NOTES 3.2

Chapter 3 - From a Cell to an Organism
Lesson 2 - Levels of Organization

Life's Organization

A reptile, like the pre-historic T-Rex, was not made of one cell. Instead, it was made of trillions of cells working together. The skin of reptiles is made of many cells that are specialized for protection. Reptiles have other types of cells, such as blood cells and nerve cells, which perform other functions. Cells work together in reptiles and enable the whole organism to function. This is the same way that cells work together in you and in other multicellular organisms.

Unicellular Organisms

Unicellular organisms have only one cell. These organisms do all the things needed for their survival within that one cell they are called **prokaryotes**

Q: What is a prokaryote?
A: a cell without a nucleus

Ex. bacteria (Figure 1)

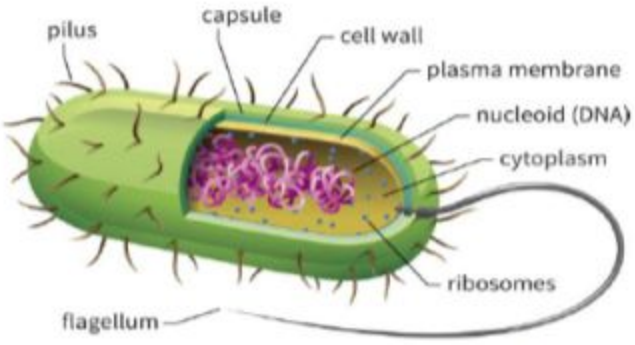


Figure 1. Bacteria

Prokaryotes...

- can live in groups called colonies
- can live in extreme environments
- the DNA is referred to as hereditary material

Multicellular Organisms

A multicellular organism is made of many eukaryotic cells working together. Each type of cell in a multicellular organism has a specific job that is important to the survival of the organism.

Q: What is a eukaryote?
A: a cell that has a nucleus and many specialized organelles

Ex. Euglena (Figure 2)

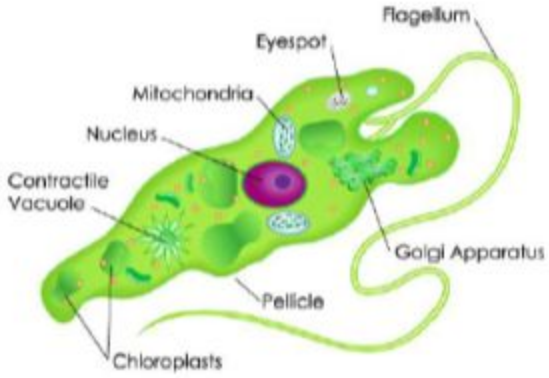


Figure 2. Euglena

Cell Differentiation

Remember that all cells in a multicellular organism come from one cell, a fertilized egg. Cell division starts quickly after fertilization. The first cells made can become any type of cell, such as a –

nerve cell, a blood cell, or a muscle cell called differentiation.

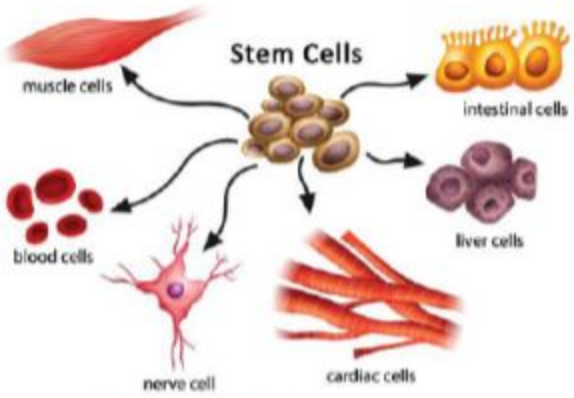
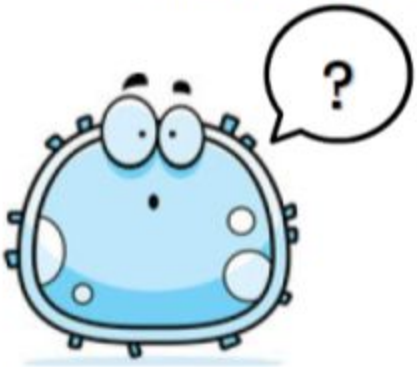


Figure 3. Cell Differentiation

Q: What is differentiation?
A: the process by which cells become different types of cells



So how does a cell know what it's going to be?

A cell's instructions are contained in its chromosomes.

Nearly all cells in an organism have identical sets of chromosomes.

If an organism's cells have identical sets of instructions, how can the cells be different?

Different cell types use different parts of the instructions on the chromosomes.

Cells

Not all cells in a developing animal or human differentiate.

Stem cells are unspecified cells that are able to develop into many different cell types. (Figure 4)

There are many stem cells in embryos but fewer in adult organisms. Adult stem cells are important for cell repair and replacement.

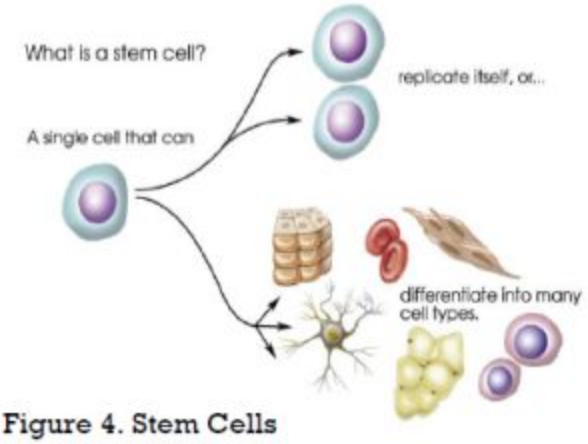


Figure 4. Stem Cells

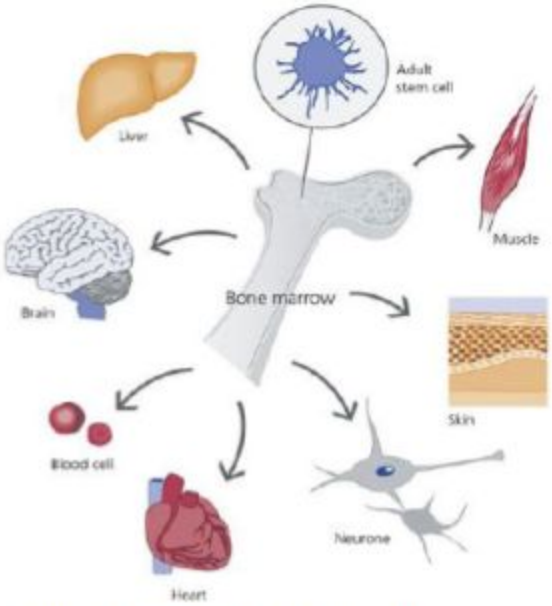


Figure 5. Stem cells in blood marrow

For example, stem cells in your **bone marrow** can produce more than a dozen different types of **blood** cells. These replace the cells that are damaged or worn out.

Stem cells in your **muscles** can produce new **muscle** cells. These can replace torn muscle fibers.

Plants also have unspecialized cells, similar to the stem cells of animals.

These cells are grouped in areas called **meristem**.

Q: What is a meristem?
A: tissue in most plants containing undifferentiated cells, found in parts of the plant where growth can take place

Meristems are in different areas of a plant, including the tips of roots and stems (Figure 6). Cell division in meristems produces different types of plant cells with specialized structures and functions. These functions include transporting materials, making and storing food, or protecting the plant. Meristem cells might become part of stems, leaves, flowers, or roots.

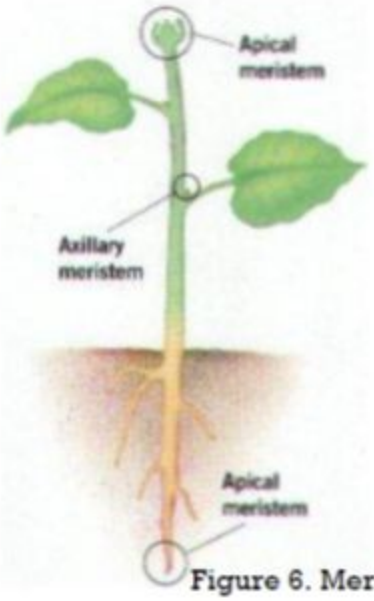


Figure 6. Meristem

Tissues

In multicellular organisms, similar types of cells are organized into groups, called **tissues**.

Q: What are tissues?
A: groups of similar types of cells that work together to carry out specific tasks

Most animals, including humans, have 6 main types of tissues. (Figure 7)

- **Muscle** tissue makes movement possible.
- **Connective** tissue provides structure & support.
- **Nervous** tissue carries messages to & from the brain.
- **Epithelial** tissue forms the protective outer layer of skin & the lining of major organs & internal body cavities.

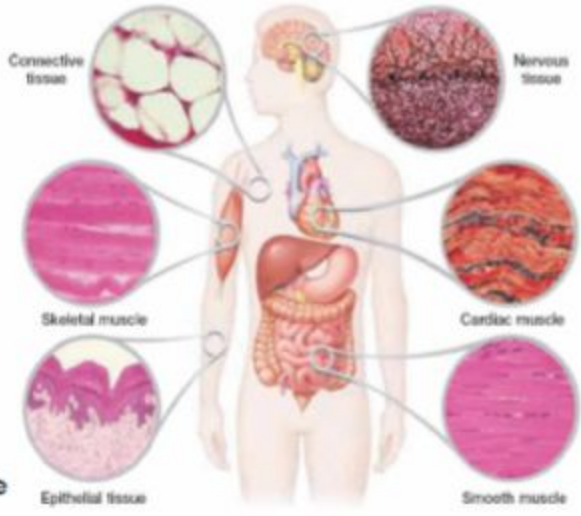


Figure 7. Types of tissue

Plants also have different types of tissues. The main types of plant tissue are dermal tissue, vascular tissue, and ground tissue. (Figure 8)

- **Dermal** tissue provides protection and helps reduce water loss.
- **Vascular** tissue transports water and nutrients from one part of a plant to another.
- **Ground** tissue provides storage and support.

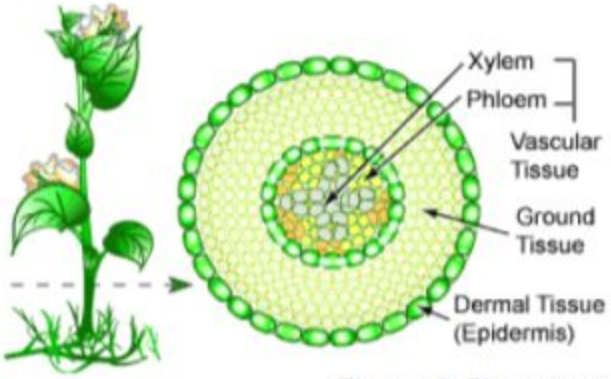


Figure 8. Plant tissues

Organs

Complex jobs in organisms require more than one type of tissue, called **organs**.

Q: What are organs?
A: groups of different tissues working together to perform a particular job

Your stomach is an organ that breaks down food. It is made of all four types of tissue: muscle, epithelial, nervous, and connective. (Figure 9)

Each type of tissue performs a specific function necessary for the stomach to work properly & break down food.

- **Muscle** tissue contracts and breaks up food.
- **Epithelial** tissue lines the stomach.
- **Nervous** tissue signals when the stomach is full.
- **Connective** tissue supports the stomach wall.

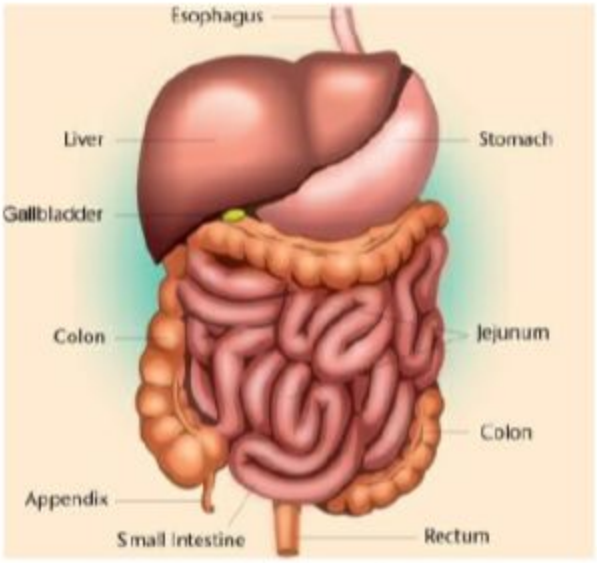


Figure 9. Digestive organs

Plants also have organs. A leaf is an organ specialized for photosynthesis. Each leaf is made of dermal tissue, ground tissue, & vascular tissue. (Figure 10)

- **Dermal** tissue covers the outer surface of a leaf.

The leaf is an important organ because it contains ground tissue that produces food for the rest of the plant.

- **Ground** tissue is where photosynthesis takes place. The ground tissue is tightly packed on the top half of the leaf.

- **Vascular** tissue moves both the food produced by photosynthesis and water throughout the leaf & plant.

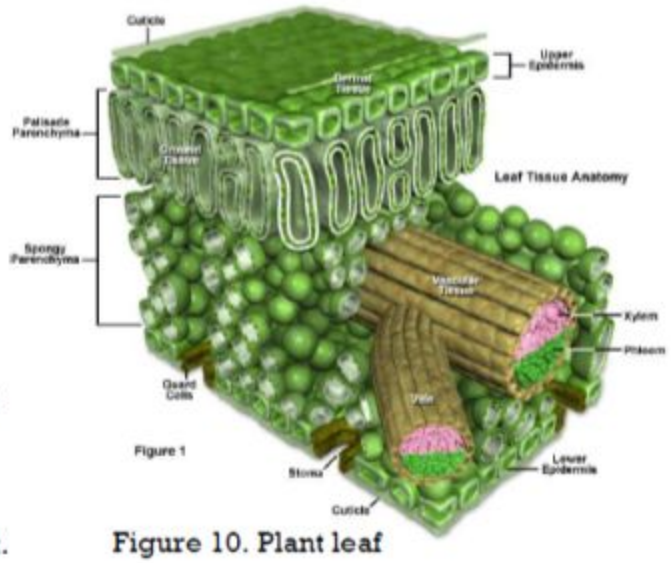


Figure 10. Plant leaf

Organ Systems

Most organs do not function alone and need **organ systems** to complete necessary processes.

Q: What is an organ system?
A: groups of different organs that work together to complete a series of tasks

Human organ systems can be made of many different organs working together. For example, the digestive system is made of the stomach, the small intestine, the liver, and the large intestine. These organs all work together to break down food. Blood absorbs and transports nutrients from food to cells throughout the body. (Figure 11)

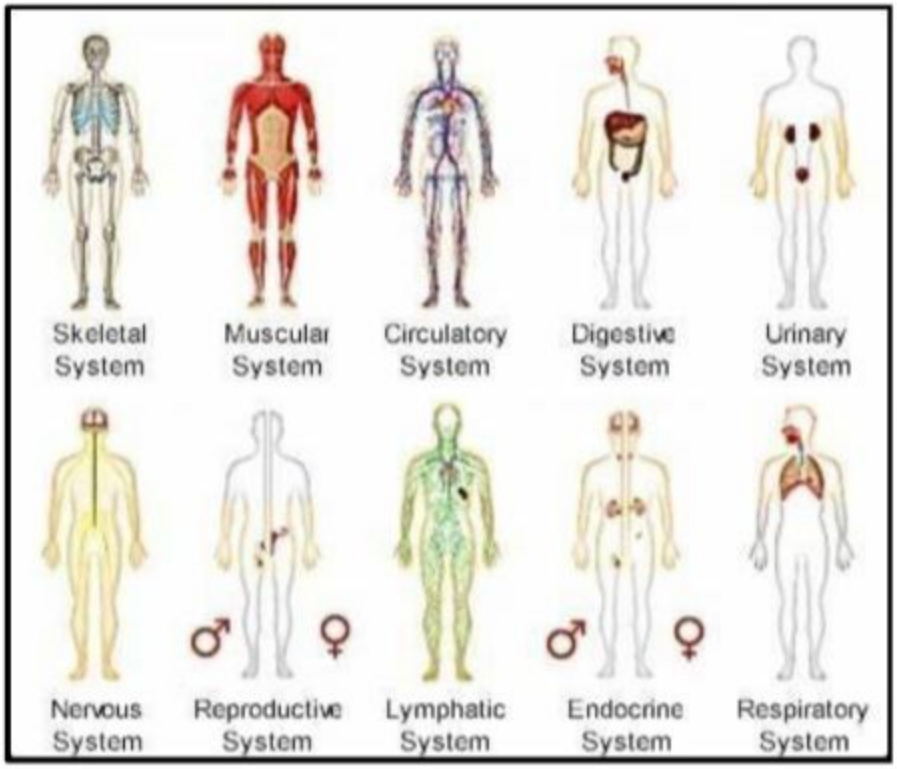


Figure 11. Organ systems

Plants have two main organ systems - the **shoot** system and the **root** system. (Figure 12)

The **shoot** system includes leaves, stems, & flowers. The shoot system transports food & water throughout the plant.

The **root** system anchors the plant & takes in water & nutrients.

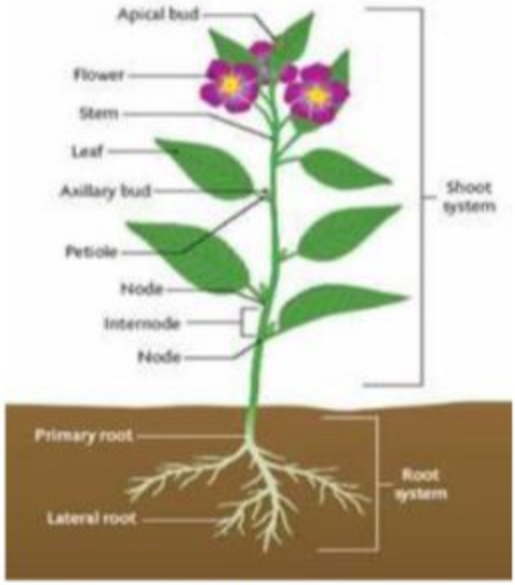


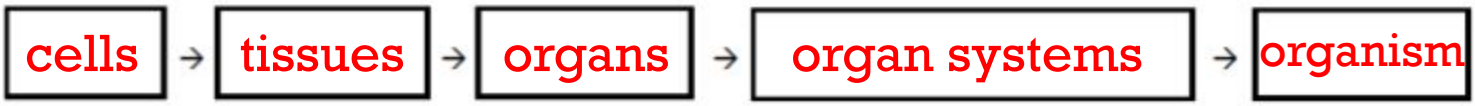
Figure 12. Plant organ systems

Organisms

Multicellular organisms usually have many organ systems. The cells of these systems work together and carryout all the jobs needed for the organism to survive. There are many organ systems in the human body. Each organ system depends on the others and cannot work alone.

For example, the respiratory system and circulatory system carry oxygen to the cells of the muscle tissue of the stomach. The oxygen aids in the survival of muscle tissue cells.

In conclusion,



Examples –

muscle cells	→	muscle	→	heart	→	circulatory system	→	human
nerves	→	brain tissue	→	brain	→	nervous system	→	human