Al-Mustaqbal University

College of Engineering and Technologies

Biomedical Engineering Department

Systemic Physiology I

Lecture: 1

Introduction to Human Physiology

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Introduction

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.

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 chemicals 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.

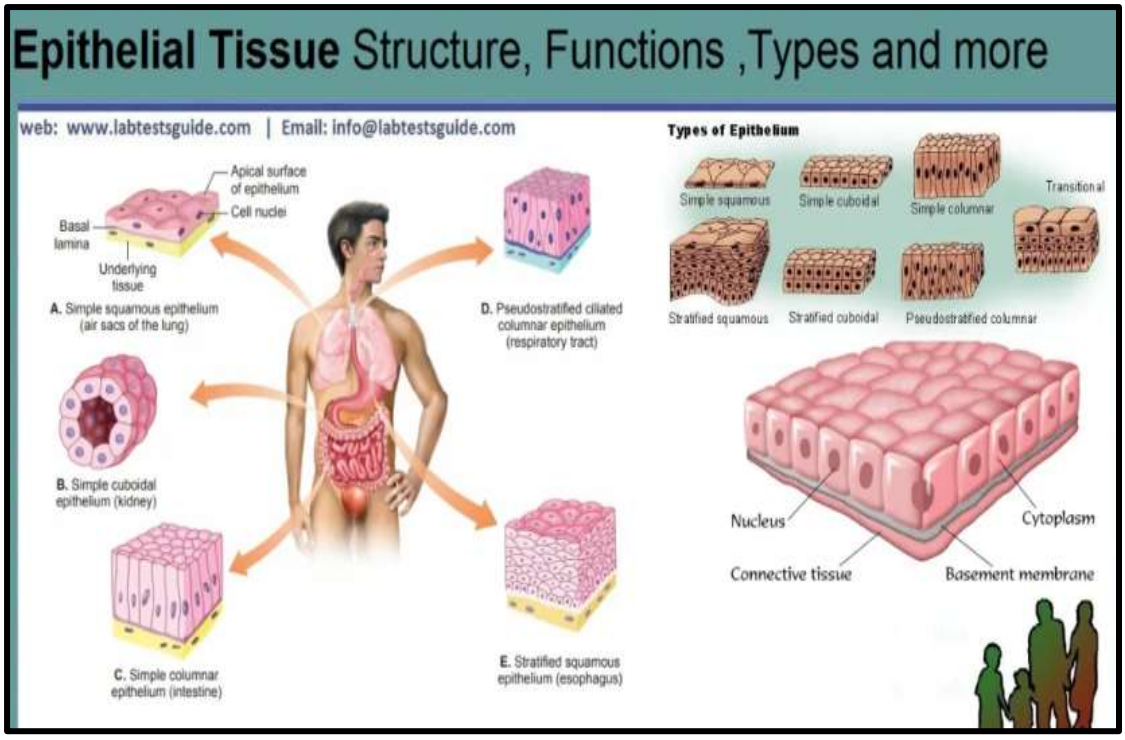
Muscle tissue is specialized for contraction and generation of tension. The different types of muscle tissue are functional adaptation of the basic contractile system of **actin** and **myosin**. Skeletal muscles are responsible for movement of the skeleton, cardiac muscle for the contraction of the heart that causes blood circulation; 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 fibers branch but are separated into individual cell by continuity of the plasma membrane, the intercalated discs.

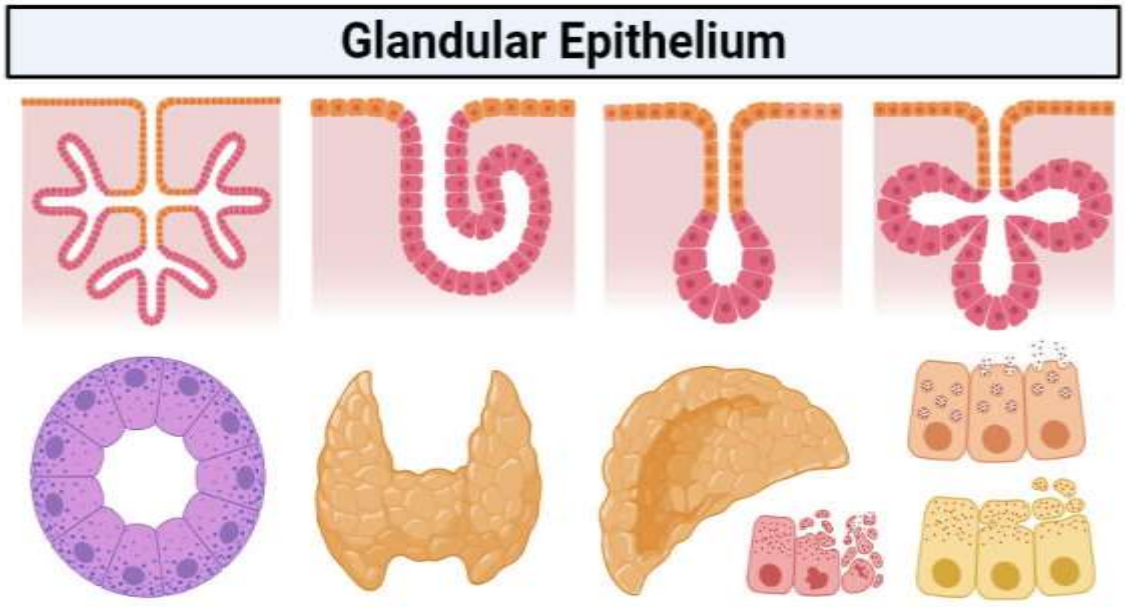
Nervous System- Conducting signals

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).

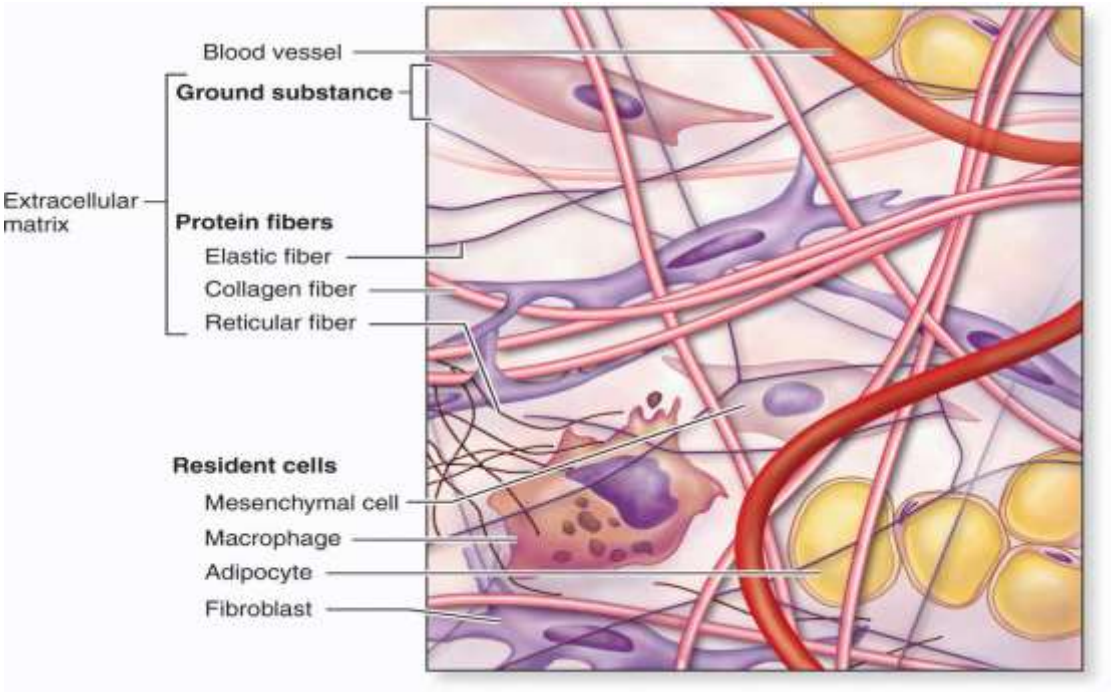




Connective Tissue

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.

Table 1. Elements in the Human Body.

Element	**Body weight %**
Hydrogen, H	9.5
Carbon, C	18.5
Nitrogen, N	3.3
Oxygen, O	65.0
Sodium, Na	0.2
Magnesium, Mg	0.1
Phosphorus, P	1.0
Sulfur, S	0.3
Chlorine, Cl	0.2
Potassium	0.4
Calcium	1.5

Table 2. Components of Body System.

System	Components
Circulation	Heart, blood vessels, blood.
Digestive system	Mouth, pharynx, esophagus, stomach, small and large intestine, salivary glands, pancreas liver, and gallbladder.
Respiratory system	Nose, pharynx, larynx, trachea, bronchi, lungs
Urinary system	Kidneys, ureters, urinary bladder, urethra
Skeletal system	Bones, cartilage, joints
Muscle system	Skeletal muscle
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 muscosa associated lymphoid tissue
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
Reproductive system	**Male:** testis, prostate, seminal vesicles, bulbourethral glands, associated ducts. **Female:** ovary, oviduct, uterus, vagina, breast.