**AP Biology Course Syllabus**

**COURSE:** Advanced Placement Biology

**TEXT:** Urry, Cain, Wasserman, Minorsky, and Reece. 2017. *Campbell Biology In Focus,* Second Edition, United States of America: Pearson Education, Inc.

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**Course Overview**

The AP Biology course is for juniors and seniors. Students are required to have completed both first year biology and chemistry prior to enrolling in AP Biology.

The course is fast paced and demanding. It is expected students spend a minimum of an hour per night (or 5 hours on the weekend) studying or reviewing. Students entering this course must be highly motivated and willing to do a significant amount of work outside of the classroom.

Students may be assigned worksheets that come from a variety of sources and are always checked for relevance and rigor. It is expected that homework will be handed in on time. Late work is unacceptable.

During each unit, we will spend time in class practicing for the free response questions found on the AP Biology Exam. The students will answer the free response questions from released AP Biology Exams. Some essays will also be assigned as homework.

The students are required to read the textbook chapter listed on the syllabus and will be tested on the material at the end of each unit.

Students will be evaluated on their understanding of scientific reasoning and research techniques. Grades will be a combination of homework, projects, labs, quizzes, and tests. The majority of points will come from labs and tests. Unit tests and the final exam will have multiple-choice and free response questions that will encourage students to analyze and synthesize information they have learned in order to prepare for AP Exam. There is also a final exam given at the end of each semester

100% - 90% = A; 89% - 80% = B; 79% -70% = C; 69% - 60% = D; Below 60% = Failure

The AP Biology course is a college level introductory course on life science designed around the AP Biology Curriculum Framework. The Curriculum Framework provides the four big ideas and the enduring understand­ings that focus on the major concepts in biology. All essential knowledge will be taught and all learning objectives will be addressed through this curriculum. The big ideas are interrelated, and they will not be taught in isolation. The course will connect the enduring understandings from one big idea with those of the others wherever practical. Students will maintain a curricular map of the big ideas and enduring understanding showing connections as they are made by the students themselves.

**The four Big ideas are:**

**Big idea 1**: The process of evolution drives the diversity and unity of life.

**Big idea 2**: Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.

**Big idea 3**: Living systems store, retrieve, transmit and respond to information essential to life processes.

**Big idea 4**: Biological systems interact, and these

Science is a process and students will be expected to work through that process. AP Biology will focus on inquiry-based laboratory work and the use of the seven science practices provided by the AP Biology Curriculum Framework in both lab and non-lab activities. A variety of supplemental student conducted labs, simulations and modeling activities designed to connect students to actual processes or examples found in nature are also used to widen the range of topics covered and to reinforce the application of science practices within a hands-on, discovery based environment. All levels of inquiry will be used and all seven science practice skills will be used by students on a regular basis in formal labs as well as activities outside of the lab experience. If a lab cannot be completed during regular class time, students must make arrangements to complete them at another time.

**Science Practices (SP)**

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 to guide investigations within the context of the AP course.

4. The student can plan 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.

**Course Calendar**

**Unit 1: Chemistry of Life (4 blocks; 8-11% of AP Exam)**

**Big ideas: 2, 3, 4**

**Connected to enduring understandings and learning objectives:**

ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.

 ENE-1.A: Describe the composition of macromolecules required by living organisms.

IST-1: Heritable information provides for continuity of life.

 IST-1.A: Describe the structural similarities and differences between DNA and RNA.

SYI-1: Living systems are organized in a hierarchy of structural levels that interact

SYI-1.A: Explain how the properties of water that result from its polarity and hydrogen bonding affect its biological function.

SYI-1.B: Describe the properties of the monomers and the type of bonds that connect the monomers in biological macromolecules.

SYI-1.C: Explain how a change in the subunits of a polymer may lead to changes in structure or function of the macromolecule.

**Readings:**

Ch 1: Introduction: Evolution and the Foundations of Biology

Ch 2: The Chemical Context of Life

Ch 3: Carbon and the Molecular Diversity of Life

**Unit 1 Overview of Lecture and Discussion Topics:**

1. Structure of Water and Hydrogen Bonding
2. Elements of Life
3. Introduction to Biological Macromolecules
4. Properties of Biological Macromolecules
5. Structure and Function of Biology Macromolecules
6. Nucleic Acids

**Unit 2: Cell Structure and Function (6 Classes; 10-13% of AP Exam**)

**Big ideas: 1, 2, 4**

**Connected to enduring understandings and learning objectives:**

EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.

EVO-1.A: Describe similarities and/or differences in compartmentalization between prokaryotic and eukaryotic cells.

EVO-1.B: Describe the relationship between the functions of endosymbiotic organelles and their free-living ancestral counterparts.

ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.

ENE-1.B: Explain the effect of surface area-to-volume ratios on the exchange of materials between cells or organisms and the environment.

ENE-1.C: Explain how specialized structures and strategies are used for the efficient exchange of molecules to the environment.

 ENE-2: Cells have membranes that allow them to establish and maintain internal environments

that are different from their external environments.

ENE-2.A: Describe the roles of each of the components of the cell membrane in maintaining the internal environment of the cell.

ENE-2.B: Describe the Fluid Mosaic Model of cell membranes.

ENE-2.C: Explain how the structure of biological membranes influences selective permeability.

ENE-2.D: Describe the role of the cell wall in maintaining cell structure and function.

ENE-2.E: Describe the mechanisms that organisms use to maintain solute and water balance.

ENE-2.F: Describe the mechanisms that organisms use to transport large molecules across the plasma membrane.

ENE-2.G: Explain how the structure of a molecule affects its ability to pass through the plasma membrane.

ENE-2.H: Explain how concentration gradients affect the movement of molecules across membranes.

ENE-2.I: Explain how osmoregulatory mechanisms contribute to the health and survival of organisms.

ENE-2.J: Describe the process that allow ions and other molecules to move across membranes.

ENE-2.K: Describe the membrane-bound structures of the eukaryotic cell.

ENE-2.L: Explain how internal membranes and membrane-bound organelles contribute to compartmentalization of eukaryotic cell functions.

SYI-1: Living systems are organized in a hierarchy of structural levels that interact.

 SYI-1.D: Describe the structure and/or function of subcellular components and organelles.

 SYI-1.E: Explain how subcellular components and organelles contribute to the function of

the cell.

SYI-1.F: Describe the structural features of a cell that allow organisms to capture, store, and use energy.

**Readings:**

Ch 4: A Tour of the Cell

Ch 5. Membrane Transport and Cell Signaling

**Unit 2 Overview of Lecture and Discussion Topics:**

1. Cell Structure: Subcellular Components
2. Cell Structure and Function
3. Cell Size
4. Plasma Membranes
5. Membrane Permeability
6. Membrane Transport
7. Facilitated Diffusion
8. Tonicity and Osmoregulation
9. Mechanisms of Transport
10. Cell Compartmentalization
11. Origins of Cell Compartmentalization

**Unit 3: Cellular Energetics (8 blocks; 12-16% of the AP Exam)**

**Big ideas: 2, 4**

**Connected to enduring understandings and learning objectives:**

ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.

 ENE-1.D: Describe the properties of enzymes.

 ENE-1.E: Explain how enzymes affect the rate of biological reactions.

 ENE-1.F: Explain how changes to the structure of an enzyme may affect its function.

 ENE-1.G: Explain how the cellular environment affects enzyme activity.

 ENE-1.H: Describe the role of energy in living organisms.

 ENE-1.I: Describe the photosynthetic processes that allow organisms to capture and store

energy.

 ENE-1.J: Explain how cells capture energy from light and transfer it to biological

molecules for storage and use.

ENE-1.K: Describe the processes that allow organisms to use energy stored in biological

macromolecules.

ENE-1.L: Explain how cells obtain energy from biological macromolecules in order to

power cellular functions.

 SYI-3: Naturally occurring diversity among and between components within biological systems

affects interactions with the environment.

 SYI-3.A: Explain the connection between variation in the number and types of molecules

within cells to the ability of the organism to survive and/or reproduce in different

environments.

**Readings:**

Ch 6. An Introduction to Metabolism

Ch 7. Cellular Respiration and Fermentation

Ch 8: Photosynthesis

**Unit 3 Overview of Lecture and Discussion Topics:**

1. Enzyme Structure
2. Enzyme Catalysis
3. Environmental Impacts on Enzyme Function
4. Cellular Energy
5. Photosynthesis
6. Cellular Respiration
7. Fitness

**Unit 4: Cell Communication and Cell Cycle (5 blocks; 10-15% of the AP Exam)**

**Big ideas: 2, 3**

**Connected to enduring understandings and learning objectives:**

ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and

homeostasis depend on organisms responding to environmental cues.

 ENE-3.A: Describe positive and/or negative feedback mechanisms.

 ENE-3.B: Explain how negative feedback helps to maintain homeostasis.

 ENE-3.C: Explain how positive feedback affects homeostasis.

IST-1: Heritable information provides for continuity of life.

 IST-1.B: Describe the events that occur in the cell cycle.

 IST-1.C: Explain how mitosis results in the transmission of chromosomes from one

generation to the next.

 IST-1.D: Describe the role of checkpoints in regulating the cell cycle.

 IST-1.E: Describe the effects of disruptions to the cell cycle on the cell or organism.

 IST-3: Cells communicate by generating, transmitting, receiving, and responding to chemical

signals.

 IST-3.A: Describe the ways that cells can communicate with one another.

 IST-3.B: Explain how cells communicate with one another over short and long distances.

 IST-3.C: Describe the components of a signal transduction pathway.

 IST-3.D: Describe the role of components of a signal transduction pathway in producing a

cellular response.

 IST-3.E: Describe the role of the environment in eliciting a cellular response.

 IST-3.F: Describe the different types of cellular responses elicited by a signal transduction

pathway.

 IST-3.G: Explain how a change in the structure of any signaling molecule affects the

activity of the signaling pathway.

**Readings:**

Ch 5. Membrane Transport and Cell Signaling

Ch 9. The Cell Cycle

Ch 16. Development, Stem Cells, and Cancer

Ch 35. The Immune System

Ch 37. Neurons, Synapses, and Signaling

Ch 38. Nervous and Sensory Systems

**Unit 4 Overview of Lecture and Discussion Topics:**

1. Cell Communication
2. Introduction to Signal Transduction
3. Signal Transduction
4. Changes in Signal Transduction Pathways
5. Feedback
6. Cell Cycle
7. Regulation of Cell Cycle

**Unit 5: Heredity (6 Blocks; 8-11% of the AP Exam**)

**Big ideas: 1, 3, 4**

**Connected to enduring understandings and learning objectives:**

EVO-2: Organisms are linked by lines of descent from common ancestry.

EVO-2.A: Explain how shared, conserved, fundamental processes and features support the concept of common ancestry for all organisms.

IST-1: Heritable information provides for continuity of life.

IST-1.F: Explain how meiosis results in the transmission of chromosomes from one generation to the next.

IST-1.G: Describe similarities and/or differences between the phases and outcomes of mitosis and meiosis.

IST-1.H: Explain how the process of meiosis generates genetic diversity.

IST-1.I: Explain the inheritance of genes and traits as described by Mendel’s laws.

IST-1.J: Explain deviations from Mendel’s model of the inheritance of traits.

SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

SYI-3.B: Explain how the same genotype can result in multiple phenotypes under different environment conditions.

SYI-3.C: Explain how chromosomal inheritance generates genetic variation in sexual reproduction.

**Readings:**

Ch 10. Meiosis and Sexual Life Cycles

Ch 11. Mendel and the Gene Idea

Ch 12. The Chromosomal Basis of Inheritance

**Unit 5 Overview of Lecture and Discussion Topics:**

1. Meiosis
2. Meiosis and Genetic Diversity
3. Mendelian Genetics
4. Non-Mendelian Genetics
5. Environmental Effects on Phenotype
6. Chromosomal Inheritance

**Unit 6: Gene Expression and Regulation (11 Blocks; 12-16% of the AP Exam**)

**Big ideas: 3**

**Connected to enduring understandings and learning objectives:**

IST-1: Heritable information provides for continuity of life.

IST-1.K: Describe the structures involved in passing hereditary information from one generation to the next.

IST-1.L: Describe the characteristics of DNA that allow it to be used as the hereditary material.

IST-1.M: Describe the mechanisms by which genetic information is copied for transmission between generations.

IST-1.N: Describe the mechanisms by which genetic information flows from DNA to RNA to protein.

IST-1.O: Describe how the phenotype of an organism is determined by its genotype.

IST-1.P: Explain the use of genetic engineering techniques in analyzing or manipulating DNA.

IST-2: Differences in the expression of genes account for some of the phenotypic differences between organisms.

 IST-2.A: Describe the types of interactions that regulate gene expression.

IST-2.B: Explain how the location of regulatory sequences relates to their function.

IST-2.C: Explain how the binding of transcription factors to promoter regions affects gene expression and/or the phenotype of the organism.

IST-2.D: Explain the connection between the regulation of gene expression and phenotypic differences in cells and organisms.

IST-2.E: Describe the various types of mutation.

IST-4: The processing of genetic information is imperfect and is a source of genetic variation.

 IST-4.A: Explain how changes in genotype may result in changes in phenotype.

IST-4.B: Explain how alterations in DNA sequences contribute to variation that can be subject to natural selection.

**Readings:**

Ch 13. The Molecular Basis of Inheritance

Ch 14. Gene Expression: From Gene to Protein

Ch 15. Regulation of Gene Expression

Ch 16. Development, Stem Cells, and Cancer

Ch 17. Viruses

Ch 18. Genomes and their Evolution

**Unit 6 Overview of Lecture and Discussion Topics:**

1. DNA and RNA Structure
2. Replication
3. Transcription and RNA Processing
4. Translation
5. Regulation of Gene Expression
6. Gene Expression and Cell Specialization
7. Mutations
8. Biotechnology

**Unit 7: Natural Selection (12 Blocks; 13-20% of the AP Exam)**

**Big ideas: 1, 4**

**Connected to enduring understandings and learning objectives:**

EVO-1: Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.

 EVO-1.C: Describe the causes of natural selection.

 EVO-1.D: Explain how natural selection affects populations.

 EVO-1.E: Describe the importance of phenotypic variation in a population.

 EVO-1.F: Explain how humans can affect diversity within a population.

 EVO-1.G: Explain the relationship between changes in the environment and evolutionary

changes in the population.

 EVO-1.H: Explain how random occurrences affect the genetic makeup of a population.

 EVO-1.I: Describe the role of random processes in the evolution of specific populations.

 EVO-1.J: Describe the change in the genetic makeup of a population over time.

 EVO-1.K: Describe the conditions under which allele and genotype frequencies will

change in populations.

EVO-1.L: Explain the impacts on the population in any of the conditions of Hardy-

Weinberg are not met.

EVO-1.M: Describe the types of data that provide evidence for evolution.

EVO-1.N: Explain how morphological, biochemical, and geological data provide evidence

that organisms have changed over time.

 EVO-2: Organisms are linked by lines of descent from common ancestry.

 EVO-2.B: Describe the fundamental molecular and cellular features shared across all

domains of life, which provide evidence of common ancestry.

 EVO-2.C: Describe structural and functional evidence on cellular and molecular levels that

provides evidence for the common ancestry of all eukaryotes.

 EVO-3: Life continues to evolve within a changing environment.

 EVO-3.A: Explain how evolution is an ongoing process in all living organisms.

 EVO-3.B: Describe the types of evidence that can be used to infer an evolutionary

relationship.

EVO-3.C: Explain how a phylogenetic tree and/or cladogram can be used to infer evolutionary relatedness.

EVO-3.D: Describe the conditions under which new species may arise.

EVO-3.E: Describe the rate of evolution and speciation under different ecological conditions.

EVO-3.F: Explain the processes and mechanisms that drive speciation.

EVO-3.G: Describe factors that lead to the extinction of a population.

EVO-3.H: Explain how the risk of extinction Is affected by changes in the environment.

EVO-3.I: Explain species diversity in an ecosystem as a function of speciation and extinction rates.

EVO-3.J: Explain how extinction can make new environments available for adaptive radiation.

SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

SYI-3.D: Explain how the genetic diversity of a species or population affects its ability to withstand environmental pressures.

SYI-3.E: Describe the scientific evidence that provides support for models of the origin of life on Earth.

**Readings:**

Ch 19. Descent with Modification

Ch 20. Phylogeny

Ch 21. The Evolution of Populations

Ch 22. The Origin of Species

Ch 23. Broad Patterns of Evolution

Ch 24. Early Life and the Diversification of Prokaryotes

Ch 25. The Origin and Diversification of Eukaryotes

Ch 27. The Rise of Animal Diversity

**Unit 7 Overview of Lecture and Discussion Topics:**

1. Introduction to Natural Selection
2. Natural Selection
3. Artificial Selection
4. Population Genetics
5. Hardy-Weinberg Equilibrium
6. Evidence for Evolution
7. Common Ancestry
8. Continuing Evolution
9. Phylogeny
10. Speciation
11. Extinction
12. Variations in Populations
13. Origin of Life on Earth

**Unit 8: Ecology (10 blocks; 10-15% of the AP Exam)**

**Big Ideas 1, 2, 3, 4**

**Connected to enduring understandings and learning objectives:**

EVO-1: Evolution is characterized by change in the genetic make-up of a population over time and is supported by multiple lines of evidence.

 EVO-1.O: Explain the interaction between the environment and random or preexisting variations in populations.

ENE-1: The highly complex organization of living systems requires constant input of energy and the exchange of macromolecules.

 ENE-1.M: Describe the strategies organisms use to acquire and use energy.

 ENE-1.N: Explain how changes in energy availability affect populations and ecosystems.

 ENE-1.O: Explain how the activities of autotrophs and heterotrophs enable the flow of energy

 within an ecosystem.

ENE-3: Timing and coordination of biological mechanisms involved in growth, reproduction, and homeostasis depend on organisms responding to environmental cues.

 ENE-3.D: Explain how the behavioral and/or physiological response of an organism is related

 to changes in internal or external environment.

ENE-4: Communities and ecosystems change on the basis of interactions among populations and disruptions to the environment.

 ENE-4.A: Describe the structure of a community according to its species composition and

 diversity.

 ENE-4.B: Explain how interactions within and among populations influence community

 structure.

 ENE-4.C: Explain how community structure is related to energy availability in the

 environment.

IST-5: Transmission of information results in changes within and between biological systems.

 IST-5.A: Explain how the behavioral responses of organisms affect their overall fitness and

 may contribute to the success of the population.

SYI-1: Living systems are organized in a hierarchy of structural levels that interact.

 SYI-1.G: Describe factors that influence growth dynamics of populations.

 SYI-1.H: Explain how the density of a population affects and is determined by resource

 availability in the environment.

SYI-2: Competition and cooperation are important aspects of biological systems.

 SYI-2.A: Explain how invasive species affect ecosystem dynamics.

 SYI-2.B: Describe human activities that lead to changes in ecosystem structure and/or

 dynamics.

 SYI-2.C: Explain how geological and meteorological activity lead sto changes in ecosystem

 structure and/or dynamics.

SYI-3: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

 SYI-3.F: Describe the relationship between ecosystem diversity and its resilience to changes

 in the environment.

 SYI-3.G: Explain how the addition or removal of any component of an ecosystem will affect

 its overall short-term and long-term structure.

**Readings:**

Ch 39: Motor Mechanisms and Behavior

Ch 40: Population Ecology and the Distribution of Organisms

Ch 41: Species Interactions

Ch 42: Ecosystems and Energy

Ch 43: Global Ecology and conservation Biology

**Unit 8 Overview of Lecture and Discussion Topics:**

1. Responses to the Environment
2. Energy Flow Through Ecosystems
3. Population Ecology
4. Effect of Density of Populations
5. Community Ecology
6. Biodiversity
7. Disruptions to Ecosystems

**Homework**: Work is due at the beginning of class unless otherwise specified. Late work is unacceptable. It expected that students spend a minimum of an hour per night to study and review. There may be homework assigned over vacation periods (summer, winter, and spring breaks). It is expected that this homework be completed and turned in when specified.

**Attendance**: Being in class is important! Students who have frequent absences often miss important information regarding topics, homework, labs and tests. **You are responsible for finding out about and turning in missed work and for getting the notes you may have missed.** Do not interrupt class in order to find out what you missed. If you have questions, you may see me after school from 2:40-3:00 or while others are working on an in-class assignment. If you miss a lab, you must come in to make up the lab or complete an appropriate alternative. **Absences and Tests:** If you know about a test ahead of time and you are absent the class period before the test, even if it is excused, **you must still take the test.** If you are absent the day of a test, you have three days to make it up.

**Behavior**: I expect you to be respectful to yourself and others and to respect people's property and space. You will be in your seat and prepared to work having all of your materials with you when the bell rings. You will turn your cell phone in at the beginning of class or keep it out of sight.

PLEASE SIGN AND RETURN THIS FORM. KEEP THE COURSE INFORMATION FOR FUTURE REFERENCE.

I have read and understand the **AP Biology Course Guidelines** and what I must do to be successful in this course.

Student (Sign Name) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_

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I have read and understand the **AP Biology Course Guidelines** and also give my child permission to watch films in class.

Parent or Guardian (Sign Name) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_

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How would you like to be contacted? Phone email

Please provide me with the best phone number or email with which I can reach you

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