

CELL TYPES

Introduction

Humans are composed of billions of cells. A tissue is a collection of cells with similar structural characteristics. Organs are group of tissues. Most organs are complex groupings of different tissue types. An organism is composed of organs that are grouped together and functionally integrated.

The four types of human tissue

1. Epithelium

Epithelium cells form sheets of cells that are tightly joined to one another. These cells cover surfaces, line cavities, and form the secretory portions of many glandular structures, which are complex invaginations of the body surface.

2. Connective tissue

Connective tissues join epithelial structures to other parts of the body. They exist under all epithelium layers and have a cellular component and an extracellular matrix. Bone, cartilage and blood are specialized connective tissues.

3. Muscle tissue

- Skeletal muscle tissue is found in the gross muscle that cause skeletal movement
- Cardiac muscle tissue is found in the heart wall and proximal portions of the aorta
- Smooth muscle tissue is a prominent component of a blood vessel walls and visceral organs such as those of the gastrointestinal, urinary and reproductive systems.

4. Nerve tissue

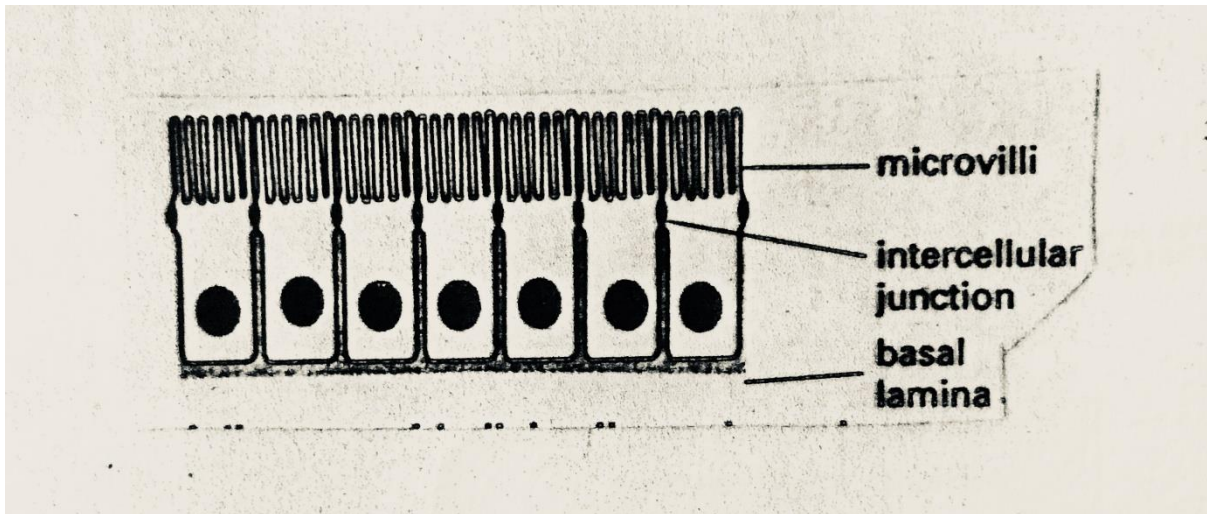
The brain spinal cord, autonomic ganglia, peripheral nerves and portions of sensory organs are composed of nerve tissue.

There are over 200 types of cells in the human body. Most tissues contain a mixture of cells types.

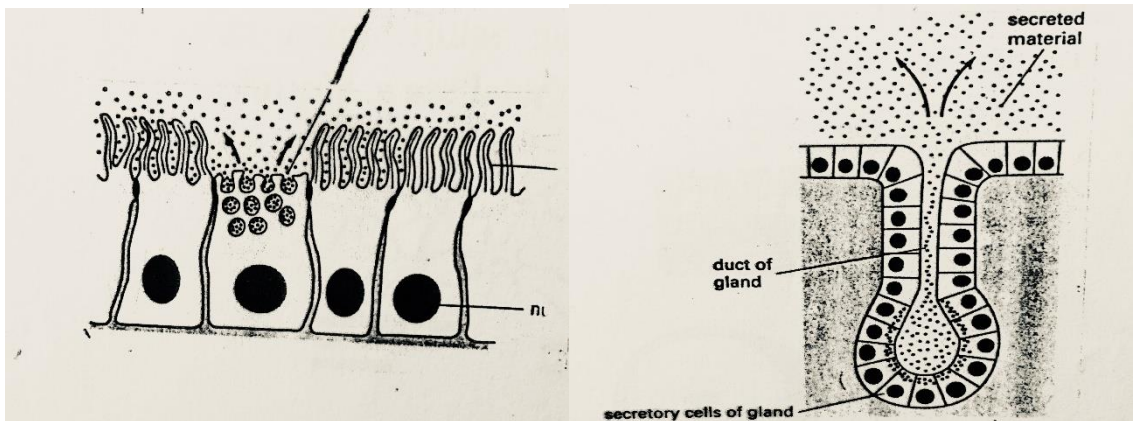
EPITHELIA

Epithelia cells form coherent cell sheets called epithelia, which line the inner and outer surfaces of the body. There are many specialized types of epithelia.

- **Absorbent cells** have numerous hair like microvilli projecting from their free surface to increase the area for absorb



- Ciliated cells have cilia on their free surface that beat in synchrony to move substances (such as mucus) over the epithelial sheet.
- Secretory cells are found in most epithelial layers. These specialized cells secrete substance onto the surface of the cell sheet.

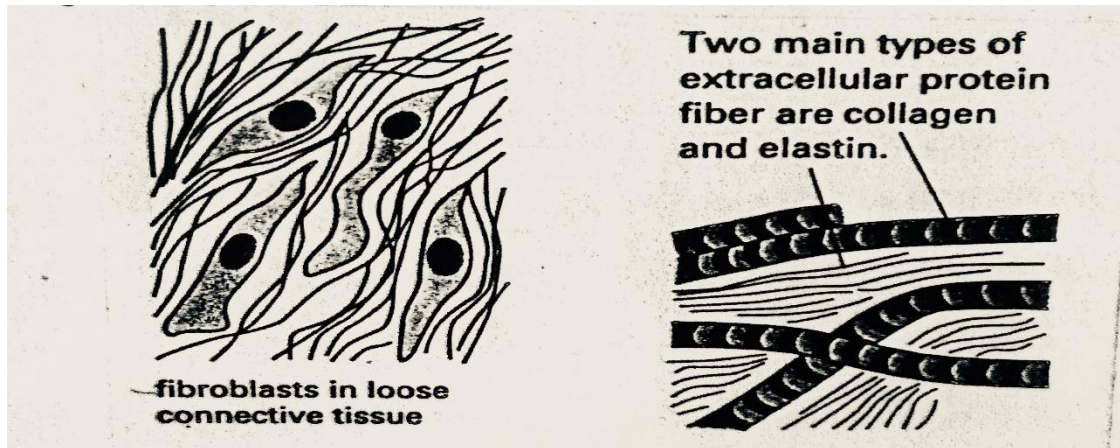


Secretory epithelial cells are often collected together to form a gland that specializes in the secretion of a particular substance. As illustrated, exocrine glands secrete their products (such as tears, mucus and gastric juices) into ducts. Endocrine glands secrete hormones into the blood.

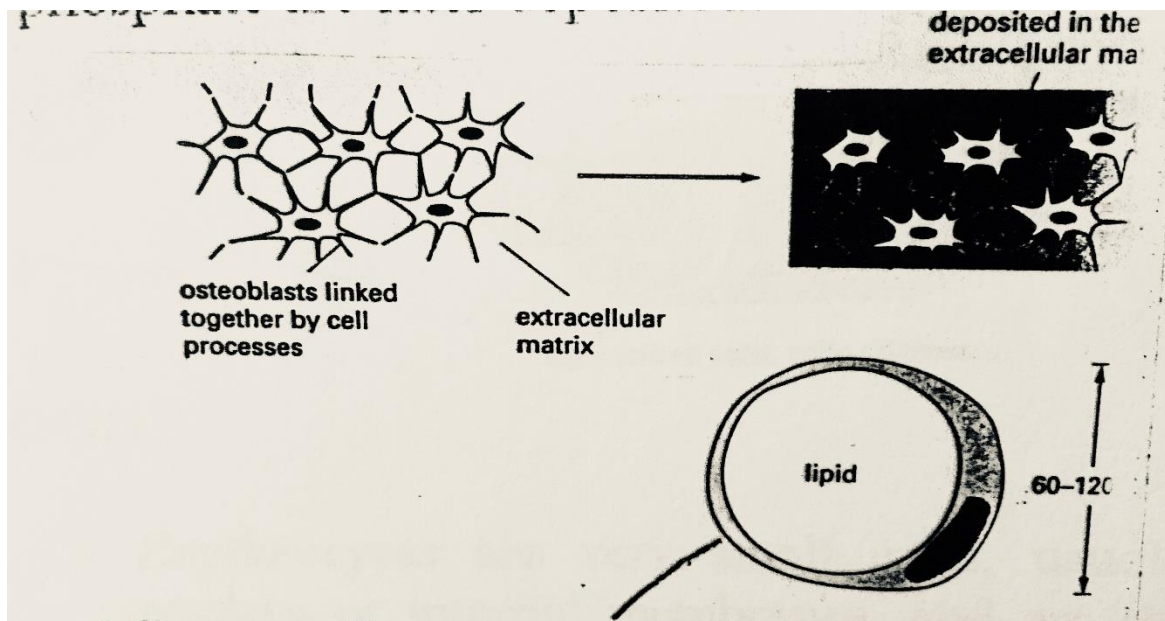
Adjacent epithelial cells are bound together by junctions that give the sheet mechanical strength and also make it impermeable to small molecules. The sheet rests on a basal lamina.

CONNECTIVE TISSUE

- The spaces between organs and tissues in the body are filled with connective tissue made principally of a network of tough *protein fibers* embedded in a polysaccharide gel. This extracellular matrix is secreted mainly by fibroblasts.



- Bone is made by cells called *osteoblasts*. These secrete an extracellular matrix in which crystals of calcium phosphate are later deposited.



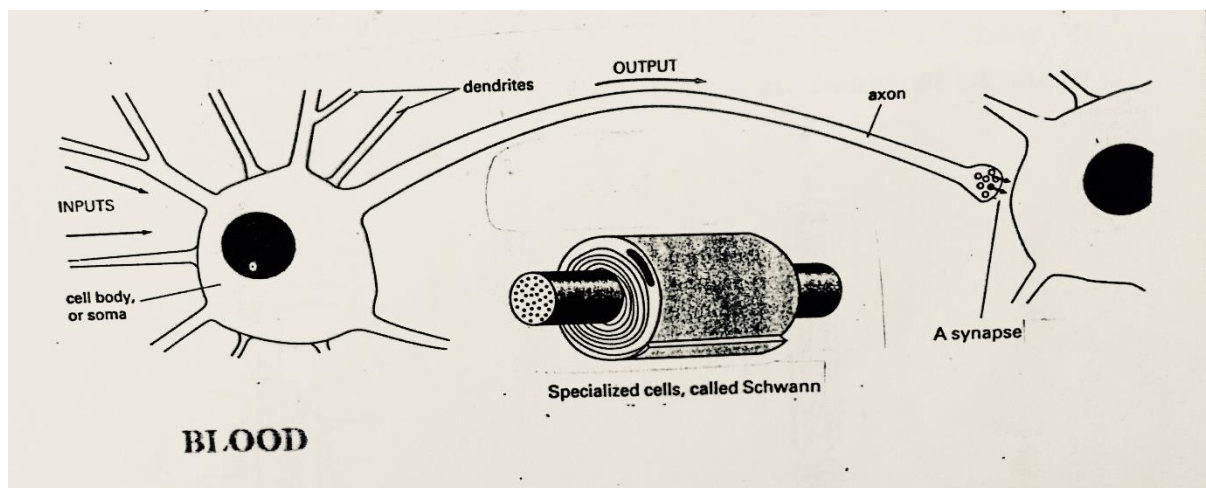
- Adipose cells, among the largest cells in the body, are responsible for the production and storage of fat. The nucleus and cytoplasm are squeezed by a large lipid droplet.

NERVOUS TISSUE

- **Nerve cells or neurons** are specialized for communication. The brain and spinal cord, for example, are composed of a network of neurons among supporting glial cells.
- **Specialized cells**, called **Schwann cells** or oligodendrocytes, wrap around an axon to form a multilayered membrane sheath.

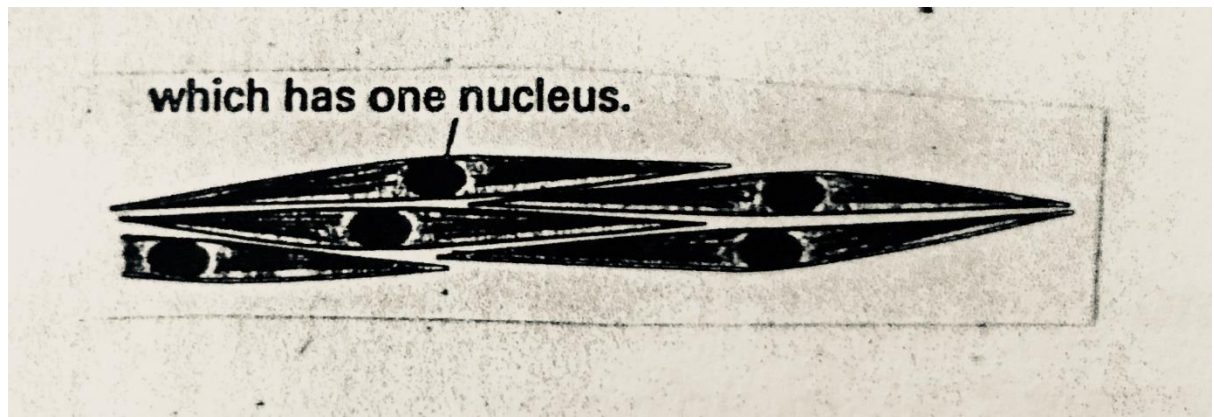
The axon conducts electrical signals away from the cell body. These signals are produced by a flux of ions across the nerve cell membrane.

A synapse is where a neuron forms a specialized junction with another neuron (or with a muscle cell). At synapses, signals pass from one neuron to another (or from a neuron to a muscle cell).



BLOOD

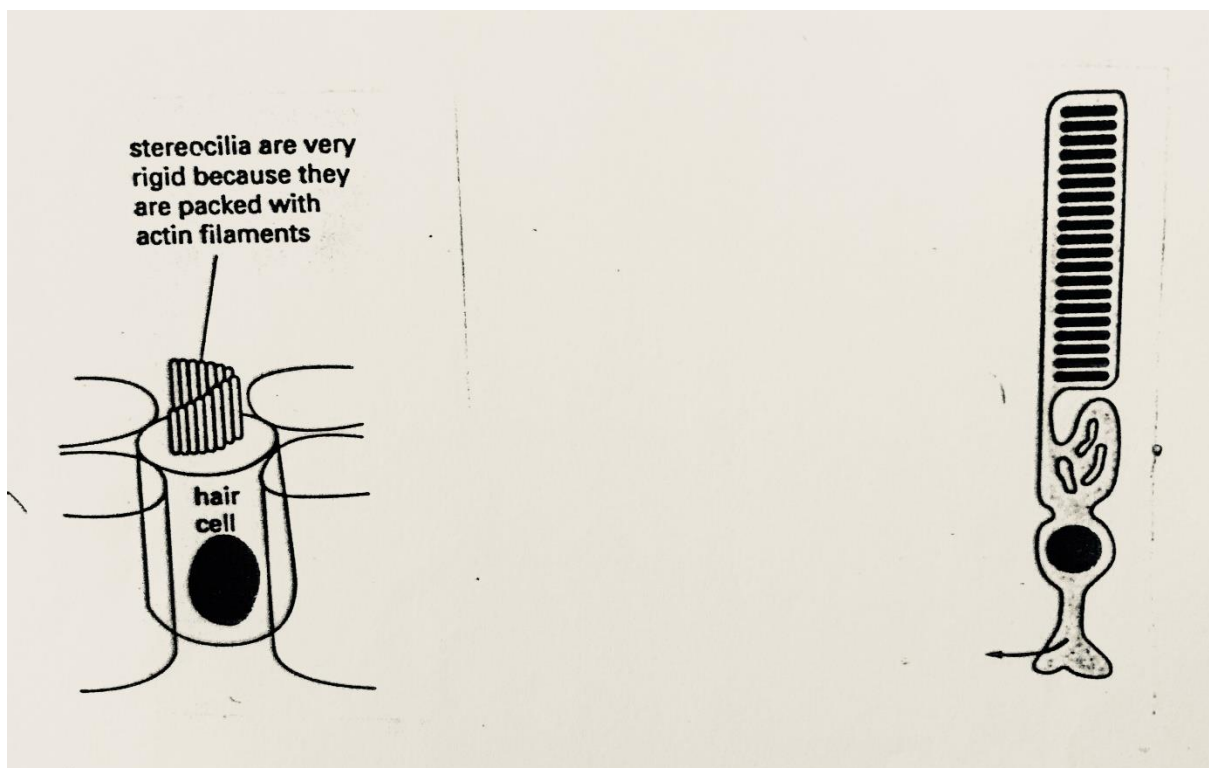
- **Erythrocytes** are very small cells, usually with no nucleus or internal membranes, and are stuffed full of the oxygen-binding protein hemoglobin.
- **Leucocytes** protect against infection.
- **Cardiac muscle** intermediate in character between skeletal and smooth muscle. It produces the heart beat. Adjacent cells are linked by electrically conducting junction that cause the cells to contract in synchrony.
- **Smooth muscle** present in digestive tract, bladder, arteries and veins. It is composed of thin elongated cells (not striated), each of which has one nucleus.



SENSORY CELLS

Among the most strikingly specialized cells in the vertebrate body are those that detect external stimuli.

- Hair cells of the inner ear are primary detectors of sound. Modified epithelial cells, they carry special microvilli (stereocilia) on their surface. The movement of these in response to sound vibration causes an electrical signal to pass to the brain.



- Rod cells in the retina of the eye are specialized to respond to light. The photosensitive region contains many membranous discs (red) in whose membranes the light-sensitive pigment rhodopsin is embedded. Light evokes an electrical signal (green arrow), which is transmitted to nerve cells in the eye, which relay the signal to the brain.

GERM CELLS

Both sperm and egg are haploid, that is, they carry only one set of chromosomes. A sperm from the male fuses with an egg from the female, which then forms a new diploid organism by successive cell divisions.

