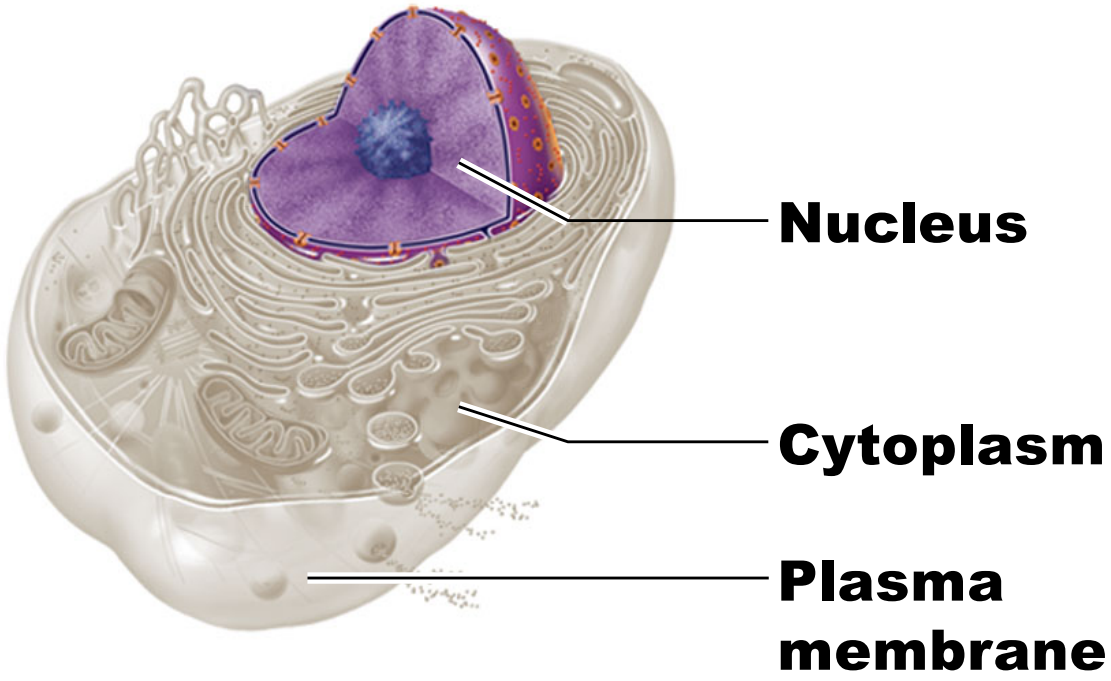
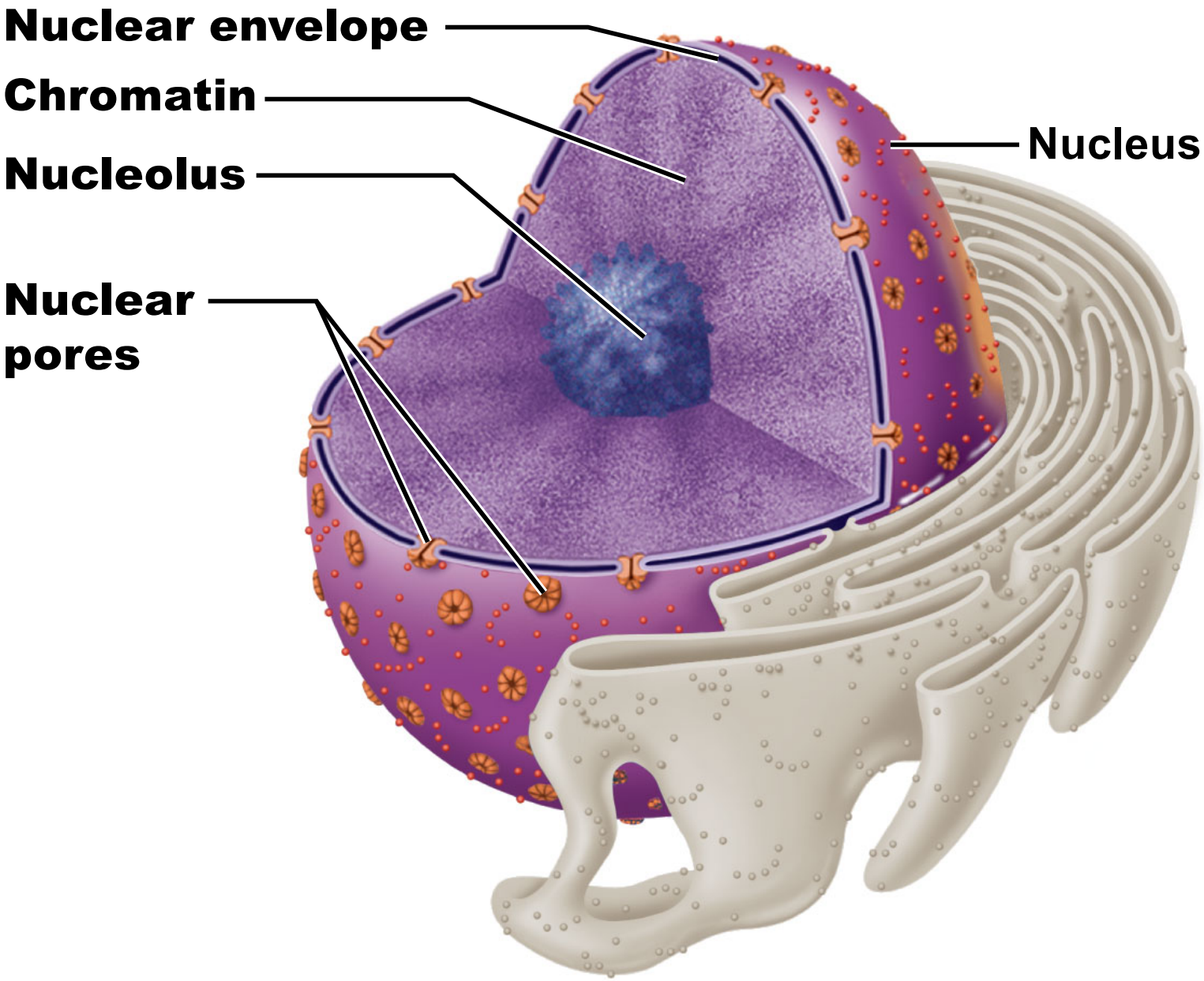
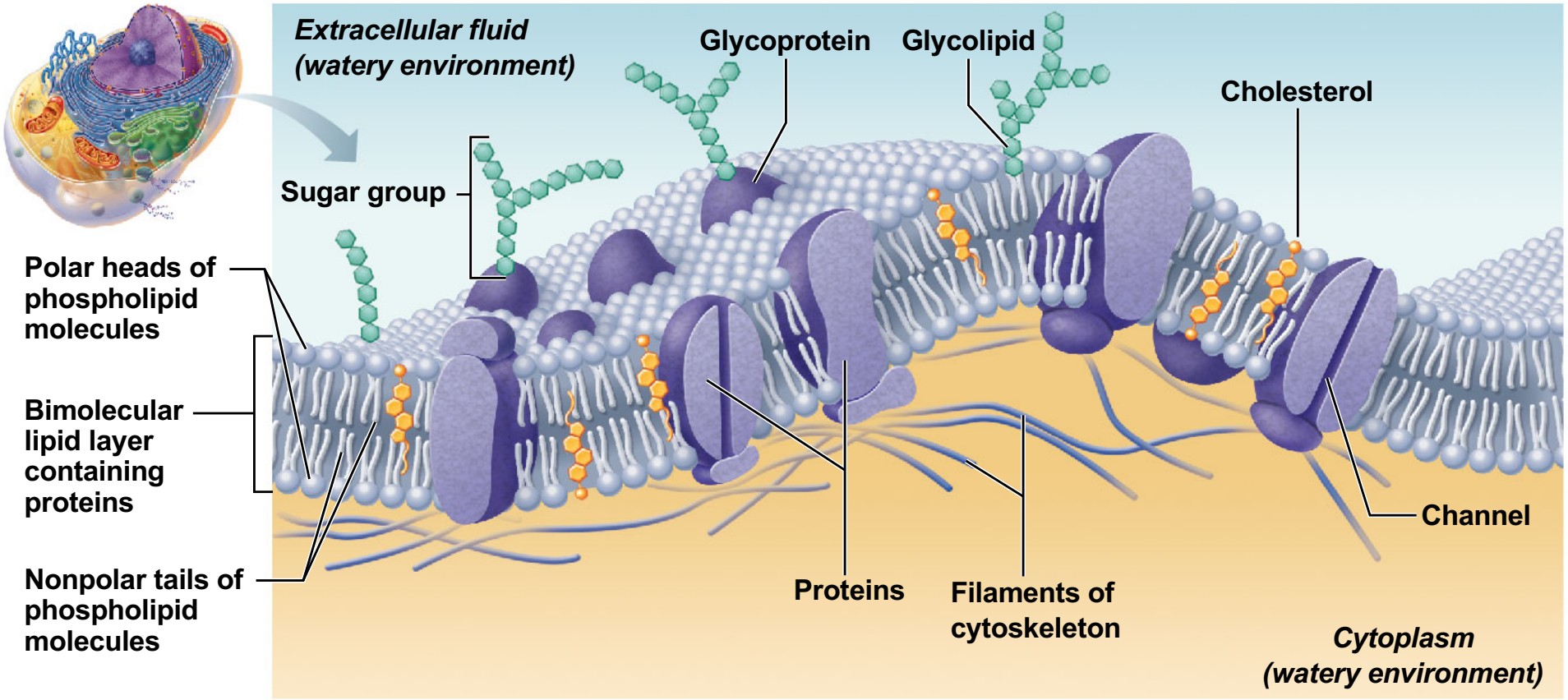
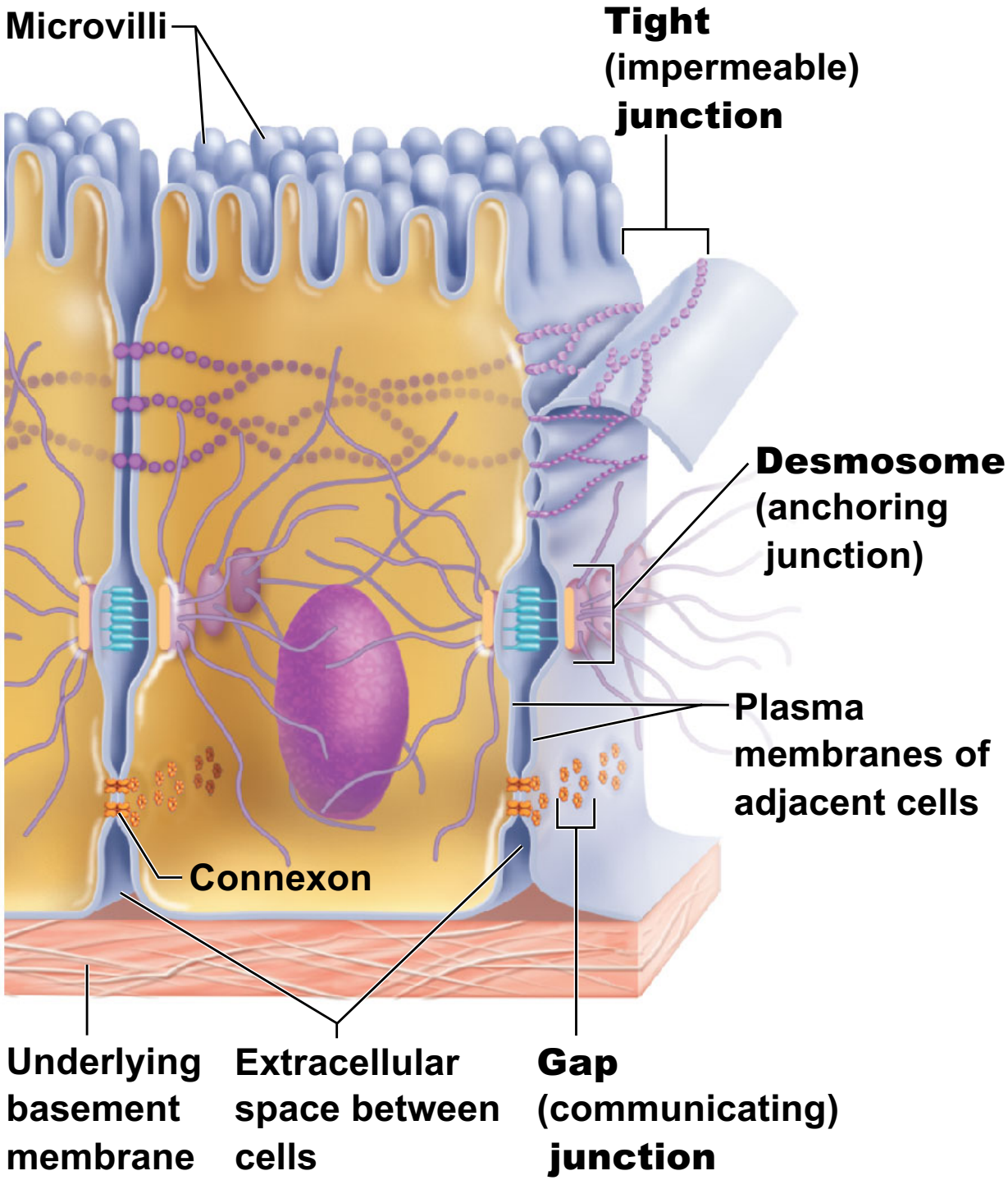


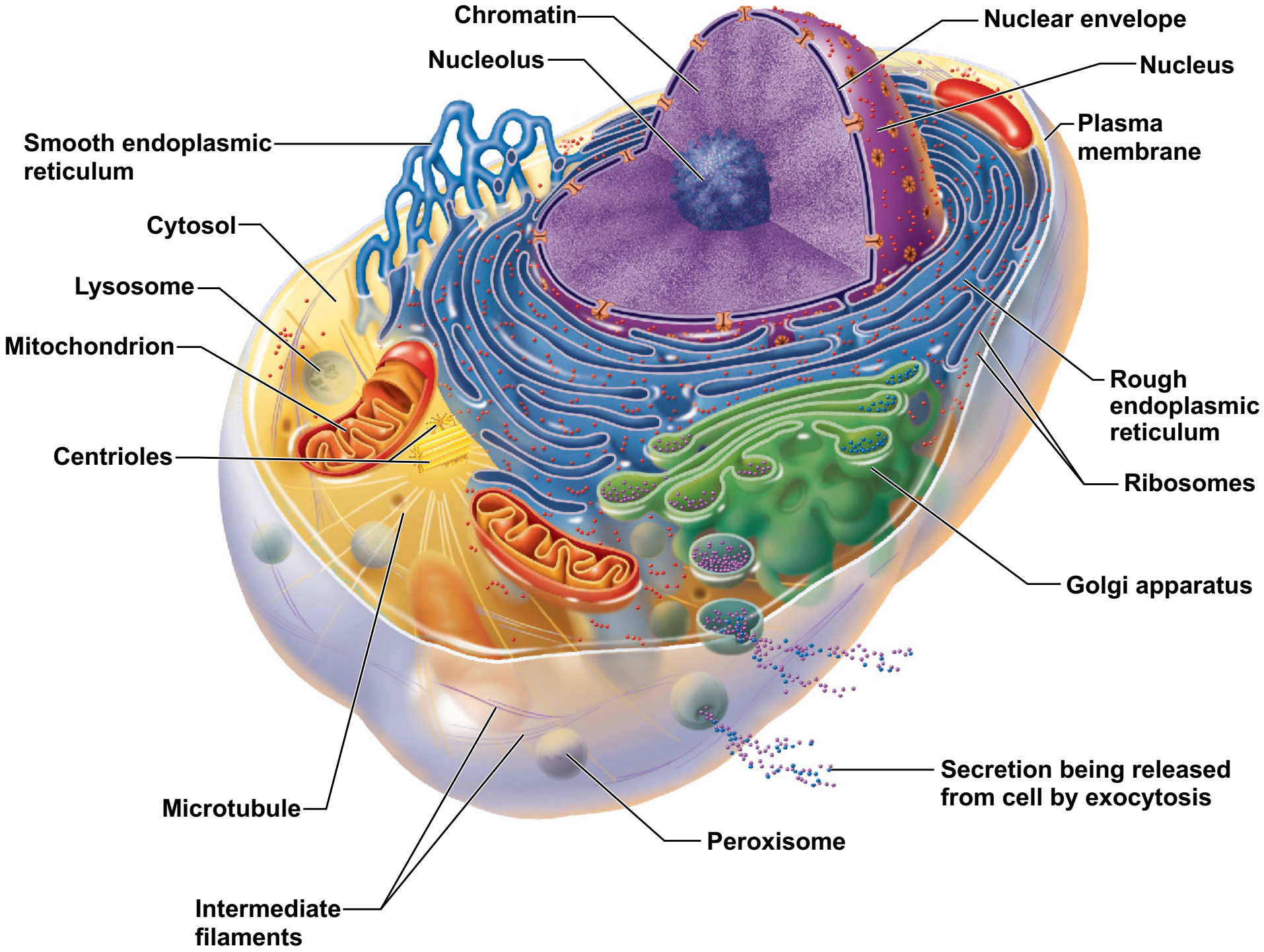
(a) Generalized animal cell

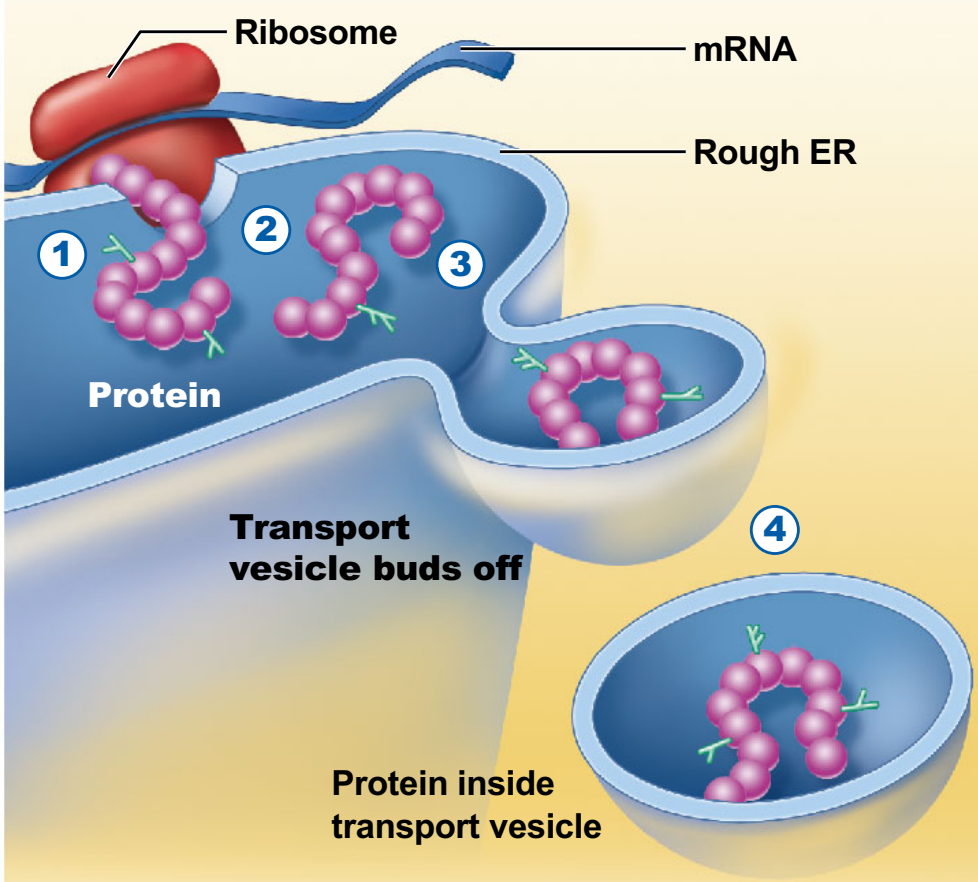

Nuclear envelope
Chromatin
Nucleolus
Nuclear pores
Nucleus

(b) Nucleus


Extracellular fluid
(watery environment)
Glycoprotein
Glycolipid
Cholesterol
Sugar group
Polar heads of phospholipid molecules
Bimolecular lipid layer containing proteins
Nonpolar tails of phospholipid molecules
Channel
Proteins
Filaments of cytoskeleton
Cytoplasm
(watery environment)


Microvilli
Tight
(impermeable)
junction
Desmosome
(anchoring
junction)
Plasma
membranes of
adjacent cells
Connexon
Underlying
basement
membrane
Extracellular
space between
cells
Gap
(communicating)
junction


Chromatin
Nuclear envelope
Nucleolus
Nucleus
Plasma membrane
Smooth endoplasmic reticulum
Cytosol
Lysosome
Mitochondrion
Rough endoplasmic reticulum
Centrioles
Ribosomes
Golgi apparatus
Secretion being released from cell by exocytosis
Microtubule
Peroxisome
Intermediate filaments

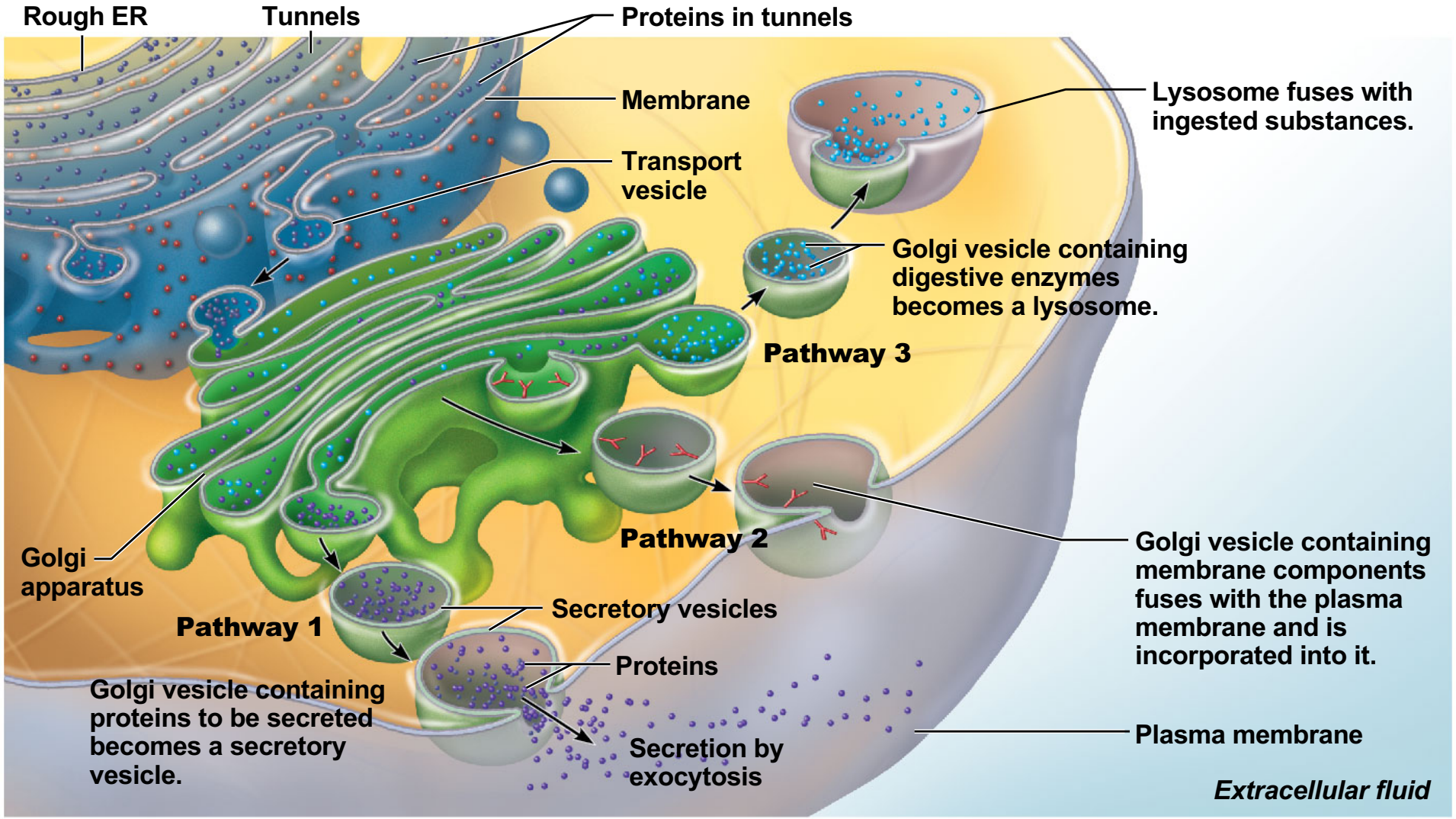


(1) As the protein is synthesized on the ribosome, it migrates into the rough ER tunnel system.

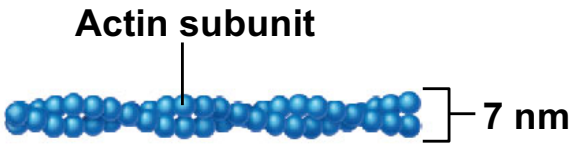
(2) In the tunnel, the protein folds into its functional shape. Short sugar chains may be attached to the protein (forming a glycoprotein).

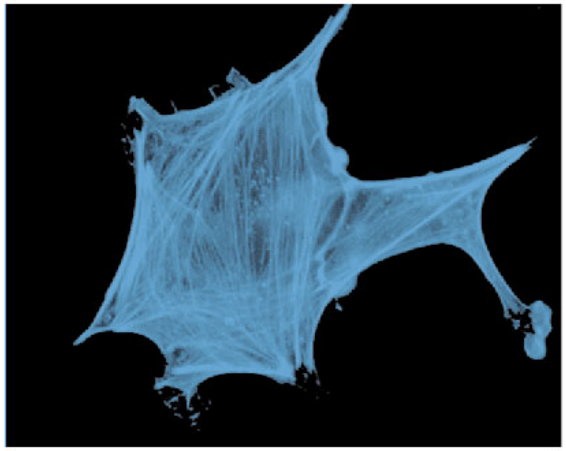
(3) The protein is packaged in a tiny membranous sac called a transport vesicle.

(4) The transport vesicle buds from the rough ER and travels to the Golgi apparatus for further processing.



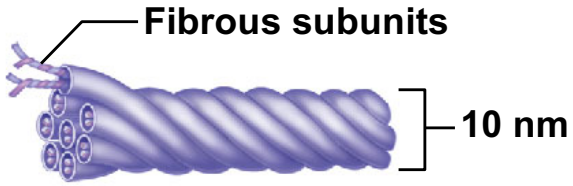
(a) Microfilaments

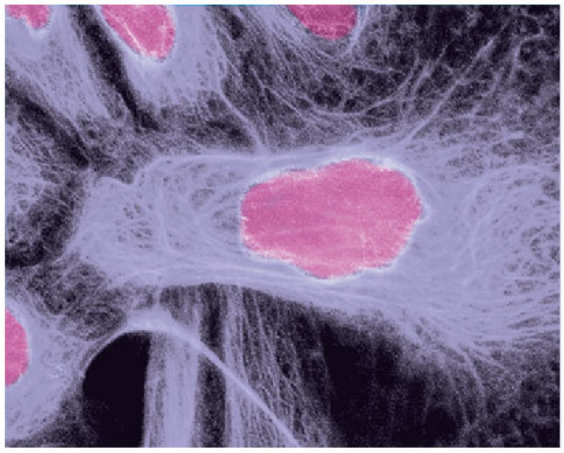




Microfilaments form the blue batlike network.

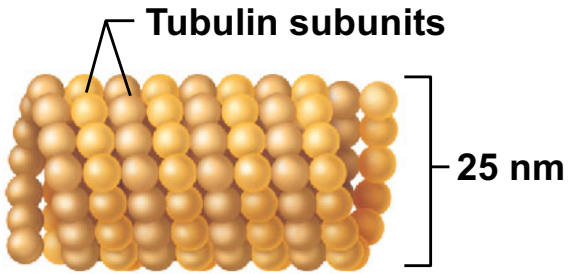
(b) Intermediate filaments

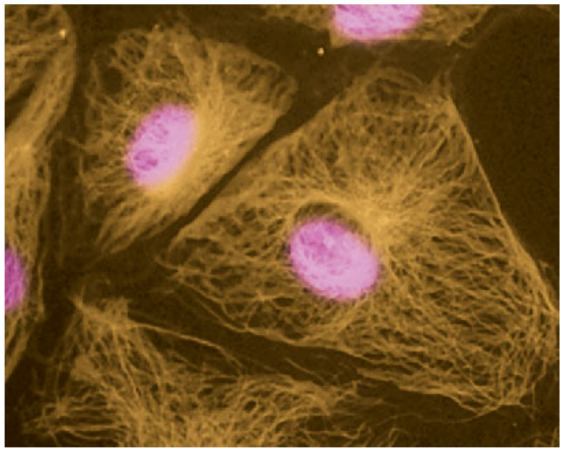




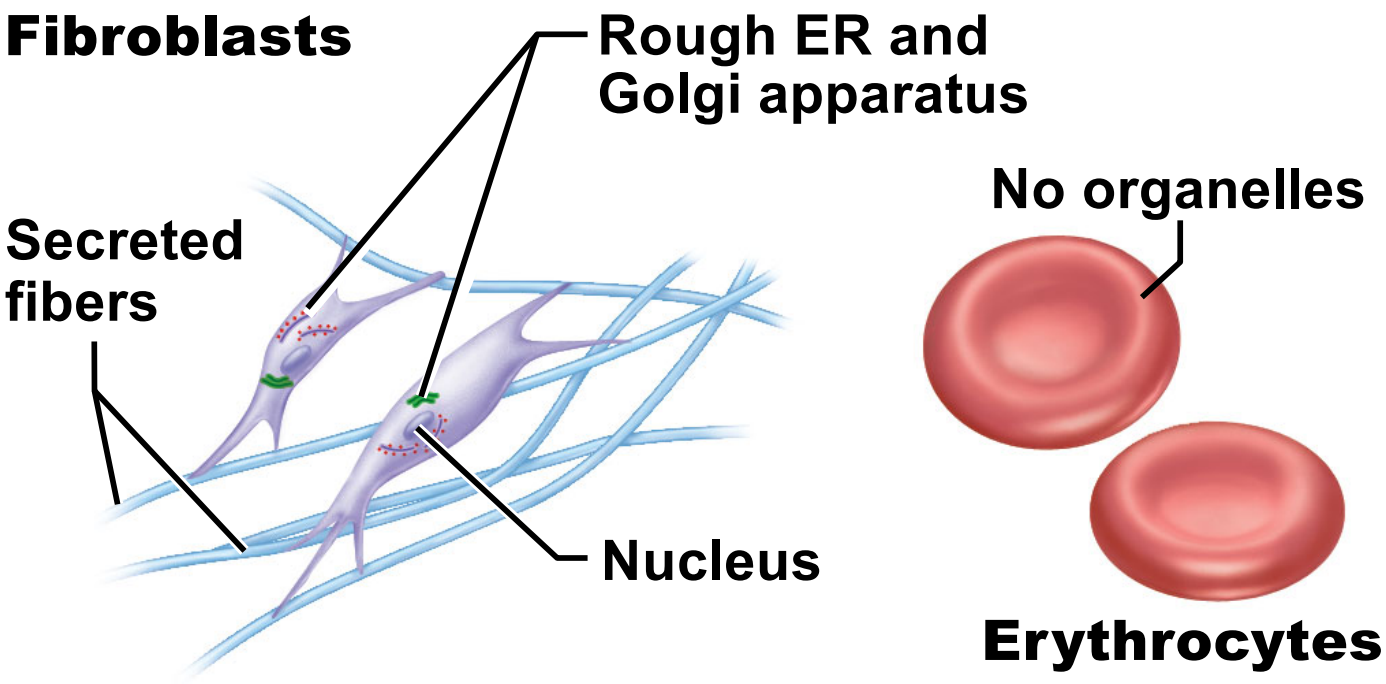
Intermediate filaments form the purple network surrounding the pink nucleus.

(c) Microtubules

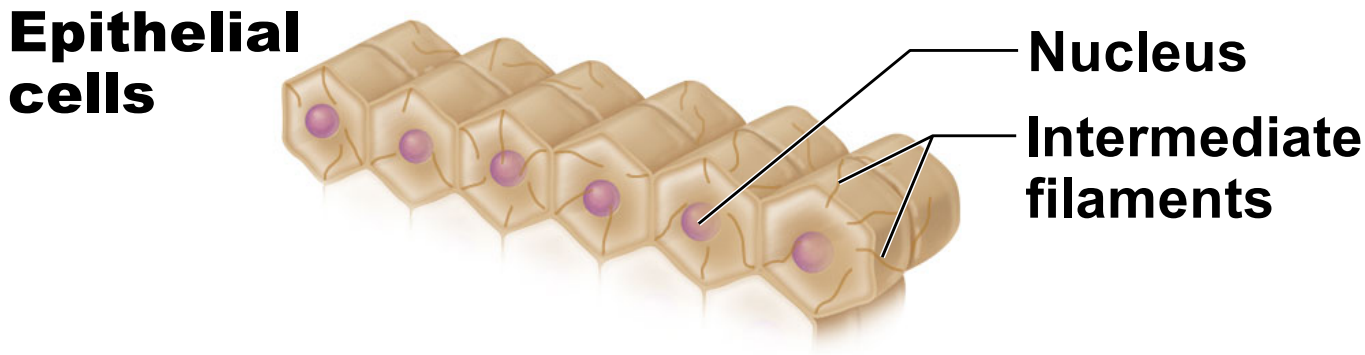




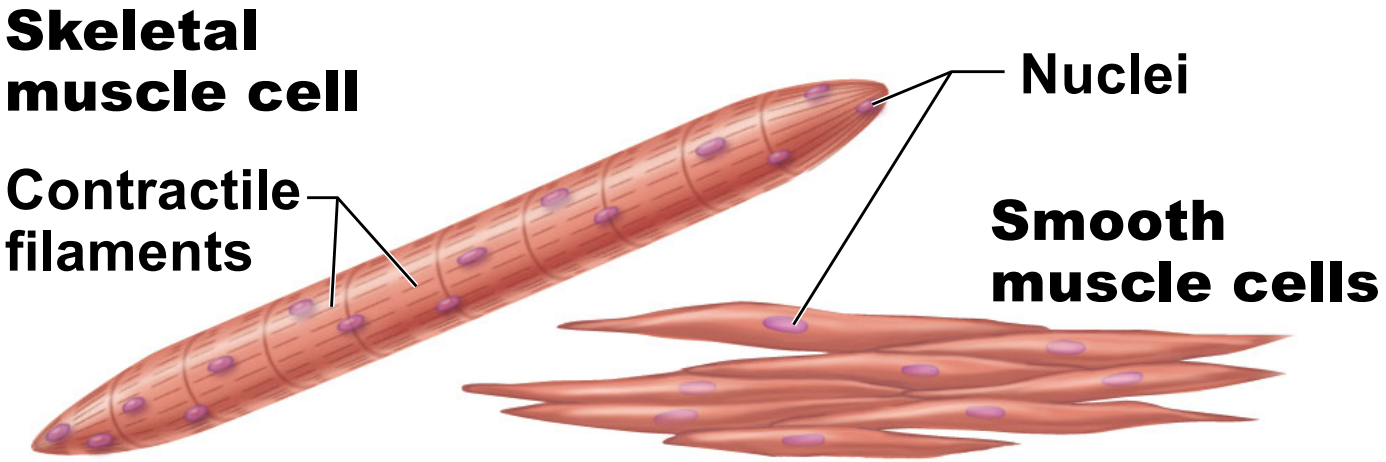
Microtubules appear as gold networks surrounding the cells' pink nuclei.



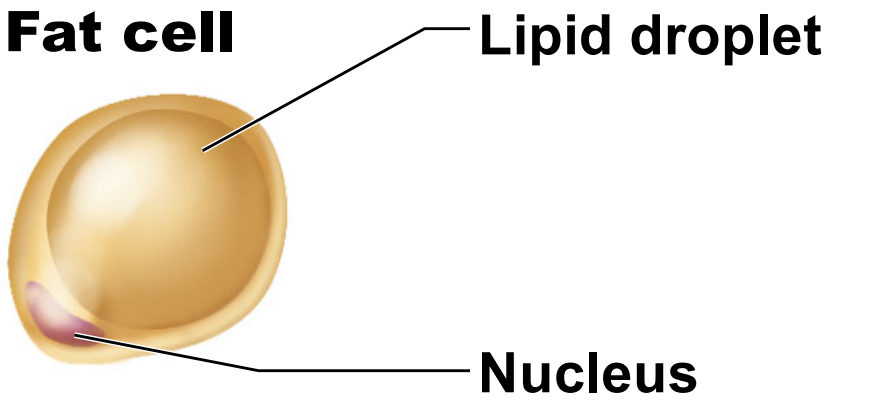
(a) Cells that connect body parts



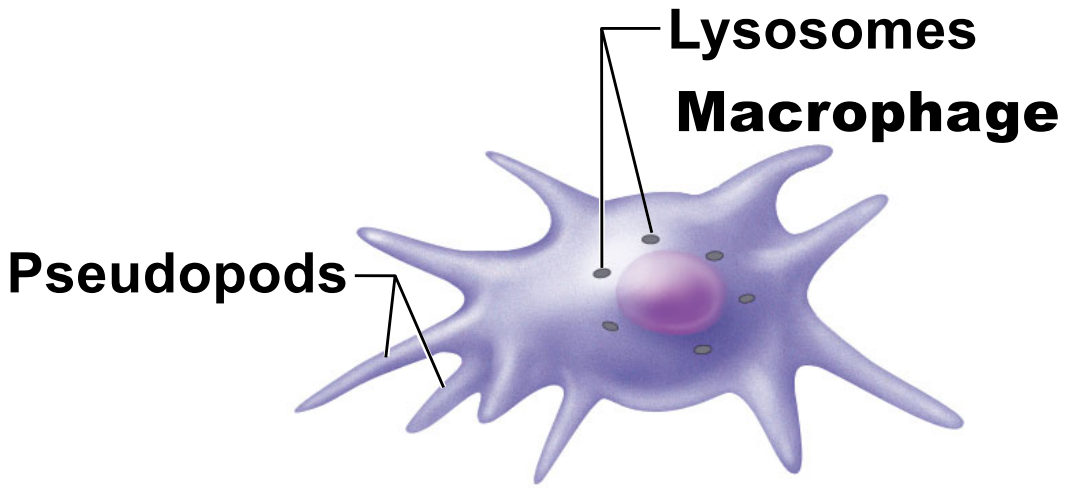
(b) Cells that cover and line body organs



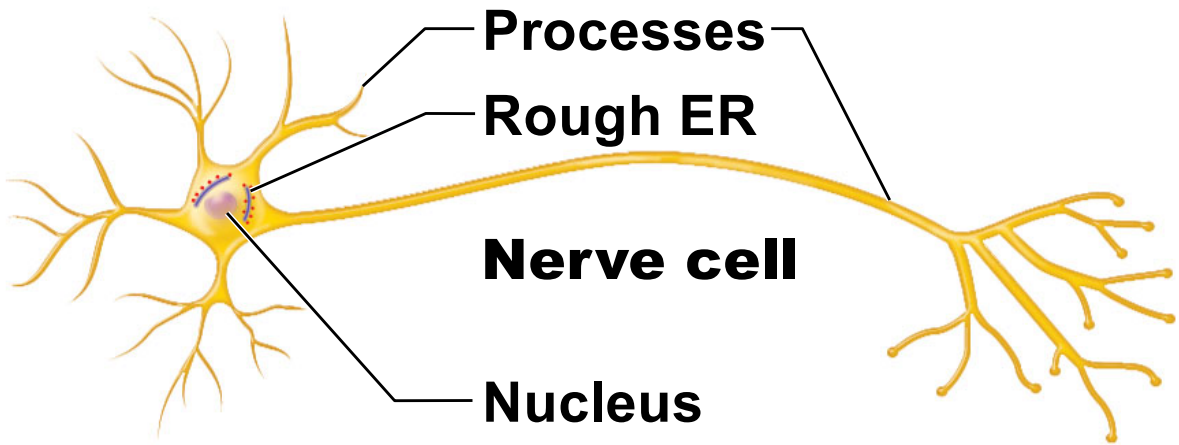
(c) Cells that move organs and body parts



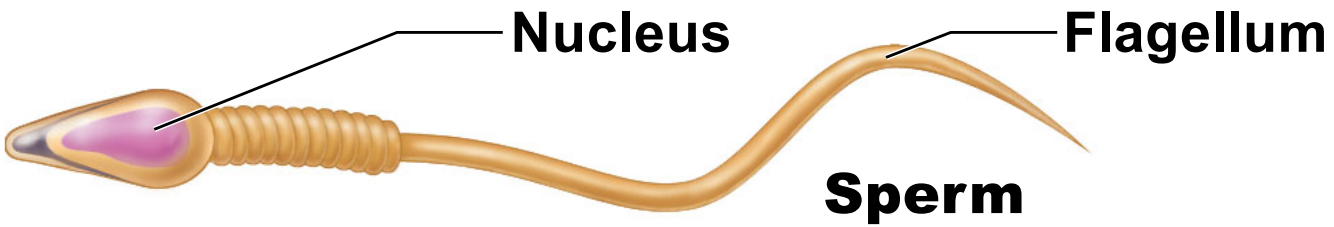
(d) Cell that stores nutrients



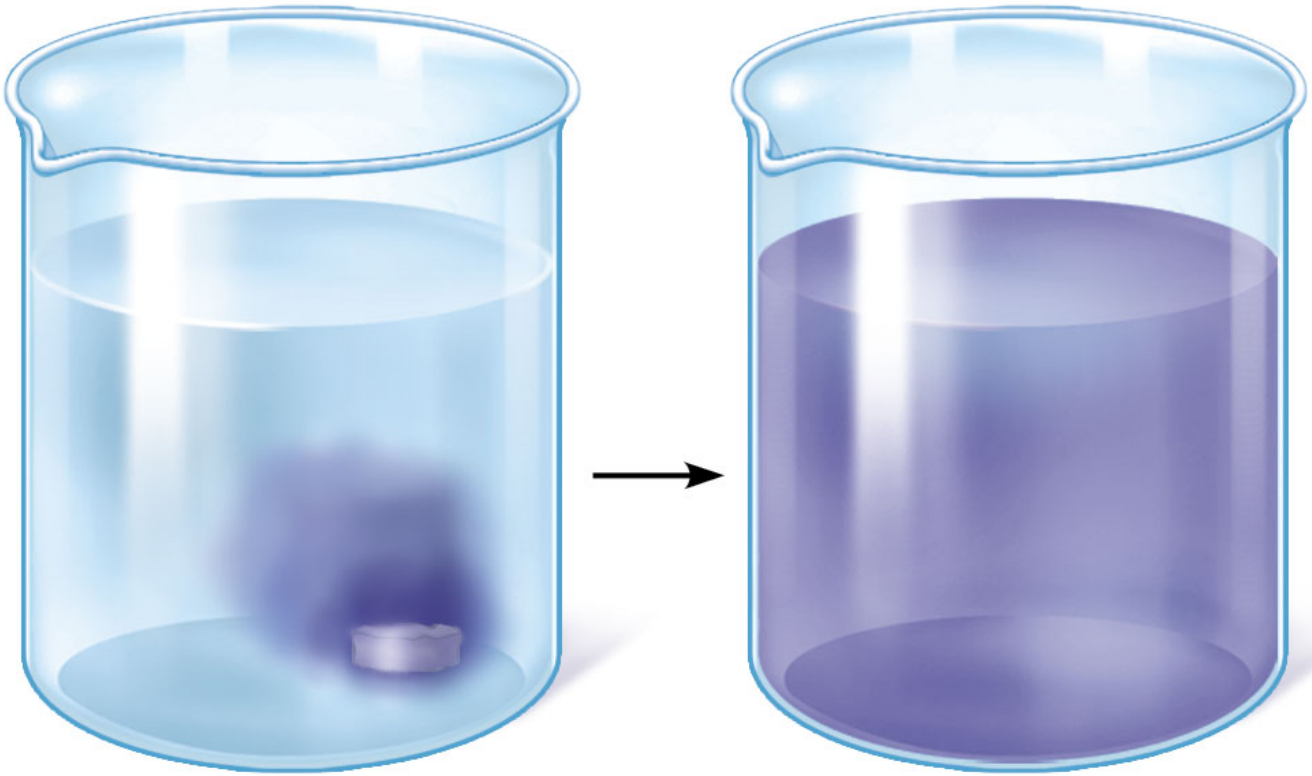
(e) Cell that fights disease

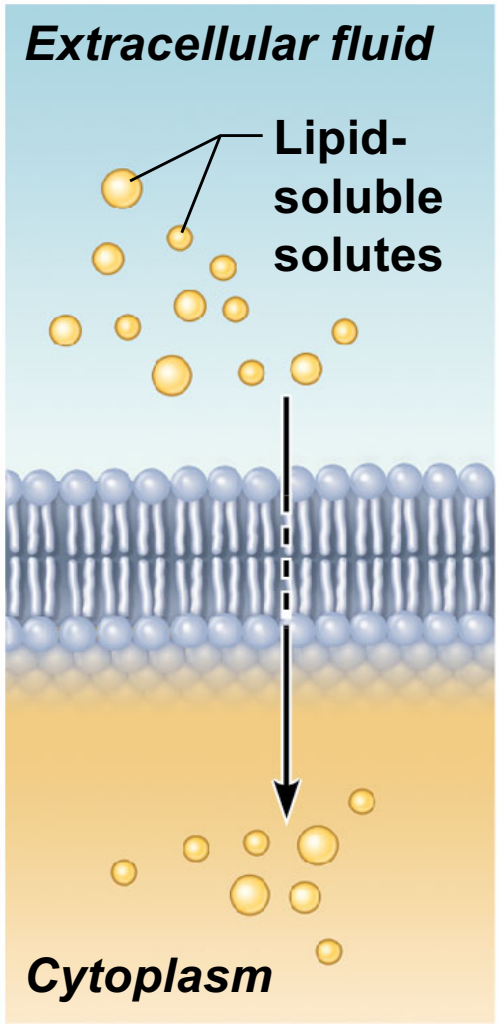


(f) Cell that gathers information and controls body functions

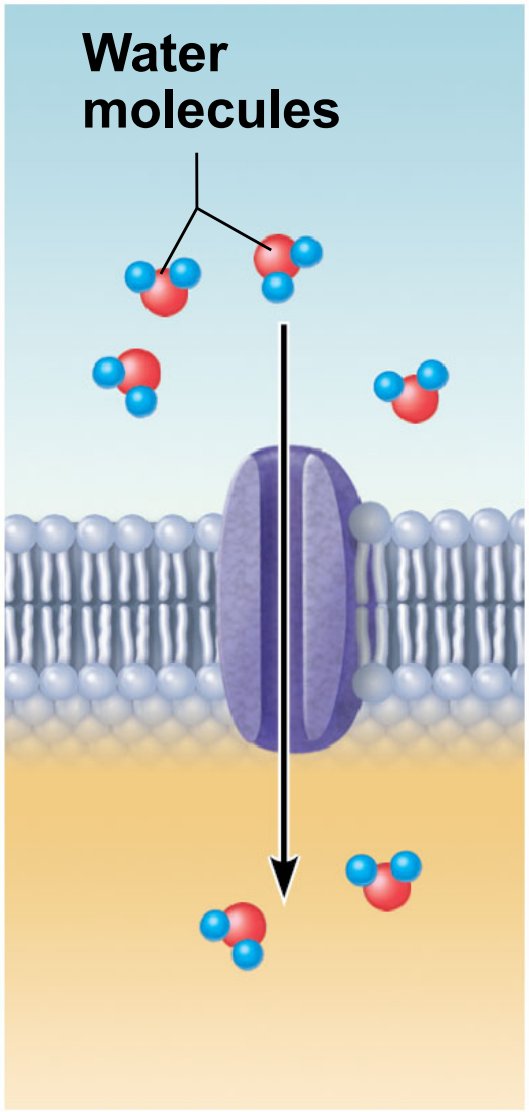


(g) Cell of reproduction

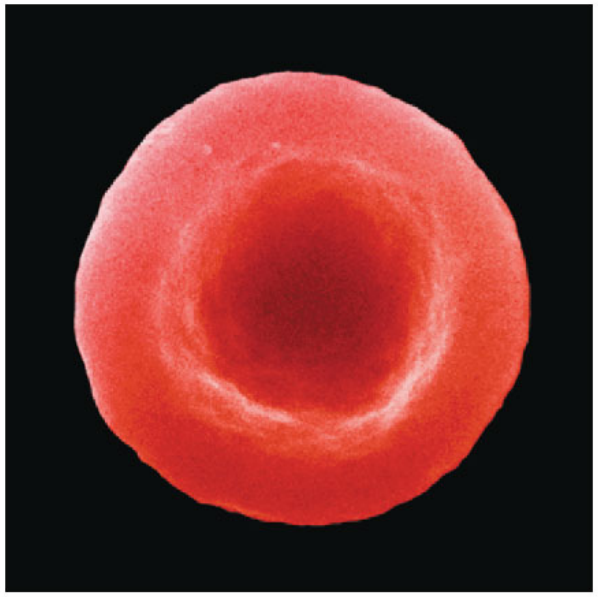




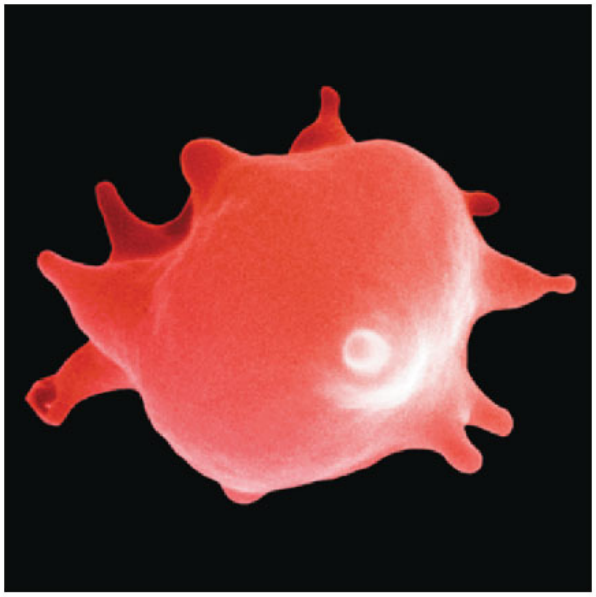
(a) Simple diffusion of lipid-soluble solutes directly through the phospholipid bilayer



(b) Osmosis, diffusion of water through a specific channel protein (aquaporin)

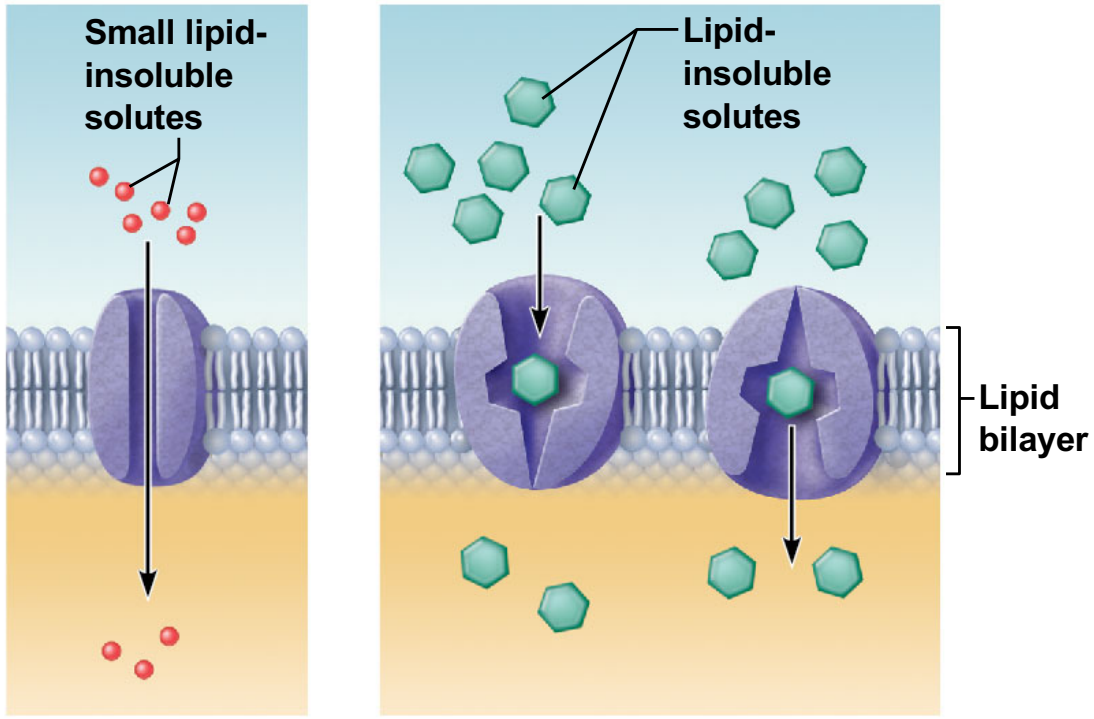


(a) RBC in isotonic solution



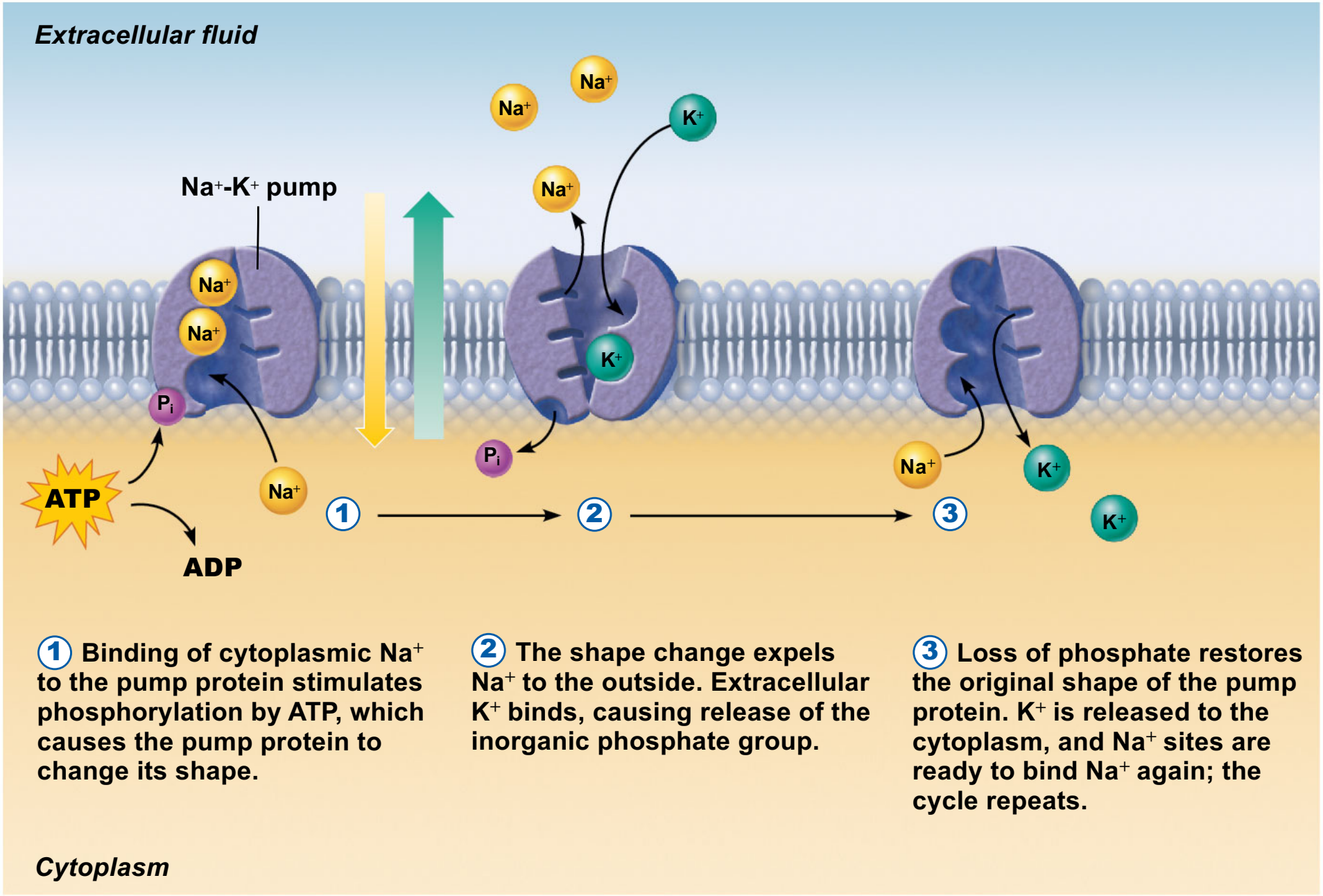
(b) RBC in hypertonic solution

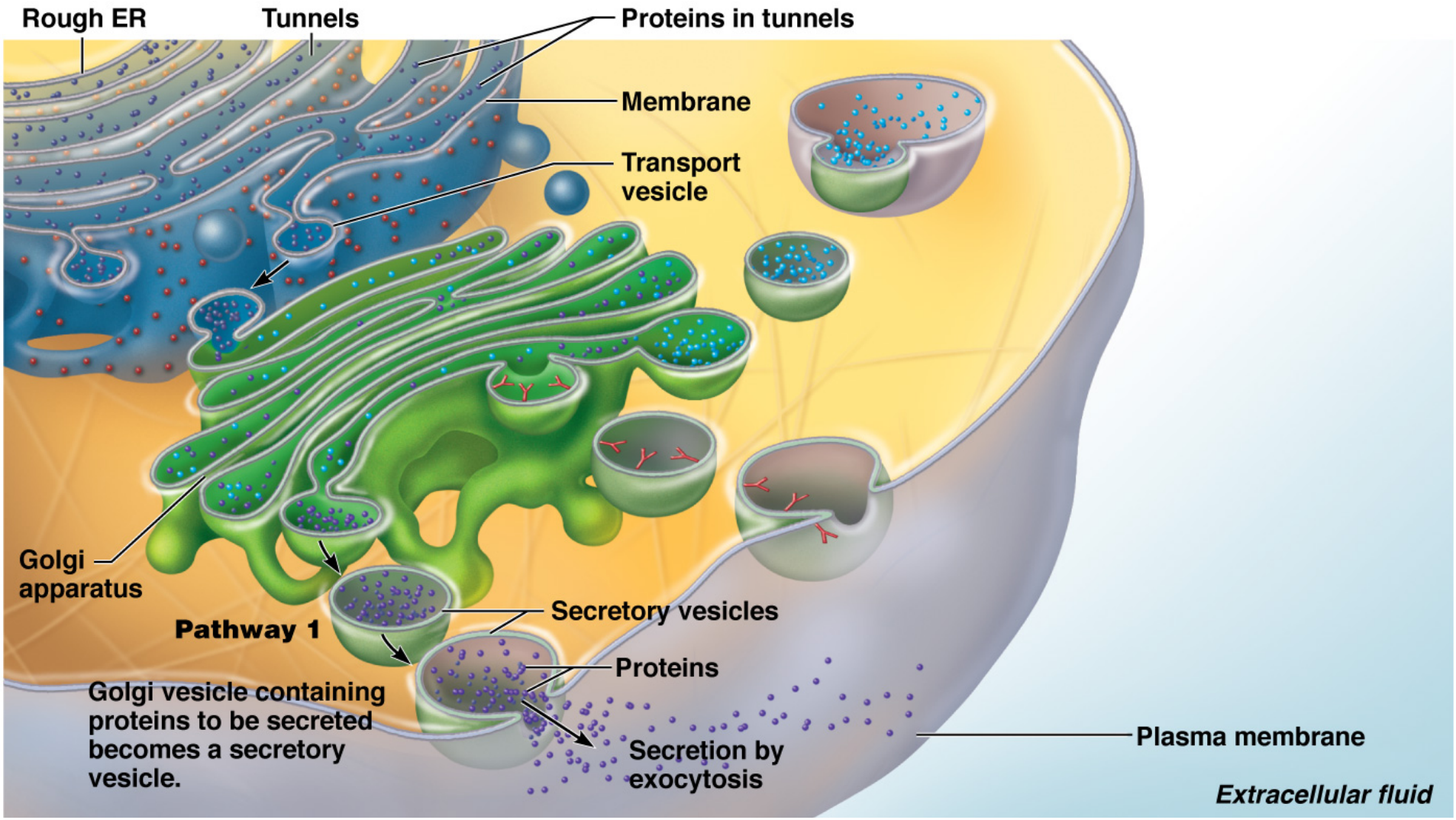
(c) RBC in hypotonic solution

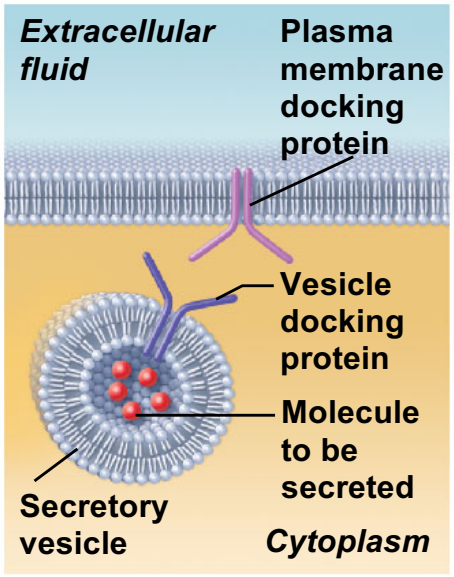


(c) **Facilitated diffusion** through a channel protein; mostly ions, selected on basis of size and charge

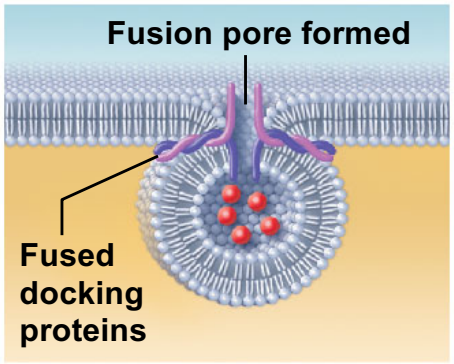
(d) **Facilitated diffusion** via protein carrier specific for one chemical; binding of substrate causes shape change in transport protein



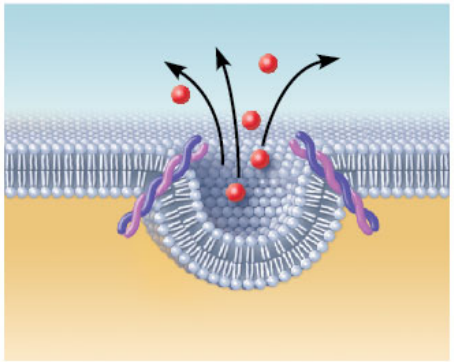

Rough ER
Tunnels
Proteins in tunnels
Membrane
Transport vesicle
Golgi apparatus
Pathway 1
Secretory vesicles
Proteins
Golgi vesicle containing proteins to be secreted becomes a secretory vesicle.
Secretion by exocytosis
Plasma membrane
Extracellular fluid



(1) The membrane-bound vesicle migrates to the plasma membrane.

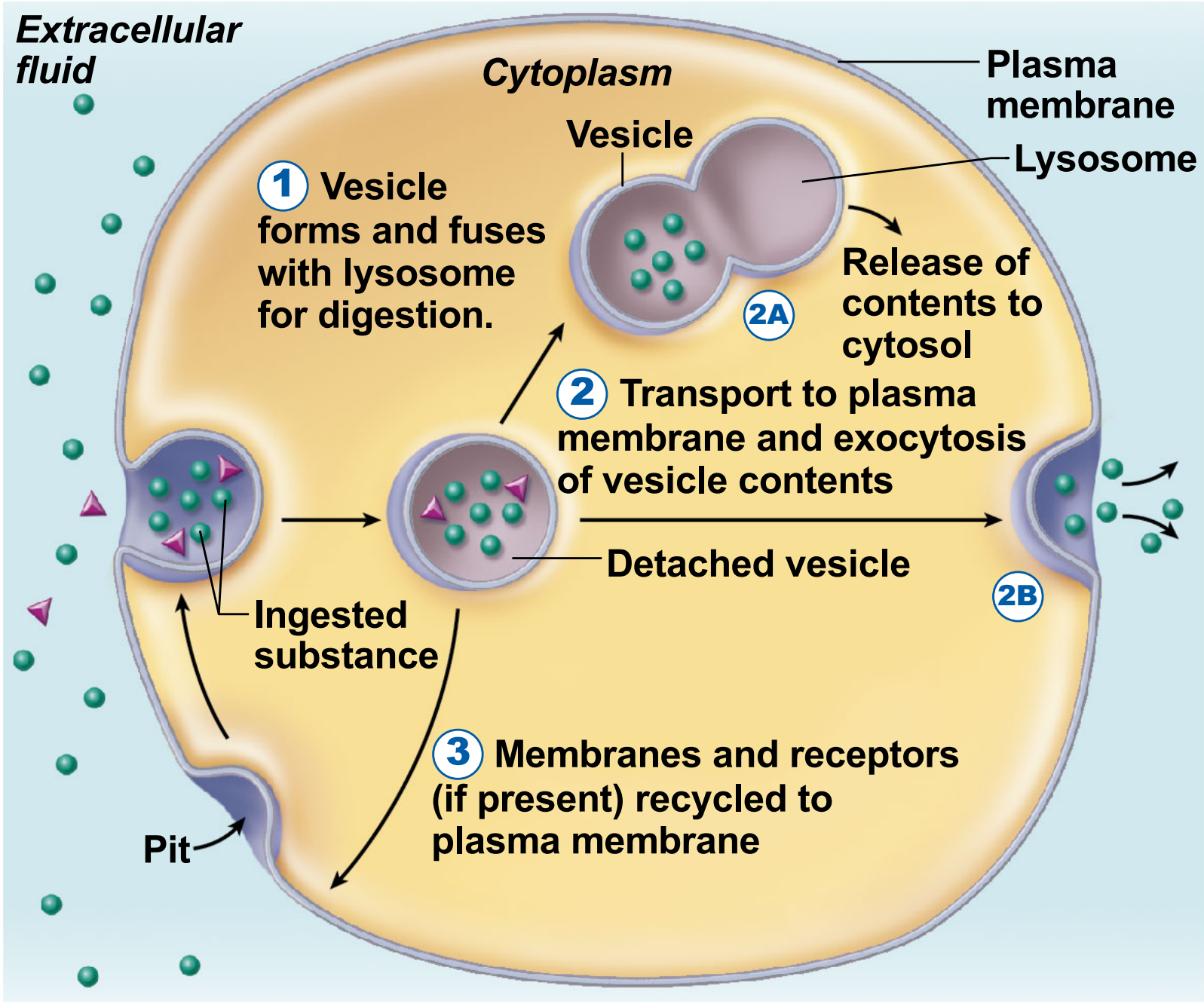


(2) There, docking proteins on the vesicle and plasma membrane bind, the vesicle and membrane fuse, and a pore opens up.

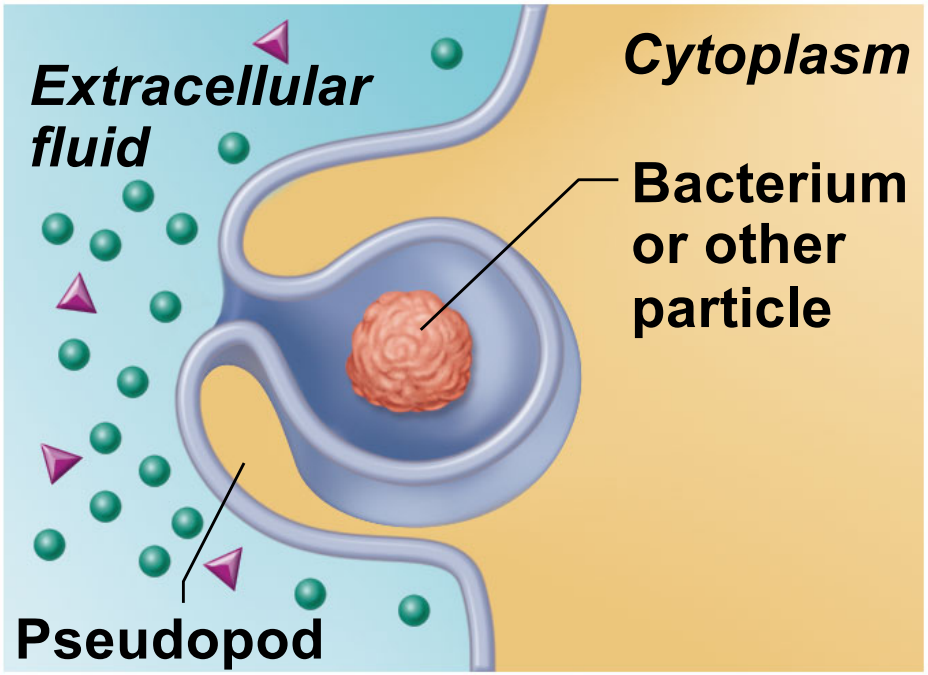


(3) Vesicle contents are released to the cell exterior.

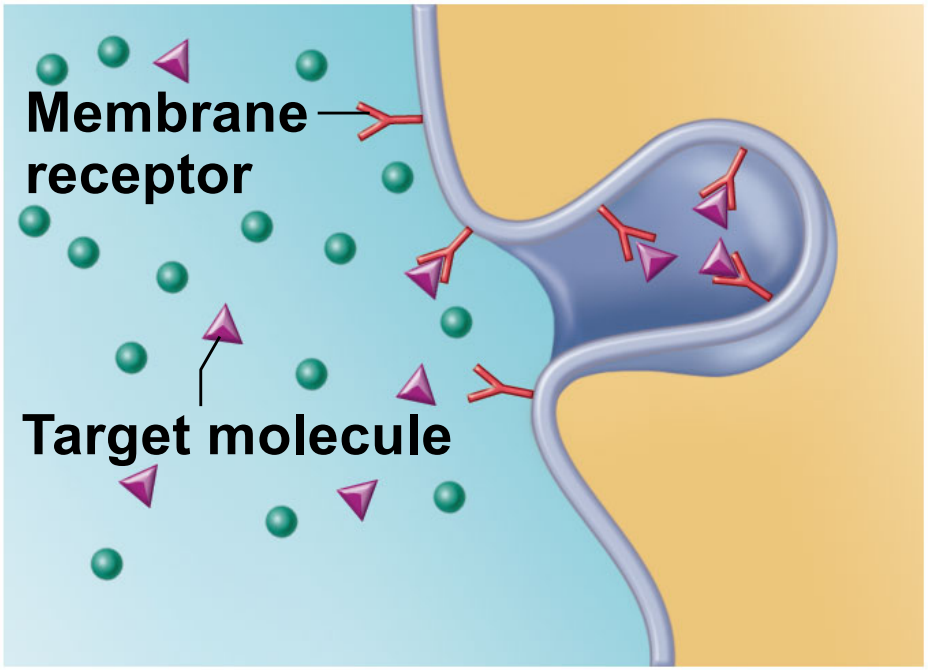
(a) The process of exocytosis



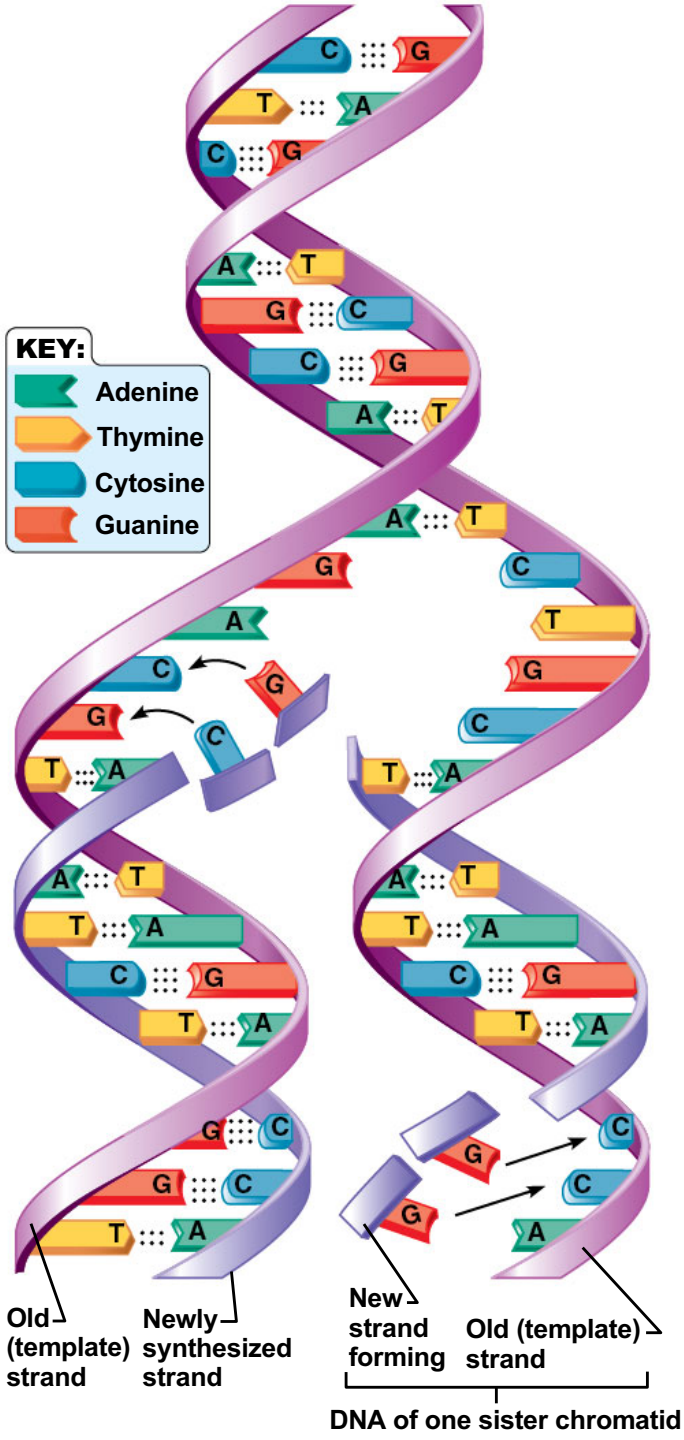
(a) Endocytosis (pinocytosis)

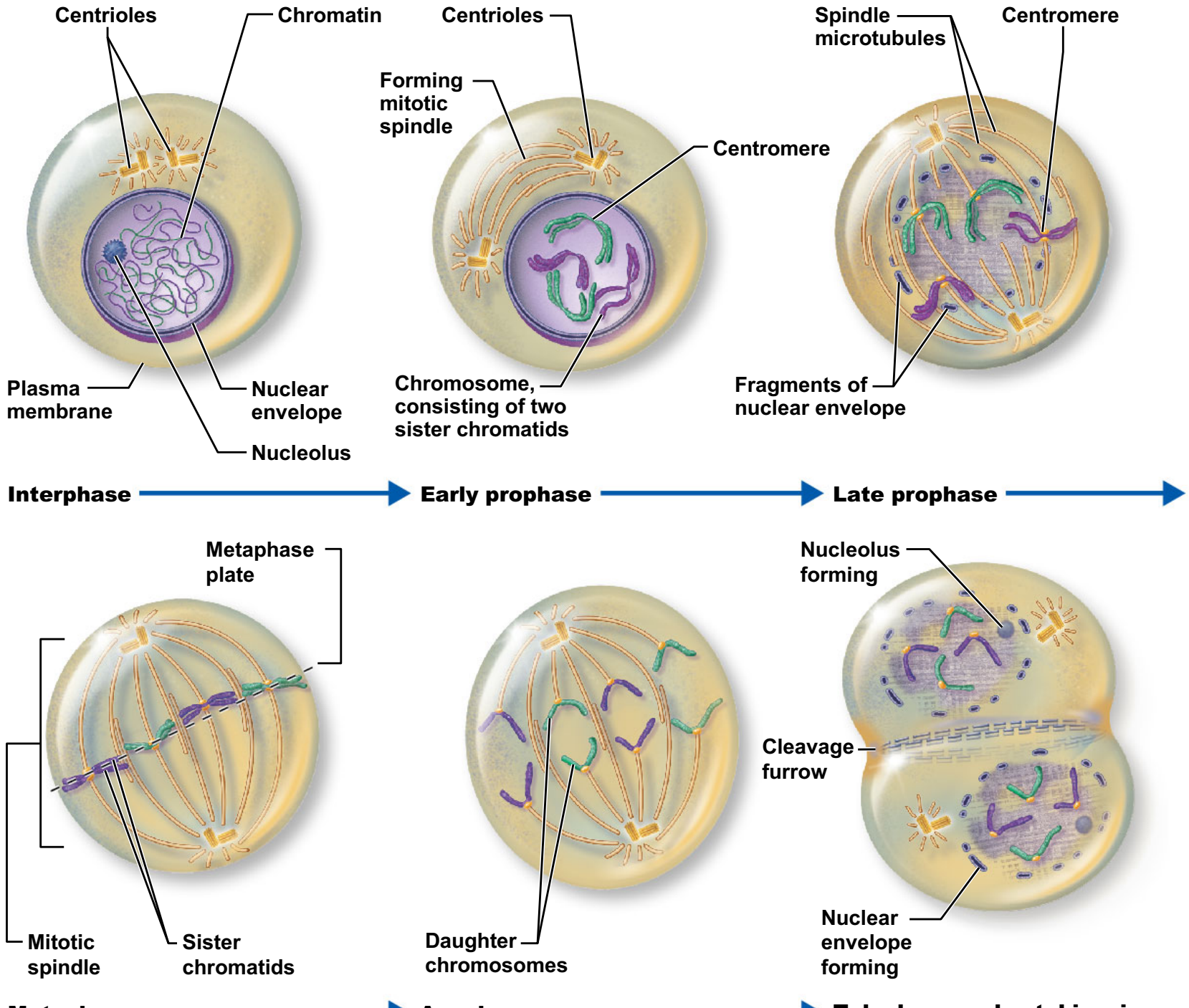


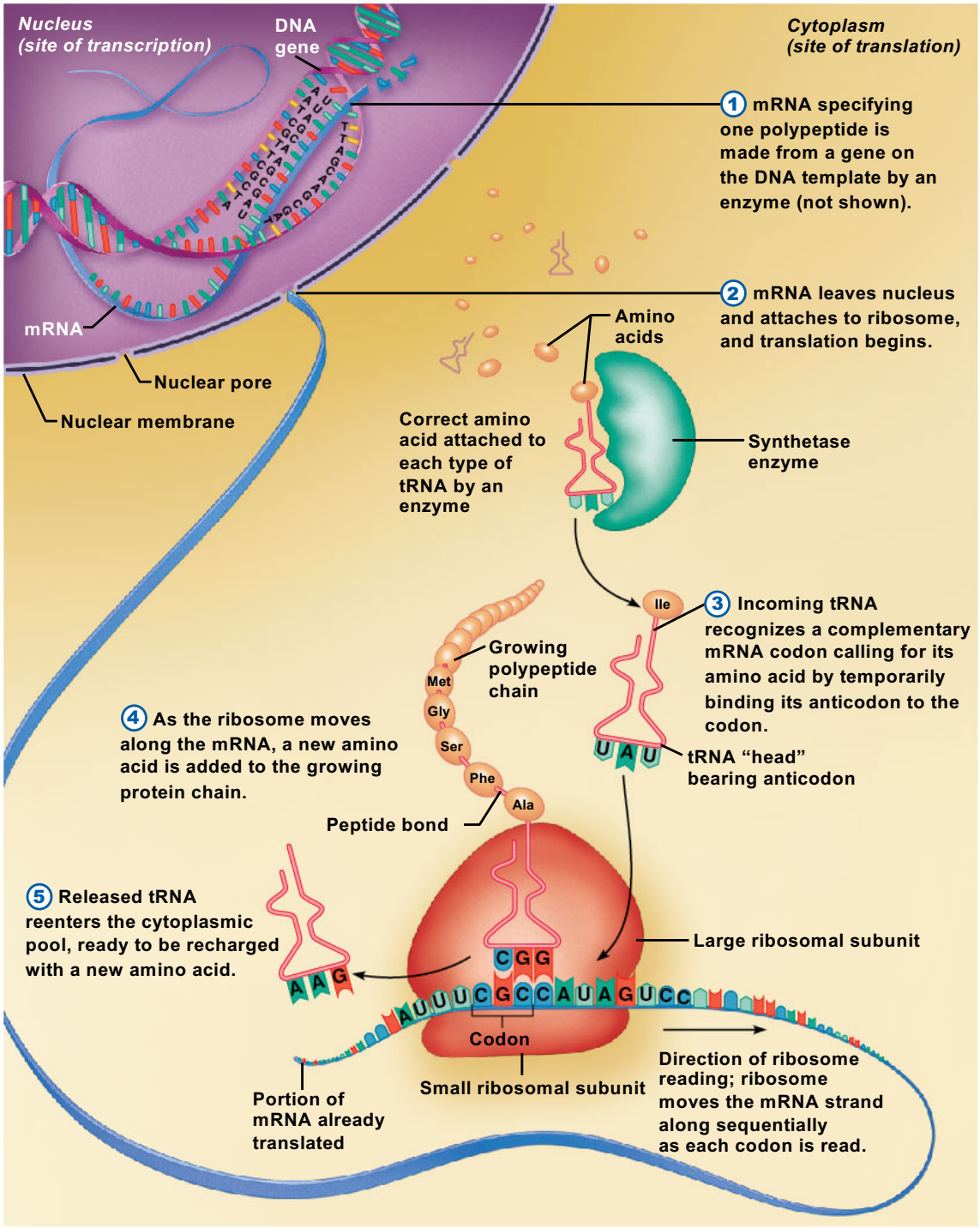
(b) Phagocytosis

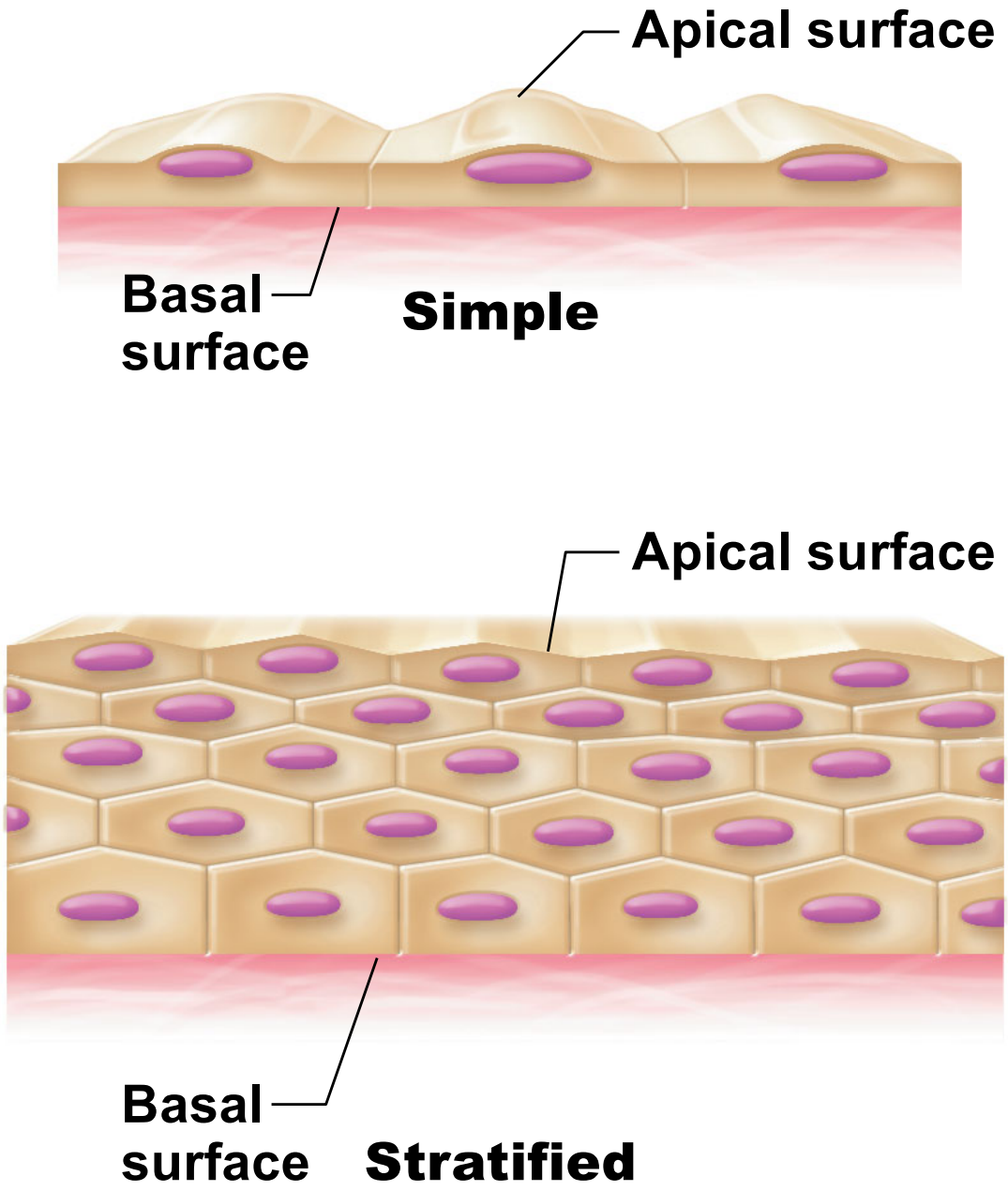


(c) Receptor-mediated endocytosis

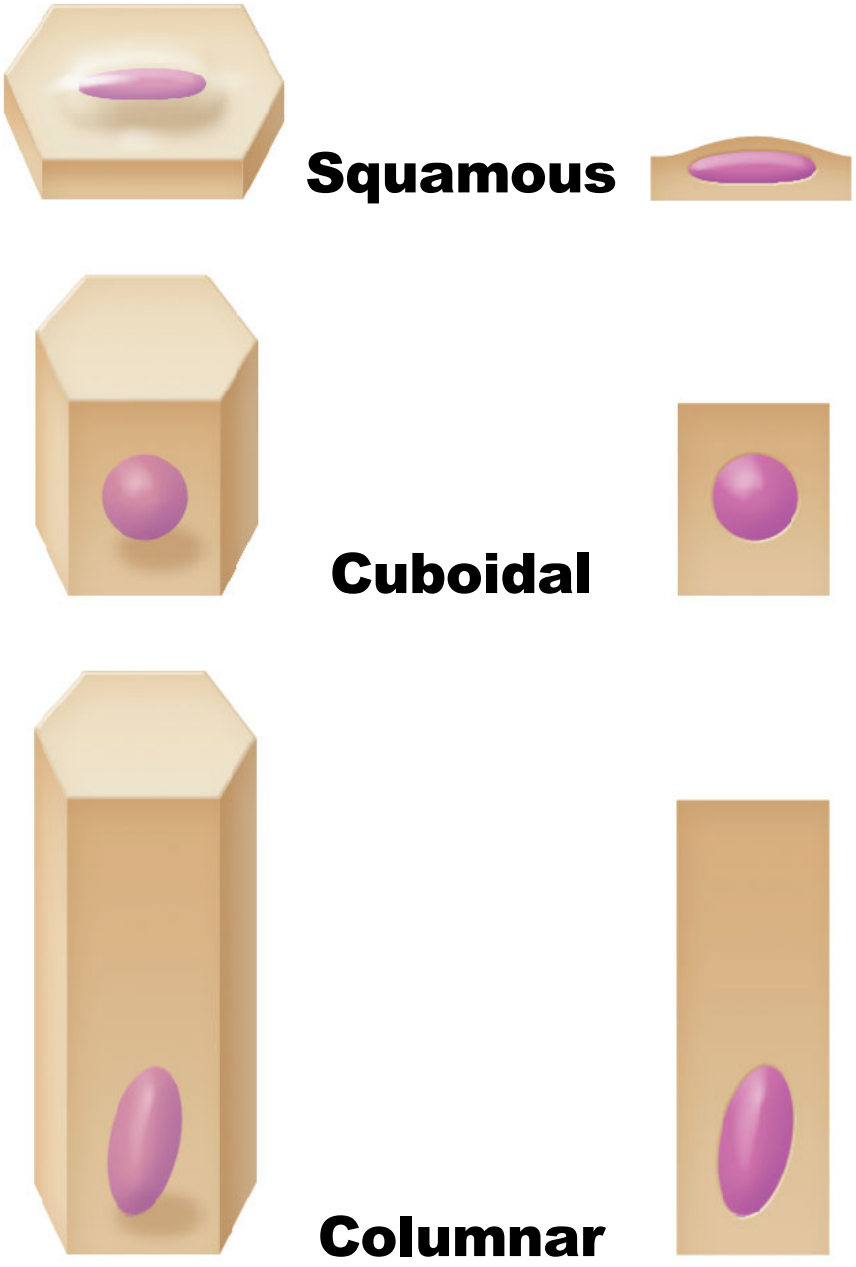








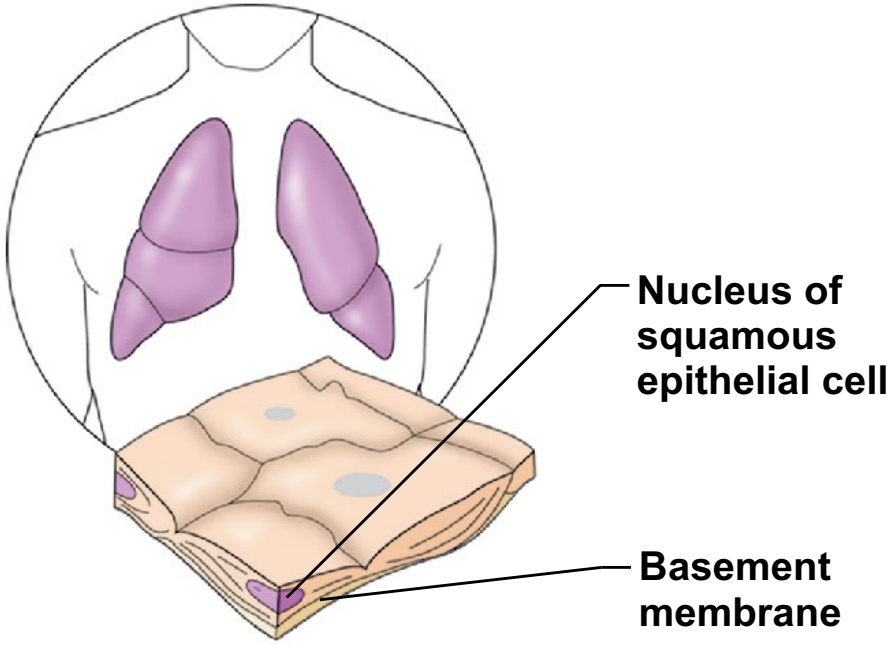
(a) Classification based on number of cell layers



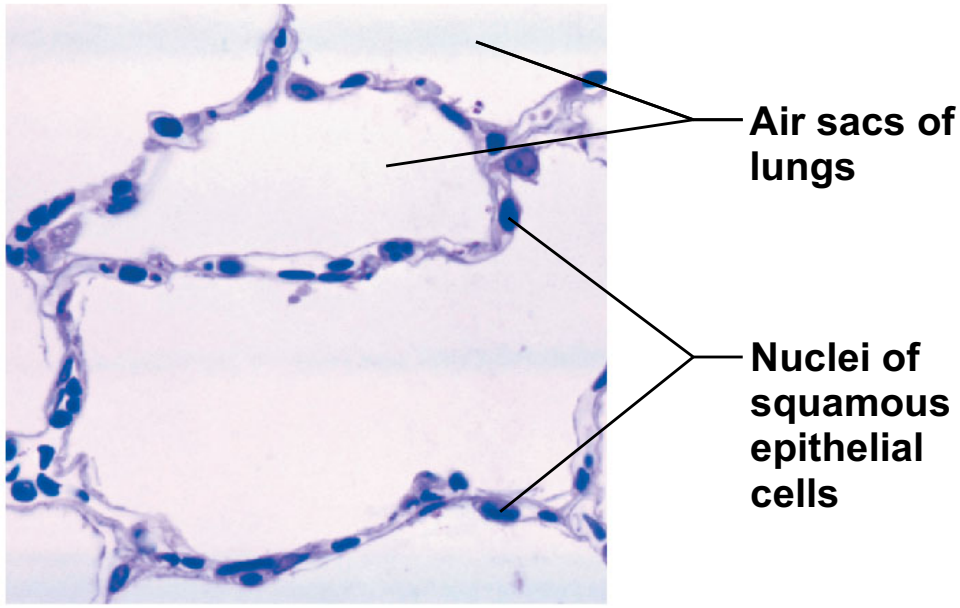
(b) Classification based on cell shape

Cell shape	Number of layers	
	One layer: simple epithelial tissues	More than one layer: stratified epithelial tissues
Squamous	Diffusion and filtration Secretion in serous membranes	Protection
Cuboidal	Secretion and absorption; ciliated types propel mucus or reproductive cells	Protection; these tissue types are rare in humans
Columnar	Secretion and absorption; ciliated types propel mucus or reproductive cells	
Transitional	No simple transitional epithelium exists	Protection; stretching to accommodate distension of urinary structures

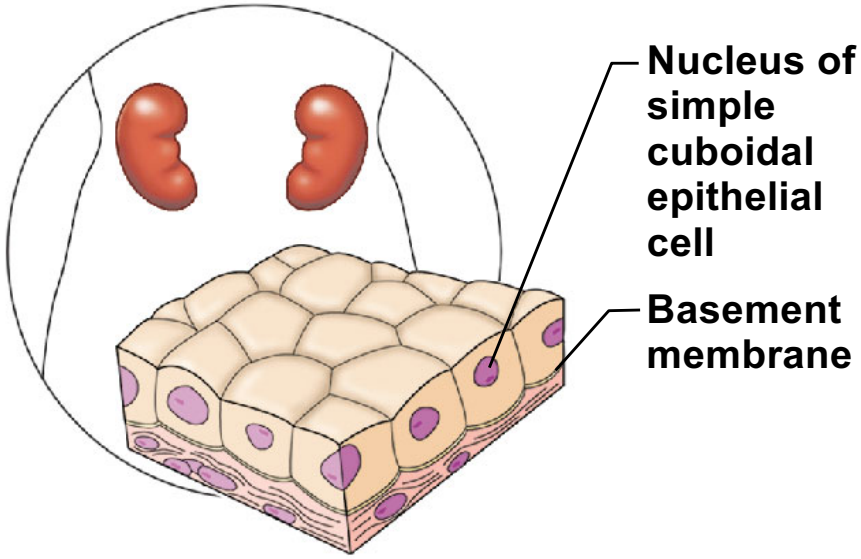
(c) Function of epithelial tissue related to tissue type



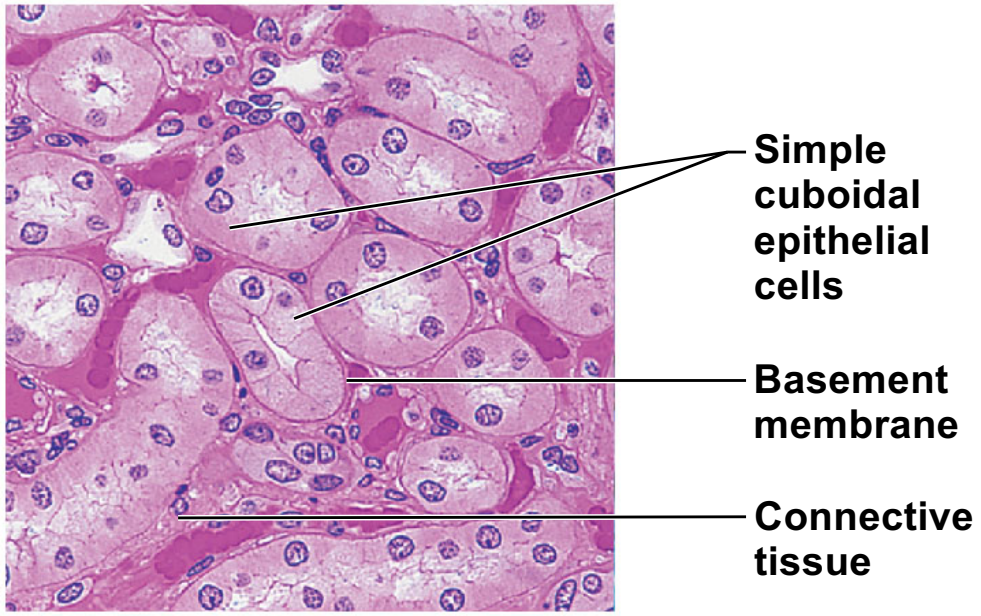
(a) Diagram: Simple squamous



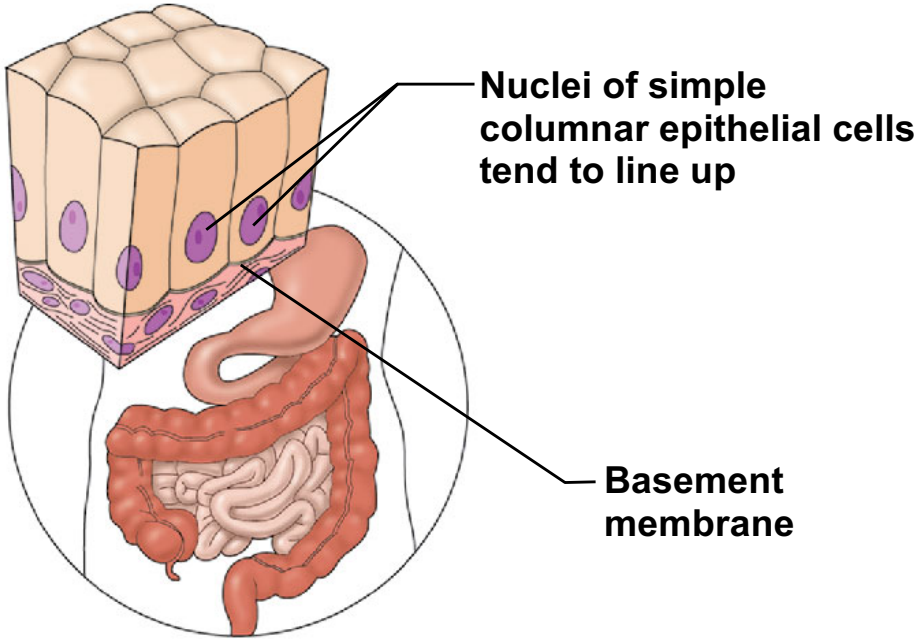
Photomicrograph: Simple squamous epithelium forming part of the alveolar (air sac) walls (275×).



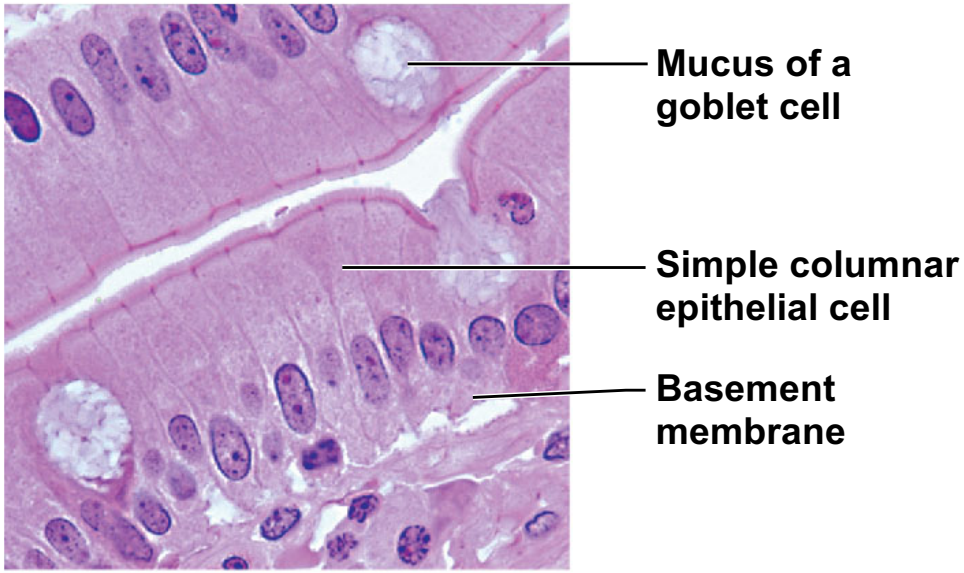
(b) Diagram: Simple cuboidal



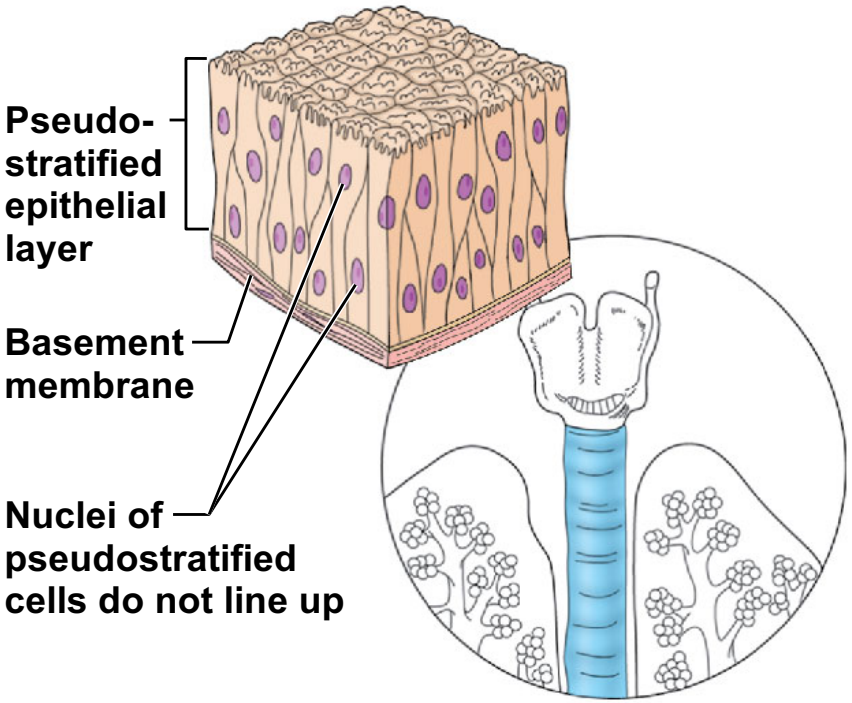
Photomicrograph: Simple cuboidal epithelium in kidney tubules (250 ×).



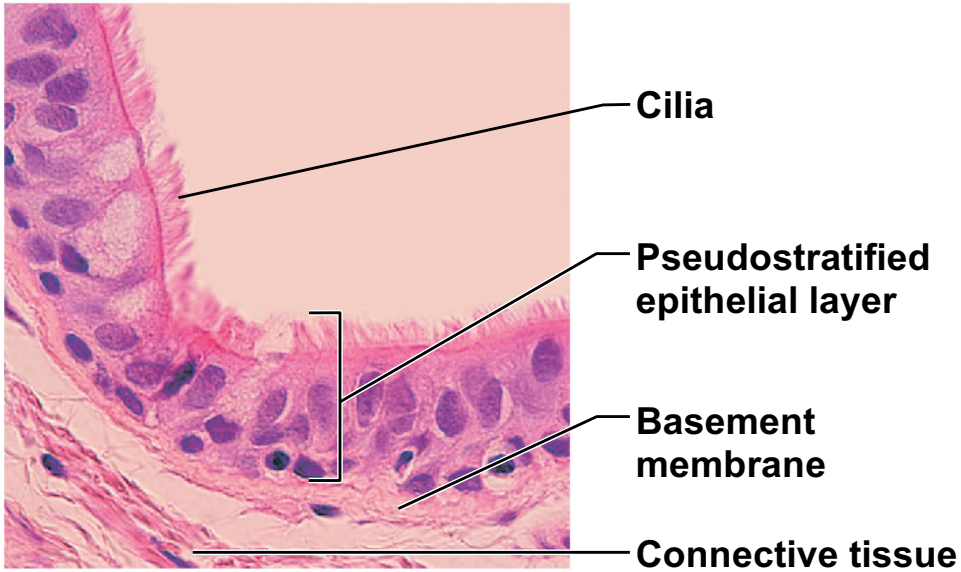
(c) Diagram: Simple columnar



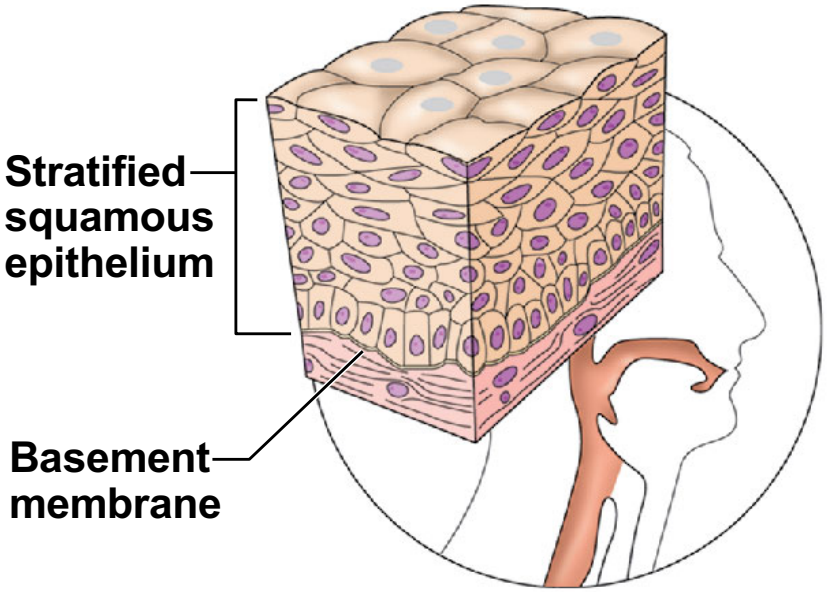
Photomicrograph: Simple columnar epithelium of the small intestine (575×).



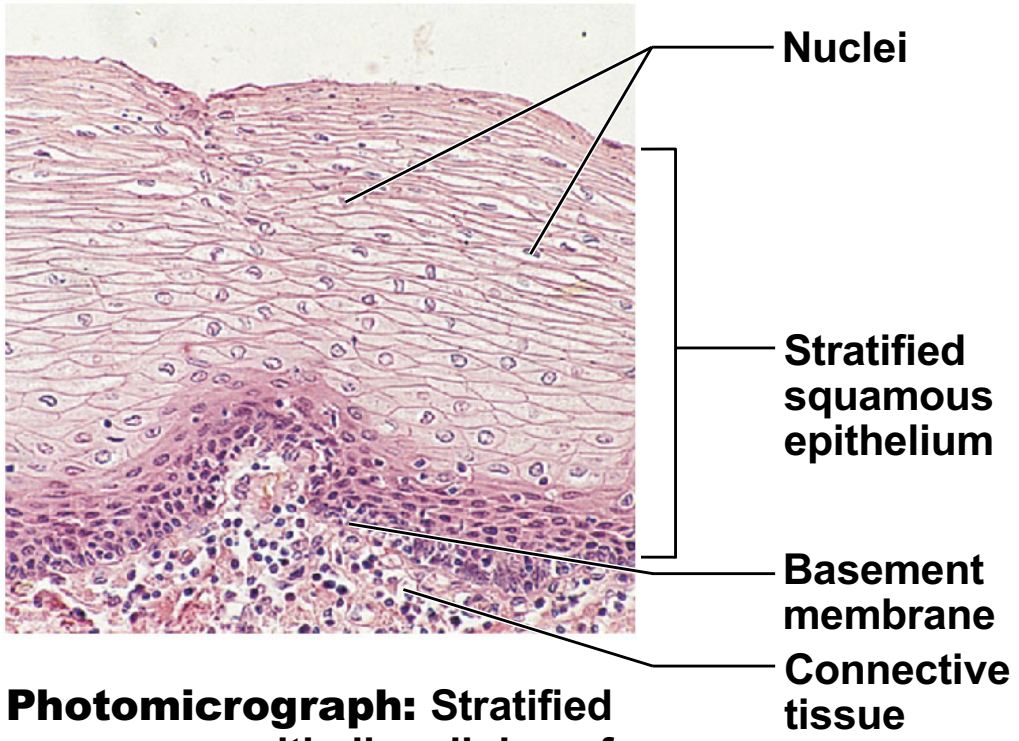
(d) Diagram: Pseudostratified (ciliated) columnar



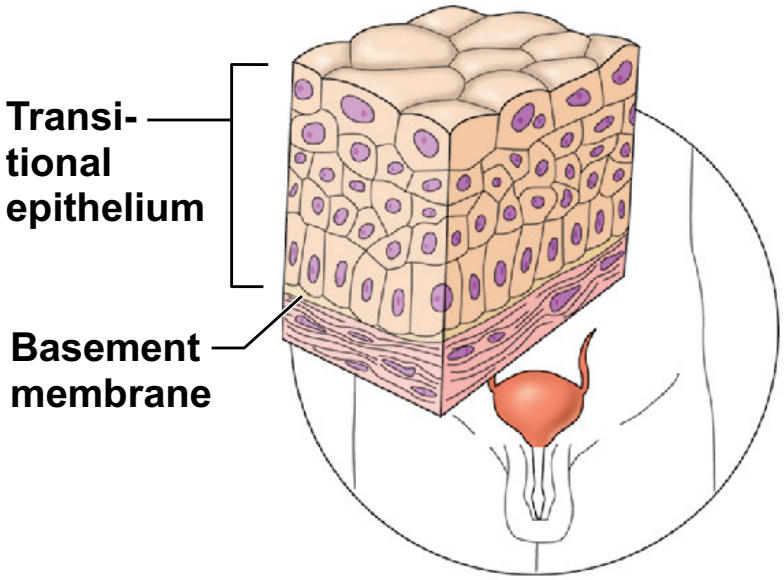
Photomicrograph: Pseudostratified ciliated columnar epithelium lining the human trachea (560 ×).



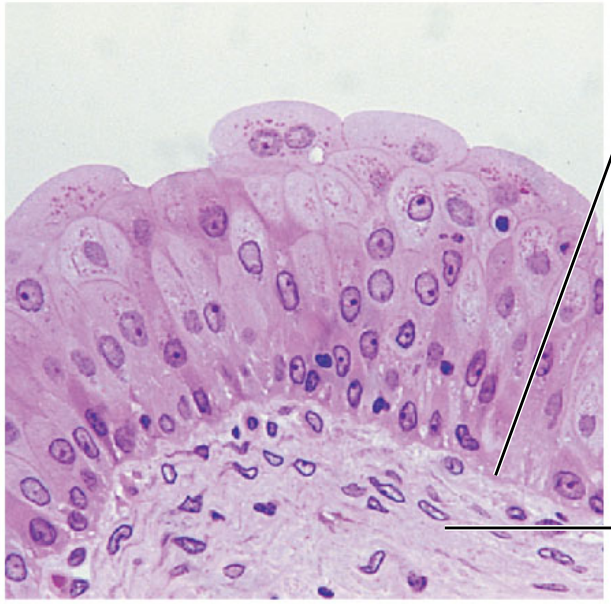
(e) Diagram: Stratified squamous



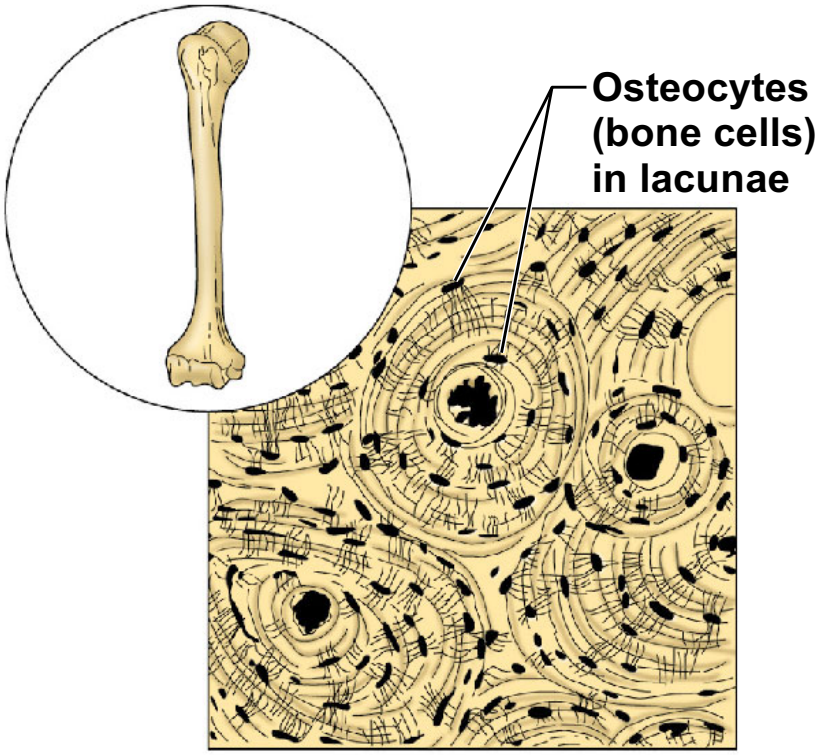
Photomicrograph: Stratified squamous epithelium lining of the esophagus (140 ×).



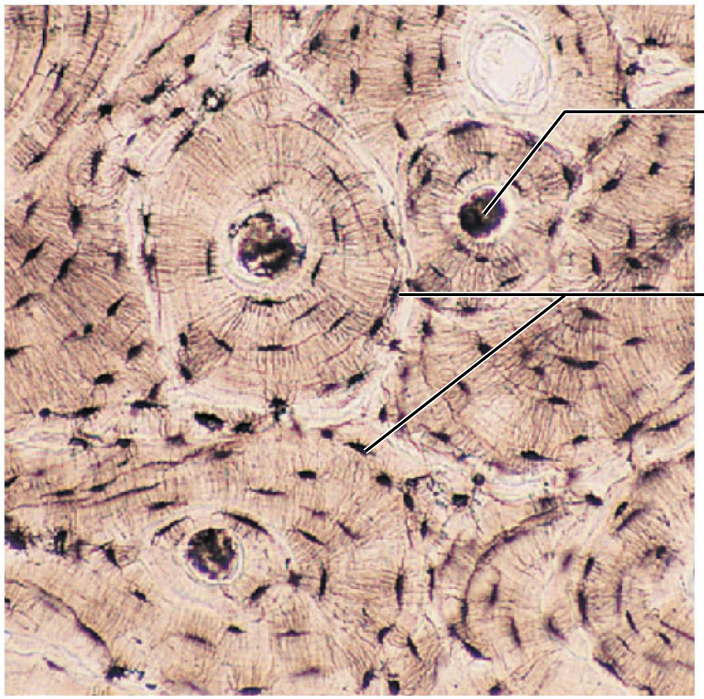
(f) Diagram: Transitional



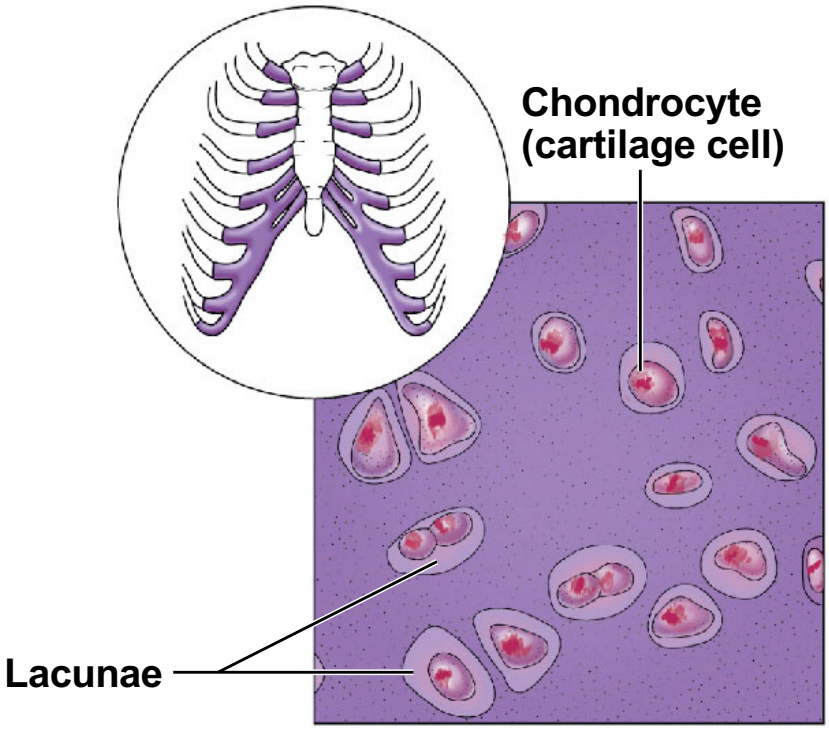
Photomicrograph: Transitional epithelium lining of the bladder, relaxed state (270×); surface rounded cells flatten and elongate when the bladder fills with urine.



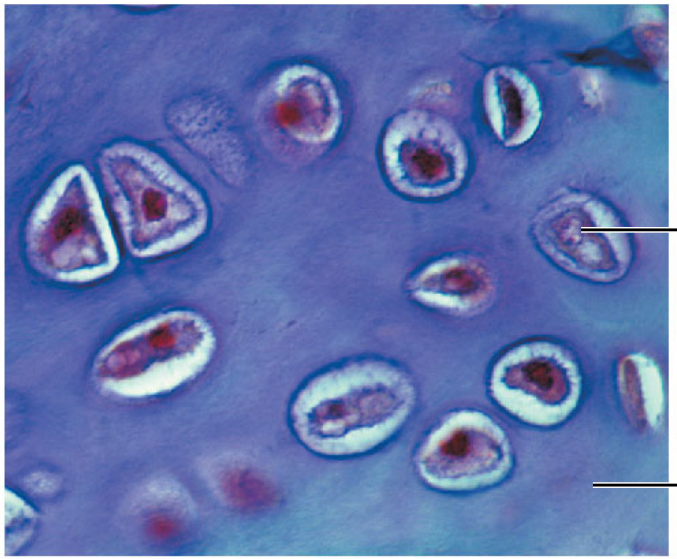
(a) Diagram: Bone



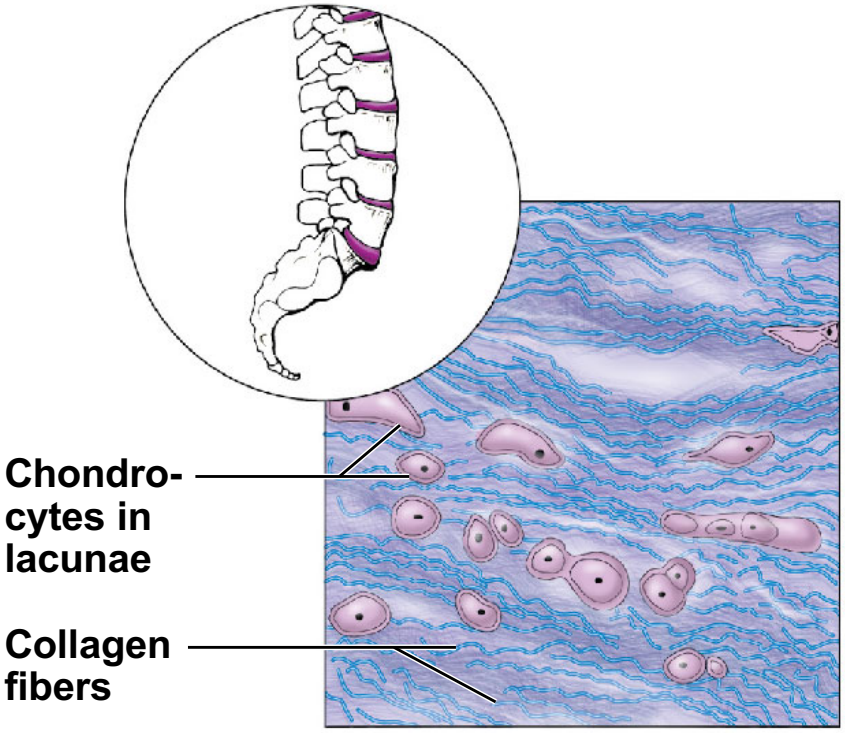
Photomicrograph: Cross-sectional view of bone (165×).



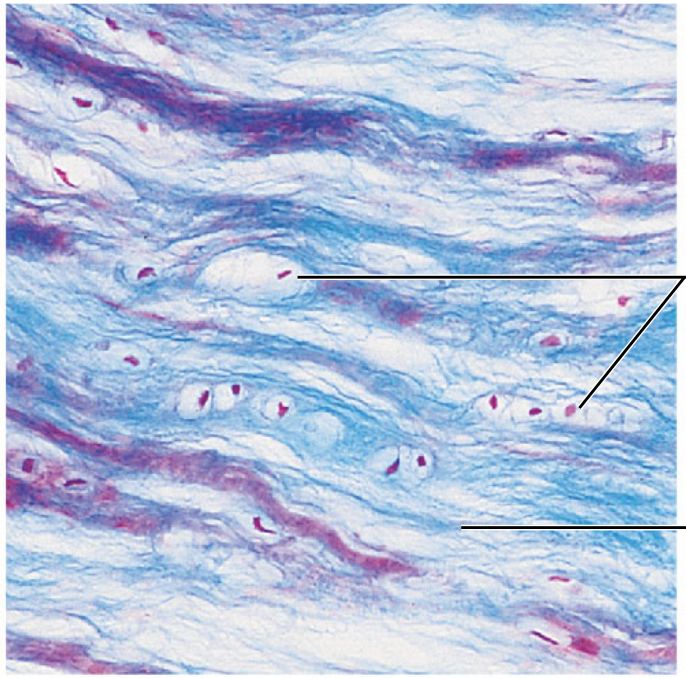
(b) Diagram: Hyaline cartilage



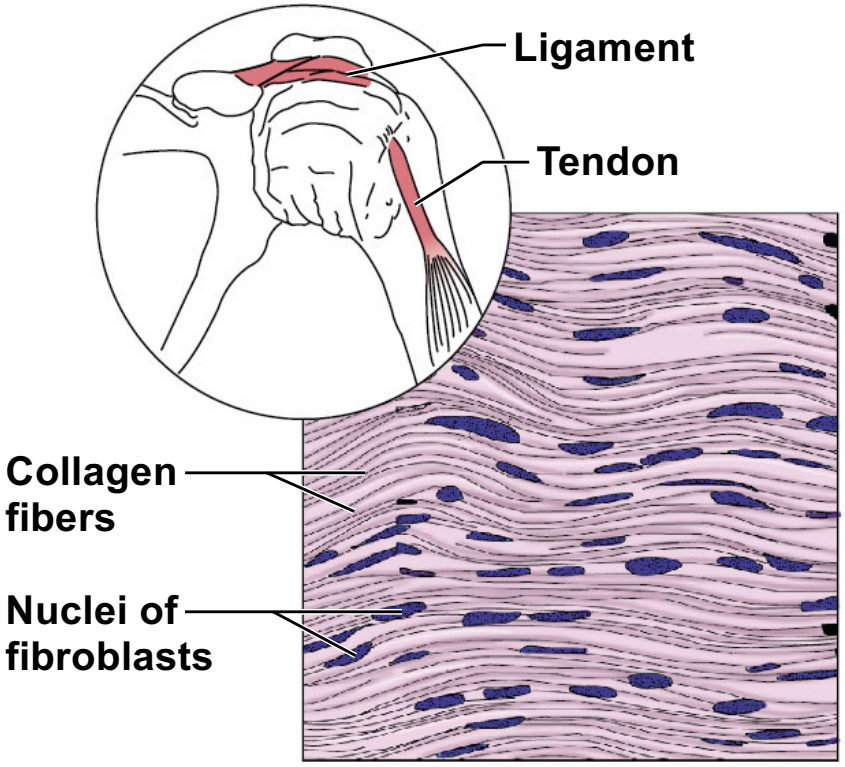
Photomicrograph: Hyaline cartilage from the trachea (400×).



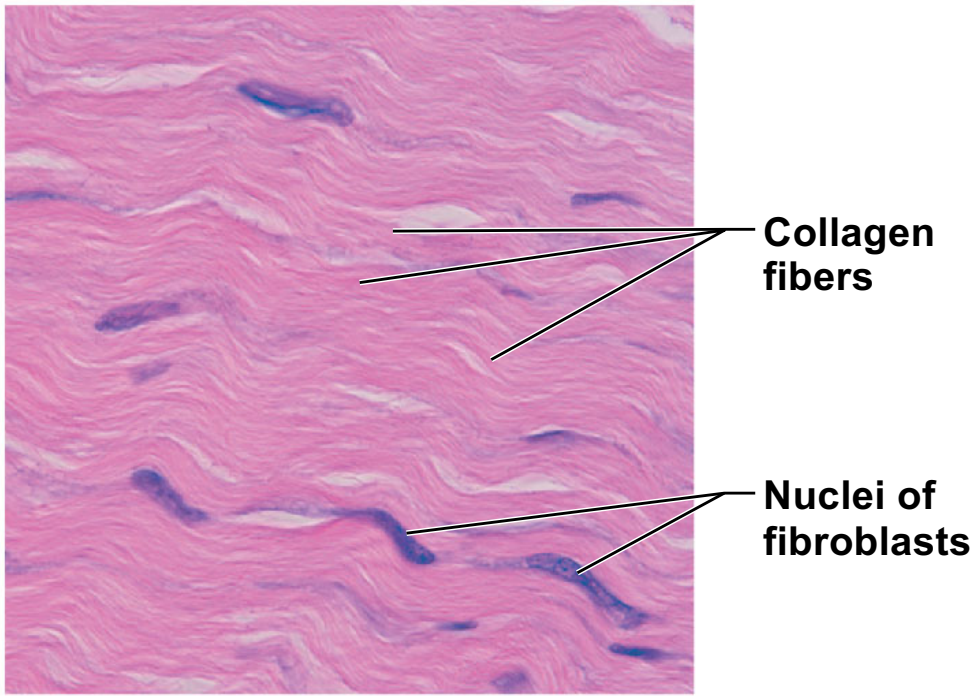
(c) Diagram: Fibrocartilage



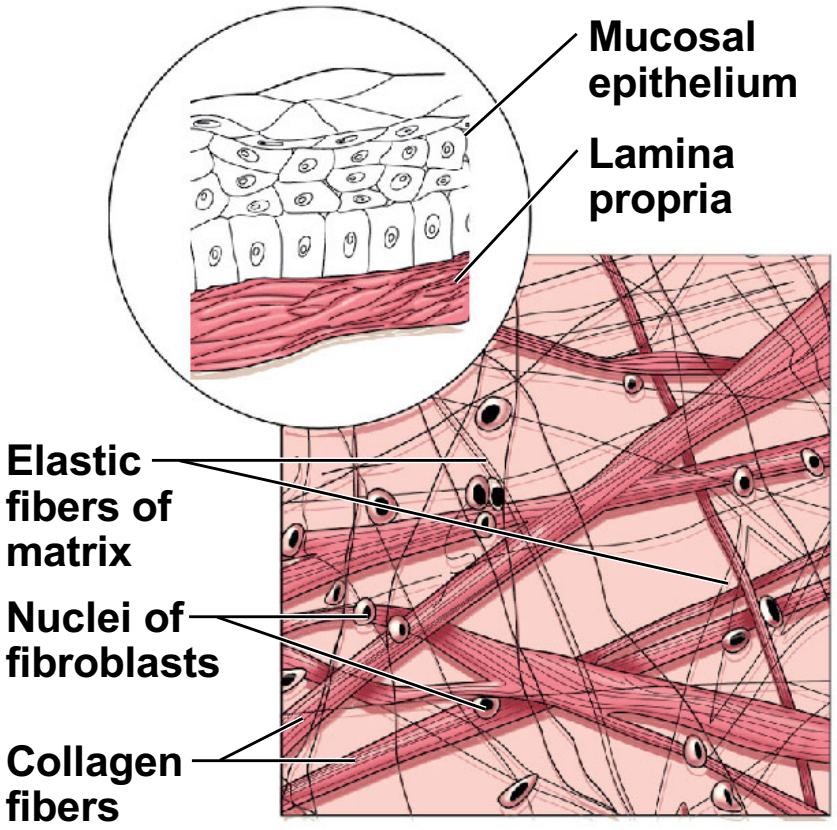
Photomicrograph: Fibrocartilage of an intervertebral disc (150×).



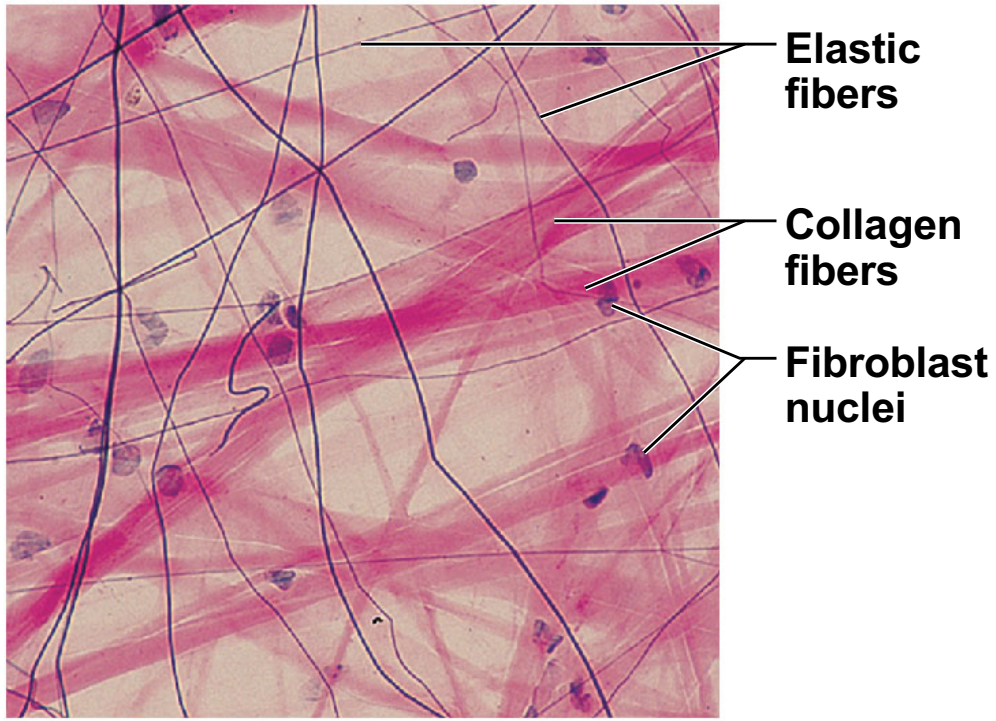
(d) Diagram: Dense fibrous



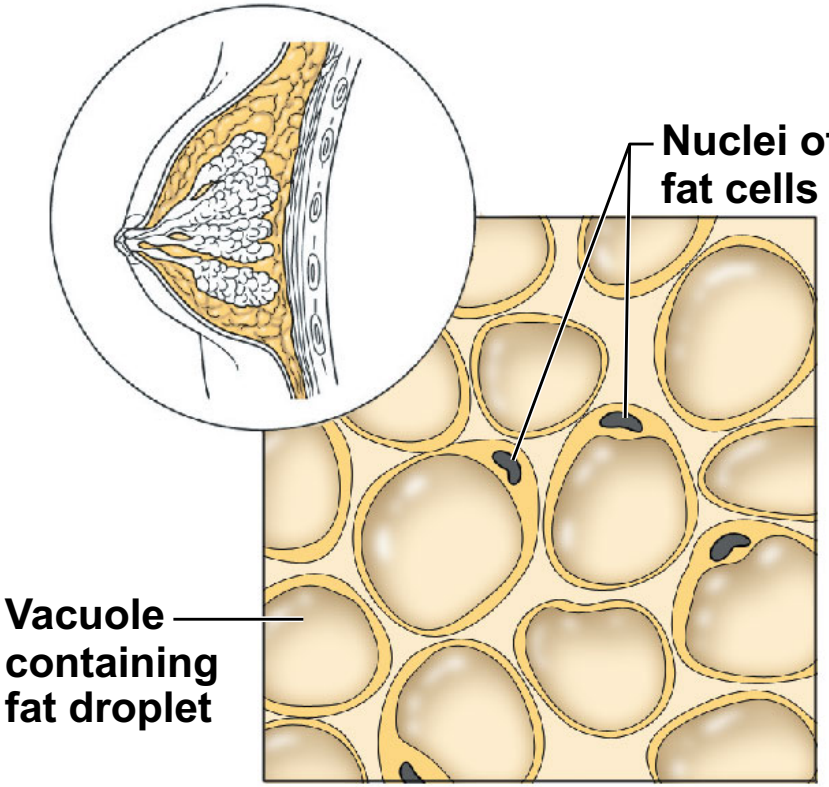
Photomicrograph: Dense fibrous connective tissue from a tendon (475×).



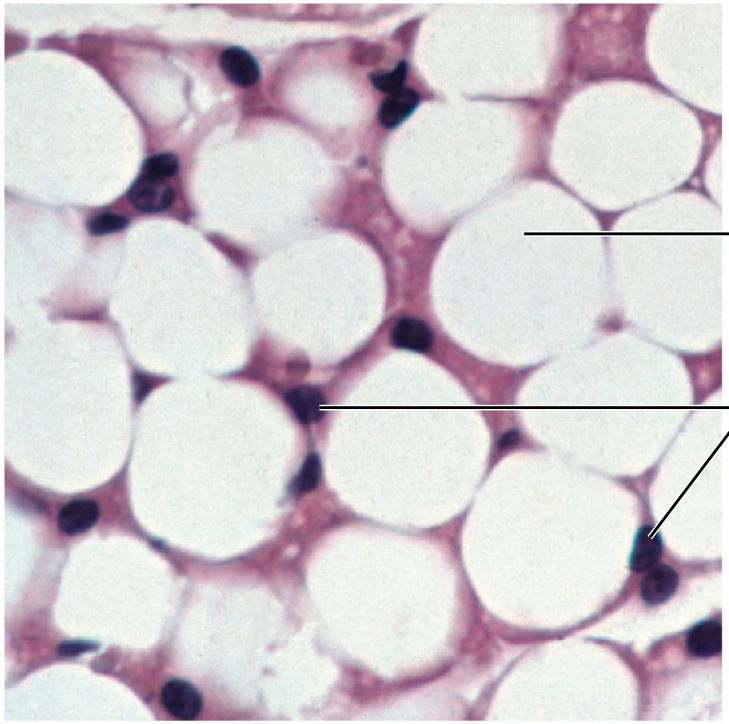
(e) Diagram: Areolar



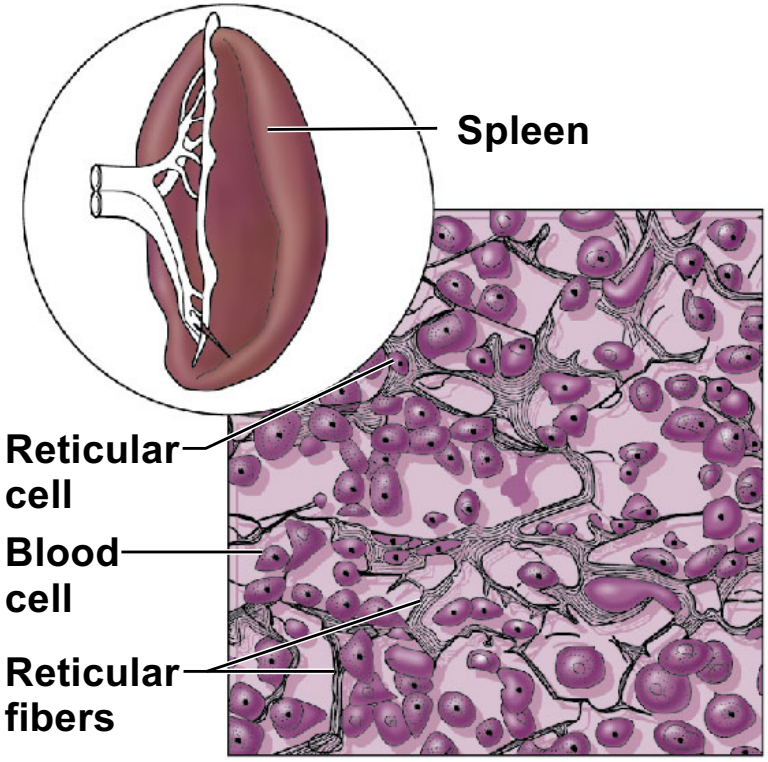
Photomicrograph: Areolar connective tissue, a soft packaging tissue of the body (270×).



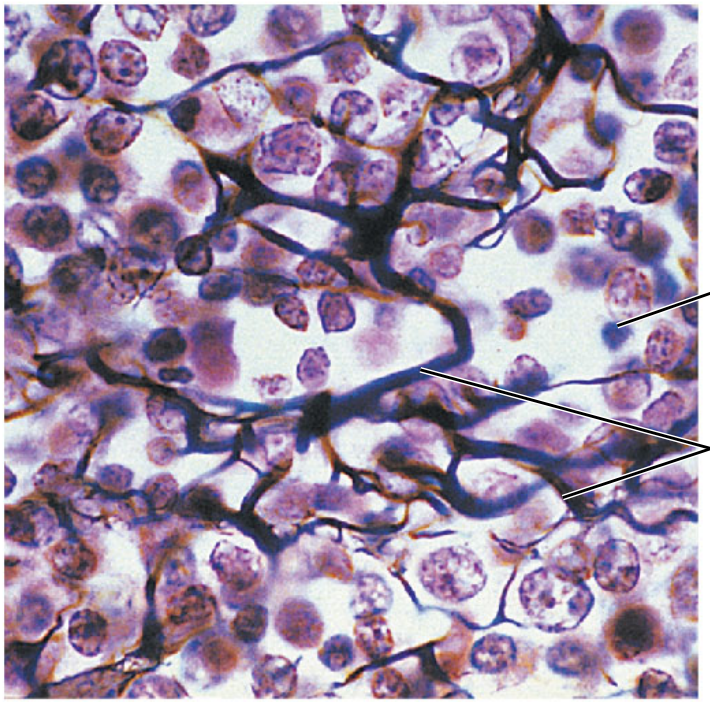
(f) Diagram: Adipose



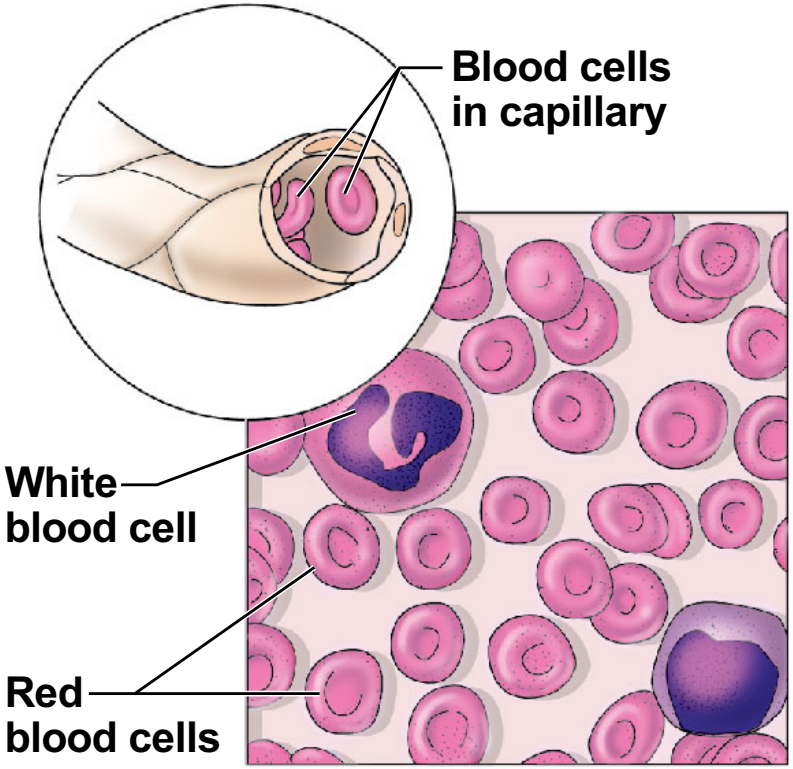
Photomicrograph: Adipose tissue from the subcutaneous layer beneath the skin (570 ×).



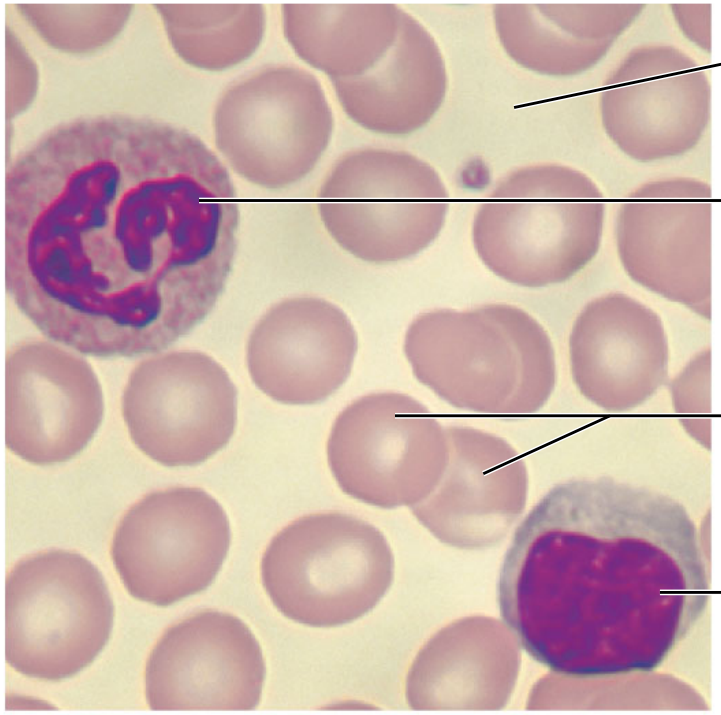
(g) Diagram: Reticular



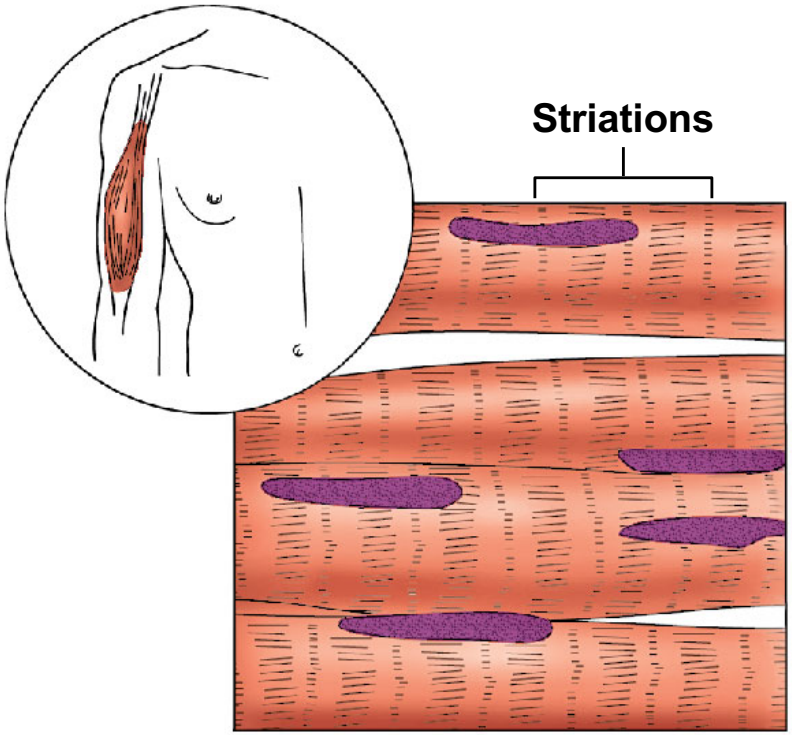
Photomicrograph: Dark-staining network of reticular connective tissue (400 ×).



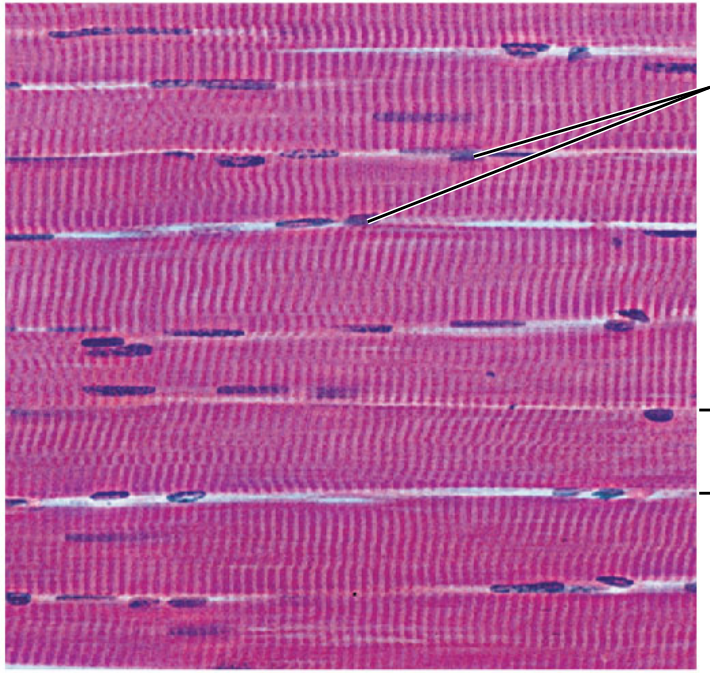
(h) Diagram: Blood



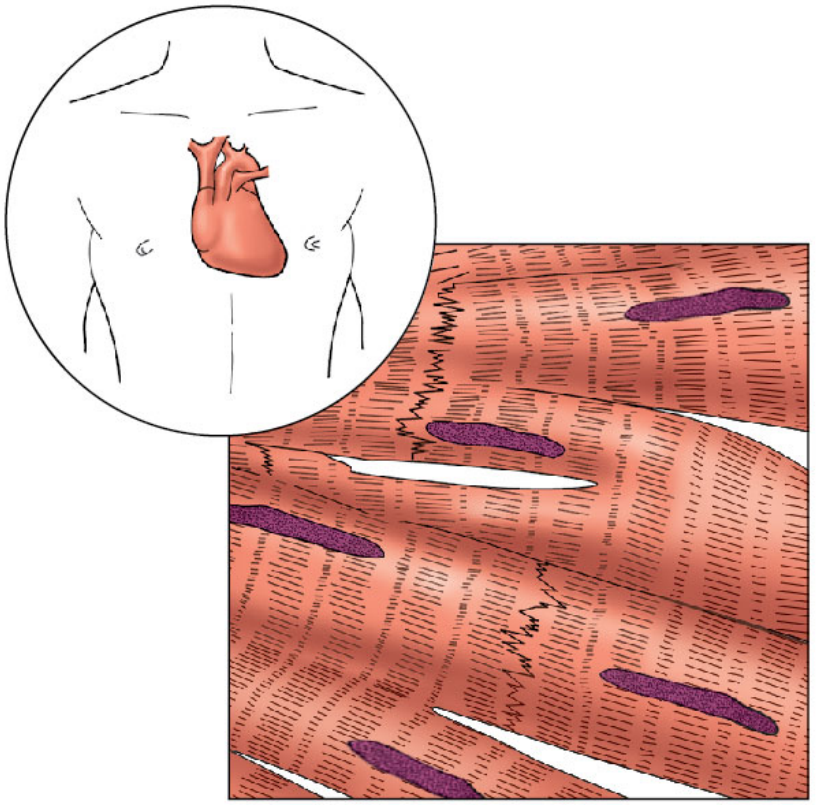
Photomicrograph: Smear of human blood (1290×)



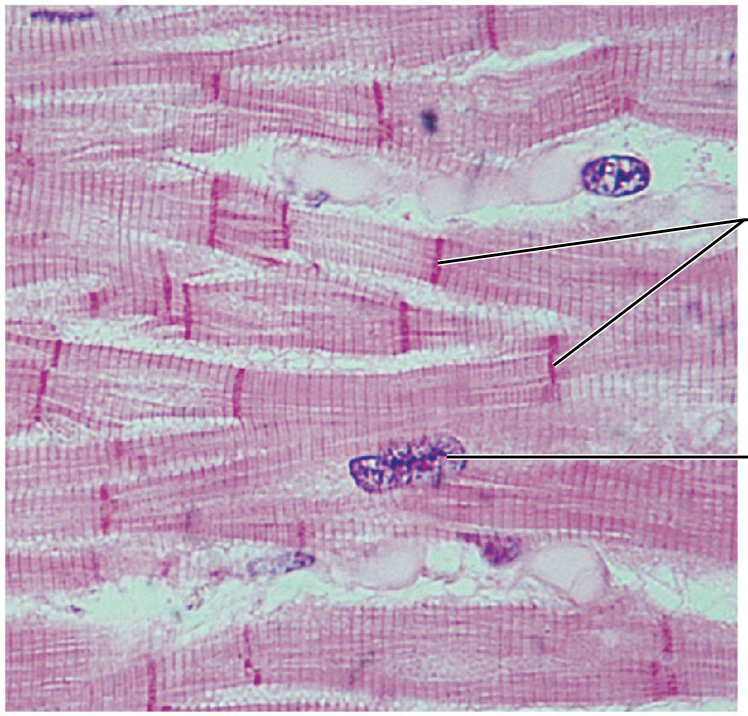
(a) Diagram: Skeletal muscle



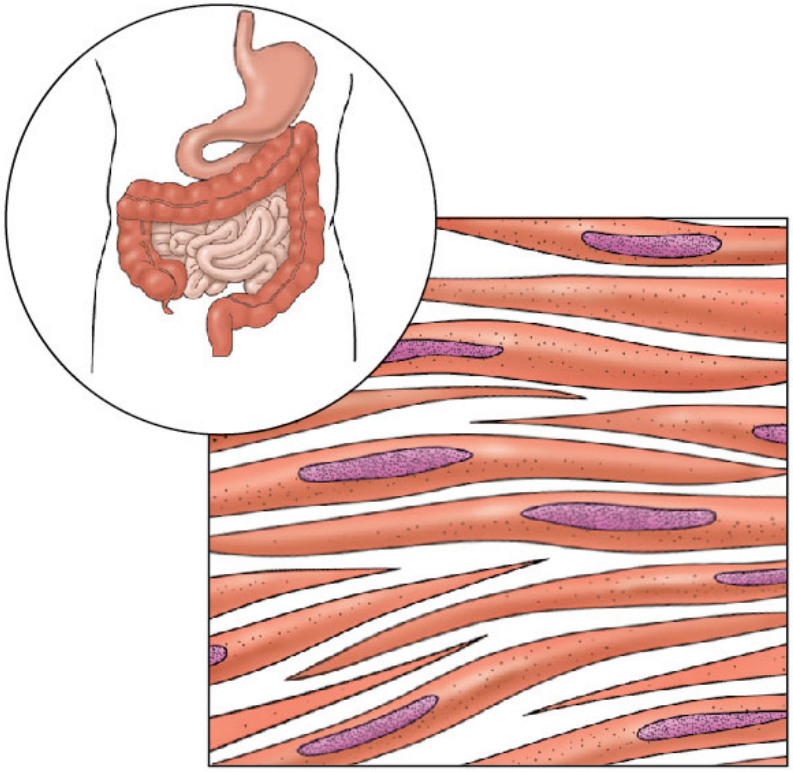
Photomicrograph: Skeletal muscle (195×).



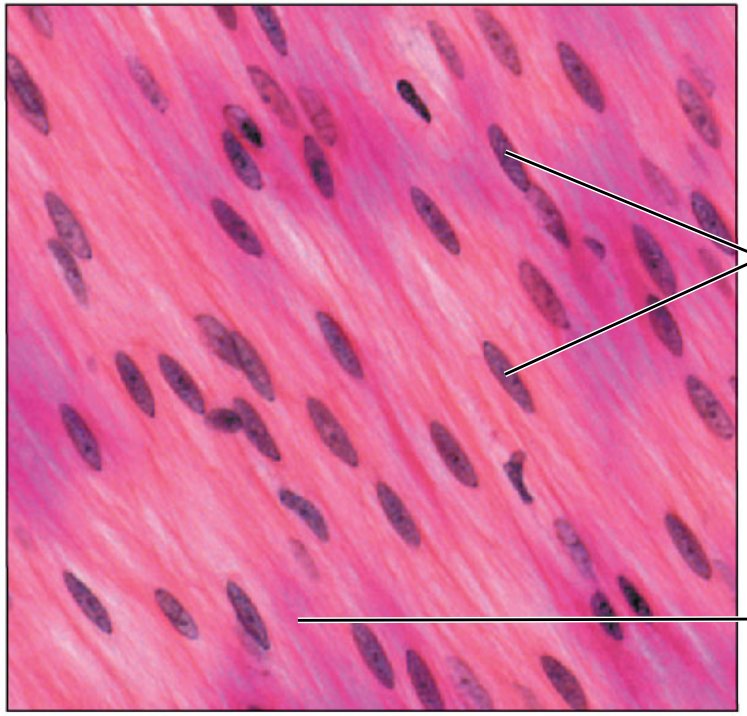
(b) Diagram: Cardiac muscle



Photomicrograph: Cardiac muscle (475×).



(c) Diagram: Smooth muscle



Photomicrograph: Sheet of smooth muscle (360×).

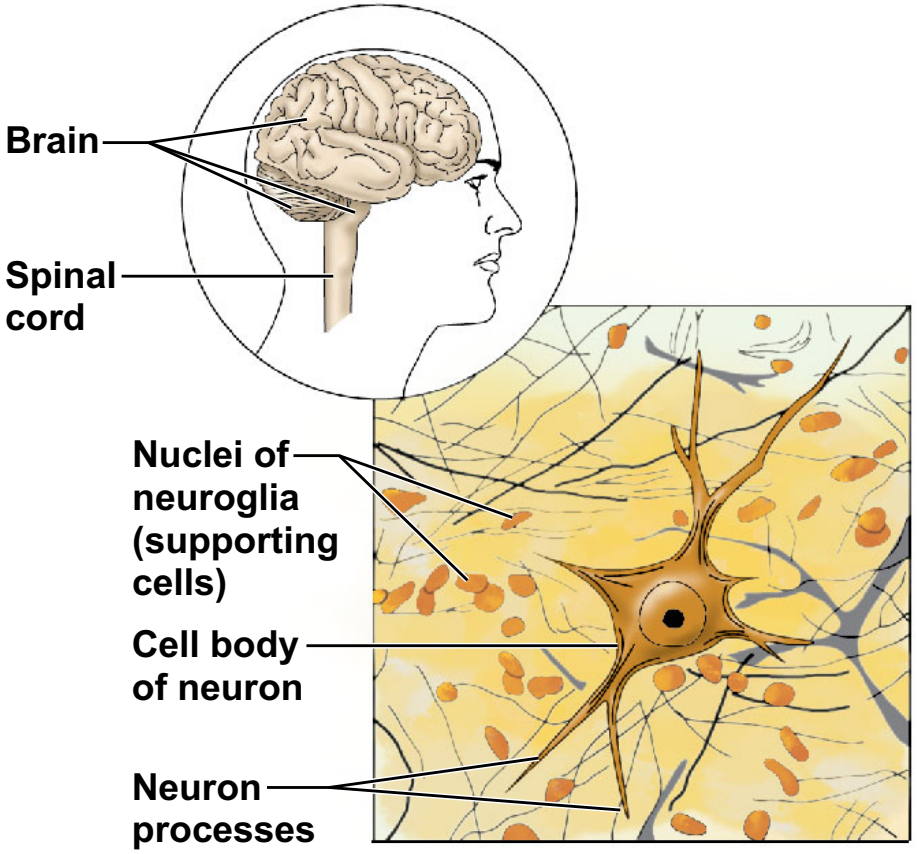
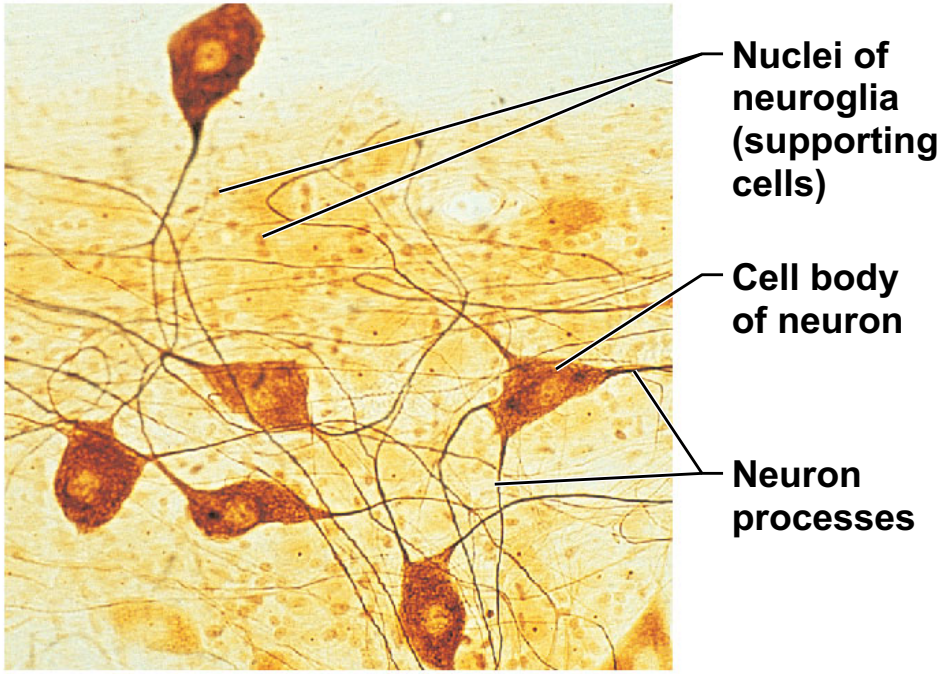
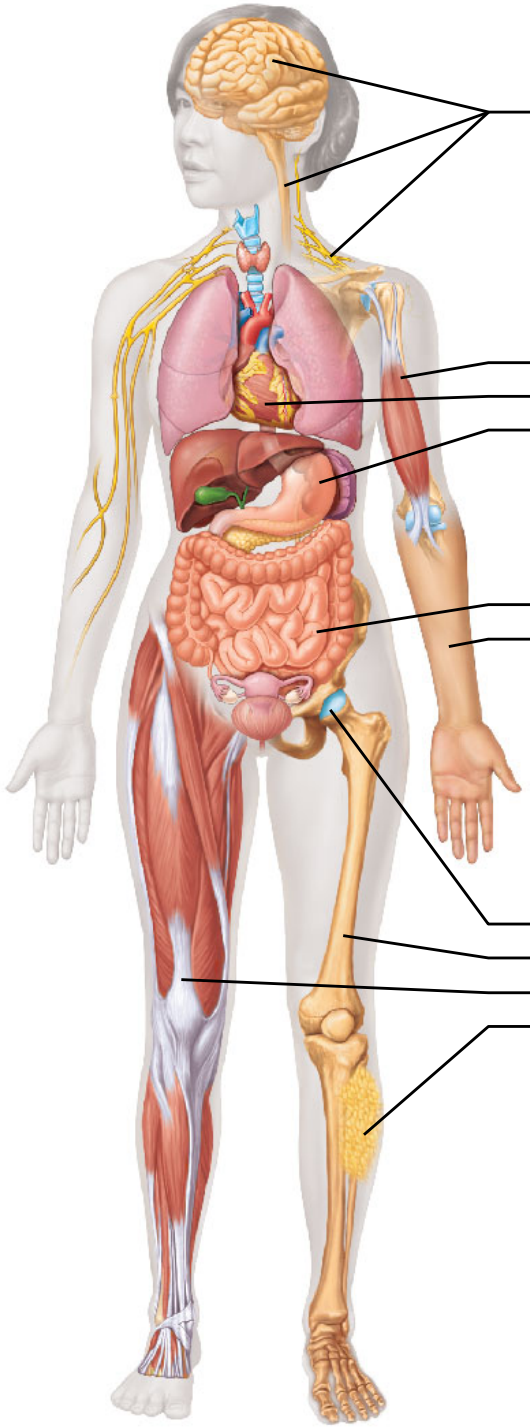


Diagram: Nervous tissue



Photomicrograph: Neurons (320×)



Nervous tissue: Internal communication and control
Hallmarks: irritable, conductive
- Brain, spinal cord, and nerves

Muscle tissue: Contracts to cause movement
Hallmarks: irritable, contractile
- Muscles attached to bones (skeletal)
- Muscles of heart wall (cardiac)
- Muscles of walls of hollow organs (smooth)

Epithelial tissue: Forms boundaries between different environments, protects, secretes, absorbs, filters
Hallmarks: one free (apical) surface, avascular
- Lining of GI tract and other hollow organs
- Skin surface (epidermis)

Connective tissue: Supports, protects, binds other tissues together
Hallmarks: extracellular matrix, varying vascularity
- Cartilage
- Bones
- Tendons
- Fat and other soft padding tissue