CHAPTER 11

ORIGINS OF EVOLUTIONARY SCIENCE

Monday, July 19, 2010
Fossils

- Examination of the fossil record reveals changes in life forms throughout the Earth’s history
- Majority of fossils are hard body parts (bone, teeth, shells)
- Some fossils are traces of activity (footprints, burrows)
- Rarely found are entire bodies (insects in amber, mammoth in ice)
- The most numerous fossils are microscopic (pollen, foraminifera)
- The study of fossils is PALEONTOLOGY
- Modern fossil record is comprised of more than ¼ million species
Evolutionary Concepts

- Wallace (evolution, natural selection)
- Mendel (inheritance)
- Darwin (evolution, natural selection)
- Lyell (uniformitarianism)
- Cuvier (paleontology)
- Malthus (populations)
- Lamarck (evolution)
- Hutton (gradualism)
- Linnaeus (taxonomy)

Timeline:

- 1750: American Revolution
- 1800: French Revolution
- 1850: U.S. Civil War

- 1795: Hutton proposes his theory of gradualism.
- 1809: Lamarck publishes his theory of evolution.
- 1830: Lyell publishes Principles of Geology.
- 1831–1836: Darwin travels around the world on HMS Beagle.
- 1837: Darwin begins his notebooks on the origin of species.
- 1844: Darwin writes his essay on the origin of species.
- 1858: Wallace sends his theory to Darwin.
- 1859: The Origin of Species is published.
- 1865: Mendel publishes inheritance papers.
Evolution

- Evolution → the change over time of the genetic composition of populations

- Natural selection → populations of organisms can change over the generations if individuals having certain traits leave more offspring (differential reproductive success)

- Evolutionary adaptations → a prevalence of inherited characteristics that enhance an organism’s survival and reproduction
Natural Selection

- Darwin observed that:
  i) organisms produce more offspring than the environment can support
  ii) organisms vary in many characteristics
  iii) these variations can be inherited
  iv) populations tend to remain stable over long periods of time
- Darwin concluded that
  i) individuals best suited for a particular environment are more likely to survive and reproduce than those less well adapted
  ii) As a result, the proportion of individuals with favorable characteristics increases
  iii) Populations gradually change in response to the environment
- Darwin called “the preservation of favorable variations” natural selection
Natural Selection

Green beetles have been selected against, and brown beetles have flourished.
Darwin also proposed that each living species has descended with changes from other species over time.
Evidence for Evolution

- **BIOGEOGRAPHY** → study of the location and distribution of organisms
  (ie. similarity amongst organisms on different continents)
- **FOSSIL RECORD** → shows a succession of forms over time
  → displays transitional links between species
  → suggests vertebrate descent
- **COMPARATIVE MORPHOLOGY** → analogous features
  → structures that share common function but not origin
Evidence for Evolution

- COMPARATIVE MORPHOLOGY → homologous features → structures that share common origin but perform different functions