Cellular Organization

Notes 6.3

There are two types of cells

As we learned in our previous notes, all life is made of cells. When we examine cells closely, we see that they can be separated into two categories: eukaryotic and prokaryotic. Eukaryotic cells are cells that contain a nucleus and have organelles. All plants, animals, fungi, and protists have eukaryotic cells. Any multicellular organism is also eukaryotic.

Prokaryotic cells are cells that do not contain a nucleus and lack organelles. Prokaryotic cells are also smaller than eukaryotic cells. All bacteria are prokaryotic. Organisms that are prokaryotic are unicellular. This does not mean that all unicellular organisms are prokaryotes!

Even with their differences, the two types of cells still have a lot in common. For example, both types of cells have a form of a cell membrane, cytoplasm, cytosol, ribosomes, and genetic material.

There are different types of prokaryotic and eukaryotic cells.

Prokaryotic and eukaryotic cells can be further divided into grouped. We will explore this as different type of organism cells: bacterial cells, animal cells, and plant cells. There are more types of organism cells than just these, but it will give us a good place to start.

Bacterial cells are prokaryotic cells. These cells have a cell wall, cell membrane, cytoplasm/cytosol, ribosomes, and genetic material. They may have other parts as well such as cilia--hair like projections from the surface of the organism--and flagellum--long, whip-like structures used for movement.

Animal cells and plant cells are eukaryotic cells. These cells have quite a lot in common! Yet, there are some key features that separate them. Plant cells have a cell wall, central vacuole, and chloroplasts/chlorophyll. Animal cells do not have these parts. Further, animal cells are usually (not always) circular in shape. Plant cells almost always appear packed closely together and have a geometric shape, such as a rectangle or square.

We can further divide bacterial, plant, and animal cells into even more types of cells. For example, there are many animal cells such as: skin cells, nerve cells, liver cells, etc. Even plants have different types of cells!

The amazing part is that each of the types of cells carries out a specific job. It does this job very well. If we remove a cell from a multicellular organism it cannot survive on its own. This is because it depends on the other cells in the organism to keep it alive; much like you depend on people in your community to help keep each other alive.

Eukaryotic cells can specialize

The different plant and animal cells we just talked about are called specialized cells. Specialized cells are cells that perform a certain function, or job. There are many ways a cell can become specialized.

1. **Shape**. Specialized cells can have a particular shape. For example, nerve cells are very long and skinny so they can send signals quickly.
2. **Organelles**. Specialized cells can have more of an organelle in it. For example, leaf cells in a plant are packed with chloroplasts so they can obtain energy from the sun. White blood cells have many lysosomes so they can break down foreign substances in the body.
3. **Parts**. Specialized cells can have parts that other cells do not or have more of a certain part. For example, cells in a plant that provide support have a thicker cell wall than those in the leaves.

As you can see there are many ways for a cell to be specialized. The three ways above just touch the surface of cell specialization. As a result of specialized cells, organisms can be bigger because they can dedicate parts of their bodies to perform certain functions. Yet, these parts cannot survive on their own.

Eukaryotic cells can work together

Parts of an organism are unable to survive on their own outside the organism. This is because the parts are specialized. A red blood cell is great at transporting oxygen and carbon dioxide, but it is not able to get energy on its own. If you remove it from the body, it will not survive. Therefore, cells work together to keep themselves and the organism alive.

When cells work together we say they are organized; much like how you keep all your science papers in your science folder. There are different levels of organization. We will examine the simplest level and work our way to the most complex.

1. **Cellular level**. This is the simplest level of organization. This level is the cell by itself. It is made of organelles. This is the highest level of organization observed in unicellular organisms.
2. **Tissue**. This is the first complex level of organization. Tissues are a collection of similar cells working for a common function. Examples of tissues include blood, muscles, and mesentery--a connective tissues that holds organs in place. Only multicellular organisms have tissues. Some organisms, like sponges, are only made of tissues and cells. Therefore, we consider sponges to be simple animals.
3. **Organs**. This is a more complex level of organization. Organs are collections of different tissues working together for a common function. You know many examples of organs: eyes, kidneys, stomach, heart, etc. However, did you know plants have organs, too? The leaf is an organ of the plant!
4. **Organ system**. The highest level of organization. Organ systems are collections of different organs working together for a common function. There are eleven (11) different organ systems in the human body. You are familiar with many of them:

digestive system, circulatory system, nervous system, etc. Much of life that we can see is organized at this level.

Organisms are most likely to be organized as individual cells (examples include bacteria and unicellular protists like amoebas), tissues (a sponge), or organ systems (examples include humans and most animals). The more organized it is, the more complex it becomes.

Practice Questions

Answer the following questions for review.

1. What are the two types of cells?
2. How are the two types of cells similar? How are they different?
3. What parts/organelles does a plant cell have that an animal cell does not?
4. What parts does a bacterial cell have?
5. Is it possible for a multicellular organism to be prokaryotic? Explain.
6. What is a specialized cell?
7. How can a cell be specialized?
8. Provide an example of a specialized cell. Explain how it is specialized.
9. What are the four levels of cell organization?
10. Which level is the simplest? Most complex?