8.2 cell structure

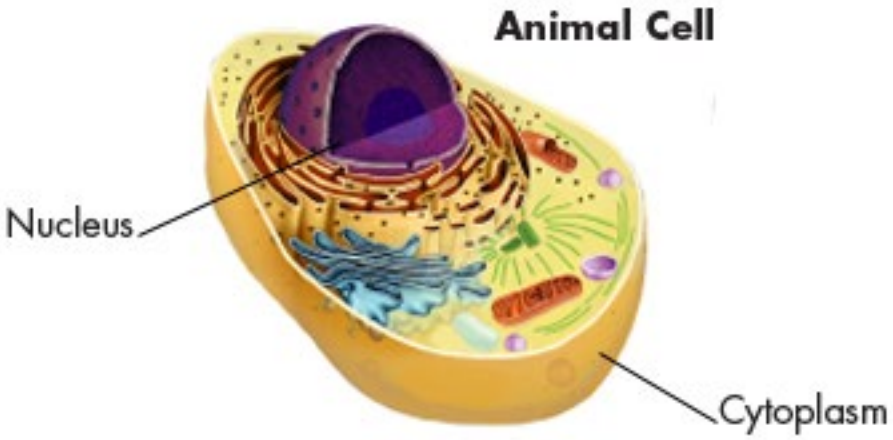
Cell Organization

The eukaryotic cell has two major parts: the nucleus and the cytoplasm.

cytoplasm - fluid portion of the cell outside the nucleus.

-Prokaryotic cells have cytoplasm too.

Eukaryotic cells contain many **organelles** - membrane bound structures that perform specialized tasks.



The Nucleus

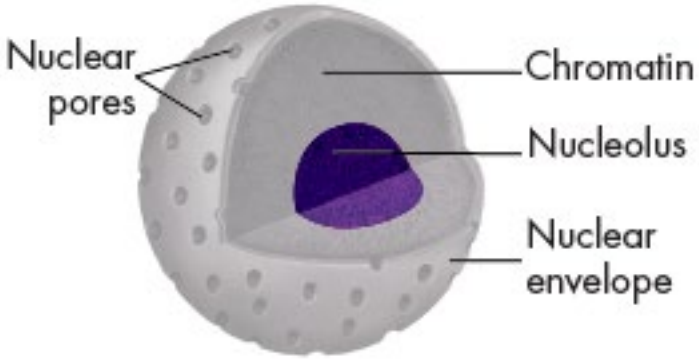
nucleus - control center of the cell.

- contains the cell's DNA
- surrounded by a nuclear envelope made of 2 membranes.
- contains **nucleolus** = site of ribosome synthesis

The Nucleus

The nuclear envelope contains nuclear pores, which allow material to move into and out of the nucleus.

Proteins, RNA, and other molecules move through the nuclear pores to and from the rest of the cell

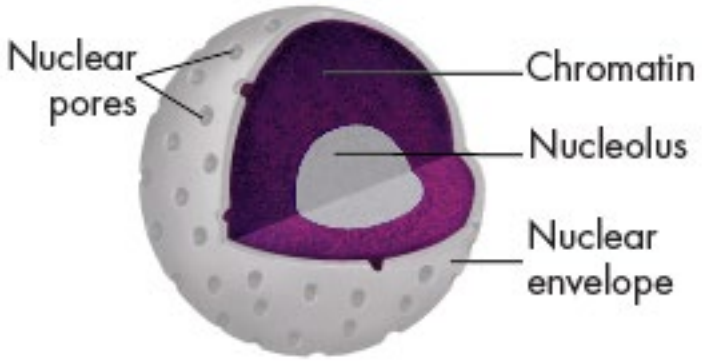


The Nucleus

DNA in the nucleus is usually seen as **Chromatin** - long, thin strings of DNA.

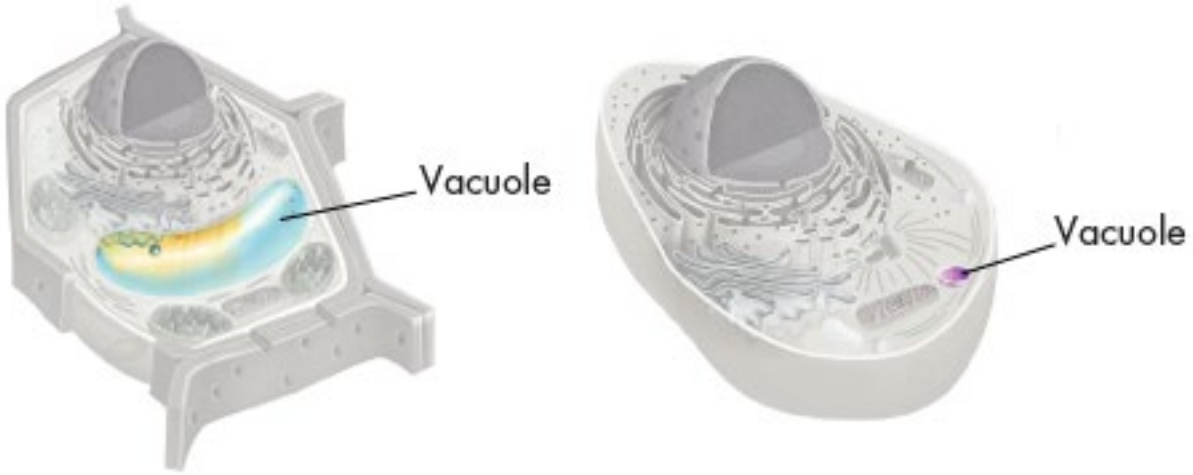
When a cell divides, its chromatin condenses into shorter, thicker **chromosomes**.

Chromosomes contain the genetic information (DNA) passed to the offspring.



Vacuoles and Vesicles

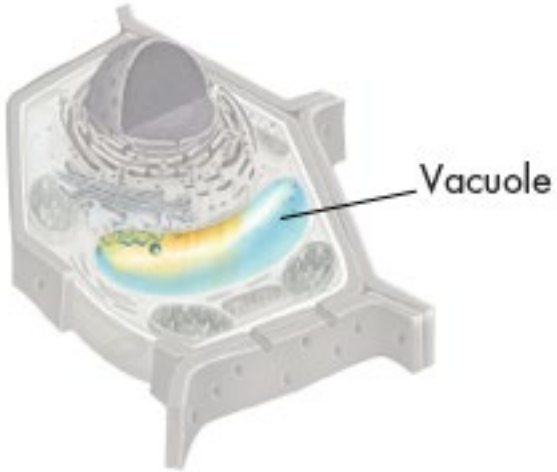
cells contain large, saclike, membrane-enclosed structures called **vacuoles** that store materials like water, salts, proteins, and carbohydrates.



Vacuoles and Vesicles

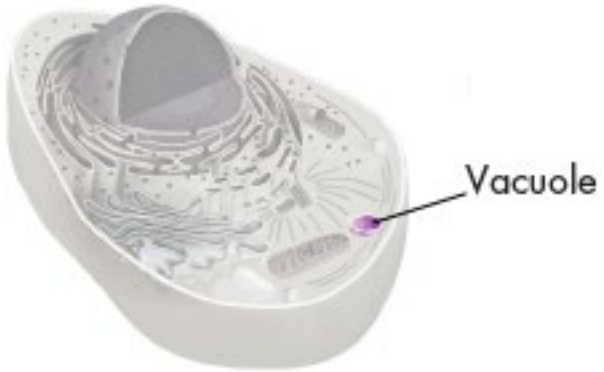
Plant cells have a single, large central vacuole.

Turgid pressure of the central vacuole increases their rigidity helping maintain plant structure.



Vacuoles and Vesicles

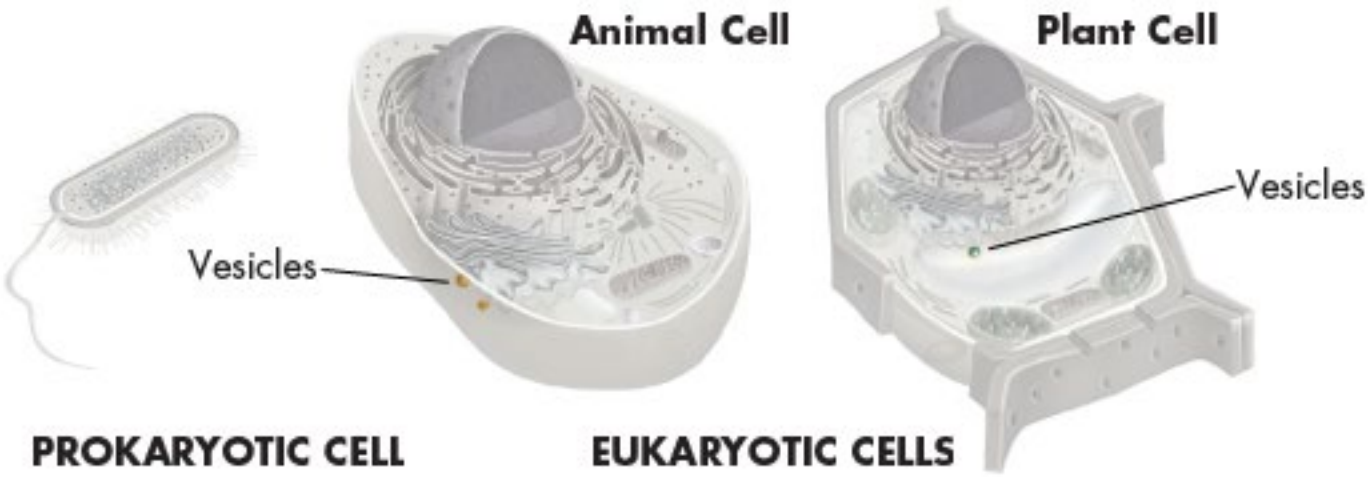
Vacuoles are present in some unicellular organisms and in some animals.



Vacuoles and Vesicles

Many eukaryotic cells contain smaller membrane-enclosed structures called **vesicles**.

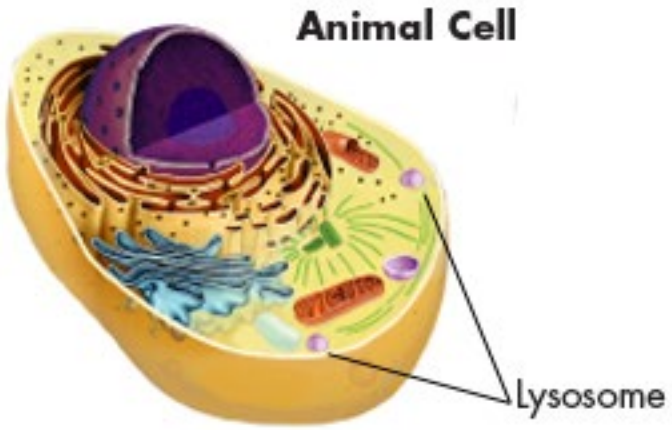
Vesicles store and move materials between organelles and to and from the cell surface.



Lysosomes

Lysosomes are organelles filled with digestive enzymes.

- breakdown lipids, carbohydrates, proteins into small molecules
- digest / recycle organelles
- involved in “cellular suicide”
- found in animal cells and few specialized plant cells



The Cytoskeleton

cytoskeleton - network of protein fibers that provide structural support for eukaryotic cells

– parts of the cytoskeleton also help to transport materials between different parts of the cell, like conveyer belts

Two principal protein filaments comprising the cytoskeleton:

1. microfilaments
2. microtubules

Microfilaments

Microfilaments - threadlike structures made of the protein actin.

- form extensive networks in some cells
- produce tough, flexible framework that supports the cell.

Microfilaments also help cells move.

– Microfilament assembly and disassembly is responsible for amoeboid movement.

Microtubules

Microtubules - hollow structures made of proteins called tubulins.

– critical in maintaining cell shape.

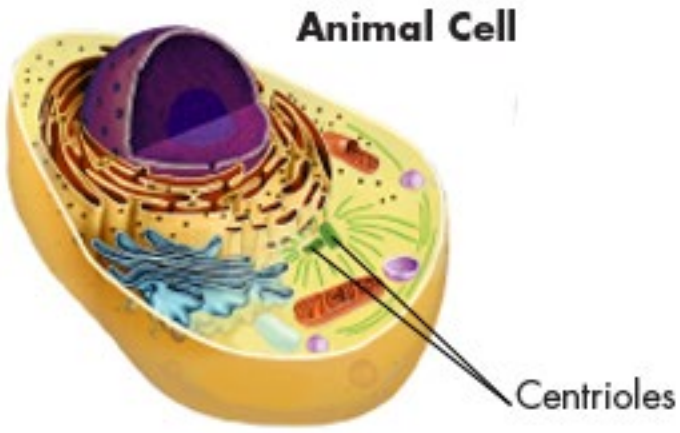
Microtubules form the mitotic spindle during cell division, which helps separate chromosomes.

Microtubules

In animal cells, centrioles are formed from tubulins.

Centrioles are located near the nucleus and help organize cell division.

Centrioles are not found in plant cells.



Microtubules

Microtubules build cilia and flagella, which enable cells to move.

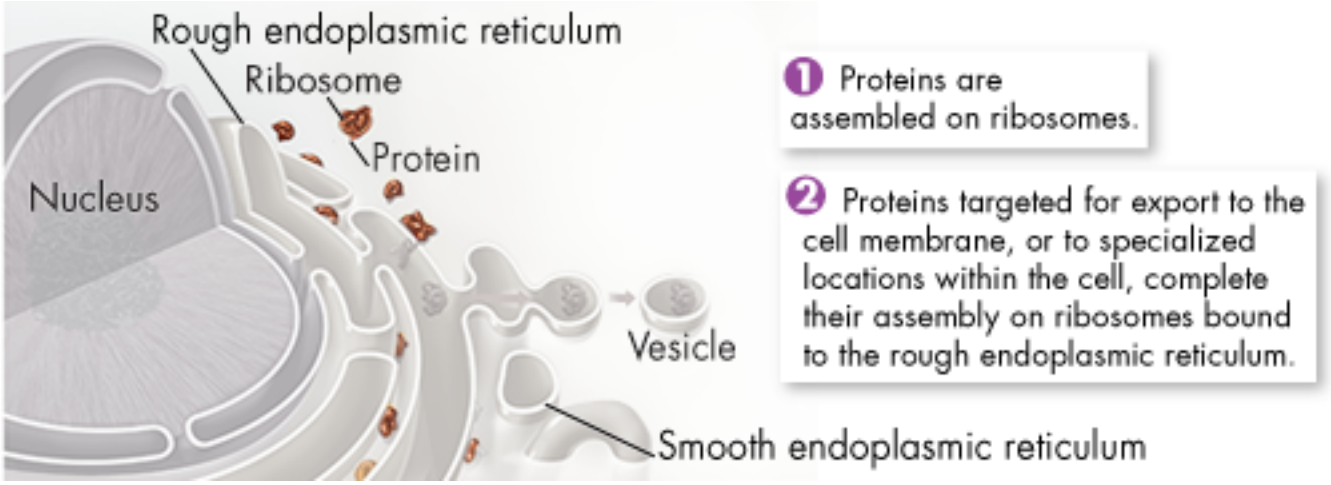
Microtubules are arranged in a “9 + 2” pattern.

Motor proteins “walk” across tubulin enabling cilia and flagella to produce movement.

Ribosomes

Ribosomes - small particles of RNA and protein
- may be free floating in cytoplasm or bound to rough ER

Ribosomes produce proteins according to DNA instructions.

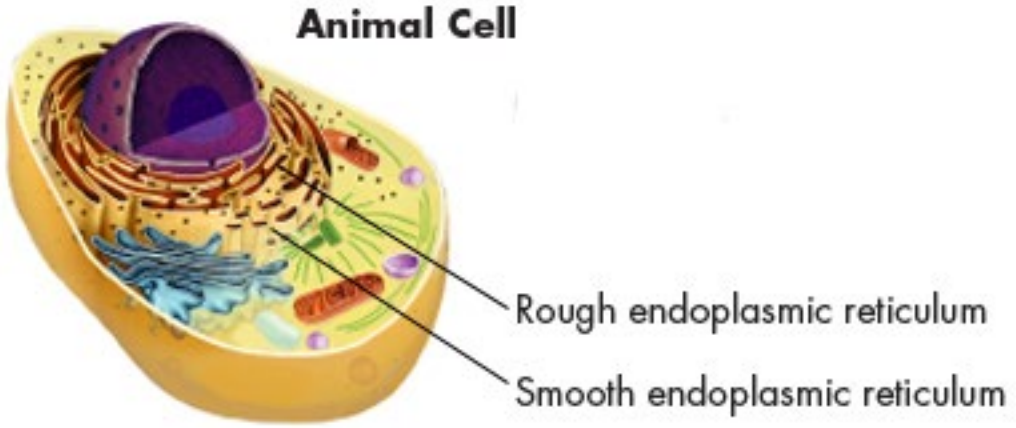


Endoplasmic Reticulum

Eukaryotic cells contain an internal membrane system known as the **endoplasmic reticulum,** or ER.

2 forms:

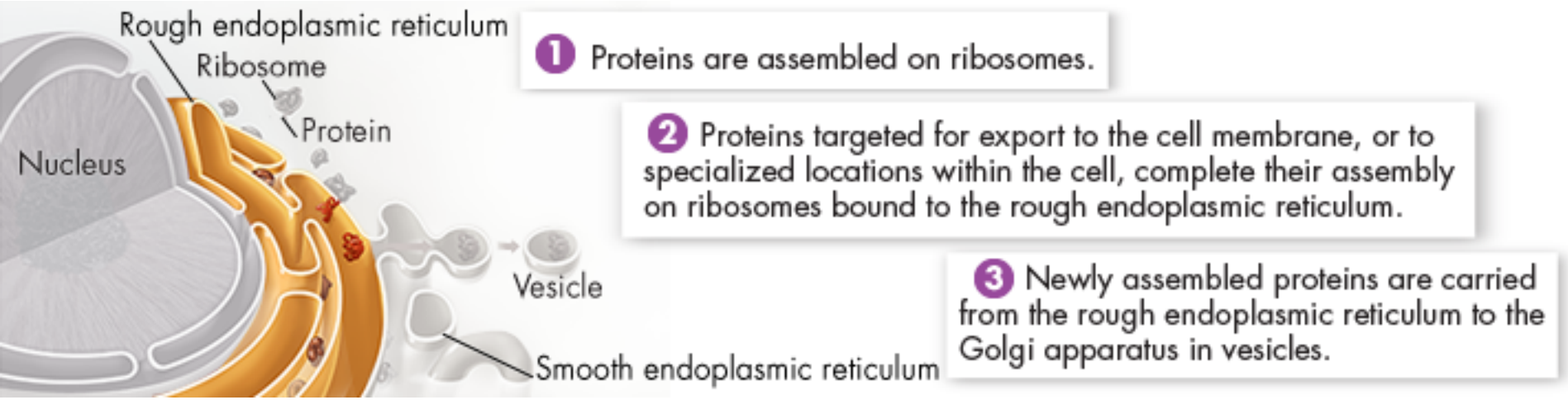
1. rough ER
2. smooth ER



Endoplasmic Reticulum

Rough ER - helps synthesize proteins
- has ribosomes on its surface.

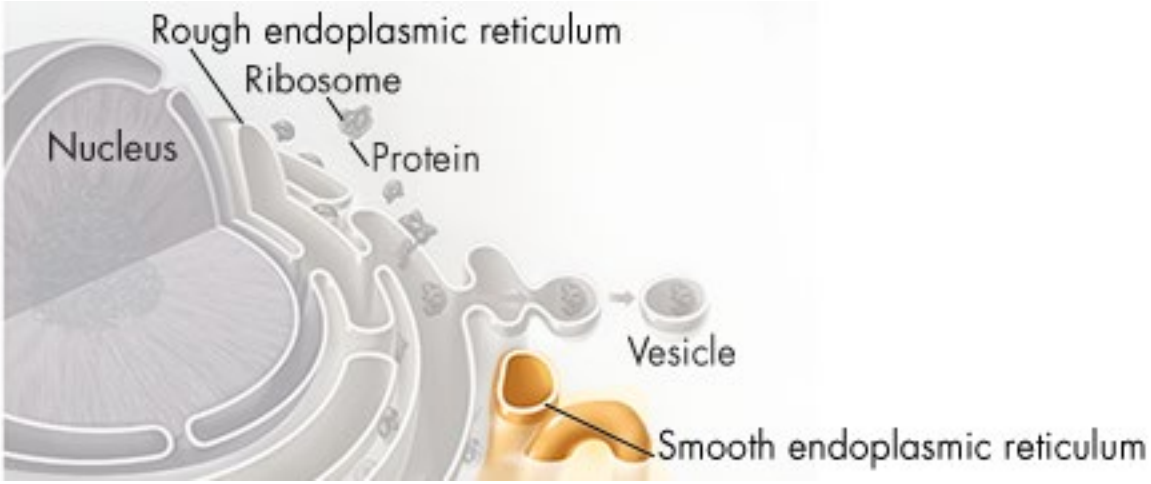
New proteins leave these ribosomes and enter the rough ER, where they may be chemically modified.



Endoplasmic Reticulum

Smooth ER - contains enzymes that perform specialized tasks, including the synthesis of membrane lipids and the detoxification of drugs.

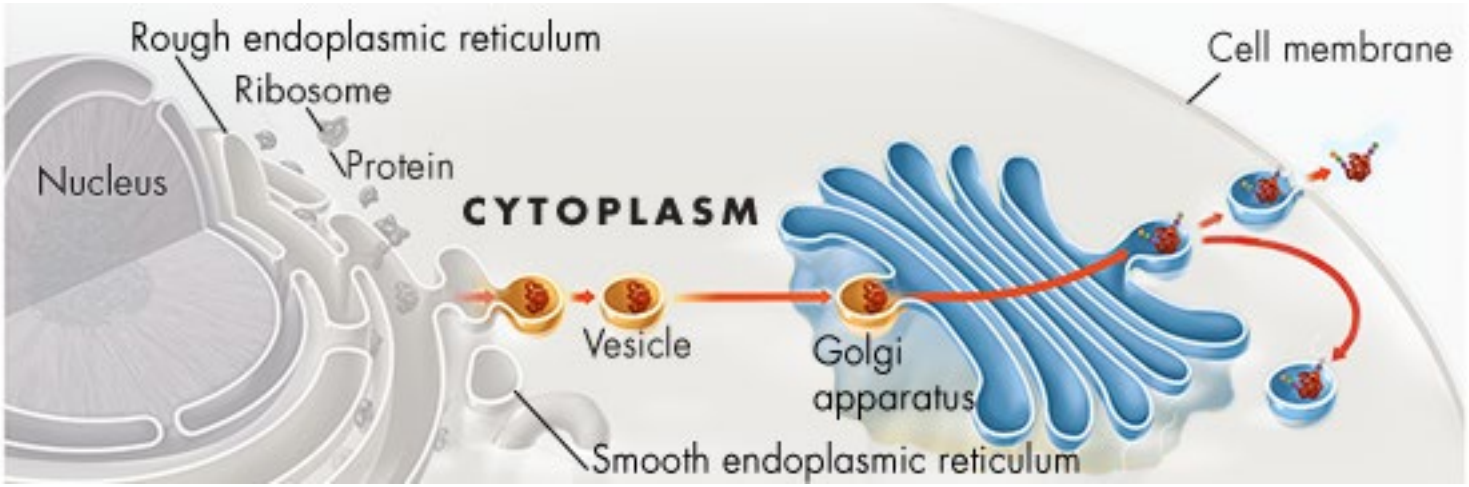
- no ribosomes on surface



Golgi Apparatus

Proteins made in the rough ER move next into the **Golgi apparatus**, which appears as a stack of flattened membranes.

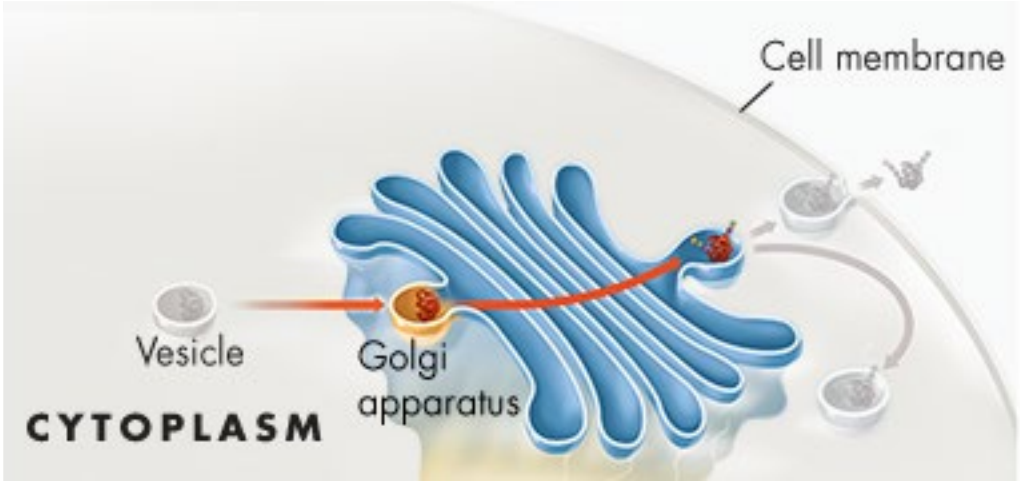
The proteins travel in vesicles that bud from the ER and carry them to the Golgi apparatus.



Golgi Apparatus

The Golgi apparatus modifies, sorts, and packages proteins and other materials from the ER for storage in the cell or release outside the cell.

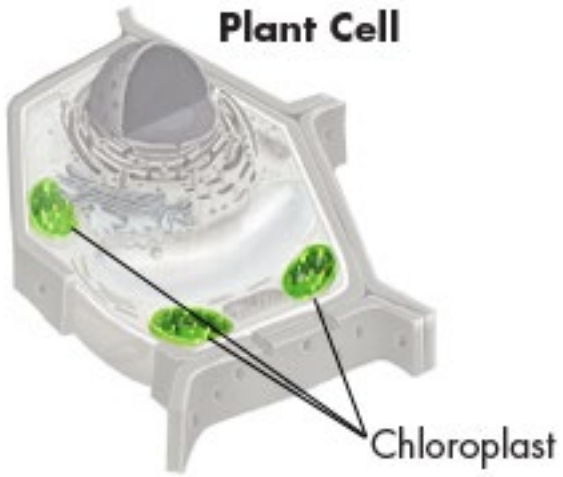
From the Golgi apparatus, proteins are “shipped” to their final destination inside or outside the cell.



Chloroplasts

Plants and some other organisms contain chloroplasts.

Chloroplasts - capture sun's energy and convert it into chemical energy through photosynthesis.

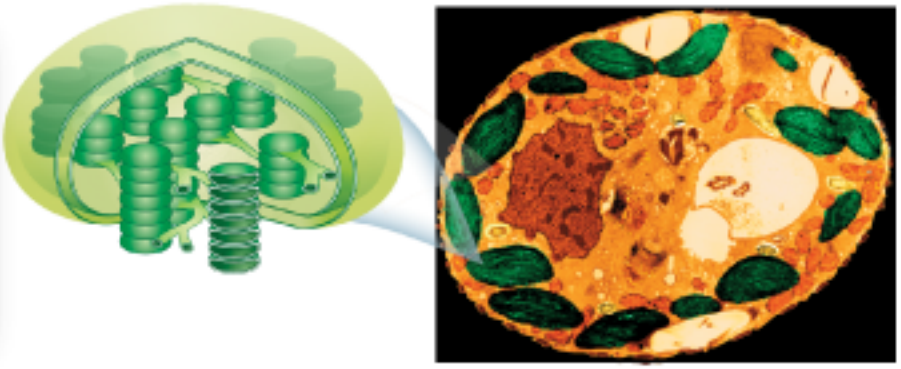


Chloroplasts

Two membranes surround chloroplasts.

Inside are stacks of other membranes, which contain the green pigment chlorophyll.

Cellular Solar Plants
Chloroplasts, found in plants and some other organisms such as algae, convert energy from the sun into chemical energy that is stored in food.

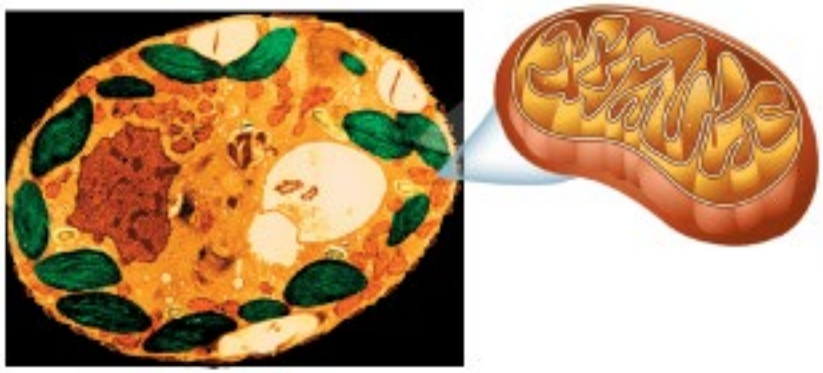


Mitochondria

Nearly all eukaryotic cells, including plants, contain mitochondria.

Mitochondria - powerhouse of the cell.

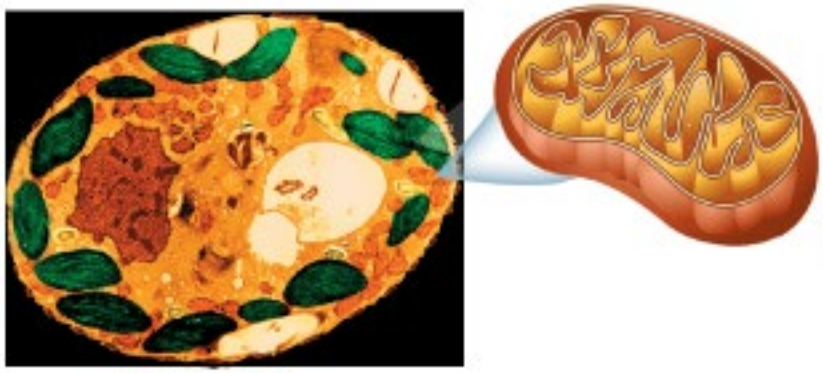
- convert chemical energy into ATP



Cellular Power Plants
Mitochondria convert chemical energy stored in food into a form that can be used easily by the cell.

Mitochondria

Two membranes enclose mitochondria. The inner membrane is folded inside the organelle.



Cellular Power Plants
Mitochondria convert chemical energy stored in food into a form that can be used easily by the cell.

Mitochondria

Chloroplasts and mitochondria contain their own DNA.

Mitochondrial DNA is identical to mom's.

endosymbiotic theory - chloroplasts and mitochondria descended from independent microorganisms.

Cell Walls

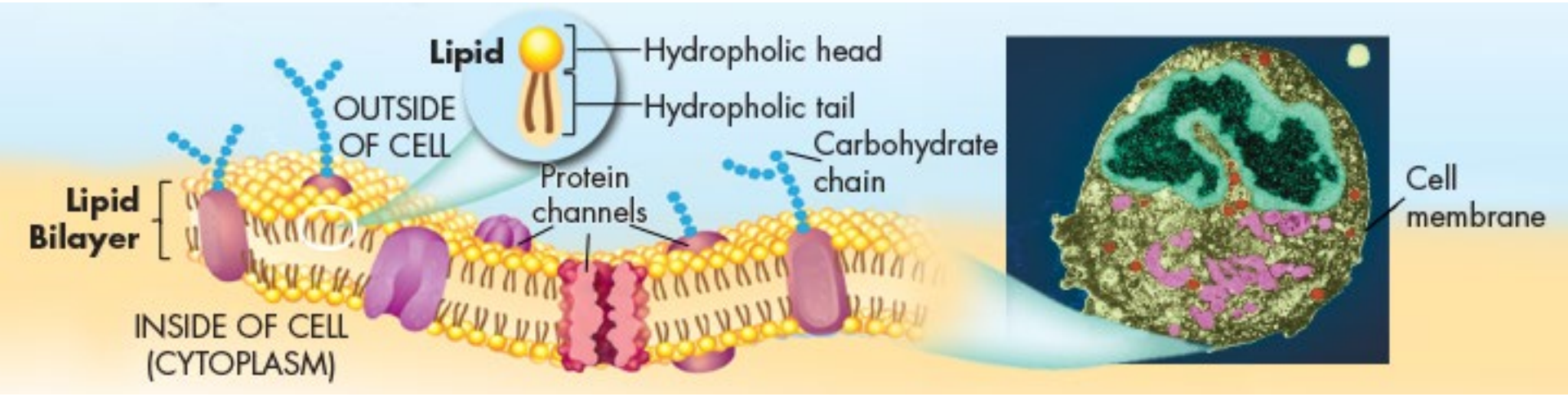
Cell wall - provides support and protection for the cell
- rigid, inflexible
- located outside the cell membrane

Prokaryotes, plants, algae, fungi, and many prokaryotes have cell walls.

Animal cells do not.

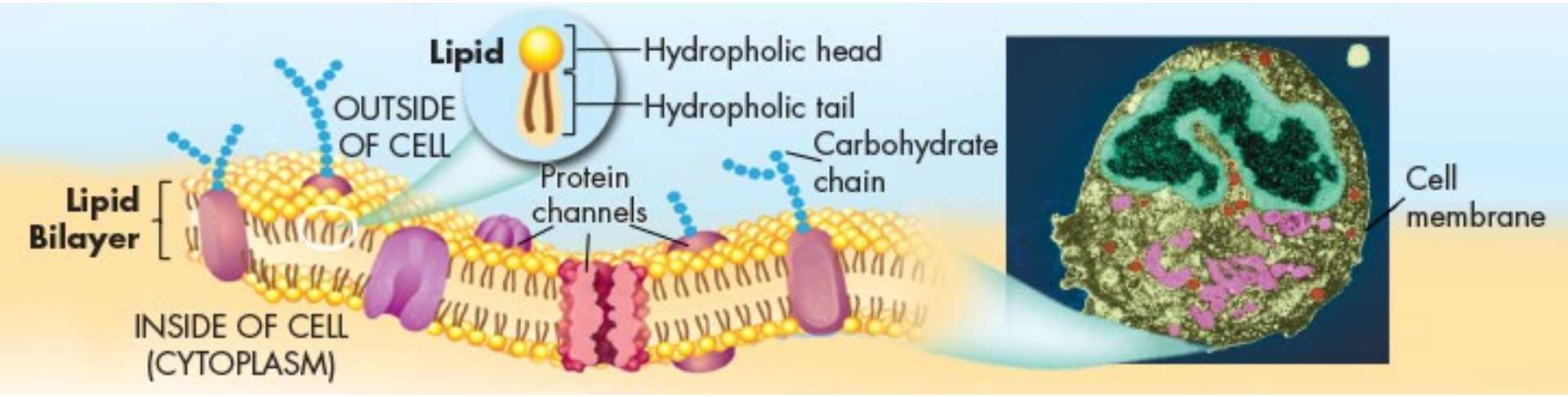
Cell Membranes

All cells contain a cell membrane that regulates what enters and leaves the cell and also protects and supports the cell.



Cell Membranes

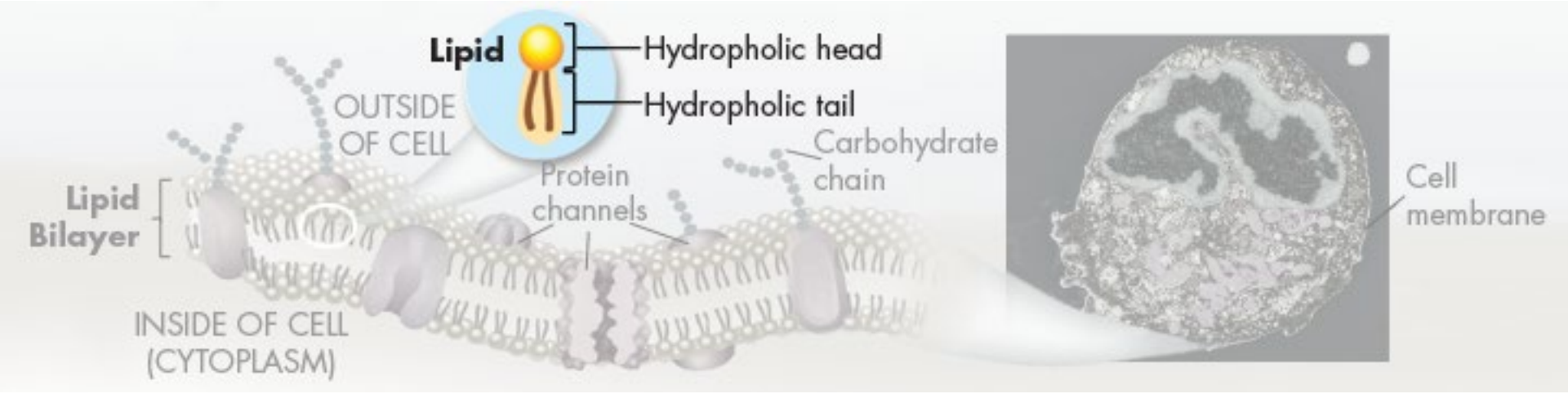
made of **phospholipid bilayer** providing a flexible structure that forms a barrier between the cell and its surroundings.



The Properties of Lipids

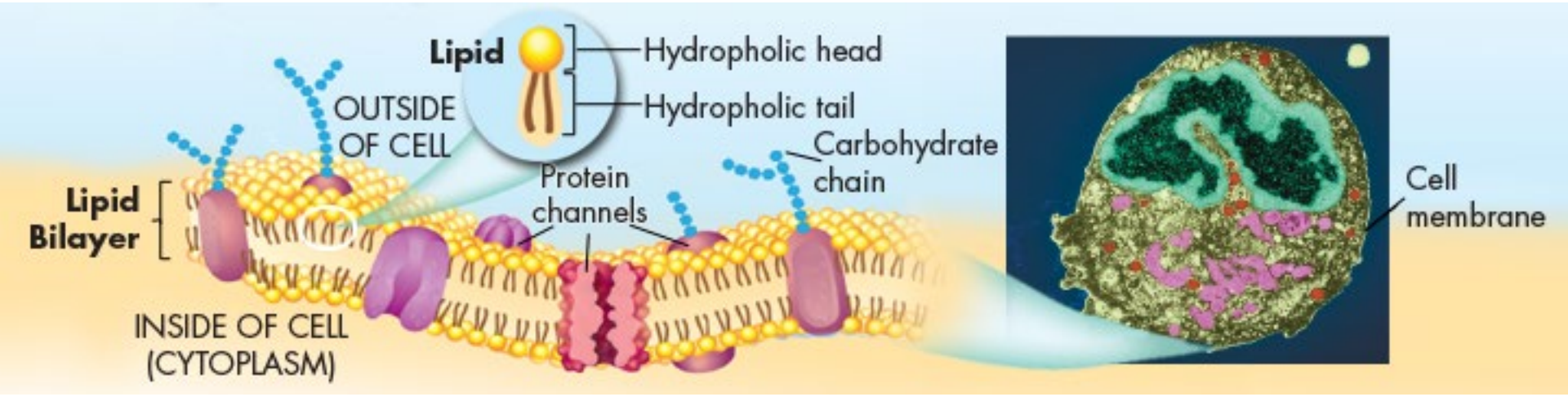
fatty acid portions of phospholipids are hydrophobic, or “water-hating.”

Phosphate end of the molecule is hydrophilic, or “water-loving.”



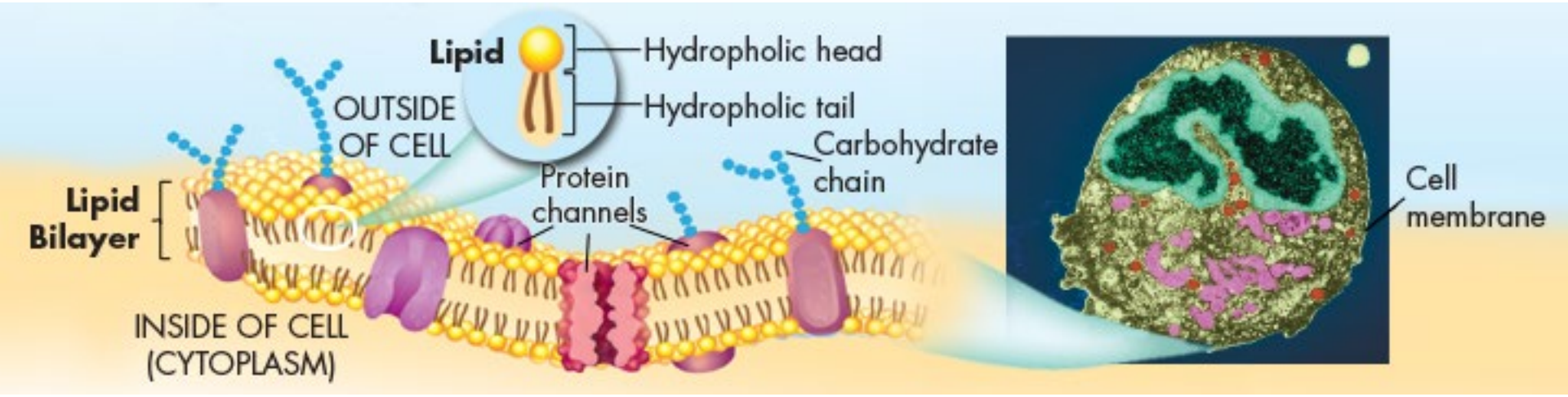
The Properties of Lipids

The phosphate heads in a bilayer are exposed to water, while the fatty acid tails form an oily layer inside the membrane which excludes water



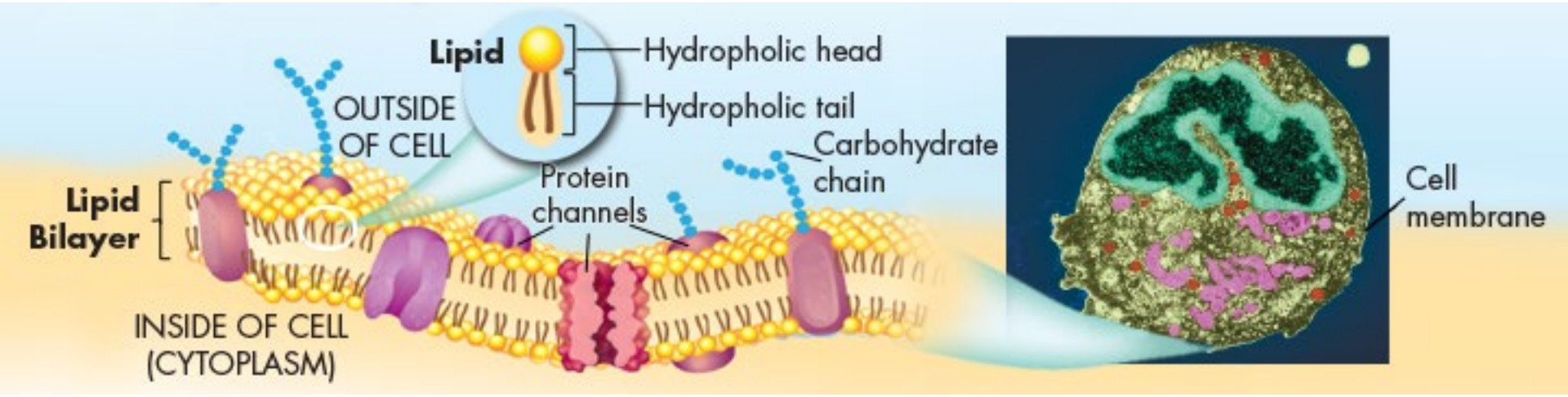
The Fluid Mosaic Model

cell membranes contain protein molecules embedded in the lipid bilayer. Carbohydrate molecules are attached to many of these proteins.



The Fluid Mosaic Model

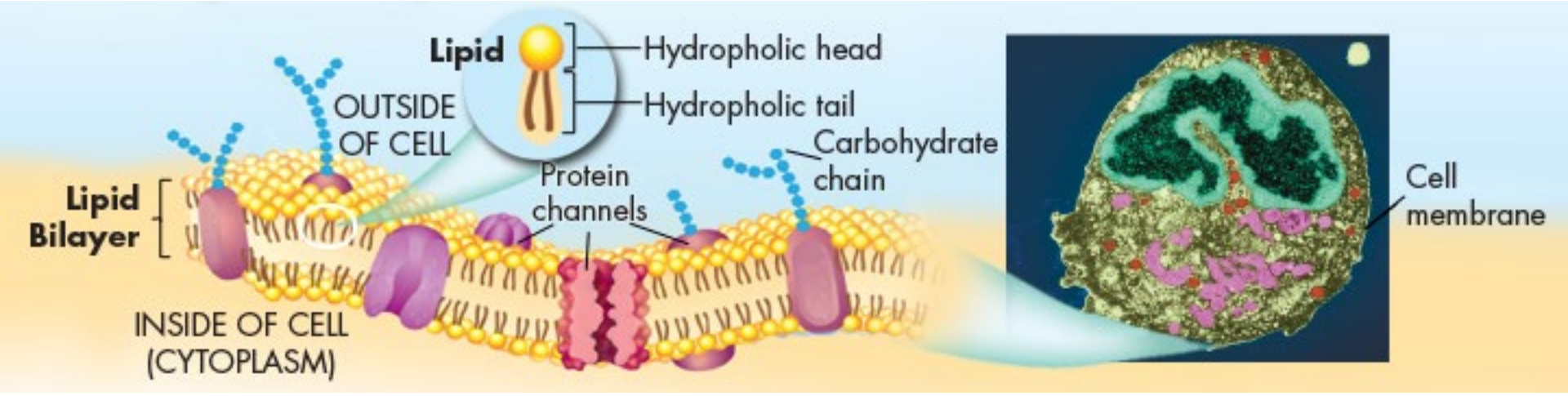
Because the embedded proteins can “float” among the lipids, and because many different molecules compose the membrane, the cell membrane is called a “fluid mosaic.”



The Fluid Mosaic Model

Some proteins form channels and pumps that move material across the cell membrane.

carbohydrates act like I.d. cards, allowing cells to identify one another.



The Fluid Mosaic Model

Cell membranes are **semipermeable or selectively permeable,** meaning some substances can pass across them and others cannot.