History of Life on Earth
26 March 2003

I. Before Life Began
   • Big Bang produced
   • Elementary particles formed
   • H gave rise to the other elements
   • Our galaxy
   • Our solar system
   • Early earth had water vapor, but little O₂
     - Oceans formed 4.5 Bya
     - Continents 3.6-2.5 Bya

II. The Origin of Life
   • Life =
   • All life
     - Synthesis/utilization of only L isomers of amino acids
     - Universality of the genetic code
   • Research and the Origin of Life
     - Simple organic molecules can be produced by purely abiotic chemical reactions (p. 167)
     - These early simple molecules
     - Lipid membranes can form spontaneously

III. Precambrian Life
   • Precambrian = 3.6 Bya – 543 Mya
   • First definitive sign of life = 3.5 Bya (bacteria)
   • No O₂ for early life,
     • By 543-505 Mya, modern-day levels of O₂ existed.
     • Eukaryotes arose from prokaryotes 1.4 Bya
       - Nucleus
       - Mitotic spindle
       - Meiosis
       - Highly organized recombination/sex
       - Mitochondria, chloroplast,

IV. Paleozoic Life: Cambrian Revolution
   • Cambrian = 543 – 500 Mya
   • Almost all modern phyla and classes
   • Burgess Shale of British Columbia is one of the best records
   • Mass extinction at the end of the cambrian
V. Paleozoic Life: Ordovician-Devonian
   • 500-354 Mya
   • Following the cambrian extinction, many phyla diversified
   • Fishlike vertebrates appeared
   • Another mass extinction
   • First evidence of terrestrial life
   • First land animals appear
   • First land vertebrates appear

VI. Paleozoic Life: Carboniferous-Permian
   • 354-251 Mya
   • Gondwanaland and Laurasia supercontinents
   • Terrestrial Life
     - Several new orders of arachnids
     - Winged insects
     - Holometabolous insects appear
     - Amphibians diversified, primitive amniotes appear
   • Aquatic Life
     - Many groups recover from Devonian extinction
     - Sharks diversify
   • At the end of the Permian, the most massive extinction in water occurred

VII. Mesozoic Life
   • 251-65 Mya: Age of Reptiles
   • Pangaea broke up
   • Another mass extinction at the end of the Triassic and one at the end of the Cretaceous
   • Terrestrial Life
     - Gymnosperms
     - Angiosperms appear
     - Most advanced orders
     - Angiosperm and insect co-evolution very
     - Most

   • Marine Life
     - Diversification again after last extinction
     - Modern corals evolved, bony fishes radiated
VIII. Cenozoic Era

- 65 Mya-present
- Laurasia breaks up
- Bering land bridge
- Gondwanaland breaks up

Aquatic Life
  - Sand urchins
  - Great
  - Sea mammals

IX. Cenozoic Era: Terrestrial Life

- Modern frogs, birds appear
- Snakes radiate
- Mammals explode:
- Worst fossil evidence

X. Pleistocene Events

- 1.8 - .01 Mya
- Continents were in their present-day position
- Four major glacial advances-retreats occurred
- The last glacier began to melt 18,000 years BP (before present),

- There is no reason