

EPITHELIUM

Definition: *Avascular tissue made of cells that cover exterior surfaces and line both internal closed cavities and body tubes that communicate with the exterior. Epithelium also forms the secretory portion of glands and ducts.*

Features:

- **POLARITY:** distinct apical, basal, and lateral surfaces
- **Basal Surface:** attached to **basal lamina** (collagen Type IV, made by epithelial cells) which is part of **basement membrane**
- Cells adhere to each other via specialized junctions (explained below)

FUNCTIONS	EXAMPLE
<i>Protective Layer</i>	Epidermis
<i>Absorption of water and solutes</i>	Intestinal Epithelium
<i>Secretion</i>	Glands (salivary, pancreas, etc)
<i>Containment</i>	Bladder, thyroid follicles
<i>Excretion</i>	Kidney tubules

TYPES OF EPITHELIA	CHARACTERISTICS
<i>Simple</i>	<ul style="list-style-type: none"> ▪ One cell layer thick ▪ Absorption, secretion, diffusion ▪ Ex.: simple columnar in small intestine
<i>Stratified</i>	<ul style="list-style-type: none"> ▪ Two or more cell layers thick ▪ Classified based on cell type of <u>surface</u> cells ▪ Protection, barrier ▪ Ex.: Epidermis (stratified squamous)
<i>Pseudostratified</i>	<ul style="list-style-type: none"> ▪ <u>All cells</u> rest on basement membrane, but not all reach apical surface ▪ Ex.: Lining of trachea
<i>Transitional</i>	<ul style="list-style-type: none"> ▪ Apical surface may appear “half-domed” ▪ Accommodates distension ▪ Ex.: lining of the bladder

TYPES OF CELLS	CHARACTERISTICS
<i>Squamous</i> (stratified is usually protective, and simple for diffusion)	<ul style="list-style-type: none"> ▪ Cells are flattened and irregularly shaped ▪ Appear “scale-like” or “squashed” ▪ Ex.: endothelium of vasculature, alveoli
<i>Cuboidal</i> (often absorptive, but sometimes secretory)	<ul style="list-style-type: none"> ▪ Round, central nucleus ▪ Width = height (ice cube shaped) ▪ Ex.: pancreas epithelium (secretory)
<i>Columnar</i> (usually absorptive, but sometimes secretory)	<ul style="list-style-type: none"> ▪ Elongated nucleus ▪ Width < height (cells long and tall) ▪ Ex.: lining of small and large intestines

SPECIALIZATIONS	DESCRIPTION
<i>Cilia</i>	<ul style="list-style-type: none"> ▪ Insert into basal bodies (1 cilium per 1 body) ▪ Motile processes of microtubules move synchronously ▪ 9 +2 microtubule arrangement ▪ Ex.: trachea and oviduct
<i>Microvilli</i>	<ul style="list-style-type: none"> ▪ insert into terminal web (stains eosinophilic – pink) ▪ actin skeleton above intermediate filaments ▪ increase surface area for absorption ▪ Ex.: small intestine
<i>Stereocilia</i>	<ul style="list-style-type: none"> ▪ long microvilli – actin (NOT cilia!) ▪ non-motile ▪ Ex.: epididymis (pseudostratified)
<i>Keratin</i>	<ul style="list-style-type: none"> ▪ Formed from dead layer of squamous cells ▪ Protects against desiccation and abrasion ▪ Ex.: epidermis (stains strongly eosinophilic)

Basement membrane = basal lamina & reticular lamina

- Stains with PAS

Basal Lamina

- Separates epithelia from connective tissue
- Collagen type **IV**, proteoglycans, glycoproteins
- Synthesized by epithelial cells

Reticular Lamina

- Connective tissue below epithelium
- Collagen type **III**

CELL-CELL CONTACTS:

Zonula Occludens (apical end)

Terminal bar = Junctional Complex = Zonula Adherens

Macula Adherens

- Stains dark with Bodian silver

CELL CONTACT	DESCRIPTION
<i>Zonula Occludens</i> (tight junction)	<ul style="list-style-type: none"> ▪ Diffusion barrier ▪ Most apical, forms band around cells
<i>Zonula Adherens</i>	<ul style="list-style-type: none"> ▪ Forms band around cell at lateral surfaces ▪ Adds to integrity of epithelial surface
<i>Macula Adherens</i> (desmosome)	<ul style="list-style-type: none"> ▪ Spot adhesions on lateral surfaces
<i>Hemidesmosome</i>	<ul style="list-style-type: none"> ▪ Link cell to basement membrane at basal surface

IMPORTANT: Don't confuse **terminal bar** (junctional complex) with **terminal web** (network of actin and intermediate filaments microvilli insert into)

EPITHELIA

1. The epithelium in the projected tissue is best described as (Lab 13, Slide 19):
 - a. Simple squamous epithelium specialized for absorption.
 - b. Simple squamous epithelium that has been keratinized to resist abrasion.
 - c. Simple squamous epithelium specialized for diffusion.
 - d. Simple squamous epithelium specialized for secretion.

Questions 2-4: Figure A (Lab 3, slide 35); Figure B (Lab 3, slide 25)

2. Select the one correct statement regarding the surface epithelium:
 - a. In both figures all of the cells reach the lumen.
 - b. In both figures the superficial cells are keratinized.
 - c. In both figures all of the cells rest on a basal lamina.
 - d. Only in Figure B do all the cells rest on a basal lamina.
3. The tissue or tissues that are specialized to resist abrasion are shown in:
 - a. Figure A only.
 - b. Figures A and B.
 - c. Figure B only.
4. The tissue or tissues that are specialized to provide a barrier to luminal absorption are shown in:
 - a. Figure A only.
 - b. Figures A and B.
 - c. Figure C only.
 - d. Figures A and C.
5. *Fill in the blanks of this sentence with one of the choices below (Lab 16, Slide 17):*
The projected EM shows the _____, and the pointer specifically points to the _____, that functions mainly to _____.
 - a. Terminal Web, Zonula Occludens, provide integrity to the epithelial surface.
 - b. Terminal Bar, Zonula Occludens, provide a diffusion barrier.
 - c. Terminal Web, Hemidesmosome, provide adhesion to the basement membrane.
 - d. Terminal Bar, Zonula Adherens, provide integrity to the epithelial surface.

Answers:

1. The slide projected shows lung alveolar tissue. It is simple squamous epithelium specialized for the exchange of oxygen and carbon dioxide. Choice C is correct.
2. In the trachea pseudostratified epithelium, all cells rest on the basal lamina. Bladder transitional epithelium is stratified and therefore not all cells touch the basal lamina. D is correct.
3. Functions of stratified epithelia (don't forget transitional epithelium is stratified) include protection, barrier, and resist abrasion. A is correct.
4. Another function of stratified epithelia is that it serves as a barrier. A is correct.
5. EM projection of the Terminal Bar (a.k.a. Junctional Complex). Arrow is specifically on the Zonula Occludens (a.k.a. tight junction) whose main purpose is to provide a diffusion barrier. Choice B is correct.