

## What is the endocrine system?

The endocrine system consists of glands that secrete hormones. These hormones travel through the bloodstream to target organs, where they regulate various physiological processes.

The endocrine system includes the hypothalamus, pituitary gland, thyroid gland, parathyroid glands, adrenal glands, and the reproductive glands.

### Thyroid

The thyroid gland is located in the neck and produces thyroid hormones, which regulate metabolism and energy production.



# Histology

## Sheet no.1

### The endocrine system and hormones

Hormones are chemical messengers that travel through the bloodstream to target organs, where they regulate various physiological processes.

### Feedback to the hypothalamus



### Feedback to the pituitary



### From pituitary through hormones to target organs



### Types of hormones

Hormones can be classified into water-soluble and lipid-soluble hormones. Water-soluble hormones bind to receptors on the cell surface, while lipid-soluble hormones pass through the cell membrane and bind to intracellular receptors.



### Pituitary gland

The pituitary gland is a small pea-sized gland located at the base of the brain. It secretes several hormones that regulate various physiological processes.



### Thyroid and parathyroids

The thyroid gland is a large gland in the neck that produces thyroid hormones. The parathyroid glands are four small glands located on the thyroid gland, which produce parathyroid hormone.

### Adrenal gland

The adrenal gland is a gland located on top of the kidney. It consists of two parts: the outer adrenal cortex and the inner adrenal medulla.

### Kidney

The kidney is an organ that filters waste from the blood and produces urine. It also produces the hormone erythropoietin, which stimulates the production of red blood cells.

### Pancreas

The pancreas is a gland located in the abdominal cavity. It produces the hormone insulin, which regulates blood sugar levels.

### Reproductive organs

The reproductive organs are the organs that produce and release eggs and sperm. They include the ovaries, uterus, fallopian tubes, and vagina in females, and the testes and vas deferens in males.

### Function of insulin

Insulin is a hormone that regulates blood sugar levels. It is produced by the beta cells of the pancreas and acts on target organs to promote the uptake of glucose from the blood.

### Reproductive organs

The reproductive organs are the organs that produce and release eggs and sperm. They include the ovaries, uterus, fallopian tubes, and vagina in females, and the testes and vas deferens in males.

### Menstrual cycle

The menstrual cycle is a series of changes that occur in the female reproductive system over a period of about 28 days. It involves the shedding of the lining of the uterus.

### Menstrual cycle

The menstrual cycle is a series of changes that occur in the female reproductive system over a period of about 28 days. It involves the shedding of the lining of the uterus.

### Menstrual cycle

The menstrual cycle is a series of changes that occur in the female reproductive system over a period of about 28 days. It involves the shedding of the lining of the uterus.

### Menstrual cycle

The menstrual cycle is a series of changes that occur in the female reproductive system over a period of about 28 days. It involves the shedding of the lining of the uterus.



### The hypothalamus and pituitary gland

The hypothalamus is a small region of the brain that controls many of the body's internal processes, including the release of hormones from the pituitary gland.

The pituitary gland is a small pea-sized gland located at the base of the brain. It secretes several hormones that regulate various physiological processes.

The hypothalamus and pituitary gland work together to regulate the endocrine system and maintain homeostasis in the body.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

The hypothalamus and pituitary gland are essential for the regulation of many physiological processes, including metabolism, growth, and reproduction.

The hypothalamus and pituitary gland are also involved in the regulation of the immune system and the stress response.

**Writer: HEBAH KHRAISAT**  
**Corrector: AHMAD AL-GHWIRI**  
**Doctor: GHADA ABO-ALGHANAM**

# Epithelial tissue

The principal functions of epithelial tissues are:

1-covering (surfaces/cavities/tubes and ducts):

EG: A-Epidermis which is the most superficial layer of skin.

B- The stomach lining

C- The intestine lining

D-The oral cavity

E-Blood vessels

2-secretion (by glands)

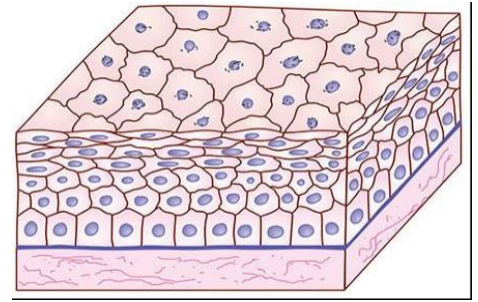
EG: salivary glands (produces saliva that enters the oral cavity increasing the moisture there in order to allow us to talk)

3-absorption

NOTE THAT there are types of epithelium tissues due to the different functions of each region.

- The shapes and dimensions of epithelial cells are quite variable, ranging from tall **columnar** to **cuboidal** to low **squamous** cells.

- The cells' size and morphology are generally dictated by their function.
- Epithelial cell nuclei vary in shape and may be elliptic(oval), spherical, or flattened, with nuclear shape corresponding roughly to cell shape.



## Epithelial Nuclei

- Because the lipid-rich membranes of epithelial cells are frequently indistinguishable by light microscopy, the number and shape of their stained nuclei are important indicators of cell shape and density.
- The nuclei also allow one to determine the number of cell layers in an epithelium, a primary morphologic criterion for classifying epithelia.
- Columnar cells generally have elongated nuclei, squamous cells have flattened nuclei, and cuboidal or pyramidal cells have more spherical nuclei.

# Types of Epithelia

- Epithelia can be divided into two main groups: **covering (or lining) epithelia** and **secretory (glandular) epithelia**.
- This is an arbitrary functional division for there are lining epithelia in which all the cells also secrete (eg, the lining of the stomach) or in which glandular cells are distributed among the lining cells (eg, mucous cells in the small intestine or trachea).

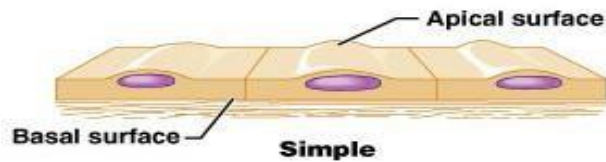
## Covering or Lining Epithelia

- Cells of covering epithelia are organized into one or more layers that cover the surface or line the cavities of an organ.
- Such epithelia are classified according to the number of cell layers and the cell morphology in the outer layer

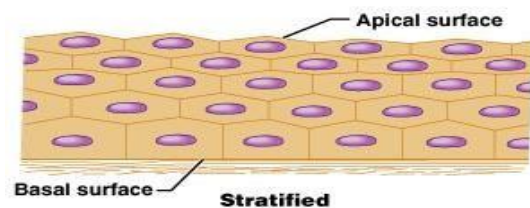
# Classifications & Naming of Epithelia

1-According to number of layers

A-Simple – one layer of cells  
(Or one row of nuclei)



B-Stratified – more than one layer of cells

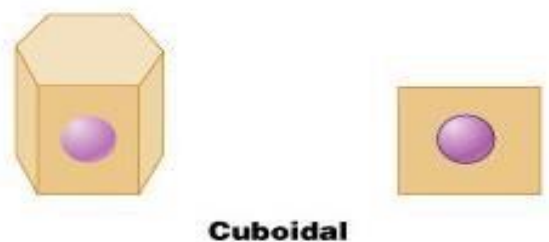


2-According to shape of cells (in stratified epithelia, shape of most apical layer)

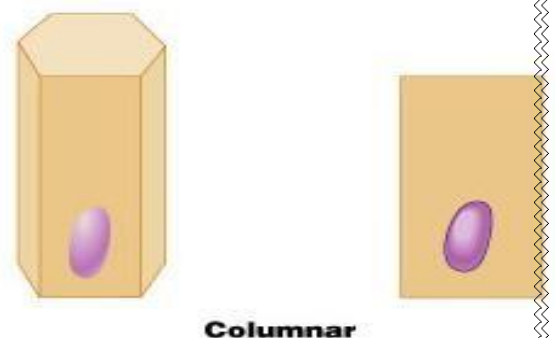
A-Squamous – cells wider than tall (plate or “scale” like)  
low cells (larger surface area)  
\*Flattened nucleus



B-Cuboidal – cells are as wide as tall, as in cubes.  
Normal/relaxed cells  
\*Rounded nucleus



C-Columnar – cells are taller than they are wide, like columns  
Elongated cells (lower surface area)  
\*Elongated nucleus



-low means the height ONLY

NOTE THAT:

- 1- \*The nucleus shape follows the general shape of the cell.
- 2-The taller the cell the more basally located the nucleus
- 3-The boundaries of the cell cannot be distinguished since

A-The membrane is made out of lipids.

B-lipids in tissue preparation are dissolved.

SO THAT MEANS that we use the nucleus number and shape to determine the type of tissue in the sample

## **Naming of epithelia**

*1-Naming the epithelia includes both the layers (first) and the shape of the cells (second)*

A-i.e., stratified cuboidal epithelium.

EG: the epidermis

*2-The name may also include any accessory structures*

A-Keratin aka dead cells

EG: dead skin (from the epidermis)

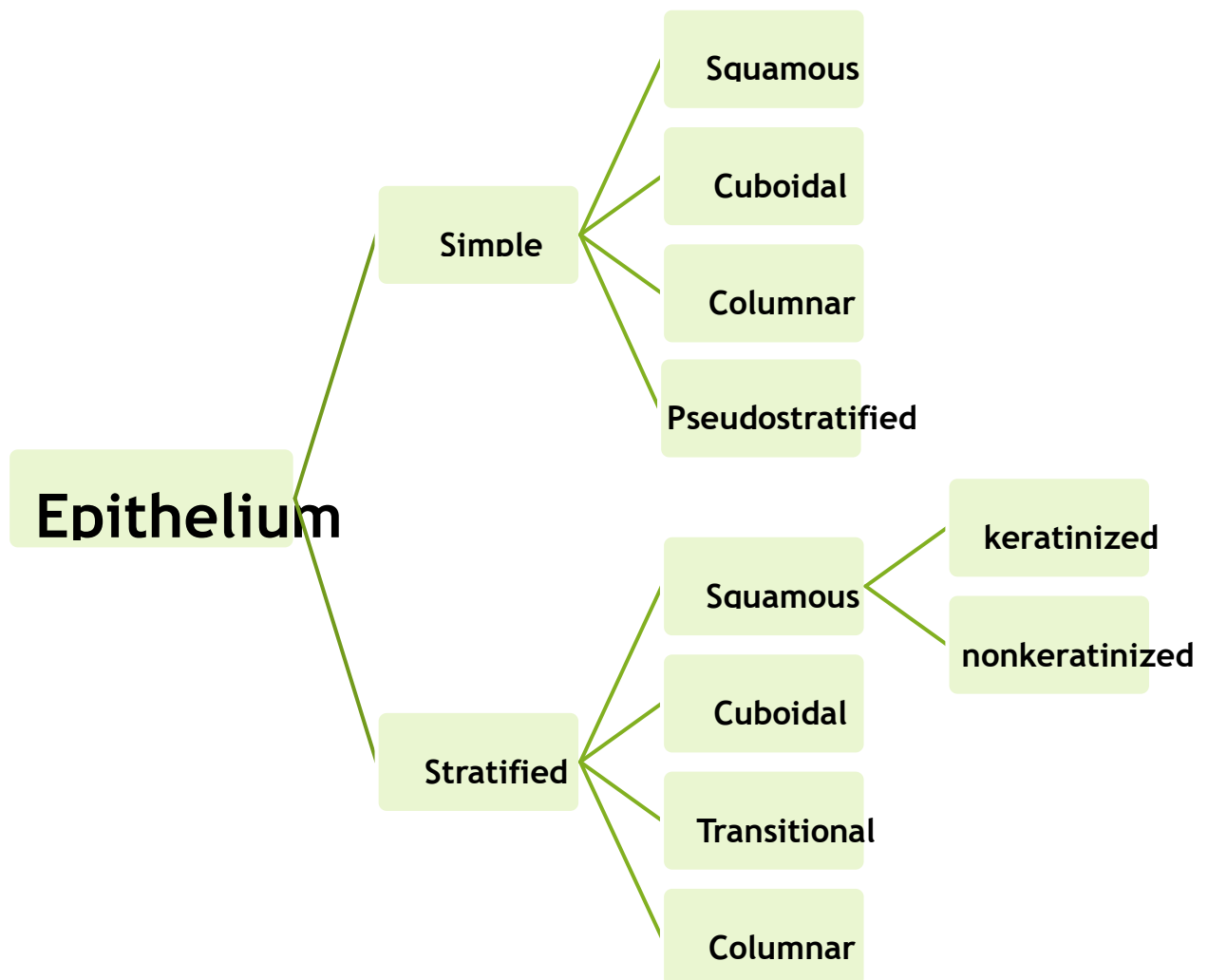
B-Goblet cells

C-Cilia

3-Special epithelial tissues (don't follow naming convention)

A-Pseudostratified

B-Transitional

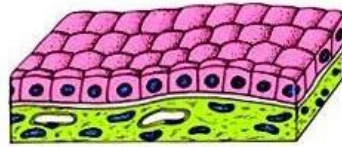


all cells in the simple epithelium rest on the basal lamina

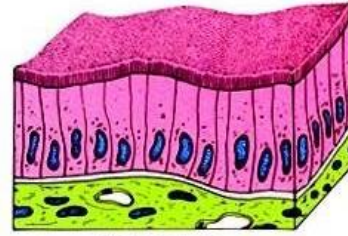
(SIMPLE)



Squamous



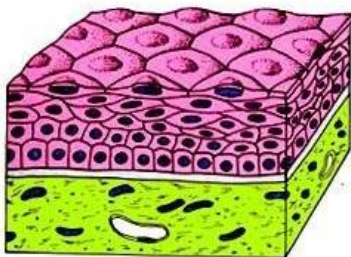
Cuboidal



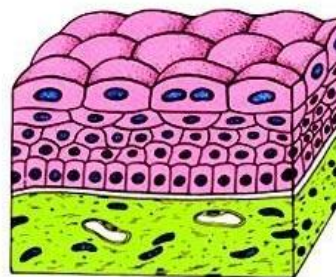
Columnar

only the deepest (the basal) layer in stratified epithelium rest on the lamina

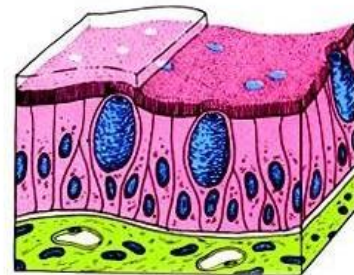
(STRATIFIED)



Squamous



Transitional



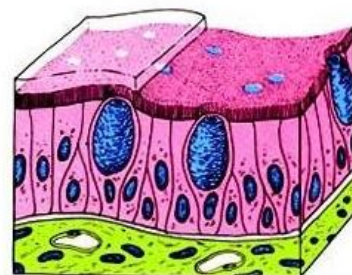
Pseudostratified

false layering

those are called goblet cells which are unicellular glands.

-The functions of goblet cells:

1. The production and secretion of mucus.



Pseudostratified



## 2. Creating a protective mucus layer.

Goblet cells can be found: in the lining of the small intestine and respiratory tract (to secrete lubricating mucus that aids the function of these organs)

-Mucus: is the gelatinous ,buttery or slippery fluid secreted from the goblet cell.

-the basal cells tend to stay at the bottom

-the nuclei tend to be higher

-the apical cells reach the surface

-they all rest at the basal lamina

Major Feature	Cell Form	Examples of Distribution	Main Function
Simple (one layer of cells)	Squamous	Lining of vessels (endothelium); Serous lining of cavities: pericardium, pleura, peritoneum (mesothelium)	Facilitates the movement of the viscera (mesothelium), active transport by pinocytosis (mesothelium and endothelium), secretion of biologically active molecules (mesothelium)
	Cuboidal	Covering the ovary, thyroid	Covering, secretion
	Columnar	Lining of intestine, gallbladder	Protection, lubrication, absorption, secretion
Stratified (two or more layers of cells)	Squamous keratinized (dry)	Epidermis	Protection; prevents water loss
	Squamous nonkeratinized (moist)	Mouth, esophagus, larynx, vagina, anal canal	Protection, secretion; prevents water loss
	Cuboidal	Sweat glands, developing ovarian follicles	Protection, secretion
	Transitional	Bladder, ureters, renal calyces	Protection, distensibility
	Columnar	Conjunctiva	Protection
Pseudostratified (layers of cells with nuclei at different levels; not all cells reach surface but all adhere to basal lamina)		Lining of trachea, bronchi, nasal cavity	Protection, secretion; cilia-mediated transport of particles trapped in mucus out of the air passages

# Simple Squamous Epithelium

## *Locations:*

Vascular system (endothelium)

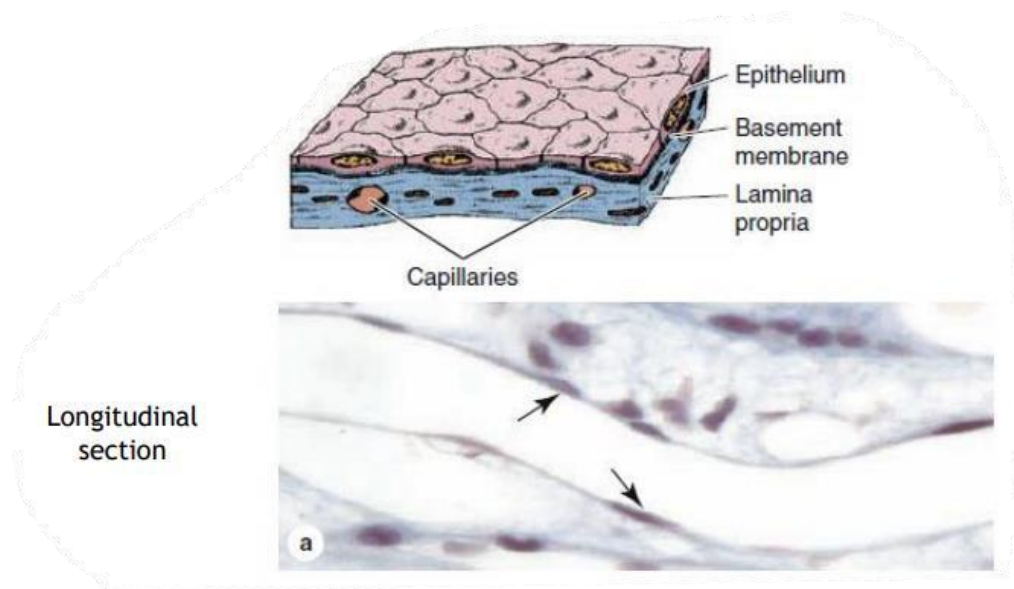
Body cavities (mesothelium)

Bowman's capsule (kidney)

Lung alveoli

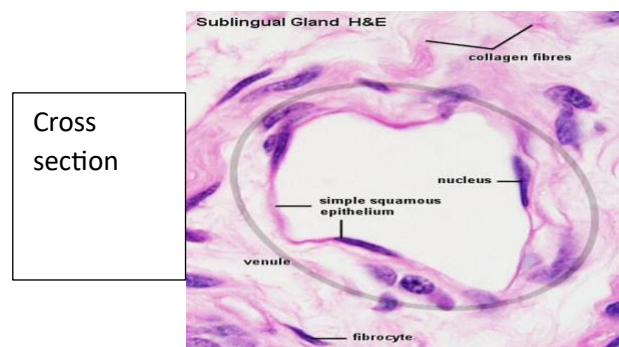
## *Major function:*

Exchange



Blood vessels are all lined with endothelium.

The heart is lined with endocardium.

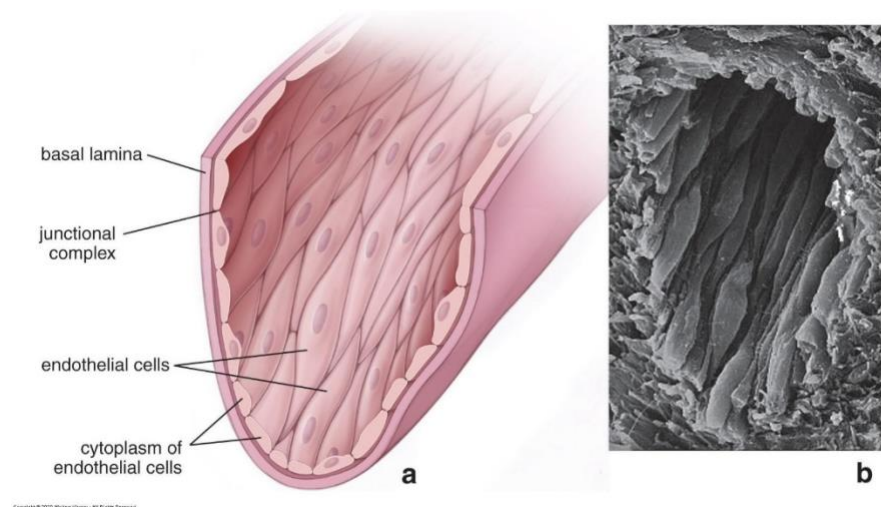


# Endothelium

*Endothelium* is the simple squamous epithelium that lines the lumen of the cardiovascular system.

## NOTE THAT

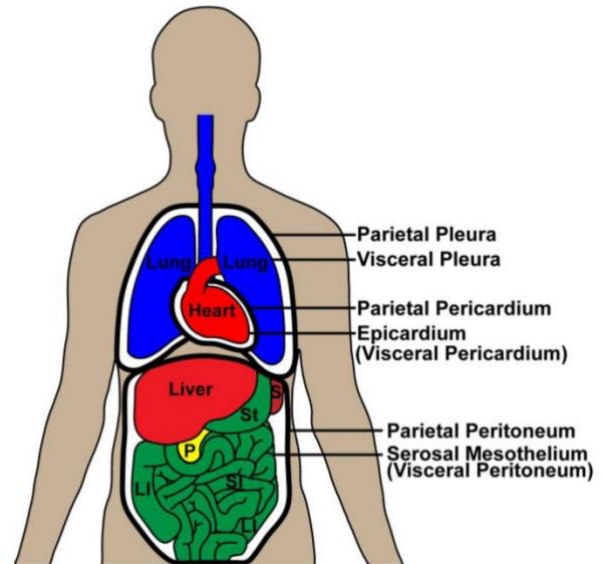
- Endothelium allows the passage of materials through its wall.
- the thinner the endothelium the better it is.



# Mesothelium

*Mesothelium* is the simple squamous epithelium that lines serous cavities (peritoneal, pleural, and

pericardial cavities) and covers many of the organs in these cavities



NOTE THAT cavities have linings and organs have coverings.

-the lung is covered by pleura

which has two layers:

1-vesciral pleura (on the lungs)

2-parietal pleura (on the thoracic cavity)

In-between we can see the pleura cavity.

