7-2 Eukaryotic Cell Structure

Eukaryotic Cell Structures
Structures within a eukaryotic cell that perform important cellular functions are known as **organelles**.
Cell biologists divide the eukaryotic cell into two major parts: the nucleus and the cytoplasm.

The **Cytoplasm** is the portion of the cell outside the nucleus.

Nucleus
The nucleus is the control center of the cell.
The nucleus contains nearly all the cell's DNA and with it the coded instructions for making proteins and other important molecules.
The nucleus is surrounded by a **nuclear envelope** composed of two membranes.
The envelope is dotted with nuclear pores, which allow material to move in and out of the nucleus.
The granular material in the nucleus is called **chromatin**.
Chromatin consists of DNA bound to protein.
When a cell divides, chromatin condenses to form **chromosomes**.
Chromosomes contain the genetic information that is passed from one generation of cells to the next.
Most nuclei also contain a **nucleolus**.
The nucleolus is where the assembly of ribosomes begins.

Ribosomes
One of the most important jobs carried out in the cell is making proteins.
Proteins are assembled on ribosomes.
Ribosomes are small particles of RNA and protein found throughout the cytoplasm.
Ribosomes produce proteins by following coded instructions that come from the nucleus.
Cells that are active in protein synthesis are often packed with ribosomes.

Endoplasmic Reticulum
Eukaryotic cells contain an internal membrane system called the **endoplasmic reticulum**, or ER.
The endoplasmic reticulum is where lipid components of the cell membrane are assembled, along with proteins and other materials that are exported from the cell.
There are two types of ER—rough and smooth.
The portion of the ER involved in protein synthesis is called rough endoplasmic reticulum, or rough ER.
Ribosomes are found on the surface of rough ER.
Rough ER is abundant in cells that produce large amounts of protein for export.
Smooth ER does not have ribosomes on its surface.
Smooth ER contains collections of enzymes that perform specialized tasks, such as synthesis of membrane lipids and detoxification of drugs.

Golgi Apparatus
Proteins produced in the rough ER move into the **Golgi apparatus**.
The Golgi apparatus appears as a stack of closely apposed membranes.
The Golgi apparatus modifies, sorts, and packages proteins and other materials from the endoplasmic reticulum for storage in the cell or secretion outside the cell.
From the Golgi apparatus, proteins are then “shipped” to their final destinations throughout the cell or outside of the cell

Lysosomes
Lysosomes are small organelles filled with enzymes.
Lysosomes break down lipids, carbohydrates, and proteins into small molecules that can be used by the rest of the cell. Lysosomes also break down organelles that have outlived their usefulness.

Vacuoles
Some cells contain saclike structures called **vacuoles** that store materials such as water, salts, proteins, and carbohydrates.
In many plant cells there is a single, large central vacuole filled with liquid.
The pressure of the central vacuole allows plants to support heavy structures such as leaves and flowers.
Vacuoles are also found in some unicellular organisms and in some animals.
The paramecium contains a contractile vacuole that pumps excess water out of the cell.

Mitochondria
Nearly all eukaryotic cells contain **mitochondria**.
Mitochondria convert the chemical energy stored in food into compounds that are more convenient for the cell to use.
Mitochondria are enclosed by two membranes—an outer membrane and an inner membrane.
The inner membrane is folded up inside the organelle.

Chloroplasts
Plants and some other organisms contain **chloroplasts.**
Chloroplasts capture energy from sunlight and convert it into chemical energy in a process called photosynthesis.
Chloroplasts are surrounded by two membranes.
Chloroplasts contain the green pigment chlorophyll.

Cytoskeleton
Eukaryotic cells are given their shape and internal organization by the **cytoskeleton**.
The cytoskeleton is a network of protein filaments that helps the cell to maintain its shape. The cytoskeleton is also involved in movement.
The cytoskeleton is made up of:

- microfilaments
- microtubules

Microfilaments
Microfilaments:

- are threadlike structures made up of the protein actin.
- form extensive networks in some cells.
- produce a tough, flexible framework that supports the cell.
- help some cells move.

Microtubules
Microtubules are hollow structures made up of proteins known as tubulins. Microtubules:

- maintain cell shape.
- are important in cell division.
- build projections from the cell surface—cilia and flagella—that enable some cells to swim rapidly through liquids.

In animal cells, structures known as centrioles are formed from tubulin.
Centrioles are located near the nucleus and help to organize cell division.