GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.

TEACHER GUIDE

THE FOSSIL RECORD
GRADES 6-8

COMMON MISCONCEPTIONS

- **Fossils are the remains of the organism itself.**
  Fossils are the *preserved evidence* of prehistoric life. The most common fossils are bones and teeth but these fossils are actually made of rock! The organic material is replaced by minerals, bit by bit over time, which is why the bones and teeth retain their familiar structure and characteristics (think about the rings in petrified wood). A few exceptions to this rule: organic matter preserved in amber and mummified remains. These are much less common than replacement fossils (bones and teeth), molds and casts.

- **Scientists can tell exactly how old a fossil is.**
  Scientists use relative and absolute dating although neither type of dating reveals the actual age of fossils. Relative dating determines the age of one fossil relative to another based on their positions in a sequence of rock layers. Absolute dating techniques mostly rely on comparing the quantities of radioactive isotopes and their daughter products found in the rock surrounding the fossil or the fossil itself. These techniques provide a numerical age or range in contrast with relative dating which places events in order without any measure of the age between events (such as the time between deposition of two rock layers containing fossils).

- **Prehistoric organisms are not alive today.**
  Descendants of prehistoric animals still exist on Earth today. Many scientists believe that most birds are descended from prehistoric flying reptiles or dinosaurs. Many students believe that all prehistoric organisms are extinct, and the only evidence that exists of them is fossils. However, many reptiles and birds show strong evidence of common ancestry with ancient reptiles, some of which were very large like pterosaurs and sauropods.

EVIDENCE OF PAST LIFE

Fossils are evidence of past life. Patterns observed in groups of organisms help paleontologists make predictions about how, when, and where organisms lived. Paleontologists are always searching for more evidence of how living things have changed over long periods of time. Scientists use two primary means of determining the age of fossils. The layer of rock a fossil is found in tells scientists how old the fossil is compared to others that have been found in layers above or below it. Additionally, scientists can analyze the number of radioactive elements, such as carbon, in a fossil to determine how long ago the organism may have lived.

THE FOSSIL RECORD

Fossils are very rare because most plant and animal tissue decomposes over long periods of time. However, plant and animal tissues can interact with and become trapped within layers of sediment, preserving them for long periods of time. The chronological order in which all fossils are compiled is known as the fossil record. The fossil record allows paleontologists to determine which organisms are most closely related to each other, as well as how and when the organisms may have lived. The fossil record, although incomplete, is the most complete evidence that exists for evolution.

CHANGE OVER TIME

The fossil record provides evidence that plants, animals, and the Earth have changed dramatically over long periods of time. As the Earth's atmosphere has changed, so have organisms' capabilities to survive in certain environments. Organisms possessing traits favorable for survival pass those traits on to the next generation, ensuring survival for their species.

TEACHER TIPS

Encourage students to formulate claims based on evidence, not previous knowledge. Many students will want to formulate claims from past experiences, but encourage them to discover new evidence and formulate new claims based upon it. This infuses authentic engagement and normalizes the shift in thinking as new evidence is compiled.

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.