Epithelial Tissue

Introduction:
- Covering
- Glandular

Covering (Biểu mô phủ):
- **Covers exposed surfaces**
- **Lines internal tracts** (of digestive/ respiratory/ urogenital)
- **Line cavities** (thorax, abdomen, heart,...)

Glandular:
Forms 2 types of gland:
- **Exocrine**
- **Endocrine**

Eoxocrine glands line under the epithelial layer, above the connective tissue layer, lie across different sections of the body

Characteristics of epithelia

Cellularity
Cells bound together by various types of cell junctions (gap junctions, tight junctions)

Polarity
Apical surface:
- Pointing towards the external environment or internal space
- Specialisations: cillia, microvilli, stereocillia

Basal surface:
- Attached to the basal membrane (Basale lamina)
- Surfaces differ in structure and function

Attachment :
Basal surface attached to a **basement membrane** made of a **thin layer of mucopolysaccharides and proteins**

Avascularity:
- Dont contain blood vessels
- Obtain nutrients by diffusion or absorption

Characteristics of epithelia (cont)

Regeneration:
- High rate of cell division (mitotic index)
- Damaged or dead cells at the exposed surfaces are replaced with basal stem cells goin up

Roles of Epithelia

Protection:
Against abrasion, dehydration, damage from chemical or biological agents

Permeability:
Any substance has to cross a layer of epithelium (via diffusion, pumps, channels)

Sensation:
- Innervated by sensory nerves
- Specialised epithelial cells can detect changes in environment and convey info to nervous system

Secretion:
Gland cells: secrete fluids

Classification (BASED ON ARRANGEMENT)

Simple: one cell layer
- Simple squamous (flattened)
- Simple cuboidal (width approx. height)
- Simple columnar (height > width)

Stratified: multiple layers
- Stratified squamous
- Stratified cuboidal
- Stratified columnar

Pseudostratified Columnar:
- Tall principle cells and short pyramidal basal cells
- ALL cells rest on basement membrane but NOT ALL reach the Lumen.

Classification (BASED ON ARRANGEMENT) (cont)

Transitional:
Special type of Stratified that can stretch and made up different types of epithelial cells

Types of Simple

Simple Squamous:
- Flattened, polyhedral cells with a bulging nucleus
- Delicate, found in protected regions (away from external environment)
- Allows for easy exchange of gases, ions and small molecules
- Lines lung alveoli, body cavities, heart, blood vessels

Simple Cuboidal:
- **Cuboidal** in **longitudinal section**, **Polygonal** in **cross section** with a central nucleus
- Involved in: secretion, absorption, excretion
- Found in : glands, ducts, parts of kidney tubules, thyroid gland

Simple Columnar:
Height > width with basal nucleus usu. same level across
- Involved in: Protection, absorption, secretion (have microvilli and cillia)
- Lining of stomach, intestines, oviducts, collecting ducts of kidneys
- Often have modified apical surface (microvillia/cillia)

Pseudostratified Columnar

- Tall principle cells and short pyramidal basal cells

- All cells stems from BASAL LAMINA but not all reach the LUMEN

Pseudostratified Columnar (cont)

Found in: nasal cavities, trachea, bronchi
--> Have cillia; propel mucous and trapped particles to the pharynx

- Also found in Epididymis (stereocillia)

Stratified Squamous

Stratified Squamous:
- **Found in**: places needed mechanical/physical protection: skin, linings of mouth, esophagus and anus
- **Protects against:** abrasion, pathogens, chemical/biological agents
- **Regeneration**: Basal cells multiply --> move towards surface --> flattening and degenerating as they reach superficial layers
- **Classified into:** Keratinised and Non-keratinised

Non - keratinised: in mouth, keep moist by glandular secretions

Keratinised: In places with mechanical and dehydration problems; keratin deposited in cells as they mature --> harden, form tough, acellular surface layer as they die

Four Major Strata:
- **Stratum corneum** Cornified layer (dead keratinised cells)
- **Stratum granulosum**: Granular layer (keratin and granules forming)
- **Stratum sphosum**: "Prickle cell" layer (many desmosomes)

Stratum germinativum: Germinal layer (forming new cells)

NOTE:
- Basal cells divide continously --> Daughter cells push upwards --> Mature then degenerate --> Are shredded
- Basal cells are cuboidal --> become squamous as moving upwards --> Lose nucleus as peak maturity

Stratified Cuboidal and Columnar

Stratified Cuboidal

Structure:
- 2 to 3 layers of cuboidal or low columnar --> more robust lining than its simple counterpart
- **Rare, found in**: ducts of salivary, sweat, mammary glands

Stratified Columnar

Structure:
- Basal layer: cuboidal
- Apical layer: columnar

Rare, found in: Urethra, ducts of salivary glands

Trasitional

Characteristics:
- **Stratified**
- **Various cell shapes**:
+ Basal cells: cuboidal
+ Intermediate: polygonal
+ Apical: round and sometimes binucleate
- **Accommodates to toxicity of urine**
- **High degree of stretch**
- **Only in urinary tracts**

Functional Correlates

Know types of epithelial cells --> Functions of an organ

Ex:
- Simple usu. means absorption, secretion
- Stratified: robust protection

--> Stratified Squamous: protection of places subjected to wear and tear
--> Simple cuboidal: secretion of glandular fluids
--> Columnar with microvilli: absorption