

Grade 12 NTI Day #6 Anatomy

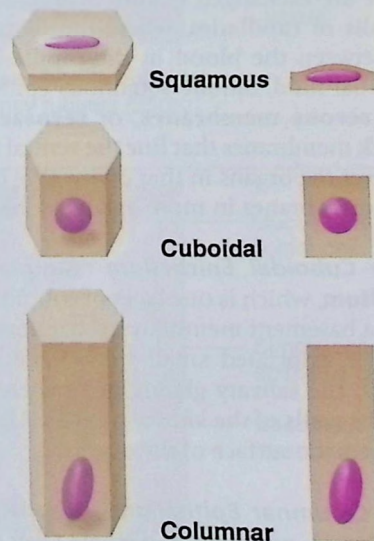
Assignment: Please read the excerpt below as an independent reading assignment. Then read and answer the questions below the excerpt.

### 3.4b Classification of Epithelia

Each epithelium is given two names. The first indicates the number of cell layers it has (Figure 3.17a). The classifications by cell arrangement (layers) are **simple epithelium** (one layer of cells) and **stratified epithelium** (more than one cell layer). The second describes the shape of its cells (Figure 3.17b). There are *squamous* (skwa'mus) *cells*, flattened like fish scales (*squam* = scale), *cuboidal* (ku-boi'dal) *cells*, which are cube-shaped like dice, and *columnar cells*, shaped like columns. The terms describing the shape and arrangement are then combined to describe the epithelium fully. Stratified epithelia are named for the cells at the *free surface* of the epithelial membrane, not those resting on the basement membrane, which can appear "squished" and variable in shape. Figure 3.17c shows the relationship between the structure of these tissues and their functions, a topic we will cover more as we look at each type.

#### Simple Epithelia

The simple epithelia are most concerned with absorption, secretion, and filtration. Because simple epithelia are usually very thin, protection is not one of their specialties.



(b) Classification based on cell shape

(a) Classification on the basis of cell shape; for each cardinal section is shown on

(Figure continues on page 88.)

Cell shape	Number of layers	
	One layer: simple epithelial tissues	More than one layer: stratified epithelial tissues
<b>Squamous</b>	Diffusion and filtration Secretion in serous membranes	Protection; transitional epithelium is modified stratified squamous; stretches to accommodate distension of urinary structures
<b>Cuboidal</b> <b>Columnar</b>	Secretion and absorption; ciliated types propel mucus or reproductive cells	Protection; these tissue types are rare in humans

### (c) Function of epithelial tissue related to tissue type

Figure 3.17 (continued) Classification and functions of epithelia. (c) Function of epithelial tissue related to tissue type.

**Simple Squamous Epithelium** **Simple squamous epithelium** is a single layer of thin squamous cells resting on a basement membrane. The cells fit closely together, much like floor tiles. This type of epithelium usually forms membranes where filtration or exchange of substances by rapid diffusion occurs. Simple squamous epithelium is in the air sacs of the lungs (called alveoli), where oxygen and carbon dioxide are exchanged (Figure 3.18a), and it forms the walls of capillaries, where nutrients and gases pass between the blood in the capillaries and the interstitial fluid. Simple squamous epithelium also forms **serous membranes**, or **serosae** (se-ro'se), the slick membranes that line the ventral body cavity and cover the organs in that cavity. (We describe the serous membranes in more detail in Chapter 4.)

**Simple Cuboidal Epithelium** **Simple cuboidal epithelium**, which is one layer of cuboidal cells resting on a basement membrane, is common in glands and their associated small tubes called **ducts** (for example, the salivary glands and pancreas). It also forms the walls of the kidney tubules (Figure 3.18b) and covers the surface of the ovaries.

**Simple Columnar Epithelium** **Simple columnar epithelium** is made up of a single layer of tall cells that fit closely together and whose nuclei appear to form a straight line. **Goblet cells**, which produce a lubricating mucus, are often seen in this type of epithelium. Simple columnar epithelium lines the entire length of the digestive tract from the stomach

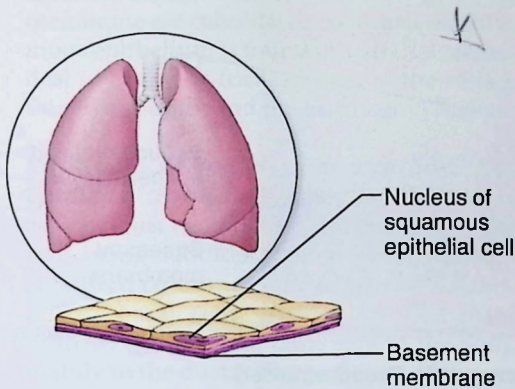
to the anus (Figure 3.18c). Epithelial membranes that line body cavities open to the body exterior are called **mucosae** (mu-ko'se), or **mucous membranes**.

**Pseudostratified Columnar Epithelium** All of the cells of **pseudostratified** (soo'do-strā'ti-fid) **columnar epithelium** rest on a basement membrane. However, some of its cells are shorter than others, and their nuclei appear at different heights above the basement membrane. As a result, this epithelium gives the false (*pseudo*) impression that it is stratified; hence its name. Like simple columnar epithelium, this variety mainly functions in absorption and secretion. A ciliated variety (more precisely called *pseudostratified ciliated columnar epithelium*) lines most of the respiratory tract (Figure 3.18d). The mucus produced by the goblet cells in this epithelium acts as a "sticky trap" to catch dust and other debris, and the cilia propel the mucus upward and away from the lungs.

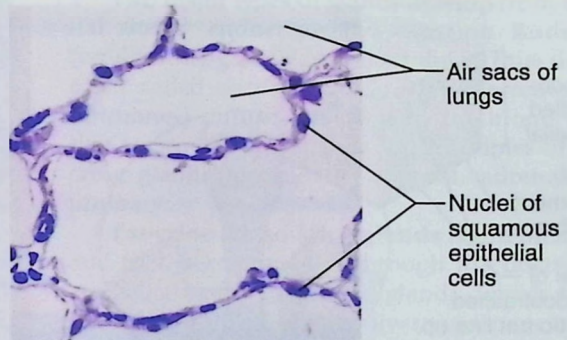
### Stratified Epithelia

Stratified epithelia consist of two or more cell layers. Being considerably more durable than the simple epithelia, these epithelia function primarily in protection.

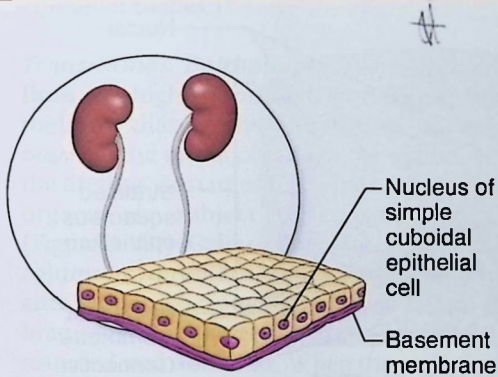
**Stratified Squamous Epithelium** **Stratified squamous epithelium** is the most common stratified epithelium in the body. It usually consists of many cell layers. The cells at the free edge are



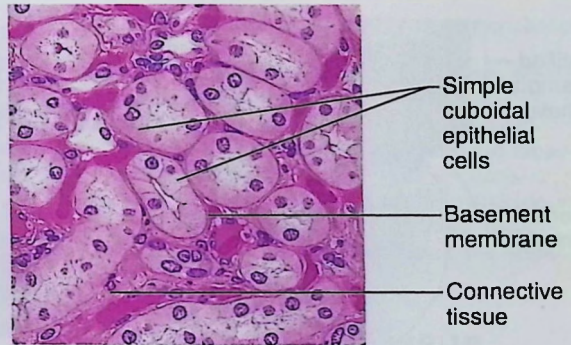
(a) Diagram: Simple squamous



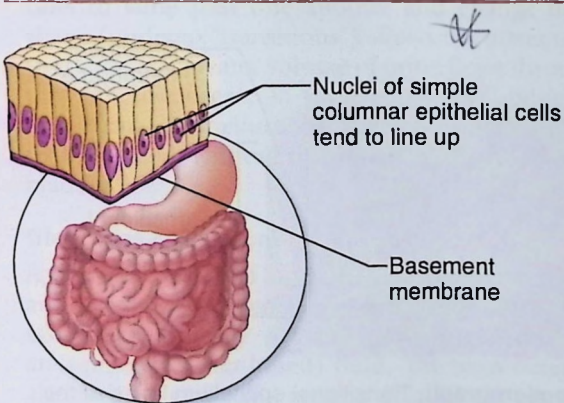
Photomicrograph: Simple squamous epithelium forming part of the alveolar (air sac) walls (275 $\times$ ).



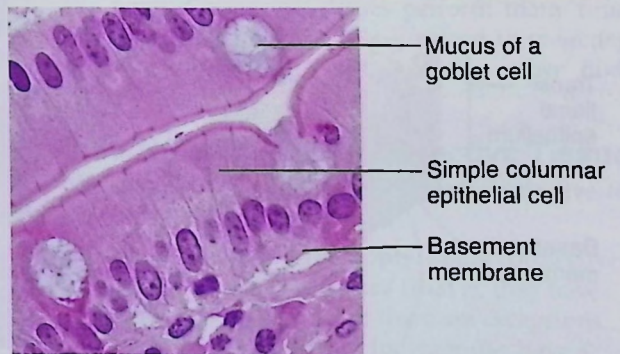
(b) Diagram: Simple cuboidal



Photomicrograph: Simple cuboidal epithelium in kidney tubules (250 $\times$ ).



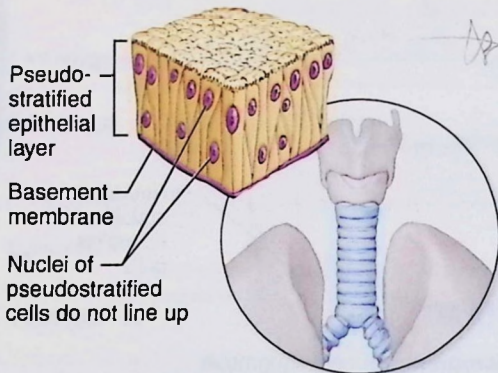
(c) Diagram: Simple columnar



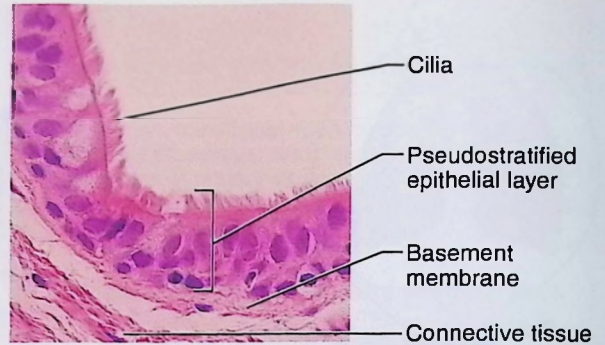
Photomicrograph: Simple columnar epithelium of the small intestine (575 $\times$ ).

Figure 3.18 Types of epithelia and examples of common locations in the body.

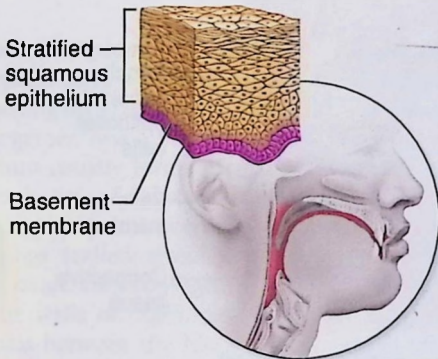
(Figure continues on page 90.)



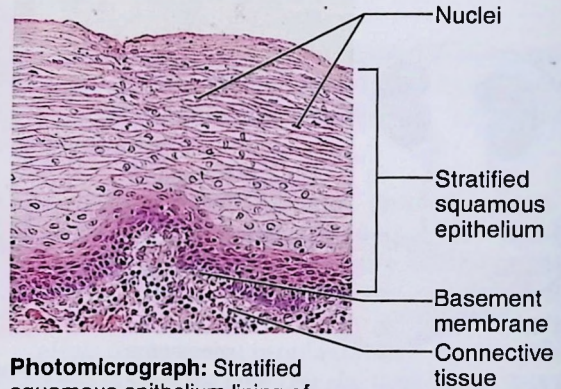
(d) Diagram: Pseudostratified (ciliated) columnar



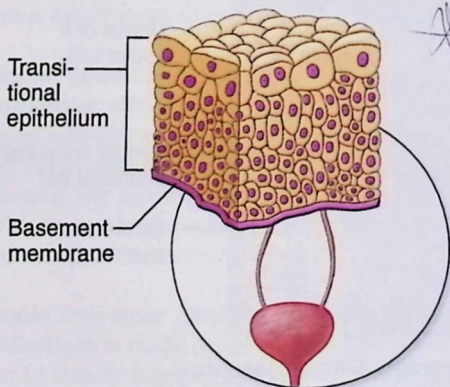
Photomicrograph: Pseudostratified ciliated columnar epithelium lining the human trachea (560 $\times$ ).



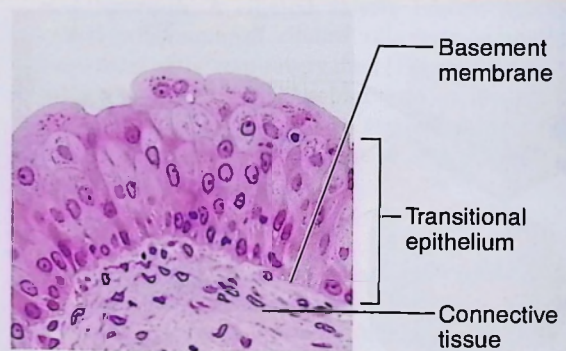
(e) Diagram: Stratified squamous



Photomicrograph: Stratified squamous epithelium lining of the esophagus (140 $\times$ ).



(f) Diagram: Transitional



Photomicrograph: Transitional epithelium lining of the bladder, relaxed state (270 $\times$ ); surface rounded cells flatten and elongate when the bladder fills with urine.

Figure 3.18 (continued) Types of epithelia and examples of common locations in the body.

squamous cells, whereas those close to the basement membrane are cuboidal or columnar. Stratified squamous epithelium is found in sites that receive a good deal of abuse or friction, such as the surface of the skin, the mouth, and the esophagus (Figure 3.18e).

**Stratified Cuboidal and Stratified Columnar Epithelia** **Stratified cuboidal epithelium** typically has just two cell layers with (at least) the surface cells being cuboidal in shape. The surface cells of **stratified columnar epithelium** are columnar cells, but its basal cells vary in size and shape. Both of these epithelia are fairly rare in the body, found mainly in the ducts of large glands. (Because the distribution of these two epithelia is extremely limited, they are not illustrated in Figure 3.18. We mention them here only to provide a complete listing of the epithelial tissues.)

**Transitional Epithelium** **Transitional epithelium** is a highly modified, stratified squamous epithelium that forms the lining of only a few organs—the urinary bladder, the ureters, and part of the urethra. As part of the urinary system, *all* of these organs are subject to considerable stretching (Figure 3.18f). Cells of the basal layer are cuboidal or columnar; those at the free surface vary in appearance. When the organ is not stretched, the membrane is many-layered, and the superficial cells are rounded and domelike. When the organ is distended with urine, the epithelium thins like a rubber band being stretched, and the surface cells flatten and become squamouslike. This ability of transitional cells to slide past one another and change their shape (undergo “transitions”) allows the ureter wall to stretch as a greater volume of urine flows through that tubelike organ. In the bladder, the ability of transitional epithelium to stretch allows more urine to be stored without increasing pressure in the bladder.

### Glandular Epithelium

A **gland** consists of one or more cells that make and secrete a particular product. This product, a **secretion**, typically contains protein molecules in an aqueous (water-based) fluid. The term *secretion* also indicates an active process in which the glandular cells obtain needed materials from the blood and use them to make their products, which they then discharge by exocytosis.

Two major types of glands develop from epithelial sheets: endocrine and exocrine. **Endocrine** (en'do-krin) **glands** lose their ducts; thus they are often called *ductless* glands. Their secretions (all hormones) diffuse directly into the blood vessels that weave through the glands. Examples of endocrine glands include the thyroid, adrenals, and pituitary.

**Exocrine** (ek'so-krin) **glands** retain their ducts, and their secretions exit through the ducts to the epithelial surface. Exocrine glands, which include the sweat and oil glands, liver, and pancreas, are both internal and external. We discuss them with the organ systems to which their products are related.

**STOP READING HERE. Skip Down to the Question Sheet**

## Multiple Choice Questions

1. **What does the term “simple epithelium” refer to?**
    - a) More than one layer of cells
    - b) A single layer of cells
    - c) Flattened cells like fish scales
    - d) Column-shaped cells
  2. **Which type of epithelial cell is described as being cube-shaped like dice?**
    - a) Squamous cells
    - b) Cuboidal cells
    - c) Columnar cells
    - d) Transitional cells
  3. **What type of epithelial tissue is primarily concerned with absorption, secretion, and filtration?**
    - a) Stratified epithelium
    - b) Simple epithelium
    - c) Transitional epithelium
    - d) Pseudostratified epithelium
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## Short Answer Question

4. **Why is stratified epithelium more suited for protection compared to simple epithelium?**
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