I'm not a robot

Epithelial tissues are thin tissues that cover all the exposed surfaces of the body. They form the external skin, the inner lining of the mouth, digestive tract, secretory glands, the lining of hollow parts of every organ such as the heart, lungs, eyes, ears, the urogenital tract, as well as the ventricular system of the brain and central canals of the spinal cord. The cells making up epithelia are often closely bound to one another through specialized structures called tight junctions. They are also free from blood vessels and nerves and are supported by a connective tissue called the basement membrane. They have polarity with a distinct basal domain facing the basement membrane and the other apical surface facing the lumen of an organ or the external environment. Epithelial tissue has a number of functions, which include protection against abrasion, radiation damage, chemical stress and invasion by pathogens. A single organ can have different types of epithelial tissue based on the substances to which different surfaces are exposed. Protective tissue tends to be thicker, made of multiple layers of cells and often has inclusions such as keratin to provide mechanical strength and resistance. The skin of most mammals contains layers of thick keratinized dead epithelial cells protecting them against water loss and other stresses. Similarly, the esophagus is also exposed to a wide range of different textures, pH levels and chemical compositions from food and drink. Therefore, it also contains protective epithelium. Due to its involvement in the digestive process, however, it remains non-keratinized, and secretes mucus to smoothen the passage of food. Alternatively, epithelial tissue can be involved in absorption, secretion and movement of substances. These epithelia are usually thin, containing cilia or microvilli and are often made of one layer of cells. With the exception of the mouth and esophagus, the rest of digestive tract consisting of the stomach, small and large intestine is covered by these kinds of thin epithelia. These cells secrete enzymes and play an important role in selectively absorbing digested food. The small intestine is particularly noted for the presence of microvilli on the epithelium that increase the surface area for absorption. Epithelia in bronchioles of the lungs contain cilia that move mucus and improve immune function. Similar ciliated epithelia in the fallopian tubes move the egg from the ovaries towards the uterus. Some tissues, such as transitional epithelia, have a specialized structure that allows them to stretch and expand the capacity of the organ. Transitional epithelia are found lining the urinary bladder as well as the ureters and urethra. Small numbers of these cells are found in the urine, as part of the normal sloughing of dead cells. However the presence of a large number of cells from the transitional epithelium or from epithelial cells in the kidney indicate urinary tract infection, high cholesterol, diabetes or kidney disease. There are different types of epithelial tissue depending on their function in a particular location. The simplest classification of these tissues is based on the number of cell layers. Simple epithelia Stratified epithelia When the epithelium is composed of a single layer of cells, it is called simple epithelial tissue and those containing two or more layers of cells are called stratified epithelial tissues. One particular type is called pseudostratified because a single layer of cells having varying heights gives the appearance of being stratified. Epithelia can also be classified based on the shape of the cells, giving rise to three types: Squamous epithelial tissue: consists of extremely thin cells that resemble the scales of a fish Cuboidal epithelial tissue: contains cells that appear square in cross-section but are marginally longer than they are wide Columnar epithelial tissue: consists of elongated cell involved in absorption of materials The number of cell layers and cell types together give rise to 6 different types of epithelial tissue. Simple squamous epithelia Simple cuboidal epithelia Simple columnar epithelia Stratified squamous epithelia Stratified cuboidal epithelia Stratified columnar epithelia Additionally, there are pseudostratified epithelia and transitional epithelia. Simple epithelia are made of a single layer of cells that are in direct contact with the basement membrane with a common apical surface. These cells can be squamous, cuboidal, or columnar. Simple squamous epithelium is found in the alveoli of lungs, and its structure is important for the exchange of gases between the blood and lungs. Simple cuboidal epithelia line the lumen of collecting ducts in the kidney and are present in the thyroid around the follicles that secrete thyroid hormones. They protect the underlying structures and have a secretory function (such as in the thyroid) or absorptive function (as in the collecting ducts of the kidney). The image shows a transverse section of a kidney and the letters 'a' and 'b' demarcate the lumen of collecting ducts. Simple cuboidal epithelia line both those structures. Simple columnar epithelia are found in the female reproductive system and in the digestive tract. The cells in the fallopian tubes are ciliated and involved in the movement of the ovum towards the uterus. Those in the digestive tract are non-ciliated, and instead contain microvilli, which gives the epithelium the appearance of being brush-bordered. Pseudostratified epithelia are formed of cells that have varying heights and therefore present the illusion of being stratified. However, every cell in this tissue makes contact with the basement membrane, thereby placing it among the simple epithelia. Stratified epithelia consist of more than one layer of cells and only one layer is in direct contact with the basement membrane. Similarly, only one layer of cells has the apical surface exposed to the lumen of the organ or to the external environment. These tissues often have a protective role, and the extent of friction or abrasion often determines the number of layers of cells. Stratified squamous epithelia are found in skin, with many dead, keratinized cells providing protection against water and nutrient loss. Stratified cuboidal epithelia are found surrounding the ducts of many glands, including mammary glands in the breast and salivary glands in the mouth. Stratified columnar epithelia are rare, found predominantly in some organs of the reproductive system, and in the conjunctiva of the eye. Transitional epithelia are a special subset of stratified epithelia that consist of ovoid cells that can stretch based on the pressure of liquids inside the organ. They are exclusively found in the excretory system. Epithelial tissues play the role of separating two structures from each other. For instance, the epithelium in a blood vessel demarcates the cells of the blood from those forming the artery or vein. This allows two organs to remain in close proximity for their function while maintaining separate internal physiology. In order to accomplish this function, however, epithelial tissues need to be tightly attached to each other, forming a mostly impenetrable layer. This is achieved by the presence of tight junctions between two epithelial cells. Tight junctions in cells are also known as occluding junctions because they prevent the flow of material through the interstitial space between two cells. These are structures formed from the close interaction between the extracellular domains of two sets of transmembrane proteins. These proteins are arranged in a row near the apical surface of epithelial cells and are predominantly made of claudins and occludins. Epithelial tissue rests on a structure called the basement membrane. It consists of two parts – the basal lamina and the reticular connective tissue underneath. The basal lamina is secreted by the cells of the epithelial tissue itself and contains proteins, glycoproteins, and collagen IV, a type of structural protein that forms sheets. The basement membrane compensates for the lack of blood vessels and nerves in the epithelium and is important for transport of nutrients, clearance of waste products, and transmission of neural and hormonal signals. It also plays an important role in anchoring the epithelium to the connective tissue underneath. Apical Surface – Part of the cell membrane of epithelial cells that faces the lumen. Differing in composition from the rest of the cell, it often contains cilia or microvilli and many specialized proteins. Cilia – Slender, cytoplasmic extrusions present in nearly every mammalian cell. Some are motile cilia that are involved in the movement of substances. Lumen – Inner space of tubular structures such as ducts or the respiratory and gastrointestinal passages. Microvilli – Large number of minute projections seen from the plasma membrane of some cells, designed to increase the surface area of the cell for secretion or absorption. 1. Which of these epithelia can stretch to increase the volume of the organ based on internal water pressure? A. Simple squamous epithelia B. Simple columnar epithelia C. Transitional epithelia D. Stratified columnar epithelia C is correct. Transitional epithelia present in the excretory system, lining the ureters, urethra and urinary bladder can stretch depending on the volume of urine. Simple squamous epithelia are present where there is absorption or movement of materials. Simple and stratified columnar epithelia usually have a secretory function. 2. How is a pseudostratified epithelium different from a truly stratified tissue? A. The nuclei are at the same level in pseudostratified epithelia. B. The apical and basal surfaces are aligned. C. There are multiple cell layers in pseudostratified epithelia. D. All the cells in a pseudostratified epithelium interact with the basement membrane. D is correct. Since all the cells of a pseudostratified epithelium rest on the basement membrane, they are classified as a simple epithelial tissue, rather than as a stratified epithelium. Their nuclei are often at different levels, their apical surfaces are not aligned with each other and consist of a single layer of cells. 3. Which of these is an important function of epithelial cells? A. Protection from chemical abrasion B. Secretion of hormones and enzymes C. Absorption of nutrients D. All of the above D is correct. Epithelia have a number of functions, including protection, secretion and absorption. They demarcate different surfaces from each other, and resist friction, invasion by pathogens, loss of water and nutrients in addition to enhancing the functions of various organs. Describe the structural characteristics of the various epithelial tissues and how these characteristics enable their functions. By the end of this section, you will be able to: Explain the general structure and function of epithelial tissue Distinguish between tight junctions, anchoring junctions, and gap junctions Distinguish between simple epithelia and stratified epithelia, as well as between squamous, cuboidal, and columnar epithelia Describe the structure and function of endocrine and exocrine glands Epithelial tissue primarily appears as large sheets of cells covering all surfaces of the body exposed to the external environment and lining internal body cavities. In addition, epithelial tissue is responsible for forming a majority of glandular tissue found in the human body. Epithelial tissue is derived from all three major embryonic layers. The epithelial tissue composing cutaneous membranes develops from the ectoderm. Epithelial tissue composing a majority of the mucous membranes originate in the endoderm. Epithelial tissue that lines vessels and open spaces within the body are derived from mesoderm. Of particular note, epithelial tissue that lines vessels in the lymphatic and cardiovascular systems is called endothelium whereas epithelial tissue that forms the serous membranes lining the true cavities is called mesothelium. Regardless of its location and function, all epithelial tissue shares important structural features. First, epithelial tissue is highly cellular, with little or no extracellular material present between cells. Second, adjoining cells form specialized intercellular connections called cell junctions. Third, epithelial cells exhibit polarity with differences in structure and function between the exposed, or apical, facing cell surface and the basal surface closest to the underlying tissue. Fourth, epithelial tissues are avascular; nutrients must enter the tissue by diffusion or absorption from underlying tissues or the surface. Last, epithelial tissue is capable of rapidly replacing damaged and dead cells, necessary with respect to the harsh environment this tissue encounters. Epithelial Tissue Function: Epithelial tissues provide the body's first line of protection from physical, chemical, and biological damage. The cells of an epithelium act as gatekeepers of the body, controlling permeability by allowing selective transfer of materials across its surface. All substances that enter the body must cross an epithelium. Many epithelial cells are capable of secreting mucous and other specific chemical compounds onto their apical surfaces. For example, the epithelium of the small intestine releases digestive enzymes and cells lining the respiratory tract secrete mucous that traps incoming microorganisms and particles. The Epithelial Cell Epithelial cells are typically characterized by unequal distribution of organelles and membrane-bound proteins between their apical and basal surfaces. Structures found on some epithelial cells are an adaptation to specific functions. For example, cilia are extensions of the apical cell membrane that are supported by microtubules. These extensions beat in unison, allowing for the movement of fluids and particles along the surface. Such ciliated epithelia line the ventricles of the brain where it helps circulate cerebrospinal fluid and line the respiratory system where it helps sweep particles of dust and pathogens up and out of the respiratory tract. Epithelial cells in close contact with underlying connective tissues secrete glycoproteins and collagen from their basal surface which forms the basal lamina. The basal lamina interacts with the reticular lamina secreted by the underlying connective tissue, forming a basement membrane that helps anchor the layers together. Figure 4.2.1 – Types of Cell Junctions: The three basic types of cell-to-cell junctions are tight junctions, gap junctions, and anchoring junctions. Cells of epithelia are closely connected with limited extracellular material present. Three basic types of connections may be present: tight junctions, anchoring junctions, and gap junctions (Figure 4.2.1). Types of Cell Junctions Epithelial cells are held close together by cell junctions. The three basic types of cell-to-cell junctions are tight junctions, gap junctions, and anchoring junctions. A Tight junction restricts the movement of fluids between adjacent cells due to the presence of integral proteins that fuse together to form a firm seal. Tight junctions are observed in the epithelium of the urinary bladder, preventing the escape of fluids comprising the urine. An anchoring junction provides a strong yet flexible connection between epithelial cells. There are three types of anchoring junctions: desmosomes, hemidesmosomes, and adherens. Desmosomes hold neighboring cells together by way of cadherin molecules which are embedded in protein plates in the cell membranes and link together between the adjacent cells. Hemidesmosomes, which look like half a desmosome, link cells to components in the extracellular matrix, such as the basal lamina. While similar in appearance to desmosomes, hemidesmosomes use adhesion proteins called integrins rather than cadherins. Adherens use either cadherins or integrins depending on whether they are linking to other cells or matrix. These junctions are characterized by the presence of the contractile protein actin located on the cytoplasmic surface of the cell membrane. These junctions influence the shape and folding of the epithelial tissue. In contrast with the tight and anchoring junctions, a gap junction forms an intercellular passageway between the membranes of adjacent cells to facilitate the movement of small molecules and ions between cells. These junctions thus allow electrical and metabolic coupling of adjacent cells. Classification of Epithelial Tissues Epithelial tissues are classified according to the shape of the cells composing the tissue and by the number of cell layers present in the tissue.(Figure 4.2.2) Cell shapes are classified as being either squamous (flattened and thin), cuboidal (boxy, as wide as it is tall), or columnar (rectangular, taller than it is wide). Similarly, cells in the tissue can be arranged in a single layer, which is called simple epithelium, or more than one layer, which is called stratified epithelium. Pseudostratified (pseudo- = "false") describes an epithelial tissue with a single layer of irregularly shaped cells that give the appearance of more than one layer. Transitional describes a form of specialized stratified epithelium in which the shape of the cells, and the number of layers present, can vary depending on the degree of stretch within a tissue. Figure 4.2.2 – Cells of Epithelial Tissue: Simple epithelial tissue is organized as a single layer of cells and stratified epithelial tissue is formed by several layers of cells. Epithelial tissue is classified based on the shape of the cells present and the number of cell layers present. Figure 4.2.2 summarizes the different categories of epithelial cell tissue cells. Summary of Epithelial Tissue Cells Watch this video to find out more about the anatomy of epithelial tissues. Where in the body would one find non-keratinizing stratified squamous epithelium? Simple Epithelium The cells in a simple squamous epithelium have the appearance of thin scales. The nuclei of squamous cells tend to appear flat, horizontal, and elliptical, mirroring the form of the cell. Simple squamous epithelium, because of the thinness of the cells, is present where rapid passage of chemical compounds is necessary such as the lining of capillaries and the small air sacs of the lung. This epithelial type is also found composing the mesothelium which secretes serous fluid to lubricate the internal body cavities. In simple cuboidal epithelium, the nucleus of the box-like cells appears round and is generally located near the center of the cell. These epithelia are involved in the secretion and absorptions of molecules requiring active transport. Simple cuboidal epithelia are observed in the lining of the kidney tubules and in the ducts of glands. In simple columnar epithelium, the nucleus of the tall column-like cells tends to be elongated and located in the basal end of the cells. Like the cuboidal epithelia, this epithelium is active in the absorption and secretion of molecules using active transport. Simple columnar epithelium forms a majority of the digestive tract and some parts of the female reproductive tract. Ciliated columnar epithelium is composed of simple columnar epithelial cells with cilia on their apical surfaces. These epithelial cells are found in the lining of the fallopian tubes where the assist in the passage of the egg, and parts of the respiratory system, where the beating of the cilia helps remove particulate matter. Pseudostratified columnar epithelium is a type of epithelium that appears to be stratified but instead consists of a single layer of irregularly shaped and differently sized columnar cells. In pseudostratified epithelium, nuclei of neighboring cells appear at different levels rather than clustered in the basal end. The arrangement gives the appearance of stratification, but in fact, all the cells are in contact with the basal lamina, although some do not reach the apical surface. Pseudostratified columnar epithelium is found in the respiratory tract, where some of these cells have cilia. Both simple and pseudostratified columnar epithelia are heterogeneous epithelia because they include additional types of cells interspersed among the epithelial cells. For example, a goblet cell is a mucous-secreting unicellular gland interspersed between the columnar epithelial cells of a mucous membrane (Figure 4.2.3). Figure – 4.2.3 Goblet Cell: (a) In the lining of the small intestine, columnar epithelium cells are interspersed with goblet cells. (b) The arrows in this micrograph point to the mucous-secreting goblet cells (LM × 1600). (Micrograph provided by the Regents of University of Michigan Medical School © 2012) Stratified Epithelium A stratified epithelium consists of multiple stacked layers of cells. This epithelium protects against physical and chemical damage. The stratified epithelium is named by the shape of the most apical layer of cells, closest to the free space. Stratified squamous epithelium is the most common type of stratified epithelium in the human body. The apical cells appear squamous, whereas the basal layer contains either columnar or cuboidal cells. The top layer may be covered with dead cells containing keratin. The skin is an example of a keratinized, stratified squamous epithelium. Alternatively, the lining of the oral cavity is an example of an unkeratinized, stratified squamous epithelium. Stratified cuboidal epithelium and stratified columnar epithelium can also be found in certain glands and ducts, but are relatively rare in the human body. Another kind of stratified epithelium is transitional epithelium, so-called because of the gradual changes in the shapes and layering of the cells as the epithelium lining the expanding hollow organ is stretched. Transitional epithelium is found only in the urinary system, specifically the ureters and urinary bladder. When the bladder is empty, this epithelium is convoluted and has cuboidal-shaped apical cells with convex, umbrella shaped, surfaces. As the bladder fills with urine, this epithelium loses its convolutions and the apical cells transition in appearance from cuboidal to squamous. It appears thicker and more multi-layered when the bladder is empty, and more stretched out and less stratified when the bladder is full and distended. Glandular Epithelium A gland is a structure made up of one or more cells modified to synthesize and secrete chemical substances. Most glands consist of groups of epithelial cells. 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 to the external environment (exo- = "outside"). Endocrine Glands The secretions of endocrine glands are called hormones. Hormones are released into the interstitial fluid, diffuse into the bloodstream, and are delivered to cells that have receptors to bind the hormones. The endocrine system a major communication system coordinating the regulation and integration of body responses. These glands will be discussed in much greater detail in a later chapter. Exocrine Glands Exocrine glands release their contents through a duct or duct system that ultimately leads to the external environment. Mucous, sweat, saliva, and breast milk are all examples of secretions released by exocrine glands. Glandular Structure Exocrine glands are classified as either unicellular or multicellular. Unicellular glands are individual cells which are scattered throughout an epithelial lining. Goblet cells are an example of a unicellular gland type found extensively in the mucous membranes of the small and large intestine. Multicellular exocrine glands are composed of two or more cells which either secrete their contents directly into an inner body cavity (e.g., serous glands), or release their contents into a duct. If there is a single duct carrying the contents to the external environment then the gland is referred to as a simple gland. Multicellular glands that have ducts divided into one or more branches is called a compound gland (Figure 4.2.4). In addition to the number of ducts present, multicellular glands are also classified based on the shape of the secretory portion of the gland. Tubular glands have enlongated secretory regions (similar to a test tube in shape) while alveolar (acinar) glands have a secretory region that is spherical in shape. Combinations of the two secretory regions are known as tubuloalveolar (tubuloacinar) glands. Figure 4.2.4 – Types of Exocrine Glands: Exocrine glands are classified by their structure. Exocrine glands are classified by the arrangement of ducts emptying the gland and the shape of the secretory region. Methods and Types of Secretion In addition to the glandular structure, exocrine glands can be classified by their mode of secretion and the nature of the substances released (Figure 4.2.5). Merocrine secretion is the most common type of exocrine secretion. The secretions are enclosed in vesicles that move to the apical surface of the cell where the contents are released by exocytosis. For example, saliva containing the glycoprotein mucin is a merocrine secretion. The glands that produce and secrete sweat are another example of merocrine secretion. Figure 4.2.5 – Modes of Glandular Secretion: (a) In merocrine secretion, the cell remains intact. (b) In apocrine secretion, the apical portion of the cell is released, as well. (c) In holocrine secretion, the cell is destroyed as it releases its product and the cell itself becomes part of the secretion. Apocrine secretion occurs when secretions accumulate near the apical portion of a secretory cell. That portion of the cell and its secretory contents pinch off from the cell and are released. The sweat glands of the armpit are classified as apocrine glands. Like merocrine glands, apocrine glands continue to produce and secrete their contents with little damage caused to the cell because the nucleus and golgi regions remain intact after the secretory event. In contrast, the process of holocrine secretion involves the rupture and destruction of the entire gland cell. The cell accumulates its secretory products and releases them only when the cell bursts. New gland cells differentiate from cells in the surrounding tissue to replace those lost by secretion. The sebaceous glands that produce the oils on the skin and hair are an example of a holocrine glands (Figure 4.2.6). Figure 4.2.6 – Sebaceous Glands: These glands secrete oils that lubricate and protect the skin. They are holocrine glands and they are destroyed after releasing their contents. New glandular cells form to replace the cells that are lost (LM × 400). (Micrograph provided by the Regents of University of Michigan Medical School © 2012) Glands are also named based on the products they produce. A serous gland produces watery, blood-plasma-like secretions rich in enzymes, whereas a mucous gland releases a more viscous product rich in the glycoprotein mucin. Both serous and mucous secretions are common in the salivary glands of the digestive system. Such glands releasing both serous and mucous secretions are often referred to as seromucous glands. In epithelial tissue, cells are closely packed with little or no extracellular matrix except for the basal lamina that separates the epithelium from underlying tissue. The main functions of epithelia are protection from the environment, coverage, secretion and excretion, absorption, and filtration. Cells are bound together by tight junctions that form an impermeable barrier. They can also be connected by gap junctions, which allow free exchange of soluble molecules between cells, and anchoring junctions, which attach cell to cell or cell to matrix. The different types of epithelial tissues are characterized by their cellular shapes and arrangements: squamous, cuboidal, or columnar epithelia. Single cell layers form simple epithelia, whereas stacked cells form stratified epithelia. Very few capillaries penetrate these tissues. Glands are secretory tissues and organs that are derived from epithelial tissues. Exocrine glands release their products through ducts. Endocrine glands secrete hormones directly into the interstitial fluid and blood stream. Glands are classified both according to the type of secretion and by their structure. Merocrine glands secrete products as they are synthesized. Apocrine glands release secretions by pinching off the apical portion of the cell, whereas holocrine gland cells store their secretions until they rupture and release their contents. In this case, the cell becomes part of the secretion. MeSH Heading Epithelium Tree Number(s) A10.272 Unique IDD004848 RDF Unique Identifier Annotationusually NIM with specific organ IM Scope NoteThe layers of EPITHELIAL CELLS which cover the inner and outer surfaces of the cutaneous, mucus, and serous tissues and glands of the body. Entry Term(s) Epithelial Tissue Mesothelial Tissue Mesothelium Entry Combination cytology:Epithelial Cells Date Established 1966/01/01 Date of Entry 1999/01/01 Revision Date 2016/05/31 Epithelium Preferred Concept UIM0007605 Scope NoteThe layers of EPITHELIAL CELLS which cover the inner and outer surfaces of the cutaneous, mucus, and serous tissues and glands of the body. Terms Epithelium Preferred Term Term UI T014791 Date01/01/1999 LexicalTag NON ThesaurusID NLM (1966) Epithelial Tissue Term UI T000898352 Date04/06/2016 LexicalTag NON ThesaurusID NLM (2017) Characteristics of Epithelial Tissue Epithelial tissues are widespread throughout the body. They form the covering of all body surfaces, line body cavities and hollow organs, and are the major tissue in glands. They perform a variety of functions that include protection, secretion, absorption, excretion, filtration, diffusion, and sensory reception. The cells in epithelial tissue are tightly packed together with very little intercellular matrix. Because the tissues form coverings and linings, the cells have one free surface that is not in contact with other cells. Opposite the free surface, the cells are attached to underlying connective tissue by a non-cellular basement membrane. This membrane is a mixture of carbohydrates and proteins secreted by the epithelial and connective tissue cells. Epithelial cells may be squamous, cuboidal, or columnar in shape and may be arranged in single or multiple layers. Simple cuboidal epithelium is found in glandular tissue and in the kidney tubules. Simple columnar epithelium lines the stomach and intestines. Pseudostratified columnar epithelium lines portions of the respiratory tract and some of the tubes of the male reproductive tract. Transitional epithelium can be distended or stretched. Glandular epithelium is specialized to produce and secrete substances. « Previous (Body Tissues)Next (Connective Tissue) » Epithelial Tissue is one the types of tissues (epithelial muscular, connective and nerve) in mammals. It is composed of polyhedral cells that are tightly aggregated that adhere firmly to each other, forming sheets of cells that cover the inside of hollow organs as well as covering the body's the surface. Epithelium, also known as epithelial tissue (plural epithelia) comprises cells that are laid out in continuous sheets, the form of single or multiple layers.Characteristics of Epithelial TissueThe epithelial tissue that is found in various parts of the body could differ in their structure and purpose, they all share the same characteristics. A few of these features are listed below:1. Shape and SizeThe epithelial tissue that is found in various parts of the body could differ in their structure and purpose, they all share the same characteristics. A few of these features are listed below:2. PolarityEpithelial cells are generally polarized that is characterized by membrane proteins and organelles dispersed in a different way inside the cell. The Apical (free) skin of the epithelial cells is located on the body's surface or body cavity as well as the internal organ or gland duct which receives the secretions of cells. Apical surfaces could include microvilli or cilia. The sides of an epithelial cells, facing adjacent cells to the opposite side, could include intercellular adhesion as well as other junctions. The base of an epithelial cell binds to extracellular material like the basement membrane that can be described as an inert connective tissues created by epithelial cells.3. Basement MembraneThe basement membrane an extracellular layer, which is composed of two layers: the basal lamina, as well as the lamina reticulare. The basal layer is close to the secretion of epithelial cells. It is a source of collagen and laminin, and proteins and glycoproteins. The reticular layer is more close to connective tissue beneath, and is a source of collagen protein that is produced by cells of connective tissues, also known as the fibroblasts.4. Intercellular Adhesion and Other JunctionsA variety of membrane-associated structures facilitate cell adhesion as well as communication. Tight junctions, also known as zonulae-occludens, are the most apical junctions, which create a complete band that surrounds every cell. The other kind of junction is called the adherens junction, also known as zonula adherens. This is also enclosed by the epithelial cell generally just below it. The tight junction. Another type of anchoring junction is called the macula adherens, also known as the desmosome that are disc-shaped structures on the surface of a cell that match with similar structures found on the cell's surface. Gap junctions facilitate intercellular communication, not adhesion or the occlusion of cells.5. AvascularThe epithelial tissues are vascular, it relies on the blood vessels of adjacent connective tissue for nutrients and to eliminate the waste. The exchange of chemicals between epithelial and connective tissue is accomplished through diffusion.6. InnervatedEpithelial tissue is internalized; that means the epithelial tissue has its own supply of nerves.7. Renew and RepairEpithelial cells exhibit an extremely high rate of cell division that allows the epithelial tissue's ability to constantly regenerate and repair itself by eliminating damaged or dead cells in exchange for fresh cells.Functions of Epithelial TissueBased on where it is located epithelial tissue plays many tasks. A few of them include:1. ProtectionOne of the primary roles of epithelial tissue is protecting. It guards the cells below from radiation, desiccation and invasion by pathogens the effects of toxins or physical injuries. Blood vessels are not present within the epithelial tissue stops bleeding from the tissue in the event of abrasion.2. TransportationThe epithelial tissue also plays a role in transporting different molecules inside and out of cells through different pumps that are present in the epithelial tissues. Apart from that, it is involved in the respiratory, digestive and urinary systems it facilitates the transfer of molecules between cells that are beneath them and the capillaries of the body and ducts.3. SecretionThe epithelium of the gland releases different macromolecules, including hormones that are that are responsible for a variety of body functions. A number of glands (exocrine and endocrine) are also responsible for maintaining the body's surface (skin) and help support the functions of various organs (digestive system).4. AbsorptionBecause of the functions of specific structures such as cilia or microvilli on the surfaces of cell, the epithelial tissue assists in the absorption process of various molecules, by expanding areas of surface. In the digestive tract, the columnar cells in the small intestine assist to absorb water as well as numerous other nutrients.5. Receptor functionThe epithelial tissue are specifically designed to perform sensory functions . They detect sensory signals and convert it into neuronal signals. Epithelial tissues, such as the columnar epithelium that is pseudostratified of the olfactory mucosa have Apical cilia that permit the sense of the smell.Types / Classification with examples and locationEpithelial tissue can be divided into two kinds:Covering and lining epithelium, also known as the surface epithelium that is the outer layer of skin as well as some internal organs. It also creates the lining for blood vessels and body cavities, ducts and the membrane of the digestive, respiratory, reproductive and urinary systems.Glandular epithelium which makes up glands' secreting portions like the thyroid gland and sweat glands, adrenal glands, as well as digestive glands.Additionally, the varieties of lining and covering epithelial tissues are classified based on how cells are arranged as well as the shape of these cells.Types / Classification with examples and locationSimple epitheliumSimple epithelium is comprised of only one layers of cells that are identical that are typically found on absorptive and secretory surfaces. The single layer aids in the process of absorptive and secretory. Simple epithelium can be divided into three distinct types and their names are based on their shape and differ according to their roles.a. Simple squamous epitheliumThe epithelium that is squamous in its basic form consists of one layer of cells that looks like tiles on the floor when seen from the apical side. It has an apical nucleus located in the center which is flattened and an oval shape or even spherical. The epithelium is most often found in the lymphatic and cardiovascular system (heart lymphatic vessels, blood vessels) which is referred to as the endothelium. It also is the epithelial layer that forms part that is composed of membranes serous (peritoneum or pleura, pericardium) and is also known as. It can also be found in air sacs in the lung, the and in the glomerular (Bowman's) capsules of kidneys, as well as the inside of the tympanic membrane (eardrum).b. Simple cuboidal epitheliumSimple cuboidal epithelium is one layers of cells with cube shapes. They are round and possess the nucleus located in the center. It is a layer that covers the ovary's surface and lines the anterior side of the capsule lenses of our eyes. It forms an epithelium with pigmentation on the posterior end of the retinas of the eyes, connects kidney tubules as well as smaller ducts from various glands, which are the an important gland's secretory portion like thyroid glands and the ducts of certain glands like the pancreas.c. Simple columnar epitheliumThe columnar epithelium is formed by one layer of cells, which is rectangular in form, and surrounded by the basement membrane. The epithelium runs through various organs, and is frequently created to be designed for a specific purpose. The stomach is lined by columnar epithelium with no surface structures. But, the area of columnar epithelium which lines the small intestinal tract is wrapped in microvilli. They offer a large surface to allow the absorption of substances from small intestinal. In the trachea the columnar epithelium is ciliated. Additionally, it has goblet cells which secrete mucus. Also, in the tubes of the uterus, ova are pushed forward through ciliary action toward the uterus.Stratified epitheliumThe stratified epithelium comprises multiple layers of cells with various shapes. Basement membranes are typically absent. When basal cells divide, daughter cells that result from cell divisions are moved by older cells up towards the Apical layer. As they advance towards the surface, and away from the blood supply of connective tissue underneath They become less hydrated and less metabolically active.These proteins dominate as the cytoplasm gets smaller and cells turn into solid, hard and eventually cease to exist. The apical layers are when dead cells shed cell junctions, they're eliminated, but continue to be replaced when new cells arise from the basal cells. There are two major kinds of epithelium that are stratified such as stratified squamous and stratified cuboidal along with an epithelium that is stratified to the columnar level.a. Stratified squamous epitheliumThe epithelium with stratified squamous cells has several layers of cell. The cells that are located in the apical layer, as well as layers beneath it are squamous. The cells in the layers below vary between cuboidal and columnar.The epithelium is formed by a layer of keratin that is located in the apical portion of cells and in layers that are a few layers deep it. The amount of keratin grows within cells when they withdraw from the blood supply with nutrients and organelles ultimately cease to function. Keratin is a durable and relatively waterproof layer that helps prevent drying out the cells that are beneath. Keratinized stratified squamous epithelium is the skin's surface.The epithelium doesn't contain huge amounts of keratin in the apical layers, and is layered several times deep. It is constantly moistened by mucous and salivary glands. The nonkeratinized stratified epithelium is found on wet areas (lining of the mouth and esophagus), a part of the epiglottis of the pharynx, as well as the vagina) and covers the tongue.b. Stratified cuboidal epitheliumThe stratified cuboidal epithelium is composed of multiple layers of cells, in which the topmost layer is composed of cuboidal cells. The deeper layer may be columnar or cuboidal. Cuboidal epithelium Stratified is visible in the salivary ducts that excretory sweat glands and salivary.c. Stratified columnar epitheliumThe epithelium with stratified columns has several layers of cells in which the top layer is composed of columnar cells. The more subordinate layer could be columnsar or cuboidal. This kind of epithelium can be found in the conjunctiva of the eyes, in parts of the urethra, as well as the tiny portion of the mucosa anal.Pseudostratified columnar epitheliumThe epithelium of pseudodostratified appears to have multiple layers as the nuclei of cells are found at different levels. Even though all cells are connected to the basement membrane as a single layer but some cells are unable to make it to the apical side. Because of these conditions it appears as an elongated tissue, but it actually is the epithelium itself. The epithelium is the line that connects epididymis to larger ducts of a variety of glands, as well as parts of the male urethra as well as airways in the majority of the upper respiratory tract.Transitional epithelium tissueTransitional epithelium tissue. Image Source: Wikipedia.Epithelium that is transitional (urothelium) is characterized by a variable look (transitional). When it is in a relaxed, or untretched state, it appears like cuboidal epithelium that has been stratified, with the exception that cells in the apical layer tend to be large and round. When tissue is stretched, cells shrink creating the appearance of stratified epithelium that is squamous. The multiple layers of elasticity and the underlying structure makes it suitable for filling with hollow organs (urinary bladder) that expand from the inside.Glandular EpitheliumEpithelial cells that are primarily used to make and release diverse macromolecules could be found in epithelia along with other roles or include glands that are specialized organs. Splendid secretory cells, often known as unicellular glands, are found in simple cuboidal, basic columnar or pseudostratified epithelia. Glands are formed from epithelia that cover in the fetus via cell proliferation and expansion into connective tissue. They are then and then the development of further differentiation.Main types of glands. Glands differentiate from epithelial tissues during embryo development. Arrows point to the released substances. Image Source: University of Vigo.Endocrine glandsThe endocrine glands' secretions which are known as hormones, pass through the interstitial fluid, and move into the bloodstream, without passing through an artery. The effects of endocrine glands are vast since they are dispersed throughout the body via the bloodstream. The most prominent endocrine glands are the pituitary gland located at the brain's base the pineal gland within the brain thyroid gland, parathyroid and thyroid glands in the in the larynx (voice box) and adrenal glands that are superior to kidneys, pancreas close to the stomach, the ovaries inside the pelvic cavity tests in the scrotum and the thymus in the thoracic cavity.Exocrine glandsExocrine glands release their products into ducts which let the secretions flow onto the surfaces of organs like the skin's surface or the lumen of hollow organ. Effects of exocrine glands are only limited and some would have negative effects if they were to enter the bloodstream. Sweat, oil, the earwax glands on the skin digestive glands like salivary glands (secrete into the mouth cavities) along with the pancreas (secretes to the small intestine) are instances of exocrine glands. Author: Jana Vasković, MD • Reviewer: Nicola McLaren, MSc Last reviewed: November 03, 2023 Reading time: 18 minutes Epithelium is one of only 4 types of human body tissues. Like all types, it is formed by cells within an extracellular matrix (ECM). The cells in this tissue are tightly packed within a thin ECM. Forming sheets that cover the internal and external body surfaces (surface epithelium) and secreting organs (glandular epithelium). Functions of epithelial tissue are secretion, protection, absorption, transportation and special sensory receptive. Think epithelial tissue is not so interesting? What until you read about all its specializations! This page will introduce you to the histology, characteristics and functions of epithelial tissue. Key facts Cell shape classification Squamous, cuboidal, columnar Cell layer classification Simple, stratified, pseudostratified, transitional Main features Contiguous cells Polarity (apical, lateral and basal cell surfaces) Intercellular junctions Basement membrane (extracellular matrix) Supported by connective tissue (lamina propria) Avascular, innervated Specialisations Apical: microvilli, cilia, stereocilia, modified stereocilia (sensory receptors) Secreting: tubular, acinar and tubuloacinar glands Functions Secretion, absorption, transportation, protection, receptor function (sensation) Epithelial cells are the building blocks of epithelial tissue. Like every other cell, they are surrounded by cellular membranes. Epithelial cell membranes have three regions (domains) different in structure and function; apical, lateral and basal. This feature is called membrane polarity. Each membrane pole exhibits various features. These can include receptors and channels for transportation of substances that the epithelial cell needs to internalize or expel, or membrane specializations. Apical poles project towards the external surface or the lumen of an organ which epithelia cover, which is why they're also called free surfaces or free domains. This pole may also show apical membrane specializations which alter the shape of this surface. Lateral surfaces are the sites where adjacent cells interconnect, forming tightly packed contiguous cells. Basal surfaces are in contact with the underlying basement membrane. As both lateral and basal surfaces are adjusted to interact with surrounding structures, they're often mentioned together as a basolateral surface. Apical specializations are different types of fingerlike cytoplasmic extensions of the apical surface. They differ in their length, motility and function. There are three types of specializations; Microvilli - are microscopic protrusions of the cell membrane which mainly function to increase the apical surface area for absorption. Large quantities of microvilli are said to form a 'brush border', due to their appearance in histological preparation. The enterocytes of the small intestine has such specializations to facilitate absorption of food in the gut. Stereocilia - a type of microvilli, but these are immotile and longer than microvilli. Their functions are absorption (epididymis and ductus deferens) and mechano-sensory reception (inner ear) Cilia - fingerlike structures present on almost every epithelial cell. There are three types of cilia; motile, non-motile (primary) and nodal. Their respective functions are; removing foreign particles from the epithelial surface, transportation of signals from the ECM to the intracellular space, and fetal development. Intercellular junctions are protein complexes on the basolateral cell membranes of epithelial cells. Their functions are to establish membrane polarity, connect adjacent cells and anchor the epithelial tissue to the connective tissue underneath it. There are five main types of junctions: Tight junctions (occluding junctions) – a complex intercellular junction that blocks the intercellular space between adjacent cells making it impassable. Adhering junctions and desmosomes – connect the cytoskeletons of adjacent cells. Communicating (gap) junctions – passageways between adjacent cells that allow the transfer of small molecules between adjacent cells. Anchoring junctions (hemidesmosomes) – a cell matrix junction that anchors the cell to the basement membrane. Epithelial cells are aligned into one or more rows, separated by thin layers of extracellular matrix. The deepest row (basal domain) produces a layer of specialized extracellular matrix called the basement membrane. This membrane demarcates the epithelial tissue from the underlying connective tissue. Remember hemidesmosomes? These and other cell-to-extracellular matrix junctions anchor epithelial cells to the underlying basement membrane. A layer of connective tissue called the lamina propria, attaches to the basal surface of the basement membrane. Lamina propria holds the epithelial tissue glued to the deep tissues and contains blood vessels that supply the epithelial tissue. Let's round this all up to understand how epithelial cells make the epithelial tissue. So, epithelial cells are tightly packed into one or more layers, held together by a variety of intercellular junctions. The deepest layer sits on a basement membrane, while the surface layer is free. Epithelial tissue is avascular but innervated. Nutrients are supplied by diffusion from blood vessels of the lamina propria. Epithelia contain stem cells in their basement membranes which enable continuous epithelial renewal. Some epithelia renew very fast (skin), while others do it at a slower pace. Get started with histology of tissues here. Epithelial tissue is classified based on the cell shape and the number of cell layers. Cell shape: squamous, cuboidal, columnar Cell layers: simple (one layer), stratified (multiple layers). When there are multiple layers, it is the most superficial surface cell layer (apical domain) that defines the shape classification. There are additional subclasses of epithelial classification for cells that have specializations (e.g. ciliated epithelium). Squamous epithelial cells appear squashed or flattened, like flakes or fish scales. The cells are wider than they are tall, with an oval shaped nucleus. Cuboidal epithelial cells are square shaped cells, they have a similar width to height ratio. The nucleus is large, round and centrally located, and the cytoplasm is rich with organelles. Columnar epithelial cells have a rectangular or column shape, meaning that they are taller than they are wide. The nucleus is also elongated, having a long oval shape. They have an organelle rich cytoplasm. These cells may have apical projections, such as microvilli or cilia. Columnar epithelial cells can be modified to produce mucous or other secretions, or form specialized sensory receptors. Simple epithelium consists of one layer of epithelial cells lying on a basement membrane. Cells can be squamous, cuboidal and columnar. Simple squamous epithelium – a single layer of thin flattened cells. This type of epithelium forms thin delicate sheets of cells through which molecules can easily pass (diffusion, filtration). Contiguous squamous epithelial cells also provide a smooth flat surface over which fluids and other tissues can move with low friction. This type does not offer great protection, in fact in some environments the cells can be shed (desquamate). Simple squamous epithelium can be found lining capillaries, inside of blood vessels (endothelium), alveoli of the lungs, glomeruli of the kidneys, the heart (endocardium) and serous membranes (mesothelium). Simple cuboidal epithelium – a single layer of cube-shaped cells. This type of epithelium offers greater protection than simple squamous due to its increased thickness. It also has secretory, absorptive and excretory functions because of its organelle rich cytoplasm. Simple cuboidal epithelium is found in organs with these functions, such as the ducts of the salivary glands, liver, pancreas and other exocrine glands. It forms thyroid follicles, kidney tubules, seminiferous tubules of male testis, and covers the surface of the ovaries (germinal epithelium). Test what you've learned about the simple epithelium with the following quiz. Simple columnar epithelium – a single layer of column shaped cells. Similar to cuboidal, it can have protection, secretion, absorption and excretion functions owing to its thickness and organelle rich cytoplasm. This epithelium often includes apical specializations (i.e. microvilli, cilia) which enhance its absorptive function or offer motility. Simple columnar epithelium can be found in the walls of the stomach, intestines and gallbladder. Learn more about simple epithelium here. Learn faster Surface epithelium Explore study unit Pseudostratified epithelium is a type of simple columnar epithelium. It is termed "pseudo" because, although single, it appears to have multiple layers. All the cells are attached to the basement membrane but not all of them reach the free surface, thus forming a sheet of cells with different heights and irregularly located nuclei. There are types of pseudostratified columnar epithelium with cilia (upper respiratory pathways, uterine tubes), with stereocilia (epididymis) and without any apical specializations (ductus deferens). Stratified epithelium consists of two or more cell layers. Based on the shape of their most apical cell layer, they are further classified into squamous, cuboidal and columnar. There are also two types of specialized stratified epithelium: keratinized and transitional. Stratified squamous epithelium – multiple layers of flat squamous epithelia which provide protection against abrasion and water loss. This type is further divided into keratinized and non-keratinized. Non-keratinized stratified squamous epithelium does not desquamate. It lines the oral cavity, esophagus, larynx, vagina and anal canal, and the outer layer of the cornea. Stratified cuboidal epithelium - also functions as a protective tissue layer. It lines the excretory ducts of the sweat glands, large ducts of excretory glands, the anorectal junction and surrounds ovarian follicles. Stratified columnar epithelium - less common than the other stratified types. It has the secretion and protective functions of all columnar epithelia. Examples of where this epithelial type can be found includes; covering the conjunctiva of the eye and in the largest ducts of exocrine glands. A special type of this epithelium forms sensory epithelium. Here, the columnar cells have various apical specializations modified to detect the various types of stimuli received by human sensory organs. Thus they are found in the retina of the eye (microvilli), taste buds on the tongue (microvilli), organ of Corti (stereocilia) and ampullae in the inner ear (microvilli, stereocilia and cilia). Why not test your knowledge of the stratified epithelium with some quiz questions? Keratinized epithelium - is a specialized stratified squamous epithelium in which the most apical (superficial) cells are dead and cyclically desquamate. The cells lose their nucleus and cytoplasm, and instead contain a tough protein called keratin which has waterproof properties. It is found in the epidermis of the skin. Find out more about stratified epithelium here. Learn faster Surface epithelium Explore study unit Transitional epithelium is a type of stratified epithelium found in organs able to distend. It is called transitional as its superficial cells can change their shape (for example, from cuboidal to squamous) when the organ stretches. It is featured only in some parts of the urinary tract; renal calyces, ureters and urinary bladder, which is why it can also be termed the urothelium. Struggling with epithelial tissues? Check out our quizzes and free worksheets for identifying epithelial tissue. Glandular cells are modified epithelial cells. They are specialized to pick up substances from the blood and modify them into a product that's then

released from the cell. They can be found scattered within the covering epithelia as unicellular glands (e.g., goblet cells in the intestinal epithelium), or they can form glandular organs (e.g., thyroid gland). Glands are classified in two ways; Based on where and how they release their product – into endocrine and exocrine glands Based on the number of comprising cells – into unicellular and multicellular glands Exocrine glands excrete their products onto the external body surface or into internal organs' cavities. They can be unicellular and multicellular. Unicellular exocrine glands are dispersed within the covering epithelia, such as goblet cells in gastrointestinal and respiratory tracts. Multicellular glands consist of two parts; a secretory unit which secretes the product and an excretory duct which conveys the product out of the gland. By the structure of their excretory duct, multicellular glands classify as simple or compound. Simple glands have an unbranched secretory duct which may have different shapes; tubular, branched tubular, coiled tubular, alveolar and branched alveolar. Compound glands have a branching excretory duct. Based on the structure of their secretory units, they are further divided into tubular, acinar and tubuloacinar. Multicellular glands can also be classified by the mode of their secretion; merocrine (excretion via exocytosis), holocrine (excretion with cell apoptosis) and apocrine (excretion by detaching the apical membrane). Merocrine glands are further divided into three types; Mucous glands; secrete viscous products rich in proteins bound to carbohydrates (sublingual glands). Serous glands; release watery fluid where proteins aren't bound to carbohydrates (parotid gland). Seromucous glands; secrete mixed products (submandibular gland). Endocrine glands do not have excretory ducts. Instead, their product, called hormone, diffuses into capillaries and travels through the bloodstream to reach its target organ/s and modify their functions. Endocrine epithelial cells can be organized in three ways; Forming parenchyma of endocrine glands (e.g. pineal gland, suprarenal gland) Incorporated in organs whose primary function is other than endocrine (e.g. juxtaglomerular cells of the kidney, Leydig cells of the testes) Dispersed within other epithelial cells, being specifically connected to autonomic neurons (diffuse neuroendocrine system - DNES) There is no uniform structure applied to all endocrine cells. Instead, they are classified by the nature of their secretion into cells that produce proteins and cells that produce lipids (steroids). Find out more about glands histology here. Many epithelial cells are able to secrete various macromolecules. The best example is glandular epithelium. Endocrine glands secrete hormones that regulate a variety of bodily functions, such as blood sugar levels (insulin), cellular metabolism (tyroxin) and cardiac cycle (noradrenalin). Exocrine glands maintain the body surfaces (sebum on the skin) and support functions of organs they discharge into (digestive enzymes in the small intestine). Absorption function is best exampled by surface epithelia with apical microvilli which significantly increase the absorptive surface area. Columnar epithelium in the small intestine is a good example. These cells function to absorb nutrients from the digestive tract, then transport the digested substances into the circulation. By having channels and pumps on their apical and basal surfaces, epithelial cells transport substances into and out of their cells. For example columnar cells of the ileum transport iron from the intestinal lumen into the capillaries, and cuboidal cells of renal tubule expel the H^+ (hydrogen ion) from the body into the urine. Squamous epithelia, which form serous and mucous membranes as well as capillary linings, are also specialised for bidirectional substance transport. Epithelial tissue forms a selective barrier, protecting the underlying organs from mechanical and chemical insults such as intoxication, tearing and infections. This is one reason why epithelia doesn't have blood vessels, as abrasion could result in tearing of the vessel and bleeding. Epithelia specialized for protection, such as the stratified squamous keratinized epithelium of the skin, are multilayered and have a high cell renewal rate. This means that they repair quickly after injury. Epithelia can be specialized to receive sensory information and translate this information into neural signals. One example is pseudostratified columnar epithelium of the olfactory nasal mucosa. These epithelial receptor cells have apical cilia which detect the chemical signals of incoming odors. They pass that signal to the olfactory nerve (CN I) which transmits the information about the smell to the central nervous system. Other receptor epithelia include stratified columnar epithelia of the retina, taste buds, organ of Corti and ampullae in the inner ear. Epithelial tissue is one of the four tissue types. It is found lining the inner and outer body surfaces and comprising the parenchyma of the glands. It is divided into surface (covering) and glandular (secreting) epithelium. Surface epithelium consists of one or more cell layers, stacked over a thin basement membrane. Based on the cell shape, epithelial tissue is classified into squamous, cuboidal or columnar. Depending on the number of layers, the tissue is divided into simple or stratified. Subclassifications include pseudostratified, ciliated or transitional. Glandular epithelial cells produce and release various macromolecules. Glands are described as endocrine or exocrine glands, depending on where and how they release their product. Based on the number of cells, they are divided into and unicellular or multicellular. All content published on Kenhub is reviewed by medical and anatomy experts. The information we provide is grounded on academic literature and peer-reviewed research. Kenhub does not provide medical advice. You can learn more about our content creation and review standards by reading our content quality guidelines. References: Ross, H. M, Pawlina, W. (2011). Histology (6th ed.). Philadelphia, PA: Lippincott Williams & Wilkins. Mescher, A. L. (2013). Junquiera's Basic Histology (13th ed.). New York, NY: McGraw-Hill Education Article, review and layout: Jana Vasković Nicola McLaren Articles within this topic: Videos within this topic: Overview and types of epithelial tissue: want to learn more about it? Our engaging videos, interactive quizzes, in-depth articles and HD atlas are here to get you top results faster. What do you prefer to learn with? "I would honestly say that Kenhub cut my study time in half." – Read more. Kim Bengochea, Regis University, Denver February 23, 2018 Gaurab Karki Class 12, Histology, Zoology 0 An epithelium is a sheet of cells that covers a body surface or lines a cavity. Epithelium forms the coverings of surfaces of the body such as Skin, Mouth, Nasal cavity (Ectodermal), Lines internal body surface such as GI tract, Lungs, Urinary bladder and vagina (Endodermal) and Lining of blood vessels, lymphatic and heart (Endothelial cells derived from Mesoderm). It serves many purposes, including protection, adsorption, excretion, secretion, filtration, and sensory reception. Epithelium also serves as glandular epithelium. There are two functional types of epithelium: lining epithelium and glandular epithelium. Polarity- Epithelium is arranged so there is one free surface (apical surface) and one attached surface (basal surface) Cellular nature– Cells in epithelium fit closely together side by side and sometimes atop each other to form sheets of cells. These sheets are held together by specialized junctions. Supported by connective tissue– Attachment to a layer of connective tissue at the basal surface forms a layer called the basement membrane, an adhesive layer formed by secretions from the epithelial cells and the connective tissue cells. Avascular– Epithelium typically lacks its own blood supply. Regeneration– Epithelium cells can regenerate if proper nourished. Absence of nerves (except for a few axons in the deeper layers) Typically epithelial tissue is classified on the basis of arrangement and shape of cells. For naming the tissue types, the arrangement of the cells is stated first, then the shape, and is followed by "epithelium" to complete the naming. For example; Simple Squamous Epithelium. 1. Classification scheme of epithelial tissue on the basis of arrangement of cells i. Simple epithelium: Cells are found in a single layer attached to the basement membrane. ii. Compound or Stratified epithelium: Cells are found in 2 or more layers stacked atop each other. iii. Pseudo-stratified epithelium: Pseudo-stratified epithelium appears to be more than one cell thick since the nuclei lie at different heights, but in fact it is single layer of cells, in contact with the basement membrane iv. Transitional epithelium: cells are rounded and can slide across one another to allow stretching 2. Classification scheme of epithelial tissue on the basis of shape i. Squamous epithelium: (Latin, squama- scale) flat, thin, scale-like cells, eg. Endothelium, mesothelium, pericardium, peritonium ii. Cuboidal epithelium: cells that have a basic cube shape. Typically the cell's height and width are about equal. Eg. Kidney tubules, thyroid glands, duct of sweat gland iii. Columnar epithelium: tall, rectangular or column shaped cells. Typically cells are longer than width. Eg. Intestinal lining, gall bladder, ducts of glands Types of epithelium tissue: simple epithelium tissue compound epithelium tissue Specialized Epithelium Simple epithelium tissue Simple squamous epithelium Simple cuboidal epithelium Simple columnar epithelium Pseudo-stratified epithelium Compound or Stratified epithelium: Stratified squamous epithelium Stratified cuboidal epithelium Stratified columnar epithelium Transitional epithelium Specialised Epithelium Glandular epithelium Germinal epithelium Sensory epithelium Ciliated epithelium