

The tissue *Epithelial tissue*

Cells of the human body do not operate independently of one another. Instead, related cells live and work together in cell communities called **tissues**.

A tissue is defined as a group of cells of similar structure that perform a specific function in the body. The four basic types of tissue are **epithelial tissue**, **connective tissue**, **muscle tissue**, and **nervous tissue**.

The epithelial tissue

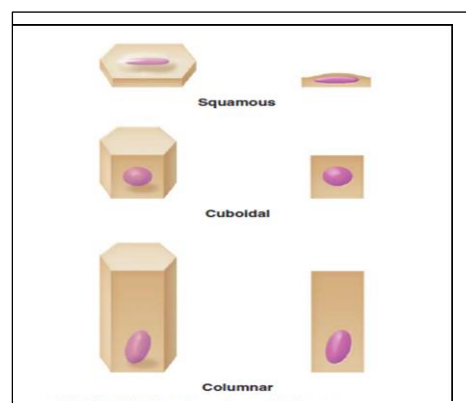
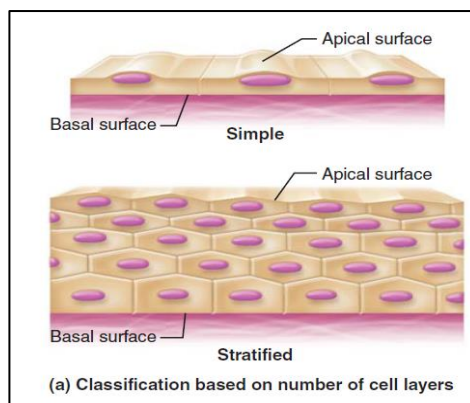
An **epithelium** is a sheet of cells that covers a body surface or lines a body cavity. Epithelial tissue occurs in two different forms:

- 1- **Covering and lining epithelium** covers the outer and inner surfaces of most body organs. Examples include the outer layer of the skin; the inner lining of all hollow viscera such as the stomach and respiratory tubes.
- 2- **Glandular epithelium** forms most of the body glands

Classification of Epithelia

Many kinds of epithelia exist in the body. Two features are used to classify and name epithelia: the number of cell layers and the shape of the cells. The terms simple and stratified describe the number of cell layers in an epithelium. **Simple epithelia** contain a single layer of cells, with each cell attached to the basement membrane. On the other hand, **stratified epithelia** contain more than one layer of cells. The cells on the basal surface are attached to the basement membrane; those on the apical surface border an open space.

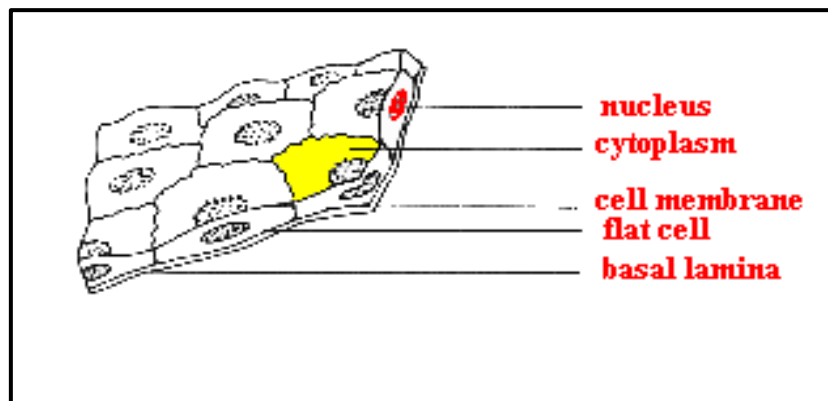
Cell shape is described as *squamous*, *cuboidal*, or *columnar*, referring to the appearance of the cells in section.



Simple epithelium can be subdivided according to the shape and function of its cells in to:


1- **Squamous epithelium.**

A simple squamous epithelium is a single layer of flat cells. this type of epithelium occurs wherever small molecules pass through a membrane quickly by processes of diffusion or filtration. The walls of capillaries consist exclusively of this epithelium. In the lungs, this epithelium forms the thin walls of the air sacs, where gas exchange occurs.



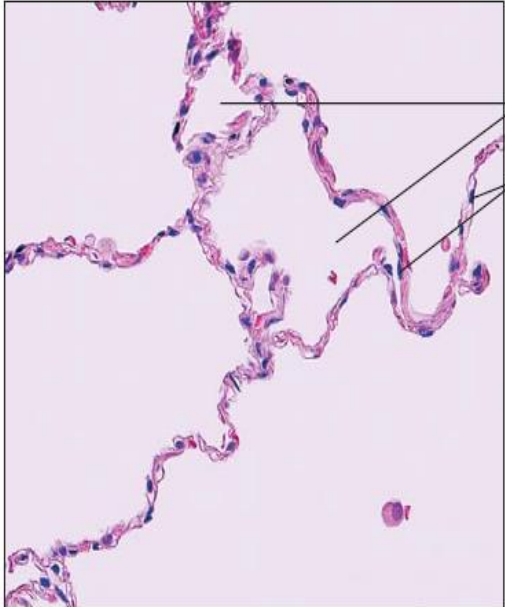

(a) Simple squamous epithelium

Description: Single layer of flattened cells with disc-shaped central nuclei and sparse cytoplasm; the simplest of the epithelia.



Function: Allows passage of materials by diffusion and filtration in sites where protection is not important; produces lubricating fluid in serosae.

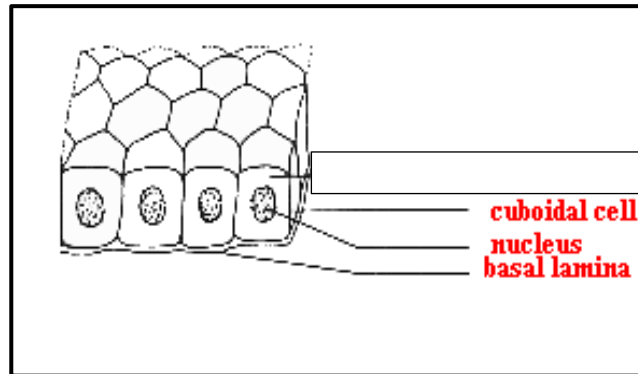
Location: Kidney glomeruli; air sacs of lungs; lining of heart, blood vessels, and lymphatic vessels; lining of ventral body cavity (serosae).



Photomicrograph: Simple squamous epithelium forming part of the alveolar (air sac) walls (140x).


2- Simple cuboidal epithelium.

Simple cuboidal epithelium consists of a single layer of cube-shaped cells. This epithelium forms the secretory cells of many glands, the walls of the smallest ducts of glands, and the walls of many tubules in the kidney. Its functions are the same as those of simple columnar epithelium.



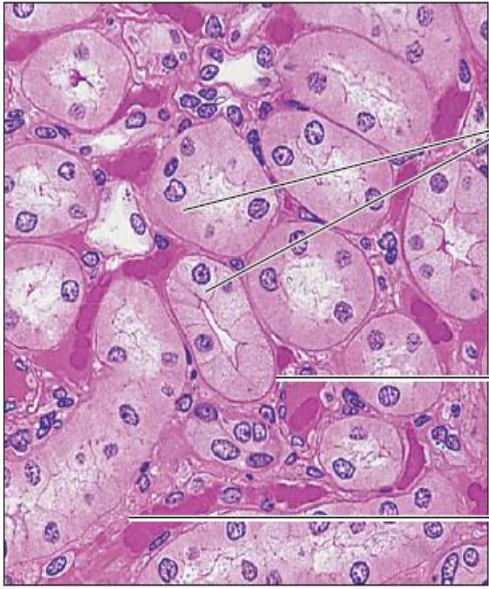

(b) Simple cuboidal epithelium

Description: Single layer of cubelike cells with large, spherical central nuclei.



Function: Secretion and absorption.

Location: Kidney tubules; ducts and secretory portions of small glands; ovary surface.



Simple cuboidal epithelial cells

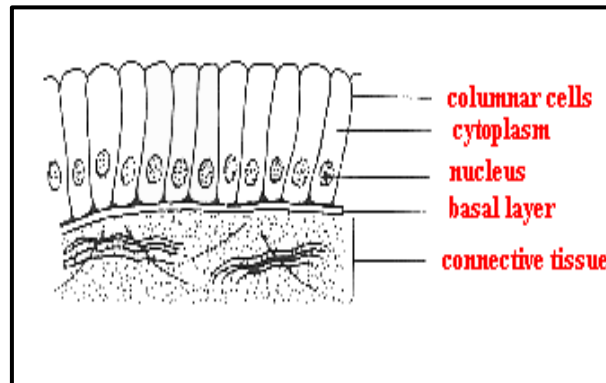
Basement membrane

Connective tissue

Photomicrograph: Simple cuboidal epithelium in kidney tubules (430 \times).

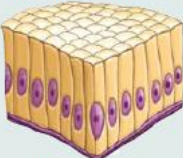
3- Simple columnar epithelium

Simple columnar epithelium is a single layer of tall cells. It lines the digestive tube from the stomach to the rectum. Some simple columnar epithelia bear *cilia*, whip like bristles on the apex of epithelial cells that beat rhythmically to move substances across certain body surfaces. A simple ciliated columnar epithelium lines the inside of the uterine tube.





(c) Simple columnar epithelium

Description: Single layer of tall cells with *round to oval* nuclei; some cells bear cilia; layer may contain mucus-secreting unicellular glands (goblet cells).



Function: Absorption; secretion of mucus, enzymes, and other substances; ciliated type propels mucus (or reproductive cells) by ciliary action.

Location: Nonciliated type lines most of the digestive tract (stomach to rectum), gallbladder, and excretory ducts of some glands; ciliated variety lines small bronchi, uterine tubes, and some regions of the uterus.

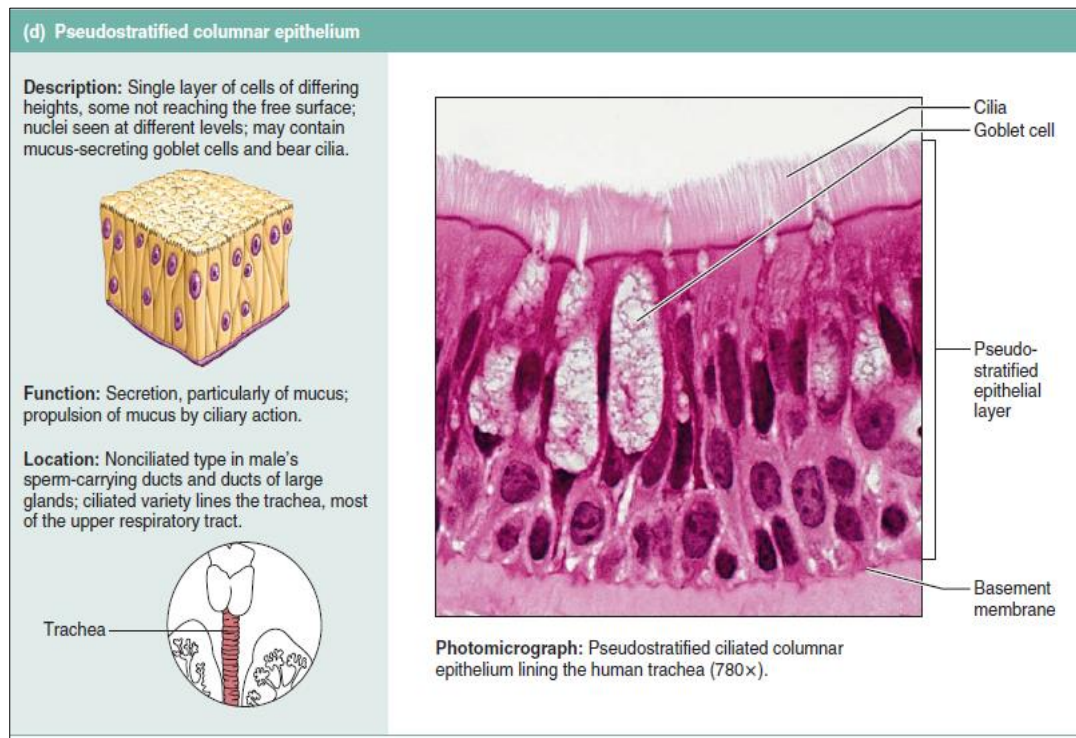


Photomicrograph: Simple columnar epithelium of the small intestine (650x).

Labels in the photomicrograph: Microvilli, Goblet cell, Simple columnar epithelial cell, Basement membrane.

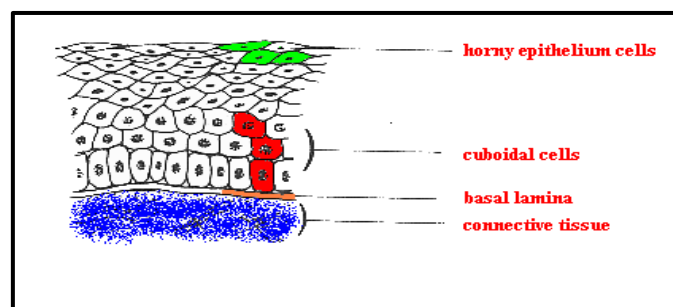
4- Pseudostratified Columnar Epithelium

Pseudostratified columnar epithelium is so named because it appears to be layered. However, true layers do not exist because each cell touches the basement membrane. In particular, the irregular placement of the nuclei creates the appearance of several layers, whereas only one exists. The lining of the windpipe, or trachea, is pseudostratified ciliated columnar epithelium.



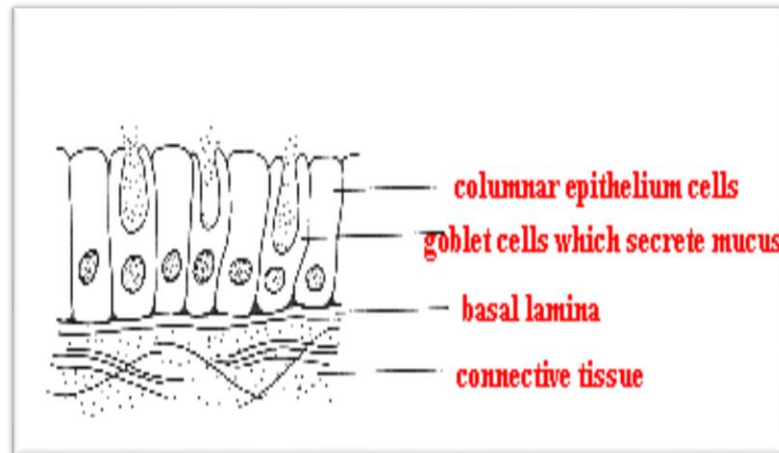
B- Stratified epithelium

Stratified epithelia have layers of cells piled one on top of the other. Only the bottom layer touches the basement membrane. The nose, mouth, esophagus, anal canal, the outer portion of the cervix (adjacent to the vagina), and vagina are lined with stratified squamous epithelium.



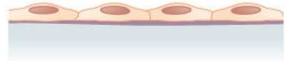

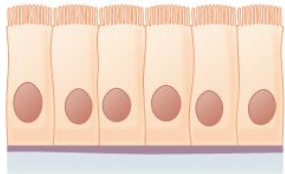

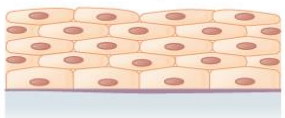

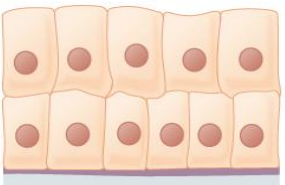
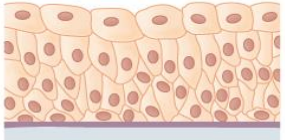
Glandular Epithelium

When an epithelium secretes a product, it is said to be glandular. A **gland** can be a single epithelial cell, as in the case of mucus-secreting goblet cells, or a gland can contain many cells.



Functions of Epithelial Tissue

- **Protection:** Epithelial cells in the skin protect underlying tissue from mechanical injury, harmful chemicals, invading bacteria and from excessive loss of water.
- **Sensation:** Sensory stimuli penetrate specialized epithelial cells. Specialized epithelial tissue containing sensory nerve endings is found in the skin, eyes, ears, nose and on the tongue.
- **Secretion:** In glands, epithelial tissue is specialized to secrete specific chemical substances such as enzymes, hormones and lubricating fluids.
- **Absorption:** Certain epithelial cells lining the small intestine absorb nutrients from the digestion of food.
- **Excretion:** Epithelial tissues in the kidney excrete waste products from the body and reabsorb needed materials from the urine. Sweat is also excreted from the body by epithelial cells in the sweat glands.
- **Diffusion:** Simple epithelium promotes the diffusion of gases, liquids and nutrients. Because they form such a thin lining, they are ideal for the diffusion of gases (eg. walls of capillaries and lungs).
- **Cleaning:** Ciliated epithelium assists in removing dust particles and foreign bodies which have entered the air passages.

tissue	Location	Function
Simple squamous epithelium 	Air sacs of lungs and the lining of the heart, blood vessels, and lymphatic vessels	Allows materials to pass through by diffusion and filtration, and secretes lubricating substance
Simple cuboidal epithelium 	In ducts and secretory portions of small glands and in kidney tubules	Secretes and absorbs
Simple columnar epithelium 	Ciliated tissues are in bronchi, uterine tubes, and uterus; smooth (nonciliated tissues) are in the digestive tract, bladder	Absorbs; it also secretes mucous and enzymes
Pseudostratified columnar epithelium 	Ciliated tissue lines the trachea and much of the upper respiratory tract	Secretes mucus; ciliated tissue moves mucus
Stratified squamous epithelium 	Lines the esophagus, mouth, and vagina	Protects against abrasion
Stratified cuboidal epithelium 	Sweat glands, salivary glands, and the mammary glands	Protective tissue
Stratified columnar epithelium 	The male urethra and the ducts of some glands	Secretes and protects
Transitional epithelium 	Lines the bladder, urethra, and the ureters	Allows the urinary organs to expand and stretch