

**ALCOSS: Biology 1**

Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an experiment.

**Mastered:**

Students will select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an experiment.

**Present:**

Students will demonstrate and expand the concept of scientific processes using their imagination and understanding.

**Going Forward:**

Students will modify their experiment to conduct it as a science fair project.

**Present and Going Forward Vocabulary:**

Abstract, double blind study, clinical trials, in vitro, in vivo, multiple parameters, therapeutic level

**Career Connections:**

Biologist, Research Scientist

**Advanced Understanding & Activity (Alternate activity):**

Students will design an imaginary experiment step by step with all of the necessary laboratory equipment and safety precautions. Plan your experiment using a graphic organizer. Consider the following questions:

- What will you test?
- How much time will the experiment take?
- Even though you are only testing one variable at a time how many experimental groups will you need?
- What will your experimental organism be?
- Why are you using this model organism?
- What safety precautions should you use?
- What things need to be held constant while the experiment is being conducted?
- What are your independent and dependent variables?
- What are sources of error to take into consideration?
- How will you collect your data and once you have how are you going to analyze the data?
- What is your hypothesis and do the results obtained support your hypothesis?

Once you have the experiment complete you will select your audience and write an illustrated story, comic book, instruction manual, or screen play about the experiment. Use your imagination to create supporting characters and situations. Your goal is to highlight the experiment and all of the things that go along with it such as safety rules, lab equipment, experimental design, data collection and analysis, conclusion and adherence to basic scientific methods while keeping your audience interested to the very end. You can use illustrations to convey information or if you choose the screenplay your vivid descriptions of the stage directions will supplement the dialogue to convey the material. It is essential that you use the associated vocabulary to convey understanding of the terms and processes. Length is not limited, there is no minimum or maximum but the experiment must be described from conception to conclusion. Refer to the rubric for details (Appendix A).

**Literature Connections/Resources:**

- Basic Lab Equipment: <http://staff.tuhsd.k12.az.us/gfoster/standard/labeq.html>
- Safe Handling of Equipment:  
<http://mdk12.org/instruction/curriculum/science/safety/handling.html>

**ALCOSS: Biology 2**

Describe cell processes necessary for achieving homeostasis, including active and passive transport, osmosis, diffusion, exocytosis, and endocytosis

**Mastered:**

Students can describe cell processes necessary for achieving homeostasis, including active and passive transport, osmosis, diffusion, exocytosis, and

**Present:**

Students will further develop the connections between cell processes and cell survival through a Think Fast activity.

**Going Forward:**

Students will research the latest advances in Cell Biology.

endocytosis.

**Present and Going Forward Vocabulary:**

Macromolecules, turgor pressure, terms related to careers-cytology, cytotechnology, cellular biology

**Career Connections:**

Cellular Biologist, Cytologist, Cytotechnologist, Microbiologist, Biologist, Biochemist, Oncologist, Immunologist, Cell Biologist, Cell Culture Scientist

**Advanced Understanding & Activity (Alternate activity):**

**Think Fast** (Student page found in Appendix A)

Students will use the “Think Fast” activity to brainstorm or research things related to cell processes and maintaining homeostasis. Students will use the summary activity and apply it to a living system.

- C** Identify five things a cell must do to survive.
- E** Name two ways a cell can get energy.
- L** Identify four macromolecules that cells need and their roles in the cell.
- L** List six ways something could enter a cell.
- P** Identify six examples of the role of fluid pressure plays in living systems.
- R** Identify four environmental factors that could affect how a cell functions.
- O** List three outcomes of osmosis.
- C** Explain the one primary reason why cells must be small.
- E** Name two biochemical processes that use or produce energy in a cell.
- S** Identify the three relative terms used to describe solutions.
- S** List five cell processes a cell uses to maintain homeostasis.
- E** Describe three careers that a Cell Scientist might have.
- S** List 20 vocabulary words that are associated with cell processes.

**Summary Essay:** Use the information above to describe what it would be like if you were a single celled organism. What are the challenges you would face to stay alive? What tools or techniques do you have to help you meet those challenges? What advantages and disadvantages do multi-cellular organisms have? How would the multi-cellular organism be impacted if its individual cellular components began to fail?

**Literature Connections/Resources:**

- Cellular Processes: [http://library.thinkquest.org/C004535/cellular\\_processes.html](http://library.thinkquest.org/C004535/cellular_processes.html)

**ALCOSS: Biology 3**

Identify reactants and products associated with photosynthesis and cellular respiration and the purposes of these two processes.

**Mastered:**

Students can identify reactants and products associated with photosynthesis and cellular respiration and the purposes of these two processes.

**Present:**

Students will choose activities in which they will apply their prior knowledge and delve deeper into the processes of photosynthesis and cell respiration by tracing one or more of the initial ingredients through both processes.

**Going Forward:**

Students will research variations in these processes and factors that can impact the rates of the processes.

**Present and Going Forward Vocabulary:**

Oxidative phosphorylation, electrochemical gradient, NAD, NADP, FAD, GTP, stroma, mitochondrial matrix, cristae, pyruvic acid

**Career Connections:**

Cellular Biologist, Cytologist, Cytotechnologist, Microbiologist, Biologist, Biochemist, Oncologist, Immunologist, Cell Biologist, Cell Culture Scientist

**Advanced Understanding & Activity (Alternate activity):**

The processes of Photosynthesis and Cellular Respiration are opposites in that the products of one become the reactants of the other. The key ingredients for the combined processes are water, carbon dioxide, light, oxygen, glucose and ATP. Having a command of the formulas and an overview of the processes the student will select one of the assignments below to investigate the complex details and explore the connectedness of the two processes.

**Option 1:** You are a mapmaker. It is your job to create a map for a Carbon Dioxide molecule through the processes of photosynthesis and cellular respiration. There is only one stipulation; the voyage must be round trip, so it must end where it begins. Be sure to explain every land mark, event or obstacle along the path.

**Option 2:** You have just gotten a job at the new toy company, “Science Toys for Girls and Boys.” Your first job is to design a board game or a video game that explains the processes of photosynthesis and cell respiration. You must do a mock up of the game, explain how it is played, and show how it will help children learn about these special cell processes.

**Option 3:** You are an investigator following a Photon as it leaves the sun. Trace it and its energy through all of the twists and turns as it is transformed through the processes of photosynthesis and cellular respiration. This particular Photon goes from the sun, into an apple tree and then into a boy under the tree that desperately needs energy to put on sunglasses. You must file a very detailed report of all of the events and the actions of the other players involved.

**Literature Connections/Resources:**

- Cell Respiration-Introduction: [http://www.phschool.com/science/biology\\_place/biocoach/cellresp/intro.html](http://www.phschool.com/science/biology_place/biocoach/cellresp/intro.html)
- Photosynthesis: <http://biology.clc.uc.edu/courses/bio104/photosyn.html>
- Wikipedia-Cellular Respiration: [http://en.wikipedia.org/wiki/Cellular\\_respiration](http://en.wikipedia.org/wiki/Cellular_respiration)
- Wikipedia-Photosynthesis: <http://en.wikipedia.org/wiki/Photosynthesis>

**ALCOSS: Biology 4**  
Describe similarities and differences of cell organelles, using diagrams and tables.

<p><b>Mastered:</b> Students can describe similarities and differences of cell organelles, using diagrams and tables.</p>	<p><b>Present:</b> Students will demonstrate and expand the concept of the functions of the organelles and the overall function of the cells by doing a RAFT activity.</p>	<p><b>Going Forward:</b> Students will research on how the functions of the individual cell impact the whole organism.</p>
---	--	--

**Present and Going Forward Vocabulary:**

Motor protein, plasmodesmata, nucleiod, plasmid, tonoplast, tight junction, peroxisomes, pinocytosis, endosomes, extracellular matrix, cell fractionation.

**Career Connections:**  
Cell Biologist, Cytologist, Cytotechnologist, Virologist

**Advanced Understanding & Activity (Alternate activity):**

**RAFT** (Student page found in Appendix A)

Students will choose one row. They will write about the TOPIC from the perspective of the ROLE to the AUDIENCE using the FORMAT. You can allow students to choose one item from each of the four columns. Provide an audience for the student to present their product. Students may need to plan their product using the organizational tool, Project Planner.

<u>ROLE</u>	<u>AUDIENCE</u>	<u>FORMAT</u>	<u>TOPIC</u>
-------------	-----------------	---------------	--------------

Nucleus	Organelles	Inter-office memo	Production is down
Plant cell	Another Plant cell	Love Letter	Communication, I feel like there is a wall between us!
Tonoplast	Roots	Urgent E-mail	Dropping Pressure
Eukaryote	Prokaryote	Late Nights Top Ten List	Reasons I am better than you
Mitochondria in a plant cell	Chloroplast in a plant cell	Recipe	Glucose
Ribosome	Endoplasmic Reticulum	Job Reference Letter	Opening in Protein Production
Multi-cellular organism	Virus	Song (style of your choice)	You can win the battle but still lose the war.
Mitochondria	Entire Cell	Energizer Bunny Commercial	ATP
Golgi Apparatus	Motor Protein	Coach's speech at halftime	Urgent shipment
Cell Membrane	self	Journal Entry	Living on the edge.
Blood Sample	Cell Biologist	Conversation	You are going to do what?
Curious Eight Year Old	Scientist	List of questions	Cells

**Literature Connections/Resources:**

- Wikipedia-Organelle: <http://en.wikipedia.org/wiki/Organelle>
- Cells and Organelles: <http://biology.clc.uc.edu/courses/bio104/cells.html>
- Cell Organelle Table: <http://www.schools.utah.gov/curr/science/sciber00/7th/cells/sciber/orgtable.html>

**ALCOSS: Biology 5**

Identify cells, tissues, organs, organ systems, organisms, populations, communities, and ecosystems as levels of organization in the biosphere.

**Mastered:**

Students can identify cells, tissues, organs, organ systems, organisms, populations, communities, and ecosystems as levels of organization in the biosphere.

**Present:**

Students will demonstrate their knowledge of the hierarchy of cellular organisms in the biosphere and the importance of differentiation. Students will expand and connect their knowledge of increased complexity at all levels of the hierarchy as well as interdependence within the levels.

**Going Forward:**

Students will further research and connect the concept of energy flow through the hierarchy of cellular organization in the biosphere.

**Present and Going Forward Vocabulary:**

Interdependence, diversity

**Career Connections:**

Cytologist, Cytotechnologist, Histologist, Histotechnologist

**Advanced Understanding & Activity (Alternate activity):**

Students will create a presentation, PowerPoint, video, or 3-D model to explain the levels of organization and the diversity and interdependence among the levels.

- From the smallest, simple, single-celled organism to the entire biosphere, it is easy to notice the increasing complexity and diversity among living things and yet there is an interdependence that exists at every level.
- Create a Prezi, PowerPoint, video, or 3D model that shows the levels of organization in the biosphere.
- Be sure to highlight examples of differentiation, diversity, and interdependence at multiple levels through-out the levels of organization.

**Literature Connections/Resources:**

- Wikipedia: Biological Organization:  
[http://en.wikipedia.org/wiki/Biological\\_organisation](http://en.wikipedia.org/wiki/Biological_organisation)

**ALCOSS: Biology 6**

Describe the roles of mitotic and meiotic divisions during reproduction, growth, and repair of cells.

**Mastered:**

Students can describe the roles of mitotic and meiotic divisions during reproduction, growth, and repair of cells.

**Present:**

Students will distinguish between the two processes by deriving a comparison and determining contrasts. Students will predict outcomes not normally associated with these processes.

**Going Forward:**

Students will research the outcomes of errors in these processes and their impact on the organism or future organisms.

**Present and Going Forward Vocabulary:**

Spermatocyte, oocyte, spermatogenesis, oogenesis, haploid, diploid, gametogenesis

**Career Connections:**

Geneticist, Cellular Biologist

**Advanced Understanding & Activity (Alternate activity):**

Students will interview a somatic cell and gametocyte. Through the interview, students will develop answers based upon the type of cell as the reason for its division, its goal, its possibility or prediction for errors, and its future continuance.

The student will create an interview with a somatic cell and a gametocyte. The interview can be in any venue that the student chooses such as a news interview, post-game sports interview, a prison interview, military press conference or a political debate format. The suggested questions are below and the student should compose three to five original questions to supplement the interview and make it more personal or accurate. The wording of the questions can be modified to fit the type of interview. The questions should be fielded to both the somatic cell and the gametocyte. The student will need to make the gender determination of the gametocyte prior to the interview.

**Basic questions:**

- What is your mission in life?
- What are your plans for the future?
- What are some of the obstacles in your way?
- If you can't complete your mission, speculate what might happen?
- What steps did you take to prepare for your mission?
- What would happen if something goes wrong with your plans?
- What are your exact plans, step by step, and how long do you anticipate each step taking?
- When will you carry out your plan?

- What items or key players will you rely on to carry out your mission?
- Where will your plan take place?
- Would other cells like you, but perhaps the opposite gender, carry out the same mission in the same way that you plan to or would they face different challenges?
- If all goes well, what will you use to determine if your mission has been a success?
- What will you do when your mission is complete?

**Literature Connections/Resources:**

- Wikipedia-Somatic Cell: [http://en.wikipedia.org/wiki/Somatic\\_cell](http://en.wikipedia.org/wiki/Somatic_cell)
- Wikipedia- Gametocyte: <http://en.wikipedia.org/wiki/Gametocyte>

**ALCOSS: Biology 7**  
 Apply Mendel’s law to determine phenotypic and genotypic probabilities of offspring.

**Mastered:**

Students can apply Mendel’s law to determine phenotypic and genotypic probabilities of offspring.

**Present:**

Students will expand their understanding of heredity and the work of Mendel and the impact Mendel’s work has made on the understanding of genetics. Students will calculate phenotypic and genotypic probabilities and expand it to modern genetics, evolution, and a deeper historical perspective.

**Going Forward:**

Students will relate Standard 8 and the deeper understanding of genetic concepts.

**Present and Going Forward Vocabulary:**

2008 Genetic Information Nondiscrimination Act

**Career Connections:**  
 Geneticist, Molecular Cell Biologist, Medical Historian

**Advanced Understanding & Activity (Alternate activity):**

**Kaplan’s Depth & Complexity** (Student page found in Appendix A)

Students will choose one element to research and complete the product. Students may need to plan their product using the organizational tool, Project Planner.

ELEMENT	QUESTIONS/ACTIVITY	PRODUCT(S)
LANGUAGE OF THE DISCIPLINE	Put yourself in Mendel’s shoes. Imagine that you are Gregor Mendel and you are working with your pea plants. Using only terms and information Mendel would have known, take notes and write plans for future experiments.  Make a list of words that Mendel used and newer words that we use today.	Journal entry or “to do” list  List of Mendel Translations
DETAILS	Mendel had to pay close attention to detail. What are some of the details he would have had to monitor while doing his experiments? Describe the traits he was working with and the tools he would have used to gather and record all of the details. What organizational skills would have helped Mendel throughout the multiple generations of his experiments?	Mendel’s “lost” personal notes to himself.  List of tools and organizational skills
PATTERNS	Mendel’s observation of specific patterns is what lead him to understand how traits are passed from one generation to the next. Identify the various patterns you recognize by doing monohybrid crosses, and dihybrid crosses. Explain uses for these patterns of probability.	Graphic organizer or Concept map

TRENDS	Mendel is considered the Father of Genetics. How did his work influence what Geneticists are doing today? How did his work contribute to works that followed that have impacted the field of Genetics today?	Create a time line of discoveries that have stemmed from the work of Gregor Mendel. Briefly explain the impact of each study on the next.
UNANSWERED QUESTIONS	Gregor Mendel published his work in 1865 and died in 1884. He must have had unanswered questions related to his work. Make a list of questions he must have had. Have any of those questions been answered since he died? If Mendel were to come back and catch up on the research what questions do you think he might still have? If you were a scientist, what genetics question would you like to answer?	List of questions and answers.
RULES	Mendel suggested three “Laws” governing how traits are inherited. Identify and explain these three laws in your own words and examples of how these laws impact heredity. Due to new knowledge gained since Mendel, we have discovered these laws are not always the correct explanation. What are some exceptions to Mendel’s laws? Explain these exceptions and give examples.	Create a Genetics Rule Book.
ETHICS	Ethical issues frequently arise around scientific discoveries. What controversy do you think might arise related to heredity or genetic technology? In 2008 the Federal Government passed a law called The Genetic Information Nondiscrimination Act (GINA). Research this law and explain what its purpose is. Do you feel there is a need for this law?	Debate both sides of a controversial issue.  Commentary on GINA
BIG IDEAS	If your teacher allowed you to teach this section on Mendel, what would be the main point(s) you would want your students to know? Be sure to explain how his work has led to the extraordinary body of genetics knowledge we have today.	Lecture notes or Power Point slide
OVER TIME	Mendel studied how traits are passed on from one generation to the next. His experiments with peas apply to all living organisms on Earth. His work led to our understanding of genetics and our understanding of how some genetic information can be found in multiple species across various levels of complexity. What role has heredity played in development of the organisms we see on Earth today, from the simplest bacteria to the most complex animal?	Answer the questions using a drawing, phylogenetic tree, poster, PowerPoint or Prezi
DIFFERENT PERSPECTIVES	What were the ideas about heredity before Mendel? What makes a person seek answers to questions that already have a generally accepted answer in place?	Debate with Mendel and the scholars of his time or those that came before him.
INTERDISCIPLINARY RELATIONSHIPS	How is the topic of heredity related to chemistry?	Diagram with commentary.

**Literature Connections/Resources:**

- Mendel’s Genetics: [http://anthro.palomar.edu/mendel/mendel\\_1.html](http://anthro.palomar.edu/mendel/mendel_1.html)
- Wikipedia-Gregor Mendel: [http://en.wikipedia.org/wiki/Gregor\\_Mendel](http://en.wikipedia.org/wiki/Gregor_Mendel)

**ALCOSS: Biology 8**

Identify the structure and function of DNA, RNA, and protein.

**Mastered:****Present:****Going Forward:**

Students can identify the structure and function of DNA, RNA, and protein.

Students will expand their connections of the central dogma and biotechnology.

Students will further research genetics and biotechnology.

**Present and Going Forward Vocabulary:**

Bioethics, Human Genome Project, comparative genomics, PCR, DNA microarray, personalized medicine, genetically-modified foods

**Career Connections:**  
 Molecular Biologist, Cellular Biologist, Medical Technologist, Hematologist, Oncologist, Nutritionist, Dietician, Geneticist, Genetic Counselor

**Advanced Understanding & Activity (Alternate activity):**

**TIC-TAC-TOE** (Student page found in Appendix A)

Students will explore new technologies and applications of the informative explosion of the understanding of DNA through the Tic-Tac-Toe activity. Students will choose three activities in a row, column, or diagonal, just like TIC-TAC-TOE. Then students will complete the contract to submit to their teachers. Students may need to plan their product using the organizational tool, Project Planner.

<p>1. Investigate the discovery of the DNA molecule and the gains in genetic research that have taken place since the basic discovery of DNA. Then jump into a time machine and scramble them up a bit. How could you influence the time line for the better or for worse? How would the scientific community and the technologies we have now be changed? At the end of your time travels, you return to the present time and start your own research. What will you do? Present the tale of your adventures in an illustrated book or video.</p>	<p>2. There are a lot of misconceptions related to the field of genetics. Develop 5 questions about DNA or an area of genetics research. Type them out on a questionnaire and ask 20 to 30 people to write down their answers anonymously. Research the answers to your own questions and compare the answers of your participants to the correct answers to identify the top three misconceptions. Then create a poster to identify the misconceptions and the corrections to the misconceptions.</p>	<p>3. In some circumstances people consult a Genetics Counselor or Geneticists to determine the likelihood of a baby being born with a certain family trait or condition. Sometimes they consult to diagnose a condition after a person shows signs of it. Two of the tools that can help in these circumstances are karyotyping and pedigrees. Research both Karyotypes and Pedigrees. Make a pamphlet to compare and contrast their usefulness, the type of information gained in each, the process involved in each, and the circumstances where each would be appropriate. Include a section on the role of Genetic Counselors.</p>
<p>4. If all living organisms have DNA and that DNA is made up of the same A's, T's, C's, and G's, then isn't it possible that some organisms have their nucleotides in the same order forming the same genes? This is the concept behind comparative genomics. Research this topic and explain what scientists have discovered and what they hope to do with this information. How could comparing DNA of two different organisms be beneficial to humans? If you were a Geneticist doing this type of work what two organisms would you compare</p>	<p>5. You might have heard something about the Human Genome Project. But what are the details? Who did it? Why did they do it? How did they do it? What did they do? How much did it cost? What did they do with it when it was done? What did they do next? What are they doing now? So what effect could it have on you? How could it be expanded to do more? Find out all of the answers to these questions and any questions you might have and then present the material in an original presentation of your choice.</p>	<p>6. Scientists frequently create models of molecules to help them understand how they function. Construct an original model of the DNA molecule. The model must include all parts of each nucleotide. It must accurately show the bonds of the complementary base pairs. It must be in the correct helical formation and must accurately show the anti parallel nature of the two strands. Create an information card to go with your model that explains the model and compares and contrasts it with an actual DNA molecule.</p>



<p>and why? Forecast where you think this research may lead.</p>		
<p>7. There is an X-Prize challenge to sequence 100 human genomes in 10 days for less than 10 thousand dollars each. The goal of this prize is to drive private research to make genome sequencing faster and more affordable. Investigate the current processes and technology that are used to sequence genomes. Can the average person have their genome sequenced? Why would a person want their genome sequenced? What is Personalized Medicine? How is it connected to this X-Prize challenge? Create your own 1-2 minute commercial with you as the star to explain Personalized Medicine and how we will get there.</p>	<p>8. Genetically Modified Foods are sometimes mentioned in the news. Do your own investigation and write a story for your school newspaper about the subject. What types of foods are genetically modified? Summarize the process of creating a genetically modified food. Are there government regulations related to genetically modified foods? Determine the purpose of genetically modifying a crop. Analyze the benefits and the risks.</p>	<p>9. These days most people know something about cancer and many people’s lives have been touched in some way by this disease. In several cancers the doctors will do a genetic test to see if a person is at risk to develop a particular form of cancer. Investigate the genetic nature of cancer and explain the connection between genes and cancer development. Would you want to know if you had a gene for cancer? Why or why not? Present your research in the form of an original essay giving credit to your sources.</p>

**Literature Connections/Resources:**

- General Institute of General Medical Science-The New Genetics:  
<http://publications.nigms.nih.gov/thenewgenetics/chapter2.html>

**ALCOSS: Biology 9**  
 Differentiate between the previous five kingdom and current six kingdom classification systems.

**Mastered:**

Students can differentiate between the previous five kingdom and current six kingdom classification systems.

**Present:**

Students will expand the concept of continuity coupled with diversity and how scientific parameters may change over time as new technologies are developed.

**Going Forward:**

Students will research and explore the complexities of classification, including Standards 10 and 11.

**Present and Going Forward Vocabulary:**

Phylogeny, morphological characters, derived characters, computational phylogenetics, cladograms, cladistics

**Career Connections:**  
 Biologist, Phylogeneticist, Natural History Museum Curator

**Advanced Understanding & Activity (Alternate activity):**

**RAFT** (Student page found in Appendix A)

Students will choose one row. They will write about the TOPIC from the perspective of the ROLE to the AUDIENCE using the FORMAT. You can allow students to choose one item from each of the four columns. Provide an audience for the student to present their product. Students may need to plan their product using the organizational tool, Project Planner.

<u>ROLE</u>	<u>AUDIENCE</u>	<u>FORMAT</u>	<u>TOPIC</u>
Locked box of unknown specimens	Scientist	Conversation	What kind of key did you say you have?
Old Man	His Great Grand Child	Grandparent “history lesson” / Monologue	They didn’t have that many kingdoms when I was a boy. Why did they have to go and change things?
Virus	Other Viruses	Motivational Speech	Who needs to be “alive?” You are perfect the way you are!
Mayor of “Valley of Death”	Newspaper Classifieds	Job opening	Decomposers needed immediately
Sheriff of “Wellville”	People of “Wellville”	Wanted Poster	Pathogens
Juliet	Romeo	Poem	What’s in a Scientific Name?
Leopard	Tiger	Invitation to Family Reunion	How to spot a family member.
Carolus Linnaeus	5-year-old son	Explanation or diagram	Answer to question “What is it Daddy? What is it?”
Stuffed Giant Panda	Natural History Museum Curator	Song	Where do I belong?

**Literature Connections/Resources:**

- Classification of Living Things: Introduction: [http://anthro.palomar.edu/animal/animal\\_1.html](http://anthro.palomar.edu/animal/animal_1.html)
- Wikipedia-Taxonomy: <http://en.wikipedia.org/wiki/Taxonomy>

**ALCOSS: Biology 10**  
 Distinguish between monocots and dicots, angiosperms and gymnosperms, and vascular and nonvascular plants.

**Mastered:**

Students can distinguish between monocots and dicots, angiosperms and gymnosperms, and vascular and nonvascular plants.

**Present:**

Students will delve deeper into the evolutionary changes that have occurred in plants and the benefits afforded with each development.

**Going Forward:**

Students will demonstrate how plants have evolved by applying this concept to the animals in Standard 11.

**Present and Going Forward Vocabulary:**

Apical meristem, floral meristem, vegetative propagation, toxicity, transpiration

**Career Connections:**  
 Horticulturist, Botanist, Gardener, Landscape Artist, Landscape Architect, Horticulture Educator, Endocrinologist, Pharmacologist

**Advanced Understanding & Activity (Alternate activity):**

**TIC-TAC-TOE** (Student page found in Appendix A)

Students will choose three activities in a row, column, or diagonal, just like TIC-TAC-TOE. Then students will complete the contract to submit to their teachers. Students may need to plan their product using the organizational tool, Project Planner.

<p>1. Draw a flowering plant. Include all of the parts associated with each organ system (roots, stems, leaves, and reproductive). Include a cross section of each system. Identify the types of cells at each layer of complexity. Identify the function of each type of cell. Detail is the goal.</p>	<p>2. Dicots are currently the primary plant life on the planet; but each type of plant is adapted to certain conditions and, at one point in Earth's history, was the main type of plant. It is possible that, as life on earth continues and new conditions arise, a new type of plant may arise and become the dominant plant life. Describe your vision of the future plants and what you think they will have to contend with to survive. How will genetics-based adaptation answer these demands? Use plausible logic to design your plant of the future. Write an original essay to explain your ideas and draw an illustration of your idea of how plant evolution may progress.</p>	<p>3. Plant, like animal, species have to compete for resources and defend themselves from predators. What are some of the methods by which plants compete with other plants for resources and how do they defend themselves from predators? Investigate why some plant species that are introduced into an area can become invasive. What type of adaptations do plants have to have to combat the environmental conditions to stay alive? How do they defend themselves from disease?</p>
<p>4. Many human medicines are made from plants. Identify ten plants that are used to create medications that have a helpful effect and ten plants that have been used to create substances that have a harmful effect. Be sure to indicate the medicine and what it is used for or the effect it has on the human body. What part of the plant does the medicine come from and what purpose does the plant have for creating that toxin or chemical? Create a two-sided poster- one side for the good and one side for the bad.</p>	<p>5. What is Vegetative Propagation? Humans have been taking advantage of the various aspects of this form of plant reproduction for centuries. Explain the various methods of vegetative propagation and the reasons each method can be helpful or harmful to humans. Create a PowerPoint, presentation, Photo Story, or poster to convey what you have learned.</p>	<p>6. Draw a claidogram or phylogenic tree showing the evolutionary relationships of the major plant types. Be sure to indicate the derived characters and at about what point in time each one appears in the historical record.</p>

<p>7. Create a historical time line showing the rise of plants from their algae ancestors. Indicate the climate or global changes that occurred or the driving forces that pushed the plants to find new ways to adapt. At each point on the time line, indicate what new adaptations occurred and the benefit of each adaptation.</p>	<p>8. Plants have hormones like other organisms. Make a list of plant hormones and their effect on the plant. Do the plant hormones serve similar functions to human hormones? If so, indicate the similar human hormone. Investigate the type of molecules that make up these hormones and how and when the plants create these hormones. What triggers the production of the hormones? Present your findings in the format you are most comfortable with.</p>	<p>9. Stomata on leaves allow gas exchange to take place in the plant. Explain how different plants living in different conditions have answered the challenges they face by the location and number of stomata. Explain the function of different types of leaves. Explain the process of Transpiration. Do all types of plants conduct Photosynthesis exactly the same way? If not what are the different methods and what do they have to do with leaf anatomy and stomata? Write an illustrated story to demonstrate what you have learned.</p>
--	---	---

**Literature Connections/Resources:**

- Encyclopedia of Life: <http://www.eol.org/>

**ALCOSS: Biology 11**

Classify animals according to type of skeletal structure, method of fertilization and reproduction, body symmetry, body coverings, and locomotion.

**Mastered:**

Students can classify animals according to type of skeletal structure, method of fertilization and reproduction, body symmetry, body coverings, and locomotion.

**Present:**

Students will recognize the unifying characteristics among animals and the progression of the diversity exhibited in the animal kingdom.

**Going Forward:**

Students will make connections with all levels of the curriculum from cells and biochemical processes to ecological impacts of organisms and evolutionary processes leading to diversity.

**Present and Going Forward Vocabulary:**

Coelom, Pseudocoelom, acoelomate, cephalization, oviparous, ovoviviparous, viviparous, *Trichoplax adhaerens*

**Career Connections:**

Geneticist, Zoologist, Mammalogist, Ornithologist, Malacologist, Herpetologist, Entomologist, Ichthyologist, Microbiologist, Protozoologist

**Advanced Understanding & Activity (Alternate activity):**

**ThinkFast (see Appendix A)**

Students will create a timeline of animal history showing increasing diversity while conserving mechanisms that work and expanding on those needed to create a new path for survival. Follow the directions at each letter.

- A** Identify 4 characteristics an organism must exhibit to be classified as an animal.
- N** Identify 5 characteristics used to classify animals within the kingdom.
- I** List 4 occupations where the job may depend on the ability to correctly classify animals.
- M** List (with examples) the 8 invertebrate phyla in order of increasing evolutionary complexity.

- A** Identify 4 environmental factors that could affect the survival of an animal species.
- L** List eight examples of different methods of animal locomotion and the benefits of each method.
- K** Identify the 1 phylum that contains vertebrates and 7 vertebrate classes in that phylum.
- I** Illustrate 3 terms that are related to animal symmetry.
- N** List 3 vertebrate body coverings with 2 examples each and identify the benefits of each.
- G** Explain the 4 characteristics of chordates and identify the 2 phyla that are invertebrates.
- D** Explain 3 discoveries that have been made about animals in the past 12 months.
- O** Describe 3 careers that a Zoologist might have.
- M** List and define 3 words that contain the letters O, P, and V that explain a mechanism of birth.

**Summary Essay:** Use the information above and further research to explain what an animal is and how animals have changed over the course of Earth's history. Create a time line of animal history showing the rise of the main groups of animals alive today and showing how diversified animals have become and yet how they have maintained some features from their past so that they could carve out a new path for survival. Time has seen the rise and fall of many species that have gone extinct. Explain how an animal might go extinct and what happens to the other animals that remain after it is gone. Explain what insight is being gained from comparing the DNA of animals. Investigate the organism *Trichoplax adhaerens* and compare it to the animals you are familiar with what characteristics do they share and how are they different? How could *T. adhaerens* stay the same for such a long period of time while all of the other organisms have seemed to change so much in the same time frame.

**Literature Connections/Resources:**

- Wikipedia: [http://en.wikipedia.org/wiki/Animal\\_Kingdom](http://en.wikipedia.org/wiki/Animal_Kingdom)

**ALCOSS: Biology 12**

Describe protective adaptations of animals, including mimicry, camouflage, beak type, migration, and hibernation.

**Mastered:**

Students can describe protective adaptations of animals, including mimicry, camouflage, beak type, migration, and hibernation.

**Present:**

Students will read the original text of the concepts of Natural Selection and Descent with Modification to analyze the evidence presented in the formation of the understanding of Natural Selection and compare to modern evidence to formulate their own understanding of how adaptations under specific conditions can impact the success or failure of a species.

**Going Forward:**

Students will further research and explore recent evidence of current examples of Descent with Modification.

**Present and Going Forward Vocabulary:**

Descent with Modification

**Career Connections:**

Ornithologist, Geneticist, Animal Researcher, Animal Geneticist, Behavior Geneticist, Animal Ecologist

**Advanced Understanding & Activity (Alternate activity):**

Students will read or listen to the audio book, *On the Origin of Species: By Means of Natural Selection* by Charles Darwin. After reading, students will produce a "press release" giving their scientific review of the evidence presented in the book. The press release can be a written document or a video. After reviewing the book, students will find modern evidence of Natural Selection that has been discovered in which Darwin would

not have known, such as genetic evidence. Then, students will produce a “Follow-up Report” analyzing and comparing the old and new evidence. This will include specific examples of adaptations and how the adaptation has contributed to the success or demise of the species. Students will use the same format as the previous one. Then, students will produce a “Future Report” with speculations as to evidence that could possibly be discovered in the future. After evidence analysis, students will produce an “Editorial” opinion stating their personal opinion on the matter.

**Literature Connections/Resources:**

- Darwin, Charles. On the Origin of Species: By Means of Natural Selection. 6<sup>th</sup> edition. <http://www.gutenberg.org/ebooks/2009>. (free download).

**ALCOSS: Biology 13**

Trace the flow of energy as it decreases through the trophic levels from producers to the quaternary level in food chains, food webs, and energy pyramids.

**Mastered:**

Students can trace the flow of energy as it decreases through the trophic levels from producers to the quaternary level in food chains, food webs, and energy pyramids.

**Present:**

Students will use technology to delve deeper into understanding the interconnectivity of organisms.

**Going Forward:**

Students will expand to incorporate added parameters.

**Present and Going Forward Vocabulary:**

Competitive Exclusion Principle

**Career Connections:**

Animal Scientist, Agricultural Scientist, Animal Ecologist, Biologist, Wildlife Biologist, Zoologist

**Advanced Understanding & Activity (Alternate activity):**

Students will construct a model of a real food web including an endangered species. Students will analyze the current conditions and predict what will happen in the future.

**Food Web Project**

Research an endangered species and create a model of the actual food web that connects the endangered species to at least ten other species, one of which must be a booming population. The food web must be complete. Do not just stop when you have reached the required ten species if there are more connections to be made. You must include producers and decomposers in the food web. Diagram the food web by doing either a poster, PowerPoint, Prezi, illustrated story, or photo story.

Once you have developed the food web model, answer the following questions in your presentation:

- How much energy is passed from one trophic level to the next?
- How many trophic levels are usually involved in a food chain and why? How many trophic levels are in your food web? Is there a correlation?
- What will happen to the food web if the endangered species goes extinct?
- Can you identify three of the organisms in the web that could be removed without causing a problem for other organisms?
- What would happen if a toxin were introduced somewhere along the web?
- What do you notice about the size and number of the organisms on higher trophic levels?
- Is it possible for one organism to occupy more than one trophic level?
- How does the concept of competitive exclusion apply to your food web?
- What biotic and abiotic factors play a role in this web?
- Identify the current population numbers for your food web and predict where the numbers will be in 20 years. Give the basis of your prediction. What do you predict will happen in the next 100 years?
- What is a population bottle neck? How does it occur? If it were to occur in this case how would it

- affect your food web? How likely is this to happen?
- What role, positive or negative, will the human population play in this food web? Explain.
  - Develop and answer two more questions of your own.

**Literature Connections/Resources:**

- Energy Flow in Ecosystems:  
<http://www.schools.utah.gov/curr/science/sciber00/8th/energy/sciber/ecosys.htm>

**ALCOSS: Biology 14**

Trace biogeochemical cycles through the environment, including water, carbon, oxygen, and nitrogen.

**Mastered:**

Students can trace biogeochemical cycles through the environment, including water, carbon, oxygen, and nitrogen.

**Present:**

Students will recognize that all of the cycles are interconnected and that the ecosystem is constantly trying to maintain a delicate balance. Students will delve deeper to demonstrate interconnectivity among the biogeochemical cycles and to explain the delicate balance within ecosystems. Students will investigate human interactions as well as natural occurrences that impact the balance within an ecosystem.

**Going Forward:**

Students will make connections to their lives and become responsible stewards of the Earth.

**Present and Going Forward Vocabulary:**

Phosphorus cycle, invasive species

**Career Connections:**

Biogeochemical Engineer, Environmentalist, Environmental Scientist, Ecologist, Climatologist, Organic Scientist, Biologist

**Advanced Understanding & Activity (Alternate activity):**

**Think Fast** (Student page found in Appendix A)

Students: Follow the directions at each letter. Write your answers on a separate piece of paper. Using your answers, complete the Summary Essay.

- C** Identify 4 biogeochemical cycles that impact life on Earth.
- Y** Identify 5 influences of human activity on the delicate balance within the ecosystems of Earth.
- C** List 4 examples of the effect of natural disasters on an ecosystem.
- L** Explain the effects of climate change on 3 species or ecosystems.
- E** Identify 8 examples of introduced or nonnative species and the impact they have on their new ecosystem.
- S** Identify 6 locations on Earth where there is current evidence of ecological succession.

**Summary Essay:** Explain the concept of a “Dynamic Equilibrium” and how it would pertain to a specific ecosystem. How does it pertain to all life on planet Earth? Create a diagram comparing and contrasting all four of the biogeochemical cycles that a recycling materials to support life here on Earth. Is there interdependence among the cycle? How do the organic molecules interact with the inorganic ones? What, if anything, could disrupt these cycles and what specific problems would arise if a disruption occurred? Are the cycles working on a local level or a global level? Explain. Could a local disruption have a global impact? Speculate with plausible evidence how these cycles began and how they developed over the course of Earth’s history and the history of life.

**Literature Connections/Resources:**

- Wikipedia: [http://en.wikipedia.org/wiki/Biogeochemical\\_cycle](http://en.wikipedia.org/wiki/Biogeochemical_cycle)
- Biogeochemical Cycles:  
[http://www.uwsp.edu/geo/faculty/ritter/geog101/textbook/earth\\_system/biogeochemical\\_cycles.html](http://www.uwsp.edu/geo/faculty/ritter/geog101/textbook/earth_system/biogeochemical_cycles.html)

**ALCOSS: Biology 15**  
Identify biomes based on environmental factors and native organisms.

<p><b>Mastered:</b> Students can identify biomes based on environmental factors and native organisms.</p>	<p><b>Present:</b> Students will understand that biomes are dynamic as well as diverse. Students will expand the concept of the how the biomes and organisms have changed over time.</p>	<p><b>Going Forward:</b> Students will understand that the processes at work creating the current biomes apply to both the future and the past.</p>
---	--	---

**Present and Going Forward Vocabulary:**  
Pangaea, continental drift

**Career Connections:**  
Ecologist, Environmentalist, Environmental Scientist, Biologist, Marine Biologist, Oceanographer, Climatologist

**Advanced Understanding & Activity (Alternate activity):**

**TIC-TAC-TOE** (Student page found in Appendix A)

Students will choose three activities in a row, column, or diagonal, just like TIC-TAC-TOE. Then students will complete the contract to submit to their teachers. Students may need to plan their product using the organizational tool, Project Planner.

<p><b>1.</b> In a PowerPoint, Photo Story, or other teacher-approved medium, summarize what a biome is, what are the conditions that create a biome, how are they identified. What are the major biomes and where in the world you are likely to find each one? Include the climate conditions and the primary plant and animal life found in each area.</p>	<p><b>2.</b> Look up the biome map of the world. Print it out on a regular sheet of paper and cut out the continents carefully. On another blank sheet of paper fit the continents together to roughly resemble Pangaea. Then write an original summary of how the biomes might have been different back then compared to now. What planetary circumstances influence the conditions that create a biome?</p>	<p><b>3.</b> Biomes are typically identified based on the predominant vegetation. Create a chart or diagram organizing the biomes based on vegetation. Once you have completed this, make a list of animals that are in some way supported by each type of vegetation. What correlations do you notice between the vegetation, the biomes, and the animals? What conditions contribute to the survival of the vegetation in each biome?</p>
--	---	---



<p>4. Investigate the last Ice Age. How do you think the Ice Age impacted the organisms that lived in those areas? What changes would it have made in the map of the World's Biomes? How have animals in the areas affected by the Ice Age changed or adapted to live in the conditions as they exist today? Report your findings and thoughts in an original illustrated book.</p>	<p>5. Select three biomes that interest you and find their location on the World Biome map. Then select an animal from each biome. Number the biomes 1, 2, and 3 then rotate the animals found in each biome to the next biome. For example the animal in Biome 1 will be transplanted to biome 2. Now analyze and predict how well the organism you transplanted will survive in the new biome. What challenges will it face? Present your analysis in an illustrated book or other teacher-approved presentation format.</p>	<p>6. In 1996 a movie called Bio-Dome was released about a group of scientists that recreated certain biomes under a dome and were going to live locked inside for a year. Do you think that this concept is reasonable? What would it take to create such a place and what could you hope to learn from it? How are the actual biomes affected by ocean currents and atmospheric conditions? How would you simulate these conditions inside of a dome? What types of scientists would you need to employ?</p>
<p>7. Humans seem to be fascinated with recreating biomes and habitats and trying to recreate places where plants and animals live. In this way we can learn about the animals or experience places it is not likely we will visit. Places like aquariums and zoo's attempt to recreate places in nature. What do you think are the challenges to this endeavor? Do you think these animals would be able to survive if released back into the wild? What type of careers could a scientist find in these places?</p>	<p>8. Create a song to help your classmates learn the climate conditions, animals, vegetation, and location of the 8-10 main terrestrial biomes.</p>	<p>9. There are so many different biomes on the planet and humans live in most of them. Explain how humans can occupy most of these areas but other animals seem to be more limited to certain types of environments. What biological challenges did humans have to overcome in order to occupy certain biomes? Identify 3 organisms that clearly cannot live in certain biomes under any natural circumstances. Present your findings in an original essay.</p>

**Literature Connections/Resources:**

- University of California Museum of Paleontology: <http://www.ucmp.berkeley.edu/exhibits/biomes/>
- World Biomes: [http://www.blueplanetbiomes.org/world\\_biomes.html](http://www.blueplanetbiomes.org/world_biomes.html)
- Wikipedia: <http://en.wikipedia.org/wiki/Biome>

**ALCOSS: Biology 16**  
 Identify density-dependent and density-independent limiting factors that affect populations in an ecosystem.

**Mastered:**

Students can identify biomes based on environmental factors and native organisms.

**Present:**

Students will understand that populations can be greatly affected by external factors and complex relationships. Students will demonstrate the

**Going Forward:**

Students will apply these concepts to their own lives.

concept of the interactions of organisms and the environmental factors that can limit the population.

**Present and Going Forward Vocabulary:**

Interspecific interactions, resource partitioning, keystone species, carrying capacity

**Career Connections:**

Biologist, Environmental Scientist, Ecologist

**Advanced Understanding & Activity (Alternate activity):**

Students will isolate a particular population and create an illustrated story about the trials and tribulations (limiting factors) the population faces. Students will include in the story if each limiting factor is density-dependent or density-independent. Students will convey what a limiting factor is, how it impacts an ecosystem and how the size of the populations may speed or slow the effects of the limiting factor or how some factors do not depend on population but may greatly impact it. Students will include the various symbiotic relationships that can be found in nature and will produce a graph related to the rise and fall of the population as each factor impacts the population. Students will consider if the population nears extinction and decide how it will recover. Students will include the concepts of ecological succession to manage the storyline.

**Literature Connections/Resources:**

- Wikipedia: [http://en.wikipedia.org/wiki/Biological\\_dispersal](http://en.wikipedia.org/wiki/Biological_dispersal)
- Wikipedia: [http://en.wikipedia.org/wiki/Population\\_distribution](http://en.wikipedia.org/wiki/Population_distribution)
- Wikipedia: [http://en.wikipedia.org/wiki/Species\\_distribution](http://en.wikipedia.org/wiki/Species_distribution)