BERG/STRYER V STUDY GUIDE

CHAPTER 13

1. Homework 2, 5-8. **Pumps** mediate active transport, and **channels** are involved with passive transport. Understand class discussion of differences between **diffusion**, **facilitated diffusion**, **primary** active transport and **secondary** active transport (**symport** or **antiport** p. 352). You should understand the math on 347. Osmotic free energy is a special case of the free energy equation. We can assume that the K_{eq} will always be 1.0 for osmosis. Therefore the standard free energy change must be zero, and $\Delta G = 0 + RT\ln(P/R)$. "Product" and "Reactant" are the "from" and "to" concentrations c_2 and c_1. When ions are involved, there has to be a voltage term added in for the "electrochemical potential" and the equation is $\Delta G = RT\ln(c_2/c_1) + Z\mathit{F}\Delta V$. The Calcium pump is a "P-type" ATPase, shown in Fig 13.5. Here Calcium ions are actively transported out of the cytoplasm with direct participation of ATP hydrolysis. Aspartate is phosphorylated (Fig 13.3). There are many examples of similar proteins including "Flippase" (Fig 13.6). Digitalis inhibits another, the Na^+-K^+ Pump.

2. The **ABC transporters** have an ATP binding cassette. These include Multidrug Resistance Protein (**MDR**), Cystic Fibrosis Transmembrane Regulator (**CFTR**), and Histidine Permease (351). Understand **patch clamp conductance** experiments (354) which can allow study of a single channel in a membrane. The **acetylcholine receptor** is located on the post-synaptic membrane in cholinergic nerves. Acetylcholine is released from the pre-synaptic membrane in response to depolarization. It travels across the synapse (355) and "pushes a button" on the receptor which opens a ligand gated **sodium channel**, allowing Na^+ to flow in. Then **potassium channels** open, allowing K^+ to flow out. **Acetylcholinesterase** normally hydrolyzes acetylcholine very rapidly, so that the response lasts only about a millisecond. Acetylcholinesterase is anchored to the postsynaptic membrane by a glycolipid "tether" but is **not** part of the receptor. The acetylcholine receptor is described in detail, and you should understand what it looks like and how it works. There are five subunits, each roughly banana-shaped and transmembrane (Fig 13.17). Binding two ACh molecules causes the receptor to open -- this appears to be due to a slight rotation of each subunit (Fig 13.18). The acetylcholine receptor is a **ligand-gated** channel. Also note that the **sodium channel** discussed from 358 ff. is a **voltage-gated** channel which is found in neurons. Potassium is too large to pass through the sodium channel (Fig. 13.27). Fig 13.29 on p. 363 conveys the differences between the **closed**, **open**, and **inactive** forms of the similar K^+ channel. Notice that the inactive form is open but blocked.

3. Multicellularity requires tight cooperation between adjacent cells. Gap junctions (364) allow sharing of metabolites between neighboring cells. Each junction is made of 12 molecules of connexin.