

6thGrade Life Science Diversity

Teacher Background Information

Biologists classify organisms on the basis of similarities and differences in their structure and behavior including the similarity in their DNA sequence. One basic difference is whether a cell has a nucleus or not (prokaryote vs. eukaryote). The organization system used today is based on one proposed by the Swedish botanist Carl Linnaeus. It divides all life into 6 kingdoms, which are further subdivided into increasingly specialized branches called phyla, class, order, family, genus, species. All life is composed of cells that carry on many of the basic functions of organisms: making proteins, extracting energy from nutrients, replicating, etc. Most cells in multi-cellular organisms carry out specialized functions not done by other kinds of cells. The work of the cell is carried out by the many types of molecules it assembles. Four types of molecules are essential to the work of the cell; these are nucleic acids (DNA and RNA), proteins, lipids and carbohydrates. The information encoded in the cells' DNA provides the instructions for making these molecules. Life on Earth is believed to have begun with simple single celled organisms about 4 billion years ago. Small differences between parents and offspring can accumulate in successive generations so that descendants are very different from their ancestors. Individual organisms with certain traits are more likely to survive and have offspring. Natural selection leads to organisms that are well suited to a particular environment. Changes in environmental conditions can affect the survival of individuals and species. Evolution builds on what already exists, so the more variety there is the more there can be in the future. Evolution does not necessitate long term progress in some set direction.

Instructional Implications

General similarities and differences among organisms are easily observed. The teacher's task is to move students toward a more sophisticated understanding of the features of organisms that connect or differentiate them: from external features and behavior patterns, to internal structures and processes, to cellular activity, to molecular structure.

Understanding and appreciating the diversity of life comes from their ability to see in organisms the patterns of similarity and difference in the living world.

Students should begin to extend their attention from external anatomy to internal structures and functions. They should learn about the accepted classification frameworks. Students should try to differentiate between familiar organisms that are alike in many ways—for example, between cats and small dogs.

Students also should expand their investigations of living systems to include the study of cells. Students can work with a light microscope and interpret accurately what they see.

Big Idea *Diverse life forms have similarities and differences in form and function.*

Essential Question *What factors contribute to the diversity of life?*

AAAS Benchmarks/National and Science Education Standards

- One of the most general distinctions among organisms is between plants... and animals.... Some kinds of organisms... cannot be neatly classified as either plants or animals. 5A/M1
- Animals and plants have a great variety of body plans and internal structures ...(that make it easier to) find food and reproduce. 5A/M2
- In classifying organisms, scientists consider details of both internal and external structures. 5A/M3b*
- ...a species (is) defined as all organisms that can mate with one another to produce fertile offspring. 5A/M4*
- All living things are composed of (one or more) cells,...whose details usually are visible only through a microscope... 5C/M1
- Living systems at all levels of organization demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, tissues, organs, organ systems, whole organisms, and ecosystems. (NSES)
- The way in which cells function is similar in all living organisms. 5C/M3b
- Small differences between parents and offspring can accumulate...in successive generations so that descendants are very different than their ancestors. 8B/M5f
- Individual organisms with certain traits are more likely than others to survive and have offspring. 5F/M2a
- Changes in environmental conditions can affect the survival of individual organisms and entire species. 5F/M2b
- Most species that have lived on earth are now extinct. Extinction of species occurs when the environment changes and the individual organisms of that species do not have the traits necessary to survive and reproduce in the changed environment. 5F/M4**(NSES)
- Cells carry on the many functions needed to sustain life. (NSES)

Student Difficulties and Misconceptions

It may be easier for students to understand that the cell is the basic unit of structure (which they can observe) than that the cell is the basic unit of function (which has to be inferred from experiments).

Students may have difficulties with the various uses of the word "adaptation" In everyday usage, individuals adapt deliberately. But in the theory of natural selection, populations change or "adapt" over generations, inadvertently. Elementary- and middle-school students also tend to confuse non-inherited adaptations acquired during an individual's lifetime with adaptive features that are inherited in a population.

Materials/Resources

FOSS: **Diversity of Life kit**
NOAA/NMFS
Discovery Southeast
Ladd McCauley Hatchery
US Forest Service
Alaska Dept of Fish and Game
US Fish and Wildlife Service
Glacier Visitor Center
GEMS Life Through Time

Assessments

Science Notebooks

Science Probes Volume 1
#16 *Is it an Animal?*
#17 *Is it Living?*
#18 *Is it made of Cells?*

Alaska GLE's

The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection and biological evolution by:

[6] **SC1.2** Recognizing that species survive by adapting to changes in their environment.
(7) **SC1.2** Describing possible outcomes of mutations (i.e. no effect, damage, benefit)

The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by:

[6] **SC2.1** Using a dichotomous key to classify animals and plants into groups using external or internal features.

[6] **SC2.2** Identifying basic behaviors (e.g., migration, communication, hibernation) used by organisms to meet the requirements of life.

[7] **SC2.1** Describing the basic structure and function of plant and animal cells

[7] **SC2.2** Identifying the seven levels of classification of organisms

[8] **SC2.1** Placing vertebrates into correct classes of taxonomy based on external, observable features

Local Connections

Seaweek
Local life forms in tide pools, forest, streams and ponds

Grade Level Scientists

Charles Darwin

Connections to other topics

Science in the middle grades should provide students with opportunities to connect their knowledge of diversity to what they are learning in geography.