

MICROBE IMAGES

Student Worksheet

OBJECTIVES

- Compare cell structure of major groupings of organisms
- Recognise the physical characteristics of cell organelles

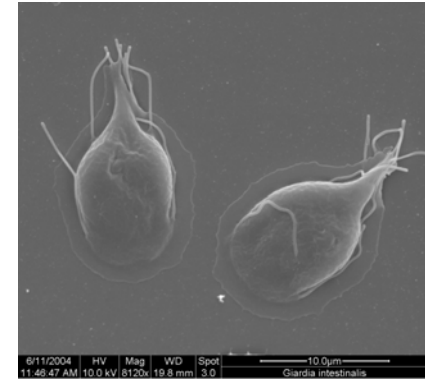
WHAT YOU WILL NEED

Table of characteristics of cells of organisms in different domains (based on nucleic acids) and kingdoms (based on structure and function).

A set of cards with electron micrograph pictures.

WHAT TO DO

1. Use table and electron micrograph images to compare characteristics of cells of different groups of organisms.



REFERENCES

- Calo, J. R. *Cell organelles*. <http://www.accessexcellence.com/AE/AEC/AEF/1996/calocell.html> (accessed 20th March, 2008)
- Teacher domain. 2008 <http://www.teachersdomain.org/resources/tdc02/sci/life/cell/animplant/index.html> (accessed 17th April 2008)
- Nayduch, D. *Eukaryotic cells and microorganisms*. <http://www.bio.georgiasouthern.edu/bio-home/nayduch/ch5a.ppt> (accessed 11 June 2009)

BACKGROUND INFORMATION

Cell part	Structure	Function	Prokaryotic cells		Eukaryotic cells			
			Eu	Archaea	Eukarya			
			bacteria	bacteria	Protists (group is in state of flux)	Fungi	Animal	Plant
Cell wall (rigid cell protector)	<p>This gives the plant its shape and structure by providing a rigid barrier around each cell. The composition varies.</p> <p>In Eubacteria it contains peptidoglycan – polymers of modified sugars cross-linked by polypeptides. In gram negative bacteria there is an outer membrane containing carbohydrates bonded to lipids (lipopolysaccharides).</p>	Provides maintenance of cell shape and skeletal support. Protects the surface barrier.	Yes These can be gram negative (with an outer and inner membrane) or gram positive (only an inner membrane)	Some have peptidoglycan cell walls	Most algae do. Protozoa and some algae do not. Some protozoa (e.g. diatoms) have silica wall	Yes Many contain a nitrogenous substance known as "chitin," which is not found in the cell walls of plants, but can be found in the outer shells of some crabs and molluscs	No	Yes Composed of cellulose fibres embedded in other polysaccharides and protein.
Plasma membrane (cell barrier)	Membrane made of a double layer of lipids (phospholipids, cholesterol, etc) within which proteins are embedded; proteins may extend entirely through the lipid bilayer or protrude on only one face; externally facing proteins and some lipids have attached sugar groups	Serves as an external cell barrier; acts in transport of substances into or out of the cell; maintains resting potential that is essential for functioning of excitable cells; externally facing proteins act as receptors (for hormones, neurotransmitters etc) and in cell to cell recognition.	Yes	Yes	Yes	Yes	Yes	Yes

Cytoplasm (scaffolding)	Cellular region between the nuclear and plasma membranes; consists of fluid cytosol, containing dissolved solutes, inclusions (stored nutrients, secretory products, pigment granules), and organelles, the metabolic machinery of the cytoplasm.	Holds everything within the cell	Yes	Yes	Yes	Yes	Yes	Yes
Glycocalyx (cell protector)	A sticky carbohydrate coating on the cell surface.	Protects the surface of animal cells, binds cells in tissues and is used for intercellular recognition.	Yes (e.g. biofilms)	Yes	Yes. In algae with cell wall, it surrounds the wall	Yes. Surrounds cell wall	Yes	No
Cell part	Structure	Function	Eu bacteria	Archaea bacteria	Protista	Fungi	Animal	Plant
Flagella and cilia (motility and increased surface area)	Composed of proteins. Structurally different in prokaryotes.	Used for direct movement of a cell. Those on animal cells are coated by the plasma membrane so provide the cell with a greater surface area – useful for absorption in the digestive tract. They can be modified to function as receptors for taste, light etc.	Some. Flagella only.	Some.	Some. Flagella are 10x thicker than prokaryotic flagella. Cilia on protozoans	Rarely e.g. Chitrids	Sometimes (Commonly found on sperm, trachea and intestine cells)	Rarely (found on some plant pollens)
Pili (for adherence)	Made from protein called pilin.	Used to attach to surfaces of other bacteria, host cells and some are specialised for DNA transfer.	Some	Some	No	No	No	No

Cytoplasmic organelles	(the metabolic machinery of the cell)							
The cell nucleus (the information centre)	The nucleus is separated from the cytoplasm by a double membrane called the nuclear envelope. The nuclear envelope isolates and protects a cell's DNA from various molecules that could accidentally damage its structure or interfere with its processing.	It houses the cell's chromosomes, and is the place where almost all DNA replication and RNA synthesis occur.	Not as a membrane bound structure.	Not as a membrane bound structure.	Yes. Lots have 2.	Yes. Some have many.	Yes	Yes
Nucleoid (information centre without a membrane)	Area in a prokaryotic cell where the DNA is concentrated as a snarl of fibres	Region where DNA is concentrated and information is processed for cell functioning.	Yes	Yes	No	No	No	No
Mitochondria (the power generators)	Rodlike, double-membrane structures; inner membrane folded into projections called cristae.	Site of ATP synthesis; powerhouse of the cell	No	Most yes. Some No. Less cristae	Yes. Less cristae.	Yes	Yes More cristae (the lines across the organelle)	Yes Less cristae (the lines across the organelle)
Chloroplasts (food generators)	Contain chlorophyll or other pigments, which function in photosynthesis. They are enclosed by two membranes surrounding the fluid called stroma, in which are embedded the thylakoids.	Conversion of light energy to chemical energy	No	No	Yes in some.	No	No	Yes

Cell part	Structure	Function	Eu bacteria	Archaea bacteria	Protista	Fungi	Animal	Plant
Vacuoles (food and waste storage)	A vacuole is a membrane-bound sac. In animal cells, vacuoles are generally small. There is often one large, central vacuole in a plant cell.	The vacuole plays a role in intracellular digestion and the release of cellular waste products. In plant cells and some protists vacuoles play a role turgor pressure. When a plant is well-watered, water collects in cell vacuoles producing rigidity in the organism. Without sufficient water, pressure in the vacuole is reduced and the cells wilt.	No	No	Yes. Size varies	Yes	Yes Small by comparison with plant vacuoles	Yes Large - can take up most of the space in the cell.
Storage granules (food and waste storage - no membrane)	Region of lipids, sulphur, poly- β -hydroxybutyrate (PHB) etc. It varies with the organism.	Plays a role in intracellular energy storage and the storage of cellular waste products.	Yes Similar to vacuoles but they are not enclosed by membranes	Yes	Yes	Yes	Yes	Yes
Lysosomes (cell destroyer)	Membranous sacs containing acid hydrolases	Digestion of food, foreign materials, and damaged organelles.	No	Yes	Yes	Yes	Yes	Yes Incorporated into vacuole
Ribosomes (protein production centres)	Dense particles consisting of two subunits, each composed of ribosomal RNA and protein; free or attached to rough ER	The sites of protein synthesis	Yes. Small	Yes. small	Yes	Yes	Yes	Yes

Endoplasmic reticulum (macromolecule managers)	Membranous system of sacs and tubules.	Transport network for molecules targeted for certain modifications and specific destinations, as compared to molecules that will float freely in the cytoplasm. The ER has two forms: the rough ER, which has ribosomes on its surface, and the smooth ER, which lacks them	No	No	Yes	Yes	Yes	Yes
Golgi apparatus (macromolecule managers)	A stack of smooth membrane sacs and associated vesicles close to the nucleus.	Packages, modifies, and segregates proteins for secretion from the cell, inclusion in lysosomes, and incorporation into the plasma membrane.	No	No	Yes	Yes	Yes	Yes