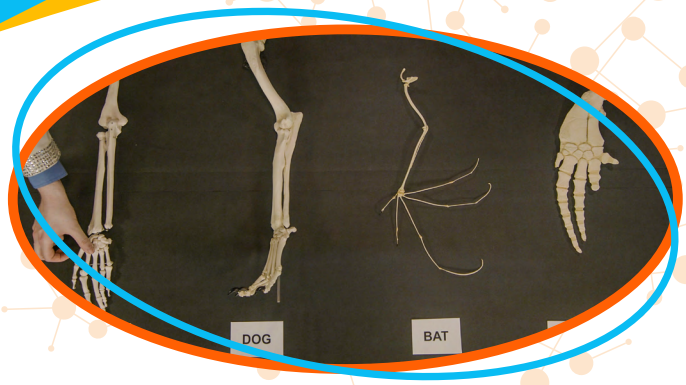
GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.



TEACHER GUIDE

COMPARATIVE ANATOMY
GRADES 6-8

COMMON MISCONCEPTIONS

- **Adaptations are anatomical traits that change in an individual organism's lifetime.**
  Many students misunderstand the word *adaptation* to mean a change that occurs within an individual organism's lifespan to increase its chance of surviving in its surroundings. A common example of this is students believing Darwin's finches changed their beak size and shape in light of drought conditions. This is not the case. Adaptations become present in populations as favorable characteristics cause some individuals in the population to survive and as future generations of those organisms possess the trait, making them most capable of surviving.

- **Modern humans were once other animals, like gorillas.**
  Students have difficulty conceptualizing relationships among aquatic and terrestrial organisms as well as human evolution. Modern humans are descendants of more primitive primates, but no gorilla alive today will ever become a human being. Students may ask, "If a gorilla lived long enough, would it turn into a human being?" Because many similarities exist between primates (such as chimpanzees and gorillas) and humans, many students believe that modern humans that exist today have evolved from other primates like gorillas. This is not the case. Modern humans possess similar structures anatomically and genetically to other primates, which means they are closely related, but small changes in DNA cause considerable changes in anatomical structure.

- **All fossils are preserved remains.**
  Most fossils are impressions, or imprints, from an organism that died and was compressed in layers of sedimentary rock. This can be called an *imprint* or a *cast*. Rarely, scientists will find whole tissue (e.g., a dinosaur bone) but almost never in its complete form. The most complete human fossil remains of early hominids ever recovered obtained approximately 40% of the full skeleton. Even more rarely, entire organisms will be preserved in ice or amber.

HOMOLOGOUS STRUCTURES

Homologous structures are evidence that organisms are related and have descended from one another over time. The word part *homo* means *same*, so homologous structures are structures that are found in multiple organisms that have similar patterns. For example, a bat and a hawk both have wings with similar bone structure. However, a bat is a mammal and a hawk is a bird. They have similar structures that show a similar pattern and are used for the same function. Other times, homologous structures can have different functions. For example, a whale fin has the same pattern and arrangement of bones as the leg of a frog, lizard, and dog, but it serves a different function in helping a whale swim versus a dog that uses that extremity to walk.

EMBRYONIC DEVELOPMENT

Embryonic development shows vast evidence that many different types of organisms show similar patterns of development, especially from the time of fertilization, until more cell specialization begins to occur. Many structures will develop similarly (e.g., brain and spinal cord), and others will develop differently (e.g., gills versus pharynx and tails versus tailbones). A fish, salamander, tortoise, pig, chicken, cow, rabbit, and human all look nearly identical shortly after the cell specialization begins to happen.

THE FOSSIL RECORD

The fossil record, to date, remains the most substantial evidence of evolution on Earth. It provides patterns of development of many organisms over time. These fossils can come in many forms—casts, molds, imprints, petrified wood, ice, amber, and more. Scientists called *archaeologists* discover and preserve fossils.

TEACHER TIPS

Use formative assessment "look fors" when students are identifying similarities and differences in organism structures to determine what misconceptions and pre-existing ideas students bring to the lesson. Also, use the probing questions to facilitate student thinking about evidence they observe, inferences they make, and how their thinking changes with new information.

ABOUT THIS LESSON

This lesson was created by the National Science Teaching Association (NSTA) to pair with the Generation Genius video and support *NGSS*.

They have requested we provide the following background with this lesson:

The Next Generation Science Standards (NGSS) are the national standards on how students learn science, and they are based on contemporary research presented in *A Framework for K–12 Science Education (the Framework).* The shift in science teaching and learning required by the Framework is summarized in this infographic: A New Vision for Science Education.

At the start of each Generation Genius lesson, students are presented with a phenomenon, then they try to explain it. Students will notice they have gaps in their knowledge and ask questions, which motivates them to build ownership of science ideas they need in order to explain how or why the phenomenon occurred. The way students build ownership of science and engineering ideas is through active engagement in the science and engineering practices (SEPs). This process of sensemaking, or doing science to figure out how the world works, is one of the major shifts the *Framework* encourages.

To engage in the SEPs, students should be part of a learning community that allows them to share their ideas, evaluate competing ideas, give and receive critiques, and reach consensus. Students can start by sharing ideas with a partner, then with a small group, and finally, with the whole class. This strategy creates opportunities for all students to be heard, build confidence, and have something to contribute to whole-class discussions. Each Generation Genius lesson provides conversational supports to facilitate such productive student discussions to contribute to sensemaking.

Excited to continue your shift toward the new vision for science education? Check out the Generation Genius Teacher Guide page on the NSTA website for resources and strategies to engage every student in your classroom in **doing** science.