ANAT 2160/BIOL 3430 Epithelium Laboratory Module

Objectives:
1) differentiate the classes of epithelia by cell shape and number of cellular layers
2) identify epithelial components in sections of organs and tissues
3) relate the structures of the various classes of epithelia to their functions

Overview
Epithelial tissue represents one of the four basic tissue types making up the structure of organs in the body. This tissue type is highly cellular, covering surfaces or lining cavities; epithelial cells may also secrete products onto the surfaces they cover or into glands. Epithelial tissues are classified by the number of cell layers, and by the shape of the cells at the surface.

Regardless of type, all epithelia in the body have these features in common:
1) they are avascular,
2) they are separated from the substrate by a basement membrane, and
3) all cells are joined together by specialized junctions providing tight seals and strength.

A) Simple epithelia: one layer of cells.

Simple squamous epithelia: the cell cytoplasm is very thin and flattened (the term "squamous" comes from the Latin word for "scale"), and the nuclei of these cells are small, usually oval. Most of the simple squamous epithelia you will see in slides in this course are cut transversely, but remember that the three-dimensional shape of these cells resembles flat paving stones with irregular borders where each cell is sealed to its neighbors.
4, esophagus: this slide has several examples of different types of epithelia. The epithelium lining the esophagus is stratified squamous (see below) and it is the most darkly-staining tissue on the slide. Examine the less cellular, loose connective tissue underlying the stratified squamous epithelium to find relatively large, irregularly shaped empty cavities lined with simple squamous epithelium. Some of these structures are veins but most are lymphatic vessels. Examine the walls of these structures at high magnification to see the appearance of this type of epithelium. Can you identify simple squamous epithelium associated with any other structures in this slide?
16, kidney: there are several types of epithelia on this slide. Identify glomeruli (relatively large, circular structures filled with knots of blood capillaries) and examine the simple squamous epithelium that lines Bowman's capsule, the sheath that surrounds the urinary space around the knot of blood vessels in the centre of the glomeruli. You can also find simple squamous epithelium in the region of the kidney where this epithelium lines many long, straight, narrow tubes cut longitudinally or at a shallow angle (these are loops of Henle and capillaries).

Simple cuboidal epithelia: the cells making up this type of epithelium are very easily identified because they have the same appearance (cubical or polygonal, with central round nuclei) no matter what the angle of section.

16, kidney: look in the regions surrounding the glomeruli for simple cuboidal epithelium making up the walls of the tubules; compare the appearance of cells in tubules that were cut in cross-section with tubules cut along their length. Even though you may not be able to clearly see the borders between cells, you can identify the presence of cells by their nuclei.

Simple columnar epithelia: individual columnar cells are elongated along one axis, and if the plane of tissue section is parallel to the long axis of these cells, their columnar form can easily be seen. However if the plane of section is at a right angle to their long axis, these cells will appear cuboidal. You must examine all areas of a slide containing this type of epithelium, to determine how the cells were cut and to confirm the identity of the epithelium.

8, ileum. This slide was made with tissue from a region of the intestine involved in absorbing nutrients from the lumen, so the epithelium is thrown into a series of folds or narrow fingers that project into the lumenal space; these projections are called villi. Look at the epithelium covering the surface of these villi. Most of the cells are columnar absorptive epithelial cells (dark-staining with elongated nuclei that are located nearer the basal surface). There are also numerous cells in this epithelium that appear barrel- or flask-shaped with white or clear cytoplasm; these are mucus-secreting cells. Mucus provides a lubricant to help food move along the intestine and to protect the epithelium from being digested by enzymes mixed with the food.

B) Stratified epithelia: more than one layer of cells; note that the names of these epithelia are taken from the shape of the **outer** layer of cells.

Stratified squamous epithelia: usually have many cell layers with the outermost cells being squamous ("scale-shaped) and cells deeper in the epithelium having polygonal or cuboidal shapes. Typically this type of epithelium is found in areas where wear or mechanical abrasion is high; esophagus and skin are two examples of this. As the outermost squamous cells wear off, they are replaced by new cells produced by cell division in the basal layer. As the newly formed cells migrate upward through the epithelium they become thinner and eventually squamous in shape.

4, esophagus: the dark-staining stratified squamous epithelium lines the esophagus and is subject to wear as abrasive food items are swallowed. Compare the shapes of the cells in the deep and surface layers. Do you see any blood vessels in this epithelium? Why does the basal margin of the epithelium have frequent infoldings?

101, cornea of the eye: the cornea of the eye is formed from collagen fibres that are transparent in life. The convex outer surface of the cornea is covered with a stratified squamous epithelium. The corneal portion of the section on your slide can be identified by the numerous straight collagen fibres underlying the epithelium. This epithelium has a large number of sensory nerve endings embedded between the cells as part of the defence system protecting the eye from mechanical damage.

Stratified cuboidal epithelia: this is a rare type of epithelium in the body, and is represented well only in some glands in the skin.

68, axillary skin: the stratified squamous epithelium of the epidermis is relatively thin in this slide. The pink-staining material under the epidermis is dense irregular connective tissue of the dermis. Deep to this tissue lie large, irregularly shaped cavities lined with simple cuboidal epithelium. These are the secretory portions of axillary glands, shaped like long coiled tubes, that release a viscous fluid onto the skin in the armpit. Mixed in with these cavities are smaller round or oval hollow profiles lined with a double layer of cuboidal epithelium; these are the ducts carrying the secretory product from the glands to the surface.

Stratified columnar epithelia: true stratified columnar epithelium is extremely rare, found occasionally in the larynx. We will not examine this type of epithelium here.

Pseudostratified columnar epithelium: this type of epithelium appears to be stratified because the nuclei of its cells are in several zones between the basal and apical surfaces. However, detailed examination of this type of epithelium in the electron microscope reveals that all of the cells have their basal surfaces anchored to the basement membrane. Cells with nuclei nearest the basal surface are small and polygonal or cuboidal, while cells with nuclei located toward the apical surface have a more elongated, columnar shape.

130, olfactory epithelium: this tissue was taken from the nasal cavity and contains pseudostratified epithelium with olfactory neurons embedded in it (these cannot be distinguished in the slide). Observe nuclei at different levels within this epithelium.

70, lung: the largest cavities on this slide represent sections of major airways within the lung. The epithelium lining these airways is pseudostratified, and some of the epithelial cells are mucus-secreting cells like those in the ileum.

Transitional epithelium: this is a specialized type of stratified epithelium, found lining the bladder, that changes its appearance as the bladder wall is stretched. When the wall is relaxed, the surface epithelial cells appear rounded and cells deeper in the epithelium will look polygonal or cuboidal. When the wall is stretched as the bladder fills, the epithelium will elongate, the cells can slide over one another and the apparent number of cell layers will decrease with the surface cells becoming more squamous in shape.

89, bladder wall: The epithelium is thrown into folds. From the appearance of the epithelium, can you tell the state of the bladder when your tissue sample was taken?