

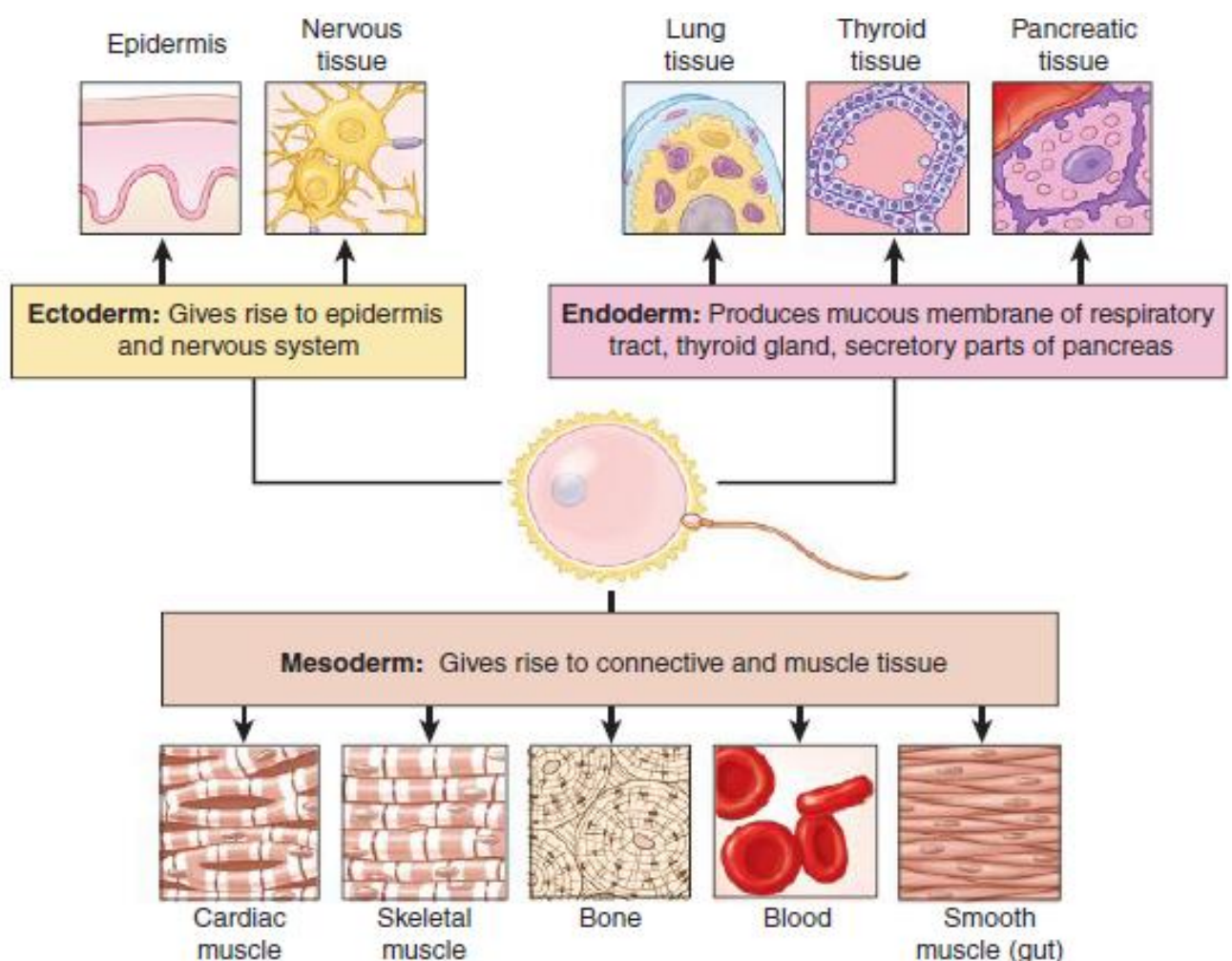
Lecture 2

TISSUES

Although the human body contains trillions of cells, all of those cells can be categorized as belonging to one of four distinct groups of **tissue**. Tissues are simply groups of similar cells that perform a common function. The four categories of tissue are **epithelial, connective, nervous, and muscular**.

Immediately after an egg and sperm unite to form a single cell, the cells begin to divide rapidly. At first, all the cells are identical.

Soon, the cells organize into three layers: the **ectoderm** (outer layer), the **mesoderm** (middle layer), and the **endoderm** (inner layer). The cells of each layer continue to divide, becoming increasingly distinct from the cells of the other layers. Eventually each layer gives rise to the different types of tissue, a process called **differentiation**.



Epithelial Tissue

epithelial tissue is a continuous sheet of tightly packed cells; it covers the body's surface, lines the body cavities and many of the organs, and forms certain glands.

The key functions of this tissue involve protection, absorption, filtration, and secretion.

In a sense, the epithelium is a *surface* tissue: its top surface is usually exposed to the environment—such as occurs with the skin or the inside of the mouth—or to an internal body cavity; its bottom surface adheres to underlying connective tissue by means of a **basement membrane**. Epithelial tissue is too thin to contain blood vessels; therefore, it depends on the connective tissue beneath to supply its needs for oxygen and nutrients. Epithelial tissue is classified by the shape of the cells as well as by the number of layers.

Cell Shape

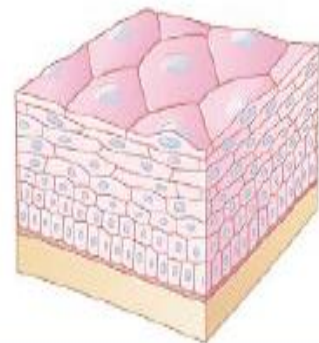
Epithelial cells may assume one of three basic shapes: **squamous**, **cuboidal**, or **columnar**

Cell Layers

Epithelia may appear as single or multiple layers.



In **simple** epithelia, every cell touches the basement membrane.



In **stratified** epithelia, some cells stack on top of other cells and the upper layers of cells don't touch the basement membrane.

Glandular Epithelium

There's another type of epithelium: **glandular epithelium**. A gland is a collection of epithelial cells that specializes in secretion of a particular substance.

- **Exocrine glands** secrete their products (such as tears, sweat, or gastric juices) into ducts. The ducts then empty onto a body surface or inside a body cavity. For example, sweat glands secrete sweat, which flows through ducts and onto the skin's surface.

- **Endocrine glands** are often called ductless glands. These glands secrete their products, called hormones, directly into the blood. For example, the adrenal glands secrete epinephrine and norepinephrine into the bloodstream.

Goblet cells are modified cells containing secretory vesicles that produce large quantities of mucus

Connective Tissue

The most widespread, and the most varied, of all the tissues is **connective tissue**. Existing in a variety of forms—ranging from tough cords to elastic sheets to fluid—connective tissue performs a variety of tasks **INCLUDING connect the body together and to support, bind, or protect organs**.

The key component of connective tissue—called **extracellular matrix**—Extracellular matrix is the framework into which the cells of tissue are embedded. The matrix consists of varying kinds and amounts of protein fibers and fluid; it's the variation in composition that gives tissue its characteristics. For example, the matrix of blood is fluid; it contains many cells but no fibers. In contrast, the matrix of bone contains few cells and many fibers, making it hard and brittle. The matrix may also be gel-like, flexible, tough, or even fragile.

The fibers found in connective tissue may be one of three types:

- **Collagenous fibers:** These are strong and flexible but resist stretching; these are the most abundant fibers.
- **Reticular fibers:** These occur in networks and support small structures such as capillaries and nerve fibers.
- **Elastic fibers:** Made of a protein called *elastin*, these fibers can stretch and recoil like a rubber band.

Types of Connective Tissue

Type	Location	Function
1-Loose fibrous connective		
• Areolar	Beneath the epithelia; between muscles; surrounding blood vessels and nerves	Connects tissues and organs together (such as skin to muscles)
• Adipose	Beneath the skin, breast, heart's surface; surrounding kidneys and eyes	Provides protective cushion, insulation; stores energy
• Reticular	Spleen; lymph nodes; bone marrow	Provides a supportive framework
2-Dense fibrous connective	Tendons; ligaments; fascia; dermis of the skin	Provides durable support
3-Cartilage		
• Hyaline	Ends of bones in joints; connecting point between ribs and sternum; rings in trachea and bronchi; larynx; fetal skeleton	Eases joint movement; firm but flexible support
• Elastic	External ear	Provides flexible support
• Fibrocartilage	Intervertebral discs; knee joint; pelvis	Resists compression and absorbs shock
4-Bone	Skeleton	Provides support, protection; serves as calcium reservoir
5- Blood	Inside blood vessels throughout the body	Transports oxygen, nutrients, hormones, wastes from one part of the body to another

Nervous Tissue

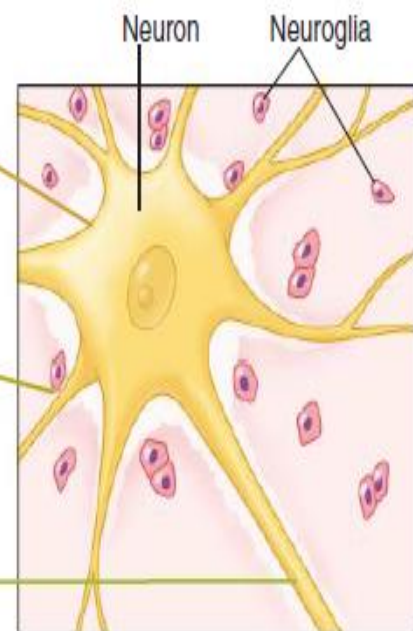
Nervous tissue has a high degree of excitability and conductivity—more so than other tissues. It's these characteristics that allow it to communicate rapidly with other parts of the body. Found in the brain, spinal cord, and nerves, nerve tissue consists of two types of cells:

- **Neurons**, the units that conduct nervous impulses
- **Neuroglia**, which protect and assist neurons.

Each neuron has a large cell body, called a **soma**. The soma contains the nucleus of the nerve cell as well as the organelles.

Extending from the soma are multiple, short processes called **dendrites**. The dendrites receive impulses from other cells, which they then transmit to the soma.

The neuron contains a single, long nerve fiber called the **axon**. The axon transmits signals to other cells.



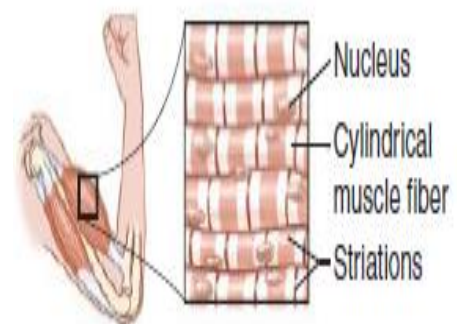
Muscle Tissue

Muscle tissue consists of elongated cells that contract in response to stimulation. The body contains three types of muscle tissue: skeletal, cardiac, and smooth.

Skeletal Muscle

consists of long, thin cells called **muscle fibers**. Skeletal muscle may also be called *striated* muscle (because its light and dark bands give it a striped, or striated, appearance) or *voluntary* muscle (because we can move it voluntarily).

Most skeletal muscle is attached to bone. This is the muscle that makes body movements possible. It is also the muscle responsible for breathing, speech, control of urination, and facial expression.

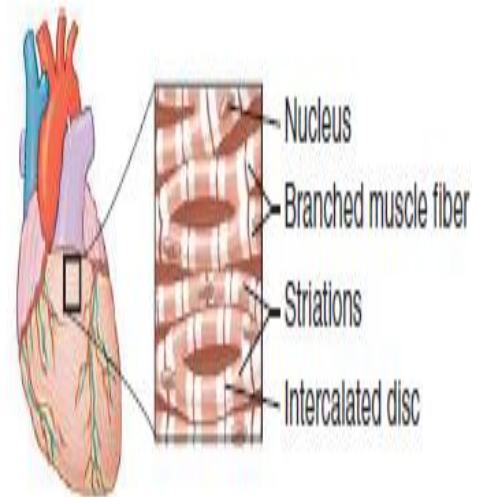


Cardiac Muscle

found only in the heart. While cardiac muscle also appears striated, it is uniquely different from skeletal muscle. For one thing, cardiac muscle cells are shorter than those of skeletal muscle.

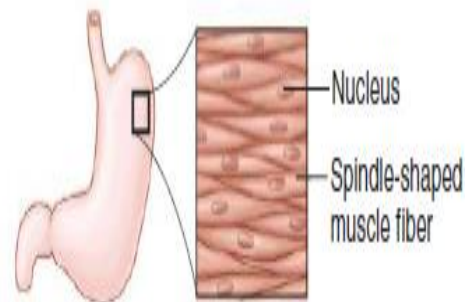
In addition, the cells are joined together with junctions called **intercalated discs**.

These junctions allow electrical impulses to spread rapidly from cell to cell; this rapid transmission permits almost simultaneous stimulation and contraction. Finally, cardiac muscle is *involuntary* muscle: its contraction is not under voluntary control.



Smooth Muscle

consists of long, spindle-shaped cells—lacks the striped pattern of striated muscle. smooth muscle is not under voluntary control. This muscle lines the walls of many organs, including those of the digestive, respiratory, and urinary tracts. Smooth muscle controls the diameter of blood vessels, making it important in controlling blood pressure and flow.



Membranes

Thin sheets of tissue, called **membranes**, fulfill many crucial functions in the body. In general, membranes line body cavities, cover body surfaces, and separate organs (or parts of organs) from each other. Some membranes secrete lubricating fluids to reduce friction during movement, such as when the heart beats or a joint bends. The two categories of membranes are **epithelial membranes** and **connective tissue membranes**.

Epithelial Membranes

The body contains three types of epithelial membranes: mucous membranes, cutaneous membranes, and serous membranes.

1. Mucous membranes

Mucous membranes line body surfaces that open directly to the body's exterior, such as the respiratory, digestive, urinary, and reproductive tracts. True to the name, mucous membranes secrete **mucus**, a watery secretion that coats and protects the cells of the membrane. Mucus also acts as a lubricant to help propel food through the digestive tract; in the respiratory tract, it traps dust and bacteria.

2 Cutaneous membrane

Known as the skin, this is the body's largest membrane. It consists of a layer of epithelium resting on a layer of connective tissue.

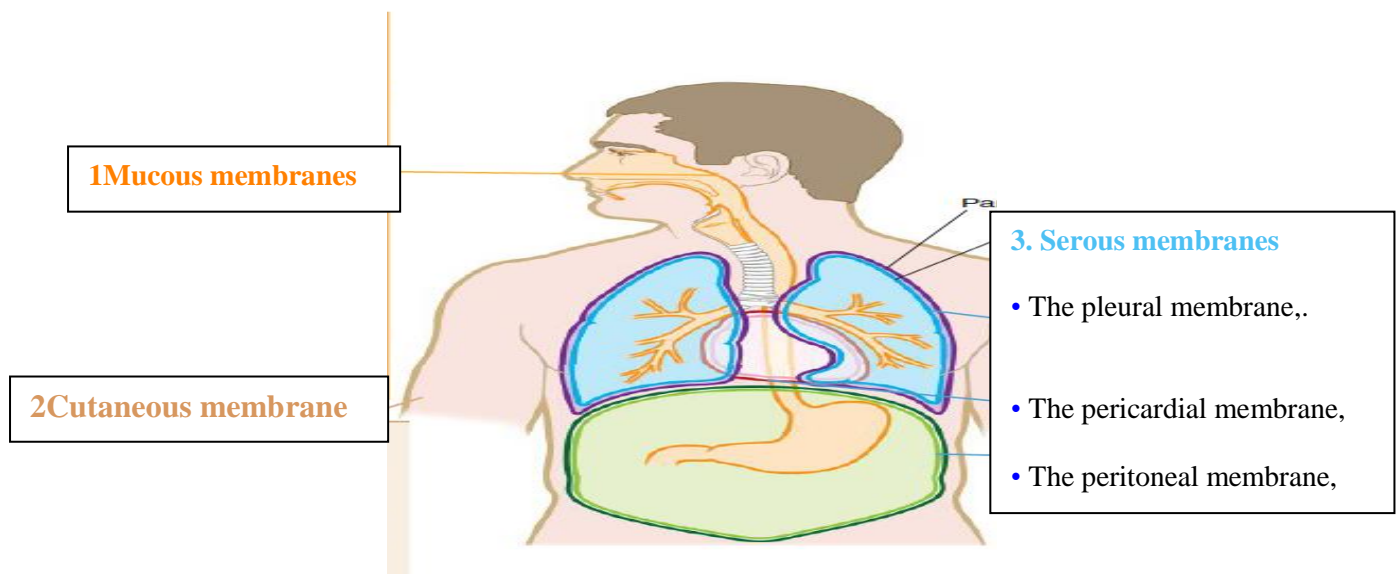
3 Serous membranes

serous membranes line some of the closed body cavities and also cover many of the organs in those cavities. The serous membrane that lines the body cavities is

actually one continuous sheet: part of the membrane (called the *parietal membrane*) lines the wall of the cavity; it then folds back and covers the organs. The part of the membrane that covers the organs is called the *visceral membrane*. There are three serous membranes:

- The , or pleural membrane, surrounds each lung and lines the thoracic cavity.
- The , or pericardial membrane, surrounds the heart.
- The , or peritoneal membrane, lines the abdominal cavity and covers the abdominal organs.

Serous membranes secrete serous fluid, which helps prevent friction as the heart beats and the lungs expand.



Connective Tissue Membranes

Some joints are lined by membranes made of connective tissue. For example, **synovial membranes** line the spaces between bones, where they secrete synovial fluid