GENERAL BIOLOGY Lecture 19 - Evolution

I. Population Genetics (continued)
- A. Evolution of a species - a GRADUAL process
  - 1. Process by which species originate - speciation - HOW??????
    - a) Reproductive isolating mechanisms
      - 1) Mechanical - reproductive organs
      - 2) Gamete isolation - external fertilization (sea urchin)
      - 3) Time isolation - species "in heat," or time of emergence (cicadas)
      - 4) Behavioral isolation - dancing or other reproductive ritual
      - 5) Hybrid inviability - incompatibility (abortion)
  - 2. Modes of speciation
    - a) Allopatric (isolated location) - most common
    - b) Parapatric (transition location) - like mountains and dessert
    - c) Sympatric (ecological, behavioral, - barriers WITHIN boundaries)

II. Evolution - proceeds by modification of the genetic makeup of existing organisms

Macroevolution - large-scale patterns, trends, and rates of change among groups of species
- A. Phenotype - morphological, physiological, and behavioral traits of an individual
- B. Phylogeny - evolutionary relationships among organisms
- C. Systems of classification (Remember KPCOFGS?)
  - 1. Evolutionary taxonomy - based on a mixture of morphological and evolutionary relationships (reptiles, birds, and mammals grouped)
  - 2. Cladistics - based on lines of decent (turtles, mammals, lizards & snakes, crocodiles, dinosaurs, and then birds)
- D. Types of speciation
  - 1. Gradualism - morphological changes occur slowly within a species
  - 2. Punctuation - morphological changes take place rapidly during speciation

III. Evolution and The Origin of Life
- A. Evolution of life is linked to the physical and chemical evolution of the Earth
- B. Early Earth
  - 1. Big Bang Theory - particles scattered and recondensed to form the Earth
  - 2. After the Big Bang, Earth had the elements needed to make biological molecules - carbon (methane), nitrogen (ammonia), water, and hydrogen
  - 3. Methane, ammonia, and water can combine (with energy in the form of lightning) to form amino acids
- C. The first protein
  - 1. Remember - life is protein - "we're all just big bags of enzymes"
  - 2. How did the first amino acids assemble to make proteins?
    - a) Hypothesis: Naturally occurring clay crystals served as templates for protein assembly
    - b) Selection of specific assembled proteins came about from "survival of the fittest"
    - c) Nucleotides (RNA) may also have been attracted to the clay particles and somehow participated in protein synthesis - replaced the clay particles
    - d) Where does the role of DNA come in this hypothetical mechanism?
- D. The first membrane
  - 1. Proteins, by themselves, form spheres called microspheres
  - 2. Microspheres tend to pick up lipids from water - outcome is a lipid film around protein
  - 3. Membranes could have arisen through spontaneous, but inevitable chemical events
- E. The first organisms - metabolism
  - 1. Probably anaerobic - produced ATP from anaerobic glycolysis
  - 2. Photosynthetic cells came along
    - a) Photosynthesis changed the surface of the Earth by increasing the oxygen supply
  - 3. New organisms used oxygen to increase respiratory efficiency
- F. The first cell and the first multicellular organisms
  - 1. Something "ate" or engulfed a mitochondrion
  - 2. Something "ate" or engulfed a chloroplast