

Life System and Environmental and Evolutionary Biology II

Lab 6: Pattern and Process in Evolution

Location: The American Museum of Natural History (AMNH)

Notes

Please read the directions on the web to the American Museum of Natural History. There is a \$9.00 “suggested” admission price for students with ID and the AMNH’s hours are 10:00 am to 5:45 PM every day.

The best times to visit are the first couple of hours in the morning, especially on weekends. Try to avoid those days when schools visit. The noise level is unbelievable! Call (212) 769-5606 to find which days those are.

Also, remember to take your class notes and the text with you. As with the previous labs, this lab should take several hours, so budget your time accordingly.

Once you reach the Museum, get a floorplan, and follow the instructions below:

This lab has three goals:

1. To demonstrate the importance of phenotypic variability as the ‘ingredients’ of evolution. What does evolution work on at a microevolutionary level?
2. To focus on the importance of primitive and derived traits in an evolutionary context. How can we tell that evolution has occurred within a particular group of organisms?
3. To examine patterns of speciation in the evolutionary record. What does evolution look like from a macroevolutionary perspective?

1 Phenotypic variability

Location: *Hall of Biodiversity*, 1st. Floor. On the wall depicting examples from all the phyla of life, find the Mollusca (they are at the far right). Using the interactive key to what is on the wall, you should be able to identify species for which multiple individuals are included in the display. Examples include *Helix polymita*, *Murex troscheli* and *Tibia fusus* (there are many more).

1. Choose any *three* of the multiple-specimen mollusc species that look interesting to you, and describe the variability that exists within each species.
2. What might account for the broad range of phenotypes that occur within each species? Speculate as to what selective factors may be at work here.
3. Consider the phenotypic variability that exists within the human species. Are some species more variable than others? If yes, why? If no, why not?

2 Genetics and phylogeny reconstruction

Location: *Hall of Ocean Life*, 1st. Floor. Turn to the right as you walk in, and go to the wall display showing the invertebrate evolutionary tree.

1. Using the tree and the interactive displays, briefly describe one example where recent investigation of genetic evidence has changed our understanding of phylogenetic relationship among invertebrate phyla.

3 Primitive and derived traits

Start: *Wallach Orientation Center*, 4th. Floor. Go to the Orientation Center and watch the film (about 15 minutes) that introduces the exhibits on this floor. Study the layout of the exhibits in more detail, and tour the exhibit, starting in vertebrate origins and ending in the Milstein Hall of Advanced Mammals. Based on information presented in the cladogram that structures the exhibit, answer the following questions:

1. List the 20 main synapomorphies for vertebrates and describe the primitive and derived states of each of these characters.

These questions require a bit more thought

2. Pick ten of the synapomorphies from your previous answer and explain the adaptive significance, if any, of each one.
3. Are these new traits 'improvements'? Explain.

One final question

4. What is the most speciose (greatest number of species) group of vertebrates? Why? (Consider your answer here in light of your answer to #3, above.)

4 Patterns of evolution

Location: *Milstein Hall of Advanced Mammals*, 4th. Floor. Find the display on horse evolution. One display shows how G. G. Simpson (a Columbia professor and one of the fathers of the Modern Evolutionary Synthesis) envisioned horse evolution. A second shows "revised" hypothesized evolutionary patterns.

1. Contrast these two phylogenies. How are they similar and how do they differ? What insights have occurred since Simpson's work to lead us to the "current" view?
2. Identify points on these phylogenies that a proponent of gradualism would agree with, and points that might demonstrate punctuated equilibrium. Is one pattern more predominant than another? If so, which and why? If not, why not?