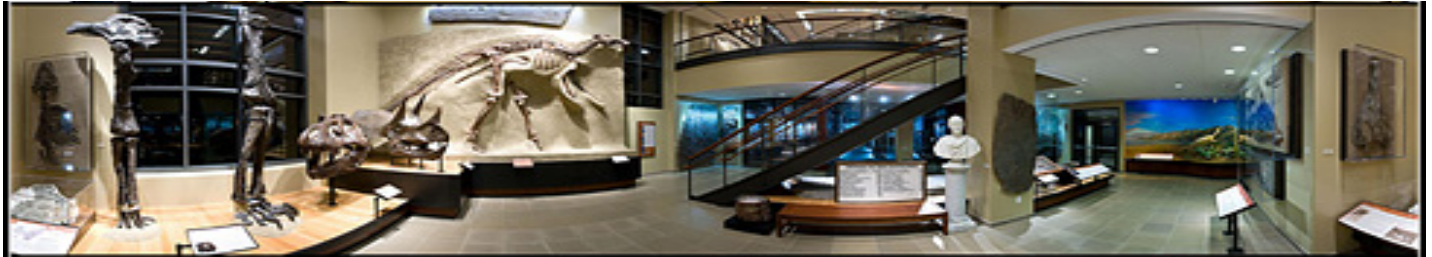


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Evolution, Speciation & Extinction

Hints for Teachers (College and AP Biology)



MUSEUM INFORMATION:

"Evolution, Speciation & Extinction" is a worksheet to practice scientific observation skills which is designed to be used in the Beneski Museum of Natural History in conjunction with the classroom curriculum; however, it can also be used independently.

- The museum does NOT provide copies of *Evolution, Speciation & Extinction*. Please prepare copies for your students.
- The Beneski Museum of Natural History displays the fossil remains of many different creatures throughout different periods of life.
- While exploring the exhibition, encourage your students to look above their heads to see specimens displayed at different levels of the museum.
- The Beneski Museum of Natural History can accommodate up to 45 children and chaperones at a time. Please consider splitting into smaller sub-groups when completing the *Evolution, Speciation & Extinction* activity.
- When your students arrive at the museum, they will be given a brief greeting by a museum staff member. After this greeting is a good time for you to talk to your students and chaperones about the *Evolution, Speciation & Extinction* activity.

PREPARING AN ACTIVITY:

- *Evolution, Speciation & Extinction* asks students to look closely at specimens and make thoughtful observations about what they are looking at. Please pay close attention to the written interpretive materials associated with each specimen.
- The museum asks that students refrain from leaning on any of the glass cases while working. We recommend providing students with clipboards or notebooks to lean on.
- *Evolution, Speciation & Extinction* has a brief set of directions printed at the top for chaperones to use.

IN THE CLASSROOM:

- Key vocabulary to review prior to your scheduled visit.

autotrophs
microphylls
carnivores

Cretaceous/ Tertiary boundary

heterotrophs
megaphylls
herbivores

desiccation prevention

symmetry
sessile
Pleistocene

desiccation prevention

body segmentation
motile
genus species

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Evolution, Speciation & Extinction Information for Chaperones



Complete this activity in the Beneski Museum of Natural History.

- Please allow your students a few minutes to explore the main and bottom floor before beginning the *Evolution, Speciation & Extinction* activity.
 - Consult with other chaperones and have students break into smaller groups and assign them each a question to start with so they start at different sections. This way not all of the students are looking for the same thing.
- ✓ Remind your students to look all around them, even above their heads.
- ✓ Remember: While in reach of students, remind them that the exhibits in the museum are fragile. Please do not allow them to touch any of the exhibits.

Acknowledgements

We wish to acknowledge and thank the staff of the following organizations for permitting us to share some of the best lab and field guide materials created for use in the Beneski Museum of Natural History.

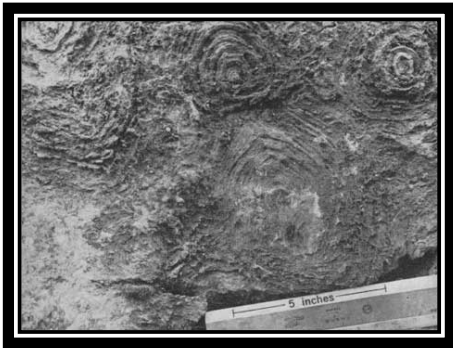
Amherst Public Schools
Brown University
Four Rivers Charter School
Greenfield Community College
Holyoke Community College
McAuliffe Regional CPS
Mount Holyoke College
Northampton Montessori School
Northampton Public Schools
Smith College
University of Massachusetts
Williamsburg School

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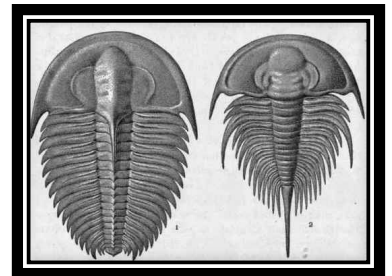


Evolution, Speciation, and Extinction College and AP Biology

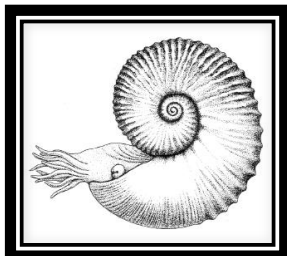
1. *On the top floor, examine the large stromatolite. What organisms were responsible for the formation of this large structure? Were these autotrophs or heterotrophs? Meaning?*



2. *Along the back wall of the top floor, behind the Paleozoic seas fossils look for the display drawers housing Trilobites, Ammonites, and Nautiloids. What type of symmetry do these organisms display? Even though these fossils are non-living, can you infer whether these animals were likely to be sessile (immobile) or motile (mobile)? How did you come to this conclusion?*



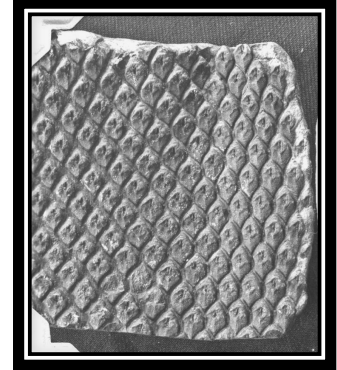
Do the trilobites and ammonites show evidence of body segmentation? What was the apparent function of the chambers inside the shell of the Nautiloides and Ammonites? Did the animal live inside these shell chambers?



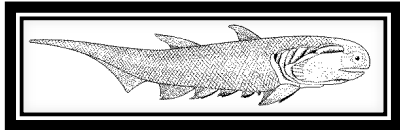
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3. *Move to the display drawers along the wall at the top of the stairs. In the Plant Fossils drawers, locate the large Lepidodendron fossil. Are the leaf-like structures coating the stem of this species microphylls or megaphylls? What structural feature preserved in the fossil leads you to this conclusion?*



4. *On the main floor by the entrance door, examine the display drawers along the back wall of the museum, starting at the main door. In what organism did jaws first evolve? What are some of advantages of jaws?*

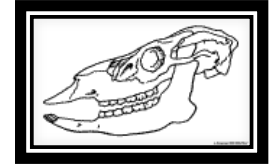
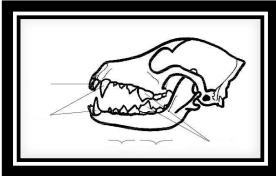


5. *Along the back wall of display drawers on the main floor: What evolutionary innovation allowed the Tetrapod lineage to become capable of completely terrestrial life – to reproduce on dry land?*

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6. Using the exhibit in the display case on the front side of the stairs on the main floor, explain how and why teeth differ between carnivores and herbivores. What are two obvious characteristics that vary with these alternative animal feeding habits?



Find one herbivore and one carnivore in the museum. List the genus and species and mention the specific traits you used to make this conclusion.

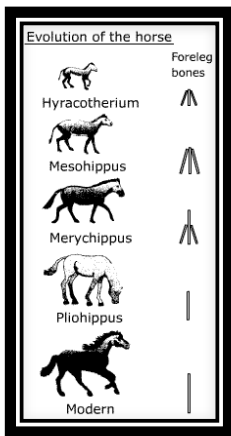
7. Examine the bird display on the main level. In what geological period did all of these birds go extinct? What general processes contributed to their extinction? Check out the *Moa* (a recently extinct, flightless bird from New Zealand). Do you see any similar feet represented elsewhere in the museum, and, if so, to whom do the feet belong? Do these similarities make sense evolutionarily?



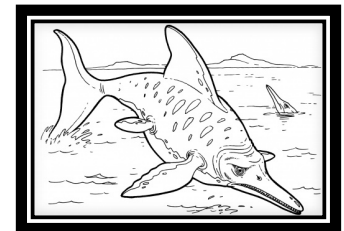
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8. Horses are native to North America, although they had gone extinct in North America prior to the arrival of humans. Horses represent a lineage that has seen an incredible sequence of evolution and adaptation over time. *Look for the large display featuring horses in the case along the backside of the stairs leading to the second floor.* The exhibit traces the evolution of horses from the ancestral forms, Hyracotherium, Mesohippus, and Merychippus, to the modern horse Equus. **Identify two evolutionary changes in the limb bones of these horses that are adaptations for a running lifestyle, and briefly explain the advantages conferred by each. How did the horses' habitat shift? How and why did teeth change with this shift in habitat?**

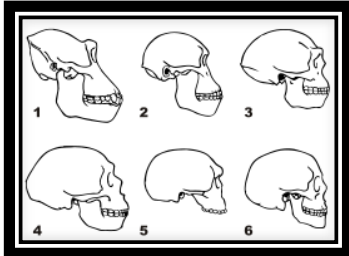


9. *On the lower level of the museum, locate the Ichthyosaur (Stenopterygius quadriscissus) fossil.* **How did this organism make a living** (i.e. where did it live and what did it eat) **and how can you tell? What was its likely ecological niche? What physical characteristics help you make this inference? What present day organism is convergent with this extinct creature?**





10. Examine the display on hominid evolution upstairs by the tables. **What are the three main evolutionary innovations that separate hominids from apes? Which of these characteristics is thought to have evolved first?**



11. Compare the teeth of *Homo sapiens*, *Pan paniscus* (the pygmy chimpanzee or bonobo), and *Paranthropus boisei*. **Explain how these differences reflect how they procured and processed food.**

Questions to think about:

12. Consider the various major extinctions that have occurred in geological history. **Compare and contrast the causes and effects of the Pleistocene extinction with the mass extinctions at the Cretaceous/ Tertiary boundary** (when dinosaurs went extinct).

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13. Essay: **Compare and contrast the adaptations of vertebrates to land versus the adaptations of plants to land.** In your answer you may want to consider gas exchange, desiccation prevention, reproduction, etc.

