

## Rainbow Connection

A scuba diving botanist is sent by the Smithsonian to collect algae. Blood is spilled and the biological uses of colored light, including photosynthesis, are explored.

As you participate in the discussions in class and try to answer the questions posed in this scenario, you should realize that there are many connections to material we discussed previously. Hopefully you see the similarities between **mitochondria** and chloroplasts, between the **chemiosmosis** that occurs in each, how **action potentials** are involved in the perception of light,

- Review Readings about **Cellular Respiration** can be found in **Chapter 6**.
- Review Readings about **energy, biochemical reactions, and enzymes** can be found in **Chapter 5**.
- Review Readings about **Natural Selection** can be found in **Chapter 12**.
- Review Readings about the **Nervous System** can be found in **Chapter 26**.

Readings about **Senses and the Eye**, can be found in **Chapter 27**.

Readings about **Photosynthesis** can be found in **Chapter 5**.

- If you are not sure what we mean when we talk about **light spectrum** or **visible light**, read pp. 92-93.
  - For a visualization of what happens when colored objects **reflects light**, study Figure 5.4
- To learn about **how we see light & color**, read pp. 565-567.
  - Not sure what **rhodopsin** is? read p. 565
  - Can't differentiate between **rods** and **cones**? read p. 566
  - Not sure how light **reception triggers action potentials**, read p. 566
  - Need more explanation of how **sensory receptors** work (or are lost when you encounter words like transduction or **receptor potential** in your readings) see pp. 560-561.
- If you are not sure what **accessory pigments** are, read p. 92 including Table 5.1
- If you need clarification on **chlorophyll structure**, including the difference between **stroma, grana, thylakoid**, and **thylakoid space**, read p. 60-61 & 93-94.
  - If you are not sure what the **reaction centers** or **antenna pigments** are, read p. 94
- For an **OVERVIEW OF PHOTOSYNTHESIS**, which introduces **NADPH** and explains the connection between the **light reactions** and the carbon reactions (**Calvin** or Calvin-Bensen cycle) read p. 95
  - For the details of the light reactions, read pp. 96-97 including:
    - **Photosystem II** on p. 96
    - **Photosystem I** on p. 97
    - **Electron Transport Chains** on pp. 96 & 97
    - **Water-splitting complex** on p. 97
    - **Chemiosmosis** on p. 97.
  - For a **graphical summary** of the light reactions, pay close attention to figure 5.8

- To test your understanding of the **effect of poisons** on photosynthesis, read Apply it now: Weed Killers on p. 97
- If you want more explanation of the **Calvin Cycle**, read p. 98, but be careful! Don't focus on the details, focus on what the process does, what goes in (reactants) and what comes out (products), and the relationship between the light reactions and the Calvin cycle (hint: calling the Calvin cycle the light independent reactions is VERY misleading even though you will read that in many other places)
- Not sure why those **red algae** are able to live in deep water and don't appear red in deep water, read p. 366
- For a nice example of **coevolution** between animals and algae, read *Is It Easier Being Green* (p. 89) and *Solar Powered Sea Slugs* (p. 101)

### Items you may have to review while reading about Photosynthesis

- You will commonly see the terms oxidation, reduction, and redox. These are explained on p. 75. We do not require you to remember these terms (although you may want to if you plan on taking more life or physical science courses) on exams, but knowing what they mean will help with reading the textbook.
- If you have forgotten how protons and electrons are organized in atoms and molecules, read pp. 20-22.
- If you are unfamiliar with (or need to review) chemical bonds, read pp. 22-24. The molecules involved in photosynthesis are assembled by covalent bonds (p. 24). That said, we will also refer to hydrogen ions quite often, so if you are not sure to what that
- HINT: When you are examining Figure 5.9 (and later ones), each grey ball represents a carbon atom + either two hydrogen or one Oxygen and one Hydrogen atom. Counting them at each step will help you answer some questions we ask. Don't try to remember how many are there at each step.
- If you are not sure what glucose, sucrose or carbohydrates are, read p. 31. When you look at the green pentagons and hexagons in figure 31, you may be confused. This might help – each letter represents an atom (C=carbon, O = Oxygen, H = Hydrogen) and each “----” represents a chemical bond between those atoms. When they leave out the letters, it means that at the junction of the two lines is a carbon atom. You will see the terms monosaccharide, disaccharide, and polysaccharides used from time to time. Again they are not something that will appear on tests, but knowing what they are (single, paired, and many sugar chains) can be useful in reading.

**STUDY TIP:** These processes can seem overwhelming, but you will learn them quite well and be able to answer our most challenging questions if you **rehearse** describing the process like this:

7. Put away your book, notes, videos, images, computer, cell phone or other aids
8. Draw a simple figure to represent ALL the steps of photosynthesis. Keep it simple so you can draw it on an exam quickly.

9. Start at the beginning the whole process or each of the major steps and describe clearly (using the terms)
  - a. what molecules are used (input),
  - b. what happens to each,
  - c. what molecules are produced (output).
  - d. be sure you are confident on how the steps are related – each produces materials for the other!
10. If you wrote them out – compare your description to the textbook, note your mistakes or omissions, throw away your drawing, and try again.
11. If you said them out loud – listen to a recording while comparing your description to the textbook OR have your study partner tell you what you missed by following along in the textbook.
12. When you feel confident, test your ability to apply your knowledge by using your diagram to
  - a. predict/explain all the effects of the poisons on p. 97.
  - b. answer test questions from old tests.