        - Vacuole-storage organelle, in all eukaryotes, though most prevalent in plant cells as a central vacuole and stores water; contractile vacuole squeexes out water to propel cell or modify tonicity
    - Endosymbiotic Theory
        - Eukaryotic cell formed when one cell engulfed another
        - Mitochondria, chloroplasts, and nucleus can act like their own cells
            - Contain their own DNA
            - Can make proteins
            - Have double membranes
            - Have ribosomes
            - Divide independently
    - Cell size
        - Surface area: volume ratio
            - Want a high ratio
            - Want more surface area, and less volume (demand)
- 6) Chapter 5, Part 1
    - Membrane structure and components
        - Fluid mosaic models: can move and is made of many parts
        - Made of amphipathic phospholipids arranged in a bilayer
            - Constant lateral movement and little flip flop
            - Hydrophilic heads and hydrophobic tails
        - Integral and peripheral membrane proteins
        - Glycolipids and glycoproteins-carbohydrates attached for cell-cell recognition
        - Membrane proteins:
            - Channels and carriers
            - Stationary enzymes
            - Receptors
            - Recognition/communication
            - Junctions
            - Maintenance of cell exterior (protein matrix)
    - Rules of Membrane Permeability
        - Selective permeability
        - Main function of membrane is to decide what can and cannot enter the cell
        - Nonpolar dissolve freely
        - Ions and polar molecules are slowed or stopped and will need a transporter (charged atoms, glucose, water)
    - Passive transport
        - Simple diffusion-occurs for molecules that easily cross the membrane on their own
        - Osmosis-diffusion of water
            - Tonicity-ability of a surrounding solution to cause a cell to gain or lose water

        - Move signal through the cell
        - Sequence of phosphorylation
            - Done by protein called kinases
            - Add a phosphate
        - Phosphorylation cascade
    - Response
        - Cellular response-changing enzymatic activity
        - Nuclear response-involves transcription factors and change in production in the cell
- Reception of Cell signals
    - G protein-coupled receptors (extracellular)
        - Receptor binds to ligand, shape change leads to binding of G protein, G protein is then turned on by joining with GTP, active G protein goes to a specific enzyme and activates it to lead to a cellular response, system is reset
    - Receptor Tyrosine Kinases-RTKs (extracellular)
        - Set off a lot of signal transduction pathways at once
        - Dimerization of receptors causes the kinase portion of the molecule to add phosphates (from ATP) to its tyrosine amino acids
    - Ligand-Gated Ion Channels (extracellular)
        - Channel with a closed gate will open when its bound by a particular ligand, allowing ion influx into the cell
    - Intracellular receptors
        - Small, hydrophobic ligands can act as messengers that freely cross the membrane, so some receptors can be found in the cytoplasm or even nucleus
- Transduction of Signals (Signal transduction pathways)
    - Signal transduction pathways are like falling dominoes
        - Interaction of mostly proteins in sequences acting like “relay molecules”
    - Phosphorylation
        - Addition of a phosphate causes a change in shape of a protein
        - Generally activates a protein
        - Done by protein kinase-enzymes that transfer phosphate groups from ATP to a protein
    - Dephosphorylation
        - Taking away of a phosphate
        - Generally deactivates a protein
        - Done by protein phosphatase-enzymes that remove phosphate groups, forms ATP, can shut off a communication signal
    - Cell communication relies upon a balance of kinases and phosphatases
    - Second Messenger systems

- Only about 34% of the potential chemical energy in glucose is transferred to heat, and the rest is lost from the system as heat
- Carbohydrates are best because they start at the beginning of the process and can therefore generate more ATP
- Overall payoffs: 34 from ETC, 2 from glycolysis, 2 from Krebs Cycle, none from fermentation (just estimates)
- Regulation of processes
  - Basic supply and demand
  - Feedback inhibition (negative feedback control) from citrate and ATP
    - Will send products back and stop the process
  - Positive feedback from AMP (indicates lack of ATP) and will activate enzymes

11) Chapter 8

- Heterotrophs vs Autotrophs
  - Heterotrophs-consumers; don't make their own "food"
  - Autotrophs-producers; plants, algae, and cyanobacteria that can generate their own "food"
- Chloroplast structure and function and Basics of light function
  - Chloroplasts
    - Present in all green parts of the plant
    - Found in mesophyll cells-interior tissue of the leaf
    - Double-membrane envelope surrounding a dense fluid stroma
    - Thylakoids-membranous sacs (third levels of membranes) enclosed in the chloroplast
      - Stacks called grana
      - Chlorophyll (green pigment) resides in the thylakoid membranes
  - Light function
    - Provide energy for photosynthesis
    - Chlorophyll a, Chlorophyll b, and carotenoids help light absorption
    - Chlorophylls absorb all light other than yellow/green, which it reflects
- Photosynthesis
  - Production of carbohydrates from sunlight and CO_2
    - The Light Reactions
      - Production of NADPH through electron excitation
      - Production of ATP through chemiosmosis/photophosphorylation
        - Pumping of H^+ across protein chain between photosystems
        - Photophosphorylation=phosphorylation powered by light
      - Splitting of H_2O to harvest electrons-production of O_2
      - Converting solar energy into chemical energy in the form of ATP and NADPH
      - Does not involve making carbohydrates or using CO_2
      - Chlorophylls do the majority of light absorption, while carotenoids are involved in photoprotection-absorption of excessive light energy
      - Photosystems consist of Reaction center and light-harvesting complex
        - PSII-comes first, contains P680
        - PSI-comes second, contains P700