Course Learning Outcomes for Unit II

Upon completion of this unit, students should be able to:

3. Examine the basic properties of living organisms, to include the categorization of life.
   3.1 Describe the components of water and the properties that make it important for living organisms.
   3.2 Categorize living organisms from smallest to largest.

4. Explain various chemical processes within living organisms.
   4.1 Describe atomic structure including how it affects chemical bonding.
   4.2 Compare and contrast the three types of chemical bonds.

8. Examine macromolecules to include synthesis, structure, and function.
   8.1 Describe the structure of carbohydrates, lipids, proteins, and nucleic acids and the roles these macromolecules play in cells.

Reading Assignment

Chapter 2:
Fundamental Building Blocks: Chemistry, Water and pH

Chapter 3:
Life’s Components: Biological Molecules

Click here to access the Chapter 2 PowerPoint Presentation.
Click here to access a PDF version of the presentation.

Click here to access the Chapter 3 PowerPoint Presentation.
Click here to access a PDF version of the presentation.

Unit Lesson

Coke or Pepsi? When you ask someone that question, most people like either one or the other. In other words, people rarely say they like both equally. On that same note; if you ask someone: chemistry or biology, the answer is usually similar. People tend to like one or the other, but not both. Many students have a fear of chemistry—you may be one of those students; however, you cannot really develop an understanding of how chemicals behave in living organisms if you do not understand the basics of chemistry. A person could spend years getting a PhD in a specified branch of chemistry, such as organic chemistry or inorganic chemistry; however, we will cover chemistry in one unit. Since this is a biology course, we will stay with the basics.

Take a look back at page 10 in your textbook, and it is easy to see why chemistry is discussed in biology and why chemistry is discussed so early in this course. Atoms form molecules, molecules form organelles, organelles form cells, and so on. Living organisms are pretty much just a very organized “clump” of chemicals. Approximately 96% of the human body, your body, is made up of the big four major chemical elements: carbon, oxygen, hydrogen, and nitrogen (Krogh, 2014). There are others like calcium, iron, potassium, phosphorus, sodium, chloride, etc. Molecules of chemicals form bonds and provide us with energy, build our structures, and perform other life sustaining functions.

Would you want to spend your entire life alone without forming any relationships or bonds with others? Strangely, chemicals are the same. Chemicals are rarely found alone in nature because they form chemical bonds. Chemicals are attracted to each other – not in the same since as humans are attracted to each other
because chemicals cannot think and form impressions or emotional bonds. Chemicals form chemical bonds based on the number of electrons in the valence or outermost shell of the atom. Atoms “want” to be stable. Stable atoms are not reactive because their valence shell is complete; if not complete, atoms will form chemical bonds with other atoms to become stable.

When atoms form bonds, molecules are synthesized. We eat food that contains molecules. Think about a carbohydrate, and sound it out: carb-o-hydrate. That means they are made up of atoms of carbon, hydrogen, and oxygen. Once we eat molecules, our body then breaks them down in order to supply energy or build its structure. We also ingest chemicals in the form of prescription or over the counter drugs. Have you ever tried to read the back of a food label or the information on a brochure attached to medication? It is like reading a new language—a language based on chemical code.

So, if chemicals make up the food you eat, and you are made up of chemicals, it seems logical to make the assumption that you are what you eat. That assumption would be correct. In order to get chemicals into our bodies, we do have to eat them. Well, most of them. We can inhale a few and even absorb a few; however, most are ingested and have to be broken back down. Think about it for a second. Your body really does not need a cheeseburger, French fries, or a milkshake; however, it can use the different chemicals in those items and build what it needs. Our bodies are pretty much like giant recycling centers. When you really think about the inner workings, it truly is incredible.

Our body is amazing, and we have many mechanisms to override things that happen or things that we do to it, including things we put into it, that it does not need. Yes, we are made up of chemicals, and yes, we must consume chemicals in order for our body to function properly; however, we must consume the correct chemicals. The human body is a machine similar to a car. The car needs to be maintained and it needs gasoline (most of them). The gasoline is fuel. Since our body is a machine, it needs fuel, as well. If you overfill the tank of the car, the excess runs out onto the ground. If you overfill your storage tank, the stomach, the energy or fuel is stored as reserve fuel and can result in numerous health issues, such as obesity, cardiovascular disease, diabetes, and the list goes on and on.

Since obesity is on the rise, this is a great opportunity to discuss what is in the food we eat and how it affects our bodies. According to Krogh (2014), some estimates suggest 1/3 of Americans are obese. How many people are in your family? If you have six, statistically speaking, two of those individuals will be obese. Maybe none of your family members are obese; statistics just reveal probability. Regardless, it is still important to understand why you need to consume calories and why you need to consume organic molecules.

There are four major classes of organic molecules. These are often referred to as biological molecules since they are important for life or living organisms. They are also referred to as macromolecules because they are large. No, you still cannot see an individual molecule with your own eyes; however, they are large when compared to inorganic molecules.

The four classes include carbohydrates, lipids, proteins, and nucleic acids. If you remember from reading Chapter 3, nucleic acids include DNA and RNA.

DNA is our entire genetic code which is then copied to RNA. Your DNA came from your parents. Each parent contributed half of your DNA. Earlier, it was stated that you are what you eat. Do you think you eat DNA? Think back to the cheeseburger mentioned earlier. A burger contains meat, often from a cow. When you eat that burger, you are eating that cow’s DNA. The lettuce and tomato also contains DNA. We eat living or once living organisms, and we do eat their genetic material. We eat it, but we do not use it. What we use are the carbohydrates, lipids, and proteins in the food.

Compare the two food labels below:

<table>
<thead>
<tr>
<th>Product A</th>
<th>1 pack, 2 oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serving Size</td>
<td>230</td>
</tr>
<tr>
<td>Calories</td>
<td>230</td>
</tr>
<tr>
<td>Fat calories</td>
<td>80</td>
</tr>
<tr>
<td>Total fat</td>
<td>9g</td>
</tr>
<tr>
<td>Saturated fat</td>
<td>6g</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>34g</td>
</tr>
<tr>
<td>Fiber</td>
<td>1g</td>
</tr>
</tbody>
</table>
When you view these two labels, you are viewing the chemicals that are found in each of the foods. Reading food labels is important. Many of us are vain and do not want to gain weight; however, we need to be more concerned with whether we are getting the nutrients that we need. Our body needs organic molecules; however, we ingest many other chemicals. Would we do that to our car? Our car needs gasoline; therefore, that is what we put into the tank.

Think about your own tank. When you look at the two labels above, it is pretty easy to determine that Product B is healthier. The serving size is larger; however, the calories are less. Examine the organic molecules. Both products contain carbohydrates, lipids, and proteins. Product B contains less simple sugars, more fiber, less fat, and more protein. Notice nucleic acids are not listed. Yes, they are there; however, they are not nutrients that we need and are not found on food labels. One more important factor is that the ingredient that is listed first is the most numerous. Practice makes perfect—the more you practice reading labels, the better you will become.

Reference

**Suggested Reading**

This article provides more information about the hydrophobic action of oil in water on a grand scale.


**Learning Activities (Non-Graded)**

*Enzymatic Breakdown of Starch*

*Note: If you are allergic to gluten or cannot eat saltine crackers, do not do this activity.*

In this activity, you will be able to observe the activity of the digestive enzyme amylase that breaks down starch.

*Estimated time to complete: 10 minutes.*

*Materials needed: Saltine crackers.*
Procedure:

1. Amylase breaks down the carbohydrate starch into glucose and is secreted both in saliva and by the pancreas. This means you have salivary amylase which immediately starts to chemically breakdown the starch in your mouth. Salivary amylase is deactivated by the acid in the stomach. Once the material moves to the small intestines, it is further chemically broken down by pancreatic amylase.

2. Take a cracker and place it on your tongue, but do not chew or swallow the cracker.

3. Note how long it takes for the cracker to start to taste sweet. This is due to the amylase action breaking down the starch to glucose.

4. Think about the following questions:
   - Why does the cracker start to taste sweet?
   - Why does your body need to secrete this enzyme in two places?
   - Why does your body start digesting starch before other molecules (such as protein or fat)?
   - What might happen if the amylase enzyme did not function properly in the body?

Non-graded Learning Activities are provided to aid students in their course of study. You do not have to submit them. If you have questions, contact your instructor for further guidance and information.