Medical School Histology Basics
Epithelium and junctions

VIBS 289 lab

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Epithelium - function

- Epithelium forms the outer protective surface of the body and all the glands. It lines the walls of most closed cavities of the body and all passages leading to the exterior, and it lines blood and lymphatic vessels.
Epithelium - function

Epithelial tissues participate in the metabolism of the body through: i) the absorption of substances from the exterior, e.g., from the lumen of the intestines; and ii) the elimination of other substances to the outside. All substances, including gases, normally received and given off from the body must pass through epithelia. For the performance of secretory functions, the epithelial tissues form specialized structures called glands.
Origin and Distribution of Epithelium

**Ectoderm** - epidermis of skin and epithelium of cornea together covers the entire surface of the body; sebaceous and mammary glands

**Endoderm** - alimentary tract, liver, pancreas, gastric glands, intestinal glands
  - Endocrine glands - lose connection with surface

**Mesoderm**
  - Endothelium - lining of blood vessels
  - Mesothelium - lining serous cavities
CLASSIFICATION OF EPITHELIA

NUMBER OF LAYERS
- SIMPLE - ONE LAYER
- STRATIFIED - MORE THAN ONE LAYER

SHAPE OF SUPERFICIAL CELLS
- SQUAMOUS - FLAT
- CUBOIDAL - CUBE
- COLUMNAR – COLUMN

OTHER
- PSEUDOSTRATIFIED - NOT TRULY STRATIFIED
- TRANSITIONAL - URINARY TRACT
Slide 109: Skin, hand, monkey

Simple squamous endothelial cells lining blood lymph vessels
- Stratified squamous epithelium of skin
- Stratified cuboidal of sweat ducts

Dermis

Epidermis

Sweat gland
Fig. 12-2  Small Intestine: Jejunum–Ileum (transverse section). Stain: hematoxylin-eosin. Low magnification.

Fig. 12-3  Intestinal Glands With Paneth Cells and Enteroendocrine Cells. Stain: hematoxylin-eosin, plastic section. High magnification.
Rat intestine

Smooth muscle

Simple columnar epithelium

Goblet cells

Small intestinal villi
EM 3: region of basal lamina and connective tissue beneath intestinal epithelial absorptive cells.

1. Plasma membrane
2. Basal lamina
3. Connective tissue

Brush border

Goblet cell
Intestinal absorptive cell nuclei
EM 3: Intestine (Basal part of cell)

Basal lamina

Connective tissue

Intestinal absorptive cells

Collagen
Fig. 15-3  Kidney Cortex: Juxtaglomerular Apparatus. Stain: periodic acid-Schiff and hematoxylin. Medium magnification.
Slide 258: Kidney (PAS)

Basement membrane of epithelium

Simple squamous epithelium

Simple cuboidal in medulla and cortex
Ileum

Intestinal absorptive cells and goblet cells

Simple columnar epithelium

Brush border

Goblet cells
Ileum, monkey (PAS)

- Basement membrane of epithelium
- Simple columnar epithelium
- Goblet cells
- Baseline membrane, brush border and goblet cells are PAS positive for sugars
- Cell nuclei
- Connective tissue
The basal lamina of epithelial cells usually is thin (EM 10f); however, under pathological conditions, it is thickened as in the lymphatic vessel and seminiferous epithelium (Sertoli cell) of an aged-rat testis (EM 8h).
SPECIALIZATION OF EPITHELIA

MAINTAIN EXTENSIVE CONTACTS AMONG CELLS STRUCTURALLY AND FUNCTIONALLY POLARIZED

JUNCIONS
ZONULA OCCLUDENS - TIGHT JUNCTION (BELT)
ZONULA ADHERENS – ADHERING BELT
DESMOSOME (MACULA ADHERENS) - SPOT ATTACHMENT
GAP JUNCTIONS - COMMUNICATION
Terminal bars
Terminal bars are part of a belt (zonula) around the cells.
EM 4: Intestine (Apical)

- Tight junction
- Zonula adherens
- Terminal web
- Goblet cells
- Glycocalyx
EM 2: Liver

- Gap junction,
- desmosome,
- tight junction
EM 2a: Liver
Gap junctions
Simple squamous epithelium cells viewed “face on”

Lumen of lymphatic vessel

Simple squamous epithelium cells viewed on their sides

vein

valve

capillary

venule
Simple squamous epithelium

Lumen of lymphatic vessels

arteriole

capillary

19680 testis

196

vein

valve
EM 10A showing capillary endothelial cells

Simple squamous epithelium: cells viewed on the side.
Fig. 9-10 Thick Skin: Epidermis and Superficial Cell Layers. Stain: hematoxylin-eosin. 40X

Fig. 9-11 Male Thick Skin: Hair Follicles and Surrounding Structures. Stain: hematoxylin-eosin.
Stratified squamous epithelium

Keratinized dead flattered cells at surface
**Slide 109: Skin, hand, monkey**

- Prickle cell layer (desmosomes)
- Epidermis

**Image Description:**
- **Epidermis:** The outermost layer of the skin, composed of several layers of cells that protect the body from external damage.
- **Dermis:** The inner layer of the skin, containing blood vessels, nerves, and hair follicles.

**Microscopic Features:**
- **Stratum corneum:** The outermost layer of the epidermis, consisting of dead, hard, or keratinized cells.
- **Stratum granulosum:** A layer immediately below the stratum corneum, characterized by the synthesis of keratin by keratinocytes.
- **Stratum spinosum:** A layer of cells below the stratum granulosum, appearing spiny due to the interlocking of keratinocytes.
- **Stratum basale:** The basal layer of the epidermis, containing living cells that continuously divide to produce new cells.
- **Keratinocytes:** Cells that produce keratin, a hard protein that makes up the outer layer of the skin.
- **Long processes of Langerhans cells:** These are antigen-presenting cells that play a role in the immune system.
- **Melanocytes:** Cells that produce melanin, the pigment that gives skin its color.

**Additional Notes:**
- The image highlights the microscopic structure of the skin, showing the various layers and cellular components that contribute to its function and protection.
Stratified cuboidal is only found in sweat ducts of skin (Slide 109).
Nuclei present in flat cells at surface

stratified squamous epithelium
non-keratinized

HIST0052 tongue
Vagina (Slide 178)
Fig. 14-5. Trachea (panoramic view, transverse section). Stain: hematoxylin-eosin. Low magnification.
Slide 133: Trachea, monkey

- Simple squamous lining the air spaces of lungs
- Pseudostratified epithelium lining tracheal lumen
- Ciliated epithelium of trachea, goblet cells, thick basement membrane
tracheal lumen (Slide 133),

transition of the luminal epithelium from stratified squamous of vocal cords to pseudostratified, ciliated epithelium

human larynx, Slide 429

Note thickened basement membrane typical of this epithelium

Plasma cells

stratified squamous
Fig. 15-8  Urinary Bladder: Wall (transverse section). Stain: hematoxylin-eosin. Low magnification.

Fig. 15-9  Urinary Bladder: Inner mucosa (transverse section). Stain: hematoxylin-eosin. Medium magnification.
Transitional epithelium

urinary bladder (Slide 160)

ureter (Slide 262)
Image of the Urinary bladder

- Transitional epithelium
- Mesothelium
- Lumen of bladder

600um
HISTO052 (tongue) to observe mucus and serous glands
In summary

All substances, including gases, normally received and given off from the body must pass through epithelia.
Questions on Epithelia

Which item(s) is/are characteristic of epithelia?
   a. secretory cells of glands
   b. covers organs
   c. line urinary tract
   d. a & b
   e. a, b, & c

Which junction - description pair match?
   a. Zonula occludes – tight junction around the cell
   b. Zonula adherens – adhering junction around the cell
   c. Hemidesmosome – spot attachment of cells to the CT below
   d. a & b
   e. a, b, & c

Which embryonic origin - distribution of epithelium do not match?
   a. endoderm - endothelium
   b. endoderm - alimentary tract
   c. mesoderm - mesothelium
   d. ectoderm - mammary gland
   e. ectoderm - epidermis
Many illustrations in these VIBS Histology YouTube videos were modified from the following books and sources: Many thanks to original sources!

Ranch just south of Fort Stockton, TX

On road from Fort Stockton to Big Bend National Park, TX
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