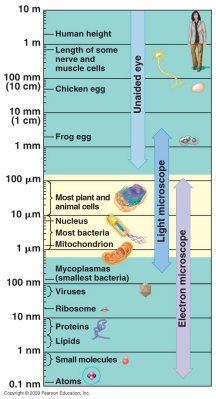
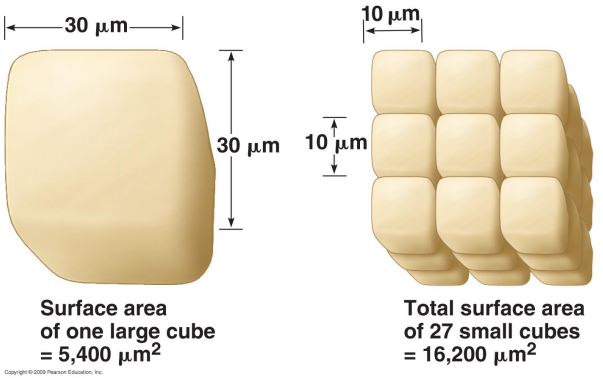
Biology – Chapter 7a
Cells

Honors Biology – Chapter 4
A Tour of the Cell

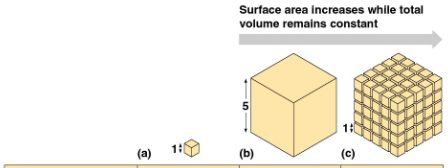
Ridgefield Memorial High School



Most cells are microscopic, but they are still bigger than molecules and atoms.

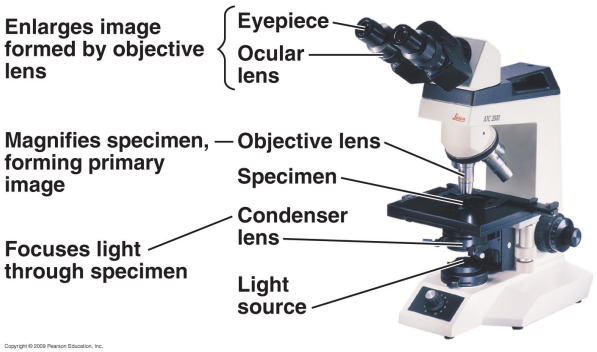


Cells are small because they need to maximize their SURFACE AREA TO VOLUME RATIO.



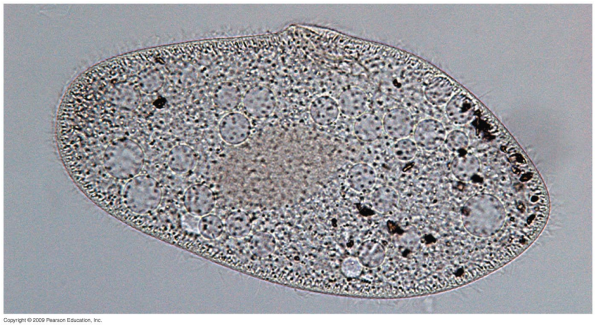
	(a)	(b)	(c)
Total surface area (height × width × number of sides × number of boxes)	6	150	750
Total volume (height × width × length × number of boxes)	1	125	125
Surface-area-to-volume ratio (area ÷ volume)	6	1.2	6

If a cell had very little surface area (picture B), it would never survive.



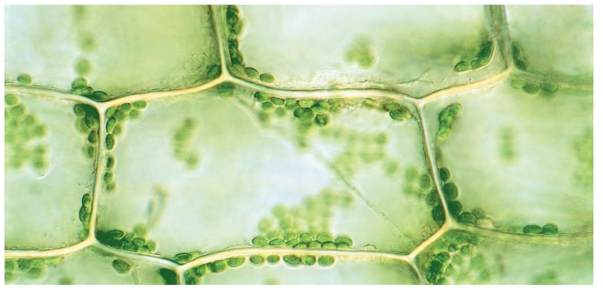
The light microscope is the easiest way to see cells.

An electron microscope is much more expensive and sophisticated than a light microscope.

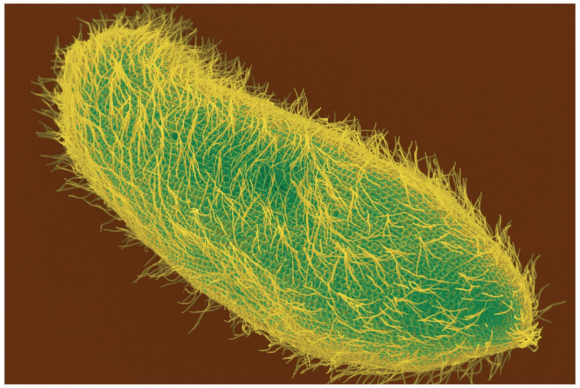


This picture of a protist (Paramecium) was taken with a light microscope.

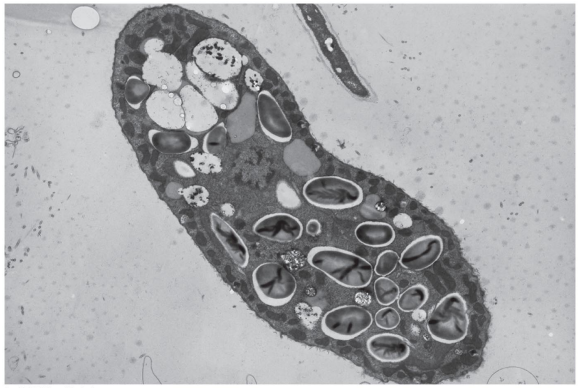
This picture of a protist (Paramecium) was taken with a different light microscope.



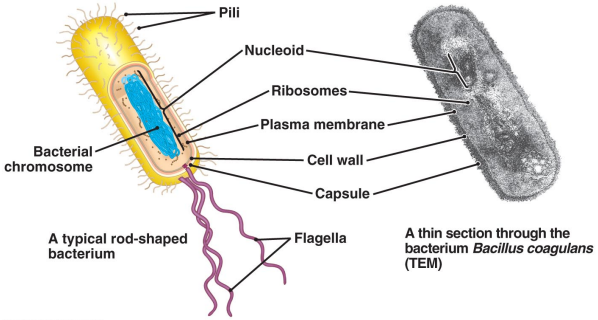
This picture of leaf cells was taken with a light microscope.



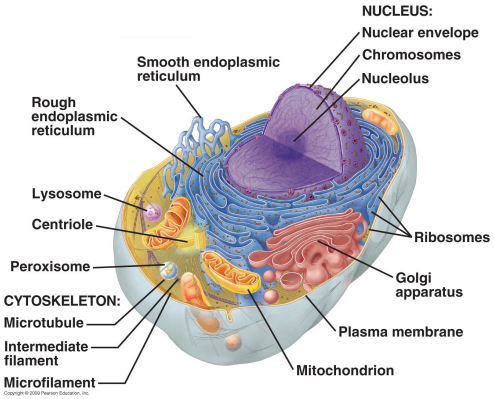
This picture of a protist (Paramecium) was taken with a scanning electron microscope.



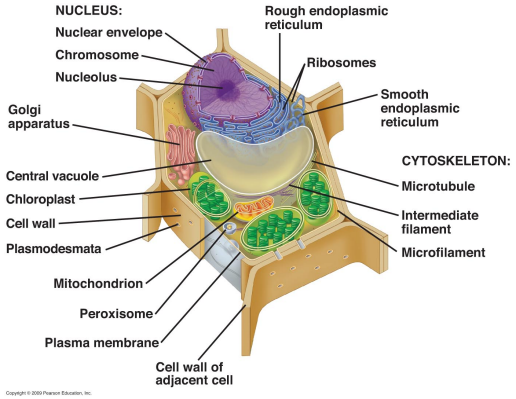
This picture of a protist (Paramecium) was taken with a transmission electron microscope.



This is the basic structure of a prokaryotic (bacterial) cell.



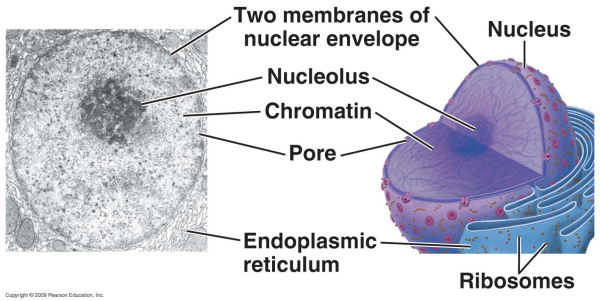
This is the basic structure of an animal cell.



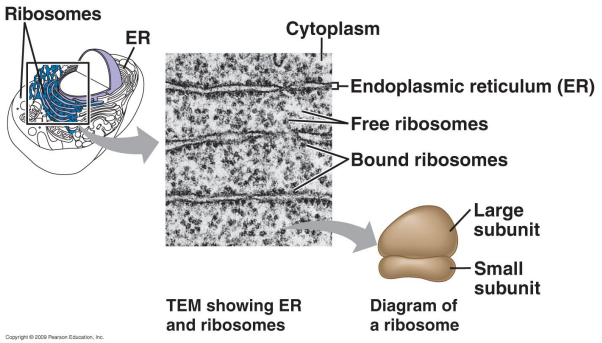
This is the basic structure of a plant cell.

Organelle	*Structure*	*Function*	*Plant? Animal?*
Nucleus	Chromatin, Chromosomes	Contains the DNA and regulates cell activities	Plant Animal
Nuclear Envelope	Phospholipid Bilayer	Contains the nucleus and has pores to let materials out	Plant Animal
Nucleolus	Dark region within the nucleus	Creates ribosomes	Plant Animal
Ribosome	Small spheres in the cytoplasm or on the Rough ER	Creates proteins	Plant Animal

The protein synthesis pathway includes the nucleus, nuclear envelope, nucleolus, and ribosomes.



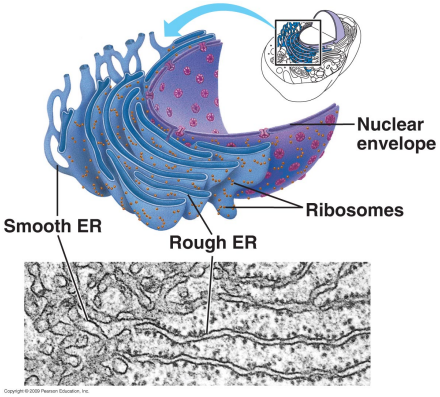
The protein synthesis pathway primarily involves the nucleus and the ribosomes.



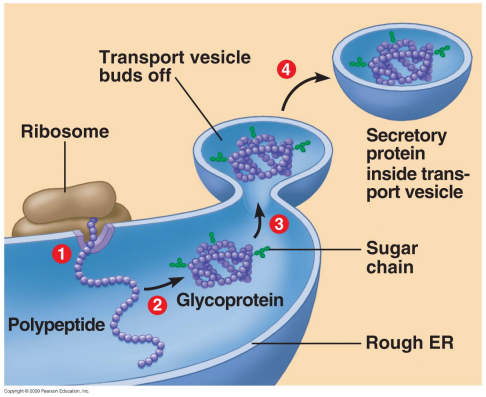
Proteins are created on ribosomes that are in the cytoplasm or on the rough ER.

Organelle	*Structure*	*Function*	*Plant? Animal?*
Rough ER	Flattened sacs of membranes with ribosomes	Creates proteins to be exported from the cell	Plant Animal
Smooth ER	Flattened sacs of membranes without ribosomes	Creates lipids and carbohydrates to be exported from the cell	Plant Animal
Transport Vesicle	Small membrane-bound sac	Moves chemicals from ER to Golgi or from Golgi to the cell membrane	Plant Animal
Golgi Apparatus	Flattened sacs of membranes without ribosomes	Modifies and distributes chemicals to be exported from the cell	Plant Animal
Cell Membrane	Phospholipid Bilayer	Creates a barrier around the cell and regulates what enters and leaves the cell	Plant Animal

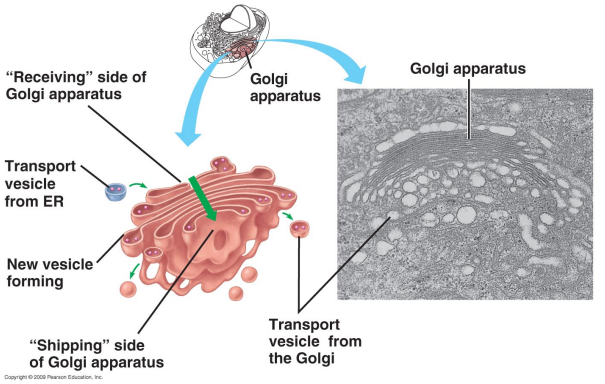
The endo-membrane system includes the rough and smooth endoplasmic reticulum, transport vesicles, Golgi apparatus, and cell membrane.



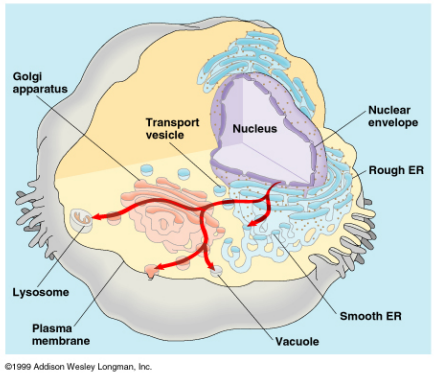
The endoplasmic reticulum has a lot of folds to maximize its surface area.



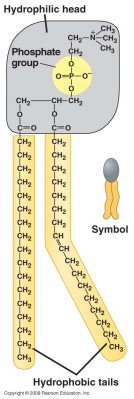
Transport vesicles move chemicals around the cell.



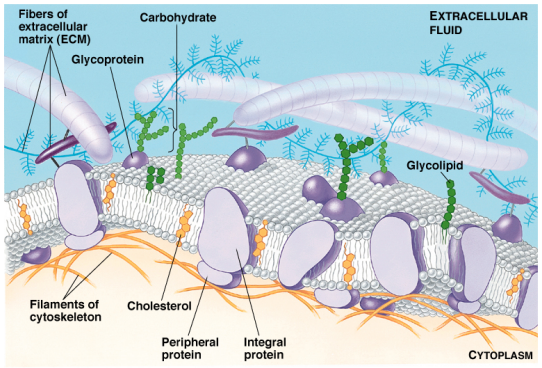
The Golgi apparatus is like the "post office" of the cell. It sorts everything out.



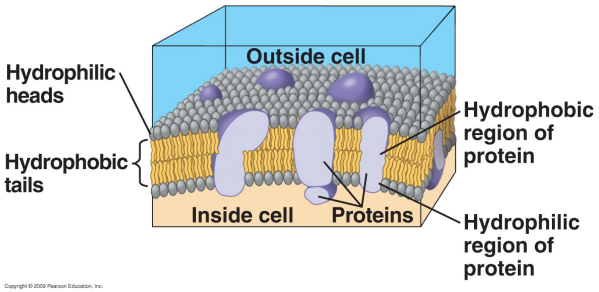
This is a summary of the endo-membrane system of a cell.



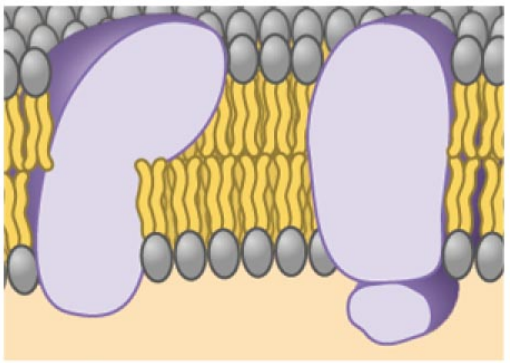
Phospholipids are the primary structural component of the cell membrane.



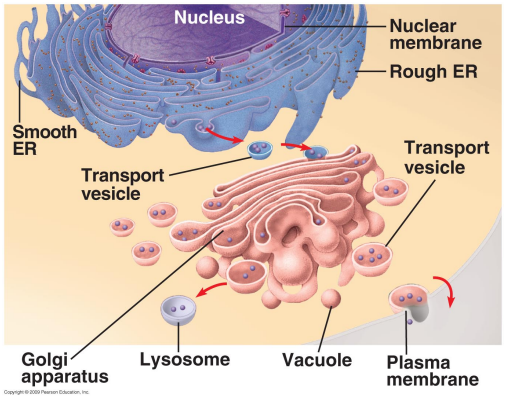
The cell membrane is called a "fluid-mosaic" model. MOSAIC means that it is made up of many different items and FLUID means that they can move around.



The cell membrane is mostly made of phospholipids and membrane proteins.



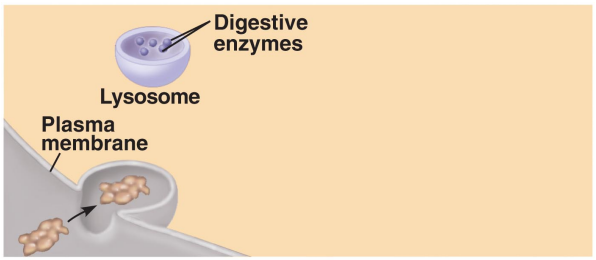
The membrane proteins are usually much larger than the phospholipids. Some membrane proteins transmit messages and others transport molecules into or out of the cell.



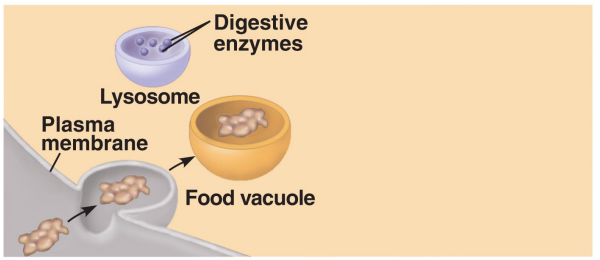
The endo-membrane system involves a lot of different organelles.

Organelle	*Structure*	*Function*	*Plant? Animal?*
Lysosome	Small membrane-bound sac	Contains enzymes that digest chemicals that are no longer needed	Plant Animal
Peroxisome	Small membrane-bound sac	Contains enzymes that break down chemical poisons such as peroxide and alcohol	Plant Animal
Central Vacuole	Large membrane-bound sac	Stores water, sugars, and other important chemicals	Plant

The storage and degradation pathway includes the lysosome, peroxisome, and central vacuole.



Lysosomes contain enzymes and can break down food.



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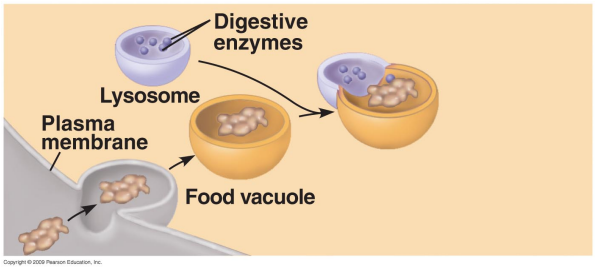

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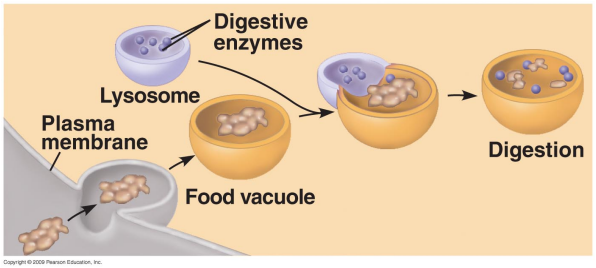
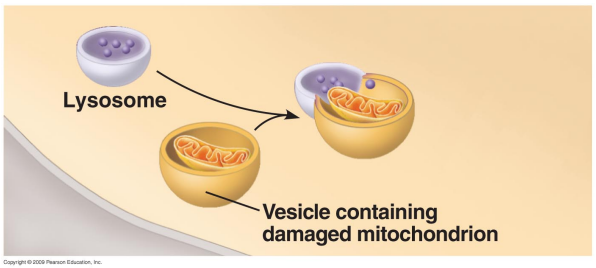
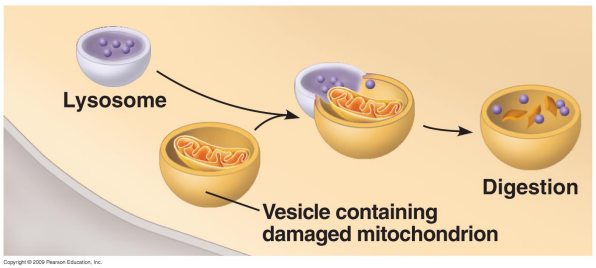


Lysosomes contain enzymes and can break down food.

Lysosomes also break down broken or damaged organelles.



Lysosomes also break down broken or damaged organelles.



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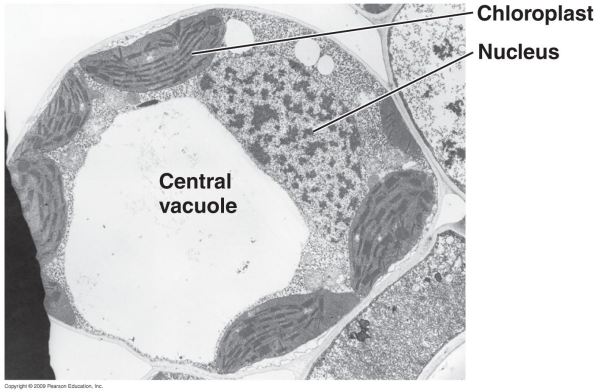
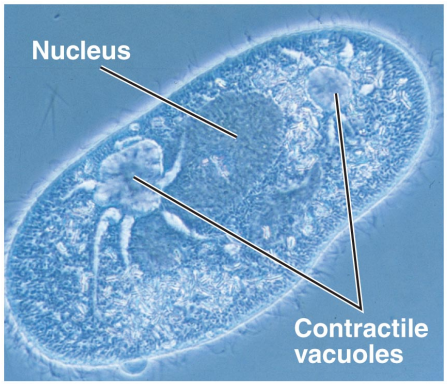


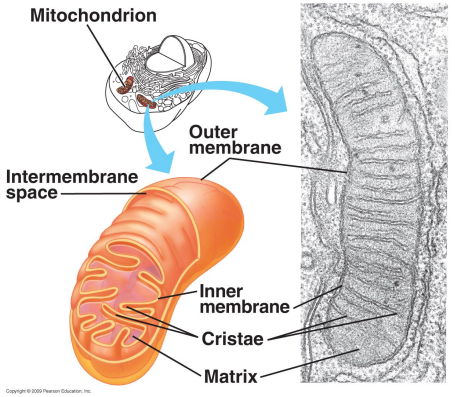
Plant cells have a large central vacuole for storage water, sugar, and other chemicals.



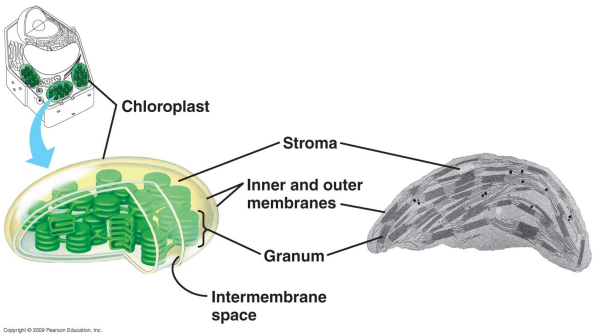
This protist (Paramecium) has a contractile vacuole that squirts out excess water.

Organelle	*Structure*	*Function*	*Plant? Animal?*
Mitochondrion	Double membrane-bound sac with a highly folded inner membrane	Production of ATP (energy)	Plant Animal
Chloroplast	Double membrane-bound sac with flattened sacs inside	Production of glucose during photosynthesis	Plant

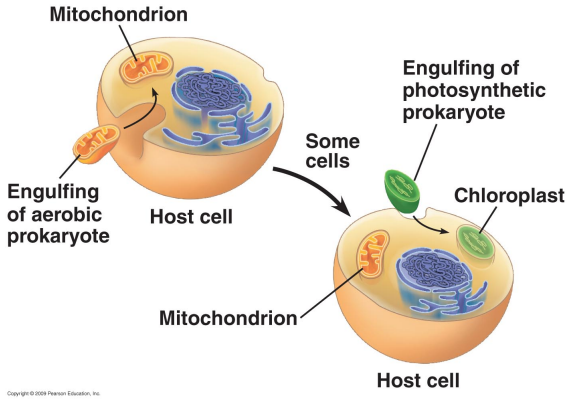
The energy transformation pathway includes the mitochondrion and the chloroplast.



The mitochondrion has a lot of folds to maximize surface area for making ATP (energy molecules).



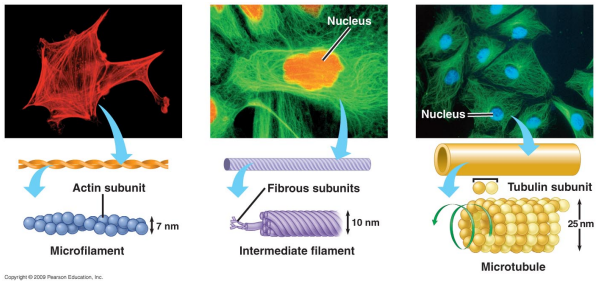
The chloroplast has a lot of internal thylakoid membranes to maximize surface area for absorbing sunlight and making glucose.



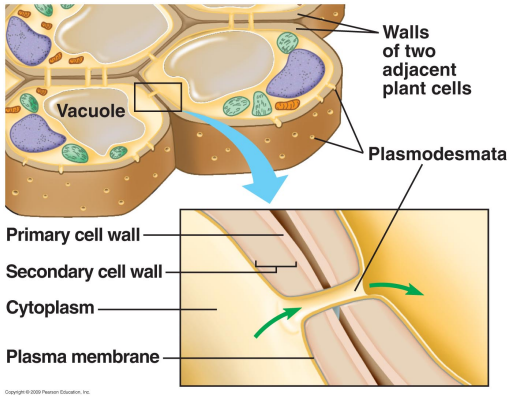
The chloroplast and mitochondrion actually used to be their own prokaryotic cells, complete with their own DNA and ribosomes!

Organelle	*Structure*	*Function*	*Plant? Animal?*
Cytoplasm	Fluid inside a cell	Contains dissolved nutrients, ions, and other chemicals	Plant Animal
Cytoskeleton	Dissolved structural proteins in the cytoplasm	Maintains the cell's shape and structure	Plant Animal
Cell Wall	Made of cellulose or other water-insoluble polysaccharides	Protects the cell, maintains it's shape and structure, and lets cells stick together	Plant
Extracellular Matrix	Structural proteins located on the outside of the cell membrane	Allows cells to stick together even though they do not have a cell wall	Animal
Cilia	Hair-like structures made of contractile proteins on the cell membrane	Moves substances across the surface of the cell	Animal
Flagellum	Thread-like structure made of contractile proteins on the cell membrane	Allows the cell to "swim"	Animal

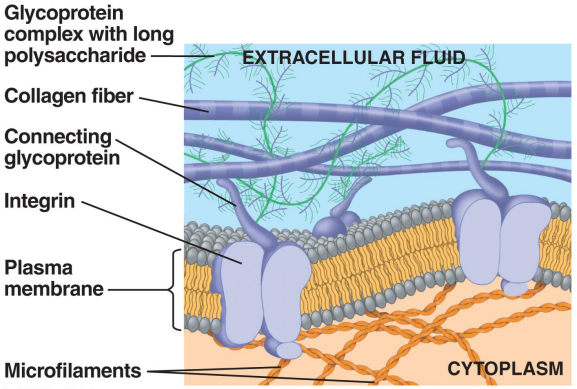
The structure, support, and movement pathway includes the cytoplasm, cytoskeleton, cell wall, extracellular matrix, cilia, and flagellum.



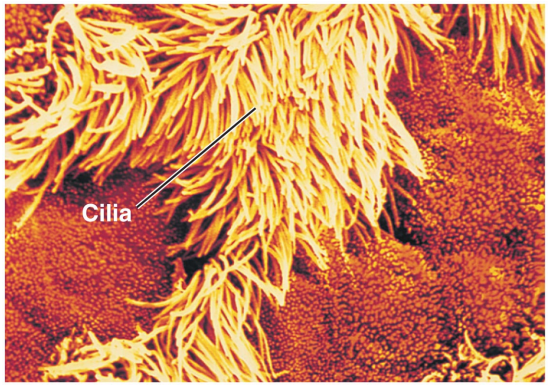
The cytoskeleton is made up of microfilaments (thinner protein strands) and microtubules (thicker protein strands).



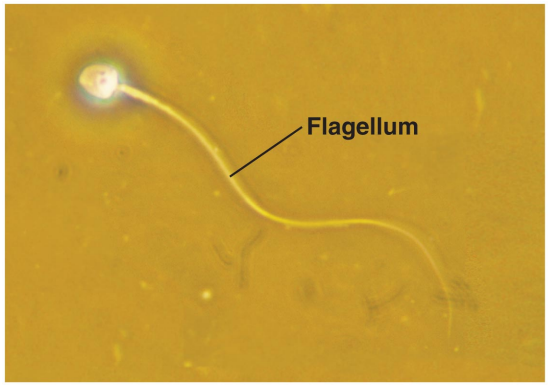
A plant cell's cell wall is a thick protective covering on the outside of the cell membrane. The cell wall is made out of cellulose.



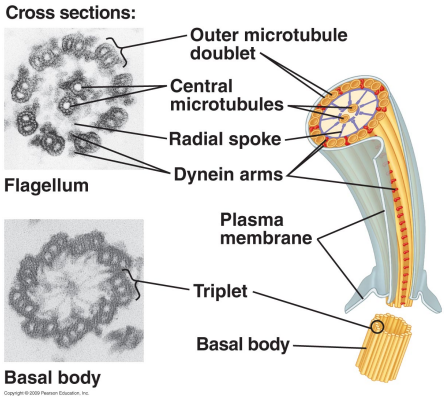
The extracellular matrix is like glue that helps animal cells stick together.



Cilia are short “hairs” on the outside of cells that beat back and forth for movement.



A sperm cell is one of the only animal cells with a flagellum (tail used for movement).



This diagram shows the structure of cilia and flagella.