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Unit 5: Cellular Biology

NOTES 5.03

FOCUS: Multicellular Organization

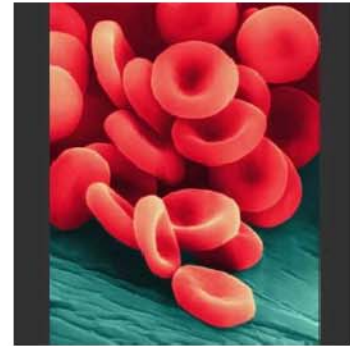
EQ: Can you name the levels of organization within a multicellular organism?

Single-celled vs. Multicellular Organisms

- Protists have complex cells that must carry out all life processes within a single cell.
- Multicellular organisms have specialized cells with different structures to carry out different functions.

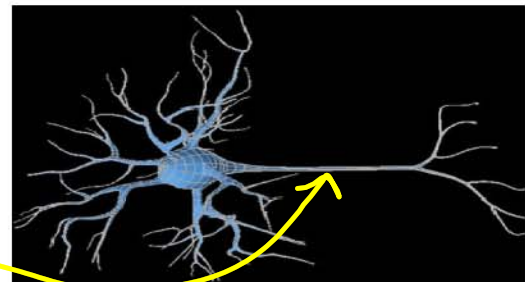
○ Ex 1: Red blood cells

- Shaped like narrow, flat discs
- Makes it easier to fit through capillaries (blood vessels that are thinner than a human hair).
- Contain hemoglobin, a molecule specially designed to carry oxygen molecules.



○ Ex 2: Nerve Cells (AKA - Neurons)

- Unique structure: Cell body surrounded by "antennae-like" dendrites that transmit information and connected to other neurons by a long "tail" called an axon.
- Allows information to pass quickly from one part of the body to the next.
- Specialized neurons in the Spine can be connected to the toes by an axon that is 3 feet long!



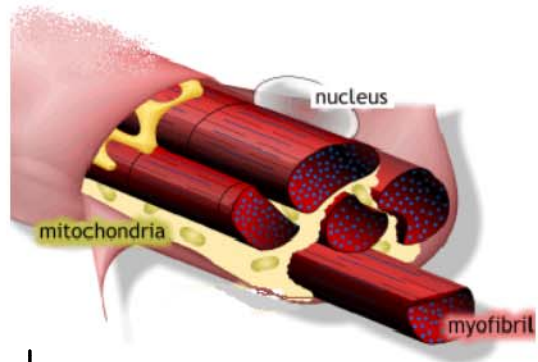
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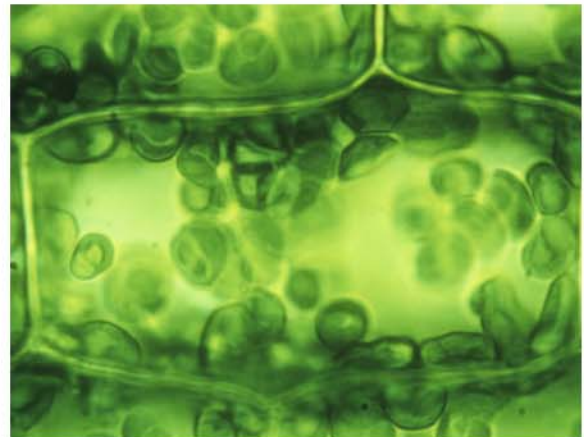
○ Ex 3: muscle cells

- Contains specialized fibers (myofibrils) that allow each individual cell to contract, allowing the muscle to move.
- Each muscle cell is connected directly to a neuron by a dendrite, which allows the muscles to react when the brain tells them to.
- Muscle cells also contain a larger number of mitochondria which give them enough energy to respond quickly when the body requires movement.



○ Ex 4: Upper leaf cells

- The cells in the upper layers of leaves (palisade) contain about 5 times more chloroplasts than the lower leaf cell layers.
- Palisade layer cells are also densely packed.
- Purpose: Gathering as much sunlight as possible for the purpose of photosynthesis.

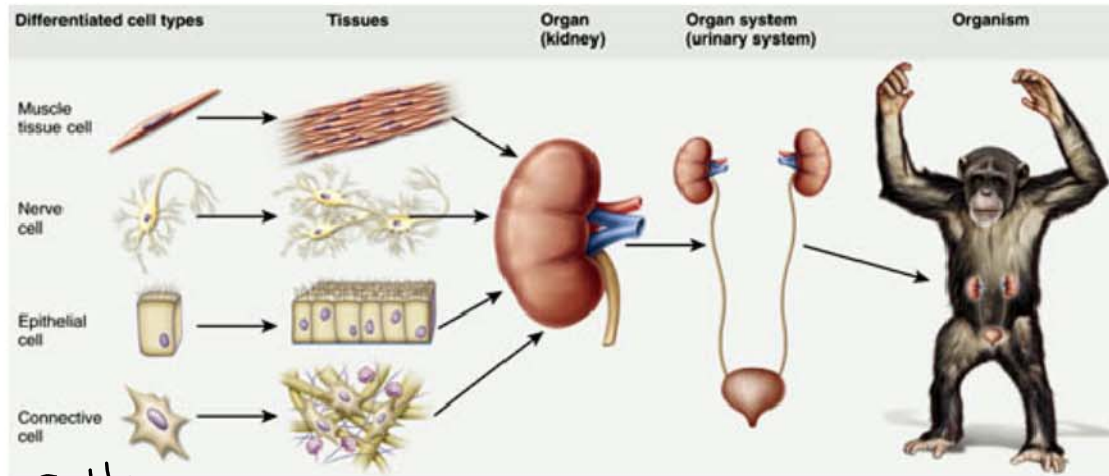


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Multicellular organisms are organized at FOUR levels:



1. Cells :
 - Cells are the basic building blocks of life for all living things.
2. Tissues :
 - Similar cells form tissues. Tissues are groups of cells working together to do the same job.
 - There are four types of tissue:
 - Muscle tissue :
 - Ex: Cardiac muscle in the heart, Smooth muscle in the digestive tract, and Skeletal muscle, which attaches to bones allowing them to move.
 - Nervous tissue :
 - Found in the nerves, spinal cord, & brain.
 - Connective tissue :
 - Serves to connect various parts of the body.
 - Includes bone, cartilage, and blood.
 - Epithelial Tissue :
 - Lines the inner and outer surfaces of the body
 - Ex: skin

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3. Organs:

- Organs are made from groups of different tissues working together to do the same job.
- Ex: lungs, heart, liver, skin, brain, large intestine

4. Organ Systems:

- Organ systems are made up of a group of different organs working together to accomplish a particular goal.

- The human body is made up of 11 different organ systems:

1) Digestive System: Breaks down food into the simple chemicals ~~energy~~ your cells need to survive.

2) Circulatory System: Responsible for the flow of blood, nutrients, hormones, oxygen and other gases to and from cells throughout the body. (Heart, veins, arteries)

3) Respiratory System: Takes oxygen into the body and expels carbon dioxide.

Urinary → 4) Excretory System: Removes excess, unnecessary, or waste materials from the body.

5) Muscular System: Powers and controls movement within the body

6) Skeletal System: Provides shape, structure, and support

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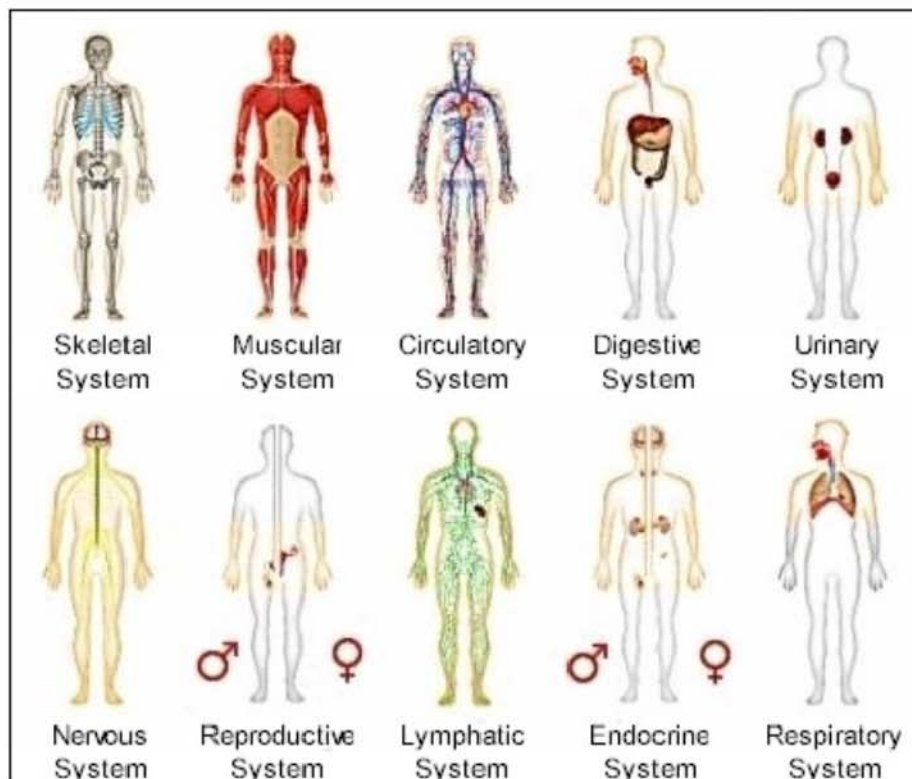
7) Endocrine System: Controls communication within the body using hormones made in glands throughout the body

8) Lymphatic System (AKA - Immune System): Defends the body against pathogens (disease-causing agents)

9) Integumentary System: Protects the body from damage coming from the outside environment and maintains homeostasis by regulating water balance and body temperature (skin)

10) Nervous System: Collects, transfers, and processes information between systems and with the surrounding environment

11) Reproductive System: Produces new life and passes on genetic information to the next generation



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Big Ideas:1) "Form Follows Function"

- The shape or structure of a cell, tissue, organ, organ system, or organism helps it carry out its intended function or purpose.

- Examples:

- Your hand's intended function is to grasp and hold objects. It would not be able to fulfill its intended function if it were shaped like your knee.



- A nerve cell's intended function is to carry messages long distances throughout the body very quickly. It would not be able to fulfill its intended function if it was small and slow-moving like a red blood cell. ($\sim 1 \text{ min.}$ vs $< 1 \text{ sec.}$)

2) "Organization leads to efficiency & effectiveness"

- Living organisms are organized at 4 levels.
- Each level of organization has a purpose.
- When every structure at every level of organization is functioning efficiently, the body will function effectively.