outside of thelaboratory investigations to meet the learning objectives within Big Idea 3.	2,6,8
CR4D	The course provides students with opportunities outside of thelaboratory investigations to meet the learning objectives within Big Idea 4.	2,6,7,9
CR5	The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.	2,8,9
CR6	The student-directed laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Biology Curriculum Framework and include at least two lab experiences in each of the four big ideas.	2,7
CR7	Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.	2
CR8	The course provides opportunities for students to develop and record evidence of their verbal, written and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral, written, or graphic presentations.	2

COURSE OVERVIEW

This course is designed to fulfill the AP Biology Curriculum framework, which focuses on the major concepts in Biology and their connections. Students will be immersed into a Biology course that focuses on Big ideas,

enduring understanding as well as essential knowledge of the biological world. The big ideas will be spiraled throughout the curriculum and giving students the ability to see scientific objectives throughout the course. Scientific inquiry will be implemented so that students can be immersed into a scientific world researching topics essential to know in Biology. Students through research will then have a deeper knowledge as well as understanding of Biology.

TEXTBOOK/RESOURCES

Campbell, Biology 9th edition. Mastering Biology. AP investigative labs: an Inquiry Based Approach. 12 AP labs through college board. AP Test Prep Series Workbook AP Biology by Fred W. Holtzclaw and Theresa Knapp Holtzclaw. Lab Bench. **CR1**

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 will be given a copy of the big ideas and enduring understandings to self-monitor mastery of these major organizing tools. The big ideas and enduring understandings will be posted in the room. As connections are made across the big ideas, students will begin to understand the interrelatedness between the big ideas and enduring understandings, as the course progresses. The learning objectives will be used as a guide to build the rest of the class discussions. Students will be given guided reading to help them understand the textbook.

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, etc.) to help the students visualize what they have read. Quizzes are interspersed throughout the unit and inform how instruction may need to be adjusted to improve student learning. **CR2, CR3A, CR3B, CR3C, CR3D, CR4A, CR4B, CR4C, CR4D, 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.

UNITS AND ACTIVITIES

UNITS AND ACTIVITIES BIG IDEAS/SCIENCE PRACTICES MATRIX	1. Use representation and models	2. Use mathematics	3. Engage in scientific questioning	4. Plan and implement data collection strategies	5. Perform data analysis & evaluation of evidence	6. Work with scientific explanations/theories	7. Connect and relate knowledge	BIG IDEA 1: EVOLUTION	BIG IDEA 2: ENERGY PROCESSES	BIG IDEA 3: INFORMATION	BIG IDEA 4: INTERACTIONS
UNIT 1: INTRODUCTION/SCIENTIFIC METHOD											
SAFETY LECTURE								X	X	X	X
Stream Team Inquiry	X	X	X	X	X	X	X	X	X	X	X
16s ribosomal DNA extraction investigation of bacterial types in stream	X	X	X	X	X	X	X	X			X
Can you design a test for pollutants such as estrogen or giardia detection in a			X	X	X	X	X	X			X

stream?											
UNIT 2: EVOLUTIONARY BIOLOGY AND DIVERSITY											
Natural Selection kit	X				X	X	X	X			X
Simulating Darwinian Theory								X		X	
mtDNA analysis	X	X	X	X	X	X	X	X		X	
Blast	X	X	X	X	X	X	X	X		X	
Population Genetics and Evolution Kit	X	X	X	X	X	X	X	X		X	
Movie: What Darwin never knew			X				X	X		X	X
Jelly bean genetics/Goldfish lab Allelic frequency	X	X	X	X	X	X	X	X		X	
Gram Staining and Microbiology Forensics		X	X	X	X	X	X	X		X	X
mtDNA analysis drawing phylogenetic trees	X	X	X	X	X	X	X	X		X	
Origin of Life kit	X	X	X	X	X	X	X	X	X		
Artificial selection lab	X		X	X	X	X	X	X		X	
Macromolecule lab	X		X						X		
Condensation/Dehydration rummy card game	X		X						X		
UNIT 3: ECOLOGY /ANIMAL BEHAVIOR											
Primary productivity	X	X	X	X	X	X	X	X	X		X
Mark and Recapture	X	X	X	X	X	X	X	X			X
Quadrat sampling	X	X	X	X	X	X	X	X			X
Ecology Inquiry Kit			X	X	X	X	X	X			X
Energy Dynamics	X	X	X	X	X	X	X	X	X		X
Species interaction			X	X	X	X	X	X			X
Animal behavior lab	X		X	X	X	X	X	X			X
HHMI- Global Change			X				X				X
UNIT 4: INTRODUCTION TO HOMEOSTASIS AND RESPONSE TO ENVIRONMENT											
Osmosis and Diffusion			X	X	X	X	X		X		
Cell size and the rate of diffusion	X		X	X	X	X	X		X		
Biorad Biofuel Enzyme Lab	X		X	X	X	X	X	X	X		X
Toothpickase	X										
Enzyme Catalysis	X		X	X	X	X	X		X	X	
UNIT 5: CELL PROCESSES/CONNECTIONS: RESPIRATION AND ANIMAL HOMEOSTASIS											
Cell Respiration using plants and crickets	X	X	X	X	X	X	X	X	X	X	
Immunology	X		X					X		X	
Heart lab investigating heart rate and blood pressure	X	X	X	X	X	X	X	X	X	X	
Brain caps	X									X	
Antibody diversity	X		X				X	X		X	

UNIT 6: CELL PROCESSES/CONNECTIONS: PHOTOSYNTHESIS AND PLANT HOMEOSTASIS											
Photosynthesis student leaf races	X	X	X	X	X	X	X	X	X		X
Photosynthesis DIPP	X		X		X	X	X	X	X		X
Photosynthesis Chromatography	X		X		X	X	X	X	X		X
Angiosperm development and Wisconsin fast plant inquiry	X	X	X	X	X	X	X	X	X		X
Pilobolus investigating tropisms.	X		X	X	X	X	X	X			X
Are you eating GMO corn?	X		X	X	X	X	X	X		X	X
Plant Hormone Inquiry											
Lettuce Hormone interaction inquiry	X		X	X	X	X	X	X		X	X
Transpiration lab	X	X	X	X	X	X	X	X	X		X
UNIT 7: MAKING NEW CELLS AND ORGANISMS											
Mitosis Inquiry lab	X	X	X	X	X	X	X	X		X	
Meiosis Inquiry Lab	X	X	X	X	X	X	X	X		X	
Cell communication lab	X	X	X	X	X	X	X	X		X	
Genetics of organisms using plants/drosophila	X	X	X			X	X			X	
M&Ms and chi square	X		X					X		X	
Drosophila chi square		X	X							X	
UNIT 8: DNA-RNA-PROTEIN –TRAIT											
Inducing RNAi by feeding inquiry lab	X	X	X	X	X	X	X	X		X	
Drosophila animal behavior	X	X	X	X	X	X	X	X		X	
PCR-Sequencing mtDNA analysis	X		X					X		X	
Bacterial transformation	X	X	X		X	X	X	X		X	
Restriction enzymes and pglo	X	X	X		X	X	X	X		X	
Biorad Comparative proteonomics	X	X	X		X	X	X	X		X	
Building DNA & RNA molecules	X		X					X		X	
Gel electrophoresis looking at mtDNA and ALU			X		X	X	X	X		X	
Sequencing and paper plasmids	X		X		X	X	X	X		X	
Molecular evolution in a test tube			X		X	X	X	X		X	

The Foundation
UNIT 1: INTRODUCTION/SCIENTIFIC METHOD CR2, CR4, CR3A

Reading: Chapter 1, 3, 4, 5,Articles: Pesticides in streams, Pharmaceuticals in streams
Enduring Understandings: 2A,3A,4A,4B
Discussion Topics and Skills: Introduction to the four big ideas and enduring understandings; connecting the two together using posters. Essential questions are presented here to demonstrate how the big ideas cross the entire curriculum:

• How have scientists worked together to investigate the science behind the concepts of biology?

• How have scientists built upon the discoveries of other scientists to develop a more complete picture of the world around us?

• How are scientists able to test the validity of their ideas?

- How does human impact such as pesticides and pharmaceutical drugs affect streams?
- Explain how Biology, Chemistry and Physics impact one another in a stream.
- How is the word theory used in science verses English?
- What advances have been made in laboratory technology to allow scientists to simulate the natural world?
- What is the affect of scientific research and technological innovations on society?

Process of science reviewed: [CR4a]

- Scientific method, with emphasis on the fact that there is not ONE way to do science
- Explain what is meant by scientific theory
- Practice with data collection, analysis, and presentation
- Building Macromolecules
- 3D Molecular water chemistry
- Origin of Life inquiry

UNIT 2: EVOLUTIONARY BIOLOGY AND DIVERSITY CR2, CR3A, CR3B, CR3D

Reading: Chapter 22,23,24,25,26, 51,4.1,5
Enduring Understandings: 1A, 1B, 1C, 1D, 3C, 3B, 4A

- PBS NOVA What Darwin never knew
- Simulating the Darwinian theory- Natural selection and Darwin
- mtDNA analysis inquiry into looking at ancestry
- Population genetics and evolution lab
- Natural selection lab
- Gram staining and Microbiology forensic investigation
- Bacterial transformation lab
- Jelly bean genetics

- Biorad –Comparative protenomics profiler
- The origin of life inquiry
- Playdough embryology

UNIT 3: ECOLOGY AND BEHAVIOR CR2, CR3D,CR4D, CR6

Reading: Chapters: 51-55
Enduring Understandings: 1A, 4A, 4B, 4C, 3E
Discussion Topics and Skills:

- Species interaction inquiry lab
- Stream investigation looking for pollution
- 16s ribosomal DNA extraction to determin types of bacteria in a stream
- Mark and recapture lab
- Quadrat sampling lab
- Energy dynamics
- Ecology inquiry lab
- Biorad- Biofuel enzyme lab
- Enzyme catalysis lab

UNIT 4: INTRODUCTION TO HOMEOSTASIS AND THE ENVIRONMENT CR2, CR3A,CR3B, CR3

Reading: Chapters 6,7
Enduring Understandings: 2A, 2B, 1B, 1C
Discussion Topics and Skills:

- Diffusion osmosis lab
- Cell structure and function
- How cell membranes work looking at active and passive transport with the U model
- Calculate surface to volume ratio in comparing cells of different sizes
- Compare cell communication processes in different types of organism
- Cell communication lab
- Plants and Animals

Define homeostasis in relation to the internal environment of an organism

Compare negative and positive feedback processes in a plant and animal

Explain apoptosis as a normal process

Evaluate data that are suggested to indicate circadium rhythms in organisms

UNIT 5: CELL PROCESSES/CONNECTIONS: RESPIRATION AND ANIMAL HOMEOSTASIS CR2, CR4B, CR5

Reading: Chapters: 9,40, 45, 43,48, 49.1,49.2
Enduring Understandings: 1B, 1C, 2A, 4B, 4A, 2C, 3E, 3B, 3D
Discussion Topics and Skills:

- Looking at cellular respiration in plants and animals inquiry

UNIT 6: CELL PROCESSES/CONNECTIONS: PHOTOSYNTHESIS AND PLANT HOMEOSTASIS CR2, CR3A, CR4B, CR3B,CR3D

Reading: Chapters 35-39, 8
Enduring Understandings: 1B, 1C, 2A, 4B ,2D, 2E
Discussion Topics and Skills:

- Cell surface lab
- Leaf races
- DPIP and chromatography lab
- Wisconsin fast plant lab
- Plant genetics
- Inquiry looking at the function of a gene in Arabidopsis thaliana
- Transpiration lab
- Pilobolus and phototropism
- Lettuce hormone interaction lab
- Plant hormone inquiry lab

UNIT 7: MAKING NEW CELLS AND ORGANISMS CR2, CR3C, CR4C, CR5,

Reading: Chapters: 12,13
Enduring Understandings: 1A, 2A, 3A, 4A, 3B, 3C
Discussion Topics and Skills:

- Mitosis and Meiosis inquiry lab
- Genetics of organisms using drosophila and plants
- Sex in dish looking at c-ferns

- BLAST mtDNA

UNIT 8: DNA-RNA-PROTEIN –TRAIT CR2,CR3B, CR4D, CR3C, CR3D, CR5

Reading: Chapters 4, 5, 15-20
Enduring Understandings: 1, 2E, 3A, 4A
Discussion Topics and Skills:

- DNA replication
- DNA structure and function inquiry
- Protein structure and function
- DNA-RNA-Protein – Sickle cell lab investigation
- mtDNA analysis
- PCR, sequencing, gel electrophoresis
- Are you eating GMO corn inquiry lab
- Inducing RNAi by feeding
- Molecular Evolution in the test tube paper pencil lab