Biologi Sel

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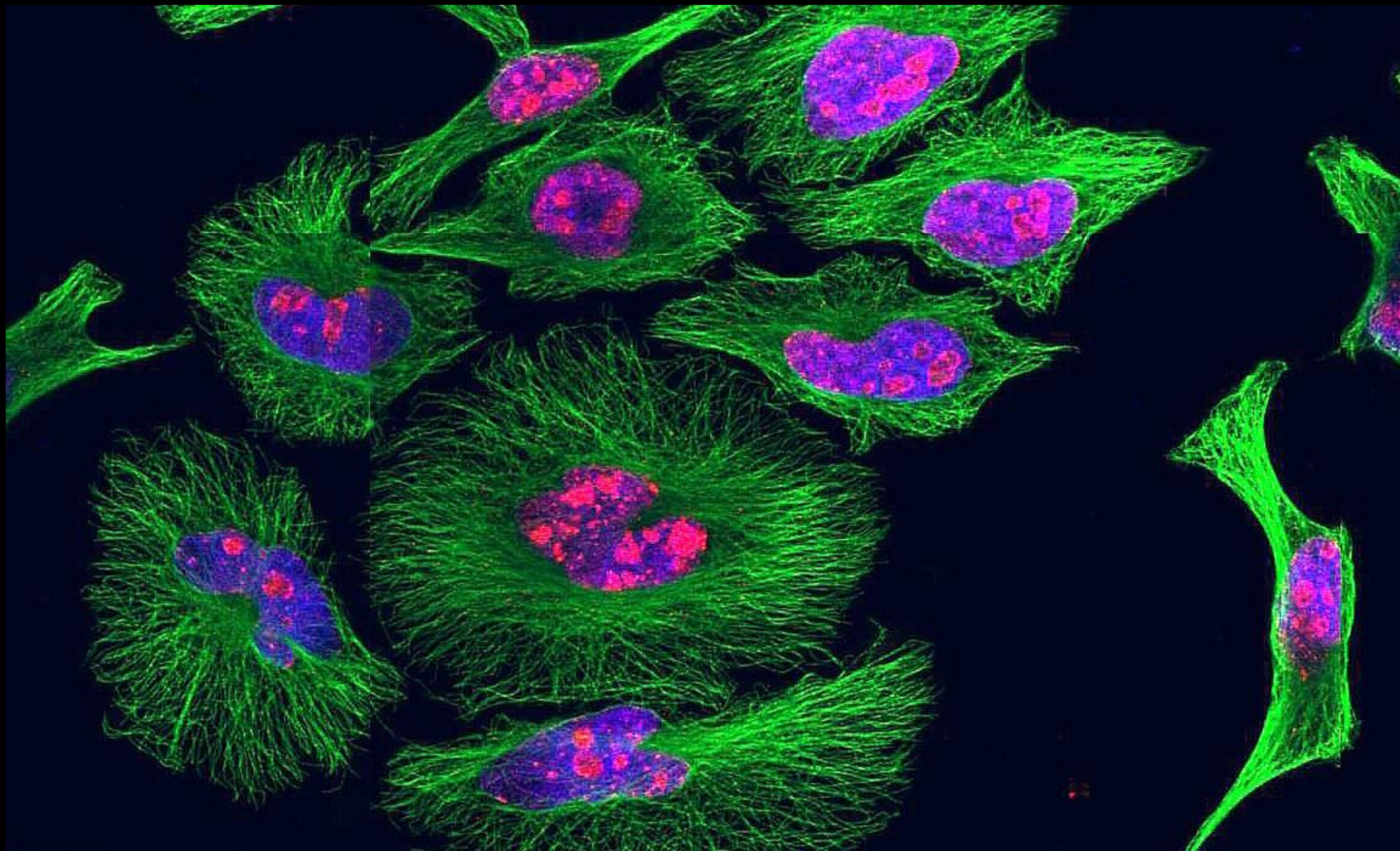
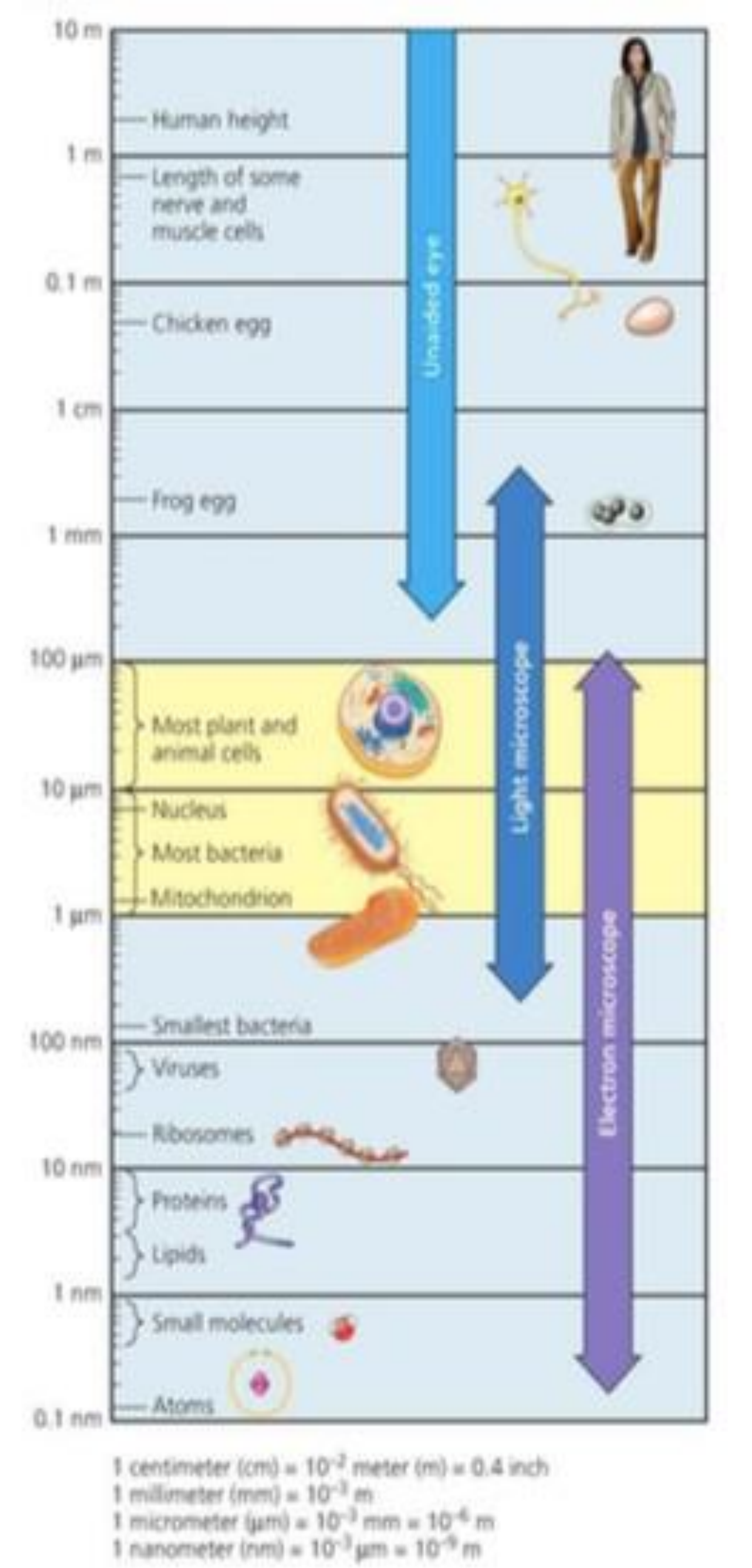
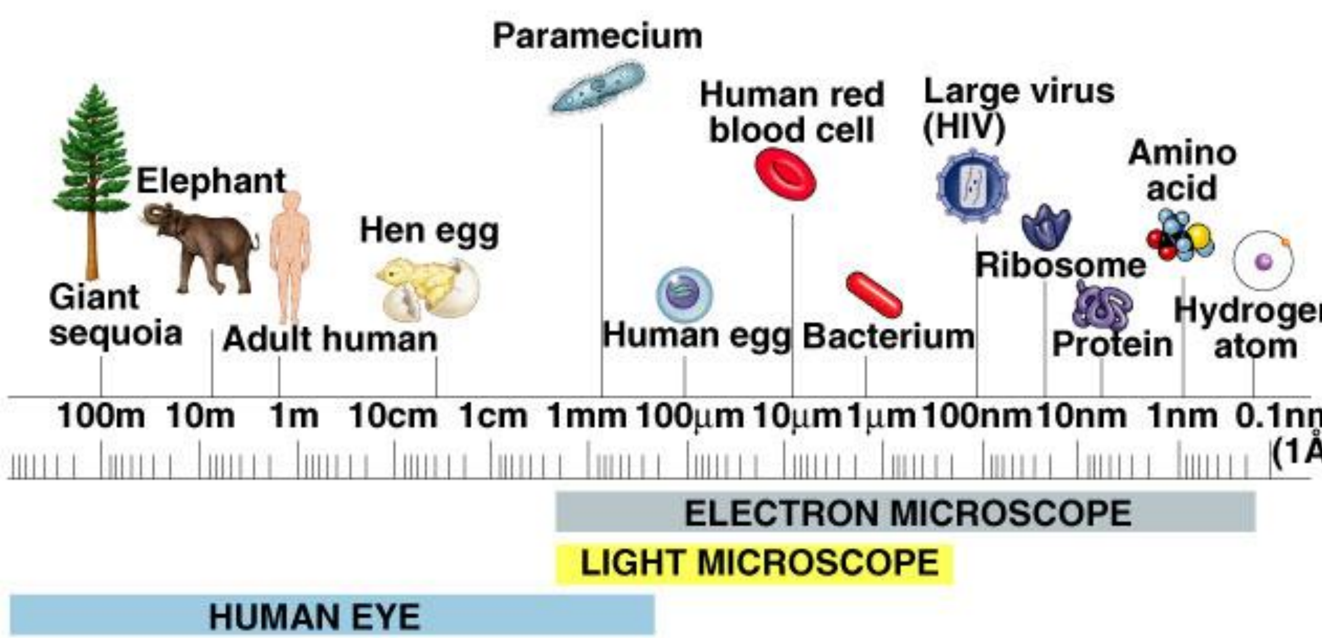


TOUR THE CELL

seberapa kecilkah sel?



Visualisasi sel

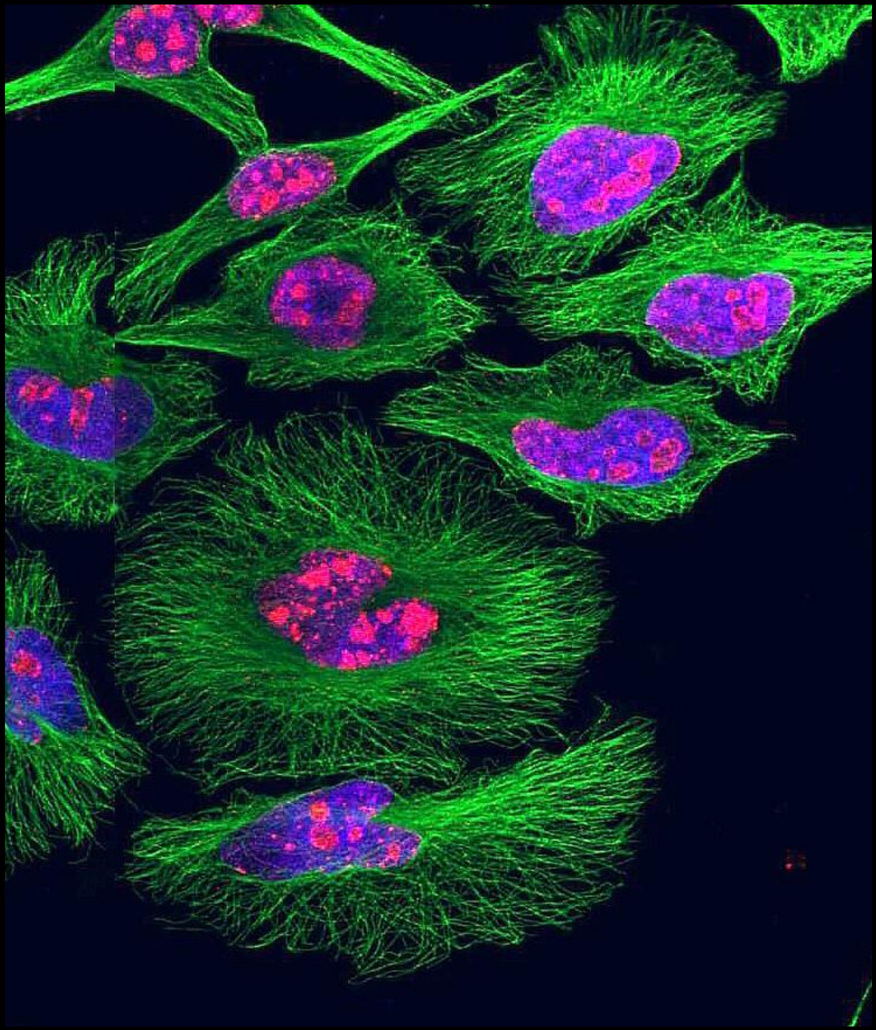


?

berapa banyak sel dalam tubuh kita?

KONSEP KUNCI

1. untuk mempelajari sel, scientist menggunakan mikroskop & alat biokimia
2. sel eukariot memiliki membran internal yang mengakomodasi fungsinya
3. instruksi genetik eukariot sel terletak di inti sel dan dibawa keluar oleh ribosom
4. sistem endomembran meregulasi jalur protein dan menampilkan fungsi metabolisme dalam sel
5. mitokondria dan kloroplas mengubah energi dari satu bentuk ke yang lainnya
6. sitoskeleton adalah jaringan serat yang mengorganisasi struktur dan aktivitas sel
7. komponen ekstraseluler dan koneksi antara sel membantu koordinasi aktivitas seluler



1. UNTUK MEMPELAJARI SEL, ILMUAN MENGGUNAKAN MIKROSKOP DAN ALAT BIOKIMIA

MIKROSKOP

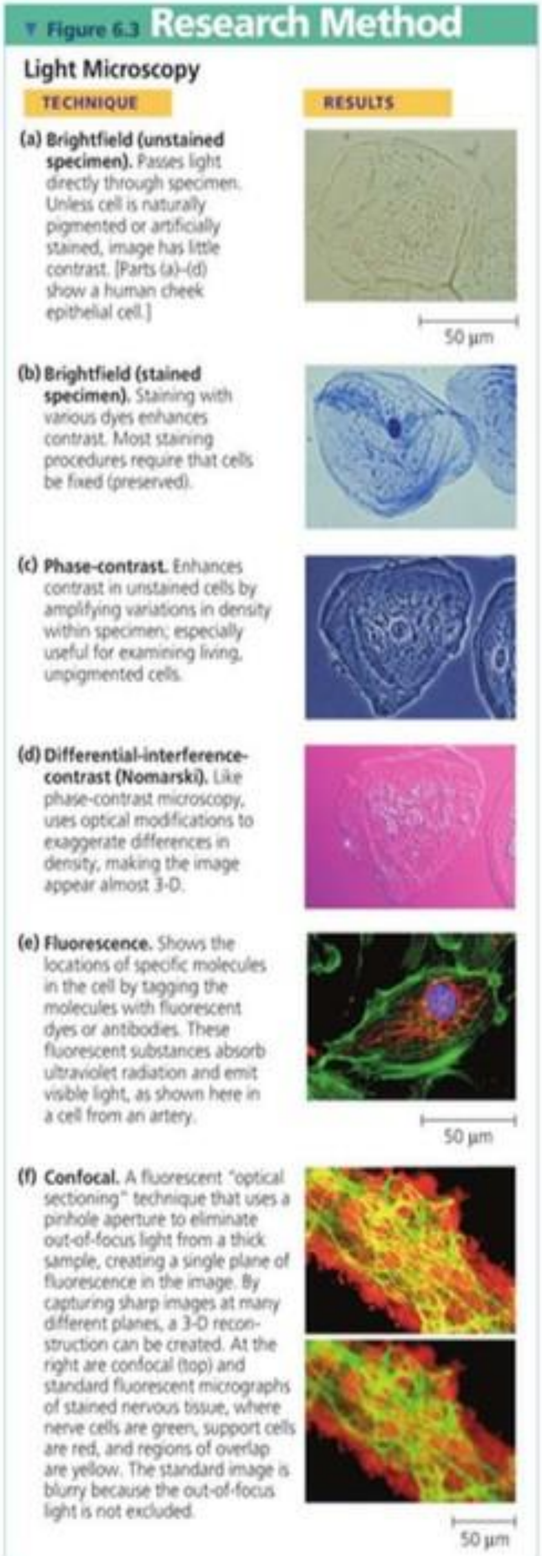
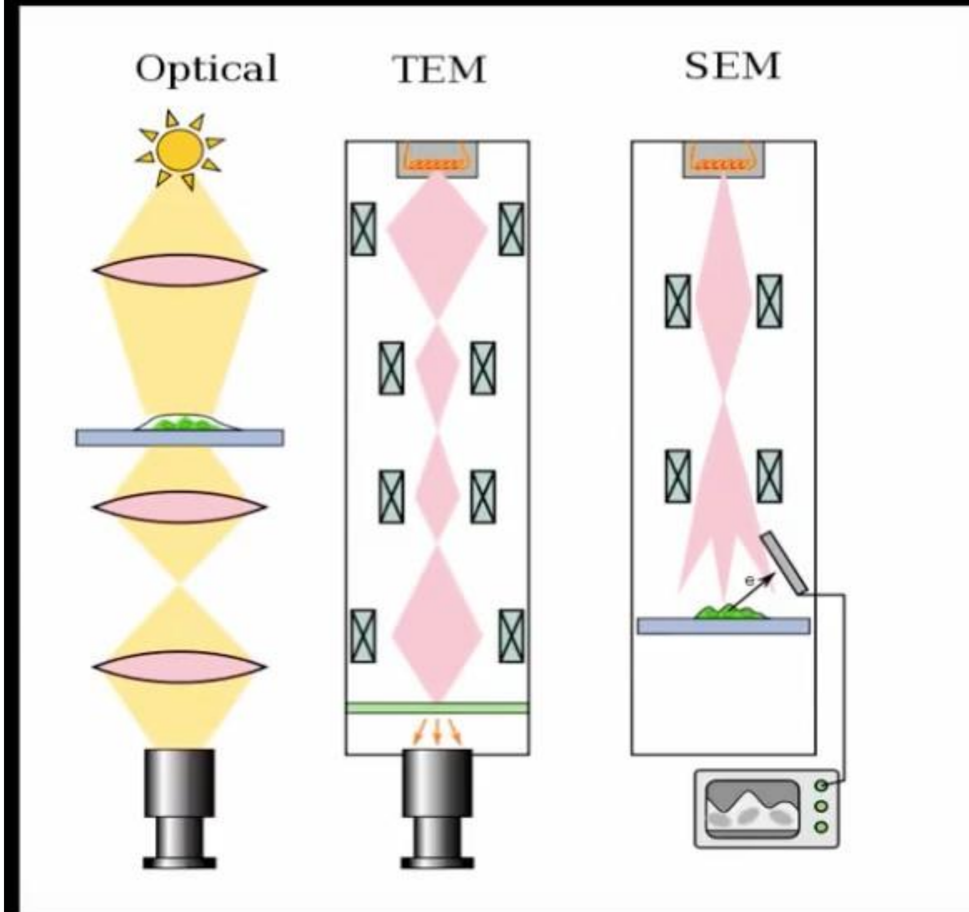


Figure 6.3 Research Method
Light Microscopy
TECHNIQUE
RESULTS
(a) Brightfield (unstained specimen). Passes light directly through specimen. Unless cell is naturally pigmented or artificially stained, image has little contrast. [Parts (a)–(d) show a human cheek epithelial cell.]
50 µm
(b) Brightfield (stained specimen). Staining with various dyes enhances contrast. Most staining procedures require that cells be fixed (preserved).
(c) Phase-contrast. Enhances contrast in unstained cells by amplifying variations in density within specimen; especially useful for examining living, unpigmented cells.
(d) Differential-interference-contrast (Nomarski). Like phase-contrast microscopy, uses optical modifications to exaggerate differences in density, making the image appear almost 3-D.
(e) Fluorescence. Shows the locations of specific molecules in the cell by tagging the molecules with fluorescent dyes or antibodies. These fluorescent substances absorb ultraviolet radiation and emit visible light, as shown here in a cell from an artery.
50 µm
(f) Confocal. A fluorescent "optical sectioning" technique that uses a pinhole aperture to eliminate out-of-focus light from a thick sample, creating a single plane of fluorescence in the image. By capturing sharp images at many different planes, a 3-D reconstruction can be created. At the right are confocal (top) and standard fluorescent micrographs of stained nervous tissue, where nerve cells are green, support cells are red, and regions of overlap are yellow. The standard image is blurry because the out-of-focus light is not excluded.
50 µm


Optical
TEM
SEM
e

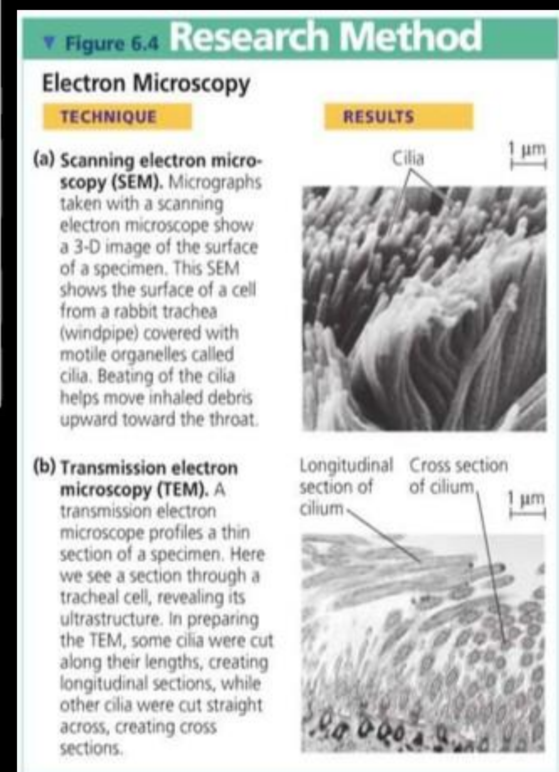
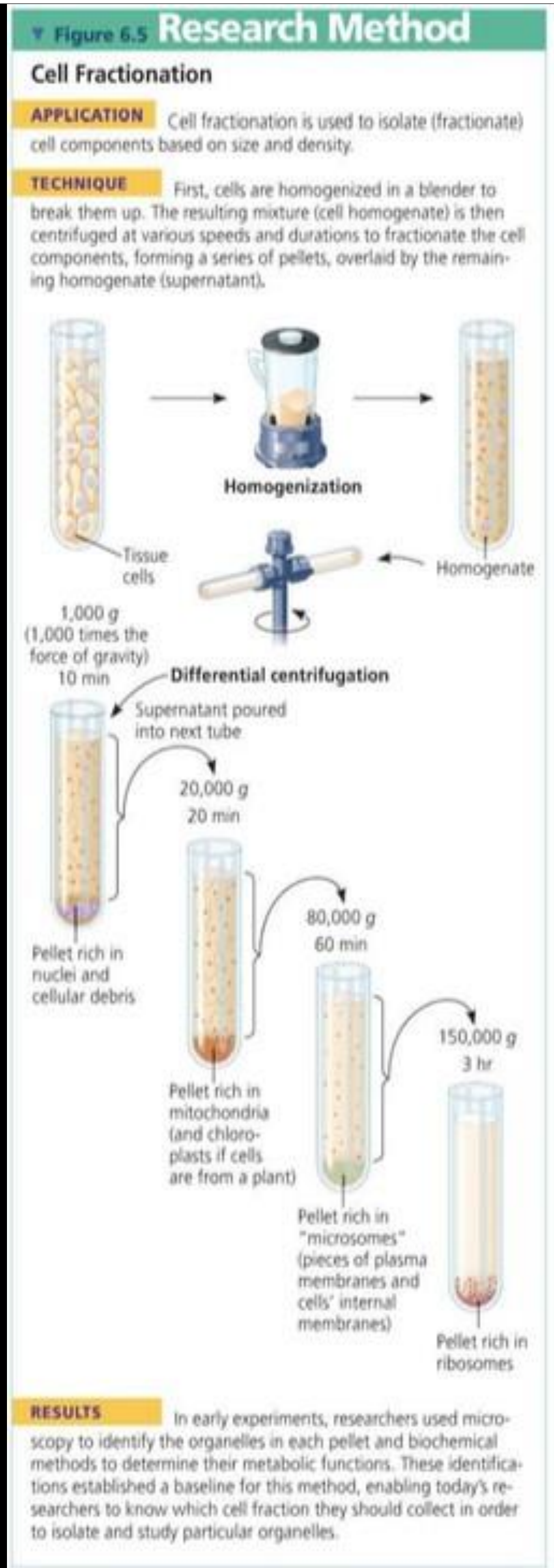


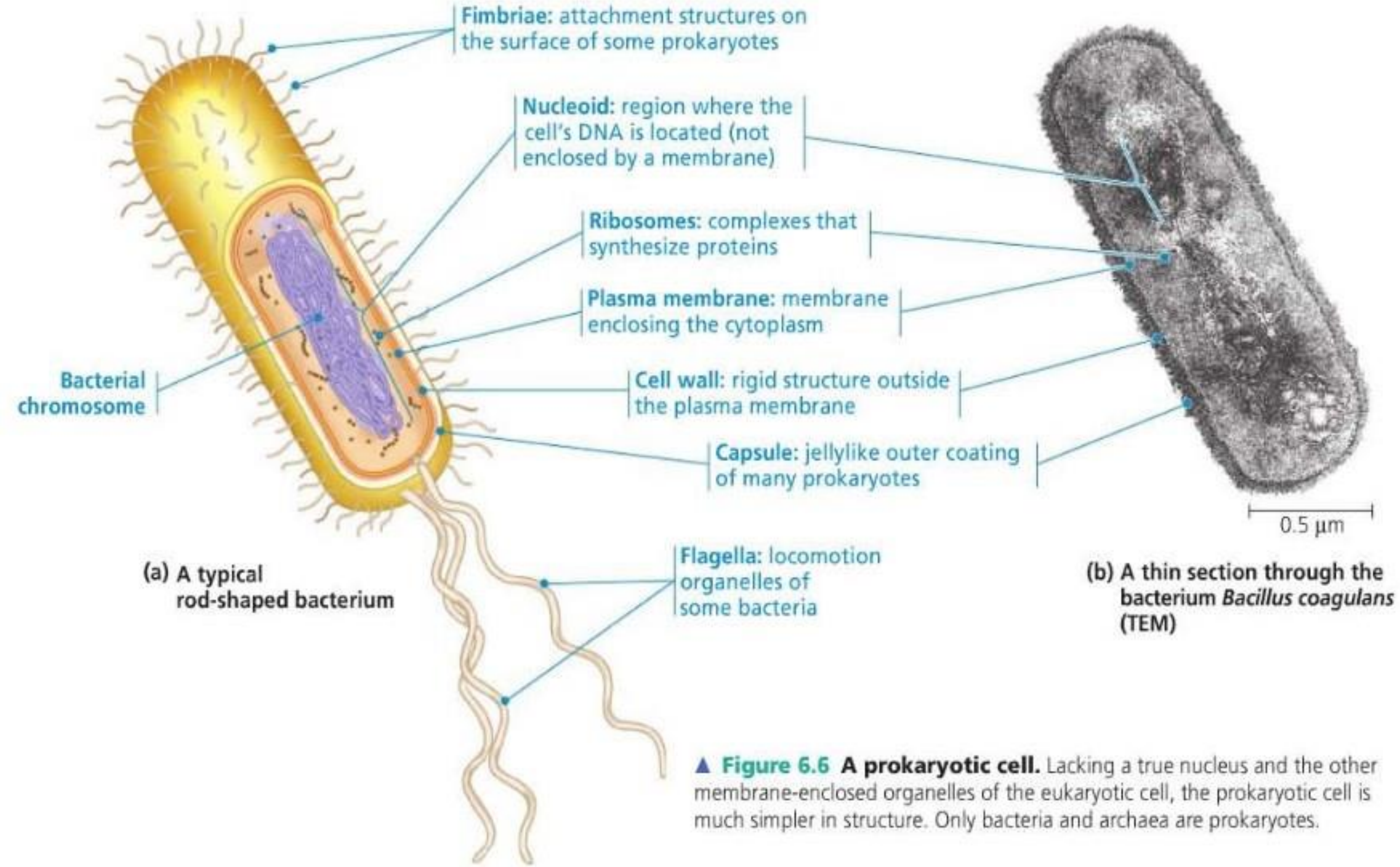
Figure 6.4 Research Method
Electron Microscopy
TECHNIQUE
RESULTS
(a) Scanning electron microscopy (SEM). Micrographs taken with a scanning electron microscope show a 3-D image of the surface of a specimen. This SEM shows the surface of a cell from a rabbit trachea (windpipe) covered with motile organelles called cilia. Beating of the cilia helps move inhaled debris upward toward the throat.
Cilia
1 µm
(b) Transmission electron microscopy (TEM). A transmission electron microscope profiles a thin section of a specimen. Here we see a section through a tracheal cell, revealing its ultrastructure. In preparing the TEM, some cilia were cut along their lengths, creating longitudinal sections, while other cilia were cut straight across, creating cross sections.
Longitudinal section of cilium
Cross section of cilium
1 µm

FRAKSINASI SEL

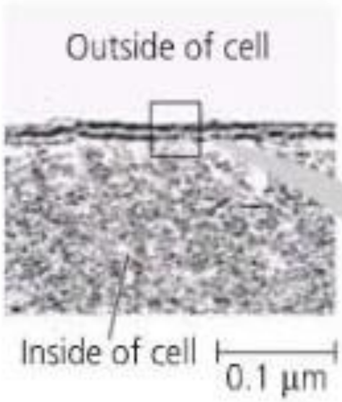


2. SEL EUKARIOT MEMILIKI MEMBRAN INTERNAL YANG MEWADAHI FUNGSINYA

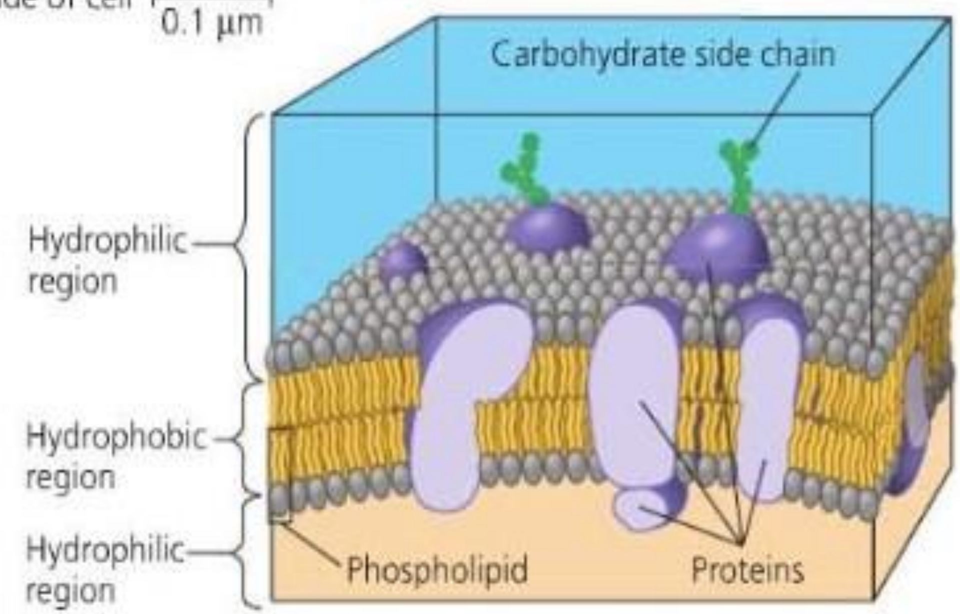
Sel Prokariot



▲ **Figure 6.6 A prokaryotic cell.** Lacking a true nucleus and the other membrane-enclosed organelles of the eukaryotic cell, the prokaryotic cell is much simpler in structure. Only bacteria and archaea are prokaryotes.

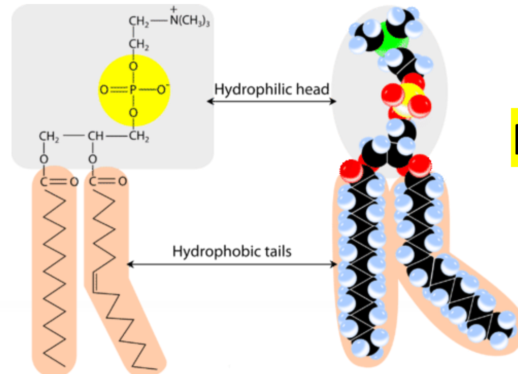


(a) TEM of a plasma membrane. The plasma membrane, here in a red blood cell, appears as a pair of dark bands separated by a light band.

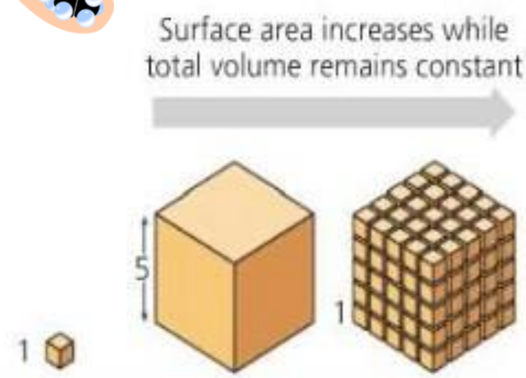


(b) Structure of the plasma membrane

▲ **Figure 6.7 The plasma membrane.** The plasma membrane and the membranes of organelles consist of a double layer (bilayer) of phospholipids with various proteins attached to or embedded in it. In the interior of a membrane, the phospholipid tails are hydrophobic, as are the interior portions of membrane proteins in contact with them. The phospholipid heads are hydrophilic, as are proteins or parts of proteins in contact with the aqueous solution on either side of the membrane. (Channels through certain proteins are also hydrophilic.) Carbohydrate side chains are found only attached to proteins or lipids on the outer surface of the plasma membrane.



Phospholipid



Total surface area [Sum of the surface areas (height × width) of all box sides × number of boxes]	6	150	750
Total volume [height × width × length × number of boxes]	1	125	125
Surface-to-volume (S-to-V) ratio [surface area ÷ volume]	6	1.2	6

▲ **Figure 6.8 Geometric relationships between surface area and volume.** In this diagram, cells are represented as boxes. Using arbitrary units of length, we can calculate the cell's surface area (in square units, or units^2), volume (in cubic units, or units^3), and ratio of surface area to volume. A high surface-to-volume ratio facilitates the exchange of materials between a cell and its environment.

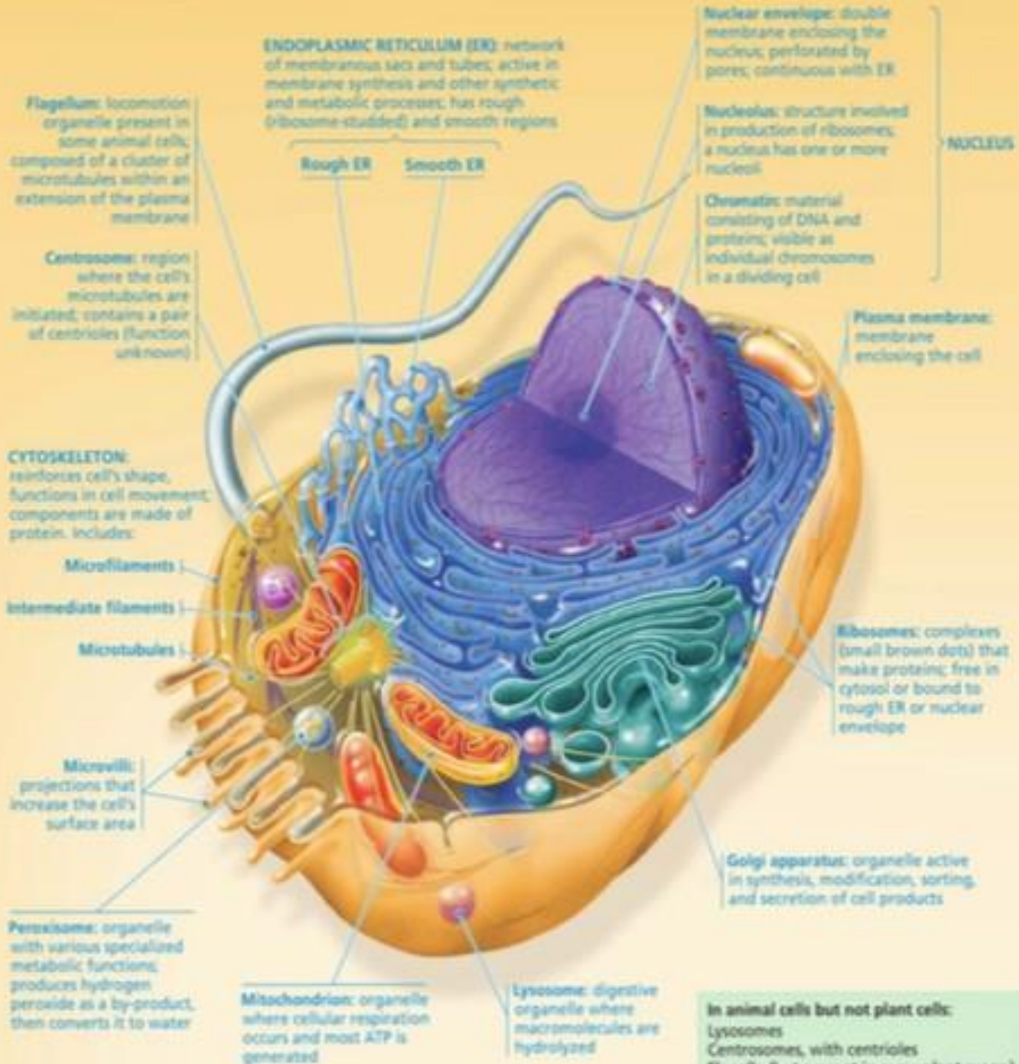
Pemandangan Sel Eukariot

▼ Figure 6.9

Exploring Animal and Plant Cells

Animal Cell

This drawing of a generalized animal cell incorporates the most common structures of animal cells (no cell actually looks just like this). As shown by this cutaway view, the cell has a variety of components, including organelles ("little organs"), which are bounded by membranes. The most prominent organelle in an animal cell is usually the nucleus. Most of the cell's metabolic activities occur in the cytoplasm, the entire region between the nucleus and the plasma membrane. The cytoplasm contains many organelles and other cell components suspended in a semifluid medium, the cytosol. Pervading much of the cytoplasm is a labyrinth of membranes called the endoplasmic reticulum (ER).



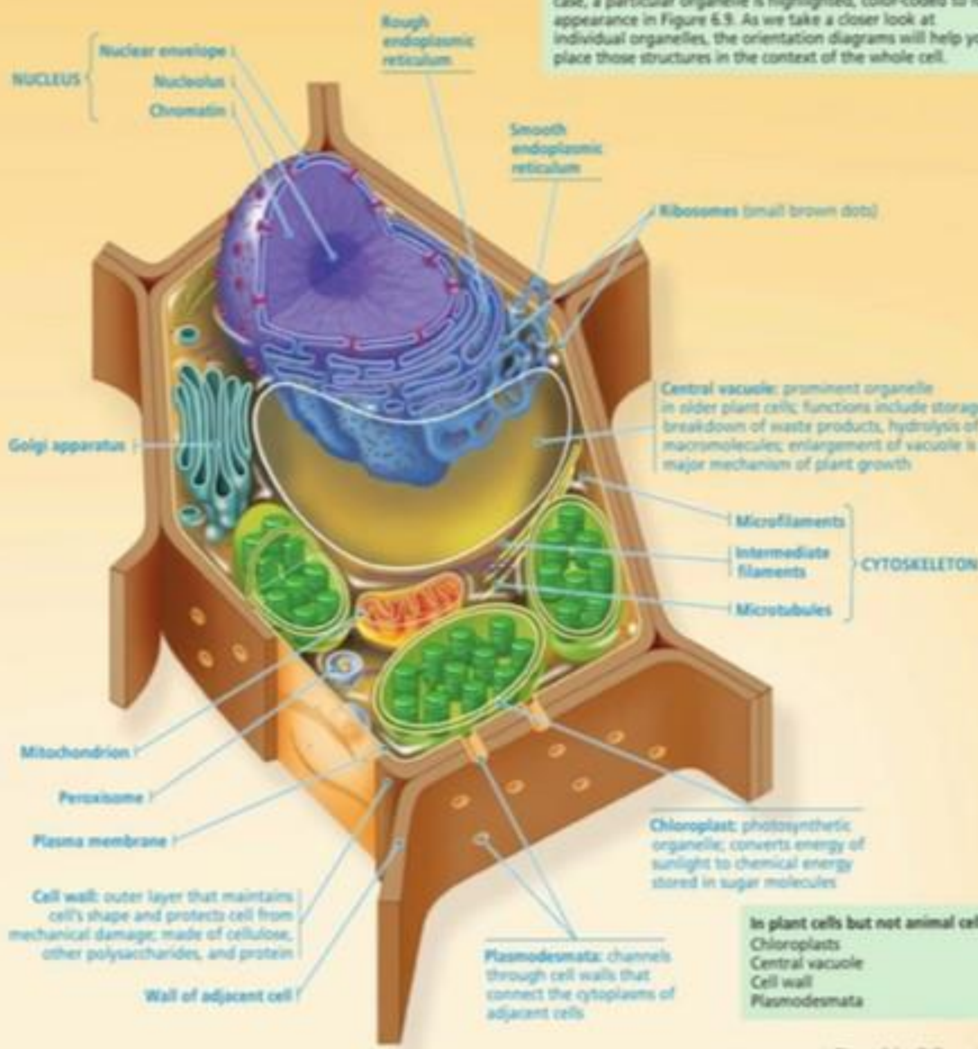
In animal cells but not plant cells:
Lysosomes
Centrosomes, with centrioles
Flagella (but present in some plant sperm)

Plant Cell

This drawing of a generalized plant cell reveals the similarities and differences between an animal cell and a plant cell. In addition to most of the features seen in an animal cell, a plant cell has organelles called plastids. The most important type of plastid is the chloroplast, which carries out photosynthesis. Many plant cells have a large central vacuole; some may have one or more smaller vacuoles. Among other tasks, vacuoles carry out functions performed by lysosomes in animal cells. Outside a plant cell's plasma membrane is a thick cell wall, perforated by channels called plasmodesmata.

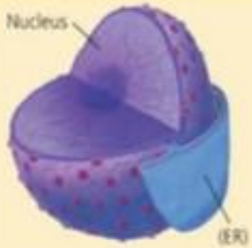
MEDIA **BioFlix** Visit the Study Area at **www.masteringbio.com** for the BioFlix 3-D Animations called Tour of an Animal Cell and Tour of a Plant Cell.

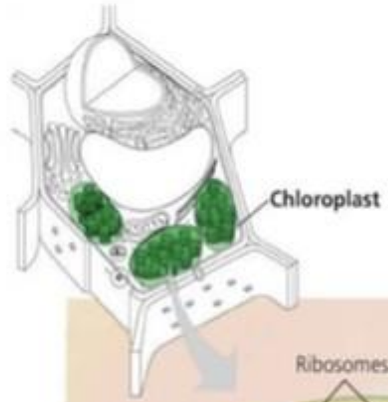
If you preview the rest of the chapter now, you'll see Figure 6.9 repeated in miniature as orientation diagrams. In each case, a particular organelle is highlighted, color-coded to its appearance in Figure 6.9. As we take a closer look at individual organelles, the orientation diagrams will help you place those structures in the context of the whole cell.



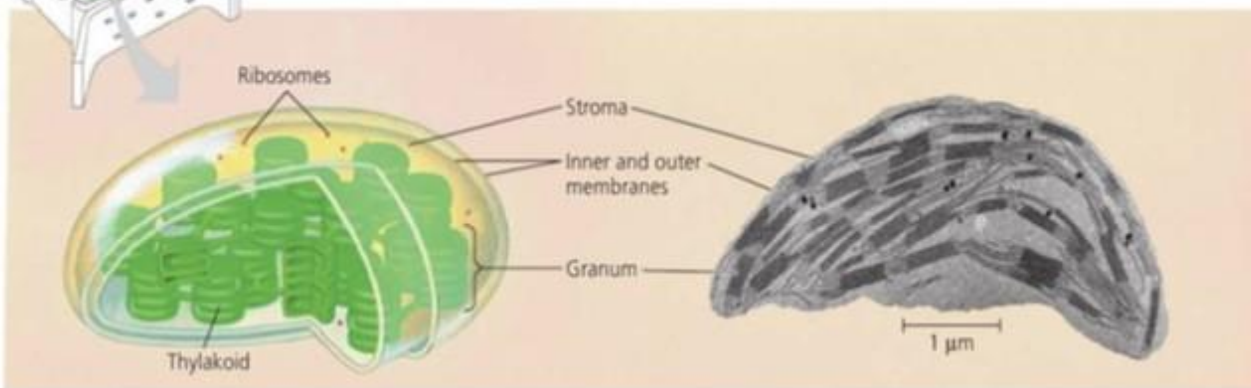
In plant cells but not animal cells:
Chloroplasts
Central vacuole
Cell wall
Plasmodesmata

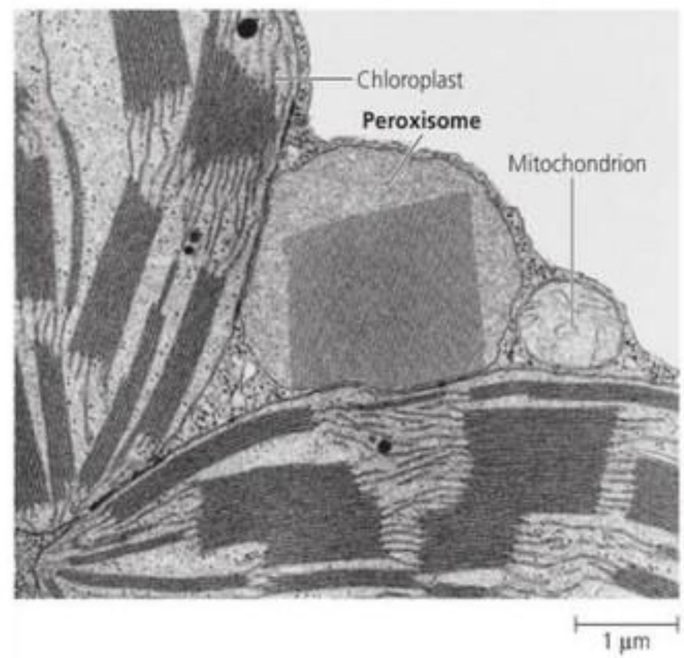
Let's Tour The Cell (3-6)

	Cell Component	Structure	Function
Concept 6.3 **The eukaryotic cell's genetic instructions are housed in the nucleus and carried out by the ribosomes (pp. 102–104)** MEDIA Activity Role of the Nucleus and Ribosomes in Protein Synthesis	Nucleus 	Surrounded by nuclear envelope (double membrane) perforated by nuclear pores. The nuclear envelope is continuous with the endoplasmic reticulum (ER).	Houses chromosomes, made of chromatin (DNA, the genetic material, and proteins); contains nucleoli, where ribosomal subunits are made. Pores regulate entry and exit of materials.
	Ribosome 	Two subunits made of ribosomal RNA and proteins; can be free in cytosol or bound to ER	Protein synthesis
Concept 6.4 **The endomembrane system regulates protein traffic and performs metabolic functions in the cell (pp. 104–108)** MEDIA Activity The Endomembrane System	Endoplasmic reticulum 	Extensive network of membrane-bounded tubules and sacs; membrane separates lumen from cytosol; continuous with the nuclear envelope	Smooth ER: synthesis of lipids, metabolism of carbohydrates, Ca^{2+} storage, detoxification of drugs and poisons Rough ER: Aids in synthesis of secretory and other proteins from bound ribosomes; adds carbohydrates to glycoproteins; produces new membrane
	Golgi apparatus 	Stacks of flattened membranous sacs; has polarity (cis and trans faces)	Modification of proteins, carbohydrates on proteins, and phospholipids; synthesis of many polysaccharides; sorting of Golgi products, which are then released in vesicles
	Lysosome 	Membranous sac of hydrolytic enzymes (in animal cells)	Breakdown of ingested substances, cell macromolecules, and damaged organelles for recycling
	Vacuole 	Large membrane-bounded vesicle in plants	Digestion, storage, waste disposal, water balance, cell growth, and protection
Concept 6.5 **Mitochondria and chloroplasts change energy from one form to another (pp. 109–111)** MEDIA Activity Build a Chloroplast and a Mitochondrion	Mitochondrion 	Bounded by double membrane; inner membrane has infoldings (cristae)	Cellular respiration
	Chloroplast 	Typically two membranes around fluid stroma, which contains membranous thylakoids stacked into grana (in plants)	Photosynthesis
	Peroxisome 	Specialized metabolic compartment bounded by a single membrane	Contains enzymes that transfer hydrogen to water, producing hydrogen peroxide (H_2O_2) as a by-product, which is converted to water by other enzymes in the peroxisome



▲ **Figure 6.18 The chloroplast, site of photosynthesis.** A typical chloroplast is enclosed by two membranes separated by a narrow intermembrane space that constitutes an outer compartment. The inner membrane encloses a second compartment containing the fluid called stroma. The stroma surrounds a third compartment, the thylakoid space, delineated by the thylakoid membrane. Interconnected thylakoid sacs (thylakoids) are stacked to form structures called grana (singular, *granum*), which are further connected by thin tubules between individual thylakoids. Photosynthetic enzymes are embedded in the thylakoid membranes. Free ribosomes are present in the stroma, along with copies of the chloroplast genome (DNA), too small to be seen here (TEM).





▲ **Figure 6.19 A peroxisome.** Peroxisomes are roughly spherical and often have a granular or crystalline core that is thought to be a dense collection of enzyme molecules. This peroxisome is in a leaf cell (TEM). Notice its proximity to two chloroplasts and a mitochondrion. These organelles cooperate with peroxisomes in certain metabolic functions.

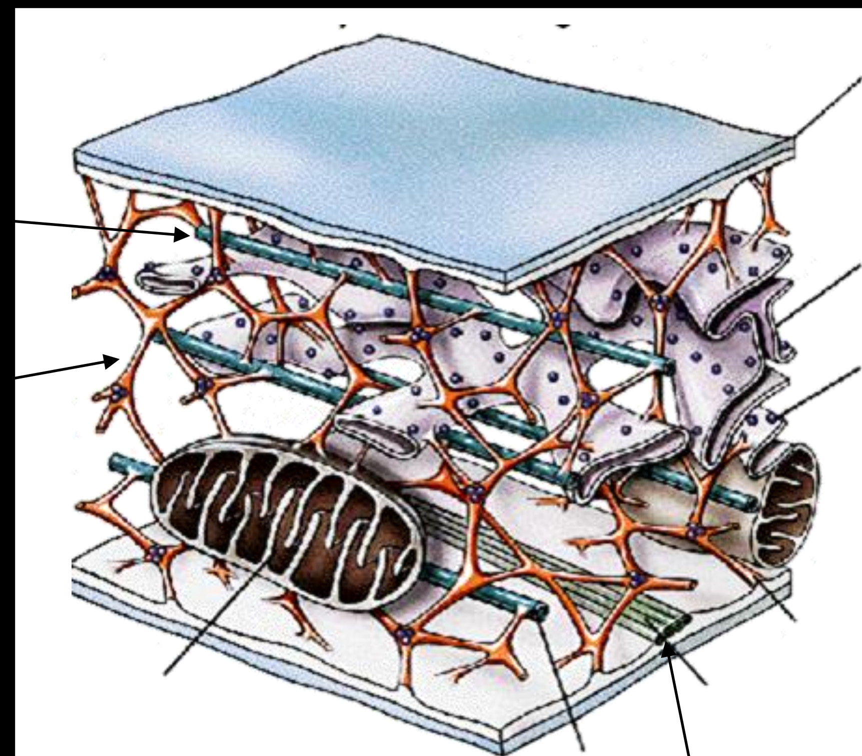
Cytoskeleton

- Network of protein fibers supporting cell shape and anchoring organelles

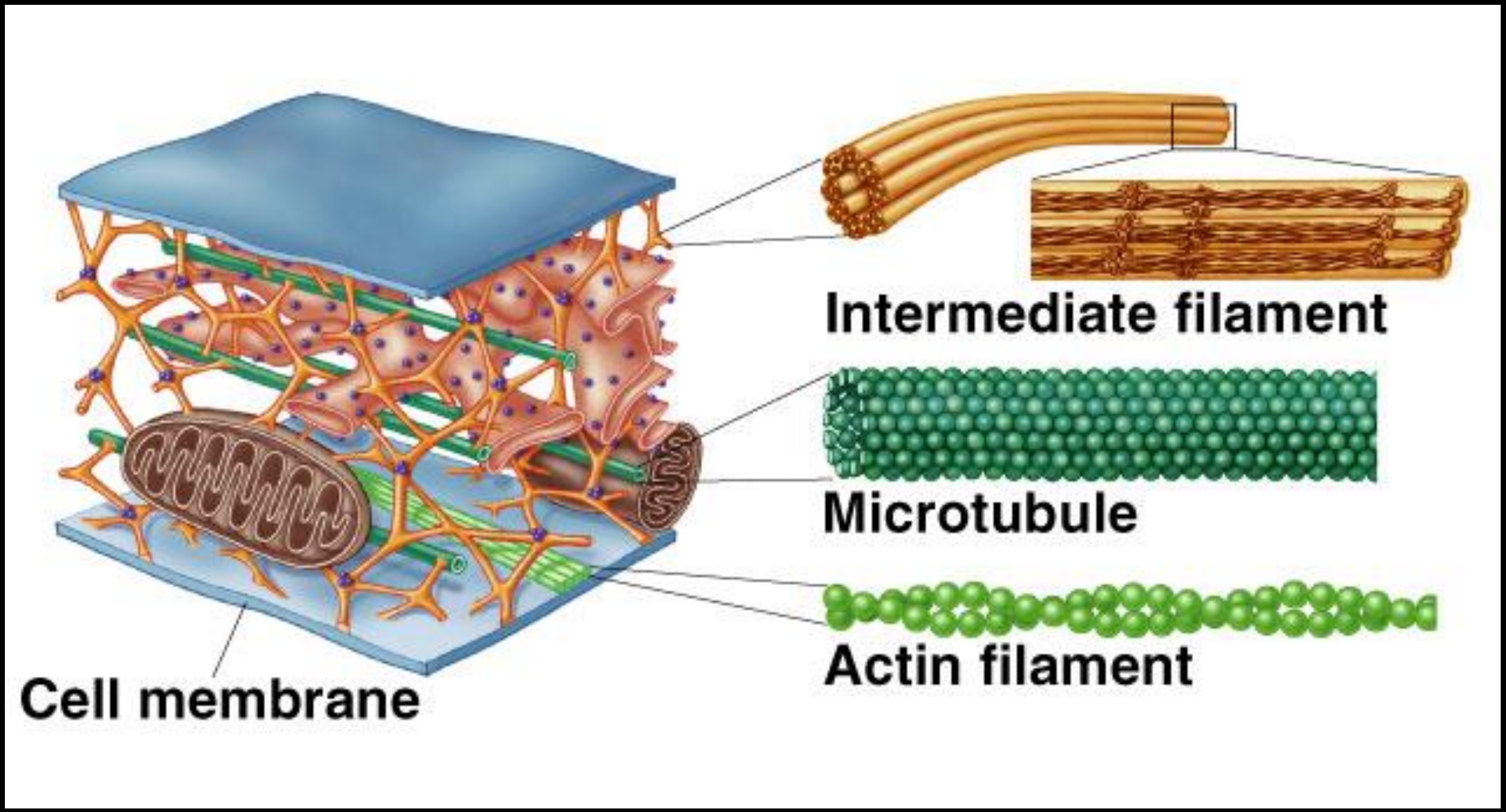
Actin filaments
    cell movement

Microtubules
    Hollow tubes
    Facilitate cell movement
    Centrioles – barrel shaped organelles occur in pairs – help assemble animal cell's microtubules

Intermediate filaments
    Stable - don't break down

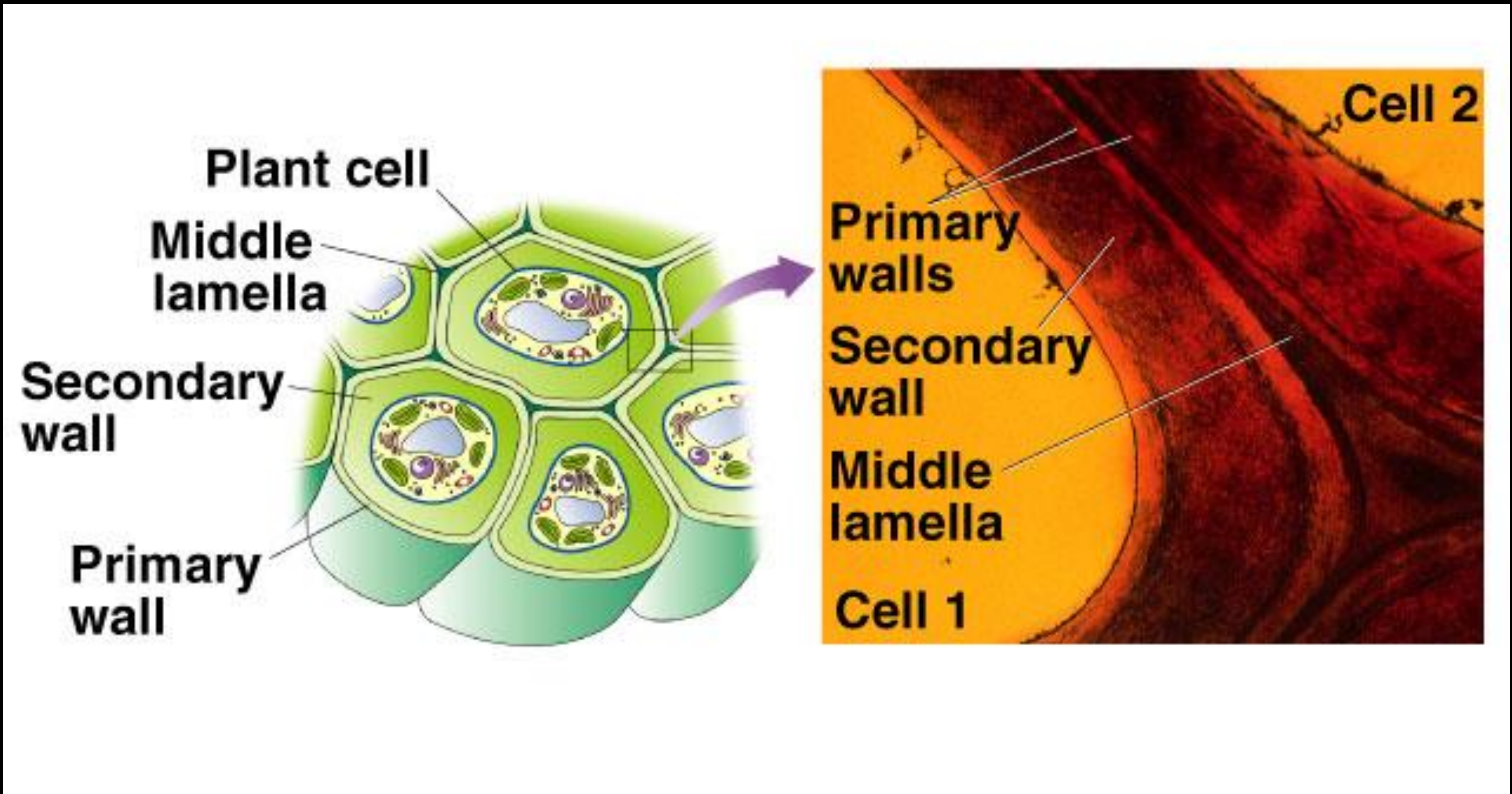


Cytoskeleton

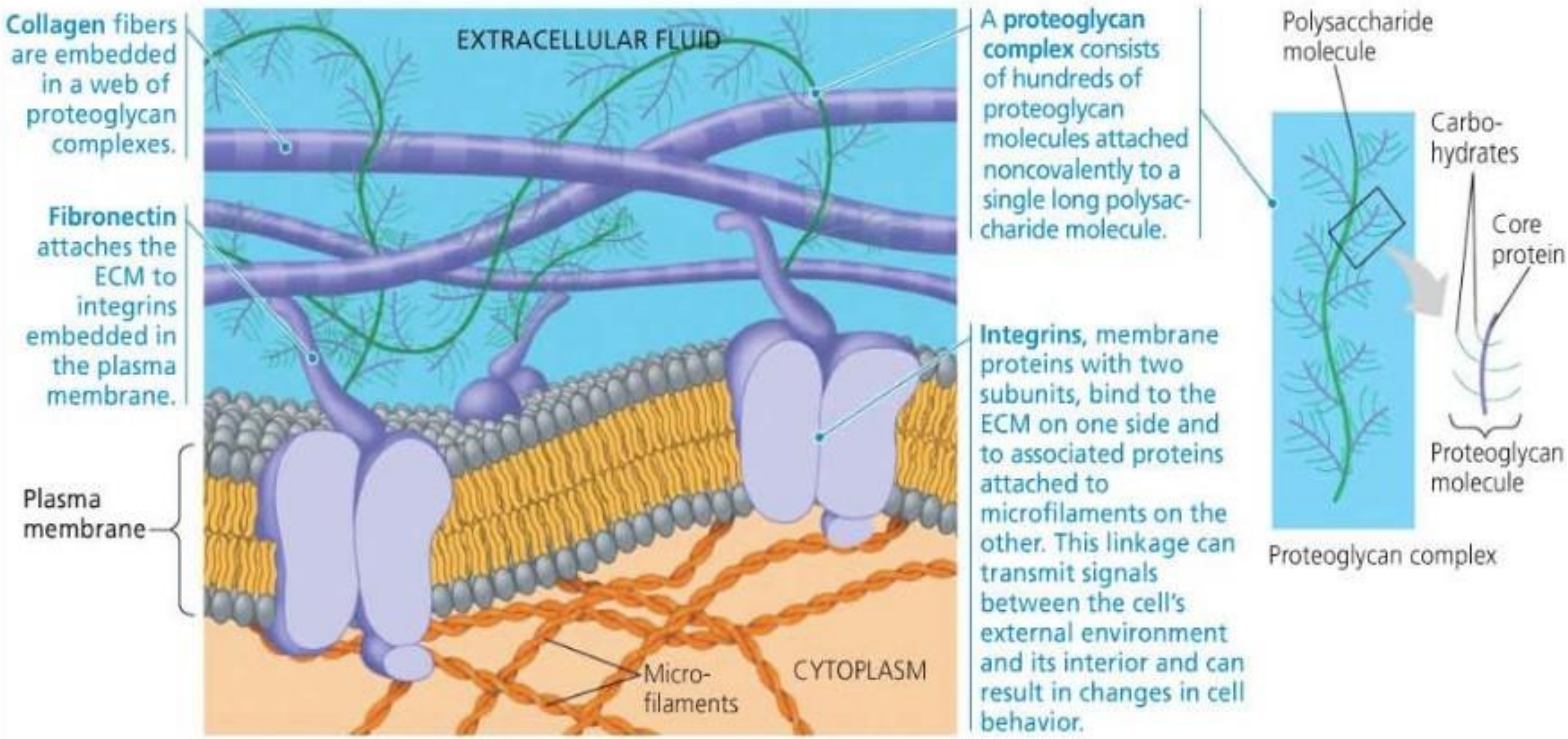


7. KOMPONEN EKSTRASELULAR & KONEKSI ANTARA SEL MEMBANTU KOORDINAT AKTIVITAS SEL

Dinding Sel Tumbuhan



Matriks Ekstraselular Sel Hewan

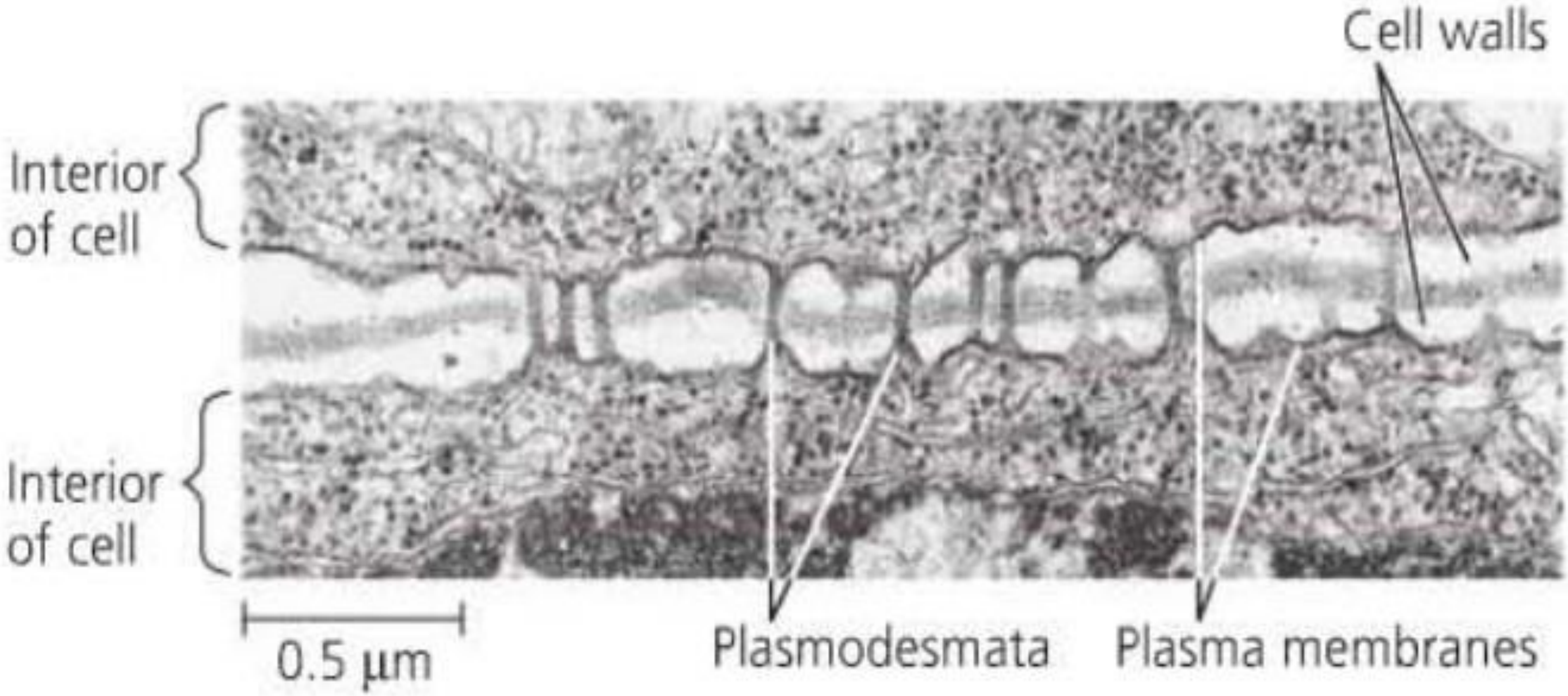


▲ **Figure 6.30 Extracellular matrix (ECM) of an animal cell.** The molecular composition and structure of the ECM varies from one cell type to another. In this example, three different types of glycoproteins are present: proteoglycans, collagen, and fibronectin.

Table 5.3 A Comparison of Prokaryotic, Animal, and Plant Cells

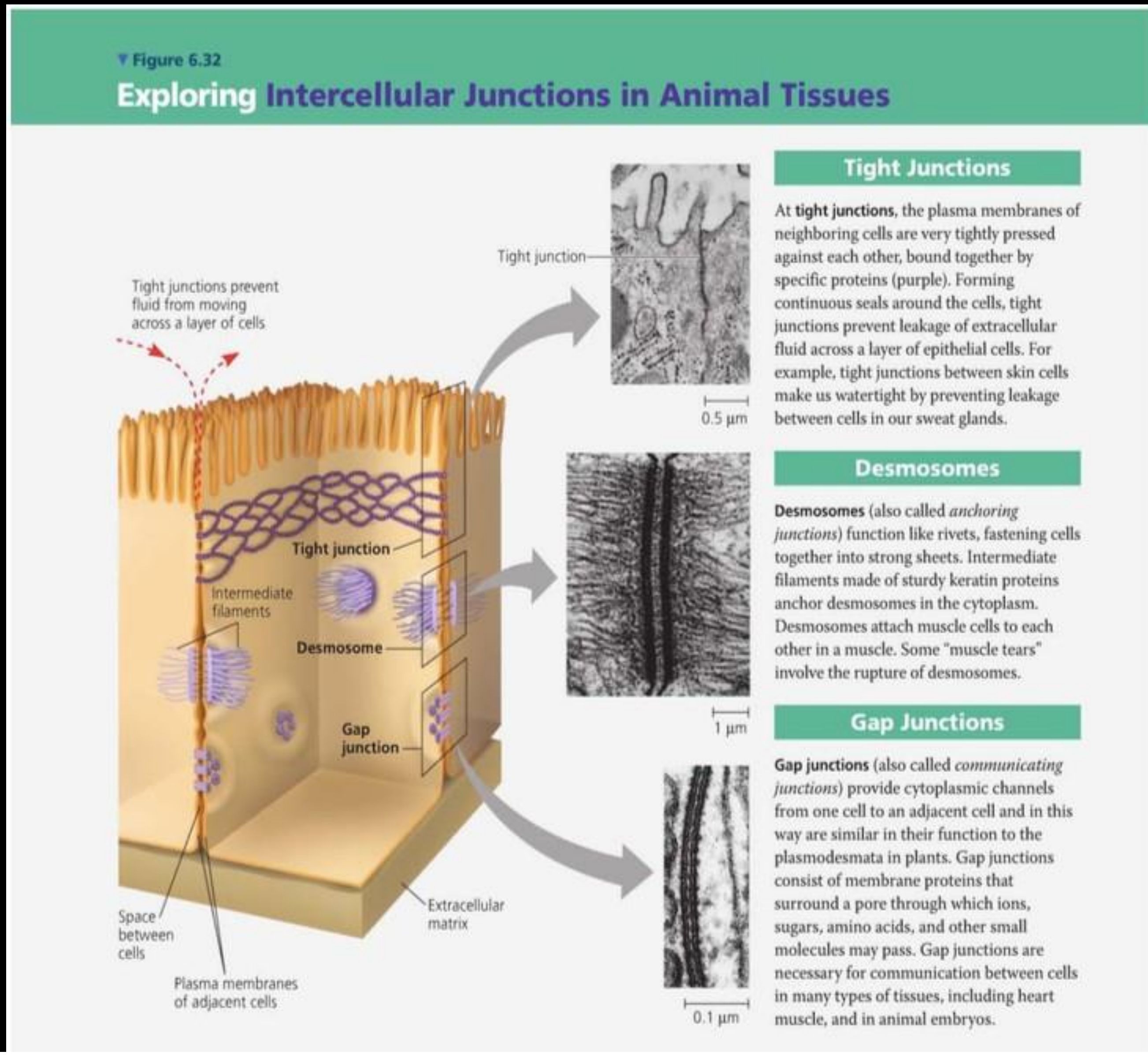
	Prokaryote 	**Animal** 	**Plant** 
EXTERIOR STRUCTURES			
Cell wall	Present (protein-polysaccharide)	Absent	Present (cellulose)
Cell membrane	Present	Present	Present
Flagella/cilia	May be present (single strand)	May be present	Absent except in sperm of a few species
INTERIOR STRUCTURES			
ER	Absent	Usually present	Usually present
Ribosomes	Present	Present	Present
Microtubules	Absent	Present	Present
Centrioles	Absent	Present	Absent
Golgi apparatus	Absent	Present	Present
Nucleus	Absent	Present	Present
Mitochondria	Absent	Present	Present
Chloroplasts	Absent	Absent	Present
Chromosomes	A single circle of DNA	Multiple; DNA-protein complex	Multiple; DNA-protein complex
Lysosomes	Absent	Usually present	Present
Vacuoles	Absent	Absent or small	Usually a large single vacuole

Plasmodesmata pada Sel Tumbuhan



▲ **Figure 6.31 Plasmodesmata between plant cells.** The cytoplasm of one plant cell is continuous with the cytoplasm of its neighbors via plasmodesmata, channels through the cell walls (TEM).

Tight Junction, Desmosomes, Gap Juction pada Sel Hewan



▼ Figure 6.32

Exploring Intercellular Junctions in Animal Tissues

Tight Junctions

At **tight junctions**, the plasma membranes of neighboring cells are very tightly pressed against each other, bound together by specific proteins (purple). Forming continuous seals around the cells, tight junctions prevent leakage of extracellular fluid across a layer of epithelial cells. For example, tight junctions between skin cells make us watertight by preventing leakage between cells in our sweat glands.

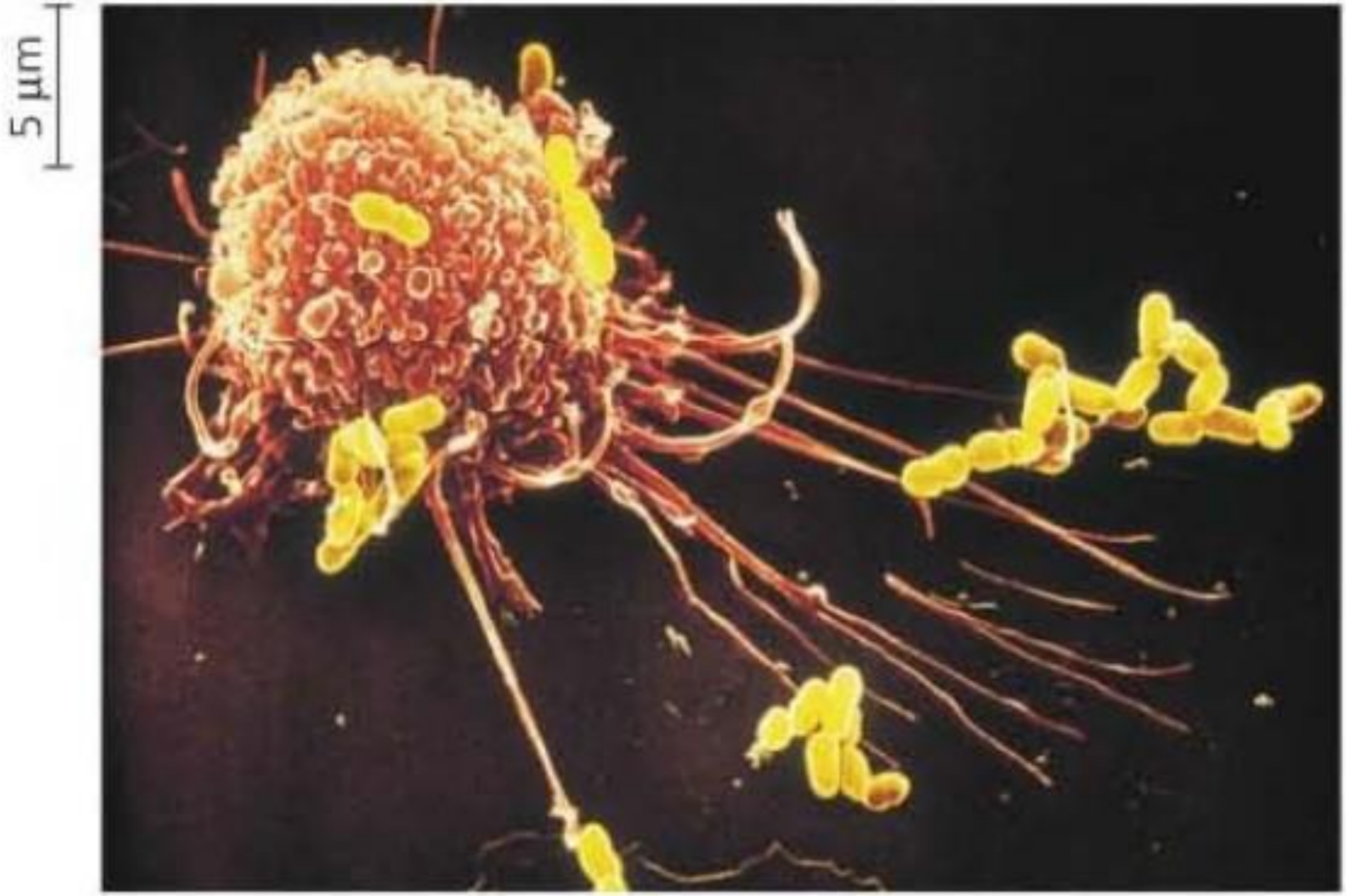
Desmosomes

Desmosomes (also called *anchoring junctions*) function like rivets, fastening cells together into strong sheets. Intermediate filaments made of sturdy keratin proteins anchor desmosomes in the cytoplasm. Desmosomes attach muscle cells to each other in a muscle. Some "muscle tears" involve the rupture of desmosomes.

Gap Junctions

Gap junctions (also called *communicating junctions*) provide cytoplasmic channels from one cell to an adjacent cell and in this way are similar in their function to the plasmodesmata in plants. Gap junctions consist of membrane proteins that surround a pore through which ions, sugars, amino acids, and other small molecules may pass. Gap junctions are necessary for communication between cells in many types of tissues, including heart muscle, and in animal embryos.

Sel: Satuan Kehidupan yang Lebih Besar dari bagian-bagiannya



▲ **Figure 6.33 The emergence of cellular functions.** The ability of this macrophage (brown) to recognize, apprehend, and destroy bacteria (yellow) is a coordinated activity of the whole cell. Its cytoskeleton, lysosomes, and plasma membrane are among the components that function in phagocytosis (colorized SEM).

DAFTAR PUSTAKA

- Campbell, Neil A., Jane B. Reece. 2008. Biology. 8th ed. Pearson Benjamin Cummings, San Francisco.

-https://www.youtube.com/watch?v=zcUlQ14iUqA

-https://www.youtube.com/watch?v=d4TJ4NY1IA0

- https://www.youtube.com/watch?v=qaElp0M3NZw

TUGAS

MENGGAMBAR STRUKTUR SEL BAKTERI/HEWAN/TUMBUHAN PADA KERTAS HVS/BERGAMBAR DAN DILENGKAPI DENGAN PENJELASAN SINGKAT DARI BAGIAN-BAGIAN SEL

BUAT SEKREATIF MUNGKIN. GAMBAR YANG MENARIK INSYAALLAH AKAN DIUPLOAD KE MEDIA SOSIAL STFI

DEADLINE: 1 MINGGU SETELAH PERKULIAHAN