

**Department of biology**

**Zoology**

**First stage**

**(7)**

**Animal Tissues**

**By**

**Assist. Prof. Dr. Dhurgham Ali Al-Sultany**

**Tissue Level of Organization**

The tissues of **multicellular**, complex animals are four primary types: **epithelial, connective**, **muscle**, and **nervous**. Recall that tissues are groups of similar cells group of similar cells carrying out related functions. These tissues combine to form organs—like the skin or kidney—that have specific, specialized functions within the body. Organs are organized into organ systems to perform functions; examples include the circulatory system, which consists of the heart and blood vessels, and the digestive system, consisting of several organs, including the stomach, intestines, liver, and pancreas. Organ systems come together to create an entire organism.

**1st Epithelial Tissues**

Epithelial tissues cover the outside of organs and structures in the body and line the lumens of organs in a single layer or multiple layers of cells. The types of epithelia are classified by the shapes of cells present and the number of layers of cells. Epithelia composed of a single layer of cells is called simple epithelia; epithelial tissue composed of multiple layers is called stratified epithelia. The table summarizes the different types of epithelial tissues.

**Table 1: Different types of epithelial tissues**

|  |  |  |
| --- | --- | --- |
| **Cell shape** | **Description** | **location** |
| Squamous | flat, irregular round shape | **simple:** lung alveoli, capillaries **stratified**: skin, mouth, vagina |
| Cuboidal | cube shaped, central nucleus | glands, renal tubules |
| Columnar | tall, narrow, nucleus toward base tall, narrow, nucleus along cell | simple: digestive tract pseudostratified: respiratory tract |
| Transitional | round, simple but appear stratified | urinary bladder |

**Squamous Epithelia**

Squamous epithelial cells are generally round, flat, and have a small, centrally located nucleus. The cell outline is slightly irregular, and cells fit together to form a covering or lining. When the cells are arranged in a single layer (simple epithelia), they facilitate diffusion in tissues, such as the areas of gas exchange in the lungs and the exchange of nutrients and waste at blood capillaries.



Figure 1.: Squamous epithelia cells (a) simple , stratified (b)

**Cuboidal Epithelia**

Cuboidal epithelial cells are most commonly found in a **single layer** representing a simple epithelia in **glandular tissues** throughout the body where they prepare and **secrete glandular material**. They are also found in the walls of tubules and in the ducts of the kidney and liver.



Figure 2: **Simple cuboidal epithelial** cells line tubules in the mammalian kidney, where they are involved in filtering the blood.

**Columnar Epithelia**

Columnar epithelial cells are taller than they are wide: they resemble a stack of columns in an epithelial layer, and are most commonly found in a single-layer arrangement. The nuclei of columnar epithelial cells in the digestive tract appear to be lined up at the base of the cells, as illustrated in Figure 3. These cells absorb material from the lumen of the digestive tract and prepare it for entry into the body through the circulatory and lymphatic systems.



Figure 3: **Simple columnar epithelial** cells absorb material from the digestive tract. Goblet cells secret mucous into the digestive tract lumen.

Columnar epithelial cells lining the respiratory tract appear to be **stratified**. However, each cell is attached to the base membrane of the tissue and, therefore, they are simple tissues. The nuclei are arranged at different levels in the layer of cells, making it appear as though there is more than one layer, as seen in Figure 4. This is called **pseudostratified**, columnar epithelia. This cellular covering has cilia at the apical, or free, surface of the cells. The cilia enhance the movement of mucous and trapped particles out of the respiratory tract, helping to protect the system from invasive microorganisms and harmful material that has been breathed into the body. Goblet cells are interspersed in some tissues (such as the lining of the trachea). The goblet cells contain mucous that traps irritants, which in the case of the trachea keep these irritants from getting into the lungs.



Figure .4: Pseudostratified columnar epithelia line the respiratory tract. They exist in one layer, but the arrangement of nuclei at different levels makes it appear that there is more than one layer. Goblet cells interspersed between the columnar epithelial cells secrete mucous into the respiratory tract.

**Transitional Epithelia**

Transitional or uroepithelial cells appear only in the urinary system, primarily in the bladder and ureter. These cells are arranged in a stratified layer, but they have the capability of appearing to pile up on top of each other in a relaxed, empty bladder, as illustrated in Figure .5. As the urinary bladder fills, the epithelial layer unfolds and expands to hold the volume of urine introduced into it. As the bladder fills, it **expands** and the lining becomes thinner. In other words, the tissue transitions from thick to thin.



Figure 5: Transitional epithelia of the urinary bladder undergo changes in thickness depending on how full the bladder is.