Epithelial Tissues

Structure
Epithelial tissue covers the whole surface of the body. It is made up of cells closely packed and ranged in one or more layers. This tissue is specialised to form the covering or lining of all internal and external body surfaces. Epithelial tissue that occurs on surfaces on the interior of the body is known as endothelium. Epithelial cells are packed tightly together, with almost no intercellular spaces and only a small amount of intercellular substance. Epithelial tissue, regardless of the type, is usually separated from the underlying tissue by a thin sheet of connective tissue; basement membrane. The basement membrane provides structural support for the epithelium and also binds it to neighbouring structures.

Types of Epithelial Tissue
Epithelial tissue can be divided into two groups depending on the number of layers of which it is composed. Epithelial tissue which is only one cell thick is known as simple epithelium. If it is two or more cells thick such as the skin, it is known as stratified epithelium.

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

\textit{Squamous (pavement) epithelium}. Squamous cells have the appearance of thin, flat plates. The shape of the nucleus usually corresponds to the cell form and help to identify the type of epithelium. Squamous cells, for example, tend to have horizontally flattened, elliptical nuclei because of the thin flattened form of the cell. They form the lining of cavities such as the mouth, blood vessels, heart and lungs and make up the outer layers of the skin.

Simple squamous epithelium

\textit{Simple Cuboidal Epithelium}. As their name implies, cuboidal cells are roughly square or cuboidal in shape. Each cell has a spherical nucleus in the centre. Cuboidal epithelium is found in glands and in the lining of the kidney tubules as well as in the ducts of the glands. They also constitute the germinal epithelium which produces the egg cells in the female ovary and the sperm cells in the male testes.

Simple cuboidal epithelium
**Simple Columnar Epithelium.** Columnar epithelial cells occur in one or more layers. The cells are elongated and column-shaped. The nuclei are elongated and are usually located near the base of the cells. Columnar epithelium forms the lining of the stomach and intestines. Some columnar cells are specialised for sensory reception such as in the nose, ears and the taste buds of the tongue. Goblet cells (unicellular glands) are found between the columnar epithelial cells of the duodenum. They secrete mucus or slime, a lubricating substance which keeps the surface smooth.

Goblet cells

**Ciliated Columnar Epithelium.** These are simple columnar epithelial cells, but in addition, they possess fine hair-like outgrowths, cilia on their free surfaces. These cilia are capable of rapid, rhythmic, wavelike beatings in a certain direction. This movement of the cilia in a certain direction causes the mucus, which is secreted by the goblet cells, to move (flow or stream) in that direction. Ciliated epithelium is usually found in the air passages like the nose. It is also found in the uterus and Fallopian tubes of females. The movement of the cilia propel the ovum to the uterus.

Cilia

**Glandular Epithelium.** Columnar epithelium with goblet cells is called glandular epithelium. Some parts of the glandular epithelium consist of such a large number of goblet cells that there are only a few normal epithelial cells left. Columnar and cuboidal epithelial cells often become specialised as gland cells which are capable of synthesising and secreting certain substances such as enzymes, hormones, milk, mucus, sweat, wax and saliva. Unicellular glands consist of single, isolated glandular cells such as the goblet cells. Sometimes a portion of the epithelial tissue becomes invaginated and a multicellular gland is formed. Multicellular glands are composed of clusters of cells. Most glands are multicellular including the salivary glands.
Glandular epithelium

Stratified Epithelium
Where body linings have to withstand wear and tear, the epithelia are composed of several layers of cells and are then called compound or stratified epithelium. The top cells are flat and scaly and it may or may not be keratinised (i.e. containing a tough, resistant protein called keratin). The mammalian skin is an example of dry, keratinised, stratified epithelium. The lining of the mouth cavity is an example of an unkeratinised, stratified epithelium.

Stratified epithelium

Functions of Epithelial Tissue

- Protection. Epithelial cells from the skin protect underlying tissue from mechanical injury, harmful chemicals, invading bacteria and from excessive loss of water.
- Sensation. Sensory stimuli penetrate specialised epithelial cells. Specialised epithelial tissue containing sensory nerve endings is found in the skin, eyes, ears, nose and on the tongue.
- Secretion. In glands, epithelial tissue is specialised 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 (e.g. walls of capillaries and lungs).
- Cleaning. Ciliated epithelium assists in removing dust particles and foreign bodies which have
entered the air passages.

? Reduces Friction. The smooth, tightly-interlocking, epithelial cells that line the entire circulatory system reduce friction between the blood and the walls of the blood vessels.

(Provided by Prof. Li Jicheng)