Out of the Rainforest Part II (There is no outline for Part I)

I. Cell Structure and Metabolism: A Beginning

a. Cell membranes: Making compartments or envelopes that are semi-permeable or differentially permeable. Structurally the phospholipid bilayer and embedded proteins make this semipermeability possible.
(Two kind of proteins concern us just now: transport proteins in the membranes and enzymes, that may be in membranes or in other parts of the cell. All proteins are chains of amino acids; these chains are folded up into particular shapes; if the shape is altered, the protein does not function normally.)

b. Enzyme: a kind of protein that catalyzes (speeds up) a reaction in cells. Each enzyme has an active site where substrate(s) or reactant(s) fit. Many molecules that stick to enzymes act as inhibitors.

c. A few other parts of the cell that you need to know about to understand respiration: you can't know the players without a scorecard.
   i. Cytoplasm or cytosol: the jellylike inside of a cell where the organelles sort of float
   ii. Ribosomes: structures in which proteins are made or synthesized
   iii. Mitochondria: organelles in which many (not all) energy transformations take place...sometimes called the powerhouse of the cell. Notice that the mitochondrion has a double-wall and that the inside of the double wall has a lot of folds called cristae.
      - Recall that bacteria have ribosomes and cytoplasm but no mitochondria (or chloroplasts)

d. Back to respiration and taking apart glucose to obtain energy for life. Aerobic respiration (as we talk about it here)takes place inside the cell and involves three processes:
   i. Glycolysis: glucose (a six-carbon sugar...that means it is a chain of six carbon atoms) is taken apart to make 3-carbon molecules (pyruvic acid). Glycolysis takes place in the cytoplasm, not in any organelle. It is the oldest, evolutionarily, kind of respiratory pathway. Bacteria do glycolysis. In fact ALL cells do glycolysis. A small amount of ATP is obtained by glycolysis.

ii. Krebs cycle: After a kind of bridge step, those 3-carbon molecules from glycolysis are broken down completely. More ATP is formed as well as some other energy carriers (sometimes called hydrogen-storage molecules because they store energy as hydrogen atoms) including NADH...tune in; you'll hear more about ATP and NADH and FADH a little later. The Krebs cycle takes place in the matrix of the mitochondrion, that is, in the fluid inside the mitochondrion ....not in the cristae.The 3-C compound from glycolysis finally is converted to CO2.

iii. Electron transport chain (or respiratory chain): those energy carriers (the hydrogen-storage molecules) from the Krebs cycle are used to make a lot more ATP. They do this by a process called chemiosmosis that we will discuss on Friday. The electron transport chain is in the cristae of the mitochondrion.

e. ATP: the energy currency of cells

i. The old (evolutionarily) way: substrate phosphorylation

ii. The new (evolutionarily) way: oxidative phosphorylation and the wonders of damming up H+ How is damming up H+ ions useful in making ATP?

II. Chemiosmosis: A chemical/electrical charge gradient and transport across a membrane

a. The membrane: The inner mitochondrial membrane This membrane lies between the mitochondrial matrix and the space between the inner and outer mitochondrial membranes (what Lewis calls the intermembrane compartment)

b. The first transport: By the electron transport chain proteins

i. Energy-rich NADH and FADH give up high-energy electrons to proteins (respiratory electron carriers) embedded in the membrane.

ii. The electron transport chain proteins use the energy of the electrons they carry to pump H+(protons) across the membrane into the intermembrane compartment.

iii. The electrons are then handed on to the next carrier in the chain.

c. The gradient: Protons (H+)
    i. at a higher concentration in the intermembrane compartment and
    ii. at a lower concentration in the matrix. The membrane does not allow protons to pass through except through the enzyme that catalyzes ATP formation (ATP synthase).

d. The second transport: through an enzyme, also embedded in the membrane
    i. H+ moves down the gradient, through the enzyme that catalyzes a reaction forming ATP. The energy from the movement of protons through the enzyme powers the reaction.

e. Electrons to OxygenThe last electron carrier passes its electron to oxygen.
    i. Oxygen combines with H+ and forms water.

f. How could one stop chemiosmosis?

III. Back to how rotenone acts and why it does not poison the plant that produces it.