

Al-Mustaqbal University

College of Engineering and Engineering Technologies

Biomedical Engineering Department

Subject: *Systemic Physiology I*

Introduction to Human Physiology

Class : *4th*

Lecture: *2*

By Assistant Lecturer : Zainab Sattar Jabbar



Introduction

Anatomy and Physiology

➤ **Anatomy** :Study of the structure of the body.

Examples: heart has 4 chambers, lungs have lobes.

➤ **Physiology** :Study of the function of the body.

Examples: heart pumps blood, lungs exchange gases.



Key Difference

 Anatomy = structure

 Physiology = function

Introduction

Physiology?

- **Physiology** tells us how the bodies of living organisms work. Physiology is based on the gross and microstructure. Both structure and function must be studied at all levels from the cellular to the molecular to the intact organism.
- **Physiology** is the study of the functions of living things.

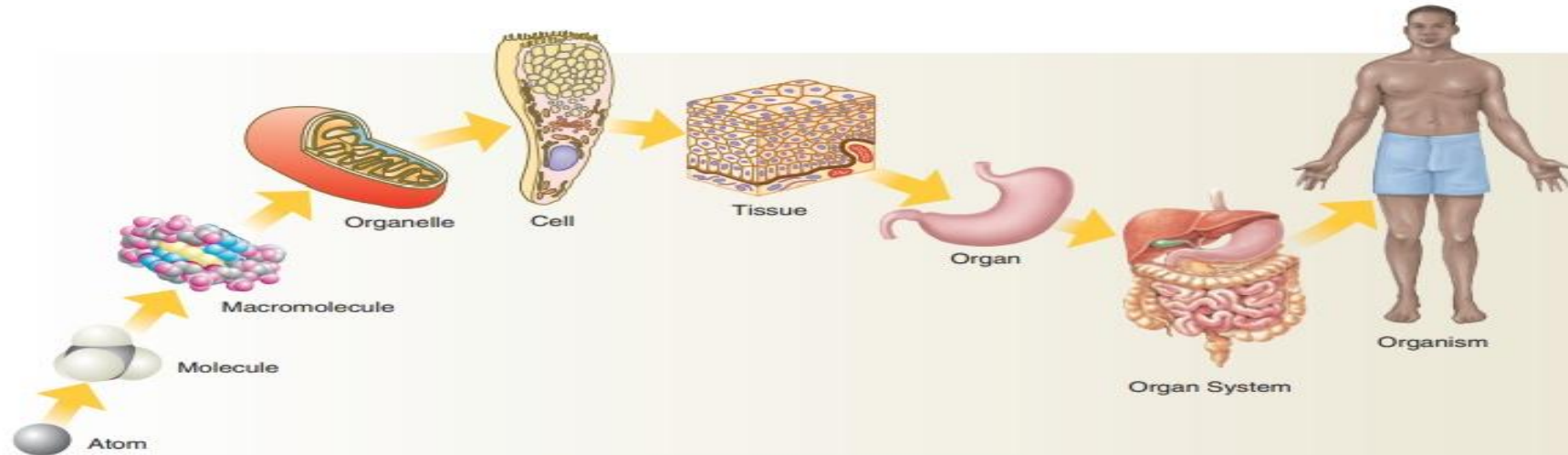


FIGURE 1-1 Organization levels of the body.

Adapted from Shier, D.N., Butler, J.L., and Lewis, R. *Hole's Essentials of Human Anatomy & Physiology*, Tenth edition. McGraw Hill Higher Education, 2009.

Gross and microstructure



- Gross structure?** ➤ Gross structure: The study of body parts and organs visible to the naked eye.
- Like the heart, lungs, muscles, and bones.



- Microstructure?** ➤ Microstructure: The study of cells and tissues that require a microscope to be seen.
- Like cells and tissues.



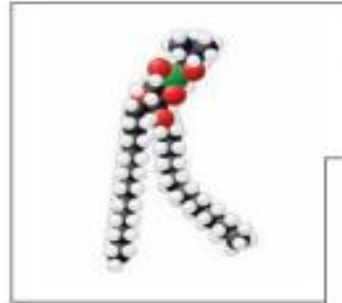
Key Idea?

Structure (gross + micro) determines function in the body.

Levels of structural organization

- From single cell to organ system cells are the basic units of living organisms. The number of cells is very large. For example, an adult person contains approximately 100 trillion cells.
- Humans have several levels of structural organizations that are associated with each other. The chemical level includes all chemical substances essential for sustaining life. These chemicals are made up of atoms joined together in various ways. The diverse chemicals, in turn, are put together to form the next higher level of organization, the cellular level.
- Cells are the basic **structural and functional units of life** and organization. Each cell has a different structure, and each performs a different function.

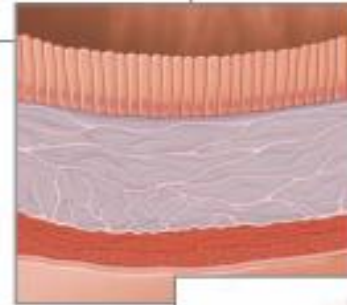
Levels of structural organization



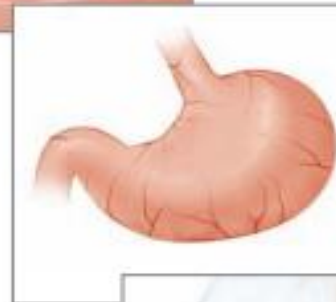
(a) **Chemical level:** a molecule in the membrane that encloses a cell



(b) **Cellular level:** a cell in the stomach lining



(c) **Tissue level:** layers of tissue in the stomach wall



(d) **Organ level:** the stomach



(e) **Body system level:** the digestive system

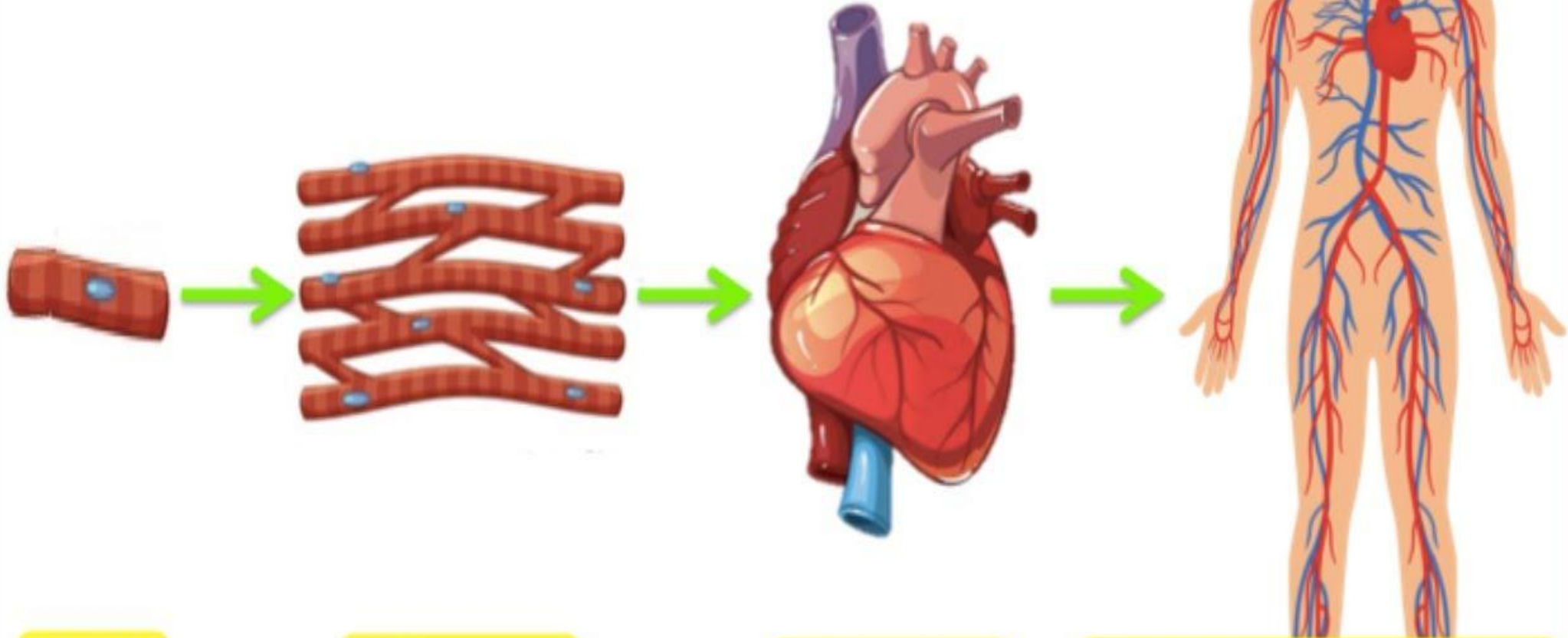


(f) **Organism level:** the whole body

Levels of structural organization

- Higher levels of organization are built from lower levels. Therefore, molecules combine to form cells, cells combine to form tissues, tissues combine to form organs, organs combine to form organ systems, and organ systems combine to form organisms.
- **Cells** are the basic structural and functional units of life and organization.
- **Tissues** are formed when cells with similar or related features and functions join together.
- **Organs** are made up of different types of tissues that work together. They perform specific and specialized functions within the body. Organ Systems are made up of different organs that perform coordinated functions

Levels of organisation



Cell

Tissue

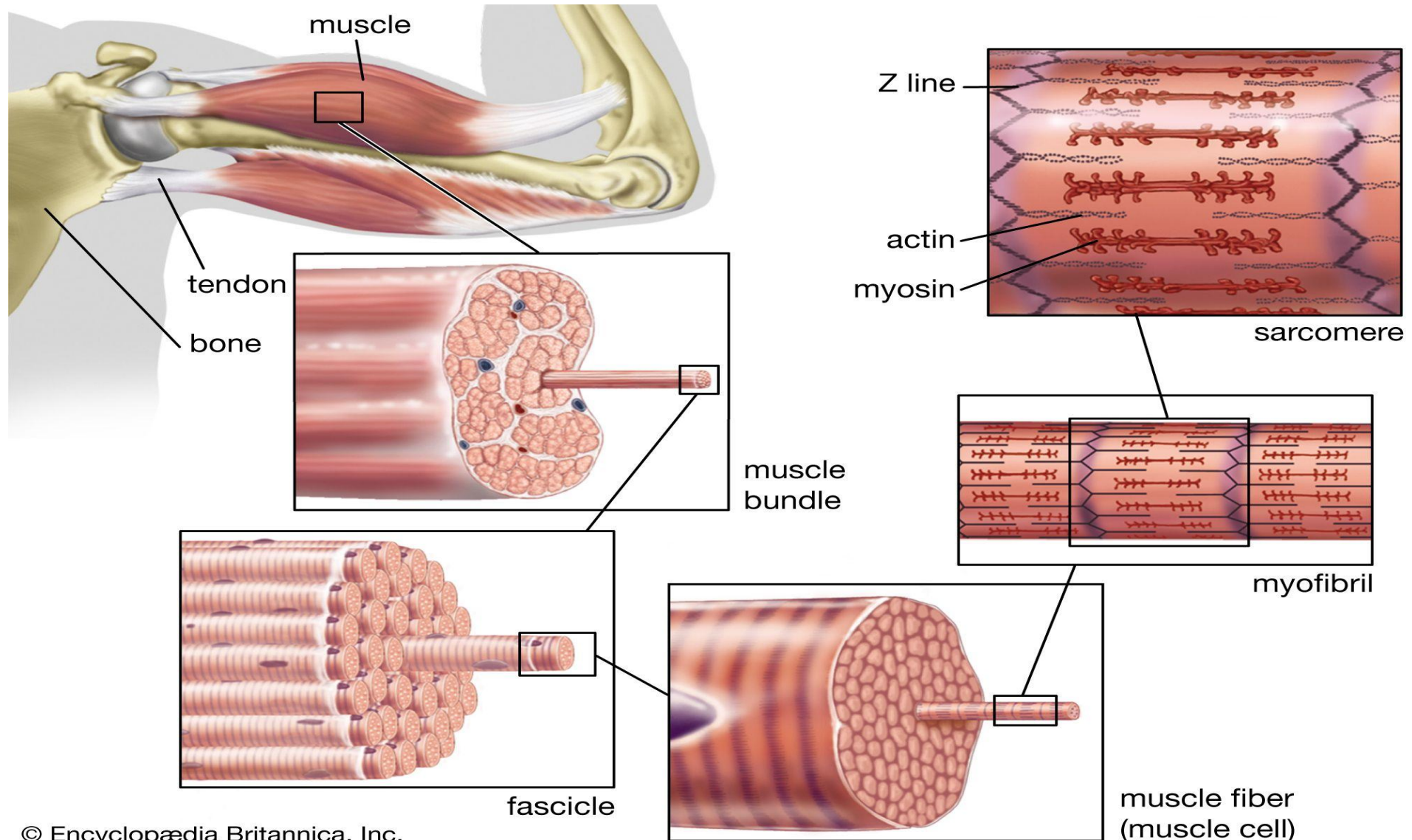
Organ

Organ system

Muscle tissue

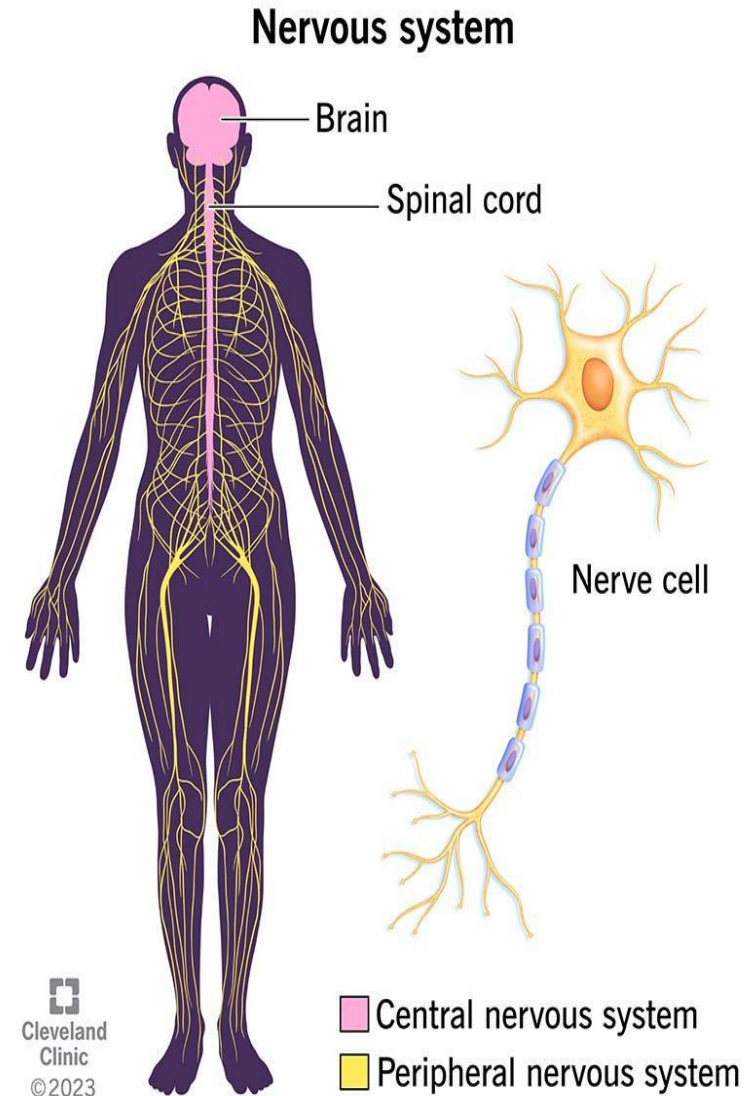
- **Muscle tissue** is specialized for contraction and generation of tension. The different types of muscle tissue are functional adaptation of the basic contractile system of actin and myosin.
- **Skeletal muscles** : are responsible for movement of the skeleton.
- **Smooth muscle:** is responsible for propelling contents within soft hollow organs, such as the stomach, intestine, and blood vessels. Smooth muscle is not under voluntary control and has no striations.
- **Cardiac muscle:** cardiac muscle for the contraction of the heart that causes blood circulation. fibers branch but are separated into individual cell by continuity of the plasma membrane, the intercalated discs.

Muscle tissue



Nervous System- Conducting signals

- This tissue is specialized for conduction and transmission of electrical impulses and the organization of these nerve cells or neurons is the most complex of any of the tissue.
- The neuron has a cell body that contains the nucleus and the other organelles with very high metabolic activity (e.g., ribosomes and mitochondria).
- The neuron is further specialized for having processes, which contact it through the synapses to other neurons, making a long chain of conducting tissue linking the various parts of the body.



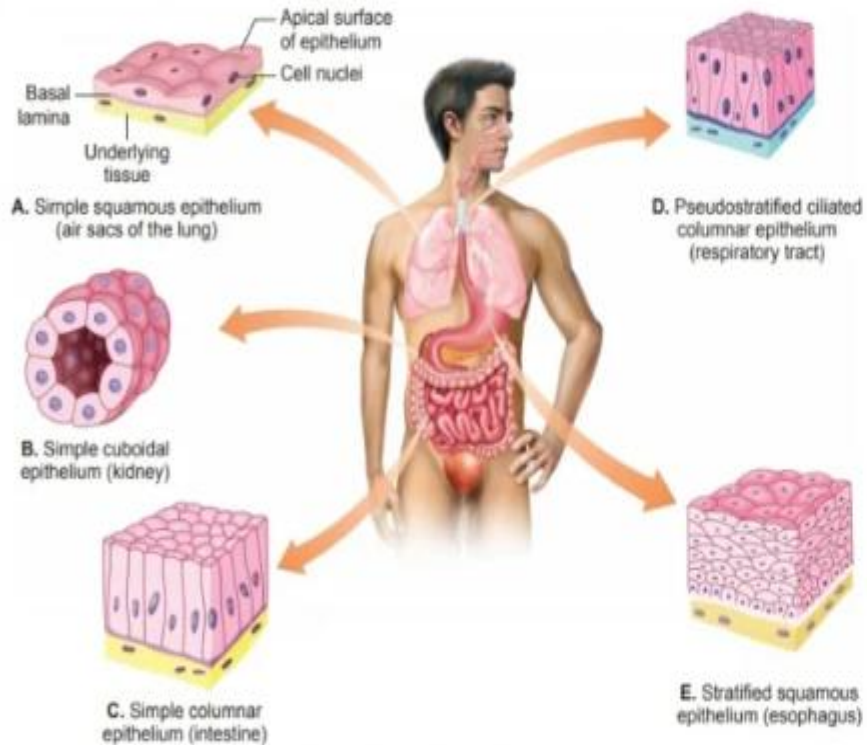
Epithelial tissue

- It is functionally very diverse. It includes the membranes that cover body surfaces and line hollow viscera internal organs, forming barrier between the interior of the body and the environments.
- Epithelial cells may be modified to function as sensory receptor, detecting specific stimuli from the environment. Epithelial cells also form the **endocrine glands** (pituitary, parathyroids, thyroid, adrenals, ovary, and testis), which secrete 4 hormones directly into the blood and the **exocrine glands** secrete substances via ducts (e.g., salivary glands, pancreas and liver).

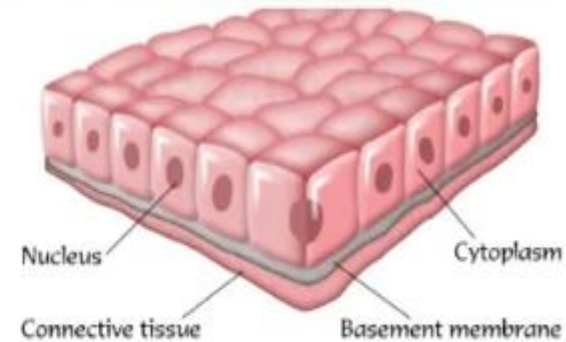
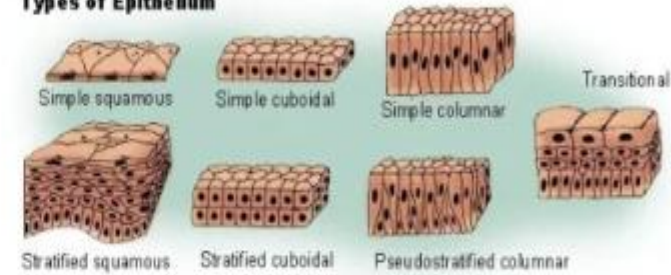
Epithelial tissue structure

Epithelial Tissue Structure, Functions, Types and more

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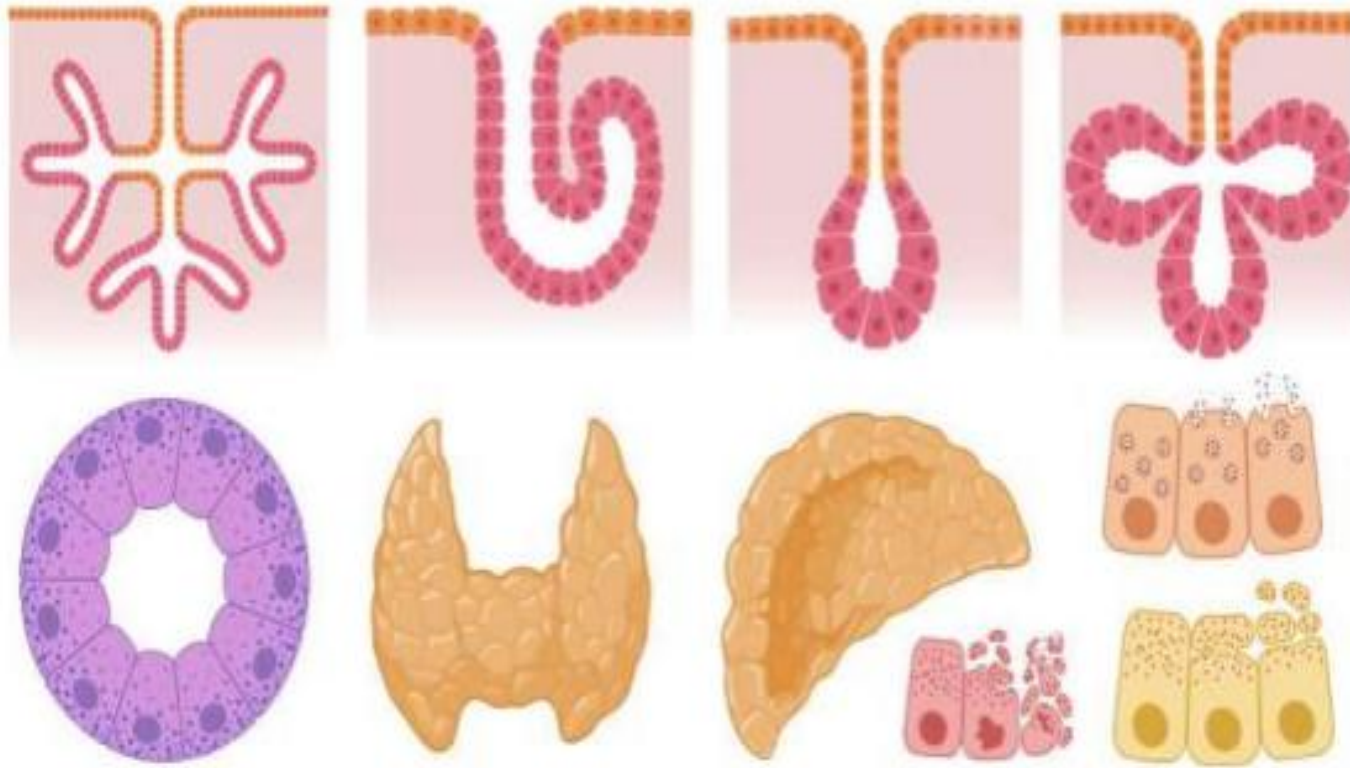


Types of Epithelium



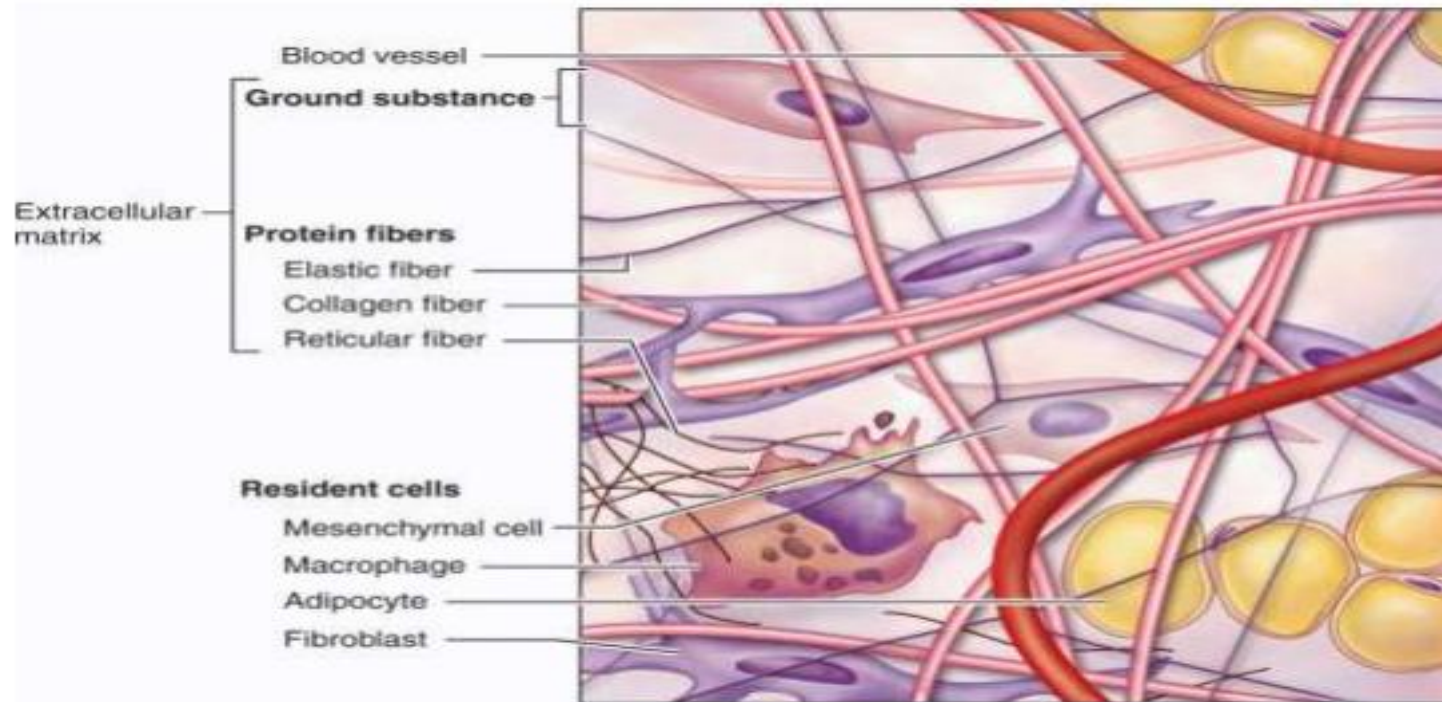
Glandular epithelial tissue

Glandular Epithelium



Connective Tissue

- It is **mesodermal in origin** and functions **in supporting, connecting and transporting**.
- It covers wide variety of tissues, but having more intercellular materials or matrix, than cells. It also contains extracellular fibers, which may be tough collagenous fibers or the resilient elastic fibers.



Connective Tissue

Life processes

- The following are the important life processes of humans:
 - **Metabolism:** includes catabolism and anabolism that provides energy and body's structural and functional components.
 - **Excitability:** Ability to sense changes in and around us.
 - **Conductivity:** ability to carry the effects of stimulus from part of a cell to another.
 - **Contractility:** ability to contract in response to stimulus.
 - **Growth.**
 - **Differentiation.**
 - **Reproduction.**

Composition of the Body

- At an average, **60%** of the body weight of young adult male is **water**. The remaining is composed of minerals, fat and proteins.
- The human body contains organic compounds such as lipids, proteins, carbohydrates and nucleic acids.
- The **lipids** are important forms of storage fuel in addition to providing insulation of the body as a whole or essential component in the structure of plasma membranes, myelin and other membranes. **Carbohydrates** serve as a lesser form of fuel storage (400-500 gms).
- **Proteins** serve as the structural basis for all enzymes, contractile muscle proteins, connective tissue, such as collagen and elastin and in addition as a fuel (about 15%), or precursor for carbohydrate in the process of gluconeogenesis. Ingested glucose is converted to glycogen and stored in the liver, muscle and adipose tissue.

Components of Body System

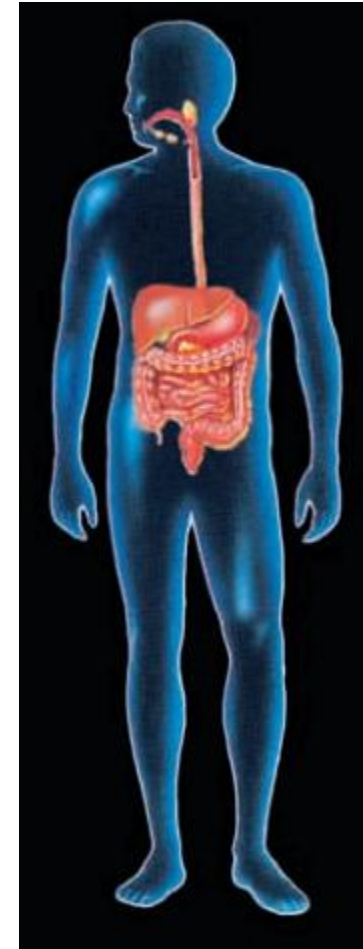
- **Circulation** : Heart, blood vessels, blood.
- Transport materials from one part to another, defends against disease.



Circulation system

Components of Body System

- **Digestive system:** Mouth, pharynx, esophagus, stomach, small and large intestine, salivary glands, pancreas liver, and gallbladder.
- Ingests and digests food, absorbs nutrients into blood.



Digestive system

Components of Body System

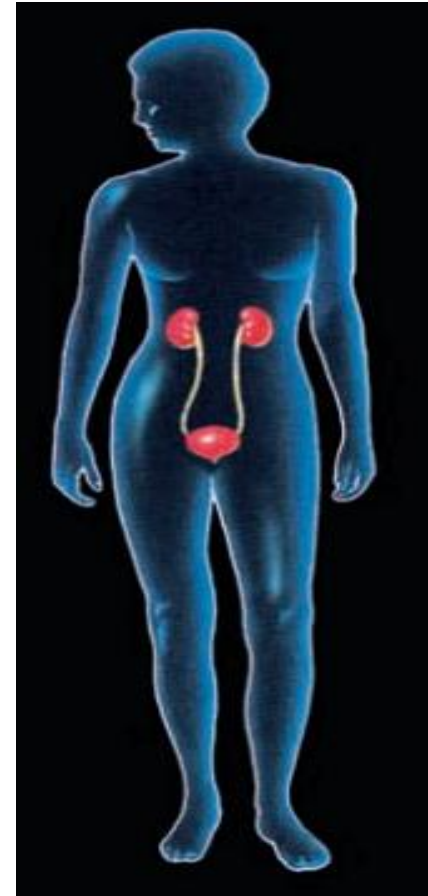
- **Respiratory system:** Nose, pharynx, larynx, trachea, bronchi, lungs.
- Exchanges gases between blood and external environment.



Respiratory system

Components of Body System

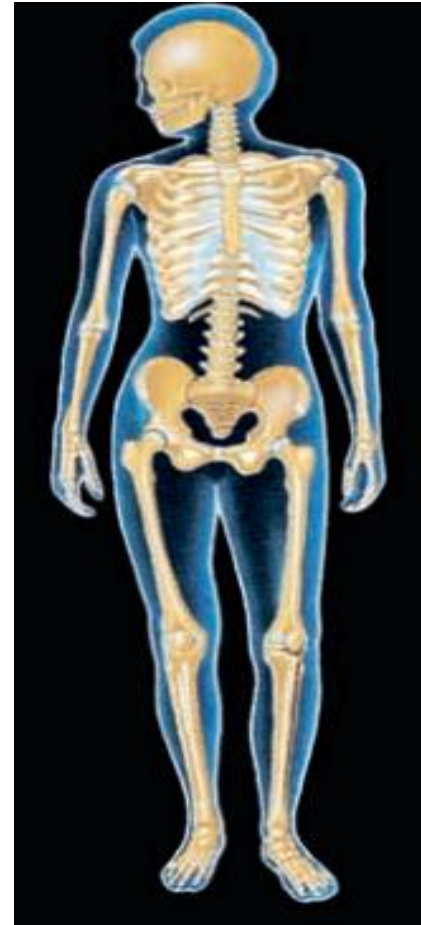
- **Urinary system:** Kidneys, ureters, urinary bladder, urethra.
- Excretes metabolic wastes , regulates fluid balance and acid base balance.



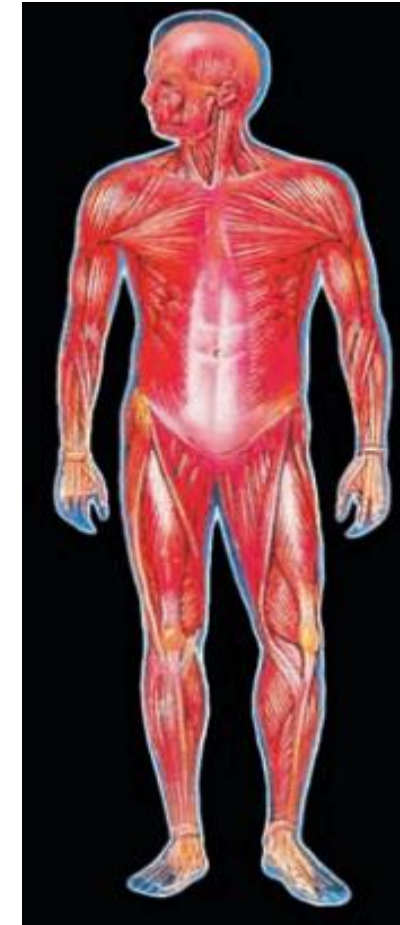
Urinary system

Components of Body System

- **Skeletal system:** Bones, cartilage, joints
- **Muscle system :** Skeletal muscle



Skeletal system



Muscle system

Components of Body System

- **Integumentary system** : Skin, hair, nails
- **Immune system** : Leukocytes, thymus, bone marrow, tonsils, adenoids, lymph nodes, spleen, appendix, gut-associated lymphoid tissue, skin-associated lymphoid tissue, mucosa associated lymphoid tissue



Integumentary system



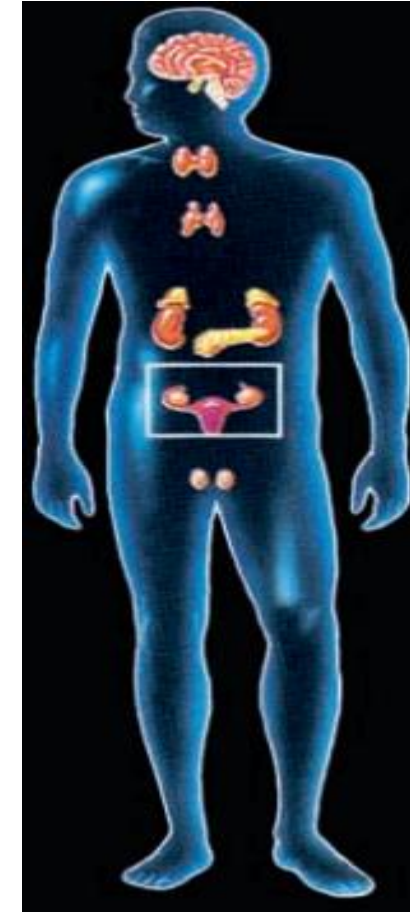
Immune system

Components of Body System

- **Nervous system:** Brain, spinal cord, peripheral nervous system
Special sense organs
- **Endocrine system:** All hormone-secreting tissues including hypothalamus, pituitary, thyroid, parathyroids, adrenals, endocrine pancreas, kidney, intestine, heart, thymus, pineal



Nervous system



Endocrine system

Components of Body System

- **Reproductive system :**
- **Male:** testis, prostate, seminal vesicles, bulbourethral glands, associated ducts.
- **Female:** ovary, oviduct, uterus, vagina, breast.



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THANK YOU