

AP[®] Biology

Syllabus

EXPECTATIONS

AP[®] Biology is both a challenging and a rewarding course. It provides students with an opportunity to develop a conceptual framework for modern biology, emphasizing applications of biological knowledge and critical thinking to environmental and social concerns. In this course, students will experience science as a process through a series of investigations in which they will utilize their conceptual understanding of biological processes to develop advanced inquiry and reasoning skills. This is a college-level course, and students will be held to high expectations and mature responsibilities just like a college freshman taking Introduction to Biology.

GOALS OF THE COURSE: The Four Big Ideas

The AP Biology Examination continues to emphasize the concepts and themes of biology. Less weight is placed on specific facts than on the “big ideas” that tie them together. There are two major goals of AP Biology: (1) to enable students to develop a real understanding of the principal concepts in biology and (2) to experience science as a process of problem solving and discovery. AP Biology at our school accomplishes these two goals in the following way. Each unit is organized and taught with great attention paid to the *Four Big Ideas* below. Lessons are designed to highlight the repeating, overarching themes or patterns that thread their way through three major *topics* (subject areas in biology). Those topics are:

- The process of evolution drives the diversity and unity of life.
- Biological systems utilize free energy and molecular building blocks to grow, to reproduce and to maintain dynamic homeostasis.
- Living systems store, retrieve, transmit and respond to information essential to life processes.
- Biological systems interact, and these systems and their interactions possess complex properties.

For example, the concept of energy transfer will help us connect topics as diverse as cellular respiration and ecosystem dynamics. In addition, the context for all *concepts* (the most important ideas that form our current understanding of a particular topic) and lab work is evolution. Evolution is the underlying foundation for all modern biological thought, and this is emphasized in every unit, as it is the common thread that links everything together.

THE FOUR BIG IDEAS & MAJOR CONCEPTS

The FOUR BIG IDEAS are:

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

Enduring Understanding

1A: Change in genetic makeup of a population over time is evolution.

1B: Organisms are linked by lines of descent from common ancestry.

1C: Life continues to evolve within a changing environment.

1D: The origin of living systems is explained by natural processes.

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

Enduring Understanding

2A: Growth, reproduction and maintenance of the organization of the living systems requires free energy and matter.

2B: Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.

2C: Organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.

2D: Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.

2E: Many biological processes involved in growth, reproduction and dynamic homeostasis include temporal regulation and coordination.

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

Enduring Understanding

3A: Heritable information provides for continuity of life.

3B: Expression of genetic information involves cellular and molecular mechanisms.

3C: The processing of genetic information is imperfect and is a source of genetic variation.

3D: Cells communicate by generating transmitting and receiving chemical signals.

3E: Transmission of information results in changes within and between biological systems.

Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

Enduring Understanding

4A: Interactions within biological systems lead to complex properties.

4B: Competition and cooperation are important aspects of biological systems.

4C: Naturally occurring diversity among and between components within biological systems affects interactions with the environment.

4D: 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 also be posted in the room. As connections are made across big ideas, a line will join the related enduring understandings, visually building a web of relatedness as the course progresses. The learning objectives will be used as a guide to build the rest of the class discussions, not as a checklist to be marked off through the year, but as a way to help students learn a focused amount of biological content with the use of specific scientific process skills. Skills will be practiced every day, not necessarily all skills every day, but each day at least one skill will be used to introduce the biological content students study.

Curricular Requirements [CR]

CR1 Students and teachers use a recently published (within the last 10 years) college-level biology textbook.

CR2 The course is structured around the enduring understandings within the big ideas as described in the AP Biology Curriculum Framework.

CR3a Students connect the enduring understanding within Big Idea 1 (the process of evolution

- drives the diversity and unity of life) to at least one other big idea.
- 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.
- 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.
- 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.
- CR4a** The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.
- CR4b** The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.
- CR4c** The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 3.
- CR4d** The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.
- CR5** The course provides students with opportunities to connect their biological and scientific knowledge to major issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.
- 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.
- 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.
- 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.

COURSE PLANNER

The following table lists the units we'll be studying, in sequential order throughout the year, and how many days we will spend on each unit. Also listed are the AP Biology labs we will be doing that correspond to the units

	Unit	Chapter		Labs
1 st Semester	1 The Chemistry of Life	1	The Science of Biology	
		2	The Nature of Molecules and Properties of Water	
		3	The Chemical Building Blocks of Life	
	2 The Cell	4	Cell Structure	Diffusion & Osmosis
		5	Membranes	
		9	Cell Communication	
		10	How Cells Divide	
	3 Cellular Energetics	6	Energy & Metabolism	Enzyme Catalysis
		7	How Cells Harvest Energy	Cellular Respiration
				Photosynthesis
		11	Sexual Reproduction & Meiosis	Mitosis & Meiosis

2nd Semester	4 Heredity	12	Patterns of Inheritance			
		13	Chromosomes, Mapping, and the Meiosis Connection			
	5 Molecular Genetics	14	DNA: The Genetic Material		Biotechnology: Bacterial Transfprmation	
		15	Genes & How They Work			
		27	The Genetics of Viruses & Bacteria			
		16	Control of Gene Expression			Biotechnology: Restriction Enzyme Analysis of DNA
		17	Biotechnology			
		18	Genomics			
	19	Cellular Mechanisms of Development				
	6 Mechanisms of Evolution	20	Genes within Populations		Artificial Selection	
		21	Evidence for Evolution			
		22	The Origin of Species			
		23	Phylogeny & Systematics		Hardy Weinberg	
		24	Genome Evolution			
		25	Evolution of Development		Comparing DNA Sequences to Understand Evolution using BLAST	
	7 The Evolutionary History of Biological Diversity	26	The Tree of Life: An Introduction to Biological Diversity			
		27	Viruses			
		28	Prokaryotes			
		29	Protists			
31		Fungi				
32		An Introduction to Animal Diversity				
8 Animal Form & Function	33	Noncoelomate Invertebrates				
	34	Coelomate Invertebrates				
	35	Vertebrates				
	43	The Animal Body and Principles of Regulation				
	48	Animal Nutrition				
	49-50	Circulation & Gas Exchange				
	52	The Immune System				
	51	Osmoregulation & Excretion				
	46	Hormones & the Endocrine System				
	53	Animal Reproduction				
	54	Animal Development				
	44	Nervous Systems				
45	Sensory & Motor Mechanisms					
9 Ecology	59	An Introduction to Ecology & the Biosphere	Fruit Fly behavior Energy Dynamics			
	55	Behavioral Ecology				
	56	Population Ecology				
	57	Community Ecology				
	58	Ecosystems				
60	Conservation Biology & Restoration Ecology					
		30	Green Plants	Transpiration		

10 Plant Form & Function	36	Plant Form
	37	Vegetative Plant Development
	38	Transport in Vascular Plants
	39	Plant Nutrition
	42	Angiosperm Reproduction & Biotechnology
	40- 41	Plant Responses to Internal & External Signals

TUTORIALS

There will be the occasional tutorial offered to help further prepare for an exam, discuss assigned topics, help with individualized problems, or provide further reinforcement to lab activities. These will be announced ahead of time and held after school for an hour every couple of weeks.

- Tutorials are optional but strongly encouraged.

LAB COMPONENT

- To stress biology and science in general as a process, lab activities emphasize development and testing of the hypothesis; collection, analysis, and presentation of data; and a clear discussion of results. Students will be given the opportunity to experience biological processes and concepts through investigations that support the various big ideas and encourage critical thinking through inquiry. We will perform at least 2 inquiry based investigations per Big Idea, and spend approximately 25 percent of class time on lab activities encouraging students to engage in:

- The generation of questions for investigation
- Selection of variables to investigate
- Design and conduct experiments
- Design their own experimental procedures
- Collection, analysis, and interpretation of data
- Determining how to best present conclusions

- Lab assignments must be completed according to the standard format (unless otherwise noted). Lab reports will be required after the lab is completed. Lab work that supports the Big Ideas and concepts listed above will be done as often as is feasible and will include the following topics:

1. Artificial Selection
2. Mathematical Modeling: Hardy Weinberg
3. Comparing DNA Sequences to Understand Evolution using BLAST
4. Diffusion and Osmosis
5. Photosynthesis
6. Cellular Respiration
7. Mitosis & Meiosis
8. Biotechnology: Bacterial Transformation
9. Biotechnology: Restriction Enzyme Analysis of DNA
10. Energy Dynamics
11. Transpiration
12. Fruit Fly behavior
13. Enzyme Activity

STUDENT ASSESSMENT

- Students are evaluated in a number of ways that reflect the nature of the course. Some of the skills I stress are:
 1. Scientific reasoning through analysis and synthesis;
 2. Research technique; and
 3. Being able to present one's point of view in writing. Students are encouraged to develop group and individual work skills, and these become part of the lab evaluation.

FORMS OF ASSESSMENT/WEIGHTING

- Grades will be calculated on a percentage basis. The value of each individual assignment varies. Students earn a grade based on the quality of the work they complete. Overall class grades are based on a straight percentage, not on a curve (although comprehensive exams will be scaled appropriately—for instance, the exams will be more difficult than the AP Exam, and a 70 percent on the AP Exam multiple-choice section— assuming your free-response section score is decent—will get you at least a grade of 3 on the overall AP Exam). This is how class grades are distributed:

Exams and Quizzes 50%

Labs and Lab Reports 25%

Scientific Writing Projects 15%

Homework/Daily Discussion/Readings 10%

Comprehensives Exams

- Once each semester, comprehensive exams will be administered, which are part multiple choice (including many questions from old AP Exams) and part free response (also taken from old AP Exams). Like the AP Exams, 60 percent of the grade on the comprehensive exams will be multiple choice and 40 percent will be free response.
- At the end of each unit covered, a comprehensive exam over the concepts and themes put forth will be administered. These unit exams will contain both multiple choice and free response questions.
- All students will be expected to take the AP Biology Exam at the end of the 2nd semester.

Quizzes

- At least one quiz per unit will be given, and often more. Some quizzes will be announced ahead of time and worth more points, some of the quizzes will specifically focus on vocabulary terms, and some will be “pop” quizzes based on pre-assigned readings, and will be given on an irregular basis. These will not be worth as much, but they will add up over time and encourage you to keep up with the readings.

Scientific Writing

- Writing is an important part of the scientific process. As such writing assignments will be an integral part of the curriculum.
- Points of Main Significance (POMS): Articles will be assigned from time to time which address some issue of the Nature of Science (NOS) as it pertains to science education/learning in science/science history, usually from professional journals. These

will require written responses demonstrating scientific understanding and the formulation of scientific arguments. Further instruction on this will be given at the time.

Lab Work

- You will be asked to perform pre-lab, answering questions about the objectives of the upcoming lab. You will also need to read through the entire lab ahead of time, and understand the materials list and steps of the lab. This will help prepare you for the lab itself. You will do these on handouts I give you and put them in your AP Biology notebook.
- Once you've done the pre-lab, you will create a section in your composition lab journal with a title, and then—thinking about the type of data you'll be collecting—make blank data tables with appropriate titles, labels, and rows/columns so that as you collect your data you will have a place to write it.
- The post-lab analysis will include questions and require you to graphically express and make sense out of your data. We will always have pre- and post-lab discussions emphasizing critical thinking and analysis. It's very important that you understand *what* we were doing and *why* we did it.

Homework— This will take several forms:

- It may include packets done outside of class over topics that were covered heavily in previous biology classes, as a reinforcement/refresher
- It will also include various internet or web-based assignments in which you will be required to watch an animation or short video and answer questions about it.
- Actively participating in lecture and lab discussions over current topics and concepts is expected of all students.
- Other assignments to help with understanding of the material will be given.

LECTURE/DISCUSSION

- Some of our class time will be spent viewing PowerPoint presentations, overheads, or Flash Player simulations from various online sources.
- You will be given reading assignments ahead of time, and will be expected to have read and studied the topics before coming to class. The pop quizzes over readings at sporadic intervals will help you to do this. You will be more engaged in discussion if you are already familiar with/have grappled with the material.
- I will NOT lecture on everything in the chapter. Again, lessons are designed to highlight the repeating, overarching themes or patterns that thread their way through three major *topics* and the various *themes* addressed earlier in this syllabus. These will be the major organizing principles for all class lectures and discussion. We will be asking ourselves repeatedly, "How does what we're studying now connect to those themes?"
- As stated earlier in the syllabus, the AP Biology Examination continues to emphasize the concepts and themes of biology. Less weight is placed on specific facts than on the "big ideas" that tie them together. However, you will be responsible on our exams and quizzes for more details than we generally will go over in class on a day-by-day basis, which puts the onus of responsibility on you to work with each other in study groups or by yourself to get some details. I will provide you with "focus sheets" so you know what to spend the most time on.
- Often, some of the short-answer questions at the end of the Campbell chapters will be used as kickoffs for lecture discussions. If you answer these on your own, you will be more prepared.

PRACTICE EXAMS

- Periodically, students will be given AP Biology Practice Exams, using old released exams. Taking the actual test can (a) help provide experience that will benefit students when the actual test occurs in May and (b) help me assess your knowledge.
- These will be done after school or in class as time permits. It will be scored just like the real exam, using AP rubrics, so we can establish a baseline of knowledge and so I can assess where our strengths lie, to teach you better.
- The week before the actual AP Biology Exam, we will take another practice exam that you haven't seen yet. We will spend the rest of the week discussing the results and doing final review for the actual test.

AP BIOLOGY EXAM

- The AP Biology course and its teaching are more than sufficient preparation for committed students who wish to get high scores on the AP Biology Exam. This test is held in May, all students who take AP Biology must take the AP Biology Exam. A grade of 3 or higher will save many students time and money in college, depending on their desired degree field.

According to the College Board Website, the AP Biology Exam consists of two sections: multiple choice and free response. Both sections include questions that assess students' understanding of the big ideas, enduring understandings, and essential knowledge and the ways in which this understanding can be applied through the science practices. These may include questions on the following:

- the use of modeling to explain biological principles;
- the use of mathematical processes to explain concepts;
- the making of predictions and the justification of phenomena;
- the implementation of experimental design; and
- the manipulation and interpretation of data.

The exam is 3 hours long and includes both a 90-minute multiple choice section and a 90-minute free-response section that begins with a mandatory 10-minute reading period. The multiple-choice section accounts for half of the student's exam grade, and the free-response section accounts for the other half.

Grade Qualification

5 Extremely well-qualified

4 Well-qualified

3 Qualified

2 Possibly qualified

1 No recommendation

After the AP Biology Exam

After the AP Biology Exam class is not over. We will still have an end of the year lab project and final exam. It is important that students take these assignments seriously and work until the end to be successful in the class. Successful completion of the lab project is a requirement for passing the

class. Students who do not turn it in will not pass the class. More details about the lab project will be given at the time of the assignment.