The Origin and Chemistry of Life

1. Spontaneous Generation of Life?
   a. Early scientists thought it could be done
   b. Pasteur proved that it did not happen
   c. The problem is that it must have once - what about the origin of life?

2. Molecular Structure of Living things - Kinds of basic chemicals
   a. Carbohydrates - C, H, O
      i. Structural elements and energy storage
      ii. Produced by photosynthesis - also by animals
      iii. Three classes
         1. Monosaccharides - simple sugars - glucose
            a. Can contain different numbers of carbons in backbone
               i. Hexose best known
      2. Disaccharides - 2 simple sugars linked together
         a. Sucrose - table sugar
         b. Lactose - milk sugar
      3. Polysaccharides
         a. Multiple sugars hooked together
            i. Cellulose - major component of wood, paper and cotton
            ii. Glycogen - sugar storage in animals
            iii. Chitin - covering on insects
   b. Lipids - fats - energy storage product
      i. Triglycerides
         1. Long chain "fatty acids" attached to glycerol - 3 carbon sugar
      ii. Phospholipids
         1. Triglyceride with one fatty acid removed and replaced by phosphate
         2. Neat characteristics. - one end dissolves in water, other does not.
            a. Make up membranes - We will see
   c. Proteins
      i. Amino acids - 20 of them
      ii. Hooked together with peptide bonds
      iii. Can make very complex structures
         1. Almost everything you see on an animal is a protein
            a. Hair
            b. Skin
            c. Egg white
3. Chemical evolution
   a. How do you make original molecules of life
      i. Haldane and Oparin
         1. Hypothesis that earth had a highly reducing atmosphere of water,
            methane, ammonia, and hydrogen.
         2. Produce a spark and you get a soup of amino acids and other organic
            compounds
         3. The problem is that the early atmosphere was probably carbon dioxide
            a. Not really a problem because other gas mixtures yield the
               same result
            b. Need a long period of chemical evolution
   
4. Fossil record of living things
   a. Microfossils in rocks - as old as 3.8 billion years ago - earth is 4.6 billion
   
5. Origin of Metabolism
   a. Heterotrophic world - origins - gained food from biotic soup of environment - probably
      anaerobes
   b. Autotrophes - plants were late comers
   c. Appearance of photosynthesis
      i. Major change - molecular oxygen in atmosphere
      ii. Interfere with anaerobes - put them out of business
         1. But oxidative metabolism yields lots more energy
      iii. "Red" beds - oxidized Fe - first evidence of oxygen in the atmosphere.
   
6. Prokaryotes
   a. Bacteria and Blue-green algae
      i. No organized cell nucleus
      ii. 1 to 2 billion years were only life on earth
   b. Eukaryotes
      i. Have a true nucleus - surrounded by membrane
      ii. Potential symbiotic origin
      iii. First arose about 1.5 billion years ago