

## A SUMMARY OF EUKARYOTIC CELL STRUCTURE AND FUNCTION

CELL PART	STRUCTURE	FUNCTION	COMMENTS
Plasma membrane (cell membrane)	Lipids and proteins in a 50:50 ratio; lipid bilayer with "floating" proteins	Limits cell, controls entry and exit, taxis & signal transduction	Living, dynamic layer; selectively and differentially permeable
Cytoplasm	Contains organelles and inclusions; fluid portion is called the cytosol	Factory area, site of metabolism (synthesis & breakdown)	Bulk of the cell
Endoplasmic Reticulum (ER)	Folded membranes forming a network of sheet-like channels	Transport, storage, synthesis of lipids and packaging of materials	"Circulatory System" of the cell; interacts with other structures.
Rough Endoplasmic Reticulum	External surface has ribosomes held in place by proteins	Same as above, but ribosomes are the site of protein synthesis	Rough or granular surface
Smooth Endoplasmic Reticulum	Surface lacks ribosomes so is smooth	Same function as described for ER	Smooth membrane surface
Ribosomes	Granules of nucleic acid (RNA) and protein in 60S and 40S subunits	Site of protein synthesis	May be free in the cytoplasm or attached to other membranes
Golgi complex (Golgi body or apparatus)	Stack of flattened membranous sacs, channels and vesicles	Transport, storage, sorting, assembly, packaging, & polysaccharide synthesis	Materials packaged here can move to cell surface in vesicles and exit via exocytosis (secretion)
Vacuoles and vesicles	Membrane bound sacs or bubbles containing a variety of materials	Storage, transport, excretion; some form during endocytosis	Vacuoles can be very large in some cells, names are inconsistent
Contractile vacuoles	Membrane bound sacs; May connect with the endoplasmic reticulum	Osmoregulation; these pump excess water <b>out</b> of cells	Undergo systole and diastole; aid fluid circulation & excretion
Lysosomes	Membrane-bound sacs or "bubbles" containing hydrolytic enzymes	Intracellular digestion; reduces large molecules to smaller units	"Digestive System" of the Cell
Peroxisomes (microbodies)	Similar to lysosomes but contain catalase and oxidase enzymes	Break down long fatty acids & toxic hydrogen peroxide (H <sub>2</sub> O <sub>2</sub> )	Break down a variety of toxic compounds
Mitochondria	Surrounded by two membrane layers: inner layer folded (cristae). Contain ccc-DNA and 70S ribosomes	Production of ATP by means of oxidative phosphorylation; can undergo fission to form new mitochondria	"Powerhouse of cell" Self replicating bodies evolved from bacteria; sensitive to antibiotics
Chloroplasts	Surrounded by two membrane layers: inner layer folds = thylakoids. Contain ccc-DNA and 70S ribosomes	Production of ATP by means of photophosphorylation; fix CO <sub>2</sub> forming sugar (fructose)	Site of photosynthesis; Self replicating bodies evolved from cyanobacteria, contain ccc-DNA & 70S ribosomes
Microtubules	Cylinders containing 13 protofilaments made of $\alpha$ & $\beta$ tubulin proteins	Support and movement; MAPs (e.g., dynein and kinesin) move on these	Part of the cytoskeleton; found in cilia, flagella, and centrioles

Cilia (short, hair-like locomotor structures)	Bounded by cell membrane; contain 9+2 microtubules & MAPs	Move cells through the environment and sweep particles into cytostome	Allow for swimming; can occur in tufts called cirri (used for walking)
Flagella (long, whip-like locomotor structures)	Bounded by cell membrane; contain 9+2 microtubules & MAPs	Move cells through the environment; some may have a sensory function	Whip-like motion; used for swimming; may be one, two or many
Cytostome (cell mouth)	Area of cell membrane without pellicle, can undergo invagination	Allows for ingestion of large particles through endocytosis	“Cell mouth” may be on cell surface or at the end of an oral funnel
Pellicle	Layer of material associated with cell membrane	Protection and support of the cellular membrane	Composition is quite variable, may be inside or outside the cell
Trichocysts	Dart-like structures that can “shoot” from cells	Defense, attachment, possibly “hunting”	Present in many ciliated protozoa
Centrioles	Hollow cylinders made of microtubules in 9 groups of three	Organize the spindle apparatus, aid cytokinesis & intracellular spatial arrangement	Lacking in some types of cells, not required for cell division
Microfilaments (actin filaments)	Thinnest fibers of the cytoskeleton; may be bound to myosin	Involved in cytokinesis; amoeboid movement, endocytosis & support	Highly dynamic; actin filament networks are frequently rearranged
Nucleus	Surrounded by nuclear envelope, holds nucleoplasm (DNA & protein)	Controls cellular reproduction and most metabolic activity	“Brain of cell” Controls cell function and heredity
Nucleoplasm	Contains chromatin made of DNA, histone proteins & enzymes	Controls cellular processes outside mitochondria & chloroplasts	Chromatin folds up into chromosomes during mitosis & meiosis
Nucleosomes	Histone octomers wrapped in DNA	Stabilize DNA and make it accessible	Accumulate to form chromatin strands
Nucleolus (Nucleoli)	Granular body made up of ribosomal-RNA (r-RNA) and protein	Site of r-RNA synthesis and assembly of ribosomal subunits	“Pacemaker of cell” Influences rate of protein synthesis
Spliceosomes	Granular bodies made of s-RNA & protein	Modify RNA molecules by removing introns	Site of post-transcriptional modification
Cell walls (Fungi & Algae)	Rigid layers outside cell membranes; most made of polysaccharides	Support and protection; influence cell shape and function	Non-living material made or accumulated by the living cell
Skeletons (Protozoa)	Rigid layers outside cell membranes; made of glass or CaCO <sub>3</sub>	Support and protection; influence cell shape and function	Non-living material made or accumulated by the living cell

**Note** – Eukaryotic microorganisms vary considerably in structure and physiology, so not all of the structures included above are found within all types of cells. Some eukaryotic cells contain more than one nucleus, some lack mitochondria, many lack chloroplasts and their means of locomotion is quite variable (some can't swim at all).

Some structures found only in association with multicellular organisms are not included.