I. Cytoskeleton - structural framework extending throughout the cytosol
   A. Composition - protein fibers
      1. microtubules
      2. microfilaments
   B. Functions
      1. “skeleton and muscle of the cell”
      2. maintains cell shape
      3. connects organelles
   C. Microtubules
      1. hollow cylindrical structures (13 parallel strands)
      2. tubulins
      3. centrioles
      4. support
         a. part of “scaffolding”
         b. example:
      5. movement
         a. cilia and flagella
         b. also can move organelles and chromosomes
   D. Microfilaments
      1. solid rods of protein
      2. actin
      3. function mainly for contraction of muscle cells

II. Endoplasmic Reticulum
   A. Network of branching and converging membrane-bound channels (cisternae)
   B. System of “flexible pipelines”
   C. 2 types
      1. rough (RER)
2. smooth (SER)

III. Ribosomes
   A. Free or attached to RER
   B. NOT membrane-bound
   C. Consist of rRNA and protein

IV. Golgi Apparatus
   A. Bowl-shaped organelle, usually near nucleus
   B. Stack of parallel, flattened sacs (cisternae)
   C. “Processing and packaging plant”
      1. products enter at one side (mainly from ER)
      2. materials modified to produce final products
      3. packaged into vesicles for:

V. Lysosomes- packets of enzymes
   A. Can destroy harmful substances (bacteria, toxins)
   B. Destroy worn-out organelles
   C. Membrane-bound
   D. Enzymes
   E. Large #’s in WBC’s
   F. Mechanism
      1. phagocytic cell engulfs bacterium
      2. lysosomal membrane fuses with membrane of vesicle containing bacterium
   G. Involved in apoptosis

VI. Peroxisomes
   A. Enzymes differ from lysosomes
      1. oxidases
2. catalases

VII. Mitochondria - powerhouses of the cell
   A. Convert nutrient energy into ATP
   B. Membranes are involved in chemical reactions that produce ATP
      1. outer membrane (smooth)
      2. inner membrane
         a. numerous inward folds
         b. surrounds gel-filled space (matrix)
      c. cristae
   C. Self-replication
      1. have own DNA
      2. new mito produced by division of old ones

VIII. Centrioles
   A. Short assembly of microtubules
   B. Role in cellular reproduction (part of mitotic spindle)
   C. Basal bodies of flagella and cilia