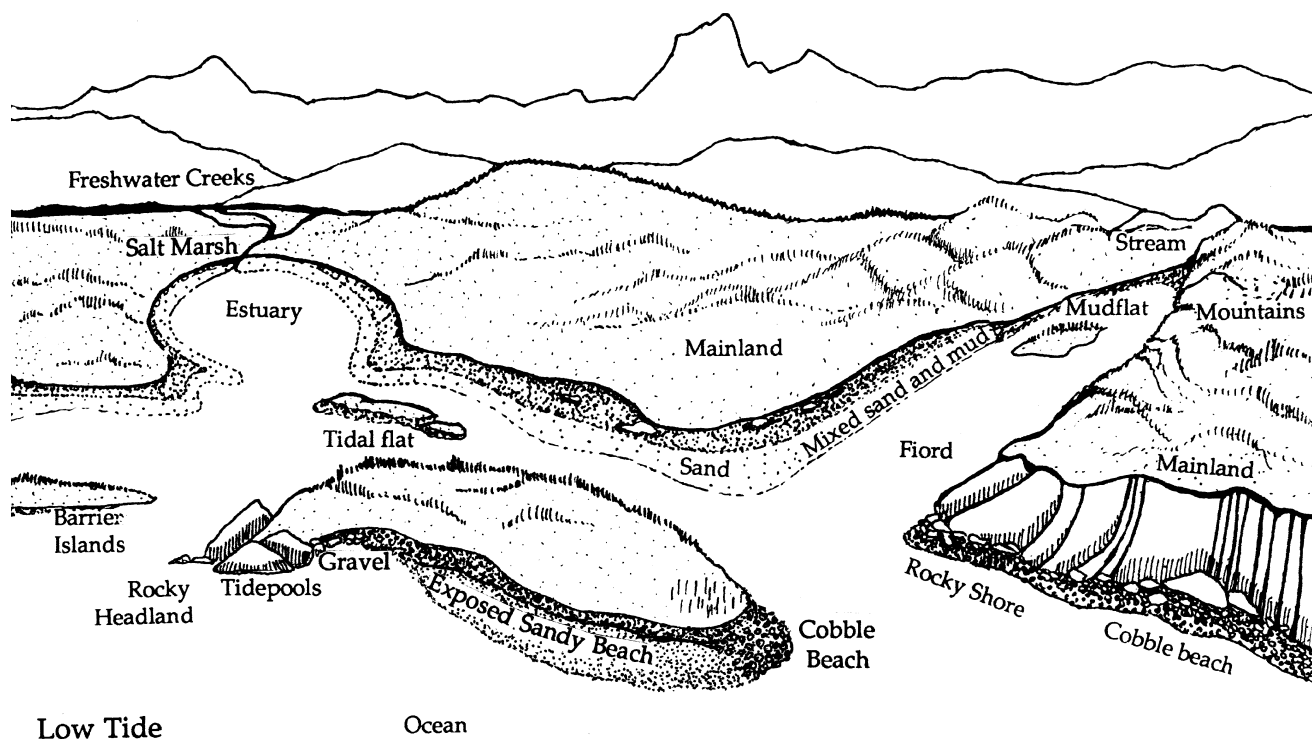


The Animal Adaptations program at Hatfield Marine Science Center is designed to be a 50-minute lab-based program for 3rd-12th grade students that examines marine organisms from three different habitats (sandy beach, rocky shore and estuary) and explores the many ways they are adapted to their particular environment. This lab focuses on the adaptations of several groups of marine animals including Mollusks, Crustaceans, and Echinoderms, and investigates how they differ depending on whether they are found in a sandy beach, rocky shore, or estuary environment. Students will work in small groups with a variety of live animals, studying individual characteristics and how these organisms interact with their environment and one another.

Background Information

The Oregon Coast is made up of a series of rocky shores, sandy beaches, and estuaries, all of which are greatly affected by fluctuating tides. Many of these areas are **intertidal** and are alternately inundated by seawater and exposed to air, wind, and dramatic changes in temperature and **salinity**. High tide floods these areas with cold, nutrient laden seawater, bringing food to organisms that live there in the form of **plankton** and **detritus**. Low tides often expose these organisms to the dangers of **predation** and **desiccation**.



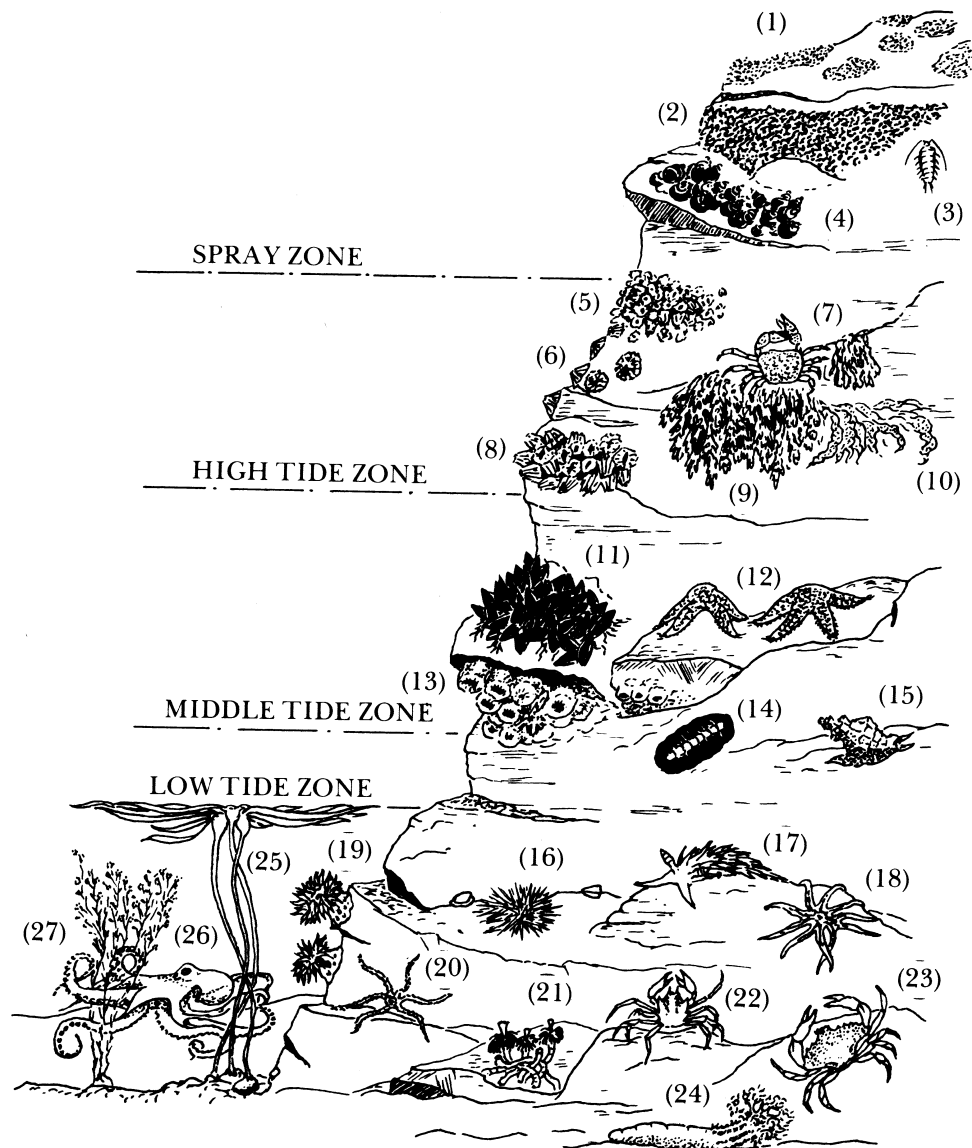
In addition to tidal effects, organisms that inhabit sandy beaches and rocky shores also have to deal with the physical stresses of pounding waves. Because of these harsh conditions, organisms have developed special adaptations that not only help them to survive but thrive in these environments.

An **adaptation** is a physical or behavioral trait that helps a plant or animal survive in a specific environment or **habitat**. Although many marine organisms may be closely related and share many characteristics or behaviors, each has its own unique set of adaptations that make it suited to a particular environment. One example of an adaptation to their environment that many marine

organisms possess is **camouflage** that makes them virtually undetectable to predators and prey alike. In this lab, we will examine a variety of organisms found on rocky shores, sandy beaches, and in the estuary and investigate how they are adapted to their particular environment.

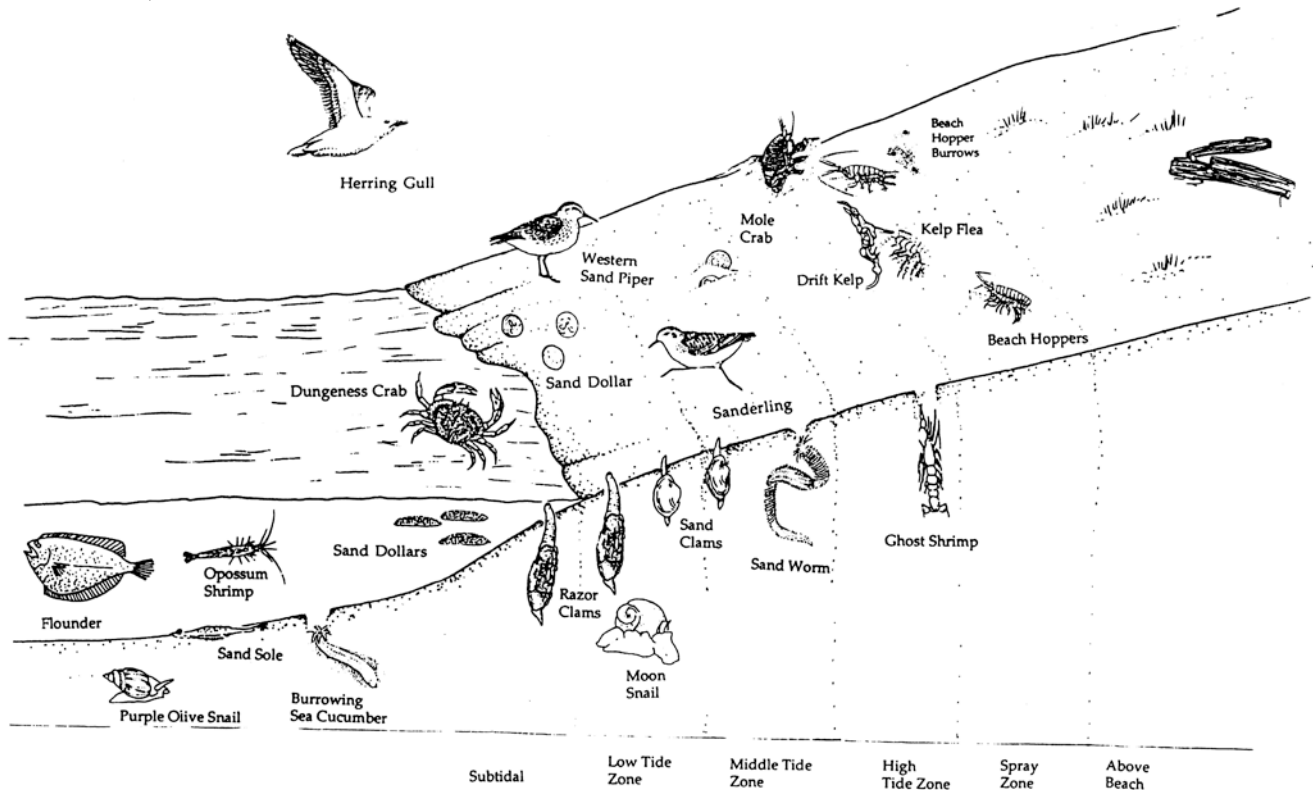
Most rocky shores are composed of impenetrable rock that the majority of organisms cannot bore into to seek protection. As a result, many organisms that are found here seek shelter from the elements and predators by hiding in rock crevices or withdrawing into hard shells. Rocky shore inhabitants are often **sessile** or attached to rocks to resist wave action and maintain advantageous positions for feeding and reproduction. Some examples of rocky shore creatures are sea stars, barnacles, limpets, urchins, and anemones.

Identifying Tidal Zones On A Beach

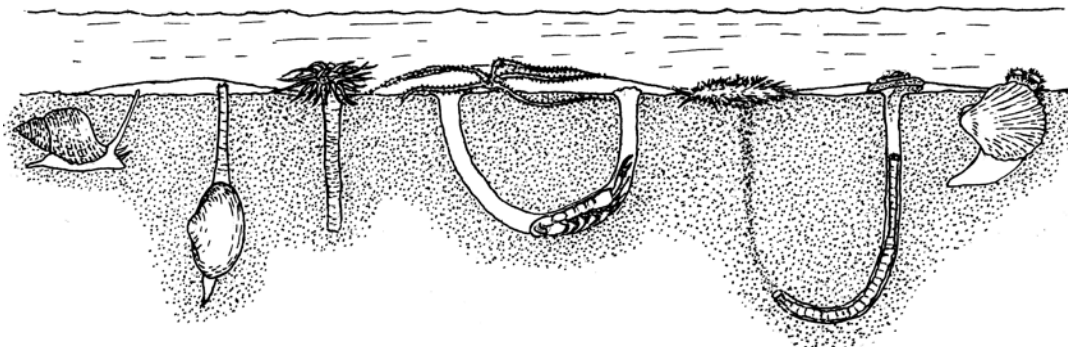


Cross-section showing vertical zonation on a rocky shore. (1) Lichens; (2) Blue-green Algae; (3) Rock Louse; (4) Periwinkles; (5) Small Acorn Barnacles; (6) Finger Limpets; (7) Rock Crab; (8) Common Acorn Barnacles; (9) Rockweed; (10) Sea Lettuce; (11) Blue Mussels; (12) Purple or Ochre Sea Stars; (13) Aggregate Anemones; (14) Black Chiton; (15) Wrinkled Whelk; (16) Red Sea Urchin; (17) Opalescent Nudibranch; (18) Sun Star; (19) Giant Green Sea Anemone; (20) Brittle Star; (21) Calcareous Tube Worm; (22) Kelp Crab; (23) Red Rock Crab; (24) Orange Sea Cucumber; (25) Bull Kelp; (26) Octopus; (27) Sargassum.

Sandy beaches are composed of tiny bits of weathered rock (sand) that are constantly being shifted by the wind and waves. Many organisms found in this environment are streamlined and/or possess shells to protect them from pounding waves. Because the sand is in constant motion, organisms that live here have nothing to attach to and may burrow in the sand to seek shelter from the elements. These animals usually possess specialized structures that enable them to dig quickly and obtain oxygen and food beneath the surface. Some examples of sandy beach animals are mole crabs, razor clams, and sand dollars.

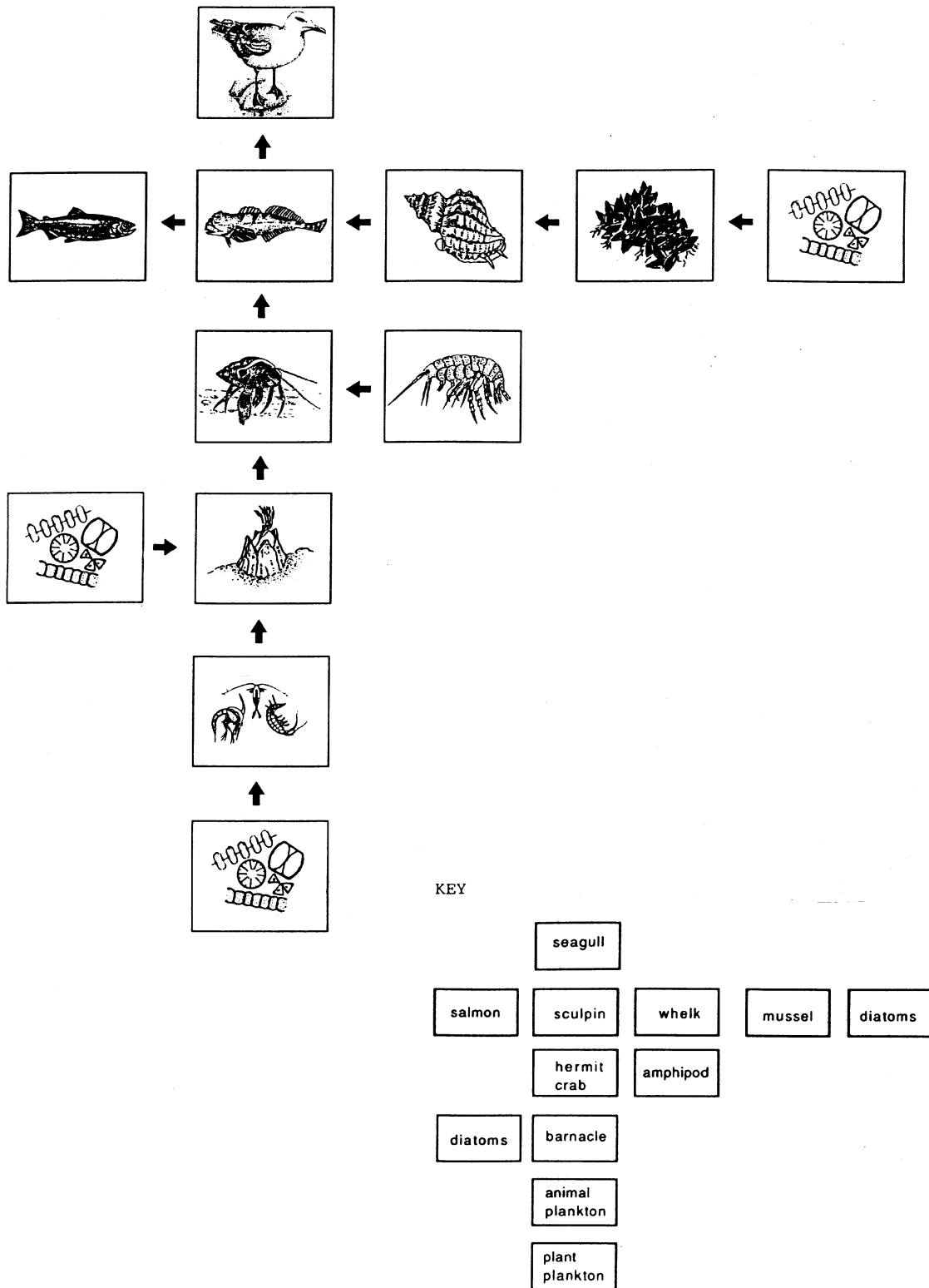


Estuaries are environments that form at the mouth of rivers where they meet the sea. Rivers erode their banks as they travel across land, carrying sediment that is then deposited when waters come in contact with the force of the ocean and river flows slow. The sediment in estuaries tends to be finer than that of sand beaches, consisting primarily of mud. As such, it can be difficult for organisms and water to move through and is often **anoxic** (devoid of oxygen). Organisms found here, including mud shrimp, polychaete worms, and cockles, create burrows in the mud and have specialized structures for obtaining oxygen and food below. Predators such as crabs, fish and birds often move in and out of the estuary with the tide, feeding on these burrowing organisms.



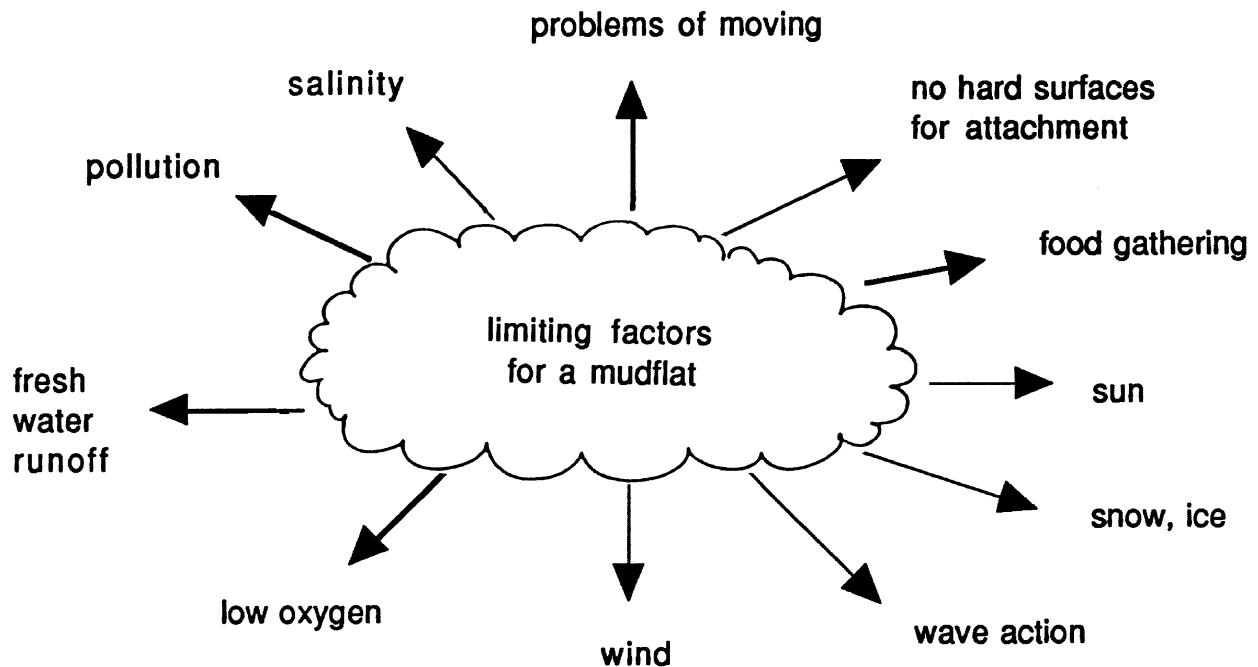
Suggested Pre- or Post-Visit Activities and Resources

Have students research organisms from one of the environments described above. Create mobiles or food webs with pictures of these organisms (example below).



Discuss one (or more) of the marine environments above then have students create a critter with multiple adaptations to that particular environment. Adaptations might include coloration, means of defense, feeding or reproduction. Have students create a picture of their critter in the appropriate environment and present it to the class, explaining how it is adapted to that environment.

Discuss the concept of **limiting factors** and how they determine what organisms can survive in an area. For example, organisms found in mud flats must be able to deal with all of the challenges listed below. Have students create a similar diagram of limiting factors for Rocky Shore and Sandy Beach environments.



“Make a Tidepool” interactive game, Rocky Shore song and other activities from the Monterey Bay Aquarium: www.montereybayaquarium.org/lc/activities/default.asp

Correlation to Oregon Science Education Standards

Grade 3

3.1 Structure and Function: **Living and non-living things vary in their characteristics and properties.**

3.1L.1 Compare and contrast the characteristics of offspring and parents.

Grade 4

4.2 Interaction and Change: **Living and non-living things undergo changes that involve force and energy.**

4.2L.1 Describe the interactions of organisms and the environment where they live.

Grade 5

5.2 Interaction and Change: **Force, energy, matter, and organisms interact within living and non-living systems.**

5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

Grade 6

6.2 Interaction and Change: **The related parts within a system interact and change.**

6.2L.2 Explain how individual organisms and populations in an ecosystem interact and how changes in populations are related to resources.

Grade 7

7.2 Interaction and Change: **The components and processes within a system interact.**

7.2L.2 Explain the processes by which plants and animals obtain energy and materials for growth and metabolism.

Grade 8

8.1 Structure and Function: **Systems and their components function at various levels of complexity.**

8.1L.1 Explain how genetics and anatomical characteristics are used to classify organisms and infer evolutionary relationships.

High School

H.2 Interaction and Change: **The components in a system can interact in dynamic ways that may result in change. In systems, changes occur with a flow of energy and/or transfer of matter.**

H.2L.2 Explain how ecosystems change in response to disturbances and interactions. Analyze the relationships among biotic and abiotic factors in ecosystems.