PBIO 375 Quiz Section

- **Goals of Quiz Section**

- **Website**

- **Quiz Section Tests**

PBIO 375
Quiz Section

Course Information | **Canvas** | **Wheater** | **Gradebook**

Information about quiz section tests

Quiz Section Schedule

Epithelia, Epithelial Transport, Clinical Examples (10/1 and 10/3)

quiz-1 slides

- **Review of Membrane Transport Proteins**
- **Epithelial Histology**
- **Epithelial Transport**
- **Clinical Examples: Epithelial Transport**

A pdf of powerpoint slides shown in class will be available at the link on the left by Tuesday morning.

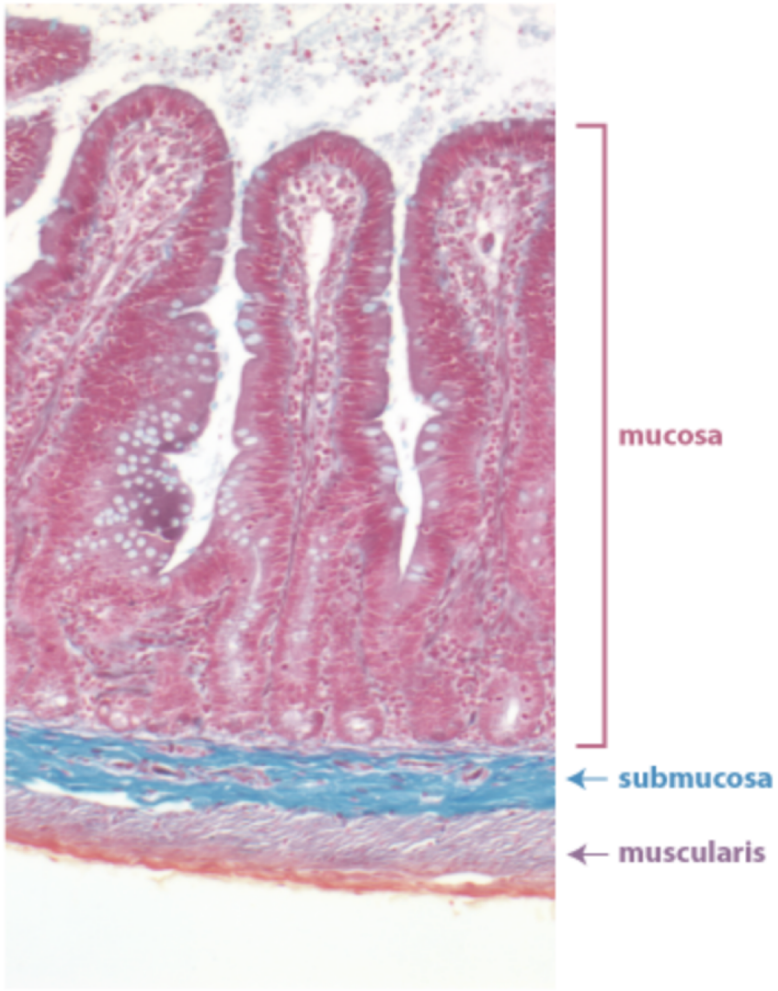
Quiz Section Schedule

Week	Dates	Topic	Tests
2	10/1 & 10/3	Epithelia,Epithelial Transport, and Clinical Examples	
3	10/8 & 10/10	Cells of the Nervous System; Brain Anatomy	
4	10/14		Midterm 1
	10/15 & 10/17	Spinal Cord Anatomy; Organization of Peripheral Nervous System; Patient Case—Autonomic Regulation	
5	10/22 & 10/24	Bone Histology; Osteoporosis; Bone Anatomy	**Quiz Section Test 1**
6	10/29 & 10/31	Muscle Histology; Muscle Anatomy; Anatomy of Knee Joint	
7	11/5 & 11/7	Spinal Reflexes; Patient Case—Diabetic Neuropathy; Patient Case—Myasthenia Gravis	
	11/8		Midterm 2
8	11/12 &11/14	Kidney Histology; Kidney Anatomy; Patient Case—Diabetes Insipidus	**Quiz Section Test 2**
9	11/19 & 11/21	Renal Clearance; Cytokine Signaling; Patient Case: Rheumatoid Arthritis	
10	11/24 & 11/26	THANKSGIVING HOLIDAY: NO MEETING	
11	12/3 & 12/5	Optional Review Session	**Quiz Section Test 3**
12	12/9		Final Exam

Quiz Section Tests will occur at the beginning of your scheduled Quiz Section period. The shading indicates the topics tested on each test. The test will last about 30 minutes, after which we will begin the next topic.

Small Intestine

This low-magnification view shows the different regions of the small intestine. The intestinal epithelium is part of the inner layer called the mucosa. The mucosa consists of a small amount of connective tissue and a highly folded **simple columnar epithelium**. The folds that poke out are called villi (singlular: villus), and the folds that dip down are called crypts. The folding of the epithelium increases the surface area for absorption of nutrients.



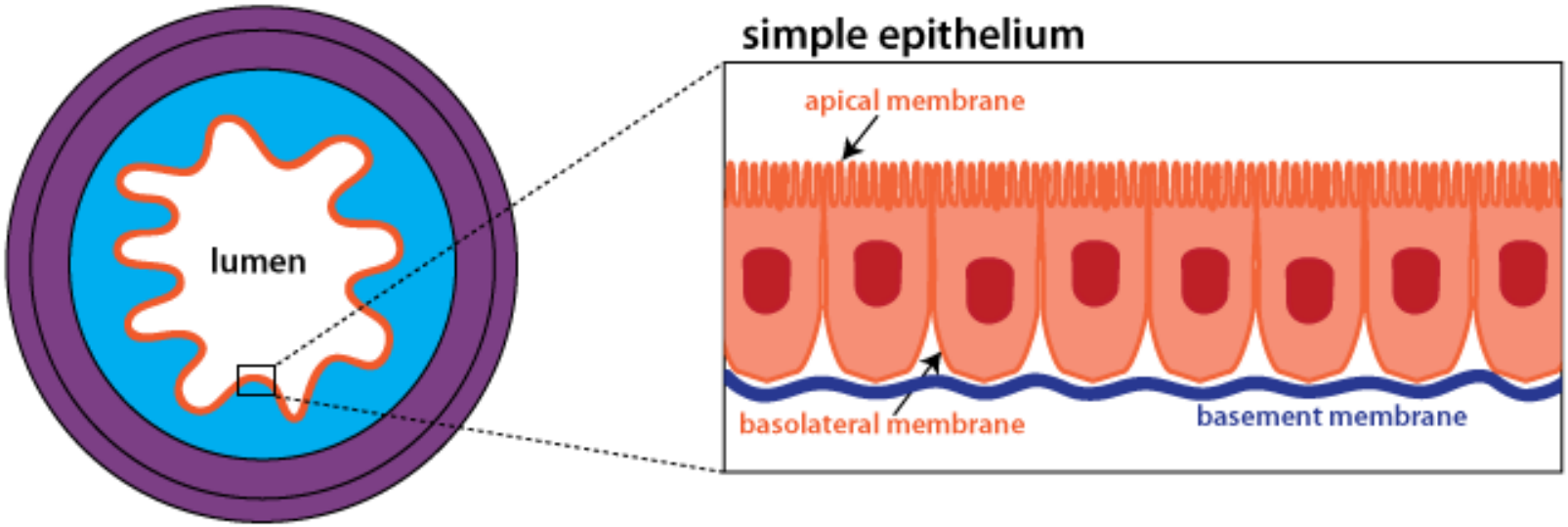
Quiz Section Tests

- 30 points each: 15 two-point questions
- don’t need a purple answer sheet
- fill-in questions
- spelling counts (-0.5 for spelling errors)
- will occur at the beginning of your section on the scheduled day

EPITHELIA

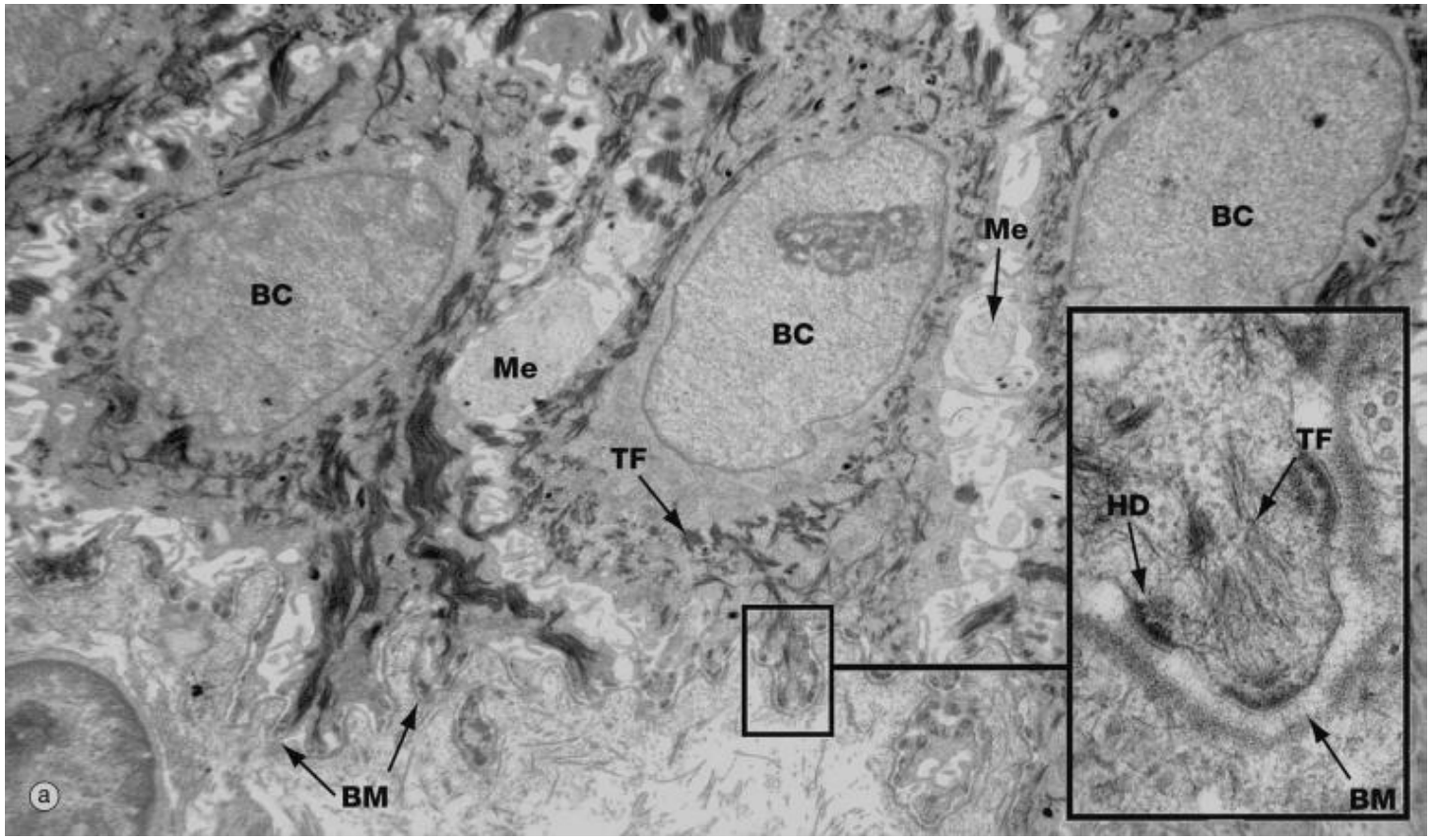
- form the linings of hollow organs or cover surface of body (skin)
- act as barriers
- apical vs. basolateral
- bound to underlying tissue by basement membrane (basal lamina)
- classified by number of layers and cell shape

Apical vs. Basolateral



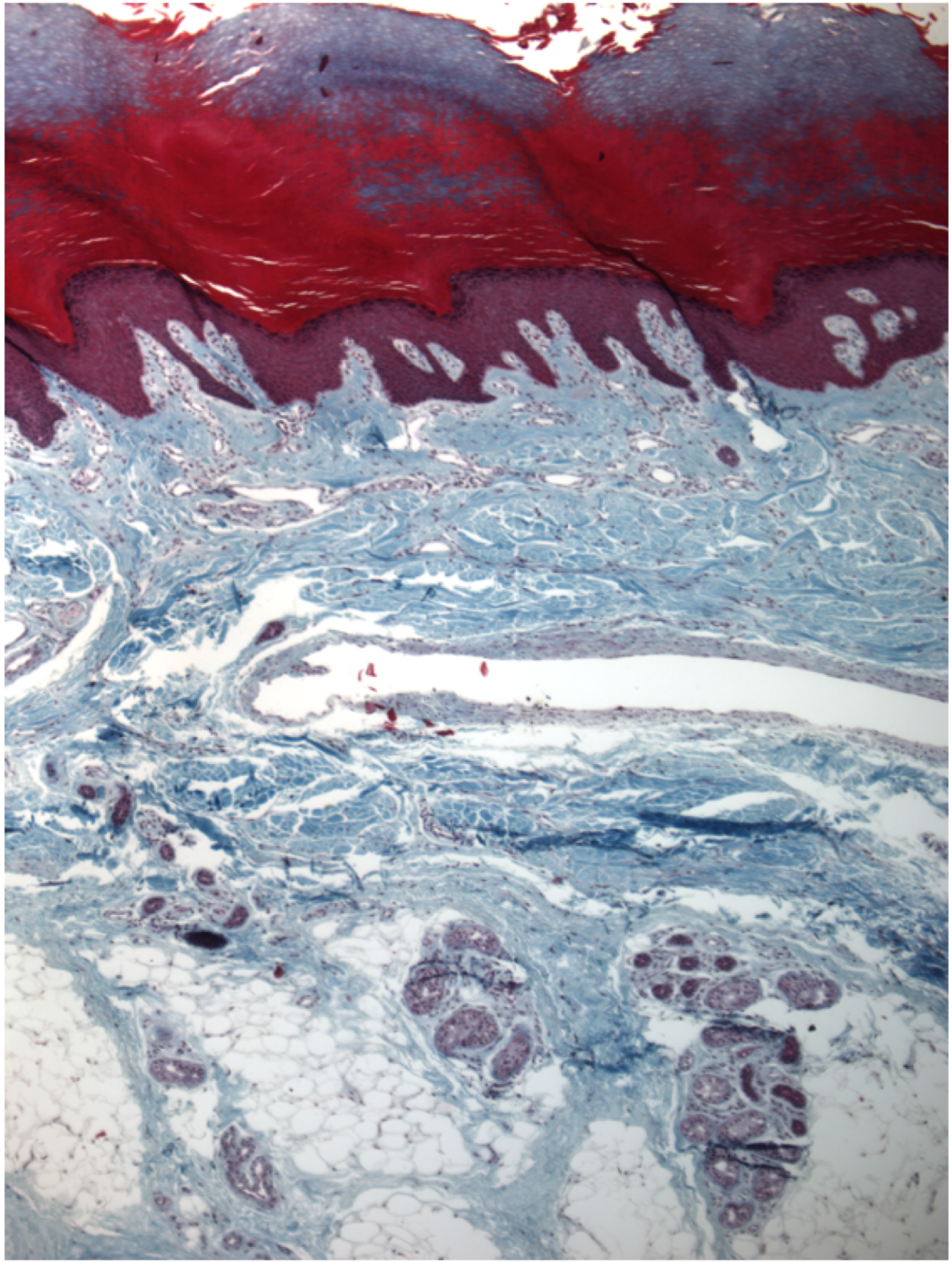
on course website

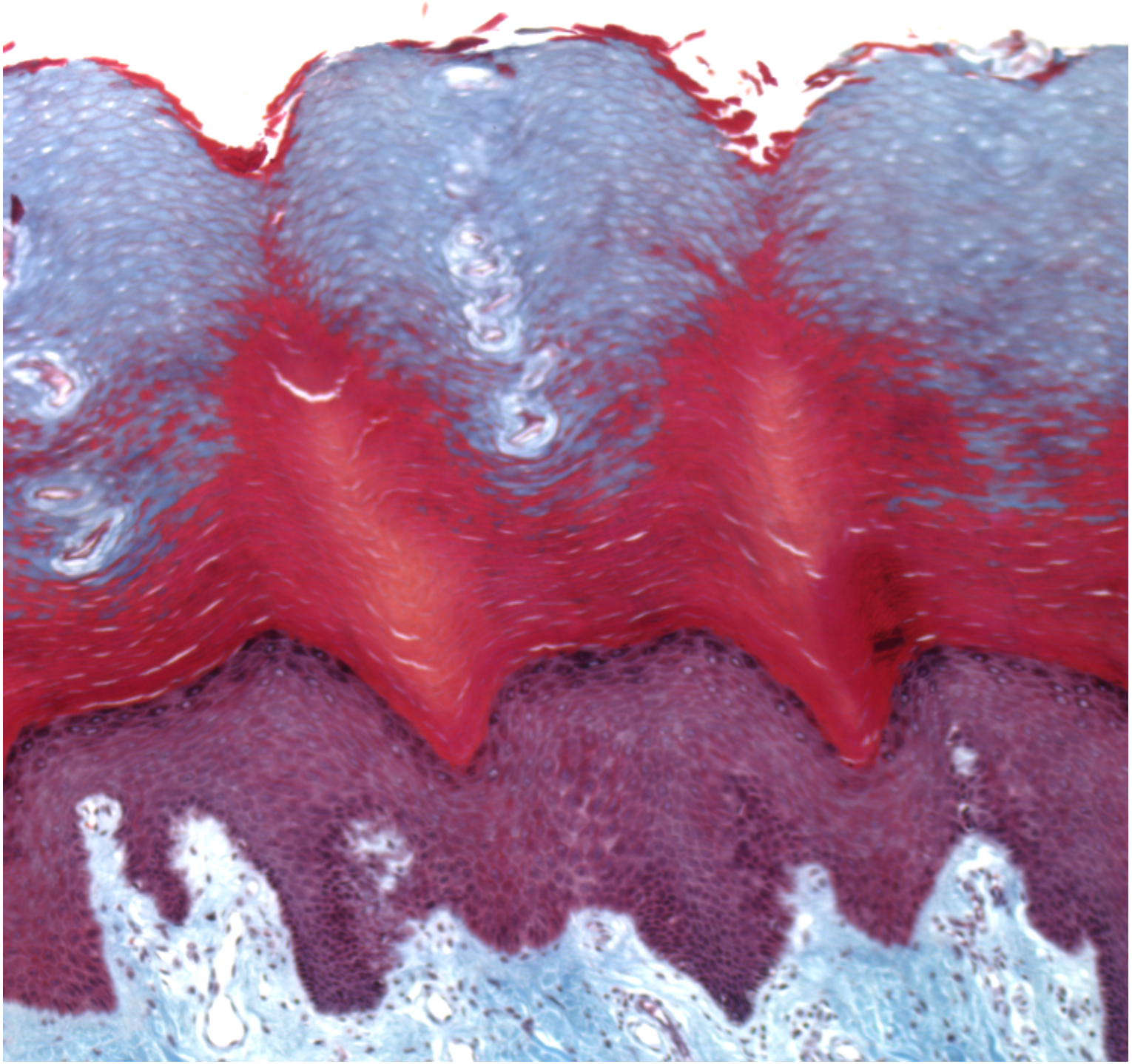
Basement Membrane

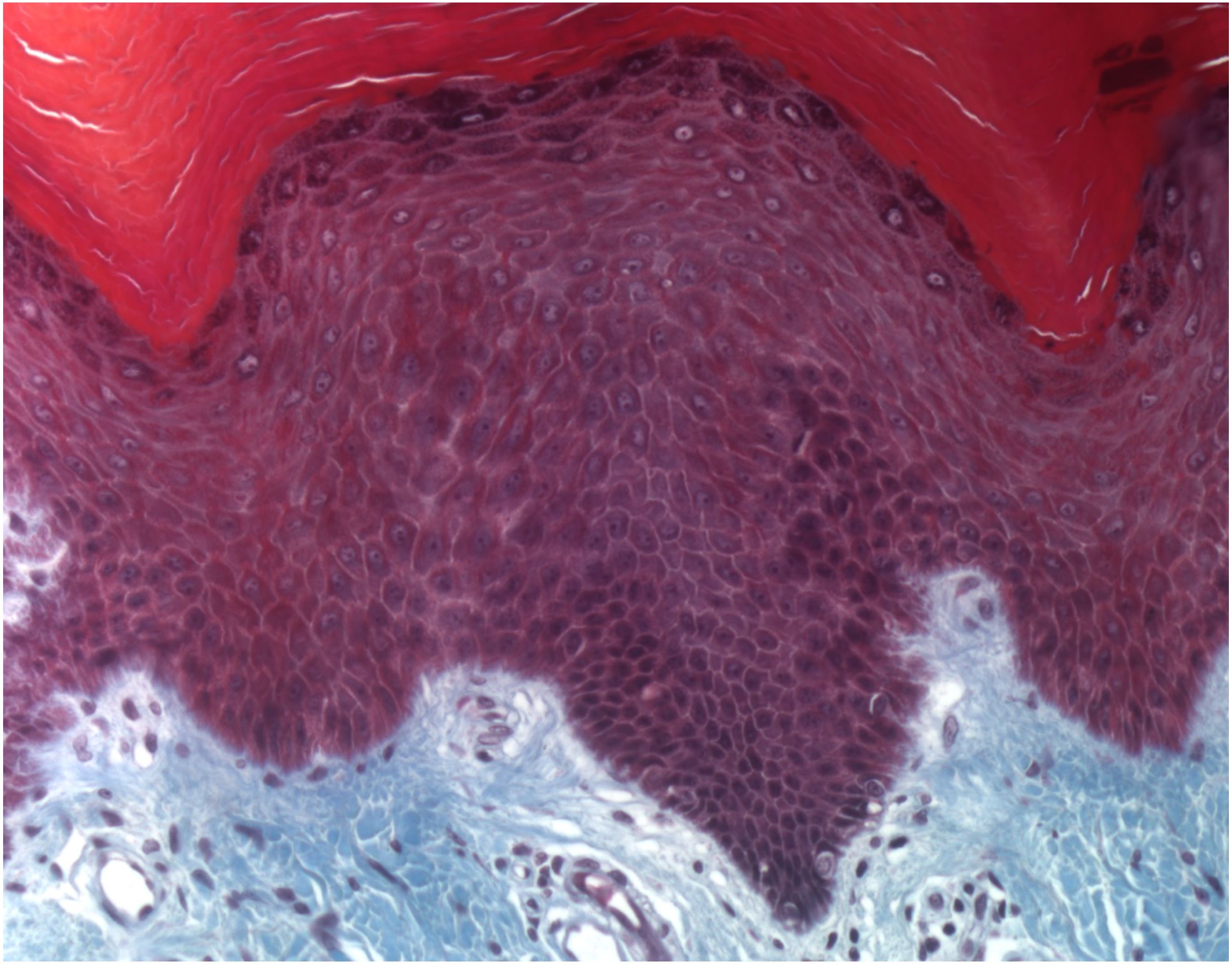


Wheater, Fig. 9.3a

basal surface of epidermis showing basement membrane (BM)

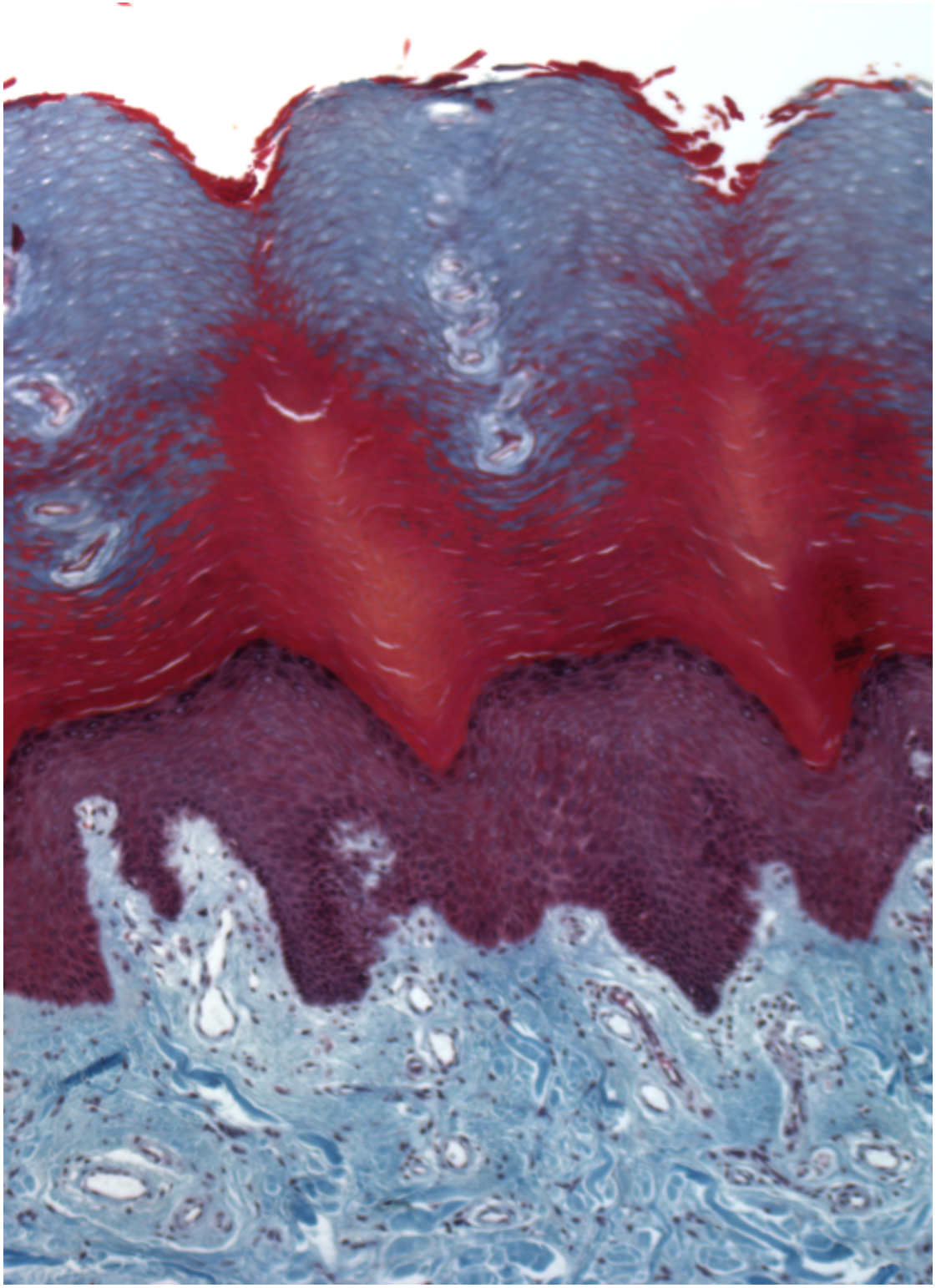

epidermis
dermis
hypodermis

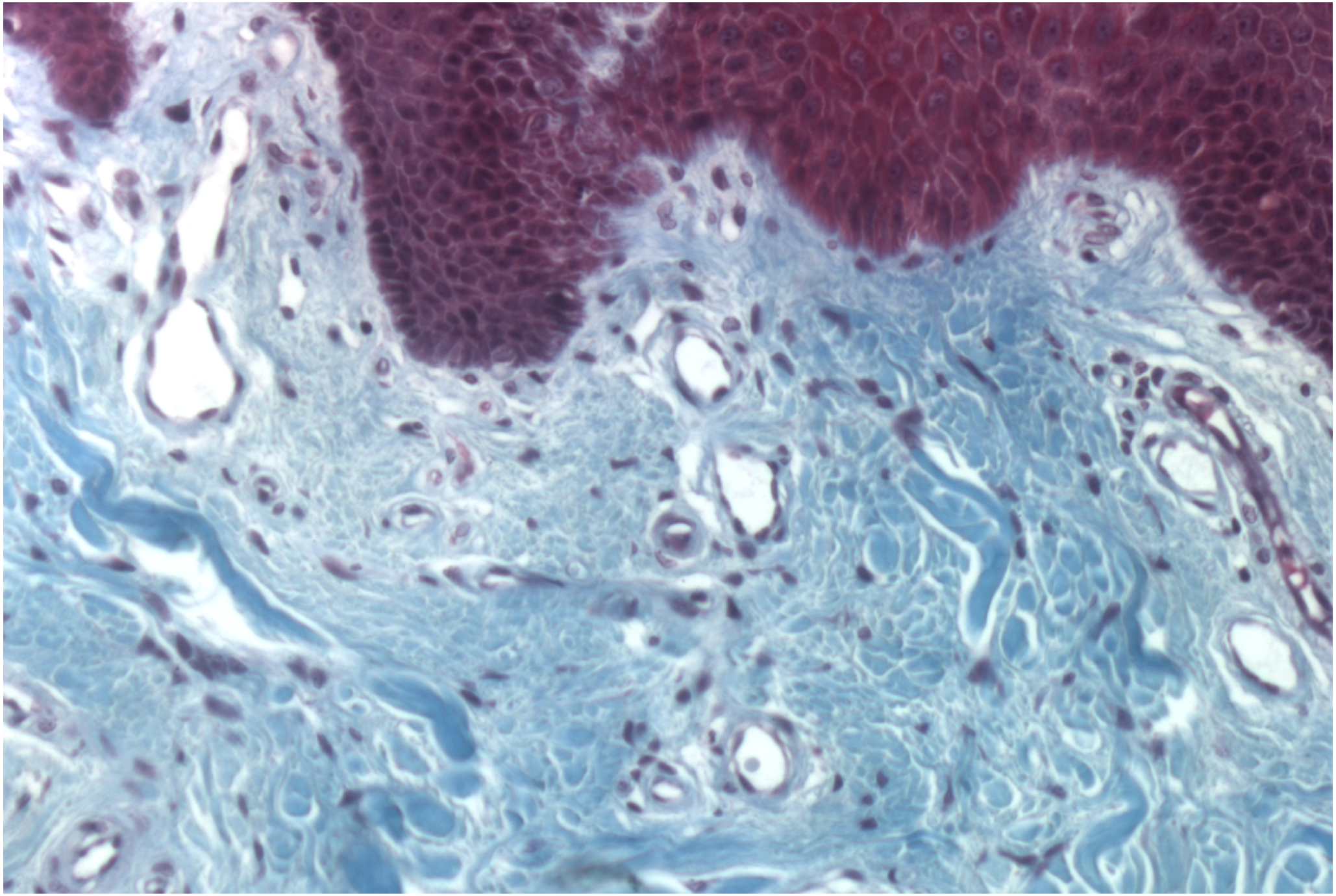

keratin
layer



Epidermis: Summary

- epithelium type: **stratified squamous keratinized epithelium**
- protective
- cells proliferate at basal surface
- at apical surface cells fill with keratin and die



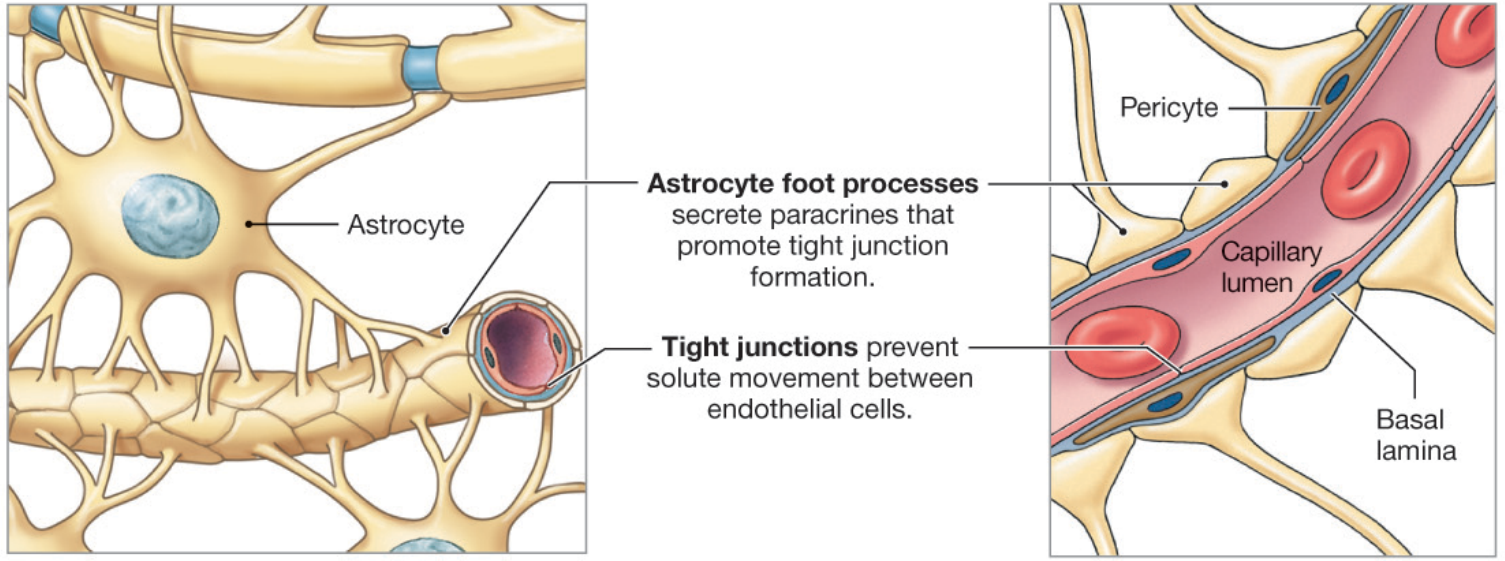


Endothelium: Summary

- epithelium type: **simple squamous epithelium**
- forms the lining of all blood vessels
- capillaries consist of just endothelium
- the **blood-brain barrier** is formed in part by tight junctions between endothelial cells in brain capillaries

Blood-Brain Barrier

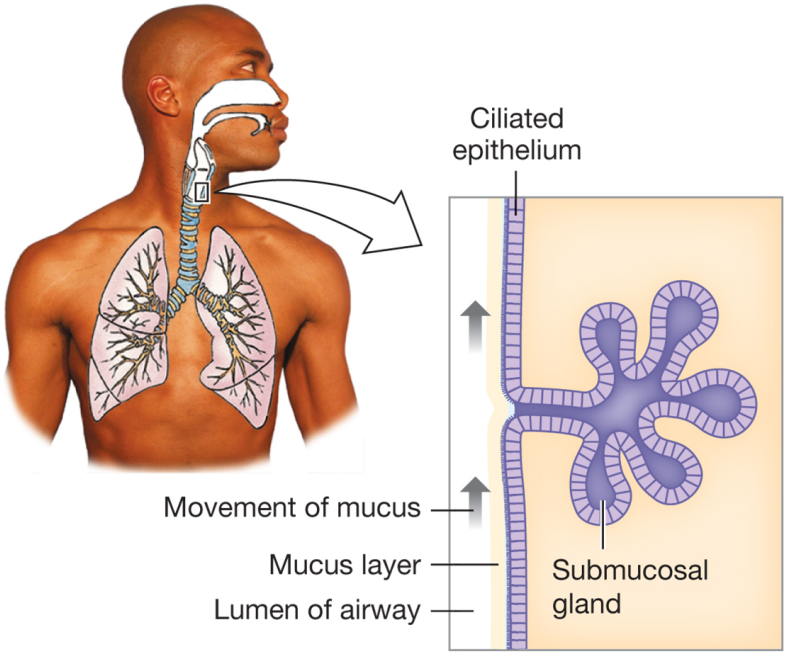
(b) Neurons are protected from harmful substances in the blood because brain capillaries are not leaky.



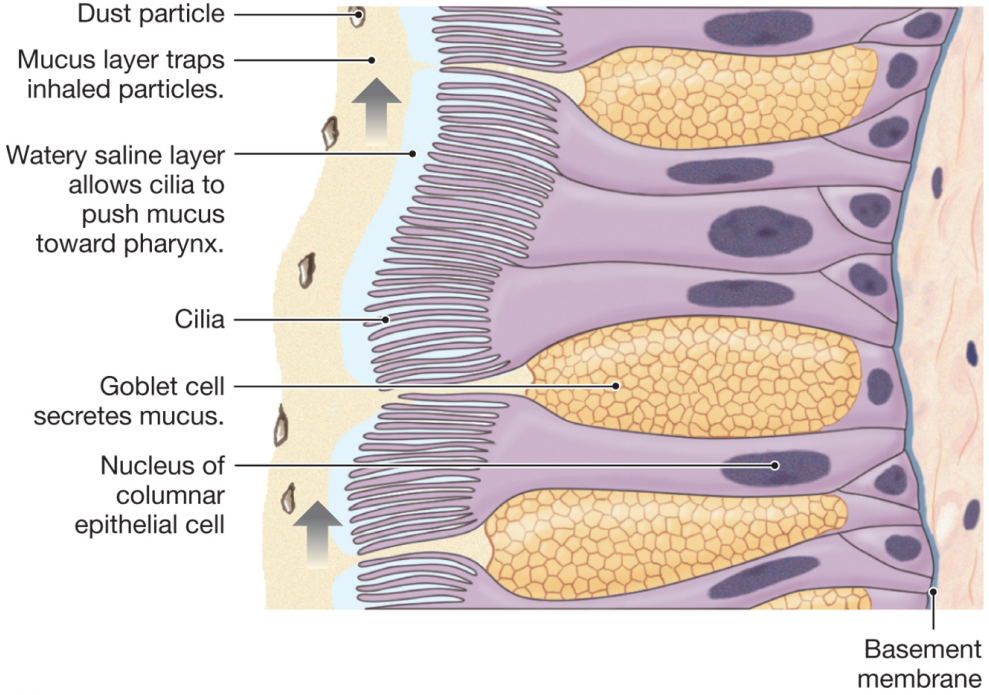
Silverthorn, Fig. 9.5b (p. 279)

Airway Epithelium

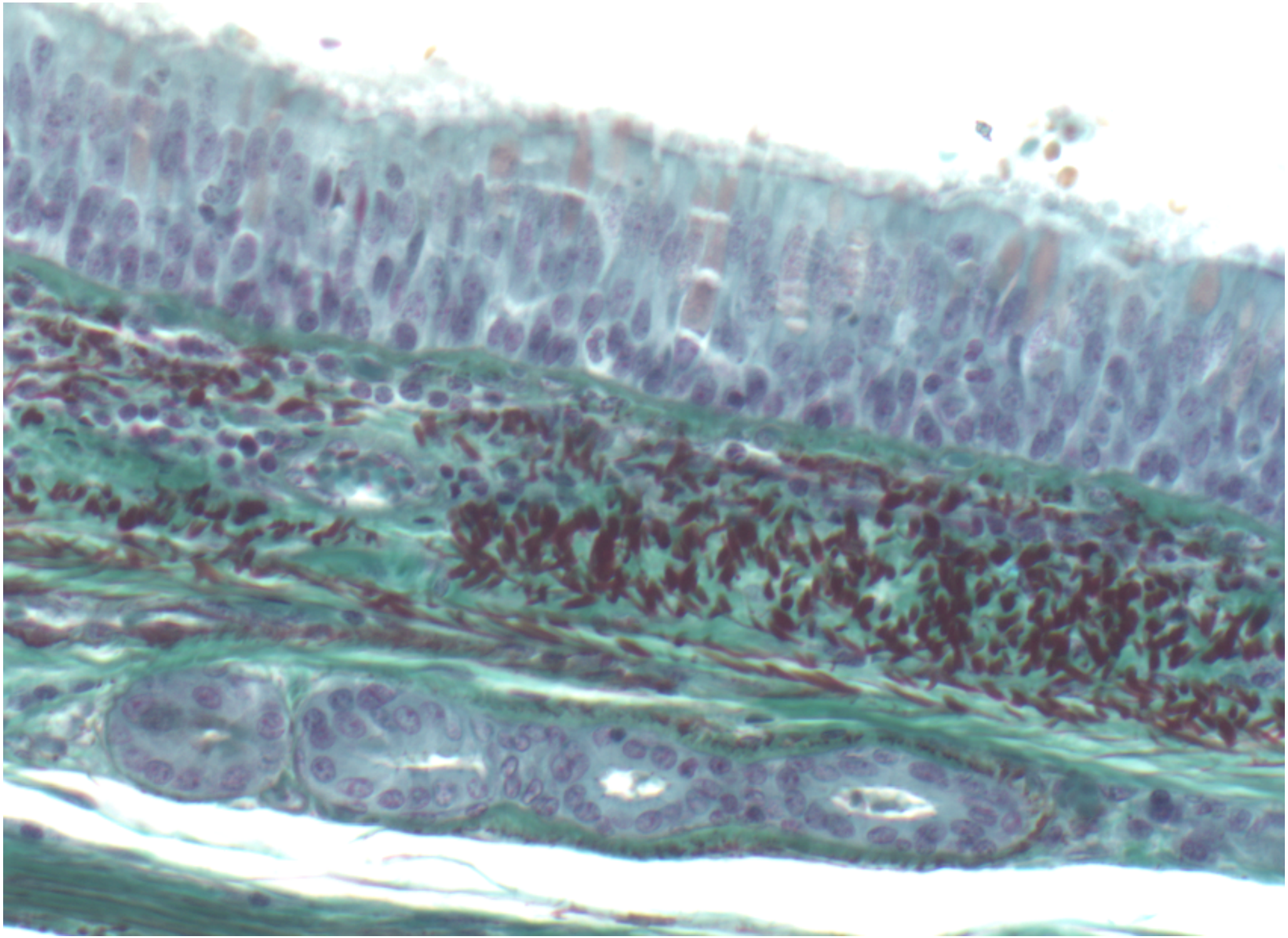
(a) Epithelial cells lining the airways and submucosal glands secrete saline and mucus.



(b) Cilia move the mucus layer toward the pharynx, removing trapped pathogens and particulate matter.



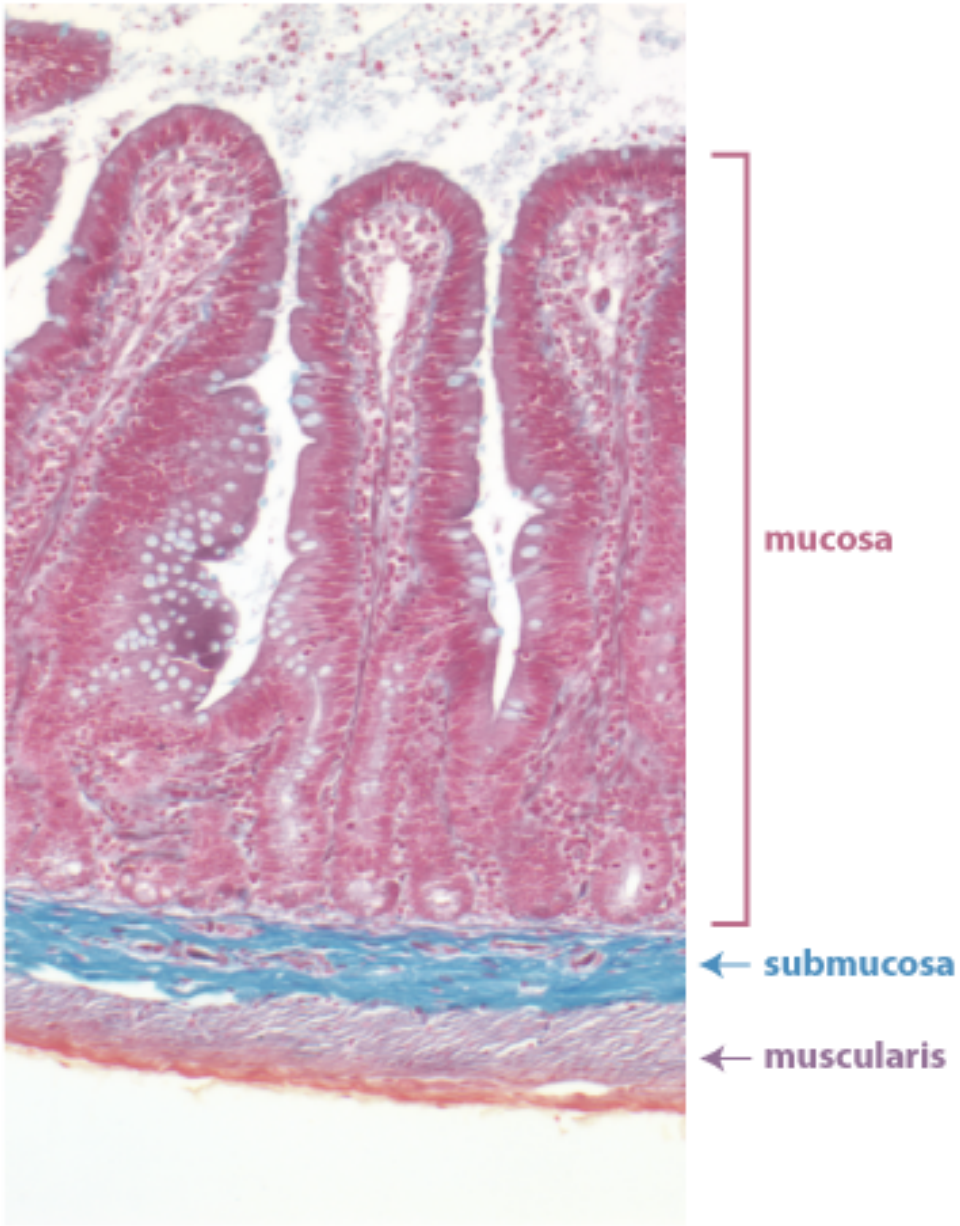
Silverthorn, Fig. 17.5a and 17.5b (p. 539)

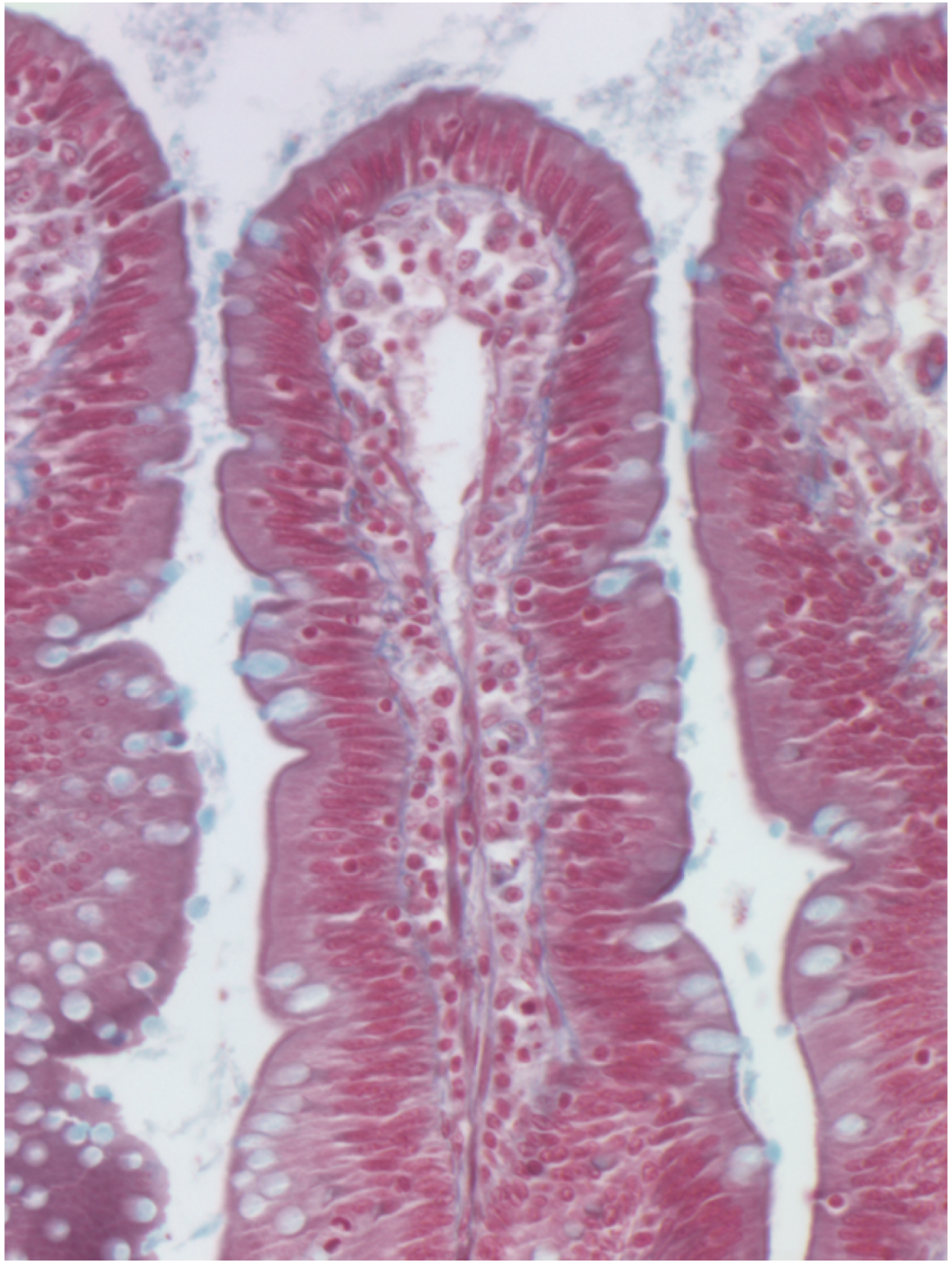


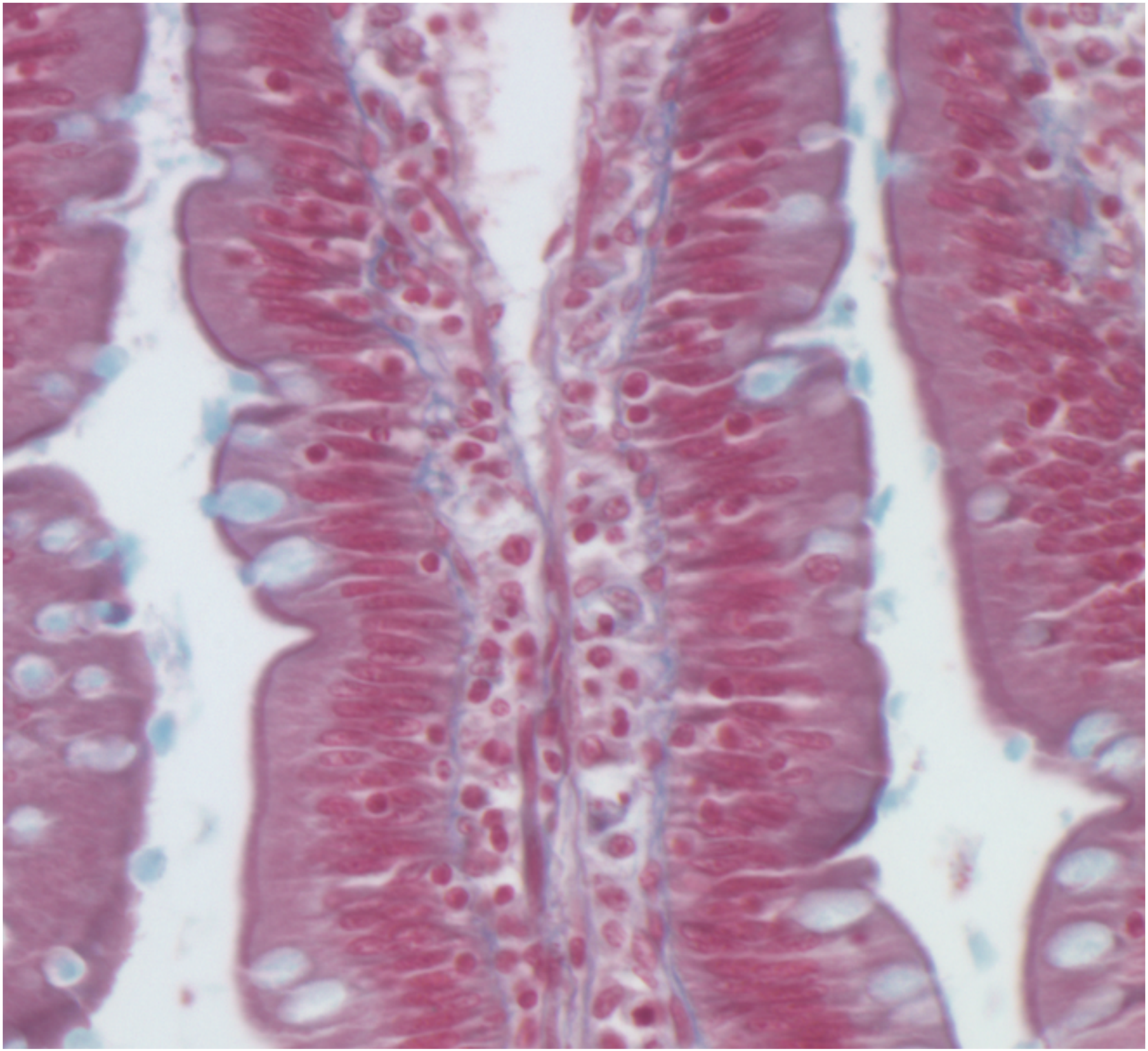
Airway Epithelium: Summary

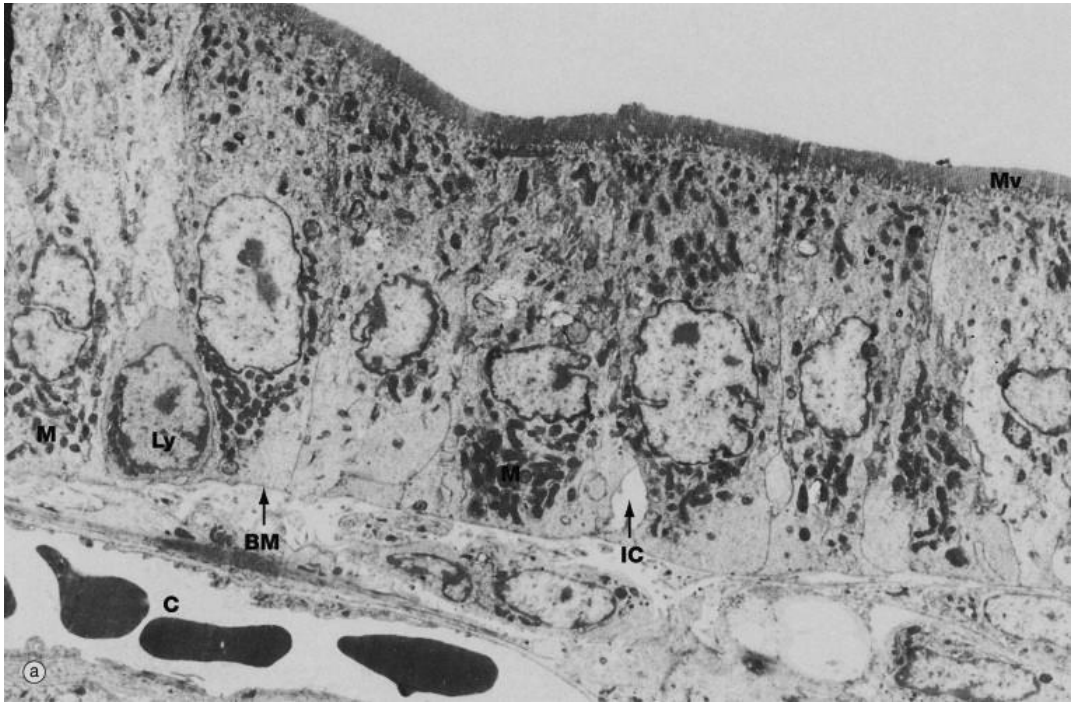
- epithelium type: **pseudostratified ciliated epithelium**
- goblet cells in epithelium secrete mucus
- submucosal glands secrete mucus
- **cilia** move mucus to pharynx

Tissue Layers in the Small Intestine

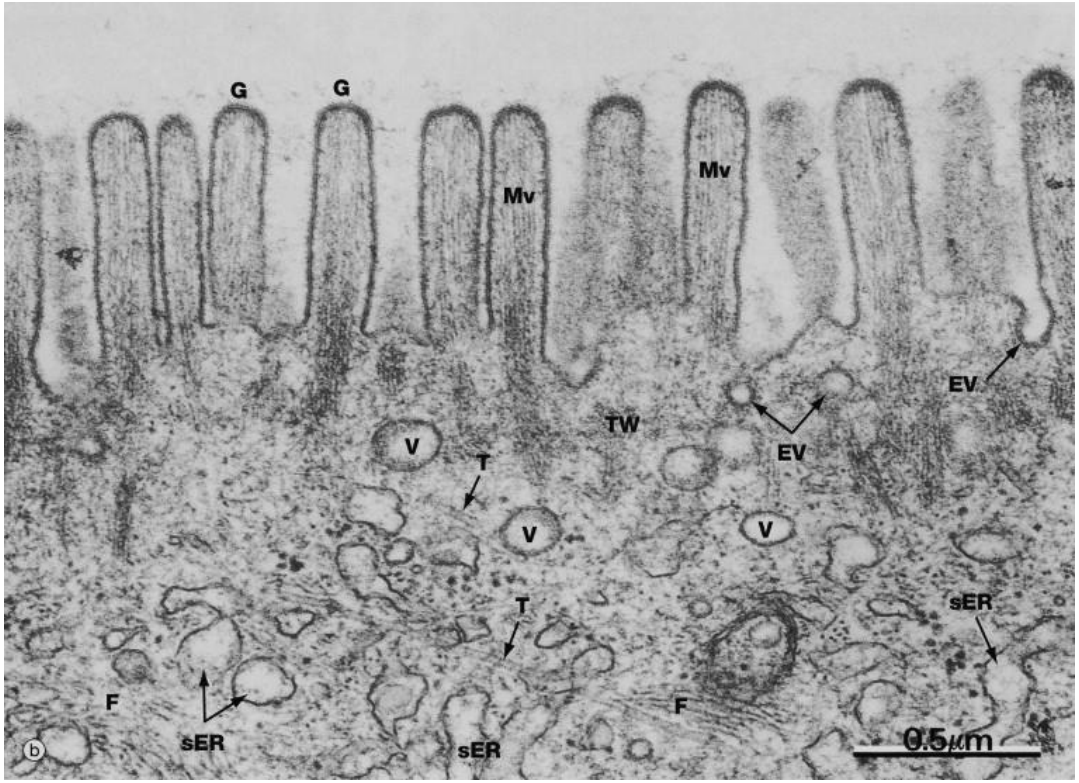








Wheater 14.25a
electron micrograph showing columnar epithelium in the small intestine

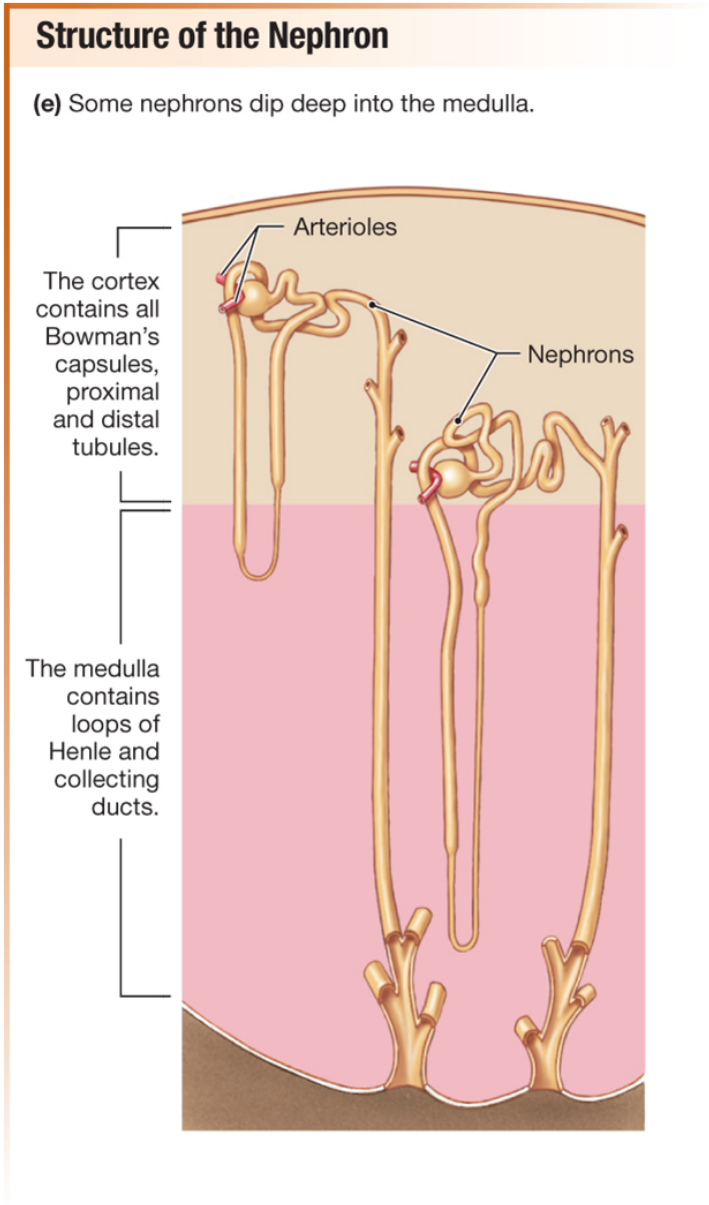


Wheater 14.25b
high magnification electron micrograph showing **microvilli** (brush border)

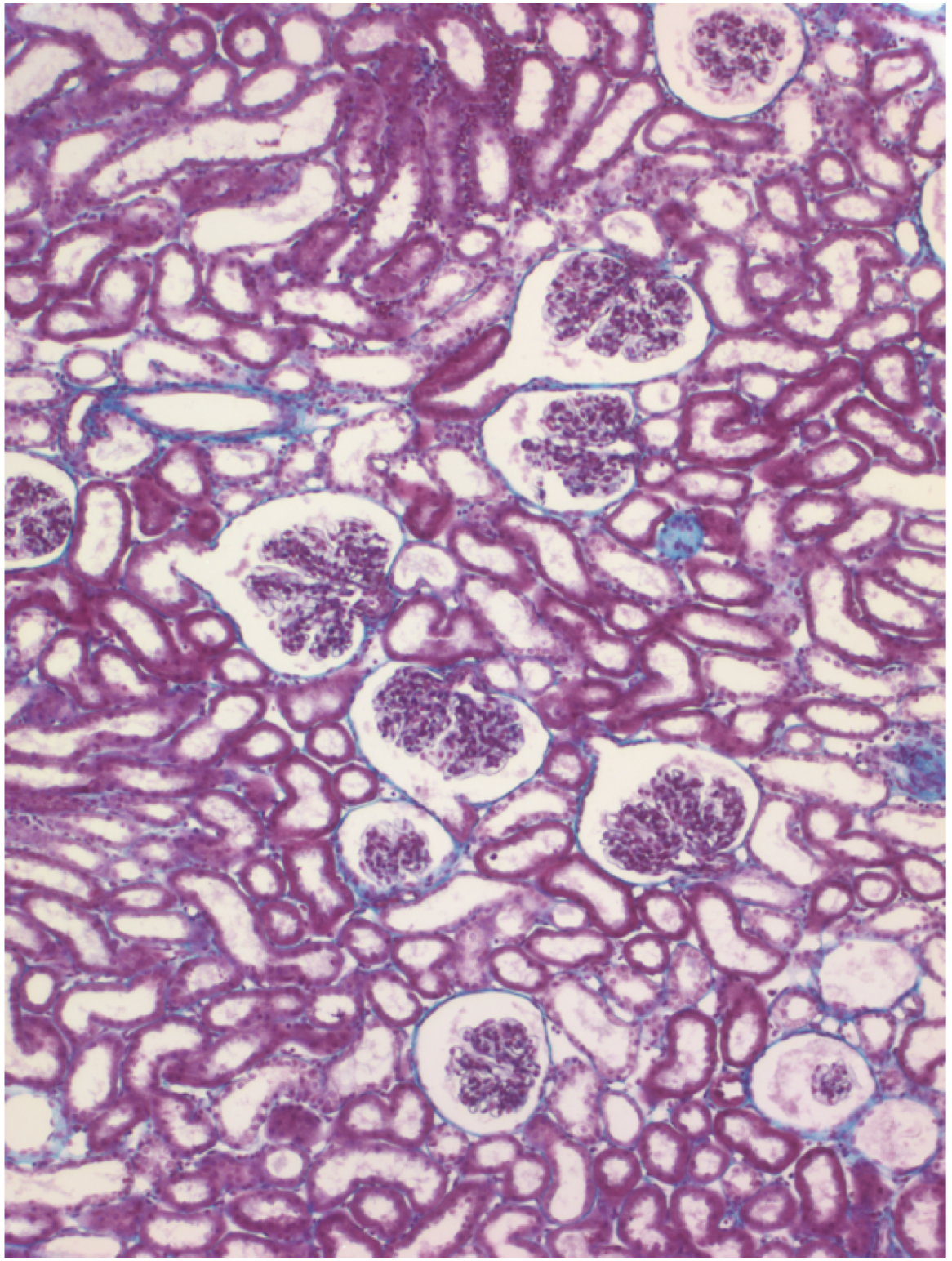
Small Intestine Epithelium: Summary

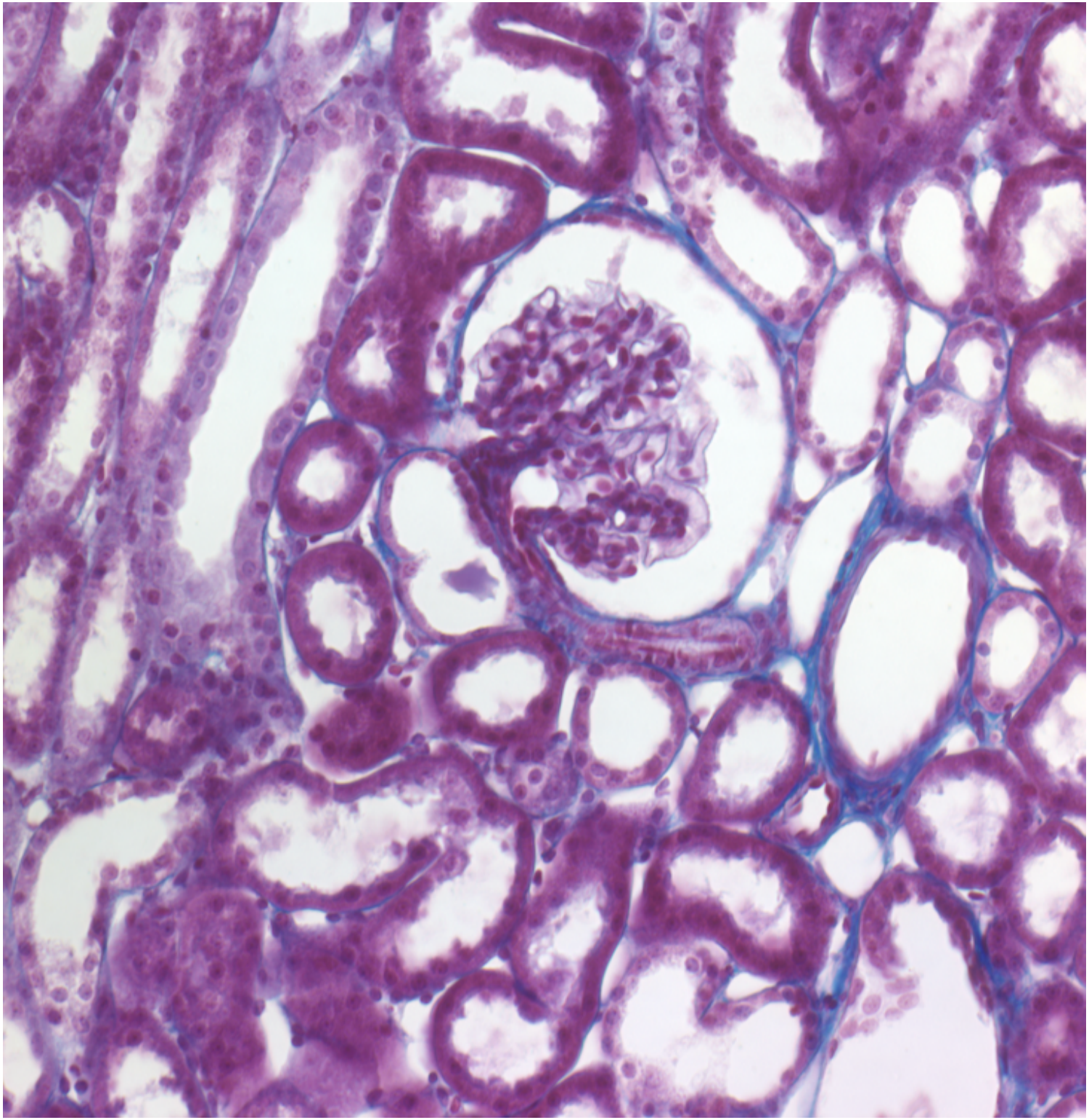
- epithelium type: **simple columnar epithelium**
- folding of epithelium into villi and crypts increases surface area for absorption
- apical plasma membrane folded into **microvilli**
- **goblet cells** in epithelium secrete mucus

The Nephron is the Functional Unit of the Kidney



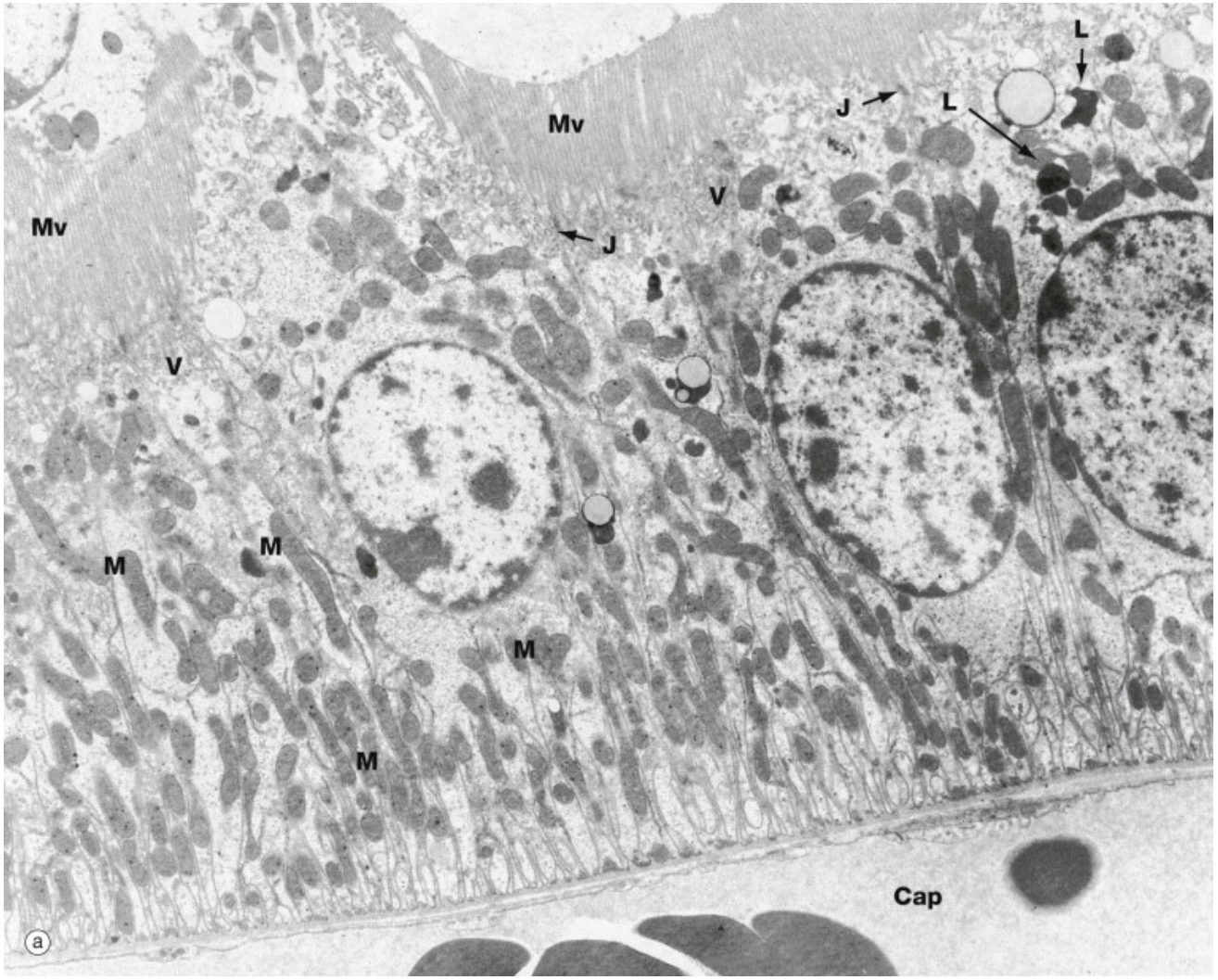
Silverthorn, Fig.19.1e (pp. 591)





Wheater Fig. 16.17a

EM of the **proximal tubule** with **microvilli** (Mv) and **mitochondria** (M)



Proximal Tubule in Kidney: Summary

- epithelium type: **simple cuboidal epithelium**
- apical plasma membrane folded into **microvilli**
- cells stain darkly due to presence of many **mitochondria**

Protein-Mediated Transport Across Membranes

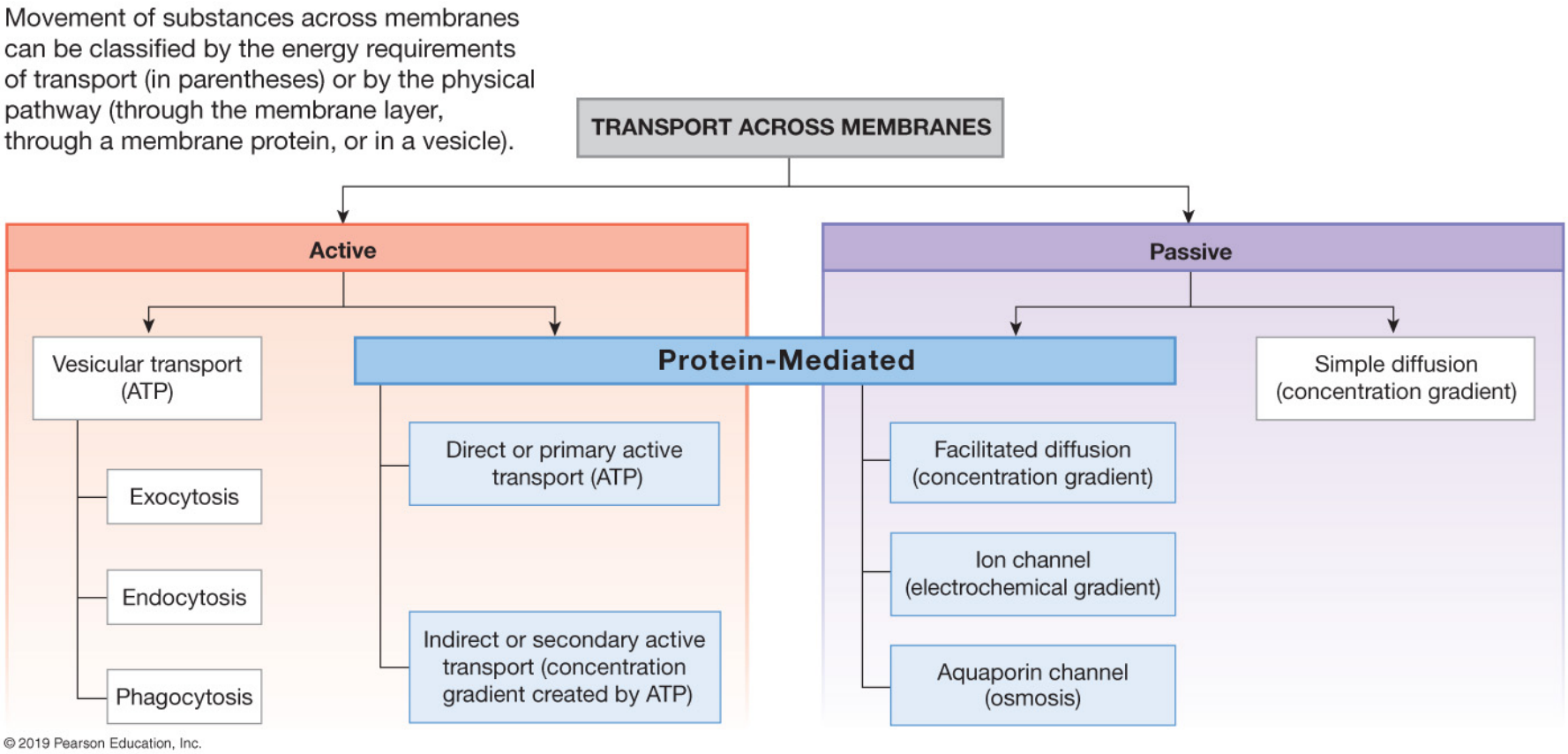
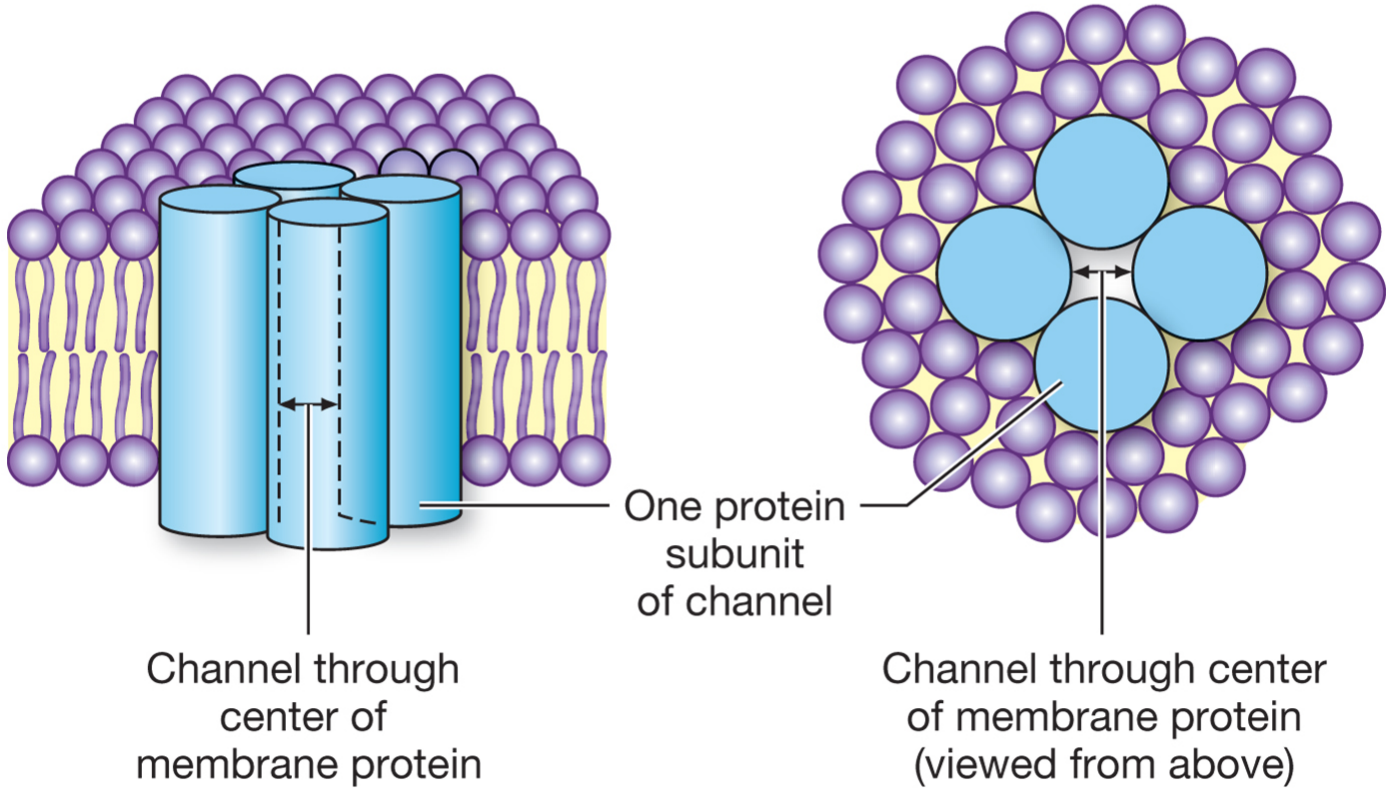


Fig. 5.5 (p. 132)
Silverthorn, Human Physiology, 8th edition

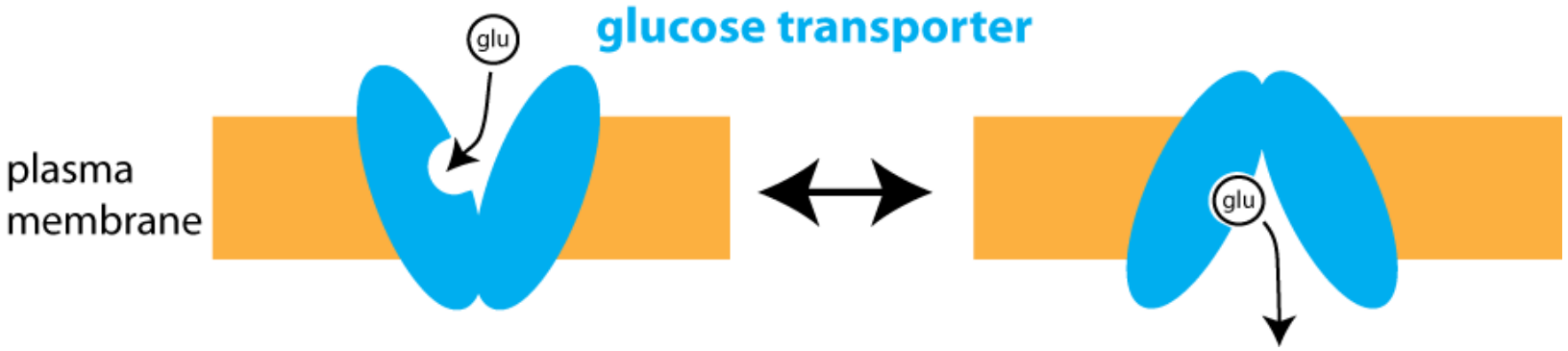
OPTIONAL READING: SECTIONS 5.4 (pp. 136-146) AND 5.6 (pp. 149-151)

Ion Channels Consist of a Water-Filled Pore through the Membrane

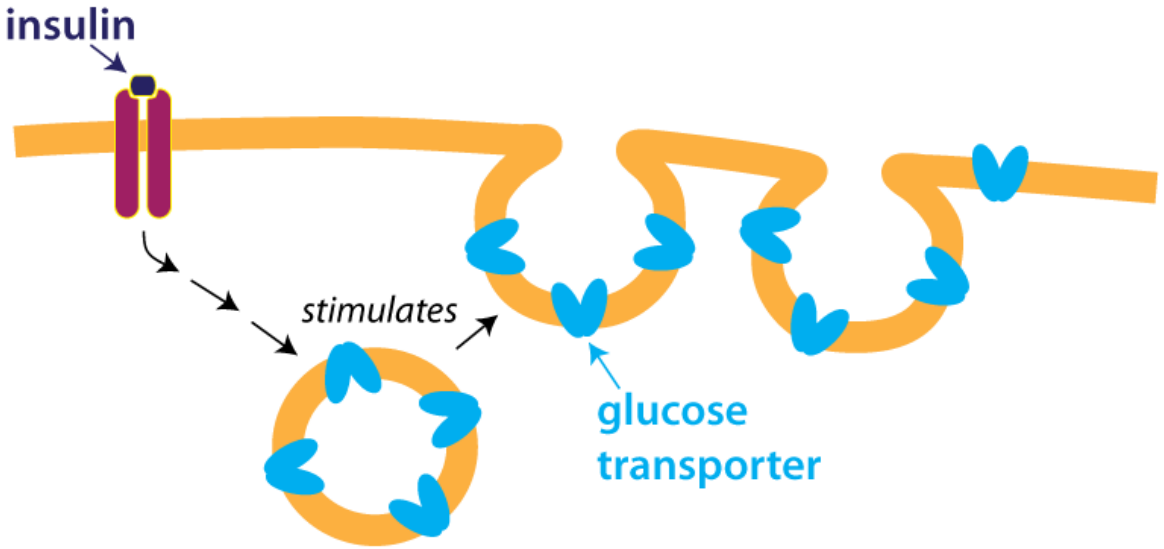


Silverthorn, Fig. 5.11 (p. 140)

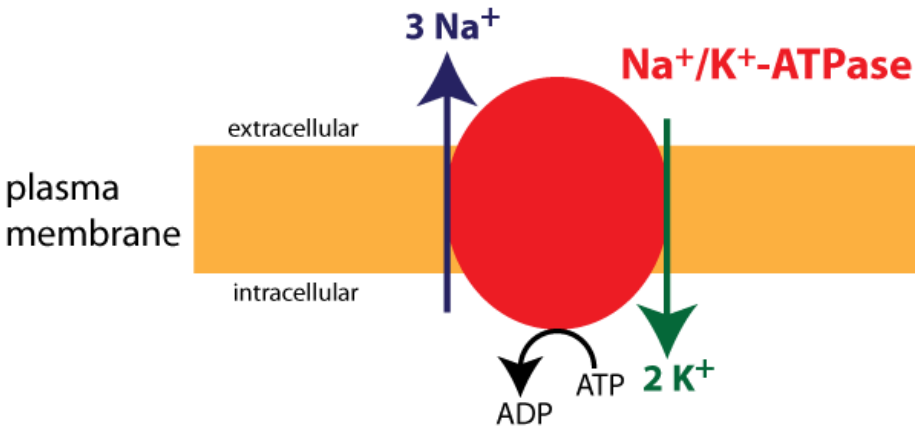
Facilitated Diffusion of Glucose



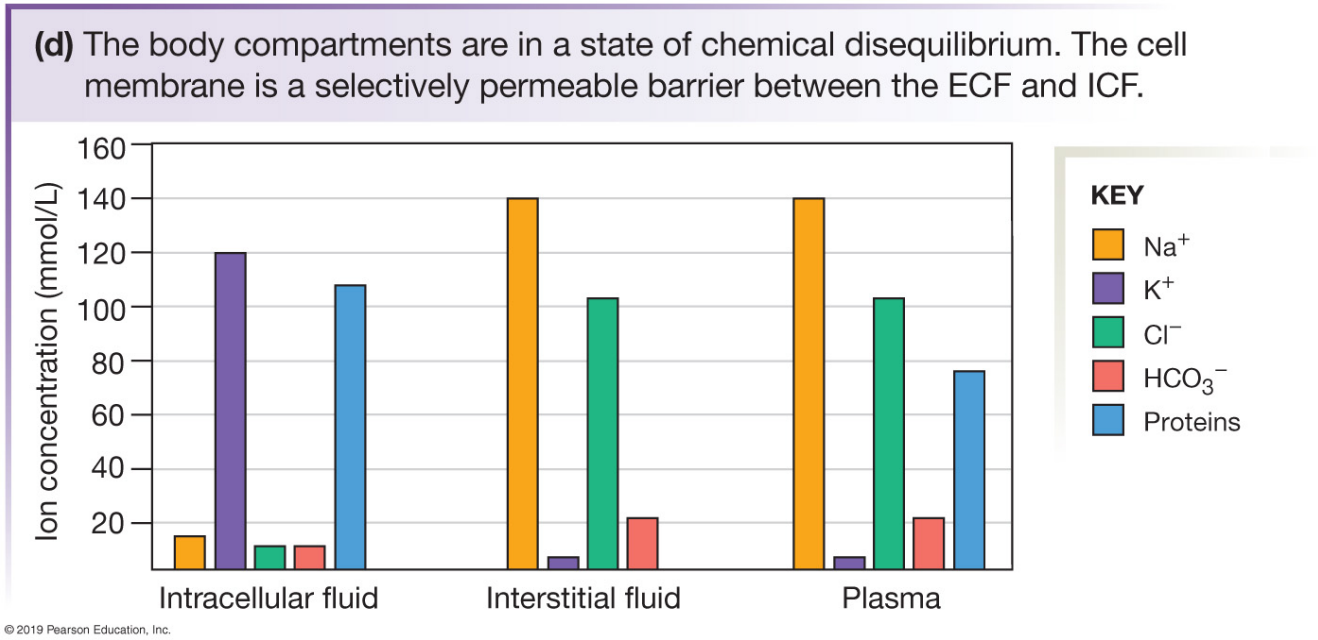
Insulin increases the number of glucose transporters on the cell membrane



Active Transport



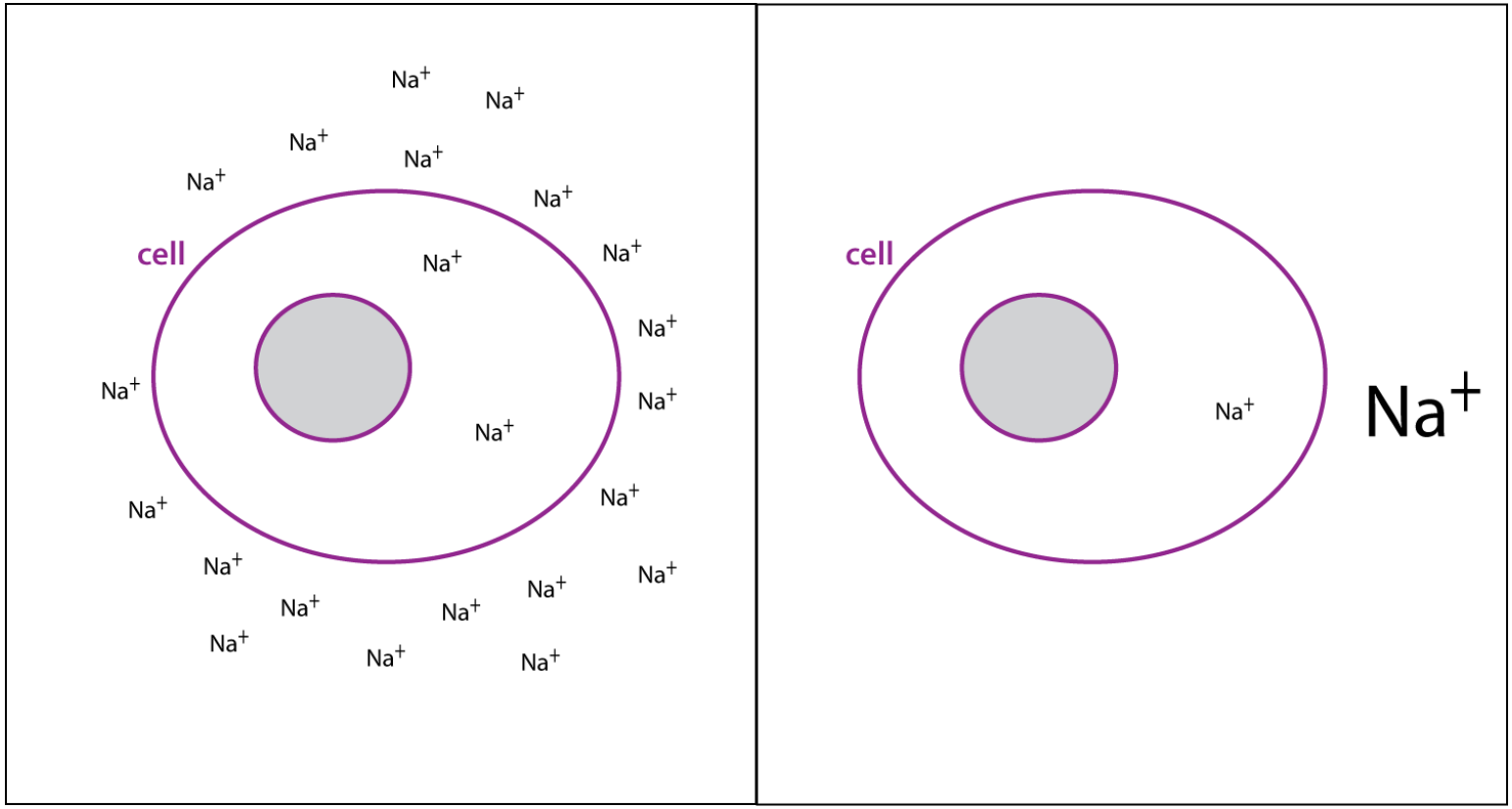
The activity of the Na+/K+-ATPase creates a Na+ gradient



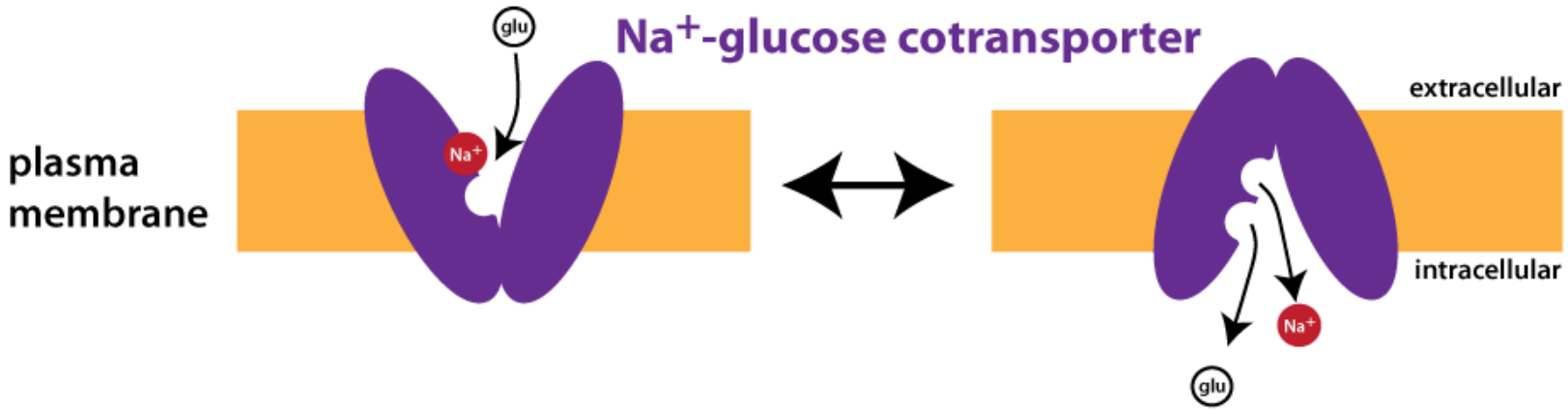
Silverthorn, Figure 5.1d, p. 123

The activity of the Na^+/K^+-ATPase creates a Na^+ gradient

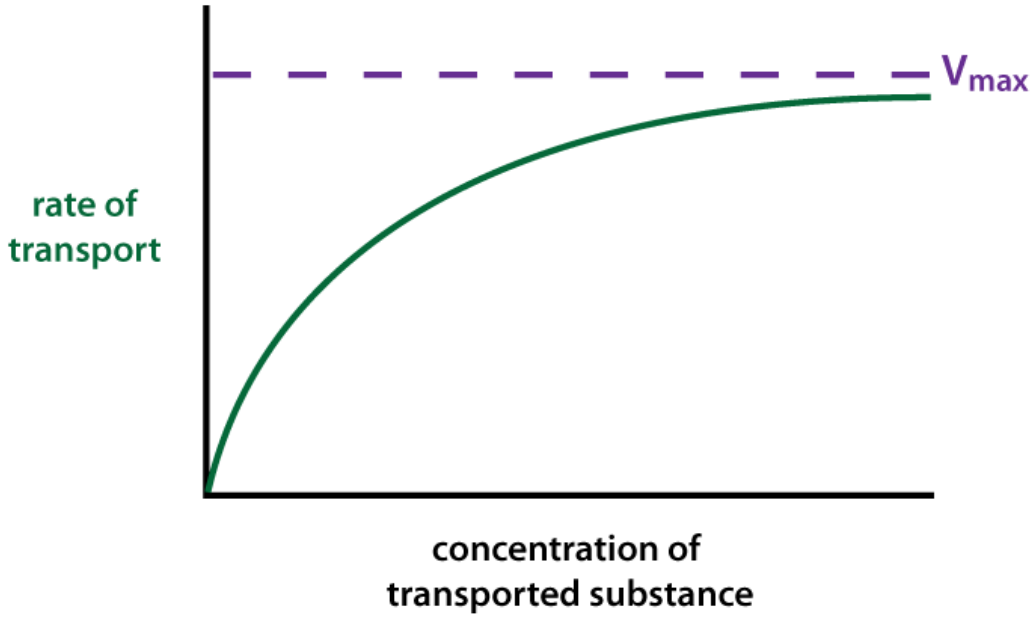
Two ways to show a Na^+ gradient:



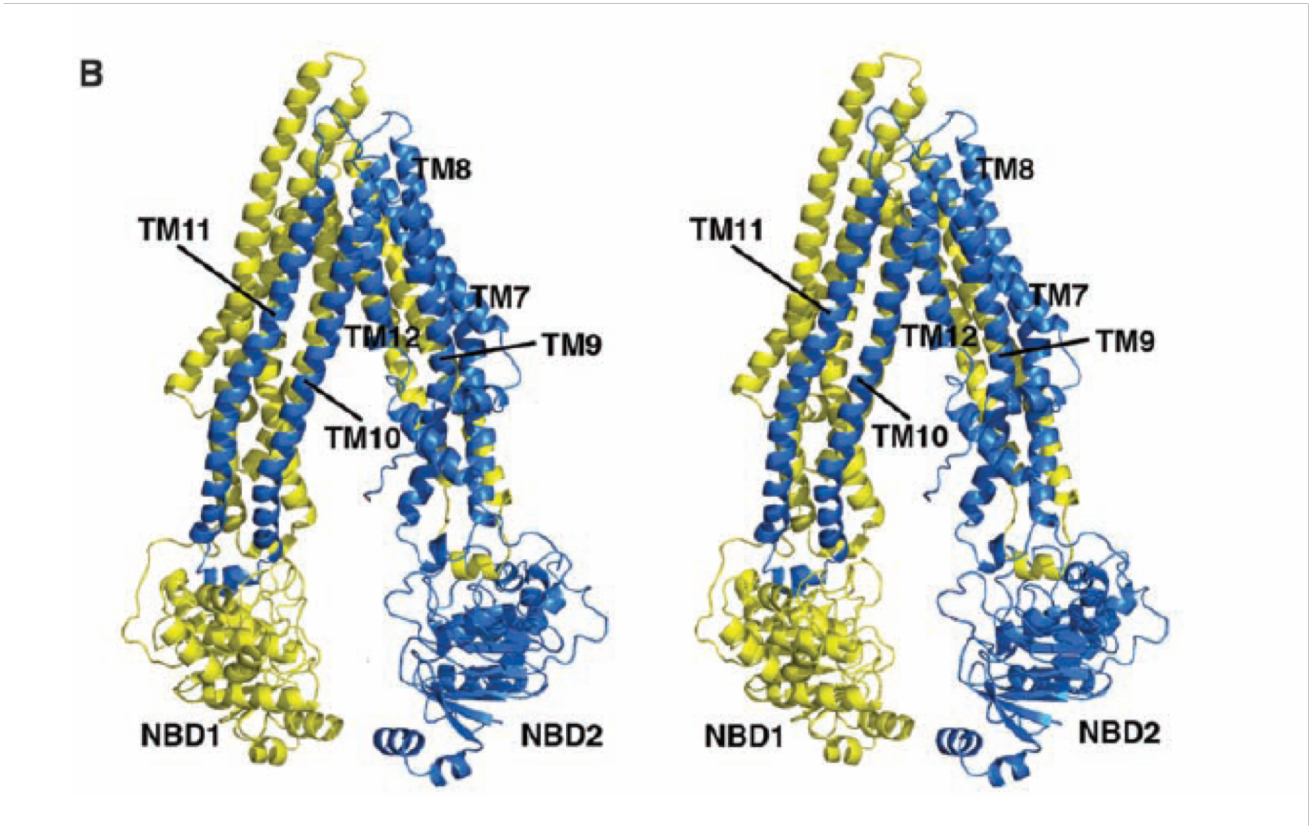
Secondary Active Transport



Carrier Proteins Can Become Saturated



ABC Transporters

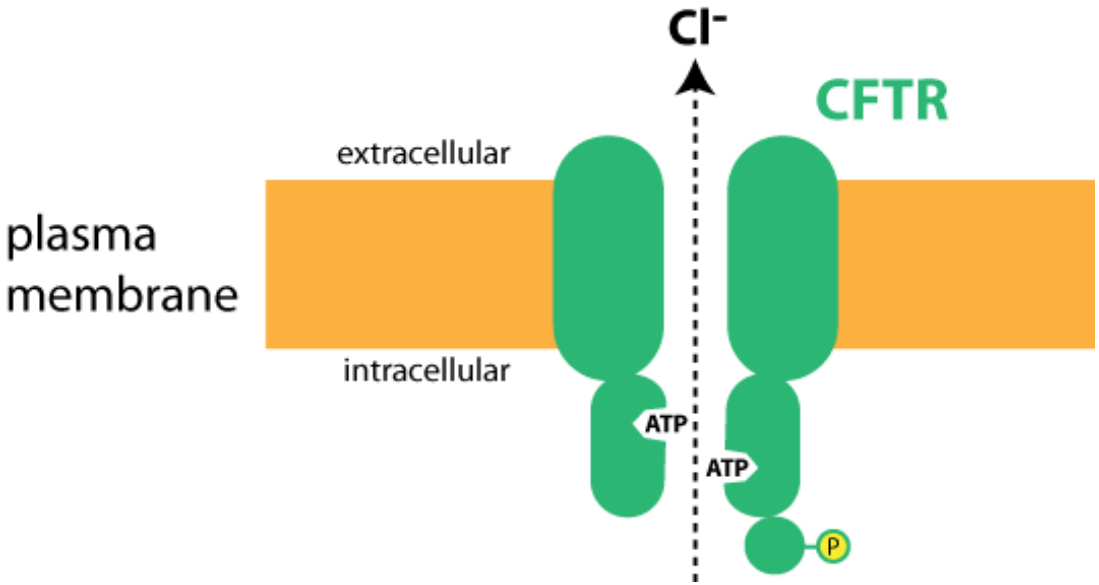


Structure of MDR1, an ABC transporter

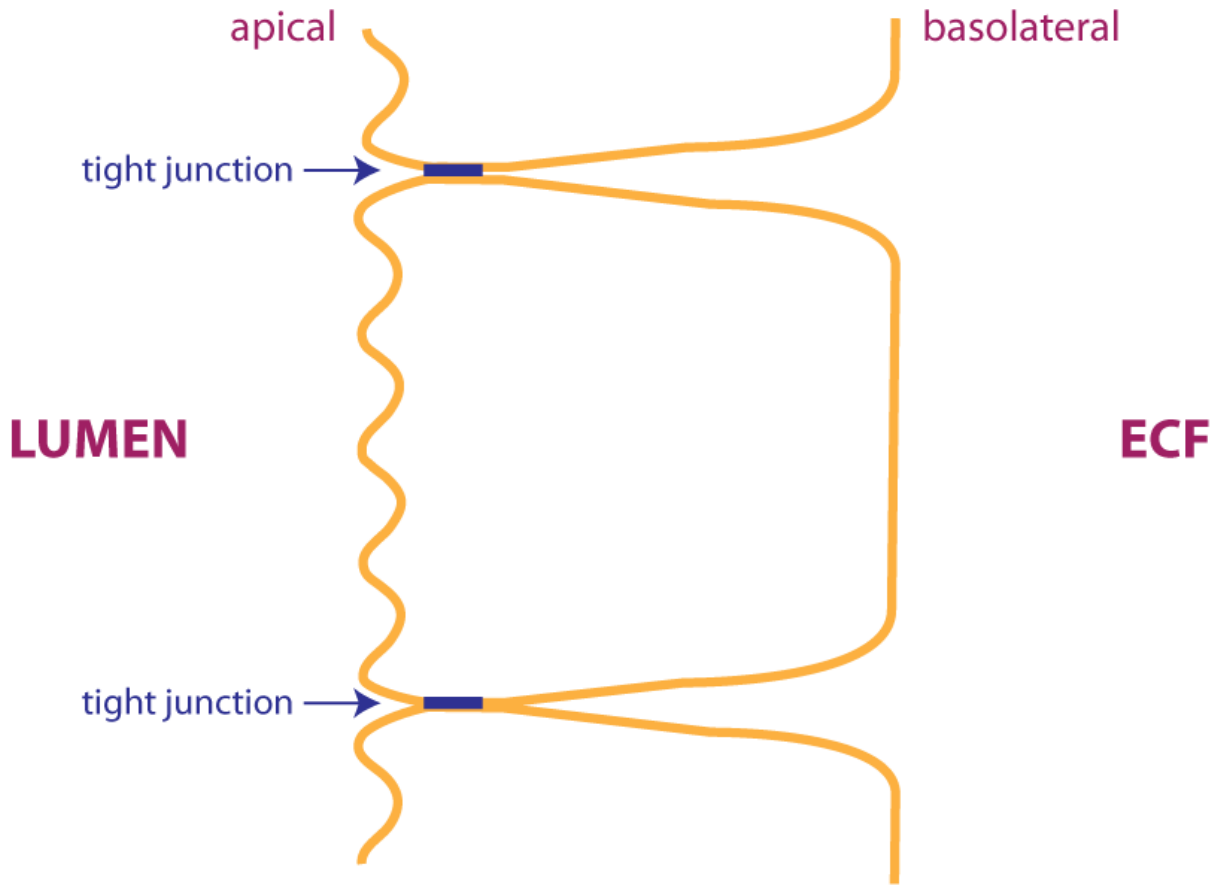
Figure 1B in Aller et al. (2009) Science 323: 1718-22

This is a stereo figure. To see in 3-dimensions, keep your head level, then cross your eyes slowly so that the two images come together in a single fused image in the center. Focus on the central image, which will be 3-D, and ignore the flat images to either side.

CFTR is an atypical ABC protein that works as a Cl- channel

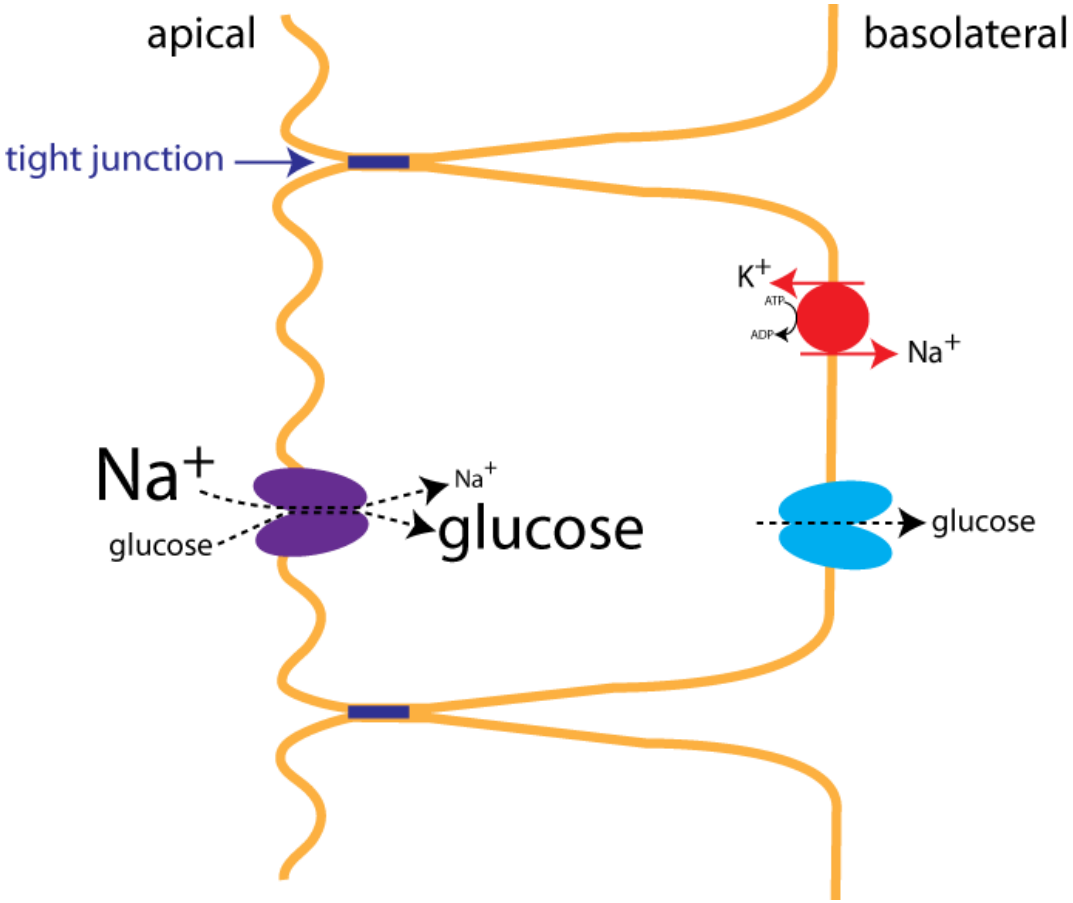


Epithelial Transport

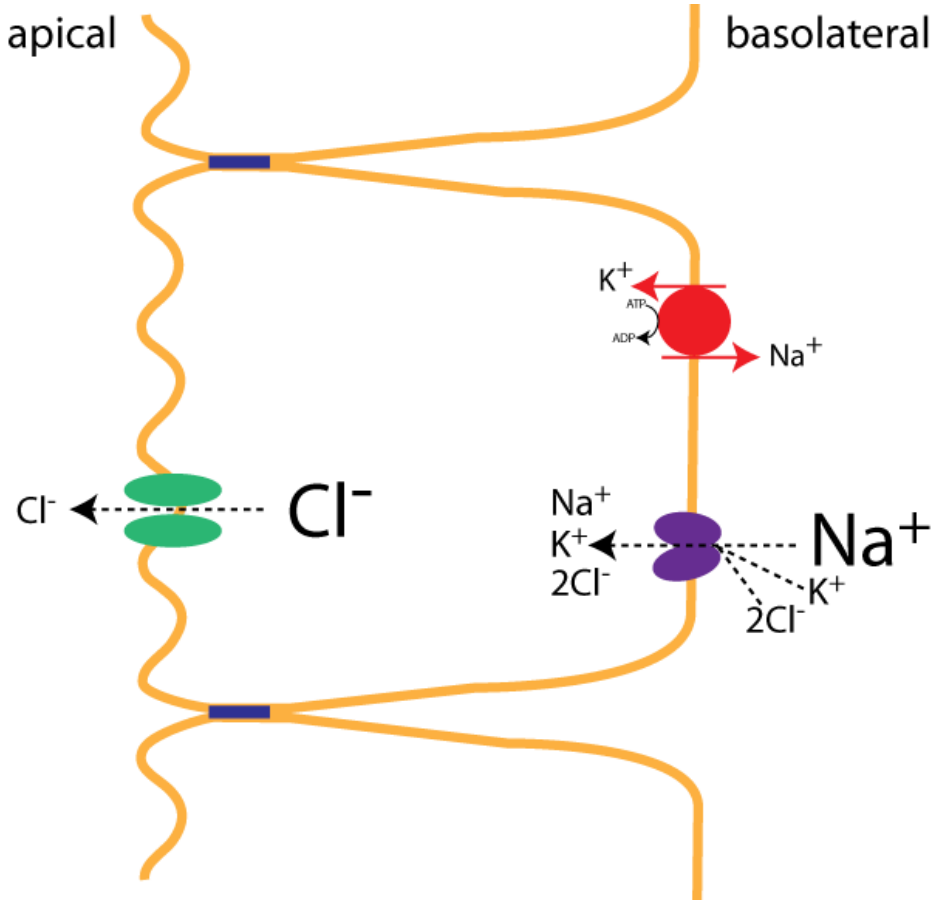


simple epithelium

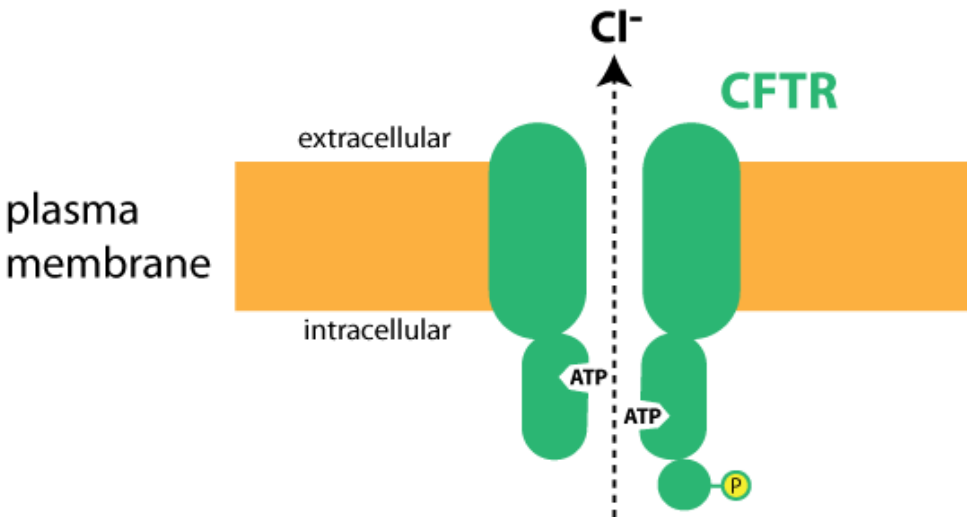
Absorption of Glucose
(Small Intestine; also Reabsorption in Kidney)



Secretion of Fluid
(Small Intestine and Airway Epithelium)

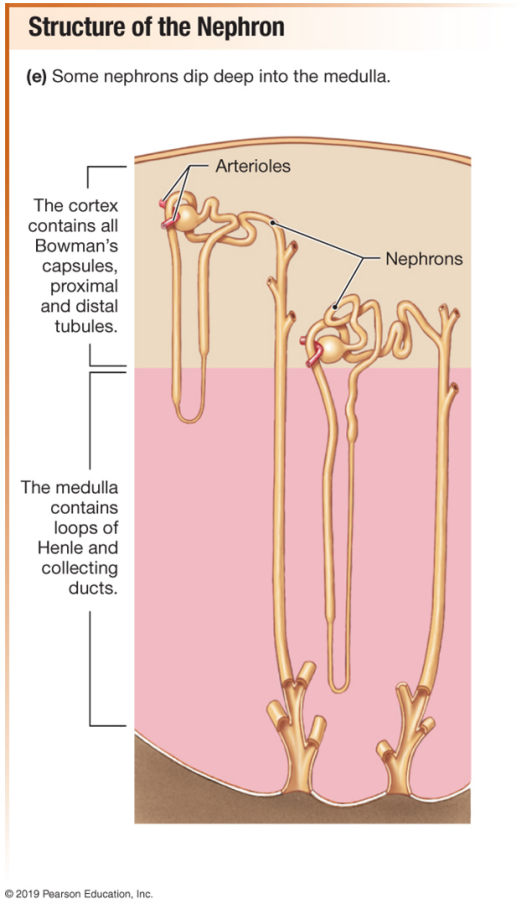


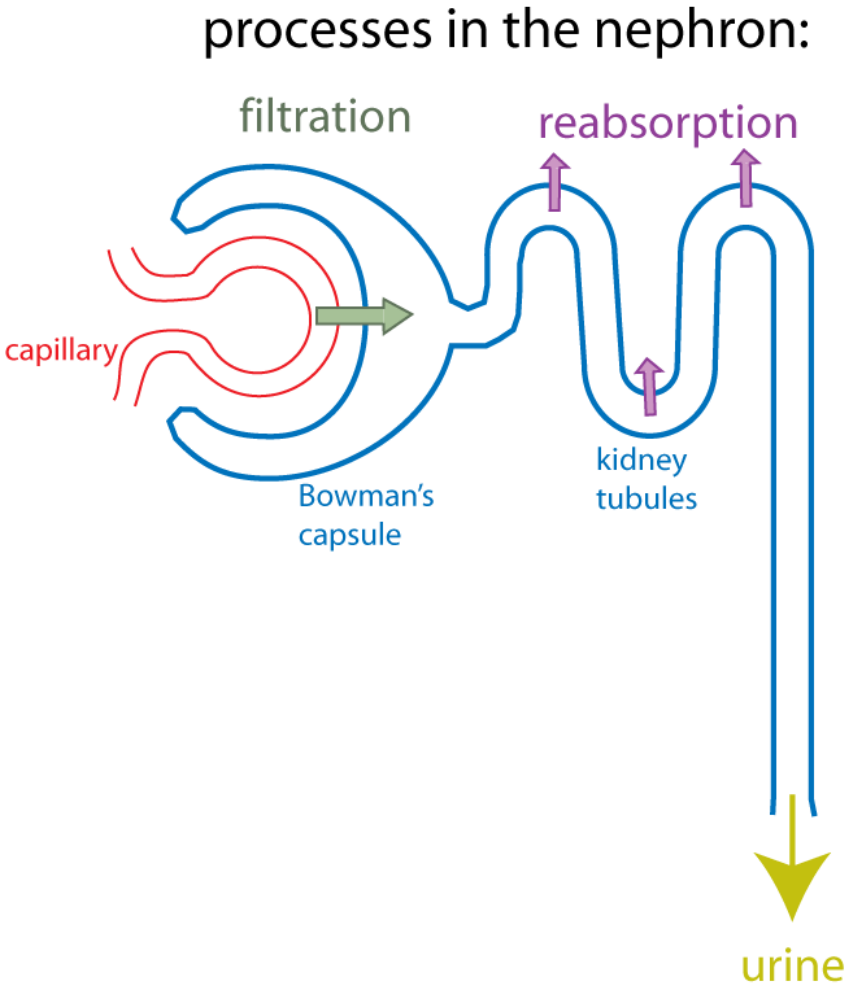
Clinical Example: Cystic Fibrosis



Clinical Example: Polyuria in Diabetes Mellitus

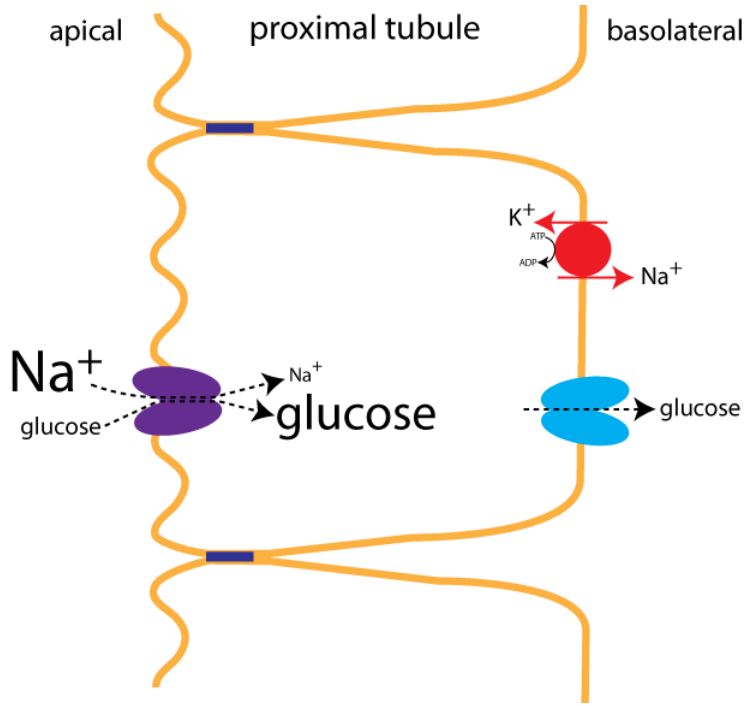
The nephron is the functional unit of the kidney



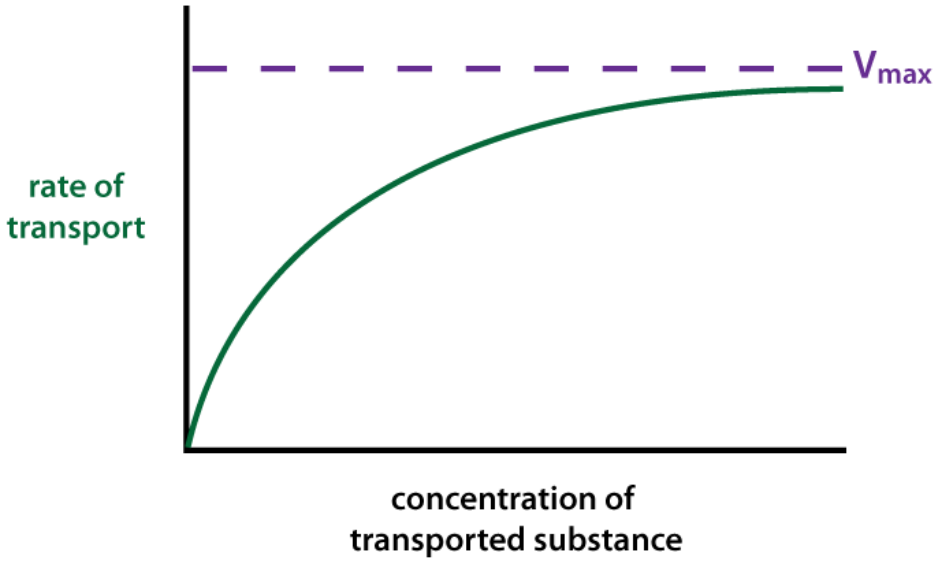


Silverthorn, Fig.19.1e
(pp. 591)

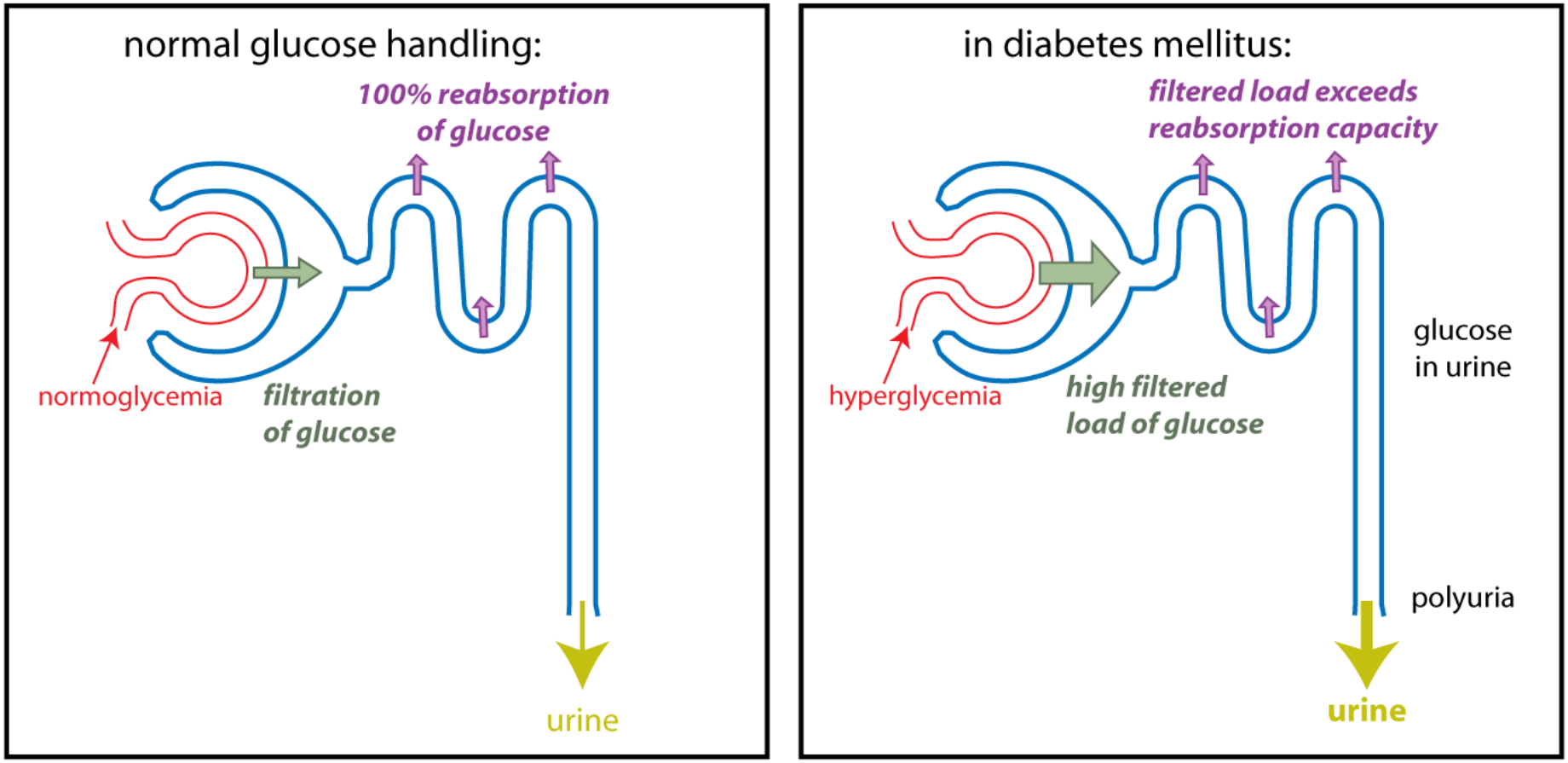
Glucose reabsorption
in the proximal tubule of the kidney



Carrier Proteins Can Become Saturated



Saturation of sodium-glucose cotransporters in the kidney tubules leads to polyuria



Clinical Example: SGLT2 Inhibitors

- **SGLT2 is sodium-glucose cotransporter specific to proximal tubule**
- **SGLT2 inhibitors are oral drugs**
- **beneficial effects on cardiovascular outcomes; progression of chronic kidney disease**