Introducing Evolution Experiences

1. Recap of Problems: Show slides:
   Diversity of life: array of microbes, plants, animals
   Life over time: fossil plants and animals, different types in different time periods of deep past;
   Modern life forms not in earlier times. If all kinds of life had appeared all at once (as traditionally believed), what should we see in fossil record? All diversity, all at once. Do we see that? No.
   Intermediate forms of life, e.g., Archaeopteryx, platypus, Euglena. What are they?
   Series of fossils: showing change over time:
      Hominin fossils (Skulls Lab and Chronology Lab)
      Vertebrate classes: gradual accumulation of traits (see chart from Patterns in Time).

2. Proposed Solution: Evolution
   Emerging Picture:
      Life emerged gradually over vast periods of time
      New organisms formed from previous organisms through gradual change
      All the major groups of living organisms are connected by common ancestry:
      Show a few evolutionary trees (phylogenies and/or cladograms);
      Develop Tree-Thinking skills.
   This is called "Evolution"

3. History of idea (briefly): see Wikipedia: Evolution: (Show Slides):
   Early Greek and Roman thinkers - just the general idea that different types of organisms can descend from other types
   Lamarck (1809) was first to propose a natural way for evolution to happen:
      Organisms "adapted" by inheriting changes acquired by use and disuse of features.
   Charles Darwin (1859) published his proposed theory of natural selection, along with abundant examples and evidence, and tested with arguments against the idea. [Show slides depicting the key parts of natural selection: Overproduction (salmon eggs), Variation (array of a species, e.g., ladybugs, or Ensatina, showing conspicuous variation), Environmental Change (CO2 "hockystick" graph of global warming), Struggle for Existence (members of same species competing for dying plants), Survival of the Fit (lungfish burrowing in mud), Inheritance of "selected" features (Parent and offspring), New Species (all with "selected" features).]
   The "Modern Synthesis" (1920-) merged growing understanding of genetics and mutation theory with natural selection. This has since been reinforced and expanded to include advances in molecular biology and Evo-Devo (revelations of evolutionary-developmental biology).

4. Darwin's Story: Show Videos
   Show one of the many good videos about Charles Darwin.
   As a child, a student, a young traveler around the world, as a family man, as a scientist;
   his Galapagos experience, Darwin's Finches
   What Darwin Didn't Know: 1 h 54'
   What Darwin Never Knew (NOVA: 1h 54’)
   What Darwin Never Saw: 46'

5. Problem: Repairing the Common Confusion of Natural Selection with Lamarck's Ideas
   Comparing Evolution Mechanisms: Information & Worksheet (3 pages)
   Lamarck vs Darwin: Dueling Theories (ENSI Lesson)
6. Natural Selection Experiences (Interactive Lessons)
   Variation Lesson (Peanut Lab, or equivalent)
   The Chips are Down, or one of the other natural selection simulations
   Chaos & Order: Non Random vs Random
   Natural Selection: An Accumulative Process (It's in the cards)
   Blocks & Screws: Screwy Contrivances
   Nova Evolution Lab Lessons (5Es, includes Training Trees - building phylogenetic trees)
   The Origin of Species: The Beak of the Finch (HHMI: highly recommended)