

AP Biology Syllabus

CURRICULAR REQUIREMENTS

		Page(s)
CR1	Students and teachers use a recently published (within the last 10 years) college-level biology textbook.	4
CR2	The course is structured around the enduring understandings within the big ideas as described in the AP® Biology Curriculum Framework.	3, 4, 5
CR3a	Students connect the enduring understandings within Big Idea 1 (the process of evolution drives the diversity and unity of life) to at least one other big idea.	3, 5, 6, 9, 11, 12
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.	3, 5, 6, 9, 11, 12
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.	3, 5, 6, 9, 11, 12
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.	3, 5, 6, 9, 11, 12
CR4a	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.	3, 5, 6, 12
CR4b	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.	3, 5, 6, 12
CR4c	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 3.	3, 5, 6, 12
CR4d	The course provides students with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.	3, 5, 6, 12
CR5	The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.	6, 12
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.	3, 7, 8
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.	3, 7
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	3, 9

***** ALL CURRICULAR REQUIREMENTS ARE ALSO NOTED ON COURSE SCHEDULE PAGES 14 – 17.**

PREPARATION FOR SUCCESS WITH CURRICULUM CHANGES

The new AP Biology Curriculum Framework represents a shift in the emphasis in the way this class will be taught I have tried to prepare for success by doing the following:

- 1.) I have intently studied the course changes through the AP Collegeboard website (<http://apcentral.collegeboard.com>) and the AP Biology Course and Exam Description, the Biology Investigative Labs: An Inquiry-Based Approach, and the AP Biology Quantitative Skills Guide.
- 2) I have followed the AP Teacher Community through the Collegeboard website and have also studied other AP Biology teachers' websites for discussions on content changes, suggestions for redesign focus, and resources for labs and activities.
- 3) I attended BioTeach 2012 – a three week intensive laboratory-based course in molecular genetics for high school science teachers. This workshop is a cooperative effort between the University of Alabama at Birmingham, CORD, and the McWane Science Center.

COURSE OVERVIEW/ INSTRUCTIONAL CONTEXT

This Advanced Placement Biology course offers students a solid foundation in introductory college-level biology. The course is structured around the four big ideas, enduring understandings, and science practices resulting in developing an understanding of concepts; a grasp of science as a process rather than as an accumulation of facts; personal experience in scientific inquiry; recognition of unifying themes that integrate the major topics of biology; and the application of biological knowledge and critical thinking to environmental and social concerns.

I teach AP Biology to juniors and seniors at a high school that employs a block schedule. I meet with students five days a week for a 96 minute period. Students will also use time before and after school and also during a 20 minute "academic flex" period to complete individual or group designed lab explorations. In addition, early release days, exam schedules, or weekend sessions provide opportunities for extended laboratory and exam review time.

Students should have completed both a year of introductory Honors Biology (9th grade) and a year of Chemistry prior to enrolling in AP Biology, so all students will come to the class with a solid foundation in these areas. I also know what topics students have previously covered because I also teach the Biology prerequisite. Thus, I will not spend class time re-teaching the basics. Instead, I will provide review opportunities for students to refresh their previous knowledge outside of class and spend class time teaching new concepts, conducting labs, making connections to overall themes, and helping students integrate new information with prior knowledge.

I am also incorporating "flipped" classroom activities into my class through the use of www.bozemanscience.com videos as well as podcasts/videos that I have developed. This not only serves as a catalyst for increasing depth and meaningful discussion but also provides more class time for individual and/or collaborative group lab exploration and design and more class time to actively participate in "doing" science.

GOALS

My goals for this course are to present an in depth, college level study of the Biological Sciences structured around the four big ideas, enduring understandings, and science practices so that students:

- 1) complete the course with a clear understanding of the biology concepts covered [CR2]
- 2) gain an appreciation for how those biological concepts are interrelated to each other, themselves, and the real world [CR3] [CR4]
- 3) develop college level critical thinking skills, writing skills, and study habits [CR7]
- 4) have an opportunity to design and complete student centered research labs [CR6][CR7]
- 5) develop an appreciation of the link between math and science and be able to appropriately choose and use a variety of mathematical processes to evaluate data [SP2][SP5]
- 6) create models and simulations to represent and explain biological concepts [CR8]
- 7) are prepared for the comprehensive AP Biology Exam in May.

My AP Biology course is designed to offer students a solid foundation in introductory college-level biology. I hope to assist students in developing an appreciation for the study of life and help them identify and understand unifying principles within a diversified biological world. What we know today about biology is a result of inquiry. Science is a way of knowing. Therefore, the process of inquiry in science and developing critical thinking skills is an integral part of this course and **25% of this course is spent doing laboratory studies. [CR7]**

At the end of the course, students will have an awareness of the integration of other sciences in the study of biology, understand how the species to which we belong is similar to, yet different from other species, and be knowledgeable and responsible citizens in understanding biological issues that could potentially impact their lives.

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.

INSTRUCTIONAL RESOURCES

Reece, Jane, et al., *Campbell Biology*, 8th Edition, 2009, Pearson Benjamin Cummings. [CR1]

Giffen, Cynthia and Heitz, Jean. *Practicing Biology* (to accompany Campbell-Reece Biology), 3rd Edition, 2008, Pearson Benjamin Cummings.

www.campbellbiology.com (The website to accompany the main text provides animations, investigations, PowerPoint and other audio-visual sources to enhance instruction)

AP Biology Investigative Lab Manual: An inquiry-based approach. 2012. New York, NY: The College Board.

Holtzclaw, Fred and Holtzclaw, Teresa Knapp; *AP Biology Test Prep Series*, 2008, Pearson Benjamin Cummings

Kaplan AP Biology 2013 - 2014. 2013. Kaplan Publishing.

<http://sciencecases.lib.buffalo.edu/cs/>, National Center for Case Study Teaching in Science (NCCST)

TEACHER RESOURCES

College Board AP Teacher Community - <https://apcommunity.collegeboard.org>

David Knuffke's Wiki- <http://dpapbio.wikispaces.com/>

Kim Foglia's Explore Biology- <http://explorebiology.com>

Cheryl Massengale's Biology Junction - <http://www.biologyjunction.com>

Kelly Riedell's AP Home - <http://kr021.k12.sd.us/>

Paul Anderson's Science Home – <http://www.bozemanscience.com>

INSTRUCTIONAL CONTENT

This course is designed around inquiry in the lab and the AP Biology Curriculum Framework, which is centered on the FOUR BIG IDEAS, the ENDURING UNDERSTANDINGS identified in the Curriculum Framework, and the seven SCIENCE PRACTICES shown below. Units will be designed to include the ESSENTIAL KNOWLEDGE components and all LEARNING OBJECTIVES will be addressed through this curriculum.

THE FOUR BIG IDEAS: [CR2]

This course is structured around the four big ideas and the enduring understandings identified in the Curriculum Framework. [CR2] All essential knowledge will be taught and all learning objectives will be addressed through this curriculum. The course will focus on inquiry-based laboratory work and the use of the seven science practices in both lab and non-lab activities.

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

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.

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.

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.

Students will be given a copy of the **BIG IDEAS** and the **ENDURING UNDERSTANDINGS** to self-monitor mastery of these major organizing tools. The big ideas and enduring understandings will also be posted in the room. The students will literally map their way through the course as connections are made across big ideas and the related enduring understandings, visually building a map of connections and relationships as the course progresses. The learning objectives will be used as a guide to build the rest of the class discussion, not just as a checklist to be marked off through the year, but as a way to help students learn content along with the use of specific science process skills. **[CR2], [CR3], [CR4]**

Daily openers will reinforce current content, revisit concepts covered in previous units, and help students make connections to current events and past material **[CR3][CR4]**. Quizzes are interspersed throughout the unit and will provide feedback on student knowledge and ways instruction may need to be adjusted to address misconceptions and improve student learning.

Tests will consist of multiple choice questions from released AP Exams and past Free Response questions (FRQ's), as well as questions from the Campbell Test Bank. The AP Teacher Community is currently compiling a GoogleDocs set of questions based on the new curriculum changes that will also be included. Students will write answers to FRQ's weekly and as part of their unit tests. Unit tests will cover several chapters at once and may include questions from past units to allow students to practice answering questions require them to make connections between content

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

CR3: Students connect the enduring understandings within each of the AP Biology big ideas with at least one other big idea.

CR4: The students are provided with opportunities outside of the laboratory investigations to meet the learning objectives within the Big Ideas.

from other units. **[CR3]**

Use of case studies will provide students with opportunities to make connections between the Big Ideas, as well as, a variety of biological concepts listed in Enduring Understandings from the Curriculum Framework. **[CR3][CR4][CR5]**

CR5: The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens

INVESTIGATIVE LABORATORY COMPONENT

The course will also focus on inquiry-based laboratory work and the use of the seven science practices shown below in both lab and non-lab activities. The lab investigations performed, and the science practices reinforced, will emphasize the understanding of science as a process rather than an accumulation of facts and stress development and testing of the hypothesis; collection, analysis, and presentation of data; and a clear discussion of results. Peer review by other students will be an integral part of creating student designed lab protocols, graphing, results analysis, and preparation of final lab presentations. Students are engaged in student-directed investigation during the 25% of instructional time devoted to laboratory work.

[CR7]

Students will conduct a minimum of eight inquiry-based investigations. There will be at least two laboratory experiences per big idea selected from the 13 labs described in the AP Biology Investigative Lab Manual: An inquiry-based approach (2012) **[CR6]**. These labs will be spread throughout the school year and will be conducted during at least one out of every four class meetings during the year. **[CR7]** Varying levels of inquiry (structured, guided, open) will be employed, as appropriate to each investigation. For example the Lab 3: Blast analysis lab is designed to allow students to first complete the analysis in a more structured format to see how to do it, then they can come up with their own question to answer as an independent investigation. However, Lab 1: Artificial selection lab can be completed as an open investigation with little other than directions on starting the plants and how to pollinate the flowers. Wisconsin Fast plants seeds for Lab 1 will be started the third week the class and this lab will be ongoing throughout the school year. Supplemental labs and activities will also be used to widen the range of topics covered in a hands-on, discovery mode.

By undertaking a variety of investigations throughout the course, all seven science practice skills will be used by students on a regular basis with a goal of leading students toward open inquiry investigations **[SP7]**. The science practice skills need to be honed over the entire course and reinforced through opportunities to make observations, ask questions based on those observations, and investigate their own questions, both in and out of the designated lab times. The switch from “cook book” type labs to student-designed investigations is a vital part of the new curriculum. In addition to the 13 AP Biology labs, additional labs will be conducted to deepen students' conceptual understanding and to reinforce the application of science practices within a hands-on, discovery based environment and, thereby, fully utilizing the Alabama Science in Motion Program through the University of North Alabama and the BioTeach Molecular Biology Program through the University of Alabama at Birmingham and the McWane Educational Environmental and Learning Center. These associations provide further experimental design and laboratory activities and an opportunity to work with other education personnel and research scientists. All aspects of the laboratory component provide enriching opportunities for students to develop, record, and communicate the results of their laboratory investigations.

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.

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.

AP LABS THAT WILL BE COMPLETED: [CR6].

Labs are completed using guidelines in the *AP Biology Investigative Lab Manual: An inquiry-based approach*, the PASCO Advanced Biology Probeware Systems information, lab protocols and equipment provided by the University of Alabama at Birmingham's BioTeach Molecular Biology Program and, the University of North Alabama's Science in Motion Program through the Alabama State Department of Education.

BIG IDEA 1: EVOLUTION

- BLAST Activity: Students will use the NCBI to compare DNA and protein sequences for organisms to test student-generated hypotheses on their relatedness
- Artificial Selection: Students will grow Wisconsin Fast Plants or other organisms to select for specific traits over several generations

BIG IDEA 2: CELLULAR PROCESSES; ENERGY AND MATTER

- Cellular Respiration: Students will investigate cellular respiration rates using probeware and computer models
- Photosynthesis : Students will design experiment to investigate photosynthetic rates under their chosen conditions
- Osmosis and Diffusion: Students will investigate the factors that affect transport in cells

BIG IDEA 3: GENETICS AND INFORMATION TRANSFERS

- Cell Division: Mitosis and Meiosis. Students measure mitotic rates before and after organisms exposed to substances presumed to affect mitotic rate.
- Bacterial Transformation Lab: Students investigate bacterial transformation using the pGLO or pBLU plasmid
- Restriction Enzyme Analysis: Students investigate restriction enzyme analysis

BIG IDEA 4: INTERACTIONS

- Energy Dynamics: Students develop and analyze models that describe energy flow
- Transpiration: Students research and develop investigation to measure the movement of water through whole plants
- Enzyme Investigation: Students investigate and measure the effects of different environmental factors on enzyme action

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

Lab reporting will be done in a variety of ways in both electronic and traditional portfolio forms. **[CR8]** All students have been issued iPads at school that will be utilized to maintain the electronic portfolio. Presentation of information must always include proper labeling of tables, graphs, and statistical analysis and may include the following:

- Formal lab reports will emphasize the development and testing of a hypothesis, the ability to organize collected data, and the ability to analyze and clearly discuss the results
- Butcher Paper foldable/poster documenting the main components of a formal lab. These may be presented to small groups or the full class
- Collaborative group or individual technology presentations of lab protocols, data analysis, and conclusions using videos, podcasts, or other student inspired creative way

CR 8: 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.

MATHEMATICAL DATA ANALYSIS

Students will identify and use appropriate mathematical procedures to analyze data from their experimental investigations. . **[SP2] [SP5]** Examples include an understanding of and ability to appropriately apply the concepts of Mean, Standard Error, and Standard Deviation, and Chi-square analysis.

EXAMPLES ILLUSTRATING CONNECTIONS MADE THROUGHOUT THE COURSE [CR3]

The words of the day every day in my classes are COMPREHENSIVE – CONNECTIONS – APPLICATION. The 4 Big Ideas provide a framework to see the “big picture” at how each piece of the diverse biological puzzle we are putting together is tied through the evolutionary history of the past. Throughout a class period, a topic, and a unit we learn more by building on what we already know and applying that knowledge to make connections to real world situations thus providing the learners with a foundation for answering unfamiliar questions, both on the AP Exam and in real life. The course will connect the enduring understandings from one big idea with those of the others whenever possible. Students will document these connections as they map their way through the course.

Evolution is the theme that unifies all that we study. It is the theme upon which the connections and relationships are based and it will be referenced throughout the entire course. **[CR3a]** We begin developing the theme of evolution with the chemistry of life. When we discuss the mitochondria and chloroplast we discuss how the structure has evolved so that the structure fits so well to its function. Later we discuss the evolutionary evidence that these two organelles contain to substantiate the origin / evolution of Eukaryotes. We also discuss that the commonality of glycolysis among all life forms and thus that it evolved very early. The unit dedicated to evolution in and of itself involves discussion of Darwin’s background and process of developing his theory. Although we take a broader look at evolution in some sections, we zoom in closer throughout the unit of plant and animal structure and function as well as taxonomy. We discuss the approach of building monophyletic trees that show the relative relationship between different groups. From this point on we will develop the means of evolution through understanding

CR3a: Students connect the enduring understandings within Big Ideas to at least one other Big Idea.

natural selection and genetics and the use of Hardy Weinberg to develop the idea of microevolution. Now knowing and understand that the genetic code is universal we use microevolution and models to discuss how speciation occurs. Throughout discussions of plant and animal structure and fuction we discuss the phylogenetic trees that lead to the many groups of each. Evolution is the theme that unifies all that we study. In addition, science as a process will be woven throughout both the lab investigations and in-class activities.

EXAMPLES OF ACTIVITIES/CONNECTIONS THAT WILL BE INCORPORATED INTO THE CURRICULUM. [CR3]

Sickle Cell Anemia Activity – Students analyze a map of the beta hemoglobin gene and corresponding amino acid sequence to understand reading frames, introns, DNA transcription into mRNA message and translation of this message into a polypeptide. This activity also links to discussion of mutations, the disease, and the heterozygote advantage as well as the evolution of allele frequencies in populations where malaria is prevalent.
<http://www.dnalc.org/resources/3d/17-sickle-cell.html>

Connects Big idea 1 and Big Idea 3. **[CR3a]**

- 1.A.2.c: Some phenotypic variations significantly increase or decrease fitness of the organisms and the population Ex: sickle cell anemia
- 3.A.3.c. Certain human genetic disorders can be attributed to the inheritance of single gene traits or specific chromosomal changes, such as nondisjunction EX: Sickle cell anemia

CR3a: Students connect the enduring understanding within Big Idea 1 to at least one other big idea.

Neuromuscular Junction Activity – Diagram and compare/contrast all the types of passive/active transport involved with the depolarization/repolarization of a neuromuscular junction or synaptic junction during the transmission of a signal from the nervous system to the muscle across a synapse.

Connects Big Idea 2 and Big Idea 3 **[CR3b]**

- 2.B.2.a Passive transport does not require the input of metabolic energy; the net movement of molecules is from high concentration to low concentration
- 2.B.2.b Active transport requires free energy to move molecules from regions of low concentration to regions of high concentration
- 3.E.2.a The neuron is the basic structure of the nervous system that reflects function
- 3.E.2.b Actions potentials propagate impulses along neurons
- 3. E.2.c Transmission of information between neurons occurs across synapses

CR3b: Students connect the enduring understandings within Big Idea 2 to at least one other big idea.

Genetically Modified Food Debate Case Study – Students research the pros and cons of GMO's and participate in a classroom debate over their use.

http://sciencecases.lib.buffalo.edu/cs/files/3-gmfoods_notes.pdf

Connects Big Idea 3 and Big Idea 4 **[CR3c]**

- 3.A.1.f: Illustrative examples of produces of genetic engineering include: Genetically modified food
- 4.A.6.f Human activities impact ecosystems on local, regional, and global scales

CR3c: Students connect the enduring understandings within Big Idea 3 to at least one other big idea.

Operon Modeling – Students will make a model of the *lac* and *trp* operons using swimming noodles to compare the two types of gene regulation.

Connects Big Idea 4 and Big Idea 3 **[CR3a]**

Pool Noodle operons- Students model how *lac* and *trp* operons work and then compare and contrast the two types of gene regulation Connects Big Idea 4 and Big Idea 3 **[CR3d]**

- 4.C.2.a. Environmental factors influence many traits both directly and indirectly EX: effect of adding lactose to a Lac⁺ bacterial culture
- 3.B.1.a.1 Regulatory sequences are stretches of DNA that interact with regulatory proteins to control transcription
- 3.B.1.b.2. The expression of specific genes can be inhibited by the presence of a repressor.

CR3d: Students connect the enduring understandings within Big Idea 4 to at least one other big idea.

MEETING LEARNING OBJECTIVES WITH NON-LABORATORY ACTIVITIES [CR4]

Science must come alive for learning to occur and for students to develop the love of the subject that will result in the development of our future scientists. To accomplish this information must be presented in a variety of ways and formats: auditory, visual, and kinesthetic. This differentiation includes modeling, diagramming, tabling, role plays, concept maps, and foldables. These different activities provide opportunities to meet the Learning Objectives outside of laboratory investigations. **[CR4]** Some examples are provided below

Students can:

- Use morphology and DNA sequence data to look at evolution in the cross dressing salmon and create a cladogram showing phylogenetic relationships in the salmon evolution case study.

LO 1.19 The student is able to create a phylogenetic tree or simple cladogram that correctly represents evolutionary history and speciation from a provided data set.

[CR4a][SP 1.1] Essential Knowledge 1.B.2

LO 1.9 The student is able to refine evidence provided by data from many scientific disciplines that support biological evolution **[CR4a][SP5.3] Essential Knowledge 1.A.4**

LO 1.18 The student is able to evaluate evidence provided by a data set in conjunction with a phylogenetic tree or a simple cladogram to determine evolutionary history and speciation **[CR4a][SP 1.1] Essential Knowledge 1.B.2**

- Use pipe cleaners to build red blood cells to model blood types and immune response

LO 2.29 The student can create representations and models to describe immune responses **[CR4b] [SP1.1 & 1.2] Essential Knowledge 2.D.4**

- Illustrate the depolarization/repolarization of a neuromuscular junction signal crossing the synaptic cleft in a diagram

LO2.11 The student is able to construct models that connect the movement of molecules across membranes with membrane structure and function **[CR4b][SP1.1,7.1] Essential Knowledge 2.B.1**

- Use swimming noodles to compare and contrast inducible and repressible gene regulation with *lac* and *trp* operons

LO 3.21 The student can use representations to describe how gene regulation influences cell products and functions **[CR4c][SP1.4] Essential Knowledge 3.B.1**

CR4a:The students are provided with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 1.

CR4b:The students are provided with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 2.

CR4c:The students are provided with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 3.

CR4d:The students are provided with opportunities outside of the laboratory investigations to meet the learning objectives within Big Idea 4.

INCORPORATION OF SOCIAL AND ETHICAL CONCERNS: [CR5]

Real world connection and application of science learning from the class to socially important issues is vital. Discussion of science articles in the science sections of newspapers, popular science magazines such as Scientific American and Discover, and science journals such as Science and Nature will be used throughout the course. Students are required to read and summarize three current science journal articles each grading period for their portfolio. One must be presented to the class in the form of a poster, presentation with visuals, pamphlet, or class Edmodo page. Examples of topics may include stem cell research, global climate change, antibiotic resistant bacteria, and genetically modified food.

A class focus project will examine the sickle cell anemia research of Dr. Tim Townes at the University of Alabama at Birmingham as he awaits approval to begin human trials to regulate gene expression to produce normal red blood cells.

CR5: The course provides students with opportunities to connect their biological and scientific knowledge to major social issues (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.

EXAM REVIEW

Students will have practice answering AP Bio exam-type questions in each of the units including multiple choice and free-response questions. Students will participate in the grading of questions from previous exams as a way to remediate and reinforce. We will spend the last week of class before the exam and a weekend session to intensely review for the exam.

COURSE SCHEDULE Includes a traditional block schedule of five 96 minute blocks per week for a period of 18 weeks. A minimum of four 3 – 4 hour class/laboratory sessions are added by utilizing Graduation Exam test days and early release mid-term exam days. Other before and after school sessions as well as a daily 20 minute academic flex period may also be utilized. *LABS/ACTIVITIES listed are representative and are NOT a complete list of all those that are included in unit design. See LABS/ACTIVITIES section for descriptions

WEEK	TOPICS <u>I. Molecules and Cells</u>	LABS & ACTIVITIES *
1	<u>INTRO/SCIENTIFIC METHOD (Chapter 1)</u> <ul style="list-style-type: none"> • Big Ideas • Experimental design • Data analysis • Evolution introduction/review 	<ul style="list-style-type: none"> ◦ Termite Trails Lab ◦ Measurement lab ◦ Start Fast Plants for LAB 1
2 – 3A	<u>UNIT 1- CHEMISTRY OF LIFE</u> <u>BIG IDEAS 2, 3 & 4</u> Water (Chapter 3) <ul style="list-style-type: none"> • Properties of water [2.A.3a.3] Macromolecules (Chapter 4 & 5) • C, H, O, N, P, S [2.A.3a] • Carbon compounds/isomers • Monomers/Polymers [• Nucleic acids [3.A.1][4.A.1.b.1] <ul style="list-style-type: none"> • DNA vs RNA [3.A.1.b.2] • types of RNA (RNAi) [3.A.1.b.4] • Proteins [4.A.1.a.2] <ul style="list-style-type: none"> • Protein folding [4.A.1.b.2] • Lipids [4.A.1.a.3] • Carbohydrates [4.A.1.a.4] • Directionality [4.A.1.b] • Emergent properties [Big Idea 4] 	<ul style="list-style-type: none"> ◦ Properties of water Lab [CR4b] ◦ Biologically Important Molecule Lab (abbreviated) [CR4d] ◦ Kennedy 3-D protein folding Activity [SP1] ◦ Biomolecule concept maps [CR4d]
3B - 4	<u>UNIT 2- CELLS [Big IDEAS 2,3,& 4]</u> The Cell (Chapter 6) <ul style="list-style-type: none"> • Sub-cellular components structure & function [4.A.2] • Cell walls [2.B.1.c] [3.D.2] • Organelle interactions [4.A.2] • Prokaryotic and eukaryotic cells [2.B.3] <ul style="list-style-type: none"> Cell membranes (Chapter 7) [2.B.1] • Fluid mosaic model [2.B.2] • Phospholipids [4.C.1] • Passive/Active Transport [2.B.2 a & b] • Role of membrane proteins [2.B.2] • Surface area/volume [2.A.3.b.1 & 2] • Selective permeability [2.B.1] • Tonicity [2.B.2] • Neuron Structure/function [3.E.2.b] • transmission/neurotransmitters [3.E.2.c] • Vertebrate brain [3.E.2.d] 	<ul style="list-style-type: none"> ◦ General microscopy / plant and animal cell lab / plasmolysis [CR4b] ◦ Cell parts charades [CR4b] <p>LAB 4 Osmosis and diffusion</p> <p>LAB 11: Transpiration</p> <ul style="list-style-type: none"> ◦ Neuron/synapse transport activity [CR4b]
5	<u>UNIT 3 Metabolism & Enzymes</u> <u>BIG IDEAS 2 & 4</u> Metabolism (Chap 8) <ul style="list-style-type: none"> • Free Energy (ATP) [2.A.1] • Coupled reactions [2.A.1.b.3] 	<ul style="list-style-type: none"> ◦ Be an enzyme modeling activity [CR4b] <p>LAB 13 Enzyme Activity</p>

6	<ul style="list-style-type: none"> Enzymes [4.B.1] Energy used for cell processes [2.A.1.d] Free energy in ecosystems [2.A.1.e & f] Cellular Respiration (Chap 9) [2.A.1] [2.A.2] <ul style="list-style-type: none"> Glycolysis, fermentation, & aerobic respiration [2.A.1.c] Photosynthesis (Chapter 10) <ul style="list-style-type: none"> Light dependent/Light independent pathways [2.A.1] [2.A.2] C3, C4 & CAM Photosynthesis 	LAB 6 Cellular Respiration LAB 5 Photosynthesis
7	<u>UNIT 4- Cell division (BIG IDEA 3)</u> Mitosis (Chapter 12) <ul style="list-style-type: none"> Mitosis and cytokinesis [3.A.2] Cell cycle regulation[3.A.2] Cancer [3/A/2/a/2] Apoptosis [2.E.1.c] Meiosis and Sexual Life Cycles (Chapter 13) <ul style="list-style-type: none"> Sexual and Asexual reproduction Meiosis and gametogenesis [3.C.2.c] Mitosis/meiosis comparison 	LAB #7 Mitosis/Meiosis
WEEK	Genetics & DNA	LABS & ACTIVITIES
8 – 9A	<u>UNIT 5 GENETICS (Chapters 13 – 21)</u> [BIG IDEAS 3 & 4] <ul style="list-style-type: none"> Probability [3.A.3.a] Origins of genetic variation [3.C.1] [4.C.1] Evolutionary significance of genetic variation [3.C.1.d] Heredity (Chap 14) [3.A.3] <ul style="list-style-type: none"> Mendel's Laws and probability [3.A.3.b] Inheritance patterns [3.A.3.b.3] Human genetic disorders [3.A.3.c] Ethical issues: Genetic testing; DNA privacy & ownership; stem cell research [3.A.3.d] [CR5] 	<ul style="list-style-type: none"> M & M Chi square Activity [CR4a] Fruit fly genetic crosses [CR4c] Stem cell Ethics debate [2.E.1] [CR5] [CR4c]
9B - 10	<u>UNIT 6 – DNA [BIG IDEAS 3 & 4]</u> Chromosomal Basis of Inheritance (Chap 15) <ul style="list-style-type: none"> DNA/RNA structure & function [3.A.1] Sex linked/limited genes [3.A.4.b] Chromosomal abnormalities [3.C.1] Non-Mendelian genetics [3.A.4] Environmental influence on gene expression [4.C.2] Non-nuclear DNA [3.A.4.c] Molecular Genetics (Chap 16) <ul style="list-style-type: none"> DNA structure [3.A.1] [4.A.1] 	<ul style="list-style-type: none"> Genetic disorders concept maps [SP1] [CR4c] BioTeach Replication Activity (advanced foldable) [SP1] [CR3c]

<p>9B – 10 (con't)</p> <p>11 - 12</p>	<p>From Gene to Protein (Chap 17)</p> <ul style="list-style-type: none"> • Replication [3.A.1.a.5] • Transcription & translation [3.A.1] • Post transcriptional processing [3.A.1.c.2] • Regulation of gene expression [3.B.1] • intracellular signals/expression [3.B.2] • Mutations [3.C.1] <p>Bacteria/Viruses (Chap 18)</p> <ul style="list-style-type: none"> • DNA and RNA Viruses [3.C.3] • Horizontal gene transfer [3.C.2] • Operons [2.C.1.a] <p>Eukaryotic Genomes (Chap 19)</p> <ul style="list-style-type: none"> • Organization of DNA [3.A.1.b] • Regulation of Gene Expression [2.E.1] [3.B.1] <p>DNA Technology (Chapter 20) [3.A.1.e]</p> <ul style="list-style-type: none"> • Recombinant DNA • DNA electrophoresis • Restriction enzyme analysis • PCR • Ethics- Genetically Modified Food, Transgenic animals, cloning [CR5] <p>Genetic Basis of Development (Chap 21)</p> <ul style="list-style-type: none"> • Development and differentiation [2.E.1] • Hox genes [2.E.1] [3.B.2.b] 	<ul style="list-style-type: none"> ◦ Protein Synthesis Theater – where everybody has a role to play [SP1] [CR4b, 4c, & 4d] ◦ Sickle Cell Anemia molecular designs activity -Beta Globin gene [CR4c] ◦ Pool Noodle operons [SP1] [CR4b,c,& d] ◦ Frankenfoods Case study [CR5] [CR4c] ◦ Recombinant Plasmid Cut & Paste Activity (BioTeach) [SP1] [CR4c] <p>LAB 9 DNA analysis (Science in Motion Rep teaches lab)</p> <p>LAB 8 pGLO Bacterial transformation (Field Trip BioTeach lab to Univ of AL Bham "GENEius Lab")</p>
<p>WEEK</p>	<p>Evolution and Organisms</p>	<p>LABS & ACTIVITIES</p>
<p>13 - 14</p>	<p>UNIT 7 -Evolution (Chapters 22 – 26)</p> <p>[BIG IDEA 1]</p> <p>Descent with Modification (Chapter 22)</p> <ul style="list-style-type: none"> • Darwin's theory [1.A.1-3] • Descent with modification & Natural selection [1.A.1] • Evidence for Darwin's theory [1.A.4] [1.B.1] <p>Evolution of Populations (Chapter 23) [1.A.1]</p> <ul style="list-style-type: none"> • Gene pools and allele frequencies [1.A.4] • Hardy-Weinberg equilibrium [1.A.1] • Natural selection & genetic drift [1.A.3] <p>Origin of Species (Chapter 24)</p> <ul style="list-style-type: none"> • Speciation [1.C.2] • Patterns of evolution [1.C.1] <p>Phylogeny and Systematics (Chapter 25)</p> <ul style="list-style-type: none"> • Phylogenetic classification [1.B.2] • Cladograms [1.B.2] <p>Tree of Life (Chapter 26)</p> <ul style="list-style-type: none"> • Early Earth/Origin of life [1.D.1&2] • Fossil record/dating [1.D.2] • History of life on Earth [1.D.2.a] 	<ul style="list-style-type: none"> ◦ Case Study: Cross Dressing Salmon – Survival of the Sneaky [SP1] [CR4a] <p>LAB 2 Hardy-Weinberg [1.A.1]</p> <ul style="list-style-type: none"> ◦ Nova Dogs and More Dogs Activity [SP1] [CR4a] <p>LAB 1 Artificial Selection using Fast plants [1.a.2.d]</p> <p>LAB 3 BLAST [1.A.4.b.4]</p> <ul style="list-style-type: none"> ◦ Access Excellence; Phylo tree activity [CR4a]

WEEK	Homeostasis, Signaling, Organ Systems	LABS/ACTIVITIES
15 - 16	<p>UNIT 8: Homeostasis, Signaling, & Organisms [BIG IDEAS 2, 3, 4]</p> <p>Animal Systems (Chap 32,33,34, 40 – 49)</p> <ul style="list-style-type: none"> • Structure and function [2.D.2] • Homeostasis [2.B.2] [2.C.2] [2.D.3] • Feedback mechanisms [2.C.1] • Thermoregulation [2.A.1.D.1] <ul style="list-style-type: none"> • Endothermy/Ectothermy <p>Body systems [2.D.2] [4.B.2]</p> <p>Nervous [3.E.2] [4.A.4]</p> <p>Immune [2.D.3 & 4]</p> <p>Excretory [2.D.2]</p> <p>Endocrine/hormones [3.D.1-4]</p> <p>Animal development [4.A.4]</p> <p>Cell Communication (Chapter 11)</p> <ul style="list-style-type: none"> • Stimulus/response [2.C.2.a] [2.E.2] • Cell signaling [3.B.2.b] • Signal Transduction [3.D.1] • Cyclic AMP [3.D.3.b] <p>Plants (parts of Chapters 29, 30, 35 – 39)</p> <ul style="list-style-type: none"> • Reproduction • Cell Signaling/Hormones • Tropism and photoperiodicity [2.C.2] [2.F.2] [2.E.3] 	<ul style="list-style-type: none"> ◦ Insulin Case Study [CR4 b,c,& d] ◦ WISC-online IPad Endocrine Hormone Game [CR4 c & d] ◦ Hormone Wanted Posters [CR4c &d] ◦ Plant manipulation activity [SP1] [CR4c & d]
17 – 18A	<p>UNIT 9- Ecology (BIG IDEAS 2, 3, & 4)</p> <p>Ecology and Biosphere (Chapter 50)</p> <ul style="list-style-type: none"> • Energy & trophic levels [2.A.1.f] <ul style="list-style-type: none"> • Biotic/abiotic factors [2.D.1.c] • Organism interactions [2.D.1.b] <ul style="list-style-type: none"> • Food webs [4.A.6] <p>Behavioral ecology (Chapter 51) [2.E.3]</p> <ul style="list-style-type: none"> • Innate/Learned behaviors [2.E.3.a] • Natural selection of traits [2.E.3.b] • Communication/responses [3.E.1] <p>Population ecology (Chapter 52)</p> <ul style="list-style-type: none"> • Density and dispersion [4.A.5.c] • Carrying capacity [4.A.5] • Population modeling [4.A.5.c] <p>Community ecology (Chapter 53)</p> <ul style="list-style-type: none"> • Ecosystem interactions [4.B.3] • Keystone species [4.B.3][4.C.4] <p>Ecosystems (Chapter 54)</p> <ul style="list-style-type: none"> • Energy flow and cycles [2.A.3.a] • Human impact [4.A.6] [4.B.3 & 4] [4.B.3.c] <p>Conservation and Restoration (Chapter 55)</p> <ul style="list-style-type: none"> • Biodiversity threats [4.A.6] [2.D.3] 	<p>LAB 12 Fruit fly Behavior Lab</p> <ul style="list-style-type: none"> ◦ Home Range data analysis mice & voles [CR4 a, c, & d] <p>LAB 10: Energy Dynamics</p> <ul style="list-style-type: none"> ◦ Mark and Recapture activity [CR4d]
18B	EXAM REVIEW (including after school and weekend)	
5/13/2013	AP BIO EXAM	
19	Special projects: Curiosity labs/ mass dissection, Hudson-Alpha Genetics Lab Visit	