AP BIOLOGY SYLLABUS

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Course Overview

The AP Biology course is designed to be the equivalent of a college-level introductory biology course. The intent of the course is to expose students to higher-level biological principles, concepts, and skills and allow them the opportunity to apply their knowledge to real-life applications. Students are also expected to learn not by memorization of facts, but through content and concept application via the AP Biology science practices.

Core concepts called “Big Ideas” and their application through the science practices are the basis of the AP Biology curriculum. These Big Ideas are

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

In the AP Biology course, the teacher serves as the facilitator while the students develop as independent thinkers and learners, especially through laboratory investigations. Many concepts that are considered prerequisite knowledge for the course can be reviewed as home study through the use of resources such as assigned websites, WebQuests, and journal articles. In class, students are given opportunities to learn and apply their knowledge through the process of inquiry rather than learning from lectures and/or prescribed lab protocols. A sense of wonder and use of original thought are fostered as students are encouraged to extend their learning via conceptual understandings and open inquiry.

Science Practices for AP Biology

A practice is a way to coordinate knowledge and skills in order to accomplish a goal or task. The science practices enable students to establish lines of evidence and use them to develop and refine testable explanations and predictions of natural phenomena. These science practices capture important aspects of the work that scientists engage in, at the level of competence expected of AP Biology students.

Science Practice 1: The student can use representations and models to communicate scientific phenomena and solve scientific problems.

1.1 The student can create representations and models of natural or man-made phenomena and systems in the domain.
1.2 The student can describe representations and models of natural or man-made phenomena and systems in the domain.
1.3 The student can refine representations and models of natural or man-made phenomena and systems in the domain.
1.4 The student can use representations and models to analyze situations or

solve problems qualitatively and quantitatively.

1.5 The student can reexpress key elements of natural phenomena across multiple representations in the domain

***Science Practice 2: The student can use mathematics appropriately*.**

2.1 The student can justify the selection of a mathematical routine to solve problems.

2.2 The student can apply mathematical routines to quantities that describe natural phenomena.

2.3 The student can estimate numerically quantities that describe natural phenomena.

Science Practice 3: The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.

3.1 The student can pose scientific questions.

3.2 The student can refine scientific questions.

3.3 The student can evaluate scientific questions.

Science Practice 4: The student can plan and implement data collection strategies appropriate to a particular scientific question.

4.1 The student can justify the selection of the kind of data needed to answer a particular scientific question.

4.2 The student can design a plan for collecting data to answer a particular scientific question.

4.3 The student can collect data to answer a particular scientific question.

4.4 The student can evaluate sources of data to answer a particular scientific question.

Science Practice 5: The student can perform data analysis and evaluation of evidence.

5.1 The student can analyze data to identify patterns or relationships.

5.2 The student can refine observations and measurements based on data analysis.

5.3 The student can evaluate the evidence provided by data sets in relation to a particular scientific question

***Science Practice 6: The student can work with scientific explanations and theories*.**

6.1 The student can justify claims with evidence

. 6.2 The student can construct explanations of phenomena based on evidence produced through scientific practices.

6.3 The student can articulate the reasons that scientific explanations and theories are refined or replaced

. 6.4 The student can make claims and predictions about natural phenomena based on scientific theories and models.

6.5 The student can evaluate alternative scientific explanations

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***Science Practice 7: The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains*.**

7.1 The student can connect phenomena and models across spatial and temporal scales.
7.2 The student can connect concepts in and across domain(s) to generalize or extrapolate in and/or across enduring understandings and/or big ideas

Teaching Strategies

In general, when we are not doing the labs and activities described in this syllabus, I will be lecturing or holding a class discussion. I expect students will spend an hour a night (or 3-5 hours on the weekend) reading, taking notes on the textbook, and completing the reading guides and internet activities according to their syllabus. Following are some selected strategies I plan to use with my AP Biology students.

Lecture & Discussion

• Lectures and discussions will be reinforced and/or prompted using video clips and animations from various on-line sources, DVD's, power point or keynote presentations, and other multimedia resources.

• Students 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 are intended to help students stay on track. Students will be more engaged in discussion if they are already familiar and have grappled with the material.

• I will **NOT** lecture on everything in the chapter. Lessons are designed to highlight the repeating, overarching themes or patterns that thread their way through the major topics and the four Big Ideas 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 ideas?"

• The AP Biology Examination emphasizes the concepts and themes of biology. Less weight is placed on specific facts than on the "big ideas" that tie them together. However students will be responsible on their exams and quizzes for more details than we generally will go over in class on a day-to-day basis, which puts the onus of responsibility on the students to work with each other in study groups or by themselves to get some of the details. I will provide students with the key "learning objectives" so they know what to spend the most time on.

Reading & Lecture Guides

I have prepared both a reading guide and lecture guide for each chapter and section we cover in the Campbell Biology textbook. The reading guide features a series of questions and activities that assist students in focusing on and mastering the key concepts for each chapter. The lecture guides allows us to move through class lectures and discussions more quickly since students don't have to write everything down. However, I will expect students to add additional notes from class lectures and activities to their lecture guidelines.

Readings

Textbook: *Biology, 11th ed., AP edition* by Campbell, et. al. 2018.

In addition to the textbook, students will read two novels during the class. These novels are *The Immortal Life of Henrietta Lacks* by Rebecca Skloot and *Your Inner Fish* by Neil Shubin. Throughout the year students will receive supplemental readings from classic scientific papers, current scientific publications, and both national and local main stream media. These readings are from publications including, but not limited to, *National Geographic, Discover, Scientific American, Science, Wired, ScienceNews*, and *The Scientist.* Students may also read *Survival of the Sickest* by Sharon Moalem.

Student Evaluation

Students are evaluated on their performance on the unit exams, quizzes, laboratory work, lab reports, projects, homework, AP exam practice questions, and other related assignments. Letter grades (A,B,F, etc.) are calculated according to the statewide mandated scale listed in the student handbook. The grading scale is listed below.

Assignment	Estimated Point Values (per occurrence)
Tests	60-120
Quizzes	10-50
Homework	10-25
Lab work and class work	20-50

Grading Procedures for Final Averages:

First Semester: Nine-weeks Grades are 20% each and the Midterm exam is 10%.

Second Semester: Nine-weeks Grades are 20% each and the Final Exam is 10%.

Note: the final exam is not the AP exam.

Unit Exams

After the completion of each unit, an exam will be administered. These exams are part multiple choice (including many questions from old AP Exams) and part free response (also taken from old AP Exams).

Quizzes

Some quizzes will be announced ahead of time and some quizzes will be "pop" quizzes based on pre-assigned readings.

Homework

Students will spend an hour a night (or 3-5 hours on the weekend) reading, taking notes on the textbook, completing their reading guides, completing on-line tasks, and other related assignments according to their syllabus. ***Students must complete the learning objectives for every unit and submit them the day of the unit exam. The learning objectives will be posted on the unit webpages and the teacher will not always remind the students about the learning objectives.***

Practice AP Exams

Students will be given portions of previously released AP Biology exams. They will take each exam and I will grade them using the AP scoring guidelines. Students will be asked to look at the questions they missed and analyze why they missed them.

Free-Response Questions

In addition to the practice AP Exams, I will assign individual free response questions from old AP exams and ones that I have developed as homework. The chosen question will reinforce the current topic of study. These practice questions are intended to improve students' skills in writing responses to free-response questions.

Make Up & Late Work

You have as many days as you miss to make up the assignments (example: miss two days of school, assignments missed during that time will be due the second day after you return). This is school policy. All assignments should be completed by the deadline provided by the instructor.

Important: If school is delayed due to weather on an exam day, students will NOT take the regularly scheduled exam on that day. Students will take the exam the first full class period immediately following the delayed day. If school is canceled due to weather on an exam day, students will take the exam the next time class meets for a full period. If school is delayed on a quiz day, students will still take the quiz in class as scheduled.

Attendance & Tardy Policy

Daily classroom attendance is expected. Excused and unexcused absences and tardies will be handled according to school policies as outlined in the student handbook

Classroom Guidelines

1. RESPECT = Respect everyone including yourself. Use respectful language, and behave politely and respectfully. Remember the Golden Rule.

2. RESPONSIBILITY = Accept responsibility for your actions. Behave in a responsible and appropriate manner. (No horseplay.)

3. No food or drinks in the classroom or the computer labs.

4. Clean workspace prior to leaving class.

5. All assignments should be completed by the deadline provided by the instructor.

6. Be prepared for class every day. It is the responsibility of the student to have the necessary materials for class (textbook, pen, pencil, notebook, etc.). Students who do not have their textbooks with them in class when the class is using textbooks will have 3 points deducted from the applicable assignment(s). T**he materials required for this class include a binder with both notebook and graph paper, pencil, and headphones (small, cheap ear buds).**

7. The instructor reserves the right to remove any student from the lab should that student jeopardize the safety of himself / herself or of another student.

8. If a student has a least one disciplinary referral, that student may not be allowed to participate in field trips or other special activities.

9. Students should never use cellular devices in class unless the instructor specifically directs the students to do so. Students whose cellular devices alert (ring, vibrate, etc.) during class will be referred for disciplinary action. Cellular devices should remain off and in lockers at all times.

10. Students who cheat / plagiarize assignments will receive no credit for that assignment. In addition, any student who allows their work to be copied will also receive no credit for that assignment.

11. Students are responsible for knowing and abiding by all information provided in the student handbook. Ignorance of school policies is not an excuse for violation of school policies.

Molecules, Cells, and Energy (Big Ideas 1-4)

Topics	Readings	Activities / Labs	Assessments
A. Molecules (BI 4) Polarity of water and its importance to biological systems Carbon's role in the molecular diversity of life Monomers, polymers & reactions involved in building & breaking them down considering polar/nonpolar interac-tions Various levels of structures in protein & carbohydrates Enzyme structure as a special protein Cohesion, adhesion, specific heat of water & its importance to biological systems Acids, bases, and buffers Identifying macro-molecules in our foods Enzyme catalysis Activation energy & specificity	Textbook chapters 3-5 (except 4.3) and chapter 8	Using kits to build macro–molecule models (SP 1) Acid/base/buffer lab activity (SP 2) Adhesion/ cohesion lab LAB: Using and understanding how different indicators are used to identify proteins, lipids, carbohydrates (incl. reducing sugars analysis) using Biuret, Benedict's, Sudan etc. (SP 6) Eduweblabs: Prelab "Enzyme Catalysis" Investigative lab #13: Enzyme Activity (BI 2) Prelab: Toothpickase Investigative Lab: Enzymes: Factors affecting the rate of activity (SP 2, 5)	Quizzes Unit exam Lab reports Students compose chart comparing structural differences & how indicators physically work Students use chart to predict contents of unknown samples

Molecules, Cells, and Energy (Big Ideas 1-4)

Topics	Readings	Activities / Labs	Assessments
<u>B. CELLS (structure & function) Big ideas 1 & 2</u> Explain similarities, differences & evolutionary relationships between prokary-otic & eukaryotic cells Cell membrane structure & function Cell communication (signals, receptors, responses hormones) Methods of transport across membranes	Textbook chapters 6, 7, & 11 (except 6.1 & 6.6)	Mini poster/ models comparing structures of cells from 3 different cell types from 3 different kingdoms (BI 3) LAB: Normal vs Plasmolyzed Cells using Plant cells Eduweblabs:Osmosis & diffusion prelabs 1 & 2 Cell size lab Mini Poster Presentations comparing 3 feedback mechanisms Inquiry lab # 4 Diffusion and Osmosis (SP 3, 4)	quizzes Mini poster comparing structures of cells from 3 different kingdoms Unit test Written lab reports Eduweblabs graph & calculations Cell Size lab calculations Formal Lab Writeup for Inquiry lab Diffusion & Osmosis Discussion of the endosymbiont hypotheses of the evolution of eukary-otic cells

Molecules, Cells, and Energy (Big Ideas 1-4)

Topics	Readings	Activities / Labs	Assessments
<u>C. CELL ENERGY</u> ATP structure & function Redox reactions in relation to cellular respiration Cellular respira-tion glycolysis, citric acid cycle, electron transport chain & chemios-mosis Mitochondria form & function Photosynthesis mechanisms; light/dark	Textbook chapters 9, & 10 (except 10.4)	Eduweblab: Respiration Investigative Lab #6 Cellular Respiration (SP 2) Fermentation in Yeast Lab Eduweblabs: Prelab Plant pigments Eduweblabs: Prelab Photosynthesis Investigative Lab #5 Photosynthesis	quizzes Unit test Written lab reports Eduweblabs graph & calculations

Heredity, Genetics, and Evolution (Big Ideas 1 & 3)

Topics	Readings	Activities / Labs	Assessments
A. Molecular Basis of Inheritance DNA structure & replication RNA structure Protein Synthesis transcription & translation Mutations - basis for natural selec-tion	Textbook chapters 16, 17, & 21.5	Replication, transcription, & translation simulations	quizzes Unit test
B. Mitosis & Meiosis Cell Cycle mechanism & control Chromosomes Sexual vs asexual reproduction & evolutionary advantages Stages of meiosis Genetic variation in offspring, mecha-nisms & impact on evolution Investigating genetics: environ-mental influences	Textbook chapters 12, 13, & 47.3	Eduweblabs: Prelab Crossing Over Lab Investigative Lab #7: Mitosis and Meiosis (BI 1) Karyotyping exercise	quizzes Unit test Eduweblabs results Investigative LAB Analyses Karyotyping result

Heredity, Genetics, and Evolution (Big Ideas 1 & 3)

Topics	Readings	Activities / Labs	Assessments
<u>C. Mendelian genetics</u> Patterns of inheri-tance Predicting genetic outcomes genetic counseling Gene linkage & mapping	Textbook chapters 14, & 15	Prelab activity: Looking at corn crosses & analyzing results Eduweblabs: Prelab Population Genetics Eduweblabs: Prelab Fruit fly genetics	quizzes Unit test Eduweblabs reports
<u>D. Molecular genetics</u> Regulation of gene expression Viruses Gene expression in bacteria Biotechnology DNA Technology, Recombinant DNA, PCR, Gel electrophoresis Applications of DNA technology Use of bioinformatics to analyze genomes Comparing & discussing genomic sequences in relation to	Textbook chapters 18-20, and 21.2 (except 19.3, 20.3, and 20.4)	Eduweblabs: Prelab Bacterial transformation Eduweblabs: Prelab DNA Electrophoresis Investigative lab #9: Biotechnology I and Biotechnology II. Bacterial Trans-formation and Restriction Enzyme Analysis of DNA	quizzes Unit test Eduweblabs results Investigative LAB Analyses

Heredity, Genetics, and Evolution (Big Ideas 1 & 3)

Topics	Readings	Activities / Labs	Assessments
<u>E. Evolution</u> Darwin's explorations and theory of descent with modification & natural selection Galapagos Islands Overview Evidence for evolution (molecular analyses & morphological analyses Phylogeny & systematics Evolution of populations Hardy-Weinberg	Textbook chapters 22-24	Activity: Genetics Survey Project analyzing traits of those around us Lab Investigation "2 Mathematical Modeling: Hardy-Weinberg **[CR6]** (SP2, 4, 5, 7) Activity: Students create Geologic timeline	quizzes Unit test Written lab reports

Organisms and Populations (Big Ideas 1, 3 & 4)

Topics	Readings	Activities / Labs	Assessments
A. Ecology Ecological interactions- biotic vs abiotic Behavioral ecology-natural selection involvement Population dynamics- growth & its regulations Communities & Ecosystems energy levels & flows, cycles, symbiosis & impact on evolution Human influences positive & negative	Textbook chapters 53-55 and 52.2, 56.1 and 56.4	Eduweblabs- Primary Productivity LAB: Dissolved Oxygen & Aquatic Primary Productivity (BI 1) (SP 2, 3, 4, 5, 6, 7) Activity – "My footprint" (BI 1)	quizzes Unit test Written lab reports

Organisms and Populations (Big Ideas 1, 3 & 4)

Topics	Readings	Activities / Labs	Assessments
<u>B. Biological diversity & microbiology</u> Early life on earth Evolution of prokaryotes & eukaryotes	Textbook chapters 25-26, and 27.1 and 27.2 (omit 26.4 & 26.5)	Investigative LAB # 3: Analyzing Genes with BLAST (BI 4)	quizzes Unit test lab reports
<u>C. Plant diversity</u> Structure, growth & development Plants responses to internal & external stimuli Plant nutrition Angiosperm Reproduction	Textbook chapters 35.1, 38.1, and 39 (except 39.4)	Eduweblabs: Prelab Transpiration Investigative LAB # 11: Transpiration (BI 4) (SP 2, 3, 5) LAB: Flower dissection LAB: Students conduct a long term (exp't) lab investigation plant growth from seeds under various conditions (SP 3.5, 6,	quizzes Unit test Eduweblabs results Investigative LAB Analyses

Organisms and Populations (Big Ideas 1, 3 & 4)

Topics	Readings	Activities / Labs	Assessments
<u>D. Animals</u> Basic anatomy principles Analysis of structure & function of body systems Immune, Endocrine, Nervous, Systems Animal Behaviors	Textbook chapters 40, 51, 43, 45.1, 45.2, 47.3, 48, and 49.2	Eduweblabs: Prelab Animal Behavior Investigative LAB #12: pill bug behavior (SP 3, 4) Animal Behavior: Taxis, Kinesis, and Agonistic Behavior (SP 3, 4, 6)	quizzes Unit test Written lab reports