Unit I: Cellular Communication

Living beings can be composed of a single cell (e.g., bacteria, cyanobacteria, and protists such as *Paramecium* and *Chlamydomonas* (a single-celled, photosynthetic organism that you will meet in lab)) or many cells. Not surprisingly, organisms composed of many cells are called **multicellular organisms**. An adult human is a very organized collection of about 70 trillion cells. (If you counted these cells at a rate of one cell per second, it would take you over two million years to count every cell in your body.) With a few exceptions (e.g., red blood cells), each individual cell in a multicellular organism is a living entity with a complete set of genes and life maintenance equipment. Each cell maintains its own existence in addition to making a vital contribution to the life of the multicellular organism.

In order for multicellular organisms to function properly, their cells must communicate. For instance, your muscles must contract when your brain sends a message to contract. Your salivary glands must secrete a lot of saliva when there is food in your mouth and only a little saliva at other times. Your heart rate must increase when you exercise, but not when you sleep. Unit I focuses on how cells communicate with each other in order to coordinate their functions and maintain the organism. While we will focus most closely on cellular communication in multicellular creatures, you should keep in mind that communication is very important to unicellular creatures as well. For instance, unicellular organisms must swim toward nutrition or sunlight if they are photosynthetic and must be able to sense when conditions are right to reproduce.

In this unit, we will examine four examples of cellular communication:

1) how liver cells secrete glucose
2) how cardiac muscle increases force
3) how neurons tell muscles to contract
4) how an egg knows it is fertilized

Each system uses a slightly different communication system, and taken together, these four systems represent many of the cellular communication systems scientists understand thus far.

Overview Reading

***Note**: Yes, three chapters is a lot to read, but keep in mind this is **overview** reading and should be **skimmed** at this point. These chapters will be discussed throughout this unit, and we will go into more detail as indicated by "Focused Reading." You do not need to remember every detail in this reading – just try to get the main concepts and a good idea of the topics we will encounter.*

- Chapter 2 • The Chemistry of Life
- Chapter 3 • Macromolecules & the Origin…
- Chapter 5 • The Dynamic Cell Membrane

The Liver Produces Glucose in Response to Stress

Glucose ($C_6H_{12}0_6$) is the primary sugar that biological creatures use as fuel. Humans, like other creatures, burn (oxidize) this sugar into carbon dioxide ($C0_2$) and water (H_20), using the energy released by this oxidation process to perform life's many functions (discussed in detail in Unit III). To ensure that cells have enough glucose to burn (and, therefore, enough energy to perform essential functions), the body maintains a constant supply of it in the blood (about 1 mg glucose per 1 ml blood).

Focused Reading

***Note**: Whenever you see the heading "focused reading" you should read these short sections of your textbook carefully BEFORE continuing to read in this Study Guide.*

- p 40-42 "The structures…" to "3.1 Recap"
- p 49-53 "3.3 What are…" to "Chemically…"

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- Tutorial 3.1 • Macromolecules
  (just consider the carbohydrate subsection for now)

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