

## Practical 9: Histology of Epithelia and Skin

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(Relevant Risk Management form is on page 6)

### Objectives

#### Epithelia

- Obtain an understanding of the histological appearance of various types of epithelia based on their cellular shape and number of layers.
- To examine the histological appearance of 2 other unique types of epithelia namely pseudostratified and transitional.
- To demonstrate some sites where the types of epithelia can be located
- To demonstrate certain epithelial specialisations such as microvilli and cilia.
- Relate the morphology of the epithelia to their various functions.

#### Skin

- To know the microscopic structure of the skin e.g. epidermis, dermis and hypodermis.
- To know the histological differences between hairy (thin) and glabrous (thick) skin.
- To know the histology of associated structures e.g. eccrine and apocrine sweat glands, sebaceous glands, and hair.
- To know the histological features of some sensory receptors namely: Pacinian and Meissner corpuscles.

### Virtual Slide Box

The virtual histology slides for this practical can be found in the UNSW Virtual Slides Moodle module at:

<http://moodle.telt.unsw.edu.au/course/view.php?id=21070>

### A Brief Description of Epithelium

**Epithelium forms continuous layers of cells that cover surfaces and line cavities of the body.** These cavities include the closed peritoneal, pleural, and pericardial cavities, where the epithelium is called **mesothelium**, and open organ cavities, i.e. digestive, respiratory, and urogenital organs, which connect with the outside. In addition, epithelium lines the cardiovascular and lymph passageways as **endothelium**. The **parenchymal** (secretory) cells of glands (e.g. sweat, salivary) are also epithelium.

Epithelial cells are always in **close apposition to each other**, with a space between membranes of only about 20nm. A small amount of **intercellular material**, called cement substance (glycosaminoglycans) allows cells to glide over each other and offers only minimal resistance to the migration of leukocytes and other connective tissue cells through the epithelial layers.

Epithelial **attachment points** (junctional complexes) occur between neighboring epithelial cells to hold adjacent cell membranes in close apposition. They also serve as anchoring sites for the fine filaments of the cytoskeleton, which assists in stabilizing the cell shape.

Epithelial cells **sit on a basement membrane** separating them from underlying CT.

Epithelium is **avascular** and for its nutrition depends on diffusion of substances across the basement membrane.

### *Epithelia are classified according to 3 morphological characteristics:*

- **The number of cell layers:** a single layer = **simple epithelium**; epithelia composed of more than one layer = **stratified epithelia**.
- **The shape of the component cells** when seen in sections taken at right angles to the epithelial surface: **the shape may be squamous (flattened), cuboidal (about equal dimensions), or columnar (taller than it is wide)**.
- The presence of **surface specializations** e.g. cilia, microvilli and keratin.

### *Main Functions of Epithelium*

- **Protection of underlying tissues** of the body from abrasion, radiation, dehydration, bacterial invasion e.g. the epidermis of the skin.
- **Regeneration** e.g. in skin wound healing and epidermal replacement (approx every 28 days), in the renewal of the lining cells of the uterus following menstruation and in the replacement of cells lining the gastrointestinal (GI) tract (every 4 to 6 days). The turnover rate is related to their location and function.
- **Secretion** by glandular epithelial cells of products that are expelled **into the blood stream** (e.g. hormones by thyroid follicles), **into ducts and hollow organs** (e.g. stomach acids and pancreatic enzymes), or **onto the skin** (sweat from sweat glands and sebum from sebaceous glands).
- **Absorption** between body compartments via selective permeability of intercellular junctions between epithelial cells. Transcellular transport of molecules across epithelial layers e.g. lipids in the small intestine and selective re-absorption in kidney tubules (e.g. sodium).
- **Detection of sensations** via the neuro-epithelium of the taste buds, specialized hair cells in the ear and tactile endings in skin.
- **Lubrication** by various types of glandular epithelial cells which secrete copious amounts of **mucus**, a viscous product rich in mucopolysaccharides and mucoproteins. Mucus is an excellent lubricant and aids the movement of food along the alimentary tract. Mesothelial cells, lining the closed body cavities, secrete a thin serous fluid that prevents friction of organs rubbing against each other.
- **Excretion** by epithelial cells (kidney tubules, sweat glands) which filter waste products from the blood, and are then excreted as urine or sweat.
- **Diffusion of gases** ( $O_2/CO_2$ ) by **endothelium** of capillaries in the lungs.

### *Learning Activities*

#### **Simple Epithelium**

##### **Simple Squamous**

**Virtual slides: Distributing artery and vein and Aorta**

**The lumen of all blood vessels is lined by a single layer of squamous (endothelial) cells providing a smooth, low-friction surface to circulating blood cells.**

Observe **other tissues** (connective tissue (collagen, elastic fibers), smooth muscle, adipose, nerves) present in this slide.

**Where else in the body will you find this type of epithelium?**

### Simple Cuboidal

Virtual slides: Thyroid gland and Kidney

Note that the thyroid cuboidal cells are secretory in function and the height of the cell in the follicles indicates activity (low cuboidal cells equals low activity).

Observe that in the kidney slide, there is simple squamous epithelium lining the Bowman's capsule surrounding the glomerulus in the cortical region. Simple cuboidal epithelial cells line the proximal and distal convoluted renal tubules.

Where else in the body will you find this type of epithelium?

### Simple Columnar

Virtual slides: Fallopian tube-isthmus and Duodenum

Observe that the Fallopian (uterine) tube epithelium has surface specialisations termed cilia. What is the function of cilia?

Note that there are other types of tissue present such as smooth muscle, nerves, connective tissue, and blood vessels.

Observe in the Duodenum slide that the simple columnar epithelial cells have Goblet cells residing between them. What is the function of a Goblet cell?

Also, this epithelium has a striated border on its apical surface representing microvilli. This is more evident when viewed under an electron microscope. What is the function of the microvilli?

Observe other tissues (muscle, glands, CT, blood vessels) present in the duodenum slide?

Where else in the body will you find this type of epithelium?

## Stratified Epithelium

### Stratified Squamous Non-Keratinising

Virtual slides: Tongue-Foliate papillae and Cervix of uterus/vaginal canal

Note changes in cell shape from the bottom layer upwards towards the lumen.

Observe other tissues (skeletal muscle, serous glands, CT, taste buds, lymphatic aggregations) present in this slide?

The cervix slide reveals a junction between the cervical canal and the upper part of the vagina. The cervical canal is lined by simple columnar epithelium whilst the vagina is lined by non-keratinised stratified squamous epithelium.

Observe other tissues (Nabothian (cervical) glands, CT, blood vessels, smooth muscle) present in this slide?

What do the cervical glands secrete?

Where else in the body will you find this type of epithelium?

### Stratified Squamous Keratinising

Virtual slide: Skin

Note that the superficial layers of the epidermis are composed of dead cells whose nuclei and cytoplasm has been replaced with a protein called keratin.

Observe other tissues (sweat glands, CT, adipose, blood vessels) present in this slide?

### Stratified Cuboidal / Stratified Columnar

**Virtual slides: Skin and Submandibular salivary gland**

**Observe that the ducts of the sweat glands in the dermis are lined by stratified cuboidal epithelium.**

**In the submandibular gland, the excretory ducts carrying saliva to the oral cavity are lined by either stratified cuboidal epithelial cells (for smaller ducts) as shown in the slide or stratified columnar (for larger ducts) which are not shown.**

### Pseudostratified Columnar

**Virtual slides: Epididymis and Trachea**

**This type is categorized as simple because all the epithelial cells make contact with the basement membrane, but not all cells reach the surface of the epithelium.**

**In the epididymis slide, observe that the epithelial cells have long non-motile stereocilia (microvilli) on their apical surface. What is the function of the stereocilia? Observe other tissues (smooth muscle, CT, blood vessels) present in this slide?**

**In the trachea slide, observe that the epithelial cells have cilia on their apical surface and Goblet cells reside between these. What are the structural and functional differences between cilia and stereocilia?**

**Observe other tissues (hyaline cartilage, smooth muscle, CT, blood vessels, nerves, adipose cells, glands) present in this slide?**

**Note: A portion of the thyroid gland is present on this slide**

### Transitional

**Virtual slides: Urinary bladder (relaxed) and Urinary bladder (partly distended)**

**Located only in the urinary system, this epithelium is composed of 5 or more cell layers. Those located basally are either low columnar or cuboidal. The most superficial of the empty bladder are large, occasionally binucleated and exhibit rounded dome tops that bulge into the lumen (a scalloped appearance). These cells become more squamous and the epithelium thins out when the bladder is full and stretched. Compare the 2 slides and note the difference in the height of the epithelial layers from a relaxed to a more distended state.**

**Observe other tissues (large amounts of smooth muscle, CT, blood vessels) present in this slide?**

### Skin

**Virtual slide: Thick skin (human palm).**

Locate the epidermis and its component strata namely Basale, Spinosum, Granulosum, Lucidum, and Corneum, Locate dermal papillae, epidermal pegs, the dermis containing collagen and elastic fibers, sweat glands and their ducts, and sensory receptors (Pacinian and Meissner's corpuscles)

Which epidermal layer is NOT found in thin skin?

What is the anatomical name for a skin cell and what is its function?

What cell types would you find in the dermis and give their function?

What is the function of the 2 sensory receptors named above?

**Virtual slides: Thin skin (human scalp LS and TS) and Skin (axillary, human)**

Observe the hair follicles, hair bulb, erector pili muscle, eccrine sweat glands and sebaceous glands.

What is the function of a sebaceous gland?

**On the axillary skin slide**, observe the eccrine and apocrine sweat glands and note the myoepithelial cells.

What is the function of myoepithelial cells?

What is the function of an apocrine sweat gland?

**Prescribed Textbook:**

Mescher, A. (2013). *Junqueira's Basic Histology: Text and Atlas*, (13th ed.). New York: McGraw Hill.  
Read Chapter 4 (Epithelial tissue) and Chapter 18 (Skin).

[http://er.library.unsw.edu.au/er/cgi-](http://er.library.unsw.edu.au/er/cgi-bin/eraccess.cgi?url=http://www.accessmedicine.com/resourceTOC.aspx?resourceID=817)

[bin/eraccess.cgi?url=http://www.accessmedicine.com/resourceTOC.aspx?resourceID=817](http://er.library.unsw.edu.au/er/cgi-bin/eraccess.cgi?url=http://www.accessmedicine.com/resourceTOC.aspx?resourceID=817)

**Computer resources**

- 1) "AccessMedicine", the medical education resource for on-going study, review, and reference.  
Access via UNSW Library system or <http://er.library.unsw.edu.au/er/cgi-bin/eraccess.cgi?url=http://accessmedicine.mhmedical.com>
- 2) A website showing basic histology slides :  
[http://www.tropeduweb.ch/1.22WebMic\\_AllgSpez\\_060505\\_www/allgspez/WebMicAllgSpez.html](http://www.tropeduweb.ch/1.22WebMic_AllgSpez_060505_www/allgspez/WebMicAllgSpez.html)
- 3) Dr. Lazer's Histology Drawings (under the Class Program icon /Anatomy)
- 4) Histology Glossary (under the Class Program icon/ Anatomy)
- 5) Digital Atlas of Electron Microscopy