

# Epithelial Tissue

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VETS30015 / VETS90121



# Intended Learning outcomes

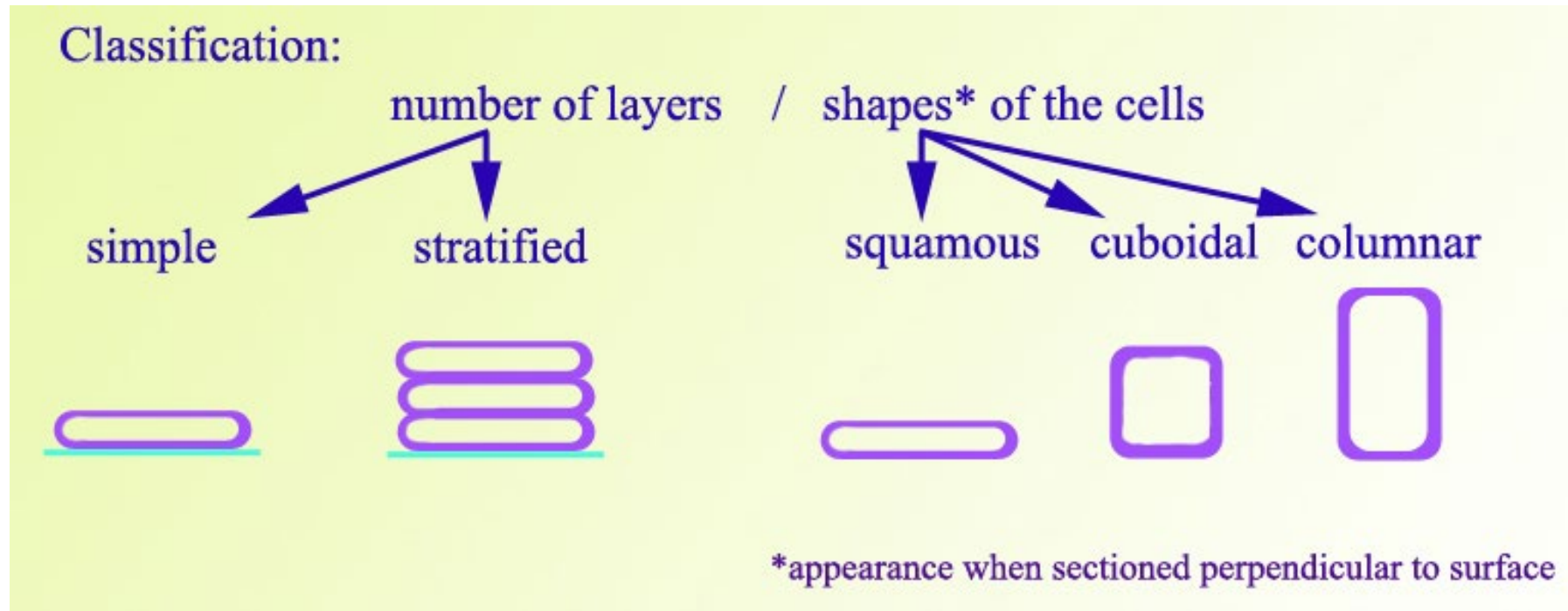
**At the end of the lecture, you should be able to:**

- Explain the system for classifying epithelial tissues
- Provide examples of different types of epithelia
- Identify the different types of epithelia

# Histology of epithelium

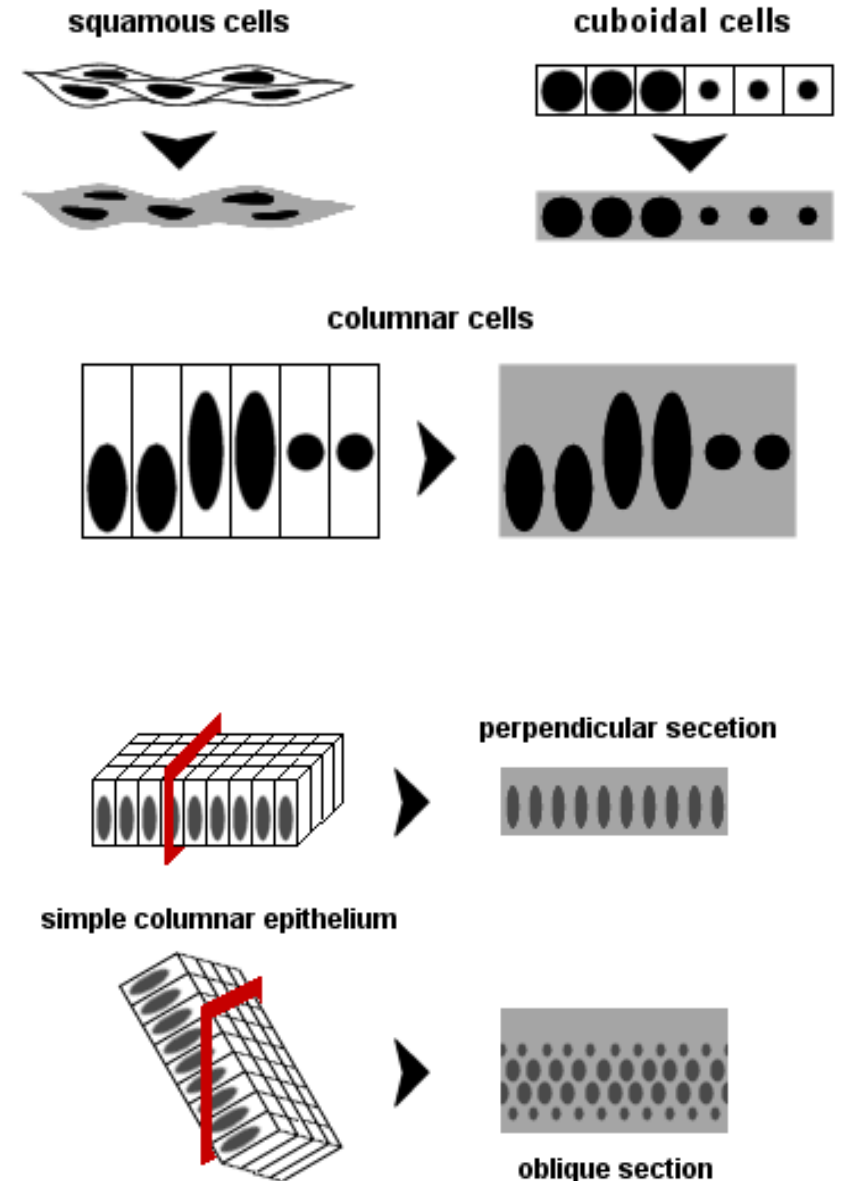
Epithelium (singular), epithelia (plural) present in two major forms:

- **Surface epithelium** – sheets of cells that cover external surfaces and line internal surfaces of body
- **Glandular epithelium** – secretory cells of glands



# Identifying epithelia

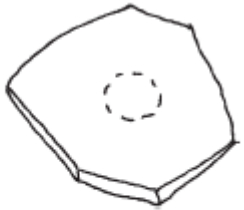
- Cell outlines are **not** always visible
- Examine the **shape, location and spacing of the nuclei**
- Plane of the section determines the number of cell layers
- A single surface is **not** lined by several types of epithelia
- The number of epithelial cell layers will be the smallest number of layers visible



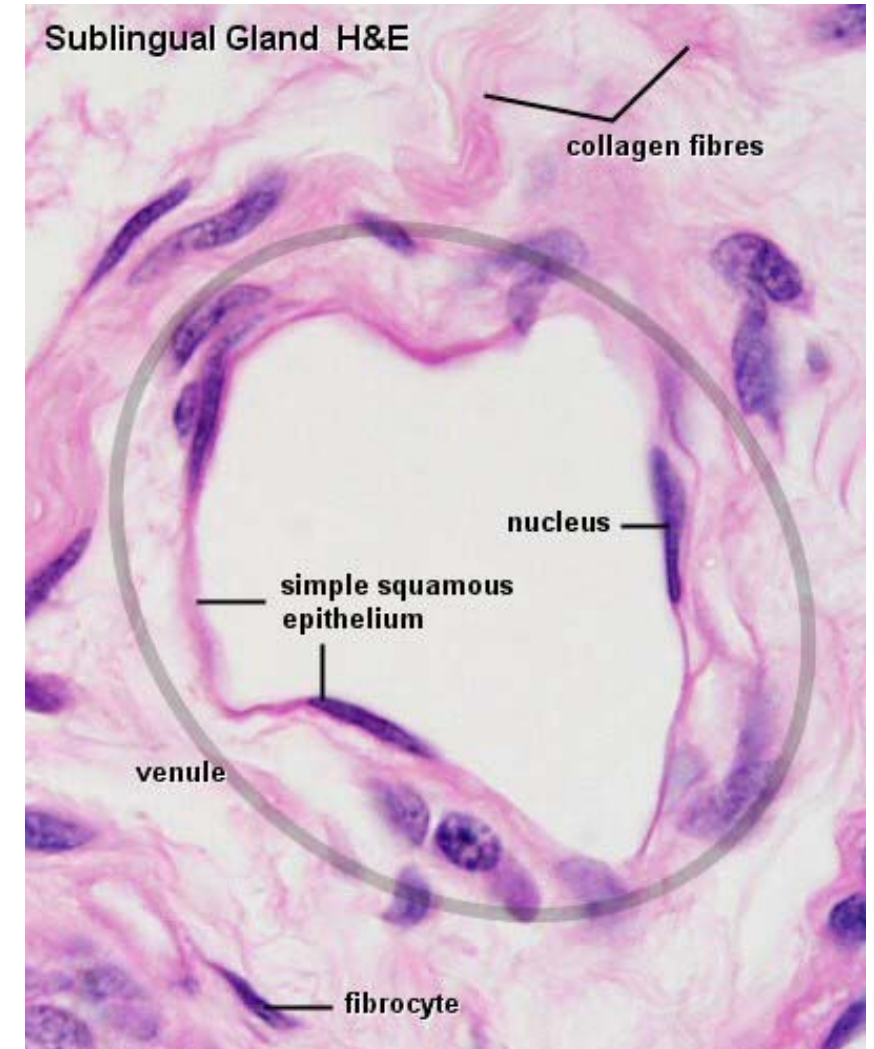
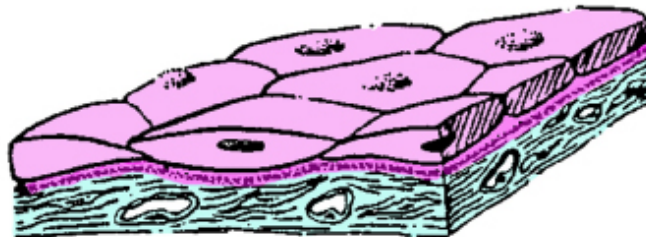


# Simple squamous epithelium

- Single layer of flattened, scale- or plate-like cells
- Shape of the nuclei – flattened or ovoid, located in the centre of the cell
- Body cavities, heart, blood vessels, lymph vessels are lined by simple squamous epithelium

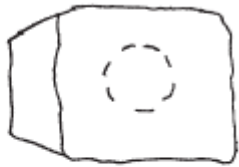


Squamous cell

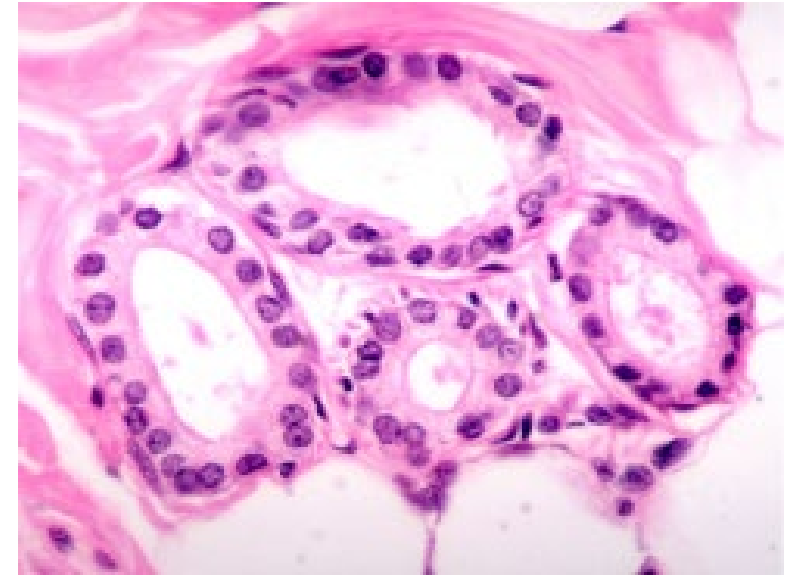
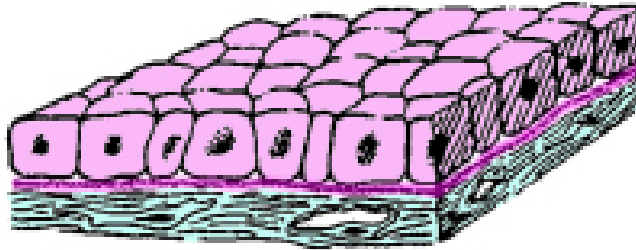


# Simple cuboidal epithelium

- Single layer of cuboidal cells
- Small excretory ducts, thyroid follicle, tubules of kidney are lined by simple cuboidal epithelium



Cuboidal cell



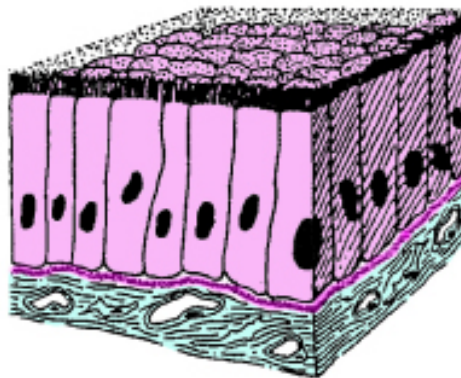
Thyroid gland H&E

# Simple columnar epithelium

- The cells are taller than they are wide
- The nuclei are located at the same height within the cells
- Internal surface of small and large intestine, gall bladder are lined by simple columnar epithelium

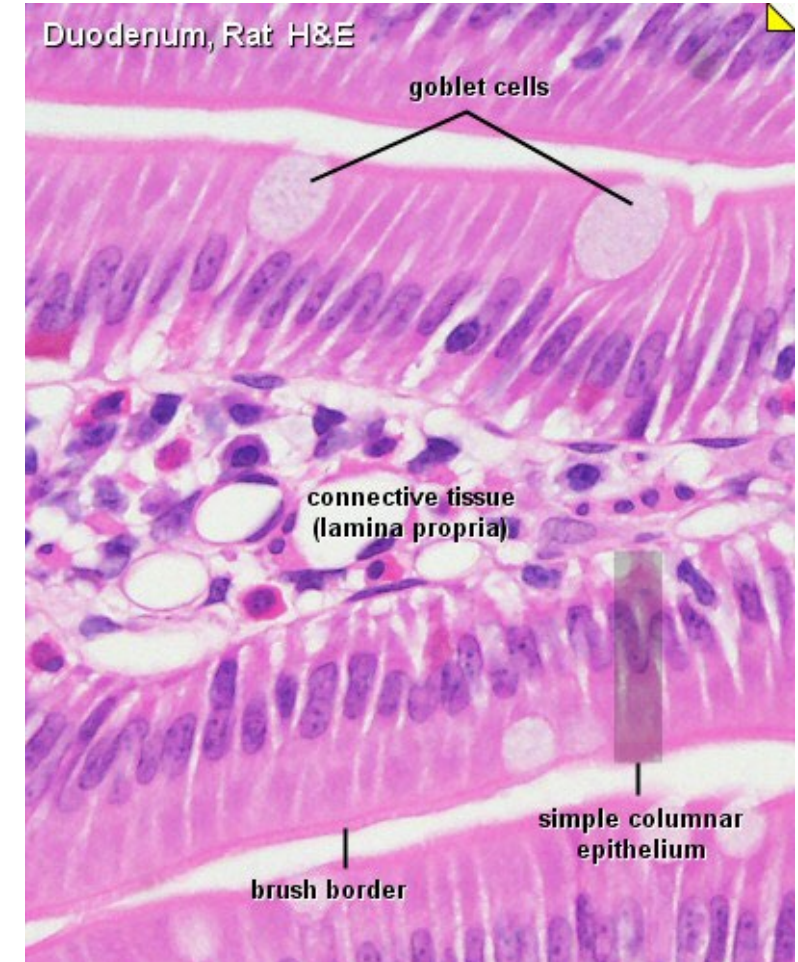


Columnar cell



# Simple columnar epithelium

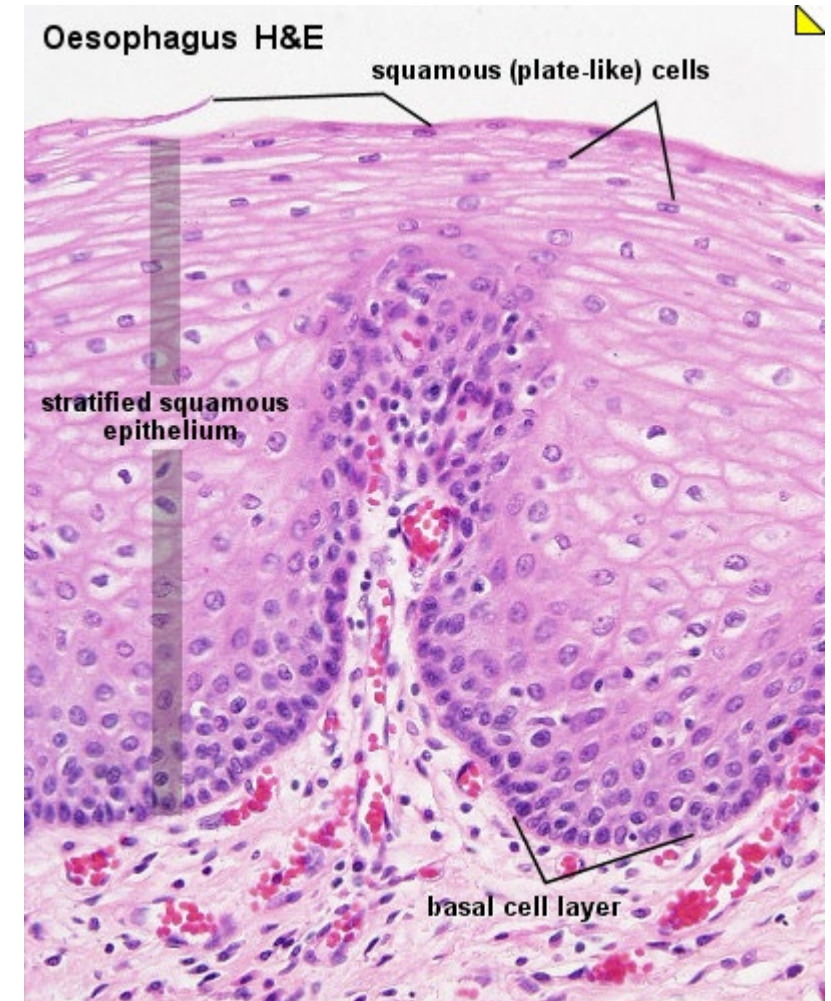
- Small intestine is lined by simple columnar epithelium
- Goblet cells – unicellular gland cells secreting mucin
- Two surfaces of the cells
  - Apical free surface – brush border to increase the surface area of absorption
  - Basal surface – basement membrane separates from the underlying connective tissue





# Stratified squamous epithelium

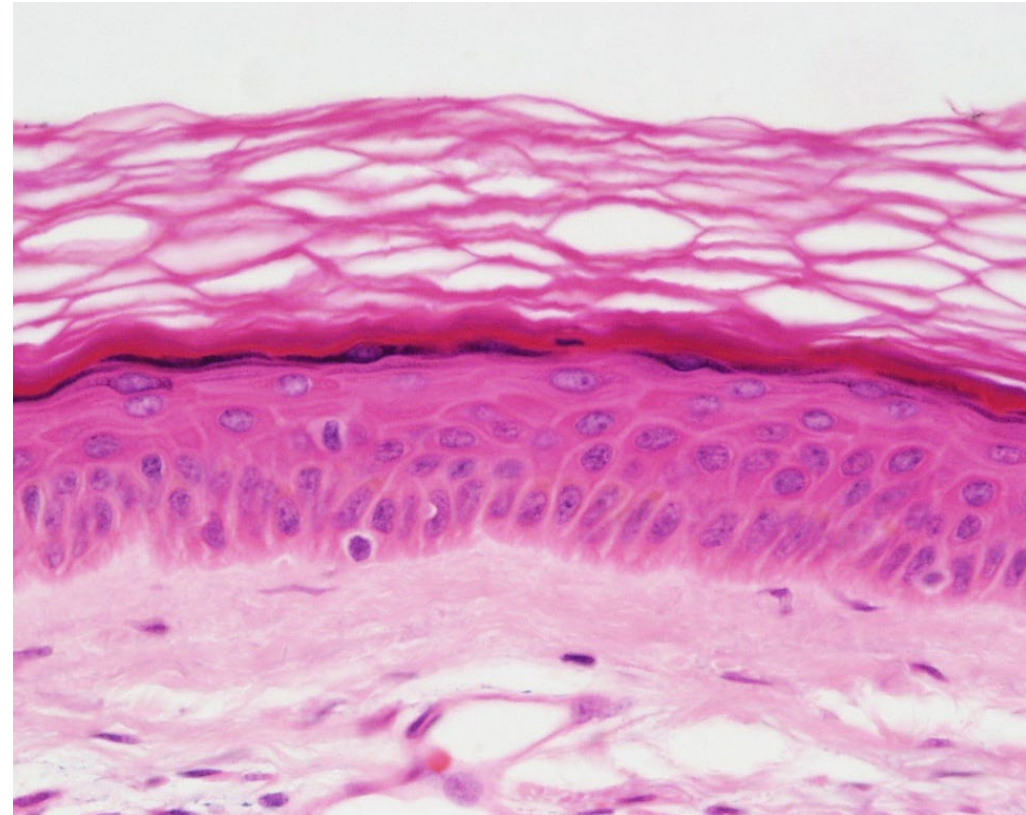
- At the surface of the epithelium, cells appear like flat scales - similar to the epithelial cells of **simple squamous epithelia**.
- The shape of the cells that form the surface of the epithelium gives the name to the epithelium.
- The deepest cells are **cuboidal or columnar** in shape (basal layer).



# Stratified squamous epithelium

- **Keratinised epithelium** is a specialized epithelium containing a tough resistant protein called '**Keratin**'
- Apical cells are dead, lost their nucleus and cytoplasm
- This specialization makes the epithelium waterproof and are found in the mammalian skin

Skin – Keratinised epithelium

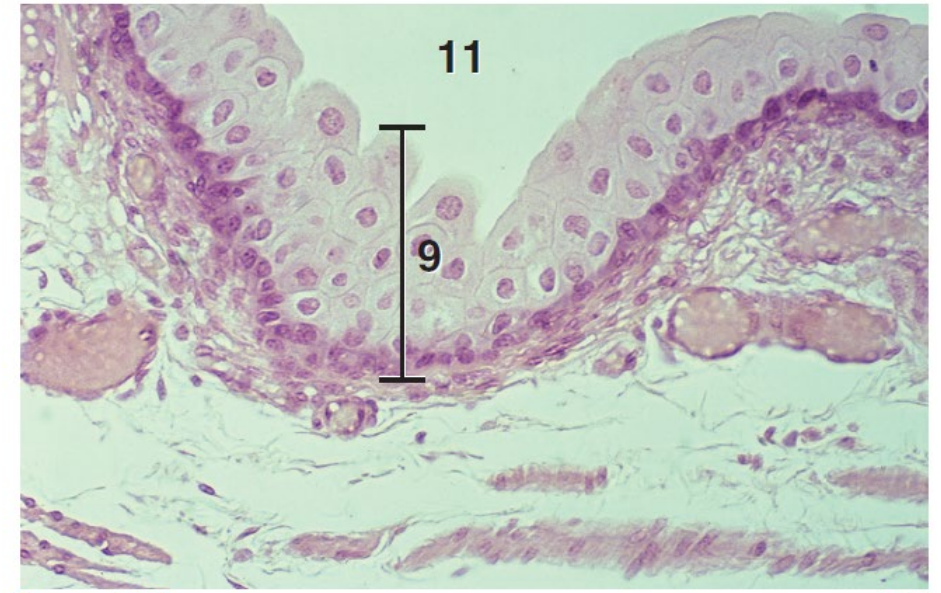




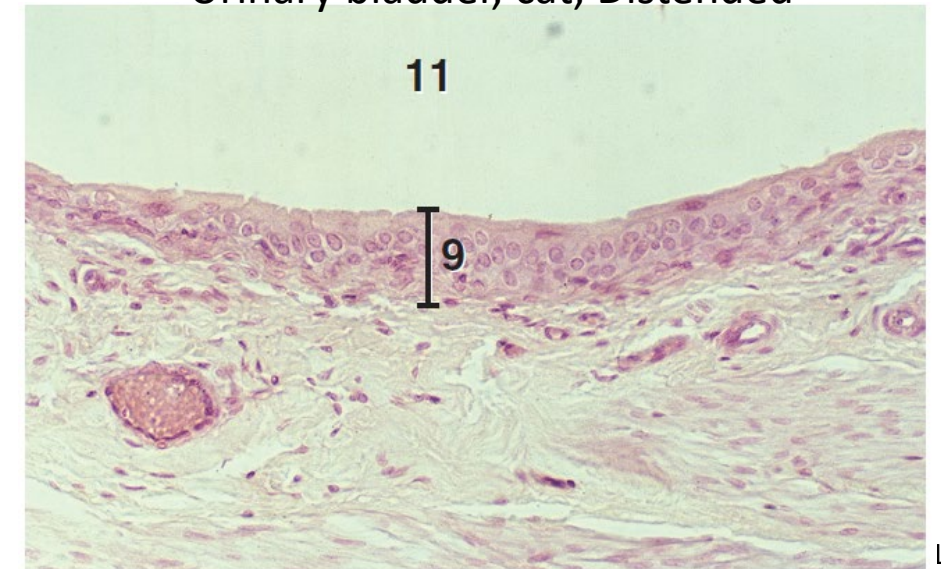
# Transitional epithelium

- The degree of distension of the organ determines the shape of the cells in the surface layer
- Relaxed state
  - Basal cells are cuboidal or columnar
  - Several layers of polyhedral cells
  - Superficial cells have convex, dome shaped luminal surface
- Distended state
  - One or two layers of cuboidal cells
  - Superficial layer of large, low cuboidal squamous cell
  - Resemble stratified squamous epithelium

Urinary bladder, cat, Relaxed

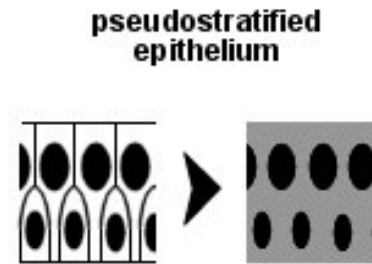


Urinary bladder, cat, Distended

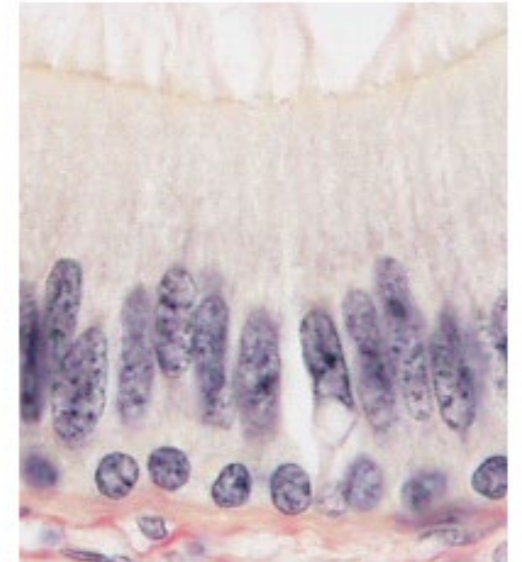


# Pseudostratified columnar epithelium

- All cells are in contact with the basement membrane
- But all of them do not reach the surface of the epithelium
- Nuclei are located in the widest part of the cells
- Nuclei are located at different heights, giving a stratified appearance
- Found in the excretory ducts of many glands



Epididymis van Gieson





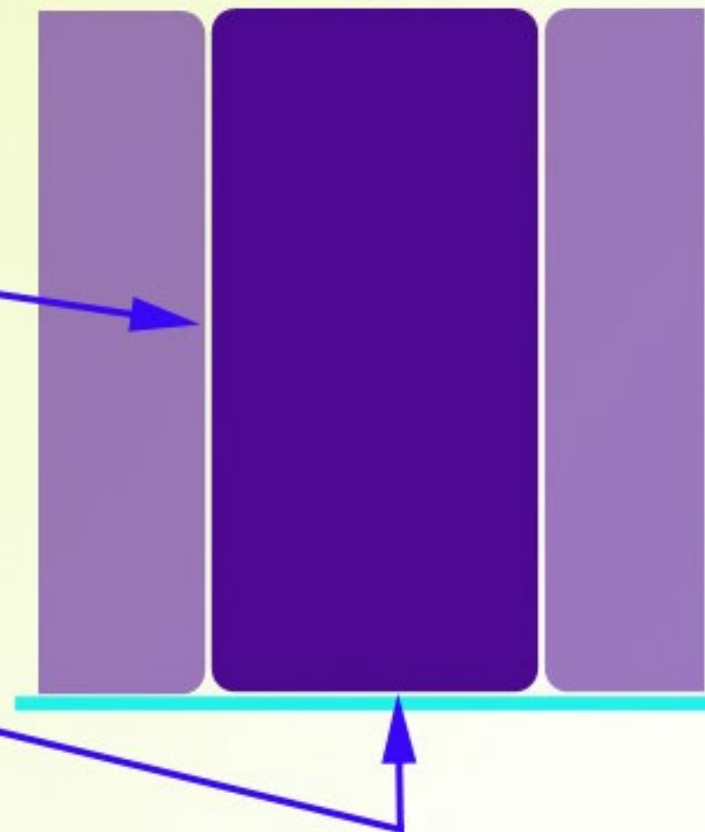
# Epithelial cell surface and specializations

Simple epithelial cells - polarised - three distinct surfaces:

apical (or free) surface

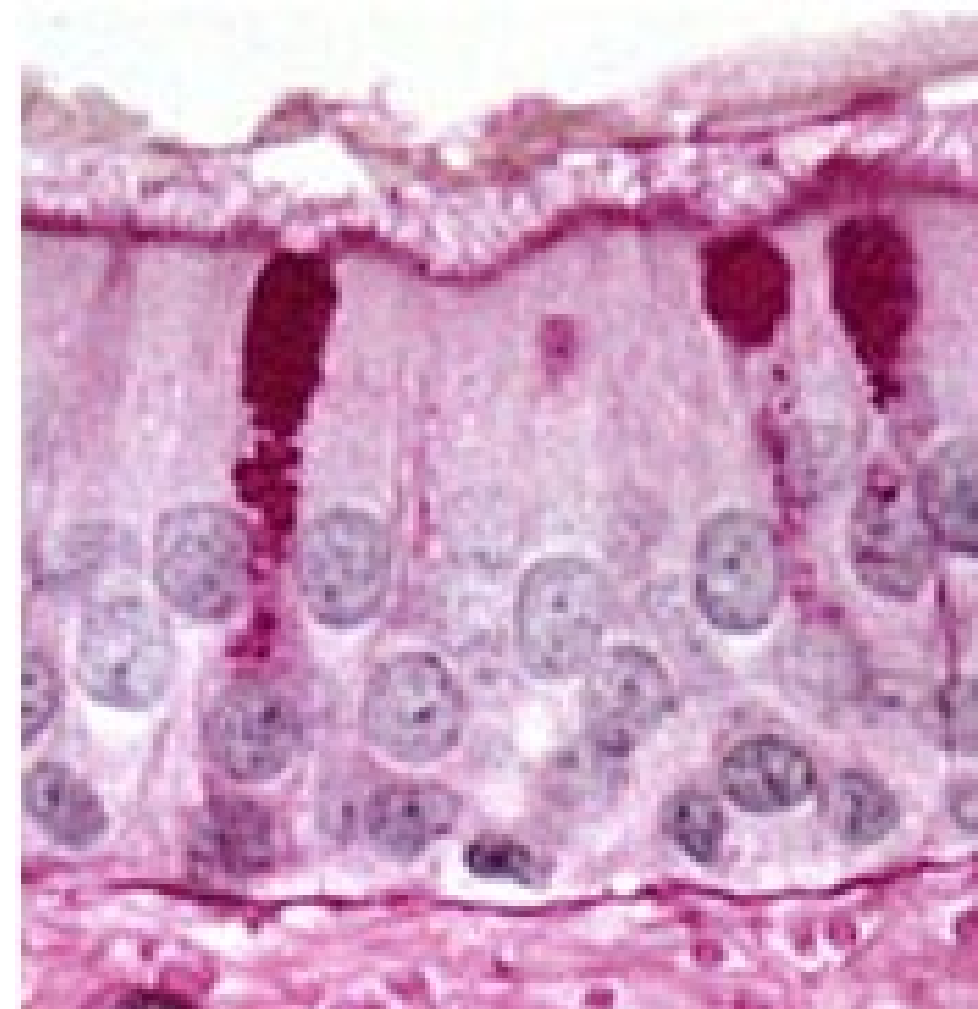
lateral (or contact) surfaces  
- neighbouring epithelial cells

basal surface  
- rests on basement membrane

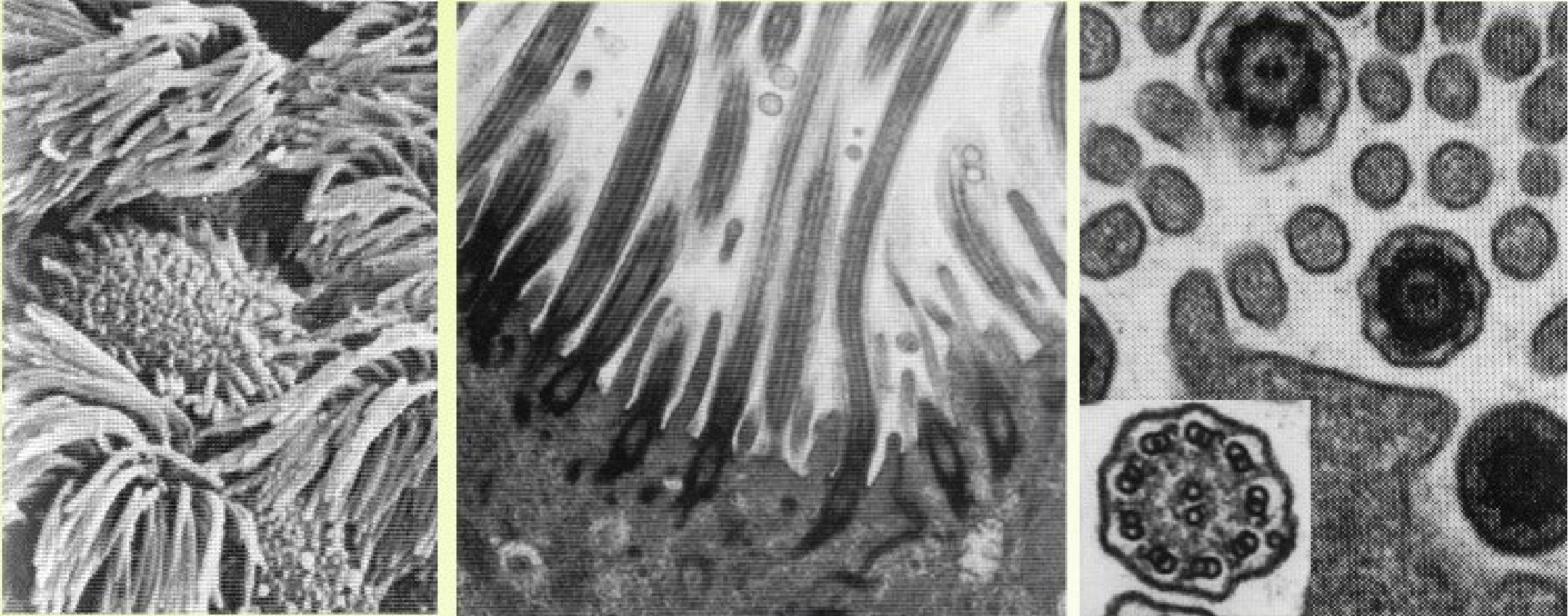


# Basement membrane

- An extracellular supporting layer of the epithelium
- Basement membrane is produced by the epithelial cells
- It separates the epithelium from the underlying connective tissue
- It act as a selectively permeable filter between epithelium and connective tissue



# Apical surface specialisations



Apical (or free) surface: cilia, microvilli/sterocilia



# Apical surface specialisations

## **Cilia:**

- Motile structures that beat in a synchronous manner to move material across epithelial surfaces.

## **Microvilli and stereocilia:**

- Non-motile, finger- or thread-shaped extensions of epithelial cells.
- Their main function is to increase the surface area of cells active in absorption.
- Microvilli are much shorter than stereocilia.



# Lateral and basal surface specialisations

## Junctional complexes

### Occluding type

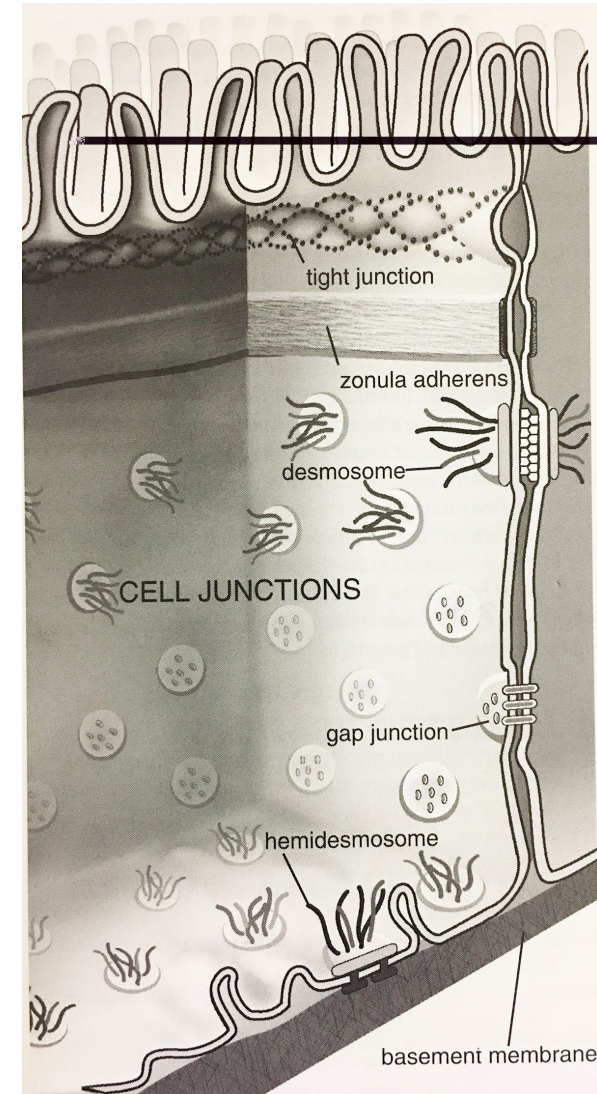
- **Tight junctions** (zonulae occludens), connects adjacent cells; close to apical surface

### Adhering type

- **Desmosomes** (maculae adherens) and zonulae adherens anchor cells to each other; connected to cytoskeleton
- **Hemidesmosomes** connect cells to basement membrane

### Communicating type

- **Gap junction** (nexus), allows movement of small molecules from one cell to an adjacent cell



# Summary

## Simple squamous

- Lines blood vessels and air sacs of lungs
- Permits exchange of nutrients, wastes, and gases



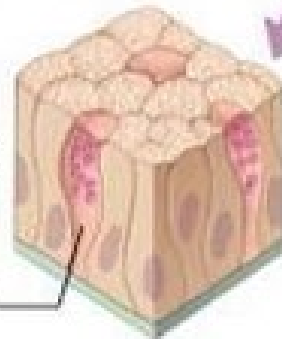
## Simple cuboidal

- Lines kidney tubules and glands
- Secretes and reabsorbs water and small molecules



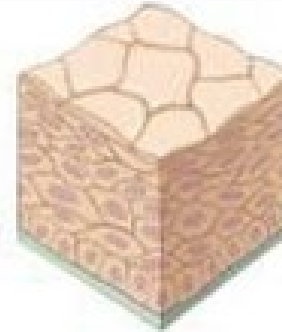
## Simple columnar

- Lines most digestive organs
- Absorbs nutrients, produces mucus



## Stratified squamous

- Outer layer of skin, mouth, vagina
- Protects against abrasion, drying out, infection



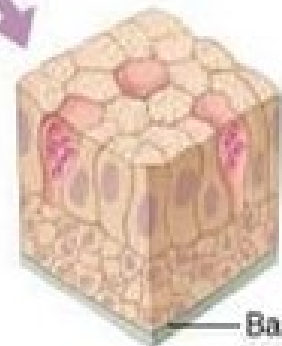
## Stratified cuboidal

- Lines ducts of sweat glands
- Secretes water and ions



## Stratified columnar

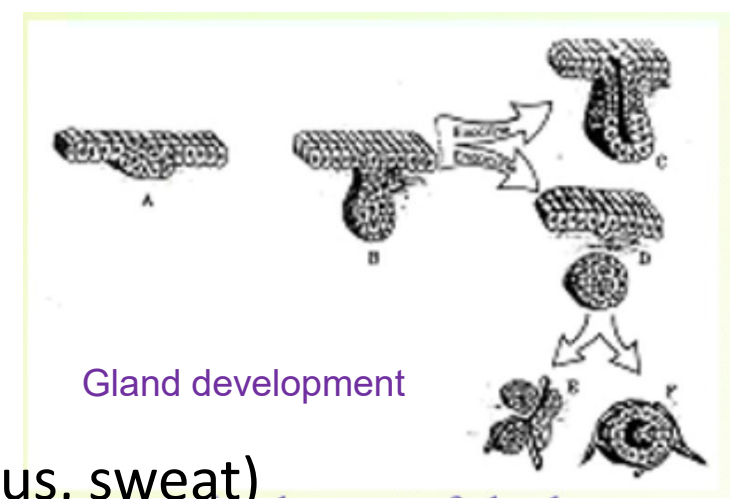
- Lines epididymus, mammary glands, larynx
- Secretes mucus



(a) Most epithelial tissues line or cover surfaces or body cavities

# Glands

- Glandular epithelial cells are specialised for secretion
- **Exocrine glands** release the secretory product (e.g. milk, mucus, sweat) via a system of **ducts** that open onto of the surfaces of the body which are in contact with the external world (skin, respiratory tract, etc)
- **Endocrine glands** release their secretory product (typically hormones) into the **spaces between the secretory cells** (extracellular space) from which it enters the bloodstream.
- Glands are developmentally derived from epithelia that grow into the underlying connective tissue
- Exocrine glands maintain the connection with the surface epithelium
- The surface connection is lost in endocrine glands





# Classification of exocrine glands

## Morphology

Simple vs compound (ducts)

Tubular vs alveolar/acinar  
(secretory units)

## Mode of secretion

Merocrine

Apocrine

Holocrine

## Nature of secretion

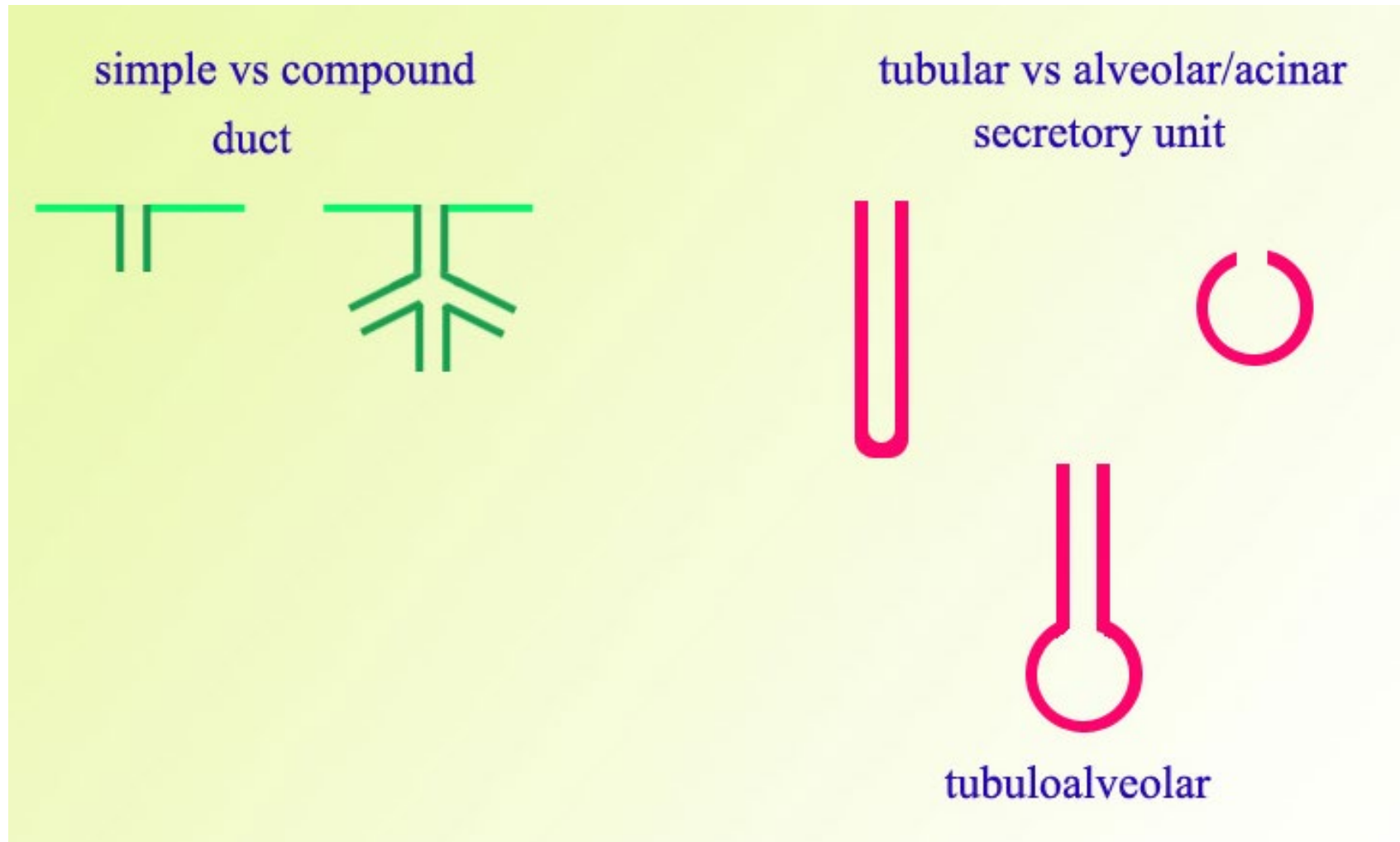
Mucous

Serous

Mixed



# Exocrine glands –classification - morphology

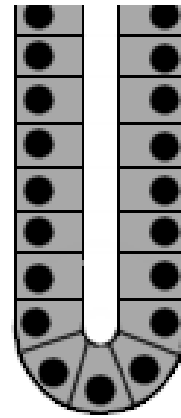


# Exocrine glands –classification - morphology

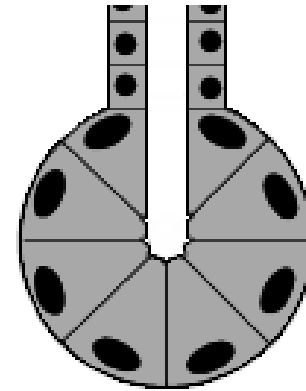
Secretory cells may form

- tubes in tubular glands
- acini in acinar glands
- alveoli in alveolar glands.

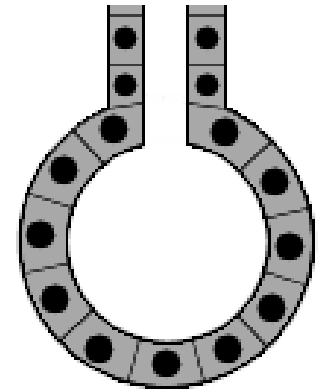
tubular



acinar

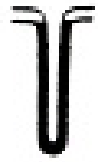


alveolar

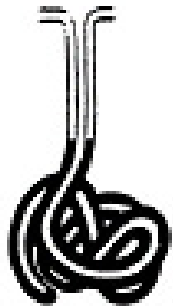


glands

# Exocrine glands –classification - morphology



simple  
tubular



simple coiled  
tubular



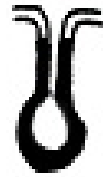
simple branched  
tubular



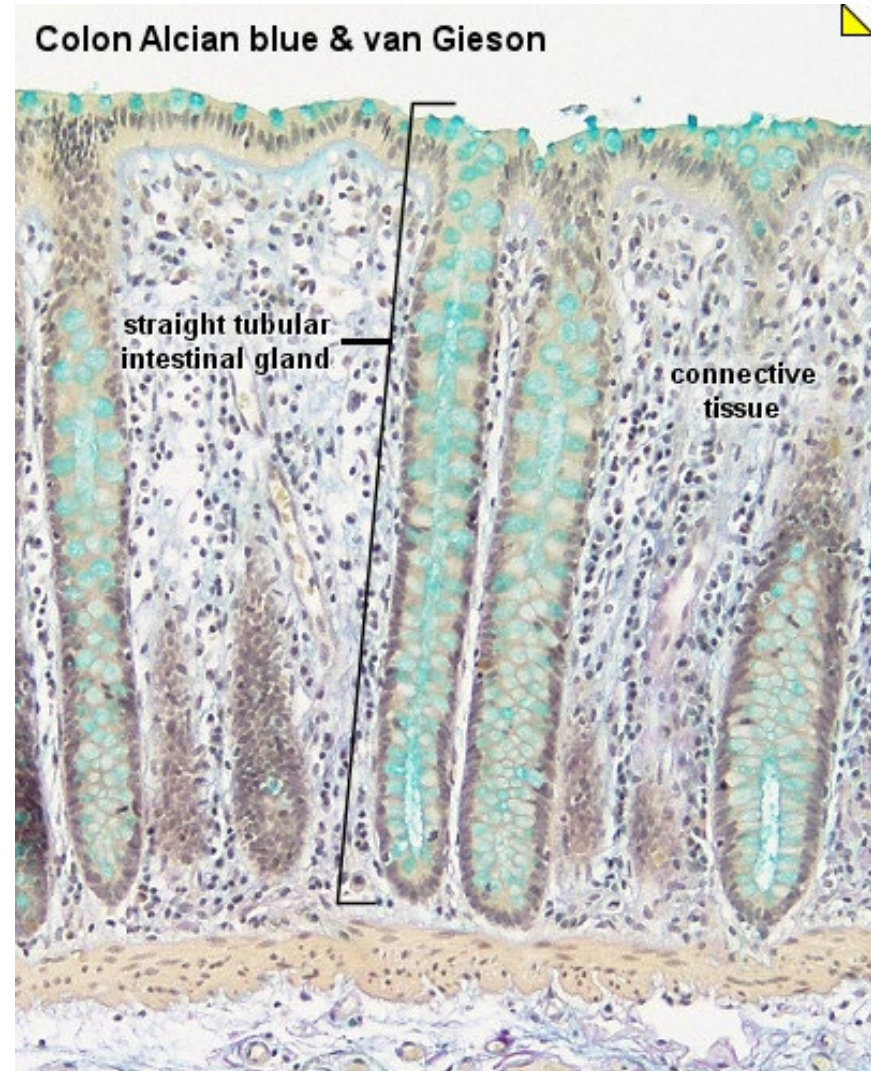
simple  
alveolar



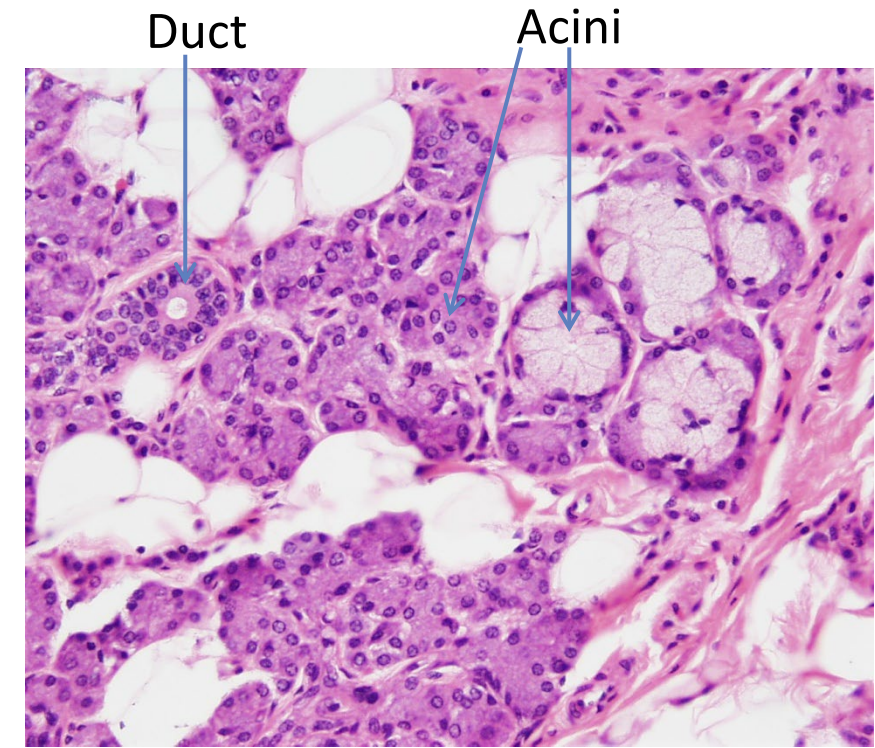
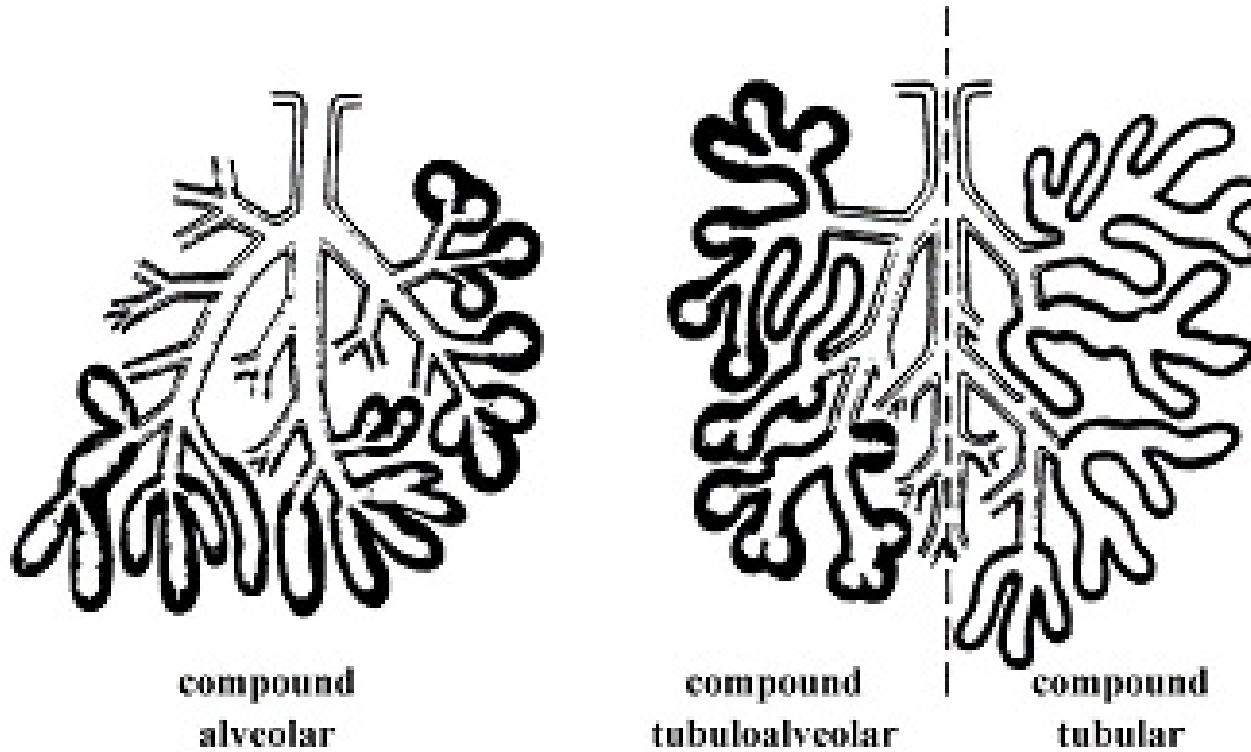
simple branched  
alveolar



simple  
tubuloalveolar



# Exocrine glands –classification - morphology



Salivary gland



# Exocrine glands –classification – mode of secretion

- **Merocrine**
  - ✓ Salivary glands
- **Apocrine**
  - ✓ Mammary glands
- **Holocrine**
  - ✓ Sebaceous glands

