DOWNLOAD PDF EPITHELIAL GLANDS

Chapter 1 : Glandular Epithelium : Anatomy & Physiology

Unicellular exocrine glands do this directly by exocytosis, while multicellular glands transport their product through a duct on the epithelial surface. Products secreted by exocrine glands include sweat, oil, mucous, bile, and more.

Epithelia are avascular, but all epithelia "grow" on an underlying layer of vascular connective tissue. The connective tissue and the epithelium are separated by a basement membrane. Epithelium covers all free surfaces of the body. Epithelium also lines the large internal body cavities, where it is termed mesothelium. Furthermore, the internal surfaces of blood and lymph vessels are lined by epithelium, here called endothelium. Epithelia are classified on the basis of the number of cell layers and the shape of the cells in the surface layer. If there is only one layer of cells in the epithelium, it is designated simple. If there are two or more layers of cells, it is termed stratified. Cells in the surface layer are, as a rule, described according to their height as squamous scale- or plate-like , cuboidal or columnar. Simple Epithelia Simple squamous epithelium This type is composed of a single layer of flattened, scale- or plate-like cells. It is quite common in the body. The large body cavities and heart, blood vessels and lymph vessels are typically lined by a simple squamous epithelium. The nuclei of the epithelial cells are often flattened or ovoid, i. Simple cuboidal epithelium Cells appear cuboidal in sections perpendicular to the surface of the epithelium. Viewed from the surface of the epithelium they look rather like small polygons. Simple cuboidal epithelium occurs in small excretory ducts of many glands, the follicles of the thyroid gland, the tubules of the kidney and on the surface of the ovaries. Can there be "low cuboidal" epithelia? Simple columnar epithelium The cells forming a simple columnar epithelium are taller than they are wide. The nuclei of cells within the epithelium are usually located at the same height within the cells - often close to the base of the cells. An example is the simple columnar epithelium which lines the internal surface of the gastrointestinal tract GIT from the cardia of the stomach to the rectum. Identifying Epithelia The outlines of individual epithelial cells are not always visible, and it may be difficult to identify the shape of the cells. It is often helpful to look at the shape, location and spacing of the nuclei in the epithelium, which together will allow a very good guess at the shape of the cells forming the epithelium. How many cell layers seem to be visible in a section depends very much on the angle between the plane of the section plane the surface of the epithelium. Oblique sections of epithelium will be visible in almost all slides of organs in which epithelium lines a surface with a very irregular profile. A single surface is usually not lined by several types of epithelia. The number of epithelial cell layers will usually be the smallest number of layers visible anywhere along the surface lined by the epithelium. Suitable Slides simple squamous epithelium: With very few exceptions, they are lined by a simple squamous epithelium. The individual epithelial cells are extremely flattened and form a much larger part of the surface than individual cells in cuboidal or columnar epithelia. The nuclei of the squamous epithelial cells are also flattened and often stain darkly. Not every epithelial cell nucleus will be included in the plane of the section, and if the vessel is very small e. Capillaries and other small vessels are easily deformed during tissue processing, and the epithelium of larger vessels may be damaged or look corrugated. It may therefore take a little more patience than you expect to find a "good" simple squamous epithelium. Draw a small vessel with its epithelial lining, label the features visible in your drawing and include a suitable scale. Most of the epithelial cells enterocytes are involved in the absorption of components of the digested food in the lumen of the intestines. Complex folds of the intestinal lining increase the surface area available for absorption. The plane of the section will therefore often pass at an oblique angle through the epithelium. The epithelium may look stratified where this happens. Scan along the epithelium until you find a spot where it is cut perpendicular to its surface, i. Mucus producing goblet cells are a second cell type of this epithelium. Round, light "hollows" in the epithelium represent the apical cytoplasm of the goblet cells, which is filled with mucin-containing secretory vesicles. Microvilli extend from the apical surface of epithelial cells into the intestinal lumen. Together, the microvilli are visible as a light red band along the apical limit of the epithelium, i. This band is call the brush border. Draw and label the epithelium. Include goblet cells in your drawing. Stratified Epithelia Stratified squamous epithelium Stratified squamous epithelia vary in thickness depending on the number of cell layers present. The deepest cells, which are in

contact with the basement membrane, are cuboidal or columnar in shape. This layer is usually named the basal cell layer, and the cells are called basal cells. Basal cells are mitotically active and replace the cells of the epithelium which are lost by "wear and tear". The basal cell layer is followed by layers of cells with polyhedral outlines. Close to the surface of the epithelium, cells become more flattened. At the surface of the epithelium, cells appear like flat scales - similar to the epithelial cells of simple squamous epithelia. Remember that it is the shape of the cell which form the surface of the epithelium which gives the name to the epithelium. Stratified cuboidal and columnar epithelia are not common. A two-layered cuboidal epithelium is, for example, seen in the ducts of the sweat glands. Stratified columnar epithelia are found in the excretory ducts of the mammary gland and the main excretory duct of the large salivary glands. Basal cells often form a well defined layer at the border of the epithelium to the underlying connective tissue. The underlying connective tissue forms finger-like extensions towards the lumen of the oesophagus, which are called papillae. The border between epithelium and connective tissue may appear quite irregular because of the papillae. This irregular border aids in anchoring of the epithelium to the connective tissue. If these extensions are not cut exactly along their long axis, they may look like isolated small islands of connective tissue and blood vessels within the epithelium. Draw the stratified squamous epithelium of the oesophagus and label your drawing. Try to draw a little schematic illustration which shows how the plane of section would effect the appearance of the connective tissue extensions. The parotid gland, a large salivary gland, is one of them. Several epithelial types are found in the duct system of the parotid. The smallest ducts, which are embedded in the secretory tissue intralobular ducts , are lined by cuboidal or columnar epithelia. Small ducts, which are embedded in connective tissue located between areas of secretory tissue interlobular ducts , are lined by columnar or pseudostratified epithelia. These ducts finally coalesce to form the main excretory duct of the parotid which is lined by a stratified columnar epithelium. Draw the stratified columnar epithelium seen in the largest ducts and label your drawing. Pseudostratified and Transitional Epithelia These two types of epithelia are difficult to classify using the shape of the cells in the surface layer and the number of the cell layers as criteria. Transitional epithelium Transitional epithelium is found exclusively in the excretory urinary passages the renal calyces and pelvis, the ureter, the urinary bladder, and part of the urethra. The shape of the cells in the surface layer of a transitional epithelium varies with the degree of distension of the organs whose lumen is lined by this type of epithelium. The most basal cells have a cuboidal or columnar shape. There are several layers of polyhedral cells, and, finally, a layer of superficial cells, which have a convex, dome-shaped luminal surface. In the distended state of the epithelium only one or two layers of cuboidal cells are followed by a superficial layer of large, low cuboidal or squamous cells. In the distended state the epithelium will resemble a stratified squamous epithelium. Pseudostratified columnar epithelium All cells of this type of epithelium are in contact with the basement membrane, but not all of them reach the surface of the epithelium. Nuclei of the epithelial cells are typically located in the widest part of the cell. Consequently, the nuclei of cells which do or do not reach the surface of the epithelium are often located at different heights within the epithelium and give the epithelium a stratified appearance. The epithelium will look stratified but it is not - hence its name "pseudostratified". Pseudostratified columnar epithelia are found in the excretory ducts of many glands. Suitable Slides transitional epithelium: Several rows of nuclei appear to be topped by a layer of dome-shaped cells which bulge into the lumen of the ureter. The shape of the surface cells and the number of rows change if the bladder is distended. The number of rows decreases. This decrease should tell us that many of the nuclei located in different layers of the epithelium belong to cells which are all in contact with the basement membrane. With distension, the shape of the cells in the surface layer will become squamous. Draw the epithelium and label the features you can see. Add a simple schematic drawing of how you expect the epithelium to look like if the ureter is distended. It has not yet been resolved if all the epithelial cells are in contact with the basement membrane. Some texts consider transitional epithelium as a specialised stratified epithelium while others group it with pseudostratified epithelia. The nuclei belong to cells which are all in contact with the basement membrane. Epithelial cells can be ciliated or they can be goblet cells unicellular exocrine glands. Basal cell regenerate other cell types of the epithelium. Capillaries and small vessels are visible in the connective tissue beneath the epithelium. A ciliated pseudostratified columnar epithelium with

goblet cells is a characteristic feature of parts of the respiratory system, where it is call respiratory epithelium. It contains several cell types in addition to ciliated, goblet and basal cells. Draw the epithelium at high magnification and label your drawing.

Chapter 2 : EPITHELIAL GLANDS | Clinical Gate

Cuboidal epithelium is commonly found in secretive tissue such as the exocrine glands, or in absorptive tissue such as the pancreas, the lining of the kidney tubules as well as in the ducts of the glands.

Basement Membrane and Hemidesmosomes All epithelia rest upon a basement membrane. Along with the hemidesosome, the basement membrane forms an attachment mechanism between the epithelium and the underlying connective tissue. The basement membrane is composed of two layers: The basal layer contains adhesive glycoproteins and type IV collagen fibers that bind to the cell. The reticular lamina contains its own specific fibers and adhesive glycoproteins that bind the basal lamina to the connective tissue. Thus the epithelial cells are "glued to the basal lamina" , which is in turn "glued" to the reticular lamina. The hemidesmosomes are "spot welds", which serve as additional binding of the cells to the underlying connective tissue. Classification of Membranous Epithelium Epithelium can be arranged in sheets, hence they are referred to as membranous epithelium or organized into glands, which are one or more cells which major function is the production and release of a secretory product. Membranous epithelium is classified by the number of cell layers as either simple or stratified and the shape of their surface cells away from the connective tissue. Simple Squamous Epithelium Simple squamous epithelium is composed of a single layer of fusiform cells resting on a basement membrane. This type of epithelium is generally found in locations where there is a need for rapid transport across membranes and where is a need for a smooth, non-sticking surface. The endothelium lining the blood vessels is a good example. The endothelium is a name given to the simple squamous lining of all blood vessels. The inner surface of the blood vessels must remain smooth or the blood will clot. Other examples include the serous linings of the pericardial, pleural, thoracic, and abdomino-pelvic cavities. The serous lining prevents the sticking of the organs to the body wall. Simple Cuboidal Epithelium Simple cuboidal epithelium is composed of a single layered sheet of cuboidal-shaped cells resting on a basement membrane. This epithelium forms the secretory and excretory portions of many glands. The functions of this epithelium are to synthesize a secretory product such as amylase in salivary glands and to line passageways ducts that transport the product. Simple Columnar Epithelium Simple columnar epithelium is a single layer of columnar cells resting on a basement membrane. This type of epithelium lines most of the gastro-intestinal tract, lines ducts of salivary glands, and forms the ameloblasts enamel forming cells of the developing tooth. The epithelium is involved in the synthesis of secretory products in both the GI tract and developing tooth, absorption in the GI tract, and lining passageways that carry a secretory product in the salivary glands. Stratified Squamous Epithelium Stratified squamous epithelium is made of several layers of cells with only a single layer resting on the basement membrane. Although the intermediate layers of cells vary in shape, the surface cells are fusiform squamous. The basal layer of cells resting on the basement membrane undergoes mitosis and migrates toward the surface. The cells will change shape and become the squamous surface cells. In time, the cells are sloughed off and replaced by the underlying cells. The function of this epithelium is to protect against friction. This epithelium can be further divided into two categories dependent on the presence or absence of keratin in the surface layer. A proteinaceous material called keratin replaces the cytoplasm and organelles of the superficial cells of the stratified squamous keratinized epithelium. Keratin makes the epithelium more protective against abrasive forces and helps prevent water loss. This epithelium is characteristic of the skin and the gingiva. The surface cells of the stratified squamous non-keratinized mucous epithelium do not contain keratin and can be distinguished by the presence of the nucleus in the surface cells. This epithelium forms the alveolar mucosa and inner lining of the cheeks and the lips. Stratified Cuboidal Epithelium Stratified cuboidal epithelium is relatively rare in the human body. The epithelium, which is only two cell layers thick, forms portions of the duct system of the salivary glands, and thus functions to carry secretory products to the oral cavity. Transitional Epithelium Transitional epithelium is a specialized stratified epithelium found in the urinary system and sometimes is referred to as the "urinary epithelium". This epithelium is characterized by large surface cells, which are times the size of the underlying cells. Because of the convex shape of the cell, they are referred to as dome cells. When the urinary bladder is empty and

contracted, the epithelium is formed by several layers; however, as the bladder fills and becomes extended, the epithelium is reduced to only layers to allow for the expansion of the bladder. Stratified Columnar Epithelium Stratified columnar epithelium is relatively rare in the human body. The epithelium, which is only two cell layers thick, forms portions of the duct system of the salivary glands. Thus, it functions to carry secretory products to the oral cavity. Pseudostratified Columnar Epithelium Pseudostratified means "falsely stratified", referring to the apparent layers of the nuclei. This epithelium is actually composed of three different cells of varying heights. The basal cell is a small pyramidal shaped cell whose nucleus is located nearest to the basement membrane. The tallest is columnar with its nucleus located near the surface, whereas the third type, the fusiform cell, has a nucleus intermediate in location. However, each of the cells rests upon the basement membrane making it a simple epithelium. This epithelium when ciliated is found in the respiratory system and is frequently referred to as "respiratory" epithelium. It functions in lining the major air passageways are to lubricate and to cleanse the air. Morphological Classification of Glands Histogenesis of Glands Glands are aggregations of epithelial cells that produce a secretory product. Glands are categorized as either being exocrine or endocrine. The product of an exocrine gland is carried to its site of function by a system of epithelial lined ducts. The endocrine glands are ductless; the secretory product is released into the cardiovascular system where it is carried to its "target" organ. The salivary glands are examples of exocrine glands whereas the pituitary, thyroid and adrenal glands are endocrine glands. The histogenesis formation of both glands is similar. The glands develop as a down growth of the surface epithelium into the underlying connective tissue. In the case of the developing exocrine glands, the cluster of cells of that form secretory cells maintain their attachment to the surface of the epithelium by excretory ducts. On the other hand, the cells of the endocrine glands lose their attachment with the surface and are invaded by blood vessels. The blood vessels are necessary for the transport of released secretory products. Unicellular versus Multicellular Glands As the name indicates, a gland may be formed by a single cell or multiple cells. There is only one unicellular gland in the entire body. This single-cell gland is called a Goblet cell. It is named after the shape of a water goblet. The gland is found in the epithelial lining of many respiratory organs and digestive system organs and secretes a protective layer of mucous. Shape of the Secretory Unit The secretory cells of glands are organized into three distinctive shapes around a central lumen forming a secretory unit. In the tubular gland, the secretory cells are organized in the shape of an elongated hollow tube. In the alveolar gland, the secretory cells form a sac-like structure around a central lumen. The secretory unit is referred to as an alveolus or acinus. Tubuloalveolar glands are formed by a combination of a tube and alveolus, which resemble a saccular dilation at the end of a tube. Mucous Cells Mucous cells secrete a thick, viscous mucoprotein called mucinogen. When mucinogen mixes with water it becomes mucus. Mucus is an inert substance used to coat food making it easier to transport through the esophagus to the stomach, as protection against the digestive enzymes released by the GI tract, and to trap particles of dust and other foreign material in the respiratory system. Mucous cells are roughly pyramidal in shape with a flattened nucleus located next to the basement membrane. The cytoplasm of the cell is poorly stained because the mucinogen is removed by the solutions used to prepare the tissue for light microscopic examination. Serous Cells Serous cells secrete a watery product usually containing enzymes. The serous cells are pyramidal in shape. The nucleus is usually spherical and tiny secretory granules can be seen in the apical cytoplasm near the luminal surface. Serous Demilune Some glands, particularly the salivary glands, secrete both serous and mucous products into the saliva. The individual secretory units clusters of secretory cells may be made of either serous or mucous cells. In some of the salivary glands, the secretory unit is made of both cell types. In this case, a cluster of serous cells called a serous demilune forms a half-moon shaped structure on the surface of mucous cells. Glands of the Skin Two additional glands of importance are the sweat glands and the sebaceous glands of the skin. The secretions of these glands are neither serous or mucous. Sweat glands secrete a watery product that contains waste products and can cool the body by the evaporation of the fluid. Sebaceous glands, on the other hand secrete, secrete an "oily substance" along the shaft of hair in the hair follicle. Sebaceous glands are important to the dental hygienist because they can also be found in the walls of the cheek and lips. These glands, which are referred to as Fordyce spots, are unusual because they are not associated with hair follicles. Mechanisms of Secretion There are three primary

mechanisms for the release of membrane secretory products to be release from a cell. Merocrine secretion is the most common form of secretion. Merocrine secretion is characterized by the fusion of the membrane of the secretory to the plasma membrane. At its point of fusion, the pelamesa membrane degenerates and releases the protein without any loss of cytoplasm. Apocrine secretion is a similar process in which the membranes of the secretory granules fuse to membrane; however cytoplasm is lost during the process. Mammary glands and the aprocrine sweat glands under the arms are examples. Obviously, apocrine secretion is not as important to the dental hygienist, as both intrinsic and extrinsic salivary glands release amylase by merocrine secretion. Holocrine secretion is unusual in that the entire cell becomes so filled with secretory product that the cell dies and the entire cell is released from the gland. Sebaceous glands release their oily content by this mechanism.

Chapter 3 : SIU SOM Histology GI

Glands, such as exocrine and endocrine, are composed of epithelial tissue and classified based on how their secretions are released. Key Terms epithelium: A membranous tissue composed of one or more layers of cells that form the covering of most internal and external surfaces of the body and its organs.

June 2, 0 Comments Glandular Epithelium A gland is one or more cells that produce and secrete a specific product. The product is always a water-based fluid aqueous and usually contains proteins the product is referred to as a secretion. Secretion is considered an active process. Glands are classified into two groups based on characteristics: Where they release their product- glands can be endocrine secrete internally or exocrine secrete externally. The number of cells they contain- glands can be unicellular one-celled or multicellular more than one cell. Endocrine Glands Endocrine glands are also called ductless glands because eventually, they lose their ducts. They produce hormones chemical messengers and secrete them by exocytosis into the extracellular space. After entering the extracellular space, they enter the blood or lymphatic fluid and travel to specific organs. Each hormone makes its target organ respond in a specific way. For instance, hormones produced by intestinal cells cause the pancreas to release enzymes that aid in digestion. Not all endocrine glands have the the same structure, so a single description cannot be used. Typically, they are compact multicellular organs but there are individual hormone producing cells as well specifically in digestive tract mucosa and the brain. Hormones secreted by endocrine glands vary. For instance, one gland might secrete an amino acid while another secretes glycoproteins or steroids. Importantâ€" not all endocrine glands are epithelium. Exocrine Glands Exocrine glands secrete their products onto the skin or into body cavities. Unicellular exocrine glands do this directly by exocytosis, while multicellular glands transport their product through a duct on the epithelial surface. Products secreted by exocrine glands include sweat, oil, mucous, bile, and more. Unicellular exocrine glands Important examples of unicellular glands include goblet cells looks like a goblet and mucous cells. Unicellular glands can be found within the epithelial linings of the intestinal and respiratory tracts. In humans, unicellular exocrine glands produce mucin, a complex glycoprotein that dissolves in water. When the mucin is dissolved, it forms mucous which protects and lubricates surfaces. Multicellular exocrine glands Structurally, multicellular exocrine glands are more complex than their unicellular neighbors. They have two main parts: In almost all cases, the secretory unit is surroundedby connective tissue. The connective tissue supplies the secretory unit with blood vessels and nerve fibers. It also forms a fibrous capsule that extends into the gland and divides it into lobes. Multicellular exocrine glands are classified by structure and secretion type. Structural classification Image of a unicellular exocrine gland goblet cell. Multicellular exocrine glands are structurally classified depending on the structure of their duct. Simple glandsâ€" have an unbranched duct Compound glandsâ€" have a branched duct The glands can be further categorized by their secretory units as: Tubularâ€" if the secretory cells form tubes Alveolarâ€" if the secretory cells form small sacs Tubuloalveolarâ€" if they have both tubular and alveolar secretory units Modes of secretion Since multicellular exocrineglands secrete their products in a number of different ways, they can be further classified by function. Holocrine glandsâ€" accumulate their products until they rupture and die. Holocrine glands secrete dead cell fragments along with their main product, this is why they must rupture and die when the product is released. Sebaceous oil glands are the only holocrine glands within the human body. There is still controversy in the scientific community pertaining to whether humans have this third type of gland. Studies are currently underway.

Chapter 4 : Epithelial Tissue : Anatomy & Physiology

A gland can be classified as an endocrine gland, a ductless gland that releases secretions directly into surrounding tissues and fluids (endo- = "inside"), or an exocrine gland whose secretions leave through a duct that opens directly, or indirectly, to the external environment (exo- = "outside").

In general, epithelial tissues are classified by the number of their layers and by the shape and function of the cells. Squamous epithelium has cells that are wider than their height flat and scale-like. This is found as the lining of the mouth , oesophagus the blood vessels and in the alveou of the lungs. Cuboidal epithelium has cells whose height and width are approximately the same cube shaped. Columnar epithelium has cells taller than they are wide column-shaped. By layer, epithelium is classed as either simple epithelium, only one cell thick unilayered or stratified epithelium as stratified squamous epithelium , stratified cuboidal epithelium , and stratified columnar epithelium that are two or more cells thick multi-layered , [6] [7] and both types of layering can be made up of any of the cell shapes. This kind of epithelium is therefore described as pseudostratified columnar epithelium. In general, it is found where absorption and filtration occur. The thinness of the epithelial barrier facilitates these processes. The four major classes of simple epithelium are: Non-ciliated epithelium can also possess microvilli. Some tissues contain goblet cells and are referred to as simple glandular columnar epithelium. The ciliated type is also called respiratory epithelium as it is almost exclusively confined to the larger respiratory airways of the nasal cavity, trachea and bronchi. Stratified epithelium[edit] Stratified epithelium differs from simple epithelium in that it is multilayered. It is therefore found where body linings have to withstand mechanical or chemical insult such that layers can be abraded and lost without exposing subepithelial layers. Cells flatten as the layers become more apical, though in their most basal layers the cells can be squamous, cuboidal or columnar. This specialization makes the epithelium waterproof, so is found in the mammalian skin. The lining of the esophagus is an example of a non-keratinized or "moist" stratified epithelium. These nuclei are pyknotic , meaning that they are highly condensed. Parakeratinized epithelium is sometimes found in the oral mucosa and in the upper regions of the esophagus. It is sometimes called urothelium since it is almost exclusively found in the bladder, ureters and urethra. Type Description Squamous Squamous cells have the appearance of thin, flat plates that can look polygonal when viewed from above. The cells fit closely together in tissues; providing a smooth, low-friction surface over which fluids can move easily. The shape of the nucleus usually corresponds to the cell form and helps to identify the type of epithelium. Squamous cells tend to have horizontally flattened, nearly oval shaped nuclei because of the thin flattened form of the cell. Squamous epithelium is found lining surfaces such as the skin , and alveoli in the lung , enabling simple passive diffusion as also found in the alveolar epithelium in the lungs. Specialized squamous epithelium also forms the lining of cavities such as in blood vessels, as endothelium and in the pericardium , as mesothelium and in other body cavities. Cuboidal Cuboidal epithelial cells have a cube-like shape and appear square in cross-section. The cell nucleus is large, spherical and is in the center of the cell. Cuboidal epithelium is commonly found in secretive tissue such as the exocrine glands , or in absorptive tissue such as the pancreas, the lining of the kidney tubules as well as in the ducts of the glands. The germinal epithelium that covers the female ovary , and the germinal epithelium that lines the walls of the seminferous tubules in the testes are also of the cuboidal type. Cuboidal cells provide protection and may be active in pumping material in or out of the lumen, or passive depending on their location and specialisation. Simple cuboidal epithelium commonly differentiates to form the secretory and duct portions of glands. Columnar Columnar epithelial cells are elongated and column-shaped and have a height of at least four times their width. Their nuclei are elongated and are usually located near the base of the cells. Columnar epithelium forms the lining of the stomach and intestines. The cells here may possess microvilli for maximising the surface area for absorption and these microvilli may form a brush border. Other cells may be ciliated to move mucus in the function of mucociliary clearance. Other ciliated cells are found in the fallopian tubes , the uterus and central canal of the spinal cord. Some columnar cells are specialized for sensory reception such as in the nose, ears and the taste buds. Hair cells in the inner ears have stereocilia which are similar to microvilli.

Goblet cells are modified columnar cells and are found between the columnar epithelial cells of the duodenum. They secrete mucus, which acts as a lubricant. Single-layered non-ciliated columnar epithelium tends to indicate an absorptive function. Stratified columnar epithelium is rare but is found in lobar ducts in the salivary glands , the eye , pharynx and sex organs. This consists of a layer of cells resting on at least one other layer of epithelial cells which can be squamous, cuboidal, or columnar. Pseudostratified These are simple columnar epithelial cells whose nuclei appear at different heights, giving the misleading hence "pseudo" impression that the epithelium is stratified when the cells are viewed in cross section. Ciliated pseudostratified epithelial cells have cilia. Cilia are capable of energy dependent pulsatile beating in a certain direction through interaction of cytoskeletal microtubules and connecting structural proteins and enzymes. In the respiratory tract the wafting effect produced causes mucus secreted locally by the goblet cells to lubricate and to trap pathogens and particles to flow in that direction typically out of the body. Ciliated epithelium is found in the airways nose, bronchi , but is also found in the uterus and Fallopian tubes , where the cilia propel the ovum to the uterus. Structure[edit] Cells of epithelial tissue are scutoid shaped, tightly packed and form a continuous sheet. They have almost no intercellular spaces. All epithelia is usually separated from underlying tissues by an extracellular fibrous basement membrane. The lining of the mouth, lung alveoli and kidney tubules are all made of epithelial tissue. The lining of the blood and lymphatic vessels are of a specialised form of epithelium called endothelium. Table of epithelia of human organs Epithelium lines both the outside skin and the inside cavities and lumina of bodies. The outermost layer of human skin is composed of dead stratified squamous , keratinized epithelial cells. Other surfaces that separate body cavities from the outside environment are lined by simple squamous, columnar, or pseudostratified epithelial cells. Other epithelial cells line the insides of the lungs , the gastrointestinal tract , the reproductive and urinary tracts, and make up the exocrine and endocrine glands. The outer surface of the cornea is covered with fast-growing, easily regenerated epithelial cells. A specialised form of epithelium â€” endothelium forms the inner lining of blood vessels and the heart , and is known as vascular endothelium, and lining lymphatic vessels as lymphatic endothelium. Another type, mesothelium , forms the walls of the pericardium , pleurae , and peritoneum. Basement membrane[edit] Epithelial tissue rests on a basement membrane , which acts as a scaffolding on which epithelium can grow and regenerate after injuries. The basement membrane acts as a selectively permeable membrane that determines which substances will be able to enter the epithelium. They consist of protein complexes and provide contact between neighbouring cells, between a cell and the extracellular matrix , or they build up the paracellular barrier of epithelia and control the paracellular transport. There are mainly 5 different types of cell junctions: Tight junctions are a pair of trans-membrane protein fused on outer plasma membrane. Desmosomes attach to the microfilaments of cytoskeleton made up of keratin protein. Hemidesmosomes resemble desmosomes on a section. They are made up of the integrin a transmembrane protein instead of cadherin. They attach the epithelial cell to the basement membrane. Gap junctions connect the cytoplasm of two cells and are made up of proteins called connexins six of which come together to make a connexion.

Chapter 5 : Epithelium - Wikipedia

Prelab Exercise 1 -EPITHELIA 1 Epithelia and Glands Epithelial cells cover or line surfaces and also form ducts and www.nxgvision.com may be arranged in a single layer (simple epithelium) or in multiple layers (stratified.

Development[edit] This image shows some of the various possible glandular arrangements. These are the simple tubular, simple branched tubular, simple coiled tubular, simple acinar, and simple branched acinar glands. This image shows some of the various possible glandular arrangements. These are the compound tubular, compound acinar, and compound tubulo-acinar glands. Every gland is formed by an ingrowth from an epithelial surface. This ingrowth may in the beginning possess a tubular structure, but in other instances glands may start as a solid column of cells which subsequently becomes tubulated. In many glands, the number of branches is limited, in others salivary, pancreas a very large structure is finally formed by repeated growth and sub-division. As a rule, the branches do not unite with one another, but in one instance, the liver, this does occur when a reticulated compound gland is produced. In compound glands the more typical or secretory epithelium is found forming the terminal portion of each branch, and the uniting portions form ducts and are lined with a less modified type of epithelial cell. If the gland retains its shape as a tube throughout it is termed a tubular gland. In the second main variety of gland the secretory portion is enlarged and the lumen variously increased in size. These are termed alveolar or saccular glands. Here is a diagram that shows the differences between Endocrine and Exocrine glands. The major difference is that Exocrine glands secrete substances out of the body and Endocrine glands secrete substances into capillaries and blood vessels. Endocrine gland Endocrine glands secrete substances that circulate through the blood stream. The glands secrete their products through basal lamina into the blood stream. Basil lamina typically can be seen a layer around the glands to which a million maybe more tiny blood vessels are attached. These glands often secrete hormones which play an important role in maintaining homeostasis. The pineal gland , thymus gland , pituitary gland , thyroid gland , and the two adrenal glands are all endocrine glands. Exocrine gland Exocrine glands secrete their products through a duct onto an outer surface of the body, such as the skin or the gastrointestinal tract. Secretion is directly onto the apical surface. The glands in this group can be divided into three groups: Apocrine gland is often used to refer to the apocrine sweat glands , however it is thought that apocrine sweat glands may not be true apocrine glands as they may not use the apocrine method of secretion. Holocrine glands the entire cell disintegrates to secrete its substances. Merocrine glands cells secrete their substances by exocytosis e. Also called " eccrine ". The type of secretory product of exocrine glands may also be one of three categories: Serous glands secrete a watery, often protein-rich, fluid-like product, e. Mucous glands secrete a viscous product, rich in carbohydrates such as glycoproteins , e. Sebaceous glands secrete a lipid product. These glands are also known as oil glands, e. Fordyce spots and meibomian glands.

Chapter 6 : Epithelial Tissue

Epithelium can be arranged in sheets, hence they are referred to as membranous epithelium or organized into glands, which are one or more cells which major function is the production and release of a secretory product.

Thus, these epithelia do not need to keratinize to avoid desiccation. The lubrication provided by mucus helps to protect against abrasion. Again, cell morphology changes from base to apex of the epithelium, the outermost being "squamous" in appearance whereas the basal cells appear more cuboidal or low-columnar. The orientation of the tissue can be confusing because of connective tissue projections that push up into the epithelium. Unlike keratinizing epithelium, nuclei are still present in most surface cells although they are often difficult to see in sectioned tissue. As protection against desiccation, it undergoes a process known as cornification or keratinization. The absence of nuclei in this layer shows that it is devoid of live cells. In some slides, the keratinized region is gray, but occasionally it has been penetrated in places by red stain. Note the differences in morphology of the cells as they move toward the surface. You will learn the names of these layers when we study the skin. Pseudostratified epithelium W pg 85 5. The basement membrane looks like a pink line at the base of the epithelium, which is rather easily seen in places on this slide. Ultrastructure refers to structures seen at the electron microscope level. Only some of these cells reach the free surface of the epithelium, where it is generally ciliated and contains goblet cells. The cilia appear as hairlike projections at the cell apex. What substructures form the core of each cilium? We will compare the epithelium lining the lumen of a distended glass slide 19, even box numbers or digital slide and a non-distended ureter glass slide 19 even or digital slide The surface cells have been stretched thin, as have the other layers, and there actually appear to be fewer layers, as the cells can slide past one another to a certain degree. Electron Micrographs While understanding the light microscopic structure of tissues and organs is important for interpreting pathological change, much of the really interesting biological side of medicine now involves understanding cell structure in more detail. Therefore, we feel you should be comfortable with interpreting electron micrographs by the time you complete this course, as they are becoming more important in diagnosis and many of the micrographs in your professional literature will be of this sort. We assume that you already have a general knowledge of cell ultrastructure and can recognize the nucleus, mitochondria, cell membranes, endoplasmic reticulum and ribosomes. Please review these structures in these sources and the electron micrographs listed below. The basal bodies are centrioles and have 9 triplets of microtubules with no central pair. The cytoplasm is full of intermediate filaments tonofilaments , some of which are attached to the desmosomal plaque. Under it, you can see connective tissue, which we will study next time. Note how thin the epithelium is. Shown is the epithelial lining cell of a proximal tubule in the kidney. Webscope Imagescope You can appreciate that this epithelium skin is stratified has multiple layers of cells and that the layers near the surface at the top of the micrograph have keratinized lost their nuclei and become a layer of keratin. The spiny appearance of cells deeper in the epithelium can also often be seen in the light microscope. They are points of cell-cell attachment, made more obvious by shrinkage during preparation. What junctions are found here? This is the lining of the esophagus, where it is no longer necessary to have an outer keratinized layer to protect against desiccation, as it was for skin. Thus, the outermost layer is still cellular and contains a nucleus. Note again the spiny appearance of the cells, due to the desmosomal attachments. Note that most of them are filled with secretory product mucus and that they do not have cilia. The line indicates the plane of section on EM Note the tops of the goblet cells protruding between the cilia. What are the differences among cilia, microvilli, stereocilia and kinocilia which you will come across later? This micrograph displays the transitional epithelial lining of the bladder. The wall of the urinary bladder contains 3 layers of somewhat irregularly arranged smooth muscle.

Chapter 7 : Epithelial Tissue and Mammary Gland | histology

In this Anatomy and Physiology lesson Mr. Zabel explain what histology is and goes over the four major types of tissues found in the body. This lesson focuses on epithelial tissues and how they.

Return to the Histology Tutorial menu. Epithelial surfaces are plentiful in the human body. The entire body has an epithelial covering called skin. The respiratory tract, gastrointestinal tract, and urinary tract all have epithelial linings. Any glandular, exocrine secretion must pass through an epithelial-lined duct. Epithelia form a mechanical barrier on surfaces exposed to the external environment. Epithelia can be specialized to perform additional functions such as removing inhaled debris with cilia in the respiratory tract, or absorbing nutrients from the gastrointestinal tract, or secreting mucin and fluid to provide lubrication and transport in ducts. There are several major types of epithelia: Cells toward the surface have smaller nuclei and greater amounts of cytoplasm with keratin. Mucosal surfaces without much wear and tear are not covered with a layer of keratin non-keratizining squamous epithelium , as on the cervix. On surfaces receiving greater wear and tear, there is a thick layer of acellular keratin keratinizing squamous epithelium , as on skin. They typically line glandular lumena or ducts. Columnar cells often produce mucin and may be called a mucinous epithelium. An example is the surface lining of the colon. They may have cilia or microvilli along the lumenal border. The cell nuclei are typically located toward the basal lamina. A variation of this pattern is a cuboidal epithelium where the cells are about as tall as they are wide, but there are gradations between cuboidal and columnar epithelium. This type of epithelium lines the respiratory tract from the nasopharynx down into the bronchioles of the lung. The cells are connected in a way that allows stretching and expansion. The overlying cell layer next to the lumen "umbrella cells" can spread thinly. This epithelium lines the urinary tract from the renal calyces down to the urethra. An example is the ureter. Cuboidal epithelium typically lines ducts draining glands. The small ducts of sweat glands including breast, a modified sweat gland can pile up to a stratified cuboidal appearance in larger ducts. Cuboidal epithelium is also found in renal tubules. The mesothelium that lines many body cavities, such as the pleural space , has a simple cuboidal appearance, but mesothelial cells are of mesenchymal origin and thus, technically, are connective tissue. Glands Glands are composed of collections of specialized epithelial cells that secrete one or more substances. Glands can be categorized as: Types of exocrine glands include mucinous glands in which the product secreted has a high concentration of mucinous material and serous glands in which the secretion is watery and often contains proteins such as enzymes. If the secretory product leaves the cell by exocytosis, then merocrine secretion occurs. If a portion of secretory cell cytoplasm forms the secretion, then apocrine secretion has occurred. The secretion product acts as a hormone, a substance with an action on tissues located at a distance from the endocrine gland. There are also single scattered cells in tissues which have a neuroendocrine function. Gland structure can be simple or complex. The goblet cells of the gastrointestinal tract are unicellular mucinous glands. Multicellular glands can be tubular , such as those in the gastric mucosa or colon, or acinar , such as those around a central lumen in the pancreas. A large gland can be divided into lobes and lobules , such as in the parotid glands or the breast. Myoepithelial cells , such as those around breast lobules, aid in contraction for secretion. Specialized Epithelial Components Basement membrane: Integrins in the epithelial cells extend into the basement membrane and attach to laminin which in turn attaches to type 4 collagen and to fibronectin in the portion of the basement membrane known as the basal lamina. There are anchoring fibrils of type 7 collagen. Thus the basal lamina acts as an anchoring point for the epithelium. The basal lamina forms a meshwork that acts as a filter, both physically and electrically, to trap or exclude molecules. A lamina reticularis of the basement membrane interfaces with the underlying connective tissue. It is essentially the layered remains of dead cells. The keratin layer is continuously being desquamated and replaced. Hair and nails are additional forms of keratin. Microvilli have a central core of actin filaments anchored by villin and a terminal web with spectrin. Dynein arms with ATPase activity attach to the microtubules to power movement. Terminal bars at the apical region of epithelial cells represent junctional complexes with several components. The zonula adherens has extracellular cadherins which join cytoskeletal elements through transmembrane proteins. The desmosomes

have attachment proteins that link to intermediate filaments of cytokeratin. There are also gap junctions that provide a means for selective communication by passage of small molecules between cells.

Chapter 8 : Epithelium and Glands

A gland is a single cell or multicellular organ composed predominantly of epithelium within a supporting framework of connective tissue Endocrine Glands Lack ducts and secrete products (hormones) directly into blood.

Recognize and distinguish the various endocrine organs thyroid, parathyroid, adrenal and pituitary. Understand the relationship between structure and function especially with respect to the pituitary. The endocrine glands are aggregations of epithelial cells embedded within connective tissue and surrounded by rich vascular networks. They may constitute separate organs, as the thyroid or adrenal glands, or they may occur as collections of cells embedded amid the tissues of another organ, such as the pancreatic islets and the interstitial cells of the testis. Endocrine glands differ from exocrine glands in that they possess no excretory ducts, and their secretions are usually released into interstitial tissue, to be picked up by blood and lymph capillaries. These secretions, the hormones, are characterized by being effective in minute amounts and often exert their influence on target organs or tissues at some distance from the gland. Hormones may be stored within the glandular cells pituitary , or by a special means of extracellular storage the thyroid , or they may be released into the blood as fast as they are produced the adrenal cortex. In some glands, the hormones, their precursors, and even the products associated with hormone formation may be visible within the individual cells as granules or droplets, particularly if special staining techniques are applied. In observing the endocrine glands, the student should pay particular attention to the relationships of the major structural and functional components, the epithelial cells and their vascular supply. The particular cytological features within the epithelial cells which aid in identification of the various glands should be noted. Thyroid Examine the human thyroid slide 67 under low power. The glandular epithelium is arranged in follicles lying within a connective tissue stroma, in which blood vessels and lymphatics form rich plexuses around each follicle. The follicles are filled with colloid which contains a high M. Its staining properties can vary considerably, even within the same follicle. The apparent follicular size varies greatly due to differences in the amount of colloid stored and the plane of section. Under high magnification, observe the follicular epithelial cells which may be low cuboidal to low columnar. Note that in some follicles the edge of the colloid mass is scalloped or vesicular suggesting that some of the colloid was lost during processing. This is usually attributed to lowered viscosity adjacent to the cells because of hydrolytic enzyme activity. Parathyroid These glands consist of four structures attached to, or embedded within, the posterior surface of each thyroid lobe. The parathyroid secretion, parathormone, is a polypeptide important in the regulation of calcium and phosphorus metabolism. The parathyroid glands consist of closely packed masses and cords of epithelial cells within a stromal meshwork of collagenous and reticular fibers. Oxyphil cells are interspersed singly or in clumps among the predominant cellular elements, the chief cells. Study the parathyroids slide 68 in both even and odd boxes. The chief cells are most numerous. They are the relatively small cells, therefore, their nuclei appeared to be more closely packed. Look for patches of eosinophilic cells with more widely spaced nuclei and distinct cell borders. These are oxyphils which may be found in small to large groups scattered among the chief cells. The oxyphils are larger cells with a smaller and more densely stained nucleus. The eosin staining of oxyphils may be faded on some slides, but they may usually be recognized by their nuclei and distinct cell borders. Some slides have relatively few oxyphils. Adrenal The adrenal gland is composed of two embryologically and functionally distinct glands. The cortex is of mesodermal origin and secretes several steroids. Hormones which exhibit at lease three types of activity; an effect on mineral metabolism mineralocorticoids , on carbohydrate metabolism glucocorticoids and on androgenic activity. The activity of the cells in the zona fasciculata and zona reticularis of the cortex is controlled humorally by the anterior pituitary. The cells of the adrenal medulla are of neural ectoderm origin, migrating out from the neural crest in a manner similar to autonomic ganglion cells. They become typical epithelioid secretory cells arranged in irregular rows with arterioles and capillaries on their basement membrane side and large venous capillaries at the opposite pole. Their nuclei lie toward their basement membrane, and the cells are oriented to secrete into venous capillaries. The cells are under autonomic control, receiving preganglionic acetylcholine fibers; they release their hormones, epinephrine and

norepinephrine in response to stimulation by the preganglionic fiber. There are ganglion cells in the medulla, among the secretory cells. Start with slide 69, odd adrenal gland. This well-preserved tissue from monkey clearly demonstrates the major structural features of the gland. With reversed ocular observe the central basophilic medulla containing medium to large veins , surrounded by the eosinophilic cortex. Using the scanning lens, identify the capsule, cortex, and medulla. With the 10x lens, begin at the capsule and examine the three zones of the cortex; the glomerulosa, the fasciculata, and the reticularis. Cells of the zona glomerulosa are smaller and darker than the next layer of cells and are arranged in spherical groups or arcades lying just inside the capsule. Their nuclei stain darkly. Internal to it is the zona fasciculata. No sharp dividing line separates the two zones. Cells of the fasciculata are arranged in cords with large capillary vessels between adjacent cords. In odd slides, the capillaries are collapsed but are recognizable by the flat nuclei of endothelial cells 40x. Cells of this zone are the largest of the cortical zones and light staining due to large empty spaces in the cytoplasm. These spaces originally contained lipid, but solvents used in histological preparations extracted it. These cells produce glucocorticoids and some androgen. The zona reticularis contains cells which are smaller and darker than those of the fasciculata and are arranged in anastomosing cords. These cells produce glucocorticoids and androgen. In the even numbered boxes, much of the reticularis was very poorly fixed. The head region odd number has a substantial amount, whereas, some of the body and all of the tail even numbers have little or none. The cells of the medulla are large, arranged in ovoid clusters, and are polarized with respect to their blood supply. The cells are called chromaffin cells because of their ability to stain with chromium salts. Specific cells secrete epinephrine; others secrete norepinephrine. Histochemical stains are required to demonstrate the different cell types. Slide 69, even is from the body or tail of a human adrenal and, thus, has little or no medulla. The description of the cortex above also applies, but note that the reticularis is poorly preserved. With reversed ocular, locate the central vein, the largest vessel. Observe the central vein with the scanning lens; it is surrounded over much of its surface by cortical tissue although located in the medulla the cortical cuff is unique to humans. Starting from the capsule, work across the slide observing the cortical zones, medulla, cortical material, central vein, etc. Pituitary Hypophysis This gland is composed of two tissue types, an adenohypophysis anterior lobe derived from buccal ectoderm and a neurohypophysis posterior lobe also called pars nervosa derived from neural ectoderm. The adenohypophysis contains mainly cords of glandular epithelium surrounded by blood vessels and some C. The major anterior portion of this lobe is called pars distalis. A smaller portion, pars intermedia, lies between the pars distalis and the posterior lobe neurohypophysis. The posterior lobe contains mainly nerve processes and endings, the terminal portion of the hypothalamo-hypophyseal tract along with glial cells, blood vessels and some C. From the capsule, trabeculae project into the anterior lobe, and together with a meshwork of reticular tissue, support the epithelial cords and vascular supply. The capillaries are abundant and have a very wide lumen. Although traditionally referred to as "sinusoids" their structure is that of typical fenestrated capillaries. The endocrine cell types of the anterior lobe have been classified for light microscopy L. Reddish acidophils and dark blue basophils are clearly discernible and have numerous granules. The chromophobe has a slightly basophilic cytoplasm, and few or no granules. Some, but not all "chromophobes" are degranulated acidophils or basophils. Such precise discrimination is impossible in sections stained routinely for L. Acidophiles produce somatotropin growth hormone and prolactin. Close examination of the arrangement of the cells in the anterior lobe shows them to be in irregular cords between relatively large blood capillaries. Pick out examples of capillaries in the connective tissue. The intermediate zone also has follicles containing a colloid material. On slide 65, even, locate the posterior lobe by visual inspection and under low power as a light-staining area resembling CNS tissue. Slides in odd-numbered boxes have little or no posterior lobe tissue. The posterior lobe is often separated from the anterior lobe by the intermediate lobe, but in this specimen, the intermediate lobe basophils are significant in number and are interposed between the follicles and neurohypophyseal elements. At 10x, small, dark blue sites are clear, as are nuclei of pituicytes, a neuroglial "supportive" cell. The dark blue regions are Herring bodies. They are the axon terminals of the hypothalamo-hypophyseal tract, and the material being stained are the hormones vasopressin anti-diuretic hormone and oxytocin complexed to carrier molecules neurophysins. These neurosecretory droplets are synthesized in the hypothalamus and transported down the

fibers of the tract and accumulate here. Pituicytes of various shapes may be seen around nerve fibers and Herring bodies. The nuclei are basically rounded to oval in shape; it will not be possible to see cytoplasmic processes. Other nuclei belong to fibroblasts or endothelial cells. Other Endocrine Glands The Leydig or interstitial cells of the testis produce androgens under pituitary gonadotropin control. The interstitial follicular and thecal cells of the ovary contribute to the production of estrogens while the cells of the corpus luteum form progesterone, all under pituitary gonadotropin control. The placenta has extensive endocrine functions involving both steroid and polypeptide hormones, insulin and glucagon. These endocrine tissues are studied when the student examines the organs in which they are embedded.

Chapter 9 : The Endocrine Glands

Stratified cuboidal epithelium and stratified columnar epithelium can also be found in certain glands and ducts, but are uncommon in the human body. Another kind of stratified epithelium is transitional epithelium, so-called because of the gradual changes in the shapes of the apical cells as the bladder fills with urine.

June 1, 0 Comments Epithelial Tissue Epithelial tissue is a sheet of cells that covers a body surface or lines a body cavity. Two forms occur in the human body: Covering and lining epitheliumâ€" forms the outer layer of the skin; lines open cavities of the digestive and respiratory systems; covers the walls of organs of the closed ventral body cavity. Glandular epitheliumâ€" surrounds glands within the body. Characteristics of epithelium Epithelial tissues have five main characteristics. Polarityâ€" all epithelia have an apical surface and a lower attached basal surface that differ in structure and function. For this reason, epithelia is described as exhibiting apical basal polarity. Most apical surfaces have microvilli small extensions of the plasma membrane that increase surface area. For instance, in epithelia that absorb or secrete substances, the microvilli are extremely dense giving the cells a fuz zy appearance called a brush border. Examples of this would include epithelia lining the intestine and kidney tubules. Other epithelia have motile cilia hairlike projections that push substances along their free surface. Next to the basal surface is the basal lamina thin supporting sheet. The basal lamina acts as a filter allowing and inhibiting certain molecules from passing into the epithelium. Specialized contactsâ€" epithelial cells fit close together and form continuous sheets except in the case of glandular epithelia. They do this with tight junctions and desmosomes. Tight junctions form the closest contact between cells and help keep proteins in the apical region of the plasma membrane. Desmosomes connect the plasma membrane to intermediate filaments in the cytoplasm. Supported by connective tissueâ€" all epithelia are supported by connective tissue. For instance, deep to the basal lamina is reticular lamina extracellular material containing collagen protein fiber which forms the basement membrane. The basement membrane reinforces the epithelium and helps it resist stretching and tearing. Regenerationâ€" epithelium have a high regenerative capacity and can reproduce rapidly as long as they receive adequate nutrition. Classification of Epithelia Epithelium has two names. The first name indicates the number of cell layers, the second describes the shape of its cell. Based on the number of cell layers, epithelia can either be simple or stratified. Simple epitheliaâ€" consist of a single cell layer found where absorption, secretion, and filtration occur. Stratified epitheliaâ€" are composed of two or more cell layers stacked on top of each other typically found in high abrasion areas where protection is needed. All epithelial cells have six sides but they vary in height. For this reason, there are three ways to describe the shape and height of epithelial cells. Squamous cellsâ€" are flat and scale-like. Cuboidal cellsâ€" are box-like same height and width. Columnar cellsâ€" are tall column shaped. Simple squamous epithelium Simple squamous epitheliumâ€" are close fitting and flattened laterally. Two simple squamous epithelia in the body have special names reflecting their location. Endotheliumâ€" provides a friction-reducing ling in lymphatic vessels and all hollow organs of the cardiovascular system heart, blood vessels, capillaries. Mesotheliumâ€" is the epithelium found in serous membranes membranes lining the ventral body cavity and covering the organs within it. Simple cuboidal epitheliumâ€" consists of a single layer of cells with the same height and width. Functions include secretion and absorption located in small ducts of glands and kidney tubules. Simple columnar epitheliumâ€" is a single layer of tall, closely packed cells that line the digestive tract from the stomach to the rectum. Functions include absorption and secretion. They contain dense microvilli on their apical surface. Additionally, some simple columnar epithelia may display cilia on their free surface also. Pseudostratified columnar epitheliumâ€" vary in height. All of their cells rest on the basement membrane and only the tallest reach the apical surface. When viewing pseudostratified epithelium it may look like there are several layers of cells, but this is not the case. Most pseudostratified epithelia contain cilia on their apical surface and line the respiratory tract. Stratified squamous epitheliumâ€" is the most widespread stratified epithelia. Its apical surface cells are squamous and cells of the deeper layer are either cuboidal or columnar. The outer layer of the skin epidermis is keratinized contains keratin, a protective protein. Other stratified squamous in the body is nonkeratinized. Stratified

cuboidal epithelium Stratified cuboidal epitheliumâ€" is somewhat rare in the human body. Stratified columnar epithelium Stratified columnar epitheliumâ€" is also rare in the human body. Small amounts are found in the pharynx, male urethra, and lining of some glandular ducts. Stratified columnar epithelium occurs in transition areas junctions between other epithial types. Transitional epitheliumâ€" forms the lining of hollow urinary organs, which stretch as they fill with urine. Cells in the basal layer are cuboidal or columnar. Cells by the apical surface vary in appearance depending if the organ is stretched at the time. Transitional cells have the ability to change their shape which allows more urine to flow through. For information on glandular epithelium, click here.