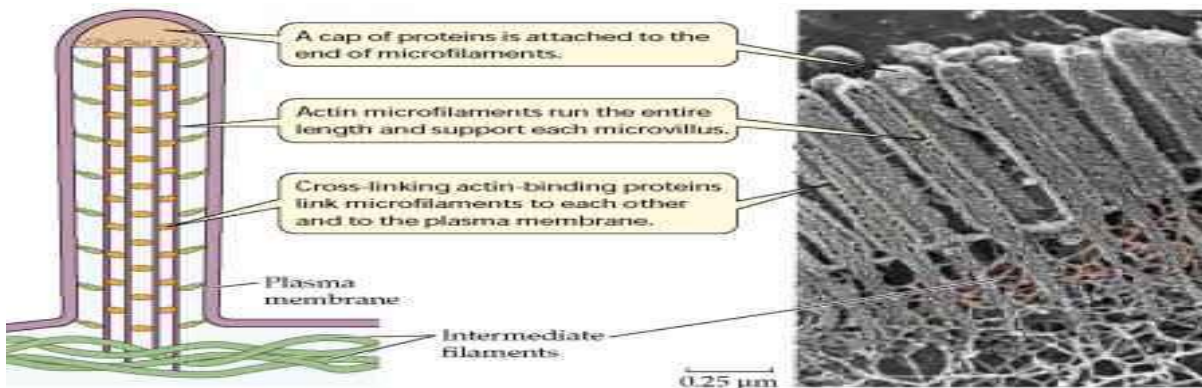


Specializations of the Apical cell Surface

1-Microvilli

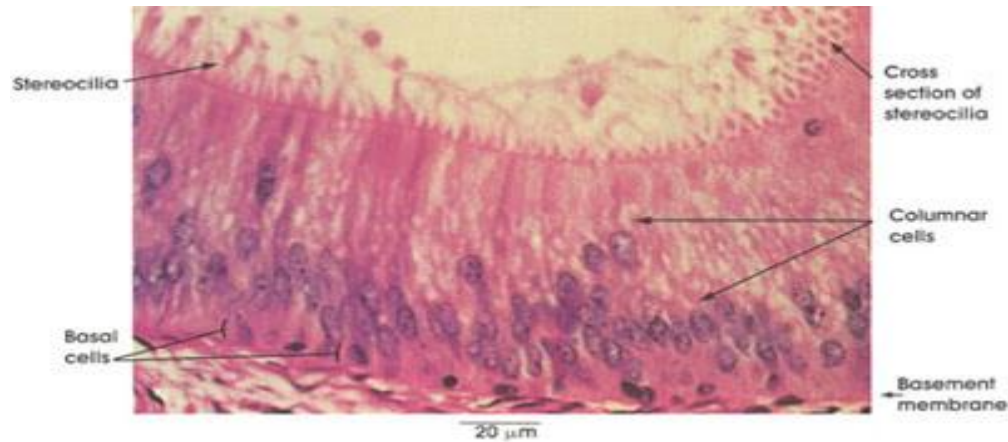
Many cells are seen to have cytoplasmic projections. These projections may be short or long fingerlike extensions or folds, and they range in number from a few to many. Most are temporary, reflecting cytoplasmic movements and the activity of actin filaments.

In absorptive cells, such as the lining epithelium of the small intestine, the apical surface presents orderly arrays of many hundreds of more permanent **microvilli**, with hundreds or thousands present on the end of each absorptive cell, the total surface area can be increased as much as 20- or 30-fold. In these absorptive cells the glycocalyx is thicker than that of most cells and includes enzymes for the final stages of certain macromolecules' breakdown. The complex of microvilli and glycocalyx is easily seen in the light microscope and is called the **brush** or **striated border**.



2-Stereocilia

Stereocilia are long apical processes of cells in other absorptive epithelia such as that lining the epididymis and ductus deferens. These structures are much longer and less motile than microvilli, are branched, and should not be confused with true cilia. Like microvilli, stereocilia also increase the cells' surface area, facilitating the movement of molecules into and out of the cell.



3-Cilia

Cilia are elongated, highly motile structures on the surface of some epithelial cells, which is much longer and two times wider than a typical microvillus. Each cilium is bounded by the cell membrane and contains an axoneme with a central pair of microtubules surrounded by nine peripheral microtubular pairs. Cilia are inserted into **basal bodies**, cilia exhibit rapid back-and-forth movements coordinated to propel a current of fluid and suspended matter in one direction over the ciliated epithelium.



Types of Epithelia

Epithelia can be divided into two main groups according to their structure and functions: **covering (or lining) epithelia** and **glandular epithelia**.

A-Covering or Lining Epithelia

Covering epithelia are tissues in which the cells are organized in layers that cover the external surface or line the cavities of the body. They are classified according to the number of cell layers and

the morphologic features of the cells in the surface layer. **Simple epithelia** contain only one layer of cells and **stratified epithelia** contain more than one layer.

Based on cell shape, simple epithelia are classified as **squamous** (thin cells), **cuboidal** (cells roughly as thick as they are wide) or **columnar**.

Stratified epithelia are classified according to the cell shape of the superficial layer(s): **squamous**, **cuboidal**, **columnar**, and **transitional**.

The very thin surface cells of stratified squamous epithelia can be "keratinized" (rich in keratin intermediate filaments) or "nonkeratinized" (with relatively sparse amounts of keratin). **Stratified squamous keratinized epithelium** is found mainly in the epidermis of skin. Its cells form many layers, and the cells closer to the underlying connective tissue are usually cuboidal or low columnar. The cells become irregular in shape and flatten as they accumulate keratin in the process of **keratinization** and are moved progressively closer to the surface, where they become thin, metabolically inactive packets (**squamous**) of keratin lacking nuclei. This surface layer of cells helps protect against water loss across this epithelium. **Stratified squamous nonkeratinized epithelium** lines wet cavities (eg, mouth, esophagus, and vagina). In such areas where water loss is not a problem, the flattened cells of the epithelial surface layer are living cells containing much less keratin and retaining their nuclei.

Stratified cuboidal and stratified columnar epithelia

Stratified columnar epithelium can be found in the conjunctiva lining the eyelids, where it is both protective and mucus secreting. Stratified cuboidal epithelium is restricted to large excretory ducts of sweat and salivary glands, where it apparently provides a lining more robust than that of a simple epithelium.

Transitional epithelium or **urothelium**, which lines only the urinary bladder, the ureter, and the upper part of the urethra, is characterized by a superficial layer of dome-like cells that are neither squamous nor columnar. These cells, sometimes called umbrella cells, are essentially protective against the hypertonic and potentially cytotoxic effects of urine. Importantly, the form of the surface cells changes according to the degree of distention of the bladder wall.

In addition to these various stratified epithelia, there is another type classified as **pseudostratified columnar epithelium**, so called because all cells are attached to the basal lamina even though their nuclei lie at different levels in the epithelium and the height of some cells does not extend to the surface. The best-known example of pseudostratified columnar epithelium is that lining the passages of the upper respiratory tract. The columnar cells of this epithelium are also heavily ciliated.