Hello, AP Biology teachers,

After extensive analysis of the redesign (and numerous conversations with the redesign committee, workshops with the redesign committee, and a review of the new exam format), I have determined that the *AP* Biology Daily Lesson Plans* curriculum still exceeds the AP College Board requirements. In fact, you may notice that the changes made to the College Board course put it closer to the *AP* Biology Daily Lesson Plans* in terms of the skills, techniques and objectives that are the basis of all Catalyst Learning Curricula lesson plans.

What are the most significant changes made to the AP Biology course? The College Board has put a heavy emphasis on modeling and simulating processes and phenomena; it expects the student to have more self-direction in exploring topics; and it expects teachers to use methods that involve the students and are more demanding (i.e., lecture, Power Point presentations, worksheets and book work are no longer acceptable methods of teaching). The kinesthetic methods that require higher order thinking--games, debates, role playing, modeling, simulations, puzzles, analogies, etc.--featured in my lesson plans are no longer optional; instead, you are being asked to use these or similar methods every day. There are a few content topics you can now drop, if desired, or you can choose to continue covering them if you have found them to be especially useful in teaching critical thinking and analysis skills. For example, we now only have to teach three systems: the immune, endocrine and nervous systems. The rest of the body systems are optional. I personally have found the digestive system to be a fun way to explore enzymes, proteins, carbohydrates, fats and general biochemistry (all of which are required still), so I will continue to cover this system in my course. We also do not have to teach most of the topics involving botany, therefore many teachers will eliminate these, while other teachers will cover topics that are not required (such as plant physiology) to teach topics that are (such as cell communication, hormones and gene regulation). I have attached a document that summarizes the content changes of the redesigned course so you can determine which optional concepts you will eliminate and which you will choose to keep.

Another change you will need to make will be to trade out the twelve former AP Biology Lab Manual labs for eight of the revised labs (there are thirteen to choose from), inserting a new lab in the spot on the calendar set aside for each experiment. Realize that the new AP Biology Lab Manual as well as the new course description is available online in PDF format at: http://advancesinap.collegeboard.org/. The new AP Biology labs demand a higher level of critical thinking skills, greater student involvement in the design of each experiment, the use of mathematical modeling and statistical analysis. I have attached a document that describes some steps you may choose to take to deal with those changes.

Included in this pdf is a revised calendar that reflects the redesign of the AP Biology course. It provides a sequence for retaining activities that meet the new requirements, the addition of all thirteen the new labs (choose eight) and content that is no longer required has been marked for omission. Of the topics that are no longer required, those for which you have a particular passion or expertise can still be used to teach topics that *are* required. Time freed up on the revised calendar can be used for extended student-

designed experiments or case studies (please see the CLC website for the new case study of AIDS and the case studies that are coming for Diabetes, Hemoglobin, Ants, Cancer, the Sonoran Desert and Addiction and Depression). If you would like a Word version of the new calendar, send me an email (Kristen.dotti@catalystlearningcurricula.com) and I will send you the Word version so you can modify the calendar as needed.

The final suggestion I would like to make is for teachers who have incoming students who lack a solid foundation in scientific thinking, graphing, data analysis and the group skills to perform lab experiments to consider using the *Experimental Biology Daily Lesson Plans* curriculum for their General Biology classes. It is important that students understand how to apply the scientific method to any topic in biology, creating their own experiments over and over until the process becomes routine. All of the AP science courses are moving away from "cookbook"-style labs to student-designed lab experiments, so giving all students in General Biology a strong foundation in designing, carrying out and analyzing scientific experiments will be a huge benefit if they go on to AP Biology, AP Environmental Science, AP Physics (B or C) or AP Chemistry. In training teachers these last seven years I have learned that students are consistently unprepared to follow the principles of scientific thought and unable to answer such questions as: When is a control group used? What is a large enough sample size? How many times does a procedure need to be repeated? How do you eliminate variables in a complex system? To address the problem, I wrote the *Experimental Biology Daily Lesson Plans* curriculum as a freshman biology course that uses 32+ integrated student-designed lab experiments.

All courses taught after the summer of 2012 will need to be approved anew by the CB in order for you to continue using the AP trademark on school transcripts. All AP Biology teachers will need to submit a new audit syllabus, following the new guidelines and submission process on the College Board site. If you need College Board approval of your course syllabus, the Audit Syllabus that corresponds to the revised AP* Biology Daily Lesson Plans calendar with the new course requirements is now available. As with the previous version, the new audit syllabus is as turn-key as possible and comes with step-by-step instructions for customizing it quickly and efficiently, and it is only available for purchase by teachers who use the *AP* Biology Daily Lesson Plans* curriculum.

Please see the attached documents below, each of which addresses a different aspect of the redesign. My life-long goal is to support teachers in producing a community of scientifically literate young adults who thrive on critical thinking and life-long learning. If there is any way that I can help you, please don't hesitate to contact me with suggestions of additional materials or training I can provide to this end.

Kristen

Tips on What to Eliminate and What to Enhance in Your Curriculum

A detailed description of the changes made to the College Board AP Biology course and exam can be found at AdvancesinAP.com. The new course description outlines every item that is required and lists several topics that are not required. I have synthesized the changes for you, in the list below, summarizing the general trends. Attached please find a revised calendar as well, which offers a suggestion for how to progress through the required topics, covering the Big Ideas, Essential Knowledge goals, Learning Objectives and Science Practices and with the new labs inserted in place. The calendar uses the microscopic-to-macroscopic approach to instruction in which students first learn about molecules, cells, tissues, organs and systems and then ecosystems.

In the most general terms, here is a summary of what has become optional:

- We do not have to cover atoms, molecules and the basics, but your students will still be required to apply their knowledge of chemistry to biology when they work with molecules of life, water, pH and polarity. There are many circumstances such as this, in which the prerequisite content is not listed as a requirement but the use of foundational information is implied in order for students to demonstrate their understanding of complex processes. I will not list each of the items that fall into this category, but suffice to say that the overall expectation for the depth of the students' knowledge has been increased.
- The only required systems are the immune, endocrine and nervous systems—the digestive, excretory, cardiovascular, respiratory, reproductive and other systems are no longer required. Realize that you can use any of the systems that are not required to teach content that is required (for example, the digestive system is an excellent vehicle for teaching enzyme function, which is still a required topic).
- A march through the kingdoms (or phyla) is not required. Students will not have to name a trait of a particular phylum or classify a particular organism.
- Most of botany is no longer required. However, botany should be used to teach several required topics so that students understand that plants are like all other organisms in that they must deal with common issues such as the timing of growth and development, responding to environmental signals or defending themselves against consumers, etc.

Here is a general list of items that are new to the course (but that are already included in the *AP* Biology Daily Lesson Plans*' activities):

- Students must know how to perform a phylogenetic comparison of organisms using character traits drawn from molecular, morphological, ecological or fossil characters (please see Days 6, 7 and 8 of the Evolution Unit in the *AP* Biology Daily Lesson Plans* curriculum).

- Students must be able to build models and create simulations and compare them to real-life processes (please see the examples listed under Science Practices #1, below).
- Students must be able to recognize how a common issue, process or solution recurs in many different areas of biology (for example: all organisms require carbon, but photosynthesis is not the only way in which carbon chains are acquired; all organisms respond to their environment, but each does so in a unique manner; selection pressure on a phenotype results in changes in the frequency of the genotype regardless of the type of organism; etc.).
- Students must realize they will be expected to analyze, remark upon or make inferences regarding data or scenarios involving topics they have not covered. The students should have covered similar concepts that can pertain to scenarios that are new or unfamiliar to them. When faced with this type of question, students' initial reaction might be concern that they did not cover the correct content when, in fact, this is a style of testing used to address application of knowledge rather than rote regurgitation of knowledge. The AP exam questions involving novel situations look very much like questions from the ACT science exam, so using old ACT exam questions might be the best way to prepare students for the emotional response they might have to this type of testing.

Below is a list of concepts that have always been included in the AP Biology course requirements but seem to be given much more emphasis now:

1. Cell signals/communication
2. Gene regulation
3. Evolution
4. Ecology
5. Homeostasis and feedback mechanisms

I highly recommend that you touch on these topics every week, so that your students see how these concepts are related to nearly every aspect of biology. For example, if you are covering the immune system, you can use an activity to help the students learn about pathogen fragments docking on the Toll surface receptor (cell signaling), and continue on: the Toll receptor signal cascade results in 40 or more genes being promoted to create the proteins that initiate the inflammatory response (gene regulation); the Toll receptor is a protein that is highly conserved throughout many phyla (evolution); and the entire process occurs for the purpose of maintaining homeostasis when there is a threat to the organism (homeostasis).

The new course description introduces 4 Big Ideas, which are described using 17 Enduring Understandings. The Enduring Understandings are delineated in 55 Essential Knowledge (EK or EU) concepts, 149 Learning Objectives (LO) and 7 Science Practices (SP). The new labs cover a portion of the EK, LO and SP requirements, all of which are outlined in the new lab manual. Below is a list of the 7 Science Practices and a sampling of the activities that address them in the *AP* Biology Daily Lesson Plans*. The *AP* Biology Daily*

Lesson Plans Audit Syllabus lists each of the Enduring Understandings, Learning Objectives and Science Practices requirements listed next to every activity in the curriculum, so you can see where each of the requirements is met in the individual lesson plans. Also, the new Catalyst Learning Curricula Case Studies will each feature a chart aligning the case study's activities with specific College Board requirements (please see the chart on the AIDS Case Study page on the CLC Web site for an example).

Science Practices

Following are the 7 Science Practices required by the College Board AP Biology course and a sample list of activities that fulfill the requirements, from the *AP* Biology Daily Lesson Plans*:

1. The student is able to use representations and models to communicate scientific phenomena and solve scientific problems.

   Some example activities include:
   - Building atoms and molecules (Days 3-4, Review of Prerequisites)
   - pH review (Day 6, Review of Prerequisites)
   - Energy and Enzymes (Day 8, Review of Prerequisites)
   - Protein folding (Day 10, Review of Prerequisites)
   - Prokaryotic and eukaryotic cell models (Days 2-3, Cell Biology)
   - Endomembrane system simulation (Day 3, Cell Biology)
   - Cell mobility (Day 4, Cell Biology)
   - Membrane transport simulation (Day 7, Cell Biology)
   - Fluid mosaic models (Day 6, Cell Biology)
   - Cell respiration simulation (Day 14, Cell Biology)
   - Photosynthesis simulation (Day 18, Cell Biology)
   - Cell signal analogies (Days 23-24, Cell Biology)
   - Modeling DNA replication (Day 8, Genetics)
   - Transcription and translation simulation (Day 10, Genetics)
   - Operon models (Day 14, Genetics)
   - Pedigrees and inheritance patterns (Day 4, Genetics)
   - Model of DNA and replication (Day 8, Genetics)
   - Transcription and translation simulations (Day 10, Genetics)
   - Transcription and translation puzzles and games (Day 11, Genetics)
   - Virus models (Day 13, Genetics)
   - Operon models (Day 14, Genetics)
   - Bacterial lifecycles (Day 16, Genetics)
   - Phylogeny mobile (Day 11, Evolution)
   - Immune system play (Days 24-25, Anatomy & Physiology)
   - Stomata and water regulation (Day 8, Botany)
   - Biome dioramas (Day 1, Ecology)
   - Population dynamics game (Day 2, Ecology)

- Island biogeography simulation (Day 4, Ecology)

2. The student can use mathematics appropriately.

   Some example activities include:
   - Making solutions (Day 6, Review of Prerequisites)
   - Photosynthesis pigments lab (Day 16, Cell Biology)
   - Monohybrid and dihybrid crosses (Day 1, Genetics)
   - Genetics problems (Day 3, Genetics)
   - Chi-squared analysis (Day 7, Genetics)
   - Population genetics (Day 1, Evolution)
   - Hardy-Weinberg calculations (Days 2-5, Evolution)
   - Water potential calculations (Day 7, Botany)
   - Human population growth calculations (Day 2, Ecology)

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

   Some example activities include:
   - Analyzing scientific procedures and data (Days 1-2, Review of Prerequisites)
   - Skull morphology lab (Day 6, Evolution)
   - Phylogenetics database lab (Days 7-8, Evolution)
   - Digestive enzymes lab (Day 15, Anatomy & Physiology)
   - Plant stress factors lab (Day 11, Botany)
   - Human population growth calculations (Day 2, Ecology)

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

   Some example activities include:
   - Bond properties (Day 5, Review of Prerequisites)
   - Exploring organic molecules (Days 10-11, Review of Prerequisites)
   - Photosynthesis pigments lab (Day 16, Cell Biology)
   - Biotechnology methods (Day 18, Genetics)
   - Skull morphology lab (Day 6, Evolution)
   - Phylogenetics database lab (Days 7-8, Evolution)
   - Prokaryotic evolution (Day 9, Evolution)
   - Food journal (Day 10, Anatomy & Physiology)
   - Tracking Endocrine signals (Day 11, Anatomy & Physiology)
   - Digestive enzymes lab (Day 15, Anatomy & Physiology)
   - Plant stress factors lab (Day 11, Botany)

- Human population growth calculations (Day 2, Ecology)
- Line transect measuring biodiversity (Day 5, Ecology)

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

   Some example activities include:
   - Analyzing scientific procedures and data (Day 2, Review of Prerequisites)
   - Bond properties lab (Day 5, Review of Prerequisites)
   - Photosynthesis pigments lab (Day 16, Cell Biology)
   - Pedigrees and inheritance patterns (Day 4, Genetics)
   - Gene linkage, sex-linked traits (Day 5, Genetics)
   - Karyotype analysis (Day 6, Genetics)
   - Chi-squared analysis (Day 7, Genetics)
   - Skull morphology lab (Day 6, Evolution)
   - Phylogenetics database lab (Days 7-8, Evolution)
   - Prokaryotic evolution (Day 9, Evolution)
   - Tissue identification lab (Day 1, Anatomy & Physiology)
   - Digestive enzymes lab (Day 15, Anatomy & Physiology)
   - Plant stress factors lab (Day 11, Botany)
   - Human population growth calculations (Day 2, Ecology)
   - Line transect measuring biodiversity (Day 5 Ecology)

6. The student can work with scientific explanations and theories.

   Some example activities include:
   - Analyzing scientific procedures and data (Days 1-2, Review of Prerequisites)
   - pH review (Days 3-4, Review of Prerequisites)
   - Cytoskeleton and mobility (Day 4, Cell Biology)
   - Fluid mosaic models (Day 6, Cell Biology)
   - Redox reactions (Day 10, Cell Biology)
   - Photosynthesis pigments lab (Day 16, Cell Biology)
   - CAM and C4 photosynthesis (Day 19, Cell Biology)
   - Haploid-diploid lifecycles (Day 27, Cell Biology)
   - Monohybrid and dihybrid crosses (Day 1, Genetics)
   - Gene regulation analogies (Day 15, Genetics)
   - Cancer timeline (Day 17, Genetics)
   - Biotechnology methods (Day 18, Genetics)
   - Skull morphology lab (Day 6, Evolution)
   - Phylogenetics database lab (Days 7-8, Evolution)
   - Prokaryotic evolution (Day 9, Evolution)
   - Phylogeny mobile (Day 11, Evolution)
   - Species interactions scavenger hunt (Day 5, Ecology)

- Line transect measuring biodiversity (Day 5, Ecology)

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

   Some example activities include:
   - Building atoms and molecules (Days 3-4, Review of Prerequisites)
   - Review of pH (Day 6, Review of Prerequisites)
   - Organic molecules (Days 10-11, Review of Prerequisites)
   - Intro to cell size (Day 1, Cell Biology)
   - Prokaryotic and eukaryotic cells models (Days 2-3, Cell Biology)
   - Endomembrane system simulation (Day 3, Cell Biology)
   - Cell mobility (Day 4, Cell Biology)
   - Fluid mosaic models (Day 6, Cell Biology)
   - Membrane transport simulation (Day 7, Cell Biology)
   - Cell respiration simulation (Day 14, Cell Biology)
   - Photosynthesis simulation (Day 18, Cell Biology)
   - Cell signal analogies (Days 23-24, Cell Biology)
   - Model of DNA and replication (Day 8, Genetics)
   - Transcription and translation simulations (Day 10, Genetics)
   - Virus models (Day 13, Genetics)
   - Operon models (Day 14, Genetics)
   - Bacterial lifecycles (Day 16, Genetics)
   - Skull morphology lab (Day 6, Evolution)
   - Phylogenetics database lab (Days 7-8, Evolution)
   - Prokaryotic evolution (Day 9, Evolution)
   - CNS exercises (Day 3, Anatomy & Physiology)
   - Comparative anatomy of water balance organs (Day 9, Anatomy & Physiology)
   - Immune system play (Day 24-25, Anatomy & Physiology)
   - Population dynamics game (Day 2, Ecology)
   - Succession (Day 4, Ecology)

YEAR CALENDAR
August

S	M	T	W	T	F	S
The topic of study for each week will be listed in this column with any recommended websites that have proven usefulness.	**Monday through Thursday classes will be 50 minutes each on this calendar.**		**Each day is comprised of activities that can be rearranged or juggled to fit the number of minutes available in the class period.**		**Extended lab periods of 90 minutes will be placed on Fridays on this calendar but can be moved to any other day as needed.**	**Videos for the week will be listed in this column. Videos should be kept in a place of common access so students can watch them outside of class.**
						Realize that most textbooks have a companion disc or website that contains animations, video clips.
Review: Website: *Education. berkeley.edu Evolution 101	*Is it Alive? *Goal Setting *Include a discussion of the possible origin of life	*Scientific Process *Writing a Free Response (FR) Essay 2004 Form B, #4	*Atoms *Ionic Molecules *FR on Radioisotopes	*Covalent Molecules *Hydrogen Bonding	*Lab - Comparing Bond Properties *Point out role of polarity in coalescence *Discuss the role of water in the origin of life	Watch videos on elements, bonding and molecular interactions.

September

S	M	T	W	T	F	S
Review: Website *SumanasInc.com watch Heat Changes Protein Structure video	**Labor Day**	*Making Solutions *Review of pH *FR 2008 #1a	*Quiz *Structural Rearrangements *Functional Groups	*Energy *Enzymes *FR Enzymes	*~~**AP Lab #2** - Enzymes~~ Replace with Lab 13 (3-4 days)	Watch videos on enzymes and energy changes in a chemical reaction.
Review: Website: *Fold It - play a game to fold real proteins	*Organic Molecules *FR 2008 #1 Or FR 2010 #2	*Organic Molecules	*Test on Review Topics *FR 2000 #1 *FR 2009 Form B, #3	**Adjustment days for differences in school calendars**		Watch *Lorenzo's Oil* and discuss the role of lipids and the use of the scientific process as a method used to guide research.
Cell Components: Websites: *Cells Alive *U of Utah, Learn Genetics Size and Magnification	*Intro to Cells *Review of Microscope Technique *FR Cell Size	*Model Building, Prokaryotic Cells *Grade a FR *FR 2011 #1	*Eukaryotic Cells *Endomembrane System	*Cell Mobility *Review of Cell Parts *Identify and defend homologous cellular features *FR 2006 #1	*~~**AP Lab #1** – Diffusion and Osmosis~~ Replace with Lab 4 (4 days)	Watch videos on prokaryotic and eukaryotic cells.
Membrane Traffic: Website: *The Biology Place BioCoach	~~*Finish Lab #1~~ *Fluid Mosaic Model *FR 2002 #4	*Active Transport Simulation	*Review for Test	*Test – Cell Parts and Membrane Traffic	*Step-wise Energy Use *Redox reactions *Practice a timed FR 2001 #4	Watch videos on cell membrane transport.

October

S	M	T	W	T	F	S
Cellular Energy: Website: *www.johnkyrk.com	*Glycolysis	*Krebs Cycle	*Electron Transport System *Efficiency *FR	*Cell Respiration Simulation *Fermentation *FR 2012 #2	*~~**AP Lab #5 – Cell Respiration**~~ Replace with Lab 6 (4 days)	Watch videos on cell respiration.
Photosynthesis:	*Leaf Structure *~~**AP Lab #4A – Plant Pigments**~~	*Light Capture *FR 2010 Form B #1	*Light Reactions	*Dark Reactions Photorespiration *CAM Photosynthesis *FR CAM/C4	*~~**AP Lab #4B –** Photosynthesis~~ Replace with Lab 5 (4 days)	Watch videos on photosynthesis.
Cell Communication and Mitosis: Website: *Nobelprize.org Control of Cell Cycle Game	*Test on Cell Respiration and Photosynthesis *FR 1999 #1 or 2004 #3	*Cell Signals – Reception Website: *U. of Utah Learn Genetics, Dropping Signals	*Cell Signal Analogies	*Share Cell Signal Analogies	*Mitosis Models *~~**AP Lab #3A –** Mitosis~~ *Cancer *FR 2011 B, #1 Replace with Lab 7 (4 days)	Watch Bonnie Bassler's TED talk on cell signals between bacteria at www.TED.com
Meiosis and Intro to Genetics: Website: *DNA From the Beginning *U. of Utah Learn Genetics, Neurofibromin	*~~**AP Lab #3B & C –** Meiosis~~	*Haploid/Diploid Lifecycles *Group FR 2004 #1	***Test** on Cell Signals and Cell Division *FR 2011 #3	*Mendel's Laws *Monohybrid Crosses	*~~**AP Lab #7 –** Fruit Flies~~ Replace with Lab 1 (4 days)	Watch *Part I: What Females Want* and *Part II: What Males Will* Do on www.pbs.org

November

S	M	T	W	T	F	S
Inheritance: Website: *Nobelprize.org DNA games	*Gene Expression *Genetic Problems *FR 2005 #2	*Pedigrees and Inheritance Patterns ~~*Fruit flies~~	*Gene Linkage *Sex Linkage ~~*Fruit flies~~ *FR 2010 #3	*Karyotyping ~~*Fruit flies~~	*Chi-Squared *Poster Presentations *Discuss ethics of genetics testing prior to conception and prior to birth *FR 2003 #1	Watch *Gattaca* to discuss ethics of genetic testing
Gene Expression: Websites: *The Biology Project *U. of Utah, Learn Genetics, Genetic Disorders Library	**Veteran's Day**	*Protein and DNA *Model DNA Replication	*FR in class 1999 #4	*Transcription and Translation *FR 2002 Form B #3	*Making Proteins *Review Game *FR 2010 Form B #2	Watch *Cracking the Code* on www.pbs.org
Viruses/Bacteria and Eukaryotic Genome: Websites: *U of Utah, Learn Genetics, Epigenetics	*Test – Genetics Part A *FR 2009 #4	*Viruses *Begin Poster Presentations *FR 2002 Form B #1	*Operons *FR 2003 Form B #1	*Gene Control *Epigenetics (Use resources at University of Utah, Learn Genetics website) *FR 2012 #3	*Bacterial Lifecycles ~~*AP Lab #6A~~ – Transformation Replace with Lab 8 (5 days) *FR 2007#4	Watch *Ghost in Your Genes* by Nova at www.pbs.org
Gene Regulation: Websites: *U of Utah, Learn Genetics, Microarray	*Cancer *Poster Presentations *FR 2003 #4	*Debate government regulation of carcinogens	**Thanksgiving Break**			

December

S	M	T	W	T	F	S
DNA Technology: Websites: *U of Utah, Learn Genetics, Pus Popping Frogs *Nobelprize.org PCR Method	*DNA Biotechnology *FR 2002 #1	***AP Lab #6B** - Restriction Endonucleases *FR 2009 B #1 Replace with Lab 9 (2 days)	~~*Field trip to Genetics Lab~~	*Test – Genetics Part B *FR 2000 #3, 2005 B #3	Watch *King Corn* or *Food Inc.* on GMO crops and the use of genetics and biotechnology in the food industry.	Watch *Secrets of Life* video on www.pbs.org
Review:	**Adjustment days for differences in school calendars**		**Midterm Exams**			
	Winter Break					
	Winter Break					

January

S	M	T	W	T	F	S
	Winter Break				*~~**AP Lab #8** – Population Genetics~~ *Replace with Hardy-Weinberg bean simulation activity and discuss ethics	Watch videos on the formation and changes of the planet.
Review of Evolution: Websites: *U of Utah, Learn Genetics, Rock Pocket Mice	* Replace (old AP Lab #8) with Lab 2 (2 days)	*Evolution Review Game Show *FR 2001 #2	*Evolution Review Game Show *FR 2008 B #3	*Evolution Review Game Show *FR 2004 #2	*Mammal Taxonomy Project *FR 2008 Form B, #4	Watch videos on the origin of life and the early earth.
Taxonomy: Website: *Education.berkeley.edu Evolution 101	*Presentation of phylogenetic hypotheses from mammal skull study *FR 2009 #3	*Protein and DNA Data Bases Opt. Replace with Lab 3 (2 days) *FR 1999 #3	*Debate on the origin of the three Domains (including the Endosymbiont Theory) *FR 2004 B #1	~~*Protists~~ *My Favorite Protist	Presentations *Multicellular Development *Phylogeny Mobiles *FR 2012 #1	Watch videos on protists.
Early Cellular Evolution: Websites: *U of Utah, Learn Genetics, Old Genes, New Tricks	~~*Invertebrates~~	~~*Dissection of Invertebrates~~ ~~*Comparative Evolution~~ ~~*FR 2002 B #1~~	~~*Field trip to Aquarium or Pet Store for Vertebrate taxonomy~~ ~~*FR 2008 B #4~~	~~*Dissection of Vertebrates~~ ~~*Comparative Evolution~~ ~~*FR 1999 #3~~	~~*Phylogeny Team Scramble~~	Watch videos on invertebrates.
Evolution of Animals: Website *SumanasInc.com watch Human Embryonic Stem Cells video	*Test – Evolution *FR 2011 Form B, #4	**Adjustment day for differences in school calendars**	*Tissue Identification Lab	*Nerve Conduction	*CNS Stimulation Exercises	Watch videos on the nervous system.

February

S	M	T	W	T	F	S
Nervous System: Websites: *U of Utah, Learn Genetics, Mouse Party, Addiction and the Brain games and videos	*Sensory Perception	~~*Muscle Contraction Models~~	*Sensory Organ Presentations *FR 2007 #2	*Sensory Organ Presentations	*Guest Speaker – Neurologist or Neurosurgeon	Watch videos on the endocrine system.
Homeostasis and Endocrine System: Website: *HHMI Holiday Lecture Making You Mind	*Water Balance and Nitrogenous Wastes *FR 2005 Form B #4	*Field Trip to Dialysis Center *FR 2000 #2 *Begin Food Journal	*Tracking Endocrine Signals *Analysis of a FR *FR 2002 #2	*Dissection to Compare Homeostatic and Nervous Systems *Discussion of adaptations due to environmental pressure	*Guest Speaker – Endocrinologist *FR 2010 #1	Watch videos on the endocrine system and homeostasis.
Digestion and Gas Exchange: Website: *Nobelprize.org A&P games	*~~Intro to Digestion~~ ~~*Begin Digestion Self-study~~	*Lab on Digestive Enzymes *FR 2011 #2	~~*Lab on Respiration Rates and Temperature~~	~~*Guest Speaker – Gastroenterologist or Cardiologist OR *Field Trip to a Cardiologist's Office~~ ~~*FR 2009 B #4~~	*~~**AP Lab #10** –~~ Circulation Use as a student-designed lab on energy and matter exchange with the environment *FR 2009 #1	Watch videos on digestion and gas exchange.
Reproduction and Development: Websites: *U of Utah, Learn Genetics, Go, Go Stem Cells, and Click and Clone	*Mating Strategies Game *FR Endocrine Disruptors	*~~Frog Dissection – Digestion, Circulation and Reproductive Organs~~	~~Guest Speaker – STDs~~	*Lab – Sea Urchin Fertilization and Development *FR 2009 Form B, #4	~~*Guest Speaker – Midwife or OB~~ ~~*Begin preparation for Third Line of Defense Play~~	Watch *The Living Body* video by National Geographic

March

S	M	T	W	T	F	S
Immune System:	*First and Second Lines of Defense *Rehearsal of Third Line of Defense Play *FR 1999 #2	*Performance of Third Line of Defense Play *FR 2005 #4	*Guest Speaker – Immunologist *FR 2002 #3	~~*Pig dissection – review of anatomy~~	*Review of Anatomy and Physiology	Watch videos on the immune system.
Fungi and Plant Origins:	*Test – Anatomy and Physiology *FR 2004 Form B #3	~~*Fungi Presentations~~	~~*Fungi Presentations~~ ~~*Begin Plant Scavenger Hunt~~	*Hike to find samples of the major divisions of plants *FR Evolutionary Obstacles of Land Plants	*Plant Scavenger Hunt Due *Major Division Dissections ~~*Begin Plant Visual Dictionary~~ ~~*FR 2009 B #2~~	Watch videos on fungi and early plants.
	Spring Break					
Plant Structures:	~~*Roots, Stems and Leaves~~ ~~*Secondary Growth Circles for HW~~	~~*Plant Tissues and Cellular Growth~~ ~~*__AP Lab #9B –__ Structure of the Stem~~	*Transport in Plants *Review of Water Potential ~~*__AP Lab #1E –__ Onion Cell Plasmolysis~~	*Stomata and Water Regulation *FR 2011 #4	~~*__AP Lab #9A –__~~ Transpiration * Replace with Lab 11 (4 days) *FR 2006 #3	Watch *The Botany of Desire* by Michael Pollan on www.pbs.org.

April

S	M	T	W	T	F	S
Plant Nutrition:	*Soil Chemistry *Root Symbionts *FR Root Symbionts	*Plant Stress Factors Lab *FR 2006 Form B, #3	~~*Flower Dissections~~ *~~FR 2008 #4~~	~~*Fruit Dissections~~ ~~*Seed Displays for HW~~	*~~Mounted Seed Displays Due~~ *Plant Hormones Labs *FR 2003 Form B, #2	Watch videos on plant nutrition.
Plant Hormones:	~~*In-class FR 2003 B #2~~	*~~Plant Visual Dictionary Due~~ *~~Field Trip to Botanical Garden~~	*Test on Fungi and Plants *FR 2005 #3	*Planetary Motion *Global Climate *Begin Biome Dioramas *FR 2007 #3	*Population Dynamics Game *Human Population Growth Calculations *FR 2003 #3	Watch *Lord of the Ants* on www.pbs.org
Ecology:	*Distribution of Life on Earth *FR 2011 Form B, #2	*Biodiversity *Succession *FR Island Biogeography *FR 2010 #4 *FR 2011 Form B, #3	*Species Interactions Scavenger Hunt *FR 2004 #4	*Energy Flow in Ecosystems *Food Webs *FR 2006 #2 *FR 2010 Form B, #3	*~~**AP Lab #12** – Dissolved Oxygen~~ *Replace with Lab 10 (2-3 days plus 3-4 weeks to run experiments) *FR 2006 B, #4 *FR 2008 #2	Watch *Cane Toads: An Unnatural History* video
Ecology:	*Nutrient Cycles *FR 2003 Form B, #3 *FR 2012 #4	*~~**AP Lab #11** – Habitat Selection~~ *or Replace with Lab 12 (2-4 days) *FR 2007 Form B, #1	*Test on Ecology *FR 2004 Form B, #2	Spend Additional Time Using CLC Case Studies: AIDS, Diabetes, Cancer, Hemoglobin, Desserts, Depression and Addiction or Ants		Watch *People Bomb* video by CNN.

May

S	M	T	W	T	F	S
Review:	*Review for AP Exam *FR 2000 #4 *FR 2001 #3 *FR 2002 Form B, #2 *FR 2002 Form B, #4	*Review for AP Exam *FR 2003 Form B, #4 *FR 2005, #1 *FR 2005 Form B, #1 *FR 2005 Form B, #1	*Review for AP Exam *FR 2006 Form B, #1 *FR 2006 Form B, #2 *FR 2007 #1 *FR 2007 Form B, #2	*Review for AP Exam *FR 2007 Form B, #4 *FR 2008 #1 *FR 2008 #3 *FR 2008 Form B #1	*Review for AP Exam *FR 2008 Form B #2 *FR 2009 #2 *FR 2010 #2	
			Exam Week			

Schedule of Practice Free Response Essays

Free Response Topic	AP Biology Exam Reference	Unit	Day
Comparison of Kingdoms	2004 Form B, #4	Prerequisites	2
Radioisotopes		Prerequisites	3
Scientific Process	2008, #1a	Prerequisites	6
Enzyme Reactivity		Prerequisites	8
Proteins	2008, #1 or 2010 #2	Prerequisites	10
Enzyme Lab	2000, #1	Prerequisites	12
Properties of Water	2009 Form B, #3	Prerequisites	12
Cell Size		Cell Biology	1
Pro vs. Eukaryotes	2011, #1	Cell Biology	2
Endosymbiont Theory	2006, #1	Cell Biology	4
Concentration and Diffusion	2002, #4	Cell Biology	6
Protein Chemistry	2001, #4	Cell Biology	10
Cell Respiration Lab	2012, #2	Cell Biology	14
Pigment chromatography	2010 Form B, #1	Cell Biology	17
C_4 vs. CAM Plants		Cell Biology	19
Photosynthesis Lab	1999, #1	Cell Biology	21
Photosynthesis Lab	2004, #3	Cell Biology	21
Cell Cycle and Regulation	2011 Form B, #1	Cell Biology	25
Meiosis	2004, #1	Cell Biology	27
Reproduction Strategies	2011, #3	Cell Biology	28
Chromosome Structure/Function	2005, #2	Genetics	3
Monohybrid Cross	2010, #3	Genetics	5
Fruit Fly Hybridization	2003, #1	Genetics	7
DNA Structure	1999, #4	Genetics	9
Polymers	2002 Form B, #3	Genetics	10
Point Mutations	2010 Form B, #2	Genetics	11
Viruses and the Central Dogma	2009, #4	Genetics	12
Lytic Virus Lifecycles	2002 Form B, #1	Genetics	13
Prokaryotes vs. Eukaryotes	2003 Form B, #1	Genetics	14
Gene Regulation Mechanisms	2012, #3	Genetics	15
Bacterial Chromosome Mapping	2007 #4	Genetics	16
Cell Death	2003, #4	Genetics	17
Biotechnology	2002, #1	Genetics	18
Bacterial Transformation	2009 Form B, #1	Genetics	19
Proteins and the Central Dogma	2005 Form B, #3	Genetics	21
Gene Regulation	2000, #3	Genetics	21
Darwinian Evolution	2001, #2	Evolution	3
Hardy-Weinberg	2008 Form B, #3	Evolution	4
Darwinian Evolution	2004, #2	Evolution	5

Homologous Traits	2008 Form B, #4	Evolution	6
Cytochrome c Comparison	2009, #3	Evolution	7
Domain System	1999, #3	Evolution	8
Prokaryotes	2004 Form B, #1	Evolution	9
Deutero/Protostome Develop	2012, #1	Evolution	11
Phylogenetics Methods	2011 Form B, #4	Evolution	17
Cephalization and Stimulus	2007, #2	Anatomy	6
Water Potential	2005 Form B, #4	Anatomy	9
Feedback Systems	2000, #2	Anatomy	10
Circadian Rhythms	2002, #2	Anatomy	11
Glucose-Glucagon Feedback	2010, #1	Anatomy	13
Inter and Extracellular Digestion	2011, #2	Anatomy	15
Create a Cardiology Lab	2009, #1	Anatomy	18
Endocrine Disruptors		Anatomy	19
Comparing Respiratory Systems	2009 Form B, #4	Anatomy	22
Cell Communication	1999, #2	Anatomy	24
Immune Response	2005, #4	Anatomy	25
Comparative Anatomy	2002, #3	Anatomy	26
Homeostasis	2004 Form B, #3	Anatomy	29
Evolution of Plant Phyla		Botany	3
Data Analysis of Water Potential	2011, #4	Botany	8
Adaptations for Transpiration	2006, #3	Botany	9
Cell Signals: Root Symbionts		Botany	10
Interpreting Transpiration Data	2006 Form B, #3	Botany	11
Hormonal Response in Plants	2003 (or Form B), #2	Botany	14
Evol. of Advantageous Traits	2005, #3	Botany	17
Desert Ecology	2007, #3	Ecology	1
Population Growth	2003, #3	Ecology	2
Ecological Succession in Plants	2010, #4 or 2011 B, #2	Ecology	3
Invasive Species	2011 Form B, #3	Ecology	4
Symbiotic Relationships	2004, #4	Ecology	5
Population Dynamics	2006, #2	Ecology	6
Role of Bacteria in Ecosystems	2010 Form B, #3	Ecology	6
Aquatic Primary Production	2008, #2	Ecology	7
Trophic Level Energy Flow	2006 Form B, #4	Ecology	7
Water Cycle	2003 Form B, #3	Ecology	8
Abiotic/Biotic Carbon Processes	2012, #4	Ecology	8
Lab on Innate Behaviors	2007 Form B, #1	Ecology	9
D.O./Photosynthesis Lab	2004 Form B, #2	Ecology	10
Survival Behaviors	2000, #4	Exam Review	
Create a Cardiovascular Lab	2002 Form B, #2	Exam Review	
Tissue layers and coelums	2002 Form B, #4	Exam Review	
Biodiversity and Evolution	2003 Form B, #4	Exam Review	
Design an Enzyme Experiment	2005, #1	Exam Review	

Population Graphs	2005 Form B, #1	Exam Review	
Sexual/Asexual Reproduction	2006 Form B, #1	Exam Review	
Structure and Function Choices	2006 Form B, #2	Exam Review	
Struct./Funct. of Membranes	2007, #1	Exam Review	
Immune Response	2007 Form B, #2	Exam Review	
Trophic Level Energy Flow	2007 Form B, #4	Exam Review	
Protein Bonds, Function, Errors	2008, #1	Exam Review	
Regulation and Disruption	2008, #3	Exam Review	
Primary Productivity & DO	2008 Form B, #1	Exam Review	
Small Unit to Complex Whole	2008 Form B, #2	Exam Review	
ATP and Energy Flow	2009, #2	Exam Review	
Amylase Reaction Rate & Conc	2010, #2	Exam Review	

Tips for Integrating the New AP Biology Labs and Experimentation Skills

Please send an email request to Kristen.dotti@catalystlearningcurricula.com for a Word version of the revised calendar that features the 13 new labs offered by the AP Biology Lab Manual, found at the AdvancesInAP.com website. Remember that your students are only required to perform 8 of the 13 labs, but you can certainly add more if you like, and you may substitute other equally involved labs as desired, or use the freed up time for project-based learning, case studies, debates, or other higher-order thinking activities. The primary objective of the labs is to develop the students' scientific thinking skills by requiring them to use the scientific process, so be sure not to turn the new labs into "cookbook" procedures that decrease the level of critical thinking.

There are several different techniques that AP (and IB) students are expected to learn, most of which are new to the AP course. The bottom line is that students must understand how to answer and implement responses to the following questions when presented with a specific circumstance or scenario (such as a lab setup) in an AP Exam essay question:

- How do you come up with an idea for an experiment?
- What is a testable question?
- Why do you test the null hypothesis instead of the alternate hypotheses?
- What makes a procedure scientifically accurate?
- When do you use a control or control group?
- When is a sample size large enough?
- How do you control variables?
- What do you do when some variables cannot be controlled?
- How do you know what type of statistical analysis to perform?
- How do you do the math for different analysis calculations?
- What do the statistical results tell you about your experiment?
- When do you reject or accept your null hypothesis?
- What types of errors are significant?
- What is the role of the peer review in science and why is it such an important aspect of making an experiment "scientific"?
- What should you look for in a scientific experiment to know if the process was rigorous and the data are sound?

As the new labs are well-written and borrow heavily from previous, familiar labs used widely in AP Biology in the last few decades, they may offer clear enough instruction to guide your students in student-designed experimentation. However, if you are not comfortable answering the above questions yourself, or if you often receive students who are unprepared to answer the above questions—i.e., if students come to your class lacking group problem-solving and communication skills, familiarity with peer critiques,

the ability to analyze the quality of a scientific procedure, etc.—you or your students may need more support to accomplish everything that will be required on the revised AP Exam. You may want to consider taking action now rather than risking poor results on the new exam next summer. Following are common concerns I have heard expressed about the lab portion of the new course and the solutions I recommend for addressing them:

"What if I am not comfortable developing an original experiment or guiding my students while they design their own experiments?"

Many teachers have tried letting their students design their own experiments and what they ended up with is chaos. Who hasn't been to a science fair, graded a stack of lab reports or witnessed a series of lab presentations in which the experiments were either literature reviews (summaries of what is already known and has already been documented about the topic) or were doomed to fail from the outset due to poor design, or featured data that was woefully misinterpreted, rendering the conclusions obsolete, or featured a procedure that failed to address the question, or resulted in students being more confused about the topic of the experiment than they were at the outset? The source of the problem is usually a lack of experience or understanding on the part of the teacher who guided the students.

Many teachers have simply never had the chance to design and carry out an experiment. They themselves need practice applying the scientific process with easy topics as well as complex (multivariate) topics. There is no substitute for experience—the more scientific experiments we design, carry out and analyze ourselves, the better we will be at guiding our students through this process.

Here are two ways to brush up your skills for teaching and guiding the scientific process:

1. Attend a 5-day Summer Workshop or a 1-day Workshop with Catalyst Learning Curricula. I will ensure that you gain firsthand experience writing scientific experiments (both simple, straight-forward experiments and experiments with hard-to-control variables) and that you leave with a clear understanding of how to answer all of the questions in the bullet-point list above.

2. Use *Experimental Biology Daily Lesson Plans* with your General Biology students. If you teach this course, when you use these day-to-day lesson plans you will learn along with your students. The *Plans* are a guide to exploring all content areas of biology using the experimental process, so you will develop a facility with different variables and scenarios, which will bolster your ability considerably within the first semester. If another teacher in your department is responsible for teaching the general biology classes and they use the *Plans*, you

will be lucky enough to inherit students who have had the experience of writing, conducting and analyzing results from 32+ student-designed experiments and who understand the scientific process because they have used it over and over in a variety of unique situations.

"What if I do not understand how to include and perform the calculations for statistical analysis?"

Statistical testing is a new requirement for the AP Biology Exam (and is required in IB, as well). Your students will be expected to analyze data using common statistical tests such as the chi-squared analysis to compare the observed results versus the expected results, a t-test to compare the means of two sample groups, and a test of correlation to determine if two variables are related in a predictable manner. You will want to be totally comfortable with the concept of a null hypothesis and the reporting of basic data analysis (trends determined by mean, median, mode, range and a line or curve of best fit, upward or downward trends in the data, etc.).

Here are two ways to brush up on your skills for teaching and guiding statistical analysis:

1. Buy the book *A Short Guide to Writing About Biology* by Jan Pechenik and read the chapter on statistical analysis of data. Using simple, straightforward explanations and numerous examples, this book walks you through each type of statistical testing method you will need to perform with your students. There are several examples of why a null hypothesis is used in science and a clear explanation of how to determine whether to reject or fail to reject the null. As department chair at a high school where I taught AP and general science classes, I required every incoming eighth grader to buy this book and we worked through it chapter by chapter as the kids progressed through the science department courses. The 8th grade students were required to master writing hypotheses and graphing and to get their feet wet writing good procedures. The 9th grade students were required to master writing experimental procedures (as well as continue to use hypotheses and graphing) and get their feet wet writing the results, introduction and conclusion sections. The 10th grade students were required to master the statistical analysis of results and perfect their description of the conclusions while adding depth to the introduction section. The 11th and 12th grade students were expected to show mastery of all aspects of the scientific process and communication of scientific information in written and oral form. I suggest coordinating your efforts in this area with other members of your department and with the faculty who teach math.

2. Find a statistics textbook, an online source, or other guide that explains clearly how to conduct a chi-squared analysis, a t-test and a test of correlation. Teach

one statistical test at a time throughout the first semester and then teach your students how to determine which type of analysis is needed as they progress through the year. Provide your students with visual explanations of each math concept so the statistics have meaning. Use their experiments as examples to explain the use of each type of analysis so the students can relate the mathematical methods to the statistical test that is used.

3. Do not allow yourself of your students to use calculators or computer programs that offer these statistics at the push of a button until they are able to perform the analyses manually and understand the meaning of what they are doing and the meaning of the resulting values.

4. I highly recommend having your students keep a lab notebook or portfolio that progresses with them vertically through the high school years (or even starting from middle school if possible) so that progress in scientific thinking and communication can be assessed authentically.

5. If math anxiety plagues you, you may want to consider taking a professional development seminar so you can practice the skills with the support of colleagues facing the same challenge.

If you need support, please call or send an email with questions or concerns, I will be happy to support you in any way that I am able. Otherwise, let's celebrate a move by the College Board towards higher expectations for critical thinking!

Kristen