# APS Science Curriculum Unit Planner

## Enduring Understanding

Although living things come in an incredible diversity of forms, they have a variety of characteristics in common.

## Correlations

<table>
<thead>
<tr>
<th>Unifying Understanding</th>
<th>Correlations</th>
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<tbody>
<tr>
<td>(1) Humans use science to organize their understanding of the natural world.</td>
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<td>(3) Form and composition are related to function.</td>
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<td>(8) Living things have survival needs.</td>
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<tr>
<td><strong>VA SOL</strong></td>
<td>BIO.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which</td>
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<td>a) observations of living organisms are recorded in the lab and in the field;</td>
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<td>b) hypotheses are formulated based on direct observations and information from scientific literature;</td>
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<td>BIO.4 The student will investigate and understand life functions of Archaea, Bacteria and Eukarya. Key concepts include</td>
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<tr>
<td></td>
<td>a) comparison of their metabolic activities;</td>
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<td></td>
<td>b) maintenance of homeostasis;</td>
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<td></td>
<td>c) how the structures and functions vary among and within the Eukarya kingdoms of protists, fungi, plants, and animals, including humans;</td>
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<td></td>
<td>d) human health issues, human anatomy, and body systems;</td>
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<td></td>
<td>e) how viruses compare with organisms; and</td>
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<td></td>
<td>f) evidence supporting the germ theory of infectious disease.</td>
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<td></td>
<td>BIO.6 The student will investigate and understand bases for modern classification systems. Key concepts include</td>
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<tr>
<td></td>
<td>a) structural similarities among organisms;</td>
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<tr>
<td></td>
<td>c) comparison of developmental stages in different organisms;</td>
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<td></td>
<td>d) examination of biochemical similarities and differences among organisms; and</td>
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<td></td>
<td>e) systems of classification that are adaptable to new scientific discoveries.</td>
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| NSES (grade level)                                                                 | UCP.1 Systems, order, and organization.  
|                                                                                   | UCP.5 Form and function  
| C.1.4 Cell functions are regulated. Regulation occurs both through changes in the activity of the functions performed by the proteins and through the selective expression of individual genes.  
| C.3.1 Species evolve over time.  
| C.3.2 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.  
| C.3.5 Biological classifications are based on how organisms are related. Organisms are classified into a hierarchy of groups and subgroups based on similarities which reflect their evolutionary relationships.  
| C.4.3 Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.  
| C.5.4 The complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism.  
| C.6.2 Organisms have behavioral responses to internal changes and to external stimuli.  
| F.1.2 The severity of disease symptoms is dependent on many factors, such as human resistance and the virulence of the disease – producing organism. Many diseases can be prevented, controlled, or cured. Some diseases, such as cancer, result from specific body dysfunctions and cannot be transmitted.  
| **Science as Inquiry** A.1.2, A.1.4, A.1.5  
| | AAAS Atlas                                                                 |  
| • The variation of organisms within a species increases the likelihood that at least some members of the species will survive under changed environmental conditions, and a great diversity of species increases the chance that at least some living things will survive in the face of large changes in the environment. 5A/H1  
| • The degree of kinship between organisms or species can be estimated from the similarity of their DNA sequences, which often closely matches their classification based on anatomical similarities. 5A/H2  
| • Life on earth is thought to have begun as simple, one-celled organisms about four billion years ago. Once cells with nuclei developed about a billion years ago, increasingly complex multi-cellular organisms evolved. 5F/H8  
| • The continuing operation of natural selection on new characteristics and in diverse and changing environments, over and over again for millions of years, has produced a succession of diverse new species. 5F/H10** (SFAA)  
|
### Essential Questions
- What does it mean to be alive?
- What are the characteristics of living things?
- What patterns exist among living things?
- How and why are there different ways to group living things?
- Are viruses considered to be living?
- How can viruses and bacteria be both harmful and helpful?
- Germ Theory is an explanation that many diseases are caused by microorganisms. How has human health benefited from this understanding? Why has human health suffered during recent decades from terrible pandemics?
- How are living things different and how are they alike? How can they be grouped by similarities?
- How can a multicellular organism, made of specialized cells, maintain homeostasis?

### Knowledge and Skills

**Students should know:**
- 1.1 Biologists study life in all its forms.
- There are commonalities among living things: characteristics of life, biochemistry, and genetic code.
- All living things are made of similar chemicals, compounds and elements.
- Living things have certain structures that serve necessary functions for growth, response to stimulus, reproduction and use of energy.
- Living things are classified into 6 kingdoms according to certain characteristics.
- 18.1 Viruses and bacteria can cause disease. Germ theory states that microscopic particles cause certain diseases. (Figure 31.1 on pp 940-941 have a nice time line describing events post-germ theory.) Viruses are not considered living because they can not reproduce on their own.
- 18.2 Viruses exist in a variety of shapes and sizes. There is a general pathway of viral infection.
- 18.3 Some viral diseases can be prevented with vaccines.
- 18.4 Bacteria and archaea are both prokaryotes but different enough to be classified into different kingdoms.
- 18.5 Prokaryotes perform important functions for organisms and ecosystems.
- 18.6 Understanding bacteria is necessary to prevent and treat disease.
- 19.1 Kingdom Protista is the most diverse of all the kingdoms.
- 19.5 Fungi are heterotrophs that absorb their food.
- 19.6 Fungi recycle nutrients in the environment.
- 20.1 Plant life began in the water and became adapted to land.
- 20.2 Plants can be classified into nine phyla. Plants, like animals, have specialized cells and tissue systems. (See plant cells and tissues section 21.1 for further information).
- 20.4 Humans rely on plants in many ways.
- 23.1 Animals are diverse but share common characteristics.
- 26.4 Evolutionary adaptations allowed mammals to succeed dinosaurs as a dominant terrestrial invertebrate. All mammals share several common characteristics.
- 28.1 The human body has five levels of organization. Students should also know the major organ systems and how they contribute to homeostasis, p. 856.
### Students should be able to:
- Define and give examples of earth’s biodiversity.
- Explain the importance of biodiversity in an ecosystem.
- List common characteristics among living things.
- List and describe the six kingdoms of life summarizing their cell structure, level of complexity, how they obtain energy, and how they reproduce.
- Explain how disease can be transmitted.
- Describe why viruses are not living things.
- Debate the pros and cons of using antibiotics.
- Classify a group of protists using a dichotomous key and a microscope.
- Explain how plants have changed over time and are now a diverse group of organisms.
- Describe why humans are animals.
- Describe how the major organ systems contribute to homeostasis.

### Stage 2: Assessment Evidence

#### Prior Knowledge and Skills
- Characteristics of living things.
- Common biochemistry of living things.
- Genetic code is universal.
- Create and administer a Diagnostic Test based on knowledge and skills that will be assessed.

#### Formative Assessment
- Classification cube or other representation of the six kingdoms with descriptions and pictures
- Webquest: Antibiotics in Agriculture, SICKENING Protists
- Interactive reviews @ClassZone.com
- Labs / possible field work
- Section quizzes

#### Summative Assessment
- Possible performance task: Students choose one of the six kingdoms and research and present the major characteristics of that group, examples of organisms from the group, along with positive and negative impacts on human life by that group.
- Unit Test

### Stage 3: Learning Plan

#### References to Adopted Materials
- Use Lesson Plan Chapters 18, 19, 20, 23, 26, and 28 pp. 136 - 214 for daily plan and suggestions for differentiation both by level and by interest.
- The Biology Lab Binder Units 6 - 9: Classification and Diversity, Plants, Animals, and Human Biology, offer paper and electronic versions of investigations, mini-labs and practice sheets.
## Suggested Investigations

- **Use pictures** (add archaea, bacteria, protists, and more varied plants to the examples of mostly animals found at: [http://www.pbs.org/safarchive/5_cool/galapagos/g52b_tax.html](http://www.pbs.org/safarchive/5_cool/galapagos/g52b_tax.html), and have students work in groups to classify them into categories. After a discussion of their classification scheme, discuss how organisms are classified into six kingdoms (and 3 domains). Have students resort using Appendix pp. R25-R31. (You will need to add information to the bacteria pictures in order for students to be able to sort them correctly). Groups need to justify their classification based on information from the appendix. The next challenge is to come up with ways in which all these organisms are similar. Students could discuss the characteristics of living things and the organisms’ chemical make-up. This could also be an opportunity to discuss other classifications systems, for example 5 kingdoms, and why it has changed.
- **Students create a cube or other visual representation to summarize the 6 kingdoms and their main characteristics as an overview of the unit.**
- **18.4 & 18.5 Uses of bacteria. Design and perform a controlled experiment, for example: Determine the best recipe for culturing yogurt or Design Your Own Investigation on p. 566 Using Bacteria to Break Down Oil.**
- **18.6 Antibiotic Use. Use the Virtual Lab on Classzone.com: Testing Antibacterial Products and / or the Webquest: Antibiotics in Agriculture found at ClassZone.com.**
- **19.1 Use dichotomous keys and microscopes to classify various protozoa, and / or Investigating Motion in Protists p. 579. Carolina Biological sells a protozoa survey mixture with a simple dichotomous key. Another option: Webquest: Sickening Protists.**
- **19.5 Exploring Mushroom Anatomy, p. 595.**
- **20.4 Investigating Medicinal Plants, p. 633 or students could research and present different plant products we use. The U.S. Botanic Garden is a great, short field trip and resource.**
- **28.1 Homeostasis and Exercise Investigation, p. 857.**

## Outdoor Education Applications

- **Investigate the biodiversity found at the Outdoor Lab or another location.**
- **Survey the Outdoor Lab or a local area for the six kingdoms.**

## Resources

### Web Sites

- **Online Biology at ClassZone.com** Resources available after creating a login and password. Under various chapters:
  - Virtual Lab: Ch 18 Testing Antibacterial Agents
  - Reviews
  - Quizzes
  - Webquest: Ch 18 Agriculture in Antibiotics, Ch 19 Sickening Protists, Ch 21 Plant Adaptations
  - SciLinks
- **Infectious Diseases**: [http://www.koshland-science-museum.org/teachers/idactivities.jsp](http://www.koshland-science-museum.org/teachers/idactivities.jsp)
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<th>Videos</th>
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<td>• None</td>
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<th>Online clips</th>
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<td>• Understanding: Viruses (54:00) Your body is under attack every minute of every hour of every day. The enemy is patient, adaptable, potentially deadly, and invisible. Called the “littlest assassins” and “phantom killers,” viruses range from the common cold to HIV and have caused epidemics more devastating than war. This video explains how viruses operate and how your immune system defends you. And it shows scientists turning the tables, transforming invading viruses into agents of healing. Produced by Discovery Channel School. Copyright: 1997 Grades: Gr. 9 - Gr. 12 (Discovery Streaming)</td>
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<td>• Understanding: Bacteria (52:06) Some bacteria have become immune to the best of our antibiotics, rendering once-treatable infections deadly. But not all bacteria are harmful; in fact, some are quite helpful. Learn how bacteria aid in meal digestion, the control of air and water pollution, and even the treatment of muscle disorders. This program includes six short segments: • Living with Bacteria (10 min.) • The Staff of Life (12 min.) • Modern Medicine (8 min.) • Restoring Gold Hills (5 min.) • The Earth beneath Our Feet (8 min.) • Restricted Waters (6 min.) Copyright: 2004 Grades: Gr. 9 - Gr. 12 (Discovery Streaming)</td>
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<tr>
<th>Field Trips</th>
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<td>• The U.S. Botanic Gardens: <a href="http://www.usbg.gov/index.cfm">http://www.usbg.gov/index.cfm</a></td>
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<td>• Smithsonian: National Museum of Natural History</td>
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