Is it a Horse? Of Course

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The process of evolution is something that students are unable to see operate because evolution commonly takes millions of years to produce macroscopic changes. Students may have been told about evolution in school, but developing a clear understanding of the theory can be difficult. By exploring the concepts presented in this month's books, students will develop a clearer understanding of the theory of evolution by observing macroscopic changes over time, and will notice shared characteristics between organisms with a common ancestor. By coupling the concepts of the books with the activities outlined below, students will continue to increase their knowledge about the process of evolution.

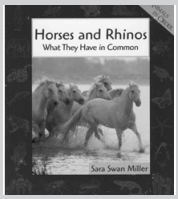
This Month's Trade Books:

Horses Past and Present

By Marianne Johnston
24 pp. Rosen Publishing Group. 2003
ISBN 082395207X
Grades K-3

Synopsis: Horses Past and Present looks at the evolution of the horse, over the last 55 million years. The book begins with a brief background on horses, and then explains the evolution of horses relating to such matters as the changing of the hoof; the migration patterns; and the taming of the horse. The book features large font and vivid photographs which complement the text. It is part of a series entitled Prehistoric Animals and Their Modern-Day Relatives which describes many different animals from past to present.

Horses and Rhinos What They Have in Common



By Sara Swan Miller
Illustrated by Steve Savage
48 pp. Scholastic Library Publishing.
1999, ISBN 0531115860
Grades 4-6

Synopsis: Horses and Rhinos compares the shared characteristics and differences of the living perissodactyls (odd-toes hoofed animals). The book groups the animals by continent, then discusses the perissodactyls of each area. The book focuses on zebras, tapirs, and burros as well as rhinos and horses. This book is part of a series of books, Animals in Order, that shows how many different modern day animals are related to one another because of their evolutionary history.

Curricular Connections:

Natural Selection is a key concept to teach when discussing the theory of evolution with students. Having students understand that conditions within an environment select for certain traits of an individual to be passed onto their offspring can be a difficult concept for children to grasp. Looking at how horses, a popular animal familiar with many students, have evolved through the years is one example of a concrete way to exhibit evolutionary change. Horses started out at about the height of a medium-sized dog, weighed around 7 kilograms, and was an herbivore, meaning it consumed twigs and bushes. Now, not only are horses taller than most humans, they also weigh between 380 to 900 kilograms (depending on the horse). However they are still herbivores, eating mostly grasses. A critical element to stress when discussing evolution with most students is that the process does not occur overnight. Students need to understand that the change in height seen in horses took place over millions of years due to their interaction with their environment. Early horses were subject to predation by many animals, including large birds. As a result of the predation; taller, faster horses were surviving which in turn meant they passed on their traits for these characteristics to their offspring. This process was repeated over millions of years, which led to the evolution of the horses we see today. This concept is illustrated in the first activity, which will compare the size of the early horse to the modern horse.

According to the K-4 national standard Properties of Earth Materials; *Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.*

Another concept central to evolution is the relationship between different species, such as the one that exists between horses and rhinos. The connection between specific species can be seen in the similar characteristics of the different animals. Two or more species may have numerous qualities in common, or only a few. The

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more traits different species have in common, the more closely related the species are likely to be. In the second activity concerning the process of evolution, students will be using a Venn Diagram to compare characteristics of horses and rhinos in order to determine if they are related.

The 4-6 grade activity meets two national science standards for the 5-8 grade levels. The first standard is under Diversity and Adaptations of Organisms; *Millions of species of animals, plants, and microorganisms are alive today. Although different species might look dissimilar, the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry.* The second standard is under Earth's History; *Fossils provide important evidence of how life and environmental conditions have changed.*

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Resources:

National Research Council (NRC). 1996. National Science Education Standards. Washington, D.C: National Academy Press.

Historie kone.
http://www.equinet.wz.cz/historie2.htm

"Skeletons." Valparaiso University. http://www.valpo.edu/organization/psme/labs/skeletons.php

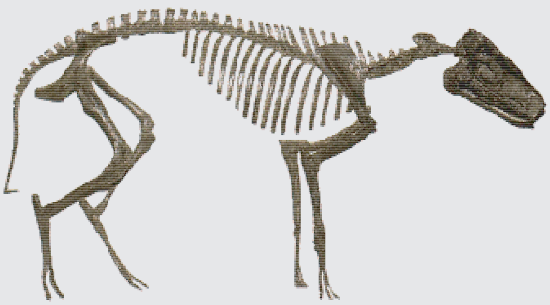
Trade Book-Inspired Investigations on Next 2 Pages:

By using the following activities, the teacher can bring clarity and purpose to the concept of evolution; the K-3 activity contrasts the size of an early horse, hoof shape, and bone structure to that of a modern horse. The 4-6 activity uses a Venn Diagram to compare horses and rhinos.

Trade Book-Inspired Investigations For K-3:

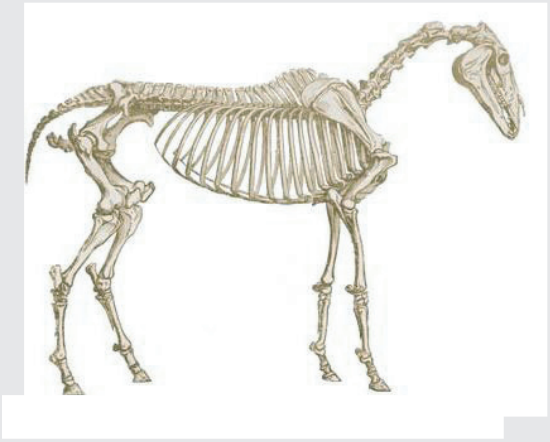
Size Comparison

To begin this activity, the teacher will need to have two overhead projectors in the classroom. The teacher will also need to create two overheads: one of a Hyracotherium or Eohippus skeleton, and the second of a modern horse skeleton. These pictures should be labeled number one and number two for use later. The images to make these overheads are provided at the end of the section. Finally, the teacher should create a 200 centimeter height chart on the wall.



Hyracotherium
http://www.equinet.wz.cz/historie2.htm

To set up the room, the teacher should position the two overhead projectors on either side of the height chart. The teacher will need to move the projectors forward or backward to make the image of the skeleton appear bigger or smaller. First, the teacher will project both images on the wall and have the class guess whether image one or image two shows the modern horse skeleton, and which image belongs to the Hyracotherium (or Eohippus). The students and the teacher will then determine how tall the Hyracotherium was (about 60 centimeters tall) by looking back through the book. Once the height of the Eohippus is found, the teacher will project the image of the early horse to a height of only 60 cm tall; the teacher may want to set the projector on the floor to show the correct height. Next, the students, with the help of the teacher if necessary, will figure out the height of a modern horse (about 150 cm from hoof to shoulder). Again, the teacher will make the projection of the modern horse be around 180 cm tall. Another way to show the students the difference between the Hyracotherium and the modern horse would be to overlay the two overheads so the students can make a direct comparison of the bone structure of the two skeletons. By overlaying the two images, the students can look at the changes which have occurred to the horse's neck, tail, rib cage, and various other bones.



Modern Horse
http://www.valpo.edu/organization/psme/labs/skeletons.php

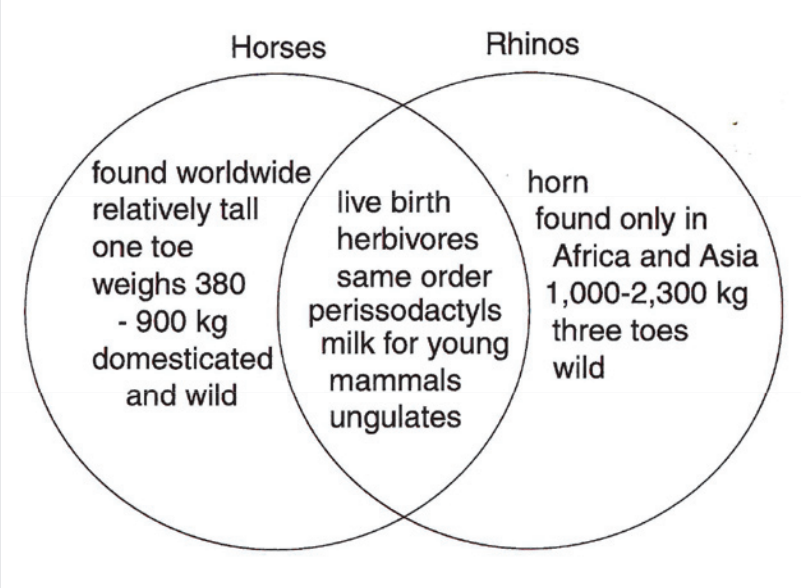
After the two projections have been created, the teacher should begin a discussion with the students about the size difference between the two horses. Ask the students questions about the two horses such as, "Which horse could better protect itself from predators?" Another question you could ask is about the horse's diet: "Do modern horses still eat the same food as the Hyracotherium?" Lead this question into a discussion about the horse's jaw, and how it works well for grinding. Also, the students may notice differences in the skeletal structure of the horses. The hooves of the Eohippus have three toes, while the modern horse only has one toe, both of which are an odd number. Students may note the similarities of the two skeletons; both the front and hind legs of the horses have bones that bend in the same direction; but, have the students notice that the leg bones have lengthened when comparing the Hyracotherium to the modern horse.

Students may ask how the horse became so tall; the answer is based upon which horse reproduced most successfully, the taller, bigger horses. As time passed, predation of smaller horses increased, and the location of their food source was located higher off the ground. Horses had to change physically or become extinct. Thus, taller horses were favored by the environment and passed on their traits of height to the next generation. As more time passed, horses became taller and taller because the environment continued to favor the taller horses. It is important for students to understand that Eohippus horses lived 55 million years ago, so it has taken a tremendous amount of time for the modern horse to become the size that we are familiar with today.

Trade Book-Inspired Investigations For 4-6:

Horses and Rhinos

Students will be constructing a Venn Diagram comparing the characteristics of horses and rhinos. To create a Venn Diagram, you need draw a circle, then draw a second circle that overlaps about a quarter of the first circle. One circle will represent the characteristics of horses, the second of rhinoceroses, and the overlapping area will indicate the traits that both animals have or share.



As the teacher reads through the Horses and Rhinos book, he or she should have the students record the similarities and differences between horses and rhinoceroses. Some examples of similarities are: both animals are perissodactyls; they are both part of the same order; herbivores; mammals; as well as bone structure and any others the students may find. Differences between the two animals may include: where they are found (horses worldwide and rhinos Africa and Asia); horses are taller; rhinoceroses have horns; the number of toes (horses have one and rhinos have three); how much they weigh (horses 380 kg to 900kg and rhinos 1,000 kg to 2,300 kg); and how humans use the animal (work vs. eco-tourism). Some information can also be gathered from the "Words to Know" section of the book so students will know the definitions of words like ungulate (a mammal with hooves). See the image below for an example of a complete Venn Diagram.

Students do not need to illustrate the genetic or behavioral similarities between horses and rhinoceroses, just observable traits. The students could work in pairs or individually while completing this activity, depending on the teacher's preference and the students' ability.

Once the students have completed the Venn Diagram, have them share theirs with the rest of the class. Have the students explain what information they found, and where they found the information. Also, have the students explain to the class how they determined whether a characteristic was that of only a horse, only a rhino, or both a horse and a rhino.