**AP Biology**  2021-2022

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Tutoring: Monday: 7:30-8am, Thurs: 3-3:30pm

Other times by appointment

Welcome to AP Biology! I love science and I am fascinated every day by the things I learn. I hope that together we can have a successful and productive year! My AP Biology course conforms to the standards instituted by the College Board for all AP courses and covers all of the topics in the AP Biology Course Description.

**Philosophy**

My philosophy of science education has two main threads. You will notice that these two things continually come up during my lectures, our discussions and the assignments. First, *we are all responsible for the health and well-being of the earth* and second, *we must know where we have been in order to see where we are going*.

Through this course, I will try to help you see that the earth around you is in constant motion. Things change, evolve, react, and are effected by the decisions you and I make. It is up to us to be part of the solution, not part of the problem. I will do my best to make sure you see how little changes you can make in your everyday life have an impact on the ecosystem.

I know that the word ‘evolution’ is touchy for some students. I believe that in the study of biology, everything should be tied to evolution. Through class discussions, reading and research, we will look back to see where we have been (ie. Where did all this stuff come from?) and we will examine ways that the theory of evolution has changed the way we think about the world around us.

**Classroom Expectations**

* Be **respectful** and **courteous** to your classmates and the teacher.
* **Actively participate** in every class.
* Allow the other students in the class (and yourself) to **learn**.
* **Be punctual!** (Be in the room and ready to go when the bell rings)
* Follow all verbal and written instructions from the teacher.
* Do your **very best** every day!

**WHS Rules**

You are expected to follow all rules & policies for WHS/UCPS outlined in the student handbook.

**Course Books**

**Campbell BIOLOGY AP\* Edition, 12th Edition (2020).** This text book is provided by the school. I hope to teach you how to effectively use textbooks this year. There are review questions, practice multiple choice questions and helpful pictures/diagrams in the text book. Please use it to help you study!

**Barron’s AP Biology 7th Edition (review book)** – this book comes highly recommended from past AP students who used it to help them review for class tests as well as the AP test in May. I recommend that you get a copy sooner rather than later.

**Materials**

* **notebook** dedicated to AP Biology – You will need some way to take notes and store all of the things you will accumulate this year. I trust that you know best how you will stay organized so use whatever works best for you!
* **composition notebook** – also called a cow notebook, this will be our lab notebook for the year. You will use it to keep track of data, analysis and conclusions drawn from lab activities.
* **calculator** – you should have a calculator for the math we do in class. You can use the same calculator that you use for math class. You may NOT use your phone as a calculator during any test.
* **pencil, ink pen, paper**! You are expected to come to class prepared!
* **highlighters** and **sticky notes** to designate questions you may have while reading and studying are very helpful.
* I love things like **colored pencils** and **markers** to make my notes more interesting.

\*\*Please come to class prepared every day!

# Course Rationale

Advanced Placement Biology is a year-long course that is divided into two semesters. **In order to receive the full credits of this AP course, a student must successfully complete each semester and must take the AP Biology Exam**, which is administered on *Wednesday, May 11, 2022 at noon*. This course is designed to expose students to advanced concepts in biology with a concentration in biochemical and physical principles that govern the existence of every organism on this planet; therefore, it is recommended that students must have taken *Honors Biology* and *Honors Chemistry* before taking this course.

# Course Dynamics

This course is taught in a mixed format that includes lecture, active learning and in-depth analysis of biological principles. It also incorporates many laboratory (College Board) components that allow students to observe, analyze, and master major areas of study in biology. During the first semester, students will be exposed to biochemistry, cell physiology, metabolism, molecular biology, genetics and evolution. The second semester will encompass organismal biology, animal behavior, human physiology and ecology. **AP Biology requires the use of critical and analytical thinking and strong writing skills** in everyday lecture discussions, inquiry activities, debates, laboratory reports, quizzes and exams. The nature of this course requires that every student develops and nurtures strong study habits in order to comprehend and master these concepts.

# Course Description & Outline

This AP Course is structured around four big ideas, the enduring understandings within the big ideas and the essential knowledge within the enduring understandings. The big ideas are connected to each other and are therefore, not taught in isolation. Students will receive a copy of the big ideas and enduring understandings to monitor their progress towards mastery of these concepts.

**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 systems and their interactions possess complex properties.

**Units of Instruction**

(SP = Science Practice – explained in the ‘Course Grading’ section below)

**Introduction**: Discussion of summer reading

*Activities:*

1. Students will engage in whole class and small group discussions on the summer reading. Analysis of graphical data from experiments presented in the book, patterns of genetics/ natural selection/evolution/ecology and the part the environment plays in the process will be discussed.

**Unit 1: Chemistry of Life**

*Topics:*

1. Properties of Water (Ch. 3)
2. Importance of carbon (Ch. 4)
3. Structure and function of large organic molecules (Ch. 5)

*Activities:*

1. Students will create models of atoms and review how electron configurations influence atom behavior and bonding.
2. Students will model the folding of proteins using their bodies as amino acids. Discussion topic: how do different environments affect the levels of folding?
3. *Investigation 4*: What causes plants to wilt if I forget to water them?(Diffusion and osmosis) (SP 3, 5)
4. *Students will complete a water lab and use statistics to analyze the data gathered in the lab.*
5. *Students will complete a lab with M & Ms candies and analyze the data using statistics.*

**Unit 2: Cell Structure & Function**

*Topics:*

1. Overview of the cell and associated organelles (Ch. 6)
2. The plasma membrane (Ch. 7)
3. Cellular transport (Ch.8)

*Activities:*

1. Students will visit the website <http://learn.genetics.utah.edu/content/begin/cells/ organelles/> to read an article supporting endosymbiont theory. The will work in pairs to evaluate the evidence presented in the article. A whole class discussion will follow.
2. Students will develop skits to relate the importance of the endomembrane system and the function of the components of this system. Peers will review and use a simple rubric to grade each group.
3. Students will construct a model of a plasma membrane, including associated proteins, using various materials (yarn, paper plates, card board, etc.) and in a class presentation justify why they selected that particular material to represent that part of the membrane. Selection of materials to represent parts of the membrane should be based on membrane function. (SP 1)
4. *Investigation 5*: Inquire lab to determine how different concentrations of salt water affect the vacuoles of plant cells.

**Unit 3: Cellular Energy**

*Topics:*

1. Introduction to Metabolism (Ch. 6)
2. Enzyme structure and function (Ch. 6)
3. Photosynthesis (Ch. 10)
4. Cellular Respiration (Ch. 9)
5. Alternatives to the processes and evolutionary significance (Ch. 9 & 10)

*Activities:*

1. Students will read the article “Symmetry, Broken-Symmetry and the First and Second Laws of Thermodynamics” from entropylaw.com and participate in whole class discussions about the laws. They will also revisit this article several times to discuss what it says about photosynthesis, the cell and evolution.
2. *Laboratory investigation 5*: What factors affect the rate of photosynthesis in living leaves? (Photosynthesis)
3. *Laboratory investigation 6*: What factors affect the rate of cellular respiration in multicellular organisms? (Cellular respiration)
4. *Inquiry lab*: Students will participate in a lab that uses snails, elodea and carbon dioxide indicator to investigate the processes of photosynthesis and cellular respiration. Students will be guided through the first part of the inquiry process (observation, formulation of question) but will gather the data they feel is significant and analyze the data in the way they feel is most appropriate. Students will write individual lab reports upon completion of this lab. (Big Idea 2, 4; SP 4, 5, 7)

**Unit 4: Cell Communication and the Cell Cycle**

*Topics:*

1. Evolution of cell signaling (Ch. 11)
2. Process of cell signaling (Ch. 11)
3. Evolution of mitosis (Ch. 12)
4. Process and results of mitosis (Ch. 12)
5. Regulation of the cell cycle (Ch. 12)

*Activities:*

1. Using their bodies, students will model each type of cell communication noting the differences in parts of the cell involved. A whole class discussion of the types of cell communication and the similarities and differences will follow.
2. Students will use the website < http://extoxnet.orst.edu/faqs/pesticide/endocrine.htm> to discover how hormones work and what disrupts these endocrine signals. Special attention will be paid to the connection between hormones and cancer.
3. Students will model the cell cycle using pool noodles as chromosomes and explain major events that take place in each stage.
4. *Inquiry lab*: Students will use mitosis cards and prepared slides of onion root tip to count cells in each stage of mitosis and calculate the percentage of time spent in each stage. Students will then infer why the length of each stage is at is presented in their data. We will compare data between groups and discuss discrepancies. Students will turn in a modified lab report that contains a hypothesis, data table, data analysis and conclusions. (SP 2, 5)

**Unit 5: Heredity**

*Topics:*

1. Process of meiosis (Ch. 13)
2. Evolutionary significance of sexual life cycles (Ch. 13)
3. Mendelian Genetics – experiments, laws and rules (Ch. 14)
4. Applications of Mendelian Genetics – pedigree analysis and disorders (Ch. 14)
5. The environment and genetics (Ch. 14)
6. Genes and chromosomes (Ch. 15)

*Activities:*

1. Students will conduct a Chi2 analysis using M&M’s candies and the published percentages of colors in each package. (SP 2, 5)
2. Students will use linked paper clips of different colors to model the movement of chromosomes during meiosis.
3. Students will use linked paper clips of different colors to model alternations of chromosome numbers, alternations of chromosome structure and why linked genes tend to be inherited together.
4. Case study: Crossing-over, gender testing and the Olympic Games. Students will investigate two cases of female athletes whose gender was called into question. They will be presented with evidence about the two women, evaluate the evidence and determine what they would have done had they been on the IOC.
5. *Laboratory Investigation 7*: Cell division: mitosis and meiosis

6. *Long term lab*: Students will grow and cross Wisconsin Fast Plants and determine how two traits are inherited by using a Chi2 analysis.

**Unit 6: Gene Expression & Regulation**

*Topics:*

1. Historical context of DNA (discovery, experiments, etc.) (Ch. 16)
2. Flow of genetic information (transcription and translation) (Ch. 17)
3. Mechanics and effects of mutations (Ch. 17)
4. Differential gene expression (Ch. 18)
5. Virus structure, function and importance (Ch. 19)
6. Gel electrophoresis (20.2)

*Activities:*

1. Students will evaluate the experiments and contributions of Watson & Crick, Griffith, Hershey & Chase, Chargaff and Messelson & Stahl.
2. Following a lecture on operons, groups of students will use pool noodles to build a working model of an operon. They will use their model to demonstrate how the system works in a short video that will be posted to our class canvas page.
3. Students will use handouts to create a 3-D cut and paste model showing how histone, acetyl and methyl molecules control access to DNA and thus how they affect gene expression.
4. *Laboratory investigation 8:* Biotechnology: Bacterial Transformation – Students will use E.coli, the p-blu plasmid and antibiotics to attempt bacterial transformation. Upon completion of the lab, students will write a complete lab report including pictures and diagrams of their blue bacterial colonies on transformed plates. (Big Idea 3; SP 3, 6, 7)

**Unit 7: Natural Selection**

*Topics:*

1. Natural selection as a mechanism for change (Ch. 22)
2. Evidence for evolution (Ch. 22)
3. The Hardy-Weinberg equation (Ch. 23)
4. Evolution of populations (Ch. 23)
5. Mechanisms of speciation (Ch. 24)
6. The History of Life (origin of life, events in the history, fossil record) (Ch. 25)
7. Phylogeny and cladograms (Ch. 26)

*Activities:*

1. Students will read the article “Public Acceptance of Evolution” by Miller, Scott and Okamoto and discuss the information presented. We will discuss how bias enters the scientific field and the graph of acceptance that is presented in the article.
2. *Inquiry Lab*: Sickle Cell Anemia Bean lab – Using red and white beans as alleles, students will generate data on a population that contains the sickle cell trait. Attention will be paid to the numbers of each allele present at the beginning of the lab. Students will be prompted to use Chi2 analysis and the Hardy-Weinberg equation should be used to analyze the data. (Big Idea 1 & 3; SP 1, 2, 5)
3. Students will reexamine data from Peter and Rosemary Grant’s study of Darwin’s finches and focus on how the environment plays a part in changes evident in the population. (The summer assignment was to read Beak of the Finch by Jonathan Weiner and the book has already been discussed at the beginning of the year.)
4. *Laboratory investigation*: Creating Coacervates lab (adapted by Larry Flammer). Students will create coacervates using a protein solution and a carbohydrate solution and observe the “creation” for signs of “life.” After taking data (student discretion), students will determine if these coacervates are alive using what they know about the characteristics of life. Students will then develop a question about the coacervates that they would like to answer, formulate a hypothesis and determine a procedure for their experiment. Students will perform their lab while recording data. Experiments, data and conclusions will be shared with the class via a mini research poster. (Big Idea 1; SP 1, 3, 4, 6, 7)
5. Students will use prepared “organism” cards to create a simple cladogram. This activity is used to introduce this concept in a playful way.

**Unit 8: Ecology**

*Topics:*

1. Animal behavior (Ch. 51)
2. Modeling population growth (Ch. 53)
3. Factors regulating population growth (Ch. 53)
4. Community interactions and biodiversity (Ch. 54)
5. Energy flow and chemical cycling in ecosystems (Ch. 55)
6. Primary productivity (Ch. 55)
7. Energy transfer and food chains/webs (Ch. 55)
8. Impact of human activities (Ch. 56)

*Activities:*

1. *Laboratory investigation*: Isopod behavior lab – Students will design experiments to test the effects of different environmental conditions on the behavior of isopods. After students conduct their experiment, they will record their data, analysis and conclusions in their laboratory notebook. (SP 3, 4, 5)
2. Project: In conjunction with the BC calculus class, students will be provided with population data for four different populations. They will use graphing calculators to graph the data and determine whether the population is experiencing logistic or exponential growth. Students also answer other questions about the population data and graphs they have constructed. (SP 1, 2, 5)
3. Students will participate in a debate on a topic decided on by the class. The topic should relate to a current global issue (climate change, genetically modified crops,

# Course Grading

1. **Exams 50%**
2. **Reading Quizzes/Quizzes 15%**
3. **Labs, Article Reviews 20%**
4. **Classwork/Homework 15%**

Please note that about one half of your six-weeks grade will come from exam scores, the other two thirds will come from various activities that will have specific due dates and must be turned in at the proper time. Work is due at the beginning of the class period. Online assignments are usually due at 10pm and will prevent you from uploading your work after this time. Work not turned in at this time will not be accepted. ***Since the grading process is laborious, late work will only be accepted one day after the due date and with a 50% reduction in the grade!!!*** Therefore students are expected to prioritize and plan ahead to maximize success.

**Cheating**

Cheating on any assignment will result in a zero for that assignment. Cheating includes, but is not limited to: receiving unauthorized aid on an assignment, clicking off of the quiz page on canvas/online quizzes (including reading quizzes and BIG quizzes), copying someone else’s work. Please see Mrs. Manley if you have questions or concerns about cheating.

**Exams**

Two exams will be given during each six-week period. Each exam will be worth 100 points. Exam material will come from assigned chapters of the AP Biology book, classroom discussions and other assigned work during class. ***Exams will be formatted like the AP test with multiple choice questions, grid-in questions, free-response questions and short answer questions.*** The tests will consist of 30 multiple choice questions, 1 long free response question and 2-3 short answer questions modeled after the corresponding section on the AP test.

**Make-up Exams:** If you are absent from school on the day that an exam is administered; it is your responsibility to schedule your make-up exam *within five school days* of your absence. I do not allow students to make up exams during class time so you will take make up exams before or after school.

\*\*\*\* Just a note: I **DO NOT** “do” extra credit. However, you will have a unique opportunity to earn points back on exam grades. When I grade the exams, I will not write on your copy. I will tell you how many questions you answered correctly. It will be **your job** to talk to other members of the class, decide which questions you missed and correct them. If you correct a question that was incorrect, you will earn ½ point back. If you correct a question that was correct to start with, you will lose ¼ point. ***Corrections will be completed in my classroom****.* Looking up answers and talking to other members of the class is encouraged. This is a completely optional assignment!

**Labs**

Students will conduct **several hands-on, inquiry experiments** in assigned lab-groups. Since every laboratory experiment requires the input from all members within the group, it is extremely important that students exchange contact information, plan, and organize the execution of the experiment. Students will be asked to analyze and evaluate their data. Mathematical analysis using many different techniques will also be required.

*We will spend at minimum 25% of our time in the laboratory setting.*

The seven science practices, skills important in the lab setting, will be used by students on a regular basis to help them make conclusions using the data they collected during the laboratory experiences. The seven science practices are outlined on the next page.

**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.

At the conclusion of each laboratory activity we perform, students will participate in a whole class discussion to share data, analysis and conclusions. Each student will compile a lab notebook this year that should contain all of the information from all of the labs we conduct, formal or informal. This notebook should be a composition notebook (cow notebook) and should be kept up-to-date at all times. *The assessment for some labs will be turning in the lab notebook, some will require a complete lab write-up and some will conclude with a lab quiz to be taken individually.*

**Lab/Other Presentations**

During the year, we will do LOTS of presentations…on our lab results, on different pieces of content, on big topics. Each group member is responsible for a part in the presentation. If you are absent on a planned presentation day:

* You must see Mrs. Manley the NEXT SCHOOL DAY and do the whole presentation by yourself.
* You should also communicate with your group members and let them know that you will not be present on the day of the presentation.
* If you fail to make-up the presentation (see first bullet point), you will only be able to earn half of the grade for the presentation. (Ex. If the presentation is worth 60 points, your grade will be 30 points because you did the work, but failed to do the presentation)

**Daily Grades**

Daily grades will consist of practice free-response questions, grades on modeling activities completed during class, homework, and other assignments that present themselves. We will usually have at least one grade per day. It is not possible to make up modeling activities so class attendance is incredibly important.

Students earn participation grades by participating in class activities. Students who work with their group, have prepared for class (readings, chapter walks, etc.) contribute and “pull their weight” will earn points while students who do not do these things will not earn points.

**Assignments:** Students will have the opportunity to obtain grades through exploratory assignments, research projects, presentations, in-class essays, and quizzes. **Ample information and time will be allocated for the completion of these assignments.** In-class essays and reading quizzes will mostly occur in an unannounced manner to ensure that all students are keeping up with the assigned readings from each chapter in the book.

**Reading Logs:** We will discuss the reading log format before you begin to complete them. Reading logs for the tested chapters are due on the day of the test and are worth 10 points per chapter. **No** late reading logs will be accepted. Reading logs are assigned at the beginning of each unit and are continually available on our class canvas page. They are **not** optional and will help you review important material for the exams and they will aid in your understanding. *You also may NOT type reading logs.*

**Quizzes:** We have big and small quizzes. Big quizzes come in the middle of units and after really important content. These quizzes are scheduled on our calendar. These quizzes should be made up in a timely manner if missed.

**Reading Quizzes:** In order to fully understand the material we will be studying this year, it is imperative that you read before you come to class. Our class calendar, available on canvas, contains the reading assignments for each unit. There will be (almost) daily quizzes on the nightly reading. These quizzes are called Reading Quizzes. If you miss a reading quiz, you should make up the quiz in 5 school days**. If you fail to make up the reading quiz, it will result in a zero for that quiz.** A mulligan can be used to replace a low quiz grade. \*\*If you

**Article Reviews**: Throughout the year, you will receive 3-4 scientific articles from a major science journal (i.e. Scientific American, Nature, Science, etc). You will be responsible for reading, analyzing and writing an article review. The information in each article will help you conceptualize topics discussed in class while allowing you to explore different realms of science. The criteria for writing a successful article review are:

* Must be typed in single spacing.
* Must not exceed one page.
* Must have a title.
* Must be critical and analytical.
* Must include possible applications.
* Must be turned in by its due date.

An article review should include 4 parts:

-a brief *summary* of the article (no more than one short paragraph),

-*analysis* of the article (what is it telling us),

-a *critique* of the science (would you have done something different), and

-possible *applications* of the results/conclusions.

\*\*These reviews will develop and enhance your analytical and critical thinking skills, which in turn will become powerful tools in your life.

**Canvas:** We will be using Canvas and google drive extensively in this class. There will be articles to print, assignments to complete and other things to participate in on our Canvas site. Some of the Canvas assignments will be graded. I will give you ample instruction on how to use the aspects of Canvas with which we will be working. We will learn together this year and I will guide you through any of the processes that are unfamiliar to you. If you have questions, please ask!

**Other Expectations**

During the next two semesters, each of you will embark on an exciting journey through life with an emphasis in biology. As the instructor for this course, I will provide an environment that is exciting and conducive to learning, embracing all angles of reasoning and most important of all, I will make the greatest effort to relate every topic to your existence as a human being on this planet. In return, I expect that each student has ***a positive learning attitude***, **asks questions** and **participates** in classroom discussions, develops and nurtures strong critical and analytical skills and comes to class fully prepared for daily lectures, laboratory experiments, exams and other activities.

## Formula For Success:

1. Prioritize and practice good **organizational skills**. Use an organizer or planner to write down assignments and keep up with due dates!
2. Form **study groups** and exchange contact information. Studying with colleagues can be very effective if done properly. (more than 3 people is usually too many)
3. Keep up with the **reading assignments**. Remember – reading logs count!
4. Study in increments. **Do not wait to study until the night before the exam**!
5. When working in groups, **participate and contribute** to the success of your group!
6. Participate in classroom discussions by asking questions. Ask for clarification of any topic during class or after class. **Remember I have an open door policy!!!**
7. Use the Barron’s book to review, complement the text and study for the AP Exam.
8. **DO NOT neglect a due date. Failure to turn in assignments creates disaster! (ie: grade = 0) Please remember that I DO NOT accept late work.**