Biology Course Map

The attached document is part of a framework that was designed to support the major concepts addressed in the Biology Curriculum of the Georgia Performance Standards through laboratory experiences and field work using the processes of inquiry. This framework is a thematic approach that is divided into the four units outlined below. Within each unit, the unifying themes of cells, organisms, ecology and evolution reoccur. Concept maps are attached to each unit outlining the understandings derived from the standards that are addressed for each of the recurring topics. There are several strategies that are common throughout the units such as the use of a laboratory notebook or field sketchbook, written laboratory reports and common teaching strategies. These strategies are described on the following pages. Whereas these units are written to be stand alone units that may be taught in any sequence, it is recommended that the organization unit be taught first and the equilibrium unit taught last.

Unit One Focus: Organization
Life is organized at all levels from cells to biosphere.

Topics:
- Cell structure and Function
- Evolutionary History
- History of Life
- Classification of Kingdoms
- Ecosystem Structure
- Viruses

Duration (Block): 23 days
Duration (Traditional): 7-9 weeks

Unit Two Focus: Energy Transformations
Energy can be neither created nor destroyed but can be transformed from one form to another as it flows through organisms and ecosystems.

Topics:
- Chemistry of Life
- Function of Organic Molecules
- Photosynthesis
- Cellular Respiration
- Cycles of Matter
- Energy Flow
- Food Chains and Webs

Duration (Block): 22 days
Duration (Traditional): 7-9 weeks

Unit Three Focus: Growth and Heredity
Organisms must be able to grow and reproduce to ensure species survival.

Topics:
- Asexual and Sexual Reproduction
- Cell Growth
- Mendelian Genetics
- DNA and RNA Processes
- Chromosomes and Mutations
- Genetic Engineering
- DNA Technology and Cloning
- Biological Resistance
- Bioethics

Duration (Block): 22 days
Duration (Traditional): 7-9 weeks

Unit Four Focus: Equilibrium
Survival and stability require that living things maintain biological balance at all levels.

Topics:
- Cellular Transport
- Homeostasis
- Natural Selection
- Plant Adaptations
- Animal Adaptations and Behavior
- Succession
- Population Genetics

Duration (Block): 23 days
Duration (Traditional): 7-9 weeks
Safety Issues:

Student safety in science education should always be foremost during instruction.

The Characteristics of Science curriculum standards increases the need for teachers to use appropriate precautions in the laboratory and the field. The guidelines for the safe use, storage and disposal of chemicals must be observed.

To ensure student and teacher safety in the science classroom, it is critical that appropriate safety policies and procedures be established in the classroom and that all students and teachers know and follow appropriate safety guidelines. The Internet and many science vendors can offer support for safety guidelines.

Common Teaching Strategies:

There are several teaching strategies that are used throughout the course. For clarification purposes they are described below:

Lab notebook or Field sketchbook: A notebook that students use to record data, journal on assigned topics and complete assigned drawing activities.

Ticket Out the Door: A commonly used summarizing strategy that is effective as a formative assessment tool. Students are given a short writing assignment on the concept covered in class that is to be turned in as they leave the classroom. These brief glimpses into student understanding may be graded or not. The same strategy can be used as a Ticket In the Door to assess student understanding at the beginning of the class on a concept from the day before or as a check on a homework assignment.

KIM diagrams: A three column table where students can organize technical language to allow better understanding of how they relate to the topic of the day. On a KIM diagram, a key term is listed in the first column, an illustration of the key term in the second column and a student derived meaning written in the third column.

Jigsaw activities: An effective grouping strategy that teachers use to facilitate peer teaching in the classroom. Students are first grouped together to become experts on an assigned topic. Student groups are then reorganized in such a manner that new groups are formed containing one student from each of the expert groups. The experts on each topic then serve as a peer teacher to the other students in the newly formed group.

Cloze: A note taking strategy where students either provide missing terms to complete a paragraph using appropriate language for the topic being addressed, or where students generate a paragraph from a list of appropriate terms.

Gallery or Poster Walk: This is a peer assessment strategy. Students place their work on a wall or other location where it can be reviewed by their peers. Students provide written commentary on the posted work and the original creators are given the opportunity to revise their product.

Teacher note: Students may require training to use appropriate feedback in their commentary.
Flapbook or Flipbook: A type of graphic organizer where students group information in order to see relationships within categories.

10-2 Lecture format: A strategy where teachers limit the introduction of material to a time frame of 10 minutes or less and then students are allowed a 2 minute opportunity to reflect on the material and share what they have learned with their peers.

Glaze the Doughnut: A type of organizer that allows teachers to pre-assess student knowledge or to monitor student progress that resembles a doughnut as one smaller circle is drawn inside another. The big idea is written inside the small circle and the doughnut is “iced” or “glazed” with what the students know about the topic. The information can then be reorganized into tables or organizers.

Name Jar: A strategy to ensure students are randomly selected to answer questions in class. Student names are placed on craft sticks and placed in a jar. During questioning the teacher selects sticks from the jar and the student identified must answer the question. Several blank sticks could be included in which the teacher must answer the questions when they are selected.

KWL: A pre and post assessment strategy often used in classrooms where, at the beginning of the lesson, teachers guide students to identify what they already know about a particular topic and what they need to know about the topic. Following the lesson, the teacher leads students to review what they have learned.

Acrostic: An activity for students to make connections between the language that often accompanies a particular topic. The key term is written vertically on paper and students write words or phrases that relate to that term using the letters that make up the key term.
The millions of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors. $SB5\ b$

The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms. $SB5\ c$

Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships. $SB3\ c$

Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and sequence of changes in fossils formed over more than a billion years. $SB7\ c$

Molecular evidence supports anatomical evidence from fossils about the sequence of descent. $SB5\ c$

Viruses are complex structures and their evolutionary relationship is still under investigation. $SB3\ d$

All organisms and systems are organized from simple parts into complex systems that must maintain homeostasis in order to survive. $SB3\ b$

Cells are composed of many different molecules that are organized into specialized structures that carry out cell functions. $SB6\ c$

Multi-cellular organisms are formed as highly organized arrangements of differentiated cells. $SB3\ b$

Cellular processes of prokaryotic and eukaryotic cells are similar in spite of their structural differences. $SB6\ a$

Evolutionary processes of prokaryotic and eukaryotic cells are similar in spite of their structural differences. $SB6\ a$

Patterns of ecological organization are similar to those of cells and organisms. $SB4\ a$

The great variety of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors. $SB5\ b$

The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms. $SB5\ c$

Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships. $SB3\ c$

Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and sequence of changes in fossils formed over more than a billion years. $SB7\ c$

Molecular evidence supports anatomical evidence from fossils about the sequence of descent. $SB5\ c$

Viruses are complex structures and their evolutionary relationship is still under investigation. $SB3\ d$

All organisms and systems are organized from simple parts into complex systems that must maintain homeostasis in order to survive. $SB3\ b$

Cells are composed of many different molecules that are organized into specialized structures that carry out cell functions. $SB5\ a$

Cellular processes of prokaryotic cells are similar in spite of their structural differences. $SB6\ a$

Molecular evidence supports anatomical evidence from fossils about the sequence of descent. $SB5\ c$
### Content and Characteristics of Science Standards for Organization

#### Content Standards:

**SB1. Students will analyze the nature of the relationships between structures and functions in living cells.**

- a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction.
- c. Identify the function of the four major macromolecules (i.e. carbohydrates, proteins, lipids, nucleic acids).

**SB3. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.**

- b. Compare how structures and function vary between the six kingdoms (Archaebacteria, Eubacteria, Protists, Fungi, Plants, and Animals).
- c. Examine the evolutionary basis of modern classification systems.
- d. Compare and contrast viruses with living organisms.

**SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.**

- a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes.

#### Characteristics of Science:

**SCSh1. Students will evaluate the importance of curiosity, honesty, and skepticism in science.**

- a. Exhibit the above traits in their own scientific activities.
- b. Recognize that different explanations often can be given for the same evidence.
- c. Explain that further understanding of scientific problems relies on the design and execution for new experiments which may reinforce or weaken opposing explanations.

**SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.**

- a. Follow correct procedures for uses of scientific apparatus.
- b. Demonstrate appropriate technique in all laboratory situations.
- c. Follow correct protocol for identifying and reporting safety problems and violations.

**SCSh3. Students will identify and investigate problems scientifically.**

- a. Suggest reasonable hypotheses for identified problems.
- b. Develop procedures for solving scientific problems.
- c. Collect, organize and record appropriate data.
- d. Graphically compare and analyze data points and/or summary statistics.
- e. Develop reasonable conclusions based on data collected.
- f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

**SCSh4. Students use tools and instrument for observing, measuring, and manipulating scientific equipment and materials.**

- a. Develop and use systematic procedures for recording and organizing information.
- b. Use technology to produce tables and graphs.
<table>
<thead>
<tr>
<th>SB5. Students will evaluate the role of natural selection in the development of the theory of evolution.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Trace the history of the theory.</td>
</tr>
<tr>
<td>b. Explain the history of life in terms of biodiversity, ancestry, and the rates of evolution.</td>
</tr>
<tr>
<td>c. Explain how fossil and biochemical evidence support the theory.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Consider possible effects of measurement errors on calculation.</td>
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</table>

<table>
<thead>
<tr>
<th>SCSh6. Students will communicate scientific investigation and information clearly.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Write clear, coherent laboratory reports related to scientific investigations.</td>
</tr>
<tr>
<td>b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.</td>
</tr>
<tr>
<td>c. Use data as evidence to support scientific arguments and claims in written or oral presentations.</td>
</tr>
<tr>
<td>d. Participate in group discussions of scientific investigation and current scientific issues.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCSh7. Students analyze how scientific knowledge is developed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students recognize that:</td>
</tr>
<tr>
<td>a. The universe is a vast single system in which the basic principles are the same everywhere.</td>
</tr>
<tr>
<td>b. Universal principles are discovered through observation and experimental verification.</td>
</tr>
<tr>
<td>c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications or prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.</td>
</tr>
<tr>
<td>d. Hypotheses often cause scientists to develop new experiments that produce additional data.</td>
</tr>
<tr>
<td>e. Testing, revising, and occasionally rejecting new and old theories never ends.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SCSh8. Students will understand important features of the process of scientific inquiry.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will apply the following to inquiry learning practices:</td>
</tr>
<tr>
<td>a. Scientific investigators control the conditions of their experiments in order to produce valuable data.</td>
</tr>
<tr>
<td>b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations’ hypotheses, observations, data</td>
</tr>
<tr>
<td>Contextual Language:</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>prokaryote, eukaryote, organelle, nutrient, organization, evolution, cladogram, theory, belief, evidence, fossil record, biodiversity, classification structure, function, variation, ecological hierarchy, abiotic and biotic factors, speciation, gradualism, punctuated equilibrium, endosymbiosis, microorganism</td>
</tr>
<tr>
<td>d. The merit of a new theory is judged by how well scientific data are explained by the new theory.</td>
</tr>
<tr>
<td>e. The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.</td>
</tr>
<tr>
<td>f. Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.</td>
</tr>
</tbody>
</table>

**SCSh9. Students will enhance reading in all curriculum areas by:**

a. Reading in all curriculum areas
   - Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
   - Read both informational and fictional texts in a variety of genres and modes of discourse.
   - Read technical texts related to various subject areas.

b. Building vocabulary knowledge
   - Demonstrate an understanding of contextual vocabulary in various subjects.
   - Use content vocabulary in writing and speaking.
   - Explore understanding of new words found in subject area texts.

c. Establishing context
   - Explore life experiences related to subject area content.
   - Discuss in both writing and speaking how certain words are subject area related.
   - Determine strategies for finding content and contextual meaning for unknown words.
Misconceptions for Organization:

Students think that:

- Viruses are living cells. Students should understand that viruses are typically identified as intracellular obligate parasites that exhibit living characteristics only when they are functioning in a host cell.

- Only animals move. Students should understand that there are many organisms that are capable of free movement including bacteria and protists. They should also recognize that not all adult animal species are motile.

- All bacteria are harmful. Students should understand that the majority of bacterial species are beneficial. Many species play an essential role in nutrient cycling and some are involved in food production processes.

- All animals are vertebrates. Students should understand that all animals are not characterized by the presence or absence of a backbone.

- Humans are not animals. Students should understand that humans share the same basic characteristics that other animals possess.

- Mushrooms are plants. Students should understand that mushrooms are fungi because they have chitinous cell walls and are non-photosynthetic.

- Man came from monkeys. Students should understand that man is not a direct descendant of monkeys. Although evidence suggests that they share a common ancestor, the evolutionary pathway of man is still a major research topic among scientists.

- Evolution happens quickly. Students should understand that evolution generally occurs over long periods of time.

- Darwin was the only evolutionary theorist. Students should understand that many scientists have contributed to our understanding of the current theory of evolution.
## Balanced Assessment Plan for Organization

<table>
<thead>
<tr>
<th><strong>Informal Observations</strong></th>
<th><strong>Selected Responses</strong></th>
<th><strong>Constructed Responses</strong></th>
<th><strong>Performance Assessments</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teacher Monitoring:</strong></td>
<td>Summative assessments:</td>
<td>Ticket out the Door:</td>
<td>• Create a new organism</td>
</tr>
<tr>
<td>• Kingdom Wall</td>
<td>Should be developed by</td>
<td>• Why do scientists organize living things into kingdoms?</td>
<td>• Outbreak at Central High School</td>
</tr>
<tr>
<td>• Geological evidence</td>
<td>teachers at natural breaks in the instructional plan</td>
<td>• Virus Position Statement</td>
<td>• Kingdom Wall</td>
</tr>
<tr>
<td>• Cell organelles</td>
<td>Should be aligned to the GPS and should include application and analysis questions</td>
<td>• Geological evidence of evolution</td>
<td>• Cladogram from Kingdom Wall</td>
</tr>
<tr>
<td>• Laboratory activities</td>
<td>Should be used to allow students to “practice” higher order test items</td>
<td>• Cell acrostic</td>
<td>• Cell lab: Comparing Prokaryotic and Eukaryotic cells</td>
</tr>
<tr>
<td>• Evolutionary Theory</td>
<td></td>
<td>• Cell model description</td>
<td>• Cell lab: Comparing Simple and Complex organisms at a cellular level</td>
</tr>
<tr>
<td>Scientist Research</td>
<td></td>
<td>Ticket in the Door:</td>
<td>• Evolution Theory Timeline</td>
</tr>
</tbody>
</table>

| **Gallery Walk:**         |                        | Graphic Organizer:        |                             |
| • Kingdom Wall            |                        | • Kingdoms                |                             |
| • Evolution Theory Timeline|                        | • Macromolecules          |                             |
|                           |                        | • Cell Organelles         |                             |
|                           |                        | • Life Processes of Simple and Complex Organisms |                             |
|                           |                        | • Organization of the Biosphere |                             |

| **Pre-Assessment:**       |                        |                           |                             |
| • What did earth look like a long time ago? |                        |                           |                             |
| • What does a typical cell look like?      |                        |                           |                             |
| • Macromolecule “Doughnut”                  |                        |                           |                             |

| **Peer Assessment:**      |                        |                           |                             |
| • Kingdom Wall            |                        |                           |                             |
| • Geological Evidence Jigsaw |                        |                           |                             |
| • Cell models             |                        |                           |                             |
| • Evolutionary Theory Timeline |                    |                           |                             |
Culminating Activity for Organization:

Students select one of the following:

- Identification of a New Organism: Students will create a new organism. These organisms will need to have the following items addressed in the essay that will accompany the model or drawing:
  - Classify the organism into a kingdom (this will include cell type, complexity, life processes).
  - Create a cladogram to show the evolutionary history of a derived characteristic.
  - Identify this organism’s role in the environment (what would be its NICHE).
  - Provide it with a scientific name.
  - Provide a model or drawing depicting this organism.

- Outbreak at Central High School (Outbreak_CHS) (pages 62-64)
  - Identify the organism that is responsible for the illness.
  - Classify organism into proper kingdom along with a brief description of the kingdoms evolutionary history.
  - Describe cell type and life processes.
  - Describe best environment for this organism to thrive.
  - A “press release” or CNN style breaking news story type format to submit findings.
Internet Resources for Organization

http://www.indiana.edu/~ensiweb/cladogen.html (This site provides background information as to the nature of cladograms.)
http://www.indiana.edu/~ensiweb/lessons/str.clad.pdf (This site provides examples of cladograms.)
http://www.indiana.edu/~ensiweb/lessons/zebra.html (This site provides a reading guide for an essay in Gould’s book Hen’s Teeth and Horse’s Toes.)
http://www.indiana.edu/~ensiweb/lessons/mclad.html#anchor95195 (This is an example of an activity for students to create a cladogram using the cytochrome c enzyme.)
http://biology.fullerton.edu/biol261/phylo/styles.html (This site provide background explanations of cladograms along with examples)
http://www.brooklyn.cuny.edu/bc/ahp/CLAS/CLAS.Clad.html (This site provides an explanation of cladograms along with a tutorial on making cladograms. This could be used as a classroom demonstration, tutorial or for make-up work.)
http://www.msnucleus.org/membership/html/k-6/lc/organ/6/lco6_3a.html (This site provides nice phylogenetic tree examples and lecture notes)
http://www.sirinet.net/~jgjohnso/classification.html (This site is an explanation of the history of the taxonomy from Aristotle to modern 3 domains. It provides easy to understand descriptions of the kingdoms including derivatives of the names.)
http://www.biology.arizona.edu (This site provide a variety of activities and resources for teachers. These activities were created by individuals in the science education programs.)
Lab Rubric

This Lab Is Completed To The Best Of My Ability.

X ____________________________

Lab Focus Question: ____________________________
(Student Signature)

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Criteria</th>
<th>Peer</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Lab Focus Question:</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Present and relevant to the topic</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>Present and closely related to the topic</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>Absent or not directly related to the topic</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Lab Procedure:</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Written as a descriptive paragraph with relevant steps and materials included</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>Written as a list with relevant steps and materials included</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>OR Written as a paragraph but missing relevant steps and or materials</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>Absent or more than 50% of relevant steps and or materials missing</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Lab Results:</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>All results are clearly written; proper units are used when necessary</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>Results are present, some without proper units or some results are missing</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>No results are included OR less than 50% of the results are included</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Lab Questions:</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Answered in complete sentences, calculations, when required are clearly shown; specific formulas or equations for reactions during the lab are shown</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>Answers not in complete sentences, most calculations, formulas or equations are shown OR less than 80% of these are shown correctly</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>Answers, calculations formulas and/or equations missing OR less than 50% of these are shown directly.</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Safety:</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>All safety procedures were observed; all safety equipment was used correctly; group was not cited for a safety violation</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>Safety procedures were observed, safety equipment was used; group cited for ONE safety violation.</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>Safety procedures were not observed; safety equipment was not used; group was cited for more than one safety violation.</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>Lab Conclusion:</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Written in paragraph form answering the lab focus question using data as supporting evidence, also explains how the information discovered in the lab is applicable in today’s society, data is identified as either qualitative or quantitative</td>
<td>5</td>
</tr>
<tr>
<td>0</td>
<td>Paragraph format absent but lab focus question is addressed using appropriate data OR paragraph format present and application to today’s society is missing OR data is not properly identified as qualitative or quantitative</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Format:</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Neatly presented, uses appropriate grammar, and adheres to format.</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>Neatly presented, few grammar mistakes, minor format mistakes</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>Neatness absent, frequent grammar mistakes, does not follow format</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Work Ethic:</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>Group is on task; no horseplay; works cooperatively; all members actively participate</td>
<td>3</td>
</tr>
<tr>
<td>0</td>
<td>Group is redirected one time; 80% of members work cooperatively and actively participate</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>Group is redirected more than one time, 50% of members work cooperatively and actively participate.</td>
<td>0</td>
</tr>
</tbody>
</table>

Total points earned = Lab grade
Laboratory experiences are an important part of science education. These experiences in the classroom allow students the opportunity to practice the processes of scientific inquiry in order to promote scientific literacy and problem solving skills necessary to develop an understanding of scientific concepts. Skills employed while doing lab include reading, writing and critical thinking as well as the appropriate use of laboratory equipment, precision and accuracy of measuring and organizing data.

For this class you will be required to keep a lab notebook. The lab notebook will be stored in my room and will be used for all labs.

**Lab Focus Question:**
What is the purpose of this lab? Why is the lab being done? The lab group is responsible for developing an appropriate lab focus question.

**Lab Procedure:**
You are expected to write a descriptive paragraph explaining how the lab was conducted. You may not use any personal pronouns such as I, we, us, etc. The narrative should contain only that information a reader would need to be able to explain how the lab was conducted. Be sure to include all equipment and/or solutions, chemicals, etc., needed to complete the lab. Make sure that no “understood” procedures are included (i.e. materials were gathered).

**Lab Questions:**
You are expected to answer all questions in a lab. The questions should be answered in complete sentences and be correct. Calculations, when required, are clearly shown. Specific formulas or equations for reaction during the lab are shown.

**Safety:**
All safety procedures are expected to be followed and all safety equipment is expected to be worn while anyone in the lab is still working.

**Work Ethic:**
Group works together cooperatively, is continually on-task and all members of group are participating. There is no horseplay or wasted time.

**Format:**
Blue or black ink is recommended with no whiteout. Proper spelling and grammar is followed and no 1st or 3rd person personal pronouns are used. Conclusion is written in such a way that lab focus question is easily identifiable. All sections are written in proper paragraph form, (remember, one sentence is not a paragraph).

**Conclusion:**
The conclusion should be written in paragraph form and should answer the lab focus question using data obtained as supporting evidence. Be sure to identify the data as either qualitative or quantitative or both. Also, explain how the skills and concepts studied in today’s lab are relevant in today’s society.
Sequence of Activities, Tasks, and Assessments for Organization
Narrative Version  
Click Here for Table Version (page 20)

Day 1:
1. Introduce the Kingdom Wall
   Have each student find 10 pictures of living organisms from magazines, internet
   sources or original artwork. Student groups of 3 or 4 will organize pictures into
   groups, create names for their groups and summarize their reasons for grouping.
   Teacher Note: The picture gathering can be done as a homework assignment two
   or three days prior or in class if appropriate resources are available. Teachers
   will need to include photos of viruses, Archaebacteria and Eubacteria for each
   student group to include. Teachers will need to monitor groups and ask questions
   that guide students in the identification of common characteristics and in dealing
   with organisms that do not fit the characteristics of any group.
   Alternate activity: A Separate Piece- Separate_Piece_Activity (page 61)
2. Ticket Out the Door: Have students write a paragraph on how and why scientists
   organize living things into groups (kingdoms).

Day 2:
1. Introduce the names of the 6 kingdoms and designate an area on the wall for each
   kingdom. Allow students approximately 5 minutes to place their pictures on the
   wall under the kingdom names they think their organisms belong.
2. Conduct a class discussion on the general characteristics of each kingdom and
   what to do with the pictures of the organisms that do not appear to fit in any
   category.
3. Using their notes and other classroom resources, have students complete a graphic
   organizer that identifies the characteristics of the 6 kingdoms. Teacher note:
   allow students the opportunity to construct their own graphic organizer OR
   provide them with an outline attached here. Six Kingdom Graphic Organizer
   (page 35)
4. Using a gallery or poster walk format, have students assess the placement of
   organisms into kingdoms and provide commentary for their reasons for moving
   an organism into another group. Allow approximately 5 minutes at each
   kingdom.
5. Conduct a class discussion on any misplaced organisms. Teacher note: Students
   will likely have difficulty in differentiating between the prokaryotic organisms and
   will need guidance in their proper placement. Include a discussion on the basic
   characteristics of viruses.
6. Ticket Out the door: Have students write a position statement on whether or not
   viruses should be designated in classification systems and their reasons for their
   decision.
Day 3:
1. Ticket In the Door: Provide students with a list of characteristics of a newly discovered organism and have them explain into which kingdom this organism would be placed.
2. Introduce the concept of sketchbook journaling to students: Students are to select an area on campus and draw what they see. The goal is to start with the landscape and eventually focus on the smaller parts that organize the organisms into the ecosystem. This process will need to be monitored and appropriate commentary and feedback provided as students will at first feel their drawings are inadequate. They will need to be prompted to focus on small sections like bricks in the wall or a section of grass or a branch on a tree instead of the larger world around them. As time progresses students will become more focused on their drawings or sketches and teacher commentary over time will become more specific to the goal and nature of the assignment. It will be necessary to provide opportunities for students to sketch throughout the unit as they will need to use their sketches in an activity at the end of the unit.

Day 4:
1. On index cards, have students illustrate what they think the earth, the state of Georgia, or their neighborhood looked like a long time ago. Group students together according to what they decided to draw and have students arrange their cards chronologically.
2. Conduct a discussion on evidence for determining the sequence of events. Teacher note: The concept that should be targeted here is that certain events must have occurred prior to others. To prompt student thought, you may need to ask general “which came first” questions, or “how do you know which came first” questions, such as, land or trees, bears or fish, or animals or plants.
3. Geological Evidence Jigsaw Activity: Through the Looking Glass (page 36). Teacher note: Students will discover the general timeframe for the appearance of organisms in the geological history of the earth. In the second round of the jigsaw students will add that information to the kingdom wall in the appropriate place. Further directions are found in the activity.

Day 5:
1. Continue Geological Evidence Jigsaw Activity: Through the Looking Glass
2. Assessment: Students will write an essay to explain why certain organisms will appear, thrive, or decline within a certain geological time period. Students will exchange their essays for peer assessment and make commentary; students will then have the opportunity to revise their work.
3. Sketchbook Journaling if time allows.

Day 6:
1. Students will conduct an activity to produce a cladogram using amylase. Amylase Activity (page 39-45).
2. Student groups will then select five organisms from the Kingdom Wall from either the plant or animal kingdom and create a cladogram using a derived or shared characteristic and prepare a presentation to explain the cladogram in terms of evolutionary and geological time; including a general hypothesis for why this characteristic evolved. **Teacher note:** Take up the student group cladograms and consolidate into a single document for use in the presentations on the next day.

3. Sketchbook journaling if time allows.

Day 7:
1. Continue Cladogram activity
2. Presentations
3. Assessment: Students are to select one characteristic from the plant kingdom and one from the animal kingdom and discuss how the evidence from a cladogram is used to determine the evolutionary history of an organism.
4. Sketchbook journaling if time allows.

Day 8:
1. Glaze the Doughnut using macromolecules as the big idea to pre-assess student understanding on how molecules are organized into living things.
2. Have students create a macromolecule flapbook. See the attachment for further directions and teacher notes [Macromolecule Flapbook](page 48).
3. Sketchbook journaling if time allows.

Day 9:
1. **What does a Cell Look Like?** Students make a clay or construction paper model of a typical cell ([What Does A Cell Look Like?](page 47)). **Teacher note:** If materials are not available students may draw a typical cell. This is intended to be a brief review as well as a pre-assessment for the general characteristics of cells; these models will be used and revised throughout the lesson as students discover more details about the structure and function of cellular components.
2. On an index card students should describe the shape of a cell, the function of a cell and explain what kind of cell their model represents. Have students present their models and, during the presentations, the students will complete a chart or a KIM diagram for the language used.
3. Introduce the Functions of Organelles Activity where groups of students are to construct organelles. See Cell Structure and Function attachment ([Cell Structure and Function](page 57-58)) for further directions and teacher notes.

Day 10:
1. Cell Parts Activity continued.
2. Sketchbook journaling if time allows.

Day 11:
1. Student groups will present their cell part explaining its function and the type of cell(s) in which their organelle would be found.
2. Have students complete graphic organizers for cellular parts and their functions and revise their cell models as necessary.

3. Ticket Out the Door: Student must create an acrostic for a prokaryote, a eukaryote, a plant cell or an animal cell.

Day 12:
1. Using the Kingdom Wall as a reference, conduct a 10-2 lecture on the cellular characteristics of each kingdom. Have students add this information to the Kingdom Wall graphic organizer.

2. Cell Lab: Students will make microscopic observations of prokaryotic and eukaryotic cells. See Comparing Eukaryotic and Prokaryotic Cells attachment (Comparing Eukaryotic and Prokaryotic Cells page 51-55) for further directions and teacher notes.

Day 13
1. Continue Cell lab.

2. Introduce Part II of Cell lab where students will make microscopic observations of multi-cellular organisms. Examples may include prepared slides of root tips, leaf epidermis, bone sections, muscle, nerve tissue, and many more. See attachment for further directions and teacher notes (Differentiation of Cells or page 56).

Day 14:
1. Cell Lab Part II continued.

2. Assign formal lab report for cell lab. (See Lab_Report and Lab_Rubric pages 12-13)

3. Ticket Out the Door: Complete a Venn diagram comparing prokaryotes and eukaryotes (Cell Venn page 49).

Day 15:
1. Complete a graphic organizer comparing the life processes of the different kingdoms. Teacher note: This can be added to the Kingdom organizer or can be completed on a Comparing Simple and Complex Graphic Organizer page 50.

2. Assessment: Have students revise their cell models and write a paragraph describing the type of cell their model represents and the general function of their cell and its cellular components.

3. Sketchbook journaling if time allows.

Day 16:
1. Development of the Evolutionary theory: Students are assigned a scientist (Evolutionary Theory Timeline pages 59-60) and are to research and create a presentation that includes the following pieces:
   - a photograph
   - the time period
   - the prevalent theory of evolution for that time frame
• a major world event of the time period
• evidence scientists used to develop his/her contribution
• dates of discovery
• publication
• acceptance of viewpoints
• how his/her work contributed to the current theory of evolution

Teacher note: The target for this activity is the development of the theory: dates, times and places are not to be assessed. Allow students to choose from a variety of presentation options such as an obituary, a CNN style breaking news story, a “Wanted Poster,” an advertisement for a speaking engagement or book signing. Students must include an index card with the scientists name and other important information on one side of the card and the theory of evolution that was accepted during that time frame on the other. The final product should undergo a peer review and a teacher review prior to presentations.

Day 17:
1. Complete research and develop presentation.
2. Sketchbook journaling for use in the ecology portion of this unit.

Day 18:
1. Student presentations
2. Classmates will take notes from the presentations on a graphic organizer they create. A sample organizer is attached (Note taking organizer or page 60)

Day 19:
1. Evolutionary Theory Line: Have groups of students sequence their cards using the side that has the accepted evolutionary theory of the time. They will check their sequence by using the scientist’s names and other information on the back. Teacher note: It will be useful to have a string stretched across the board or other area of the room for students to place their cards.
2. Assessment: Write an essay explaining the development of the theory of evolution using information from the evolutionary theory line.
3. Sketchbook journaling for use in the ecology portion of this unit.

Day 20:
1. Sketchbook Review: Students should have sketched once a week for the past several weeks. Teacher should have provided commentary to enable the students to sketch from the larger ecosystem down to some small portion of that ecosystem.
2. Students will create a Biosphere Organization flapbook (Biosphere Flapbook or page 46) to illustrate the levels of organization in the biosphere. The flaps should be labeled biome, ecosystem, community, population, and organism. From the sketchbook, students will provide examples of each of these levels of organization. They will also summarize the meaning of each of these terms.
Day 21:
Culminating activity – Students may choose one of the following
1. Identification of a New Organism: Students will create a new organism. These organisms will need to have the following items addressed in the essay that will accompany the model or drawing:
   o Classify the organism into a kingdom (this will include cell type, complexity, life processes)
   o Create a cladogram to show the evolutionary history of a derived characteristic
   o Identify this organism’s role in the environment (what would be its NICHE)
   o Provide it with a scientific name
   o Provide a model or drawing depicting this organism
2. Outbreak at Central High School (Outbreak CHS page 62-64)
   o Identify the organism that is responsible for the illness
   o Classify organism into proper kingdom along with a brief description of the kingdoms evolutionary history
   o Describe cell type and life processes
   o Describe best environment for this organism to thrive
   o A “press release” or CNN style breaking news story type format to submit findings.

Day 22:
1. Culminating activity continued.

Day 23:
1. Culminating activity continued.
2. Summative Assessment.
# Sequence of Activities, Tasks, and Assessments for Organization

## Organization Unit Summary Table

<table>
<thead>
<tr>
<th>DAY</th>
<th>Characteristics of Science and Content Standards</th>
<th>Enduring Understandings</th>
<th>Teacher and Student Activities/Tasks</th>
<th>Assessments</th>
</tr>
</thead>
</table>
| 1   | SB3b,d SCSh1a,b,c SCSh3c                         | • Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.  
• Viruses are complex structures and their evolutionary relationship is still under investigation. | Kingdom Wall: Student groups organize pictures into groups and create names for the groups  
Alternate activity: A Separate Piece [Separate Piece Activity](#) page 61 | • Teacher monitoring/questioning  
• Why did you place this organism here? Could it go in another group because…?  
• Ticket Out the Door: Explain how and why scientists organize living things into groups (kingdoms). |
| 2   | SB3b,d SCSh1a,b,c SCSh3e SCSh4a SCSh7e SCSh8c,e,f | • Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.  
• Viruses are complex structures and their evolutionary relationship is still under investigation. | • Kingdom Wall: students place a representative group of pictures on the wall or bulletin board under the appropriate kingdom  
• Large group discussion as to characteristic of each kingdom  
• Complete graphic organizer for kingdoms  
• Gallery Walk and discussions on misplaced organisms  
• Ticket out the door | • Teacher Monitoring Gallery Walk (student assessment)  
• Graphic organizer [Six Kingdom Graphic Organizer](#) page 35  
• Ticket out the Door: Prepare a position statement on whether or not viruses should be designated in the classification systems and their rationale for the decision. |
| 3 | SB3c,d, SB4a, SCSH1a,b,c, SCSH3c, SCSH4a | - Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.  
- Viruses are complex structures and their evolutionary relationship is still under investigation.  
- Patterns of ecological organization are similar to those of cells and organisms. | - Review of kingdom characteristics  
- Sketchbook Journaling | - Ticket in the Door: Place an organism in the proper kingdom and provide rationale.  
- Teacher commentary/feedback for the sketching activity |
| 4 | SB5b,c, SCSH1a,b,c, SCSH6b,c,d, SCSH7a,b,c,d,e, SCSH8b,c,d,e,f | - The millions of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors.  
- The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.  
- Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and the sequence of changes in | - Students will graphically depict their idea of the earth in the past. These drawings are then sequenced “chronologically.”  
- Geological Evidence Jigsaw activity: Through the Looking Glass page 36 | - Pre-Assessment: What did the Earth (the state of Georgia, your town or county) look like a long time ago?  
- Teacher monitors student groups as they work |
| 5 | SB5b,c SCSh1a,b,c SCSh6b,c,d SCSh7a,b,c,d,e SCSh8b,c,d,e,f | • The millions of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors.  
• The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.  
• Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and the sequence of changes in fossils formed over more than a billion years. | • Geological Evidence Activity continued  
• Sketchbook journaling if time allows | • Teacher monitors student groups as they work  
• Additions to Kingdom Wall |
|---|---|---|---|
| 6 | SB5b,c SCSh1a,b,c SCSh3a,c,d SCSh4a,b SCSh6c,d SCSh7a,b,c,d,e SCSh8b,c,d,f | • Molecular evidence supports anatomical evidence from fossils about the sequence of descent. | • [Amylase Activity](#) page 39  
• Student created cladogram from plant or animal kingdoms | • Teacher monitors students as they work |
| 7 | SB5b,c SCSh1a,b,c | • Molecular evidence supports anatomical evidence from | • Cladogram activity continued and student presentations | • Teacher monitors students as they work |
| 8  | SB1c  
SCSh9a,c,d |
|-----|-----------------------|
| 9  | SB1a,c  
SB3b  
SCSh1a,b,c |

**fossils about the sequence of descent.**

- Evolutionary History and cladogram assessment
- Sketchbook journaling if time allows
- Glaze the Doughnut using Macromolecules as the big idea
- [Macromolecule Flapbook](#) page 48
- Group discussion of how macromolecules are organized into cell organelles with additional information added to foldable (note taking strategy)
- Sketchbook journaling if time allows
- Typical cell model [What Does a Cell Look Like?](#) page 47
- KIM diagram for cell types
- Student groups for developing model and functions of organelles [Cell Structure and Function](#) pages 57-58
- Pre-Assessment: Clay or paper model of a cell or student drawing of a “typical cell”
- KIM diagram responses
- Teacher monitors student groups as they work

- Student created cladogram
- Written discussion of a specific cladogram from the plant and the animal kingdom

- All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.
- Glaze the Doughnut responses on macromolecules
- Macromolecule Flapbook
- Teacher monitoring with feedback/commentary as students work

- Cells have particular structures that underlie their functions.
- All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.
- Cellular processes of prokaryotic and eukaryotic cells are similar in spite of their structural differences.
- All organisms and systems are organized from simple
Cells have particular structures that underlie their functions.
All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.
Cellular processes of prokaryotic and eukaryotic cells are similar in spite of their structural differences.
All organisms and systems are organized from simple parts into complex systems that must maintain homeostasis in order to survive.

<table>
<thead>
<tr>
<th>10</th>
<th>SB1a,c SB3b SCSh1a,b,c</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continue working in student groups for developing model and functions of organelles <a href="#">Cell Structure and Function</a> page 57</td>
</tr>
<tr>
<td></td>
<td>Sketchbook journaling if time allows</td>
</tr>
<tr>
<td></td>
<td>Monitor group work</td>
</tr>
</tbody>
</table>

**Cell organelle presentations**
**Organelle Graphic organizer**
See [Cell Structure and Function](#) page 58
**Add cell organelles to prokaryotic, eukaryotic, plant and animal cell models.**
**Ticket Out the Door: Students**
**Student gallery walk to provide feedback/commentary for correct/incorrect and to complete graphic organizer for parts/functions**
**Acrostics**
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th><strong>create an acrostic for either prokaryote, eukaryote, animal cell or plant cell.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>• Cellular processes of prokaryotic and eukaryotic cells are similar in-spite of their structural differences.</strong>&lt;br&gt;<strong>• All organisms and systems are organized from simple parts into complex systems that must maintain homeostasis in order to survive.</strong></td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>SB1a,c SB3b SCSSh1a,b,c SCSSh2a,b,c SCSSh3a,b,c SCSSh4a SCSSh5b</td>
<td><strong>• Cells have particular structures that underlie their functions.</strong>&lt;br&gt;<strong>• All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.</strong>&lt;br&gt;<strong>• Cellular processes of prokaryotic and eukaryotic cells are similar in-spite of their structural differences.</strong>&lt;br&gt;<strong>• All organisms and systems are organized from simple parts into complex systems that must maintain homeostasis in order to survive.</strong></td>
<td><strong>• 10-2 lecture on cellular characteristics for the six kingdoms</strong>&lt;br&gt;<strong>• Cell Lab: Microscopic observations of bacteria and eukaryotic cells</strong>&lt;br&gt;Comparing Eukaryotes and Prokaryotes pages 51-55</td>
</tr>
<tr>
<td>13</td>
<td>SB1a,c SB3b</td>
<td><strong>• Cells have particular structures that underlie their</strong></td>
<td><strong>• Continue Cell lab</strong>&lt;br&gt;<strong>• Assign Formal Lab report and/or</strong></td>
</tr>
</tbody>
</table>
| SCSh1a,b,c | functions.  
- All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.  
- Cellular processes of prokaryotic and eukaryotic cells are similar in spite of their structural differences.  
- All organisms and systems are organized from simple parts into complex systems that must maintain homeostasis in order to survive.  
  | Venn diagram comparing prokaryotes and eukaryotes.  
- Introduce Cell Lab Part II where students make microscopic observations of multi-cellular organisms and add to their lab report for Part I. Differentiation of Cells page 56.  | • Formal Lab report and/or Cell Venn page 49 |
|  |  |  |
| SB1a,c |  
- Cells have particular structures that underlie their functions.  
- All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.  
- Multi-cellular organisms are formed as highly organized arrangements of differentiated cells.  
- Cellular processes of prokaryotic and eukaryotic  |  
- Cell Lab Part II - Students will make microscopic observations of multi-cellular organisms and add to their lab report for Part I. Differentiation of Cells page 56.  
- Sketchbook journaling if time allows.  | • Teacher monitoring  
• Formal Lab report  |
| 15 | SB1a,c SB3b SCSH1a,b,c SCSH7a | - Cells have particular structures that underlie their functions.
- All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.
- Multi-cellular organisms are formed as highly organized arrangements of differentiated cells.
- Cellular processes of prokaryotic and eukaryotic cells are similar in-spite of their structural differences.
- Organisms carry out common life processes differently.
- All organisms and systems are organized from simple parts into complex systems that must maintain homeostasis in order to survive.

- Compare/contrast life processes of unicellular organisms to multi-cellular organisms using a graphic organizer [Comparing Simple and Complex Organizer](page 50) or can be added to the Kingdom organizer
- Sketchbook journaling if time allows

- Revise cell models
- Write a paragraph describing the updated cell model |
parts into complex systems that must maintain homeostasis in order to survive.

- The millions of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors.
- The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.
- Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.
- Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and the sequence of changes in fossils formed over more than a billion years.
- Molecular evidence supports anatomical evidence from

- History of the Evolutionary Theory (assign students the scientist and introduce the specifics of the activity) Evolutionary Theory Timeline pages 59-60

Monitor student work
| 17 | SB5a,b,c SCSh1a,b,c SCSh6b,d SCSh7a,b,c,d,e SCSh8a,b,c,d,e,f SCSh9a,c,d | • The millions of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors.  
• The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.  
• Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.  
• Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and the sequence of changes in fossils formed over more than a billion years.  
• Molecular evidence supports anatomical evidence from fossils about the sequence of descent. | • Research scientists and produce document. Peer reviews.  
• Sketchbook journaling if time allows | • Teacher monitoring as students work  
• Peer Review |
| 18 | SB5a,b,c  
SCSh1a,b,c  
SCSh6b,d  
SCSh7a,b,c,d,e  
SCSh8a,b,c,d,e,f  
SCSh9a,c,d | - The millions of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors.  
- The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.  
- Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.  
- Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and the sequence of changes in fossils formed over more than a billion years.  
- Molecular evidence supports anatomical evidence from fossils about the sequence of descent. | Presentations  Note Taking Organizer page 60 | • Presentations |
|---|---|---|---|
| 19 | SB5a,b,c  
SCSh1a,b,c | - The millions of different species of plants, animals and | Evolutionary theory line: sequence scientist cards |
| | | | • Monitor student work  
• Essay on evolutionary theory |
| SCSh6b,d  
| SCSh7a,b,c,d,e  
| SCSh8a,b,c,d,e,f  
| SCSh9a,c,d  | microorganisms that live on earth today are related by descent from common ancestors.  
• The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every available niche with life forms.  
• Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.  
• Evolution explains the number of different life forms we see, similarities in anatomy and chemistry, and the sequence of changes in fossils formed over more than a billion years.  
• Molecular evidence supports anatomical evidence from fossils about the sequence of descent.  
| representing evolutionary theory over time  
• Students write an essay explaining the development of the theory of evolution  
• Sketchbook journaling if time allows  
| 20  
| SB4a  
| SCSh1a,b,c  
| SCSh3c  | Patterns of ecological organization are similar to those of cells and organisms.  
| Using the sketchbook journals, students will create a flapbook to depict the levels of organization within the  
| Teacher monitors students as they work  
| Flapbook  

Georgia Department of Education  
Kathy Cox, State Superintendent of Schools  
10/2/2006 2:50 PM Page 31 of 64  
All Rights Reserved
| 21-23 | SB1a,c  
SB3b,c,d  
SB4a  
SB5a,b,c  
SCSh1a,b,c  
SCSh3a,c,e  
SCSh4a,b  
SCSh6a,c,d  
SCSh7a,b,c,d,e  
SCSh8b,c | • Cells have particular structures that underlie their functions.  
• All cells are composed of many different molecules that are organized into specialized structures that carry out cell functions.  
• Multi-cellular organisms are formed as highly organized arrangements of differentiated cells.  
• Cellular processes of prokaryotic and eukaryotic cells are similar in spite of their structural differences.  
• Organisms carry out common life processes differently.  
• The millions of different species of plants, animals and microorganisms that live on earth today are related by descent from common ancestors.  
• The great diversity of organisms is the result of more than 3.5 billion years of evolution that has filled every | Culminating Activity: Students select one of the following activities.  
• Identification of a New Organism: Students will create a new organism. These organisms will need to have the following items addressed in the essay that will accompany the model or drawing:  
  o Classify the organism into a Kingdom (this will include cell type, complexity, life processes)  
  o Create a cladogram to show the evolutionary history of a derived characteristic  
  o Identify this organism’s role in the environment (what would be its NICHE)  
  o Provide it with a scientific name  
  o Provide a model or drawing depicting | • Monitor student work  
• Presentations  
• Summative Assessment |
<table>
<thead>
<tr>
<th>available niche with life forms.</th>
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<tbody>
<tr>
<td>Modern classification systems are based upon biochemical and genetic evidence that indicates evolutionary relationships.</td>
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</tr>
<tr>
<td>In the development of multi-cellular organisms, the</td>
</tr>
<tr>
<td>this organism</td>
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<tr>
<td>Outbreak at Central High School (Outbreak_CHS page 62-64)</td>
</tr>
<tr>
<td>Identify the organism that is responsible for the illness</td>
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</tr>
<tr>
<td>A “press release” or CNN style breaking news story type format to submit findings.</td>
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</tbody>
</table>
progeny from a single cell forms an embryo in which the cells multiply and differentiate to form the many specialized cells, tissues and organs that comprise the final organism.

- Patterns of ecological organization are similar to those of cells and organisms.
<table>
<thead>
<tr>
<th>Six Kingdom Classification System Graphic Organizer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common Characteristics</strong></td>
</tr>
<tr>
<td><strong>Common Examples</strong></td>
</tr>
<tr>
<td><strong>Cell Type (prokaryote or eukaryote)</strong></td>
</tr>
<tr>
<td><strong>Complexity (unicellular or multicellular)</strong></td>
</tr>
<tr>
<td><strong>Mode of Nutrition (autotrophic or heterotrophic)</strong></td>
</tr>
<tr>
<td><strong>Type of Habitat</strong></td>
</tr>
<tr>
<td><strong>Type of Reproduction (asexual or sexual or both)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Archae bacteria</th>
<th>Eubacteria</th>
<th>Protista</th>
<th>Fungi</th>
<th>Plantae</th>
<th>Animalia</th>
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<tbody>
<tr>
<td>Common Characteristics</td>
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<td>Common Examples</td>
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<tr>
<td>Cell Type (prokaryote or eukaryote)</td>
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<tr>
<td>Complexity (unicellular or multicellular)</td>
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<tr>
<td>Mode of Nutrition (autotrophic or heterotrophic)</td>
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<tr>
<td>Type of Habitat</td>
<td></td>
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<tr>
<td>Type of Reproduction (asexual or sexual or both)</td>
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</tbody>
</table>
THROUGH THE LOOKING GLASS
A Trip Through Time

INTRODUCTION

1. Show a graphic of the geologic time scale and discuss the basic units of eras and periods. Relate the divisions of a calendar (month, week, days) to the divisions of the geologic time scale. Point out that Precambrian covers about 88% of Earth’s history.

2. In order to help students understand the scope of the geologic time scale it may be helpful to use the following analogy:
   - Earth’s history is like a 24 hour clock:
     - Earth was formed at 00:01
     - The oldest known fossils appeared at about 6:00 am.
     - The oldest nucleated cells appeared between 4 and 5 pm.
     - The oldest complex organisms appeared between 8 and 9 pm.
     - The oldest plants appeared between 9 and 10 pm.
     - The oldest mammals appeared at 11 pm.

3. It is not so important that students memorize components of the time scale. They need a basic understanding of the events in conceptual or general terms in order to understand the sequence of events.

PROCEDURE

1. A JIGSAW ACTIVITY (see attached student activity sheet)
   a. Assign students to one of 3 groups (Group A).
      - Group 1: Earth Characteristics
      - Group 2: Atmosphere Characteristics
      - Group 3: Life Characteristics.
   b. Each individual group will research and complete a chart for their assigned characteristic covering each time span.
   c. Re-arrange the groups so that each new group has 3 students: one student representing earth characteristics, one representing atmosphere characteristics and one representing life characteristics (Group B).
   d. Students in new Group B will share information with each other until the chart is completed.
THROUGH THE LOOKING GLASS
A Trip Through Time

Name ________________________________________  Date __________________

**Directions**
1. Complete your assigned part of the chart working with classmates in Group A.
2. Share your information with your classmates in Group B.
3. Be prepared to discuss your completed chart with the whole class.

<table>
<thead>
<tr>
<th>TIME (millions of years ago - MYA)</th>
<th>EARTH CHARACTERISTICS</th>
<th>ATMOSPHERE CHARACTERISTICS</th>
<th>LIFE CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 mya – present</td>
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<tr>
<td>145-66 mya</td>
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<tr>
<td>245-146 mya</td>
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<tr>
<td>Time Period</td>
<td>Event Description</td>
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<td>362-246 mya</td>
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<td>439-365 mya</td>
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<td>540-440 mya</td>
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<td>3500-2000 mya</td>
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<td>4600 mya</td>
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Amylase Activity

The fossil record is one the strongest sources of evidence for evolution. Remains of organisms that no longer exist often show similarities to currently existing organisms. To establish relationships among existing organisms, scientists often compare homologous structures, biochemistry, vestigial organs and/or embryonic similarities.

Amylase is a protein found in all organisms. The length of this protein is approximately 100 amino acids. The table below represents 25% of the amylase sequence for nine different vertebrates. Each of the letters used represents one of the 20 amino acids found in nature. For this activity it is not necessary to name the individual amino acids in the sequences.

By comparing the sequences of amino acids in a similar protein, scientists can often determine evolutionary relationships between the organisms that share that protein. A cladogram can be constructed to depict the evolutionary distance between the organisms. This method takes advantage of the predictable rate at which mutations occur in DNA. Those organisms with the greatest number of amino acid sequence differences are considered to have diverged from a common ancestor the greatest number of years ago. If two organisms have relatively few differences between them, but each share a similar number of differences with the other organisms, they would be more closely related and depicted as “twigs” of a branch that would be a greater distance from the other organism.
The table below will be used to create a cladogram.

Step 1: Compare the amino acid sequence of each organism to the human. Count the number of different amino acids and record these values in Data Table I.

Step 2: Compare each of the nine vertebrates to the others. Determine the number of different amino acids in the sequence. Record these values in Data Table II.

Step 3: Create a cladogram for these nine vertebrates. Remember the greater the number of differences the less related the organisms are.

Step 4: At each fork in the cladogram created, identify the trait or characteristic that is different. Add the specific trait to the cladogram at the appropriate forks.

<table>
<thead>
<tr>
<th>Zebra</th>
<th>Turkey</th>
<th>Catfish</th>
<th>Frog</th>
<th>Human</th>
<th>Great White Shark</th>
<th>Loggerhead Sea Turtle</th>
<th>Rhesus Monkey</th>
<th>Rabbit</th>
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<td>E</td>
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</tr>
</tbody>
</table>
Analysis and Conclusions:

1. Which vertebrates are most closely related to humans? Use two types of evidence from this activity to support your choice.

2. Using just the physical characteristics of these nine organisms, would the cladogram look the same? Justify your answer.

3. Point mutations in DNA can change the sequence of amino acids in a protein chain. How many mutations occurred to alter the amylase protein of the catfish and the horse?

4. In a well developed paragraph, explain how the organisms were placed into the cladogram. Use appropriate vocabulary to support the steps of the process.
Teacher Page:

Allow students to create data tables to record their comparisons. These could be created using a word processing or spreadsheet application if computers are available. If students have exceptionalities that prevent them from creating their own, samples are provided below.

Data Table I (Comparing to Human amylase)

<table>
<thead>
<tr>
<th>Organism</th>
<th># of Differences</th>
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<tbody>
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<td></td>
</tr>
</tbody>
</table>

Data Table II (Comparing all organisms to each other)

<table>
<thead>
<tr>
<th></th>
<th>Zebra</th>
<th>Turkey</th>
<th>Catfish</th>
<th>Frog</th>
<th>Great White Shark</th>
<th>Loggerhead Sea Turtle</th>
<th>Rhesus Monkey</th>
<th>Rabbit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zebra</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
</tr>
<tr>
<td>Turkey</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
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<tr>
<td>Catfish</td>
<td>XXXX</td>
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<td>XXXX</td>
<td>XXXX</td>
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<td>XXXX</td>
<td>XXXX</td>
</tr>
<tr>
<td>Frog</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
<td>XXXX</td>
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<td>XXXX</td>
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<tr>
<td>Great White Shark</td>
<td>XXXX</td>
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<td>XXXX</td>
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<tr>
<td>Loggerhead Turtle</td>
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<tr>
<td>Rhesus Monkey</td>
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<td>Rabbit</td>
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<td>XXXX</td>
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</tbody>
</table>
Teacher Page 2:

Students should be able to create the following cladogram. If students are struggling with the concept, then it would be appropriate to provide them with the general diagram. Also, students with exceptionalities could also be provided with the general model if deemed necessary.
Data Table I (Comparing to Human amylase)

*Note: Students may want to consolidate the two data tables into one to make the cladogram construction easier.*

<table>
<thead>
<tr>
<th>Organism</th>
<th># of Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zebra</td>
<td>6</td>
</tr>
<tr>
<td>Turkey</td>
<td>7</td>
</tr>
<tr>
<td>Catfish</td>
<td>9</td>
</tr>
<tr>
<td>Frog</td>
<td>8</td>
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<tr>
<td>Great White Shark</td>
<td>14</td>
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<tr>
<td>Loggerhead Sea Turtle</td>
<td>8</td>
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<tr>
<td>Rhesus Monkey</td>
<td>1</td>
</tr>
<tr>
<td>Rabbit</td>
<td>5</td>
</tr>
</tbody>
</table>

Data Table II (Comparing all organisms to each other)
Teacher note: these are just “examples” of possible student responses. Please remember there could be other responses that are equally correct based upon the information presented in this activity and the prior knowledge of the students.
Biosphere Organization Flapbook

Fold a sheet of paper “hot dog” or landscape style.

Divide the sheet of paper into six equal sections.

Label each section as follows: biome, ecosystem, community, population, habitat, niche

Then cut each segment (top only to form flaps!)

Under each flap include the following information for each organization level:
  • Meaning of the term (NOT the definition out of the back of the book)
  • Sentence using the term in context
  • Examples of the organization level
  • Picture of the organization level

Students can be directed to use the information from their sketchbook journal or to think of one specific biome to complete this activity. Another suggestion would be to conduct the completion of the flapbook outside in the school yard. Teacher could point out the different levels as the students take notes directly into the flapbook. Students could then return to the classroom to complete the flapbook.
What does a Cell Look Like?

This activity can be used as an introduction to cells. Students may have their own perception of cells so it is good to find out what they have learned. This can be done in pairs or groups of four depending on class size. Have your students present these models. Classmates should write down any unfamiliar language used in the presentation (i.e., eukaryotic, unicellular, endoplasmic reticulum, multicellular). This could also be done as a class on the board or on chart paper.

Materials:

Modeling Clay (Play dough works fine and comes in a variety of colors)
Or
Construction paper of different colors
Index cards
Writing utensils

Give students the above the materials and ask them to construct a model of a cell. Have them answer the following questions on their index cards without a text or dictionary.

- What is the shape of a cell?
- What is the function of a cell?
- Are cells single or do they work in groups?
- Where do cells occur?
- What type of cell is your model?

Once the students have completed these activities that address cells and their functions, they should revisit this model. The index cards should be returned to the students in order for them to re-evaluate and improve the model. The index cards should be collected and re-evaluated to measure gains in student understandings of cells.
Macromolecule Flapbook

Fold a sheet of paper “hot dog” or landscape style.

Divide the sheet of paper into four equal sections.

Label each section as follows: carbohydrate, lipid, protein, and nucleic acid.

Then cut each segment (top only to form flaps).

Under each flap include the following information for each macromolecule:

- Which cell organelles are made of the molecule
- Which cell organelles produce the molecule
- Why the molecule is essential to the cell
- Drawing of cell organelle made of the molecule

Teacher Note: The goal of this activity is to begin the process of organizing matter into organisms. The focus of the macromolecules is the role they play in the structure of the organelles. This flapbook also appears in the Energy Unit. If the Energy Unit has already been taught, students should add this information to the flapbook they have already created. If this is unit is taught prior to the Energy Unit, then this flapbook will be revisited later.

Below is the type of information students need to be prompted to find and record in the flapbook. This could be done as a mini-lecture (10-2 format of lecturing) after the students complete the activity in order to ensure all students have the proper information.

Carbohydrates:
Cell walls (cellulose, peptodiglycan)
Provides energy
Mitochondria converts from glucose to energy

Lipids:
Cell membranes
Provides insulation, waterproofing

Proteins:
Cell membranes, cell walls, enzymes
Protein synthesis involves the chromosomes, ribosomes, Golgi apparatus, Endoplasmic Reticulum
Provides protection, enzymes regulate cellular activity
Enzymes are at work in the chloroplast and mitochondria

Nucleic Acids:
Chromatin, chromosomes, plasmids, DNA, RNA
Genetic information and protein synthesis
Cell Venn

Teacher Note: This may be used as a pre-assessment activity, a Ticket Out the Door or as homework for reinforcing the material.

Make a Venn diagram using the following organelles for prokaryotic and eukaryotic cells. Then use the same organelles for plant and animal cells.

1. cell membrane
2. cell wall
3. nucleus
4. ribosomes
5. cytoplasm
6. endoplasmic reticulum
7. vacuole
8. mitochondria
9. chloroplast
10. lysosomes

prokaryotic {differences} both {same} eukaryotic {differences}

Animal cell {differences} both {same} Plant cell {differences}
### Comparing Simple and Complex Organisms Graphic Organizer

<table>
<thead>
<tr>
<th>Archaebacteria</th>
<th>Eubacteria</th>
<th>Protista</th>
<th>Fungi</th>
<th>Plantae</th>
<th>Animalia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obtaining Energy and Matter</strong> (autotroph, diffusion, filterfeeder, grazer, predator, etc)</td>
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<td><strong>Transforming Energy and matter</strong> (incomplete digestive system, complete digestive system, cellular conversion)</td>
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<tr>
<td><strong>Transmitting Energy and Matter</strong> (circulatory system: open/closed, vessels, diffusion)</td>
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<tr>
<td><strong>Eliminating Energy and Matter</strong> (excretory system, diffusion)</td>
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</table>
Comparing Eukaryotic and Prokaryotic Cells

Teacher note: This activity will take approximately two full block periods. The instructions in this lab may need to be adjusted depending on the type of microscopes available for student use and the skill levels of your students.

Purpose:

This activity will enable students to distinguish between cell types, determine cell sizes, and to correctly use a microscope. The students are required to learn how to use a microscope, know how to determine size of objects, make a wet mount, stain cells, identify large cellular structures, and distinguish between prokaryotic, eukaryotic, plant and animal cells.

Materials:

- Compound microscope
- prepared slide of bacteria
- Methyl blue
- paper towel
- ruler (clear)
- Elodea or Lettuce
- Yogurt with “active” culture
- 2 slides and coverslips
- Iodine stain
- Onion
- eyedropper
- Cover slips
- Toothpicks
- Prepared slides of human epithelial tissue. (If necessary, the teacher can prepare this and have it setup for students to view. Gently scrape the inside of the cheek with a toothpick. Wash cells from toothpick to slide using a pipette of distilled water. Add a coverslip. Add iodine or methyl blue by drawing the stain under the coverslip using a paper towel. Clean slides and coverslips using a 10% bleach solution.)

Procedures: All students should complete the following sections and put all observations measurements and calculations in their lab notebooks. The teacher should verify that students have completed each section prior to the completion of the remainder of the activities.

1. Measuring the field of view:

   - Turn on the microscope's light source.
   - Adjust the amount of light for your eyes using the diaphragm located underneath the stage.
   - Calculate the total magnification of each objective by multiplying the power of the objective (the even number printed on the objective) by the ocular (the number that has an "x" behind it printed on the eye-piece). Record value in a data table.
2. Viewing Prepared Slides:
   - Slide A
     - Place the prepared slide of bacteria on the stage of the microscope.
     - Using the low power objective (usually 10x) find and focus on some bacteria cells.
     - Adjust the slide so that the bacteria cells are in the center of the field of view.
     - Using the ruler determine the distance between the bottom of the objective and the slide and record the information on the data sheet.
     - Adjust the microscope to high power (not the oil immersion objective) and refocus on the cells. If necessary re-adjust the position of the cells so that they are again in the center of the field of view.
     - If your microscope has an oil immersion objective (100x), adjust the microscope to oil immersion with the assistance of your teacher and again refocus and adjust the position of the cells if necessary.
     - Draw a perfect circle in the space on the data sheet to represent your field of view at this magnification then draw three bacteria cells (labeling all the parts that you can see) in that circle, giving as much detail as you can. Indicate the total magnification that you are using and estimate the size of one of the cells. *(Teacher note: the size of a single cell can be determined by dividing the diameter of the field of view by the approximate number of cells that fit across that diameter.)*

   - Slide B (Human epithelial cells):
     - Place the prepared slide on the stage of the microscope.
     - Observe the cells as you have done in the previous portions of this activity.
     - Again after making the circle in the space, make a drawing of the cell and label all of the structures that you see. Indicate the total magnification you are using and estimate the size of one of the cells.

3. Prepare Your Own Slides:
   - Slide One:
     - Place a very small dollop of yogurt on a microscope slide.
     - Mix the yogurt in a drop of water, add a coverslip, place the slide on the stage of a compound microscope.
     - First focus using the low-power objective.
     - Then, rotate to the high-power, and focus.
     - Finally, use the oil immersion objective to see masses of rod-shaped cells.
Draw a perfect circle in the space on the data sheet to represent your field of view at this magnification and draw three cells (labeling all the parts that you can see) in that circle. Give as much detail as you can. Indicate the total magnification and estimate the size of one of the bacteria cells.

Slide Two (wet mount):
- Place a drop of water in the middle of a clean slide.
- Remove a section of the skin from the inside layer of the onion and place it on the slide in the drop of water. Make sure the skin is smooth and is not folded or twisted.
- Place the cover slip over the top by placing the edge of the cover slip on the end of the drop of water, and then gently lower the cover slip down on the drop of water.
- Observe through the microscope (by first using low-power and working up to high-power).
- Draw a perfect circle in the space on the data sheet to represent your field of view at this magnification and draw the cells you see (labeling all the parts that you can see) in that circle. Give as much detail as you can. Indicate the power that you are using and estimate the size of one of the cells.
- Place one drop of iodine on the slide just to the side of the cover slip. Using a small piece of paper towel on the opposite side, draw the stain under the cover slip. Let the slide set for 3 minutes letting the iodine stain the cells.
- Again observe the cells through the microscope.
- Draw a perfect circle in the space on the data sheet to represent your field of view at this magnification and draw the cells you see (labeling all the parts that you can see) in that circle. Give as much detail as you can. Indicate the total magnification and estimate the size of a single onion cell.
- Clean and dry the slide and cover slip when done.

Slide 3:
- Place a drop of water on the slide again, and put an Elodea leaf or a small piece of leafy lettuce in the water.
- Put the cover slip in place as you did before and observe the leaf through the microscope (again going from the scanning objective to high-power).
- Observe the cells. You may have to use a lower power to see all of one cell at a time.
- Again after making the circle in the space, make a drawing of the cell and label all of the structures that you see. Indicate total magnification and estimate the size of a single Elodea cell.
- Clean and dry the slide after your observations and data collection.

Complete the following analysis items using the drawings and data collected over the two days.

Analysis:

- Indicate the diameter of the field of view of each power
  - Low
  - High
- The distance between the bottom of the objective and the slide when in focus with each objective.
  - Low
- Calculate the total magnification power of the microscope with each objective.
  - Low
  - High
  - Oil Immersion (if available)
- Give the size of the cells observed (estimated) and indicate the type of cell each represents
  - Bacteria (prepared)
  - Bacteria (yogurt)
  - Onion
  - Lettuce
  - Human
- What cell organelles were visible:
  - Bacteria
  - Onion (unstained)
  - Onion (stained)
  - Elodea/Lettuce
  - Human
- Compare eukaryotic and prokaryotic cells using a graphic organizer.
- Compare plant and animal cells using a graphic organizer.
- From the estimated cell size, have the student measure their height and width to determine how many cells it would take to make a body their size. Show calculations.

OR

- The students make a composite drawing of the largest cell observed with the other cells drawn inside of it in proportion to see that many bacteria cells can fit inside a human cell.

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**Inquiry Using the Digital Microscopes**

All students will show proficiency with the microscope (either digital or compound) prior to completing the activity by:

Measuring the field of view:
  - Turn on the microscope's light source.
  - Adjust the amount of light for your eyes using the diaphragm located underneath the stage.
  - Place the clear ruler on the stage and determine the diameter of the field of view while using the low power objective (the shortest one). Record value in a data table.
  - Adjust to high power (do not use the oil immersion objective – 100x) and calculate the diameter of its field of view using the directions provided above. Record value in a data table.
  - Calculate the total magnification of each objective by multiplying the power of the objective (the even number printed on the objective) by the ocular (the number that has an "x" behind it printed on the eye-piece). Record value in a data table.
Provide students with a variety of prepared slides of both prokaryotic and eukaryotic cells as well as materials to make their own slides.

Using the digital microscope each group will:

Capture and save an image of each of the following:

- Prokaryotic Cell
- Eukaryotic Cell
- Plant Cell
- Animal Cell
- Bacteria Cell

Place the images and the following information into a multimedia or word processing document: Once the images are captured, the remainder of this activity can be completed outside of the classroom. Provide adequate time for completion.

- Type of cell (prokaryote or eukaryote and bacteria, plant, or animal)
- Magnification used when image was captured
- Size of each cell
- Label any organelles visible
- Method for preparing each slide
- Create a graphic organizer to compare/contrast eukaryotic and prokaryotic cells
- Create a graphic organizer to compare/contrast plant and animal cells
Differentiation of Cells in Complex Organisms

Students will compare structures found in a variety of different types of plant and animal cells. Students should focus on cell structures found in each type and why these structures vary from cell type to cell type.

Materials:

- Compound microscope
- Leaf (cell types vary in the formation of this organ, lead students to see the variety of cells)
- Stem (either monocot or dicot, do not focus on the difference between these two, the focus is on differentiation of cells)
- Root (meristem)
- Epithelial
- Cardiac muscle
- Nerve
- Smooth muscle
- Bone

Procedure:

Students will observe each cell type available.
Students will draw (in detail) the entire field of view.
Students will label all organelles present.

Conclusion:

Students will compare and contrast the cell organelles and their functions to the single-celled organisms from the previous laboratory activity. Students will need to include in their discussions why multi-cellular organisms would need this type of differentiation. Students should also include a diagram (flow chart) of how organisms are organized (cell → tissue → organs → organ systems → organisms).

Teacher Note: The focus of this activity is to compare structures from multi-cellular organisms with those of the less complex organisms. The students are NOT to be assessed on the different types of cells. The assessment should be on the organization necessary for the complex organisms to carry out the life processes and survive.
Lab Activity: Cell Structure and Function

Research the organelles found in a cell.

Your group has been assigned the organelle _________________________________

Day 1
1. Your group will research the organelle. Be sure to include the following information:
   • If it is found in a prokaryotic cell, eukaryotic cell or both.
   • If it is found in a plant cell, animal cell or both.
   • Explain where the organelle is found in the cell (nucleus or cytoplasm)
   • Explain the function of the organelle (what it does).

   Teacher note: The function of the organelles is a major focus of this activity. Relating the functions to different types of cells is also critical. The assessment of this activity should not be a diagram of the cell to label the specific parts but rather a comparison of why some organelles are in some cells but not others. The assessment should also include the relationship of the cell organelles to the life processes (protein synthesis, respiration, photosynthesis, etc.).

2. Construct a model of your organelle. Your group will need 4 copies of the organelle. Make sure it is colorful and labeled. Tomorrow you will add your model to a class model of the cell. Make sure it is large enough to be seen. Make your organelle as realistic looking as possible and be prepared to explain its function in the cell to the class tomorrow.

3. Each member in the group must write a paragraph describing the organelle researched. Include all information discussed in step number 1. It must be in your own words and will help you prepare for your oral presentation.

Day 2
4. Your group will add your model to the classroom cell and teach the class about your organelle. Be sure to include all information found in #1.

5. As each group presents their information, complete the organelle chart below.
<table>
<thead>
<tr>
<th>Organelle</th>
<th>Prokaryotic or Eukaryotic or Both</th>
<th>Plant or Animal or Both</th>
<th>Location in cell [nucleus or cytoplasm]</th>
<th>Describe the function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nucleus</td>
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<tr>
<td>Cell Membrane</td>
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<tr>
<td>Cytoplasm</td>
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<td>Ribosomes</td>
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<tr>
<td>Endoplasmic Reticulum</td>
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<td>Golgi Apparatus</td>
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<tr>
<td>Lysosomes</td>
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<td>Mitochondria</td>
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<tr>
<td>Chloroplasts</td>
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<tr>
<td>Cell Wall</td>
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<tr>
<td>Plasmid</td>
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<tr>
<td>Chromosome</td>
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</table>
Evolutionary Theory Timeline

Purpose:
To show students that the theory of Evolution has been developed over many years by many different scientists
To show students that scientific theories change as technological advances and evidence are introduced

Task:
Each student will research an assigned contributor to the Theory of Evolution. This can be accomplished by drawing the name of the scientist from a hat or teacher can pass out slips of paper with the name of the scientist to each student. Have students research the scientist.

The “final product” should in one of the following formats:
- CNN-type breaking news story
- WANTED poster
- Advertising flyer for a speaking engagement/book signing
- Obituary

Be sure to include the following information:
- Photograph
- Dates of life
- National origin
- Major contribution to the Theory of Evolution
- Evidence used to develop major contribution
- Date of discovery, publication, acceptance of viewpoint
- 3x5 “flash card” (scientist’s name on one side, important information as bullets on the other)

The class will construct a timeline with their information using the 3X5 flash card. Hang a piece of string along the wall and have the class hang their index card on the timeline in chronological order as they present information to their classmates. The information should be placed into a graphic organizer so that all students have the necessary information.

Suggested Scientists (teachers may want to include others that had an impact on the development of the theory of evolution):

- William Bateson
- Stanley Miller
- Lynn Margulis
- Gregor Mendel
- John Ray
- G. Ledyard Stebbins
- James Watson
- Francis Crick
- Stephen Jay Gould
- James Hutton
- Charles Lyell
- Thomas Malthus
- Theodosius Dobzhansky
- Desmond Morris
- Francesco Redi
- Harold Urey
- Alfred Wegener
- Hugo de Vries
- J.B.S. Haldane
- Jean Baptiste Lemaire
- Charles Darwin
- Ernst Mayr
- Alexander Oparin
- George Simpson
- Alfred Russell Wallace
- Niles Eldridge
- G.H. Hardy
- Carolous Linnaeus

Teacher Note: The purpose of this activity is to show the development of the theory. Students should NOT be assessed on dates, names and events. The understanding students should show is how a theory is modified as new pieces of evidence are provided and accepted by the scientific community.
Graphic Organizer for Note Taking

The History of the Theory of Evolution

<table>
<thead>
<tr>
<th>Scientist</th>
<th>Date of Contribution</th>
<th>Summary of the Theory</th>
<th>Evidence Used in Support of or to Change Previous Theory</th>
<th>Historical Event</th>
</tr>
</thead>
<tbody>
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</table>
“A Separate Piece”

Step 1: Using butcher/bulletin board paper, the teacher makes six interlocking pieces resembling puzzle pieces. A seventh piece is created that does not fit into the puzzle. This should lead students to the understanding that viruses are not included in the current six kingdom classification system. The discussion at the end should lead students to debate whether viruses are living or non-living.

Step 2: Students are grouped and given the name of one of the six kingdoms (Archaebacteria, Eubacteria, Protista, Fungi, Plantae, Animalia) or Viruses

Step 3: Student groups are to create an overview of their kingdom or virus on the puzzle piece. Each group should include the following information:

- Characteristics (cell types, mode of nutrition, complexity, environmental requirements)
- Examples
- Uses
- How it benefits or harms humans
- When it first appeared

Step 4: Student groups will present their piece of the puzzle. Their peers will record the information into their graphic organizer.

Step 5: Students should be able to answer the following questions:

- Why do scientists classify organisms?
- Why are viruses not included in the 6 kingdom classification system?
- Which kingdom could be further divided? Explain your choice.

This kingdom wall can be used throughout the unit as a reference. It could also be used in the cladogram activity.
Outbreak at Central High
Unit 1: Nature of Science
Day 1

Background: For the past three weeks, absenteeism at CHS has been on the rise. Many of the students have been complaining of similar symptoms such as headaches, respiratory problems, dizziness and now 35 of the students have been hospitalized due to respiratory failure. The CDC was called in from Atlanta to trace the path of the epidemic.

It was determined that the cause was not environmental but biological.

Based on the symptoms exhibited by patients make a prediction as to which kingdom(s) of living organisms could be causing the epidemic. Explain your prediction in a paragraph using available resources.
Outbreak at Central High  
Unit 1: Nature of Science  
Day 2

Background: For the past three weeks, absenteeism at CHS has been on the rise. Many of the students have been complaining of similar symptoms such as headaches, respiratory problems, dizziness and now 35 of the students have been hospitalized due to respiratory failure. The CDC was called in from Atlanta to trace the path of the epidemic.  
It was determined that the cause was not environmental but biological.

During the course of the investigation, the following observations have been made by investigators from the CDC:

1. People affected have the following symptoms: headaches, respiratory problems, skin rashes, dizziness, and secondary infections such as sinus infections, bronchitis, and pneumonia. 75% of the patients have not responded to treatment with antibiotics.
2. Over half (52%) of the students affected are currently in P.E. or weightlifting for a sport.
3. 65% of the students affected are currently taking classes on A or B hall and soap for the biology classes is on backorder.
4. 98% of the lunchroom students affected eat lunch in the lunchroom.
5. Computer records show that 80% of the students affected are currently enrolled in English classes and have had to prepare research papers.
6. None of the students affected spend their whole school day at the ninth grade center.
7. The previous year the school roof was damaged by a hurricane. Several classrooms, the gym, media center, and hallways are leaking.
8. Last month the compressor in the lunchroom freezer went out causing all of the current food supply to spoil.
9. In addition to the sick students, the affected school personnel includes two members of the custodial staff, and two media specialists. However, none of the regular school staff are sick.
10. Two weeks ago, three students were diagnosed with viral meningitis but have returned to school symptom free

CDC investigators have collected samples of microorganisms from various sites within the school and have determined the cause of the outbreak. Now you must do the following to explain how the mystery was solved:

1. Identify at least four safety procedures that must be followed by CDC investigators as they collect samples in the school.
2. Write a paragraph explaining your thoughts on the location of the epicenter of the outbreak. Support your position using data collected by the CDC and your knowledge of the school building and procedures.
3. Write a paragraph explaining the kingdom to which the organisms causing the outbreak belong. Support your position using data collected by the CDC and your textbook or other resources describing the characteristics of the six kingdoms.
Rubric for Outbreak at Central High

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Procedures</td>
<td>At least four necessary safety procedures were correctly identified</td>
<td>Three safety procedures were correctly identified</td>
<td>Two safety procedures were correctly identified</td>
<td>One safety procedure was correctly identified</td>
</tr>
<tr>
<td>Outbreak Epicenter</td>
<td>The epicenter was correctly identified and at least three supporting facts were used to defend the choice.</td>
<td>The epicenter was correctly identified and at least two supporting facts were used to defend the choice.</td>
<td>An incorrect epicenter was identified and at least three supporting facts were used to defend the choice.</td>
<td>An incorrect epicenter was identified and at least two supporting facts were used to defend the choice.</td>
</tr>
<tr>
<td>Organism Identification</td>
<td>The kingdom was correctly identified and at least three supporting facts were used to defend the choice.</td>
<td>The kingdom was correctly identified and at least two supporting facts were used to defend the choice.</td>
<td>An incorrect kingdom was identified and at least three supporting facts were used to defend the choice.</td>
<td>An incorrect kingdom was identified and at least two supporting facts were used to defend the choice.</td>
</tr>
<tr>
<td>Initial Prediction</td>
<td>An initial prediction paragraph was turned in on Day One.</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Suggested Resources:
- biology textbook
- Diversity of Life: [http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookintro.html#The%20Diversity%20of%20Life](http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBookintro.html#The%20Diversity%20of%20Life)

Classification of Living things: [http://www.sirinet.net/~jgjohnso/classification.html](http://www.sirinet.net/~jgjohnso/classification.html)

Microorganism website: [http://www.dsmz.de/species/strains.htm](http://www.dsmz.de/species/strains.htm)