31: EPITHELIAL TISSUE (part 2)

Epithelial tissues are classified using basically two characteristics: the shape of the cells and how deep they are stacked. Each type of tissue is just what is needed in certain areas of the body. Notice that all types of epithelial tissue are anchored to basement membrane.

The first category we will consider is the "simple" category. Simple means that there is only one layer of cells.
Simple squamous tissue is a single layer of squamous cells. Squamous cells are very flat, so a single layer of these cells is perfect for places where you want to transfer gases and nutrients from one side of the cells to the other. Two places where you would find this type of tissue are the lining of the lungs (where you want to transfer oxygen and carbon dioxide) and the walls of capillaries (where you want to transfer oxygen, carbon dioxide, nutrients and wastes). Epithelium in blood vessels has a special name: ***endothelium***. The endothelial cells don't form perfect water-tight bonds between themselves. These cracks between the cells will allow small things to leak through. This leakiness is helpful in many situations, as we will see in future lessons. However, the capillaries of the brain are different; they do not leak. This lack of leakiness is called the "blood-brain barrier." These tighter junctions in the brain capillaries is to make it very difficult (hopefully impossible) for bacteria, viruses and harmful large molecules to get into the brain.

Simple cuboidal tissue has one layer of cuboidal cells. Since these cells are thicker than squamous cells, you don't expect them to do much transferring of gases or nutrients. Cuboidal cells are usually specialized for secretion and absorption. Secretion means they make some kind of product, and absorption means they take something in. This type of tissue is found in glands and in the lining of the tiny tubules in the kidneys. Some simple cuboidal cells have microvilli. ("Villi" means "little fingers.") The purpose of the microvilli is to increase surface area. This is especially helpful to cells that are involved in absorption of some kind.

Simple columnar tissue often has goblet cells, microvilli, and/or cilia. Goblet cells produce mucus. Microvilli, as we've already stated, serve to increase the surface are of the cell. Cilia are tiny hair-like structures that can move. The cilia "beat" in rhythm producing a sweeping effect. This is most clearly seen inside the Fallopian tubes where the ovum must be swept along, down the tubes and toward the uterus. Simple columnar is also found along the inside of the digestive tract.

Stratified tissues have more than one layer. ***Stratified squamous,*** the type of tissue found in the ***epidermis*** of the skin and in the lining of the mouth, has many layers of cells, with the youngest cells at the bottom and the older cells at the top. The bottom layers, just above the basement membrane, keep making more cells all the time and these cells gradually move upwards.

There are two types of stratified squamous tissue: 1) ***keratinized***, and 2) ***non-keratinized***. ***Keratin*** is the name of one of the proteins found in the cytoskeleton. Remember, there are three sizes of cytoskeleton fibers: the large microtubules, the intermediate filaments, and the tiny microfilaments. Keratin is an intermediate filament. It is keratin fibers to which the desmosomes attach. In keratinized tissue, the cells begin to fill up with keratin as they rise to the surface. By the time they reach the surface, the cells have lost most or all of their organelles, including the nucleus, and they are basically an empty shell stuffed full of keratin. Since keratin is a waxy substance, the keratin-filled cells give the surface of the skin a fairly waterproof texture. In non-keratinized epithelium, the cells stay alive all the way to the top and do not fill up with keratin. The top cells still flake off easily, though, and are constantly being replaced, just like in keratinized epithelium. An example of non-keratinized epithelium is the inside of the mouth.

Stratified cuboidal tissue is found primarily in glands such as salivary glands and mammary (milk-producing) glands because this type of tissue is very good at secretion. It is usually only two cells thick, unlike stratified squamous.

Stratified columnar tissue is not as common as the other types of epithelial tissue. It is harder to find examples of this type, but it can be found in small amounts in the eye, the throat, the uterus, the urethra (tube leading out of urinary bladder) and the salivary glands. As with simple columnar tissue, stratified columnar is good for secretion, and it is also good for protection, as it is several layers thick.

Pseudostratified columnar tissue is a major feature of the lining of the ***trachea*** (pipe leading down into lungs). "Pseudo" means "false," so pseudostratified looks like it is stratified, but it isn't. In true stratified tissue, cells are stacked on top of cells so that the cells in the top layer are not touching the basement membrane. Pseudostratified isn't stratified because each and every cell in pseudostratified is touching the basement membrane, even if it does not look like it. (The fact that their nuclei are at various levels adds to the illusion that they are stratified.) We've got to trust the professional biologists who have examined these tissues under an electron microscope and can assure us that all the cells are touching the basement membrane. Most of the cells in pseudostratified are either goblet cells or are ciliated cells. The mucus and the cilia work together to be a kind of housekeeping service, sweeping dust and dirt up and away from the lungs. When the mucus gets to the top, you either swallow it or cough it up. (Those goblet cells really starting cranking out the mucus if you get some irritating particles down your airway. Soon after you start coughing, you find that suddenly there's a large volume of mucus to cough up!)

Transitional epithelial tissue is found in the urinary bladder. It is designed to stretch and then snap back to normal again. As the bladder fills up, tiny nerves sense the stretching that is going on and send signals to your brain that tell you that you need to empty your bladder soon.