**Topic: Biology of eukaryotic cell. Structural components of cytoplasm.**

**Discipline: Biology**

**Practical class # 2**

I’d like to welcome you all to this course.

My name is Inessa Sergeevna Vyshegorodtceva

*Knowing how to spell my name may be useful to you.*

I am a candidate of Biological Sciences, associate Professor of the Department of biology and ecology.

I am your new Biology teacher. I’ll by teaching you some of the topics in biology.

Please, tell me, who is present?

We are beginning our class.

Objectives of the practical class:

To study cell theory

to learn basic component of eucariotic cell

 to consider cell organelles on microslides

 to sketch cell organelles

Let's check your knowledge. Name the type of cells

Write the correct ratio in chat.

1-с, 2-а, 3-в

 The cell theory

 The scientific theory that all living organisms are made of cells as the smallest functional unit.

 This film will introduce you to the history of the discovery of the cell and to the cell theory.

 At the present level of development of biology, the main provisions of the cell theory can be presented as follows.

 A cell is an elementary living system, a unit of structure, vital activity, reproduction and individual development of organisms.

 The cells of all living organisms are similar in structure and chemical composition.

 New cells only arise by dividing pre-existing cells.

 The cellular structure of organisms is proof of the unity of the origin of all living things.

**Task** №1

**Write down the provisions of cell theory in your notebook.**

 Have you completed the task?

Show your recordings on camera

The Cell structure

As you know, there are two types of cells: prokaryotes and eukaryotes.

The common components for both types of cells are the Outer plasma membrane and protoplast.

Plasma membrane

The plasma membrane has functions:

first, to be a barrier keeping the constituents of the cell in and unwanted substances out

second, to be a gate allowing transport into the cell of essential nutrients and movement from the cell of waste products.

 **Write down the** plasma membrane`s functions **in your notebook.**

Have you completed the task?

Show your recordings on camera

 This film tells about the structure of the cell membrane.

There are various models describing the structure of the membrane, at the moment the liquid-mosaic model proposed by Singer and Nicholson in 1972 is adopted.

 S. Singer and D. Nicholson offered model of "liquid mosaic membrane"

The components of the plasma membrane

Phospholipids: Main fabric of the membrane. The membrane is based on a double layer of phospholipids.

A phospholipid is a complex molecule, one end of which is hydrophobic, that is, it is wetted with water, and the other is hydrophilic.

Cholesterol: Tucked between the hydrophobic tails of the membrane phospholipids

Integral proteins: Embedded in the phospholipid bilayer; may or may not extend through both layers

Peripheral proteins: On the inner or outer surface of the phospholipid bilayer, but not embedded in its hydrophobic core

Carbohydrates: Attached to proteins or lipids on the extracellular side of the membrane (forming glycoproteins and glycolipids)

Task№2. Draw a model of the plasma membrane in your notebook. In the figure, sign the component parts of the plasma membrane.

## Show your picture on camera

## Cell Transport

The movement of materials into and out of the cell is essential for:

* the uptake of nutrients
* the elimination of wastes
* the exchange of oxygen and carbon dioxide for cellular respiration
* cell signalling

The movement of materials across the cell membrane is highly regulated. This regulation is possible because the membrane is selectively permeable -not all substances are capable of moving across it. Some smaller hydrophobic (non-polar / fat soluble) molecules are able to diffuse directly through the membrane. Many charged molecules (ions) are unable to diffuse through the lipid layers of the membrane, while other molecules may simply be too large. The transport of most substances is mediated by specialised carrier proteins embedded in the membrane. These proteins not only regulate what crosses the membrane, but also when substances are able to cross the membrane. For instance during vigorous exercise more glucose must be released into the blood-stream and absorbed by our muscle cells.

Watch film to better understand the mechanism of cell transport

**PASSIVE TRANSPORT:**

* Substances are moved down their concentration gradient, from an area of high to low concentration
* Does not require energy (ATP)
* May involve specialised proteins that facilitate the movement of materials across the membrane

**ACTIVE TRANSPORT:**

* Substances are moved against their concentration gradient, from an area of low to high concentration
* Requires energy (ATP)
* Requires specialised proteins that force materials across the membrane

**Endocytosis** is a special form of active transport used to transport material that are too large to diffuse through the membrane to be transported through membrane proteins. Endocytosis involves absorbing materials from outside the cell by engulfing them in the cell membrane. The membrane encloses the material and buds off to form a vesicle. This often fuses with a lysosome (full of digestive enzymes) to enable the digestion of the contents.

Endocytosis is often a **receptor mediated process**. This simply means that receptors on the cells surface will recognise particular materials and mediate their ingestion.

There are two forms of Endocytosis:

* **Phagocytosis** The ingestion of solids from outside the cell. Some white blood cells ingest pathogens/foreign material.
* **Pinocytosis** the ingestion of fluid into the cell.

Exocytosis is essentially just the reverse process. Materials to be secreted are transported to the cell surface in a vesicle (a small membrane bubble). The vesicle fuses with the cell membrane and its contents are released.

Watch this films,

Cytoplasm

Cytoplasm, the semifluid substance of a cell that is external to the nuclear membrane and internal to the cellular membrane

Cytoplasm includes

The liquid component of the cytoplasm.

contains water, minerals, ions, amino acids, sugars, etc.

Nucleus

cellular inclusions

Organelles is three types

Double membrane organelles

have two membranes:

plastids, mitochondria

Single membrane organelles

have one membranes:

endoplasmic reticulum, Golgi complex, vesicles

Non membrane organelles

do not have a membrane:

ribosomes, microtubules, microfilaments, Centrioles

special organelles

Plastids and mitochondria are called semi-autonomous organelles. They contain circular DNA like the nucleoid in bacteria and the ribosome. Proteins necessary for their work are synthesized in plastids and mitochondria

What Are Plastids?

Plastids are a group of sac-like organelles found in plant cells.

There are three types of plastids: chloroplasts, chromoplasts, and leucoplasts.

Here's a quick look at each plastid and its function in the plant cell: (на слайде)

Сhloroplast.

Their funcnion is to absorb sunlight and use it (along with water and carbon dioxide) to produce glucose, a simple sugar. The process in which chloroplasts convert absorbed light energy into sugar is called photosynthesis.

Inside, chloroplasts have stacks of pancake-like sacs. A single pancake is called a thylakoid. A stack of these thylakoids makes a structure called a granum (plural: grana). The thylakoids are green because this is where chlorophyll is stored.

There is a watery liquid surrounding all of the stacks. This liquid is called stroma.

Хромопласт

лейкопласт

Unfortunately, in the format of a remote lesson, we cannot perform laboratory work. Watch this film, to see chloroplasts in cells of elodea`s leaf.

 Draw cells of elodea`s leaf in your notebook, In the figure, sign the chloroplasts and cell wall.

 Suggest you use microphotographs from the Internet or this presentation**.**

## Show your picture on camera

#### What Are Mitochondria?

Mitochondria (singular: mitochondrion) are the powerhouses of the cell. They produce energy for plant and animal cells. Cells that require a lot of energy, like muscle cells, can have thousands of them per cell.

These organelles take glucose (sugar) in the cell and break it down to release energy in little usable chunks. This process is called cellular respiration and the usable form of energy is called ATP.

The inner membrane folds back and forth inside the mitochondrion. These folds are called cristae.

The folds are also filled with a water-based goop called the mitochondrial matrix.

 Task №4. Draw a mitochondrion in your notebook. In the figure, sign the component parts of the mitochondrion.

## Show your picture on camera

# Endoplasmic Reticulum

ER functions as a manufacturing and packaging system. It works closely with the Golgi apparatus, ribososmes, mRNA, and tRNA.
Тhe endoplasmic reticulum is a network of membranes found throughout the cell and connected to the nucleus.

# Rough (раф) and Smooth

Rough ER is called rough because it has ribosomes attached to its surface.
Proteins are synthesized in the rough endoplasmic reticulum, in the smooth ER - lipids

# Golgi Apparatus

The Golgi apparatus gathers simple molecules and combines them to make molecules that are more complex. It then takes those big molecules, packages them in vesicles, and either stores them for later use or sends them out of the cell. The vesicles are pinched off the membranes and float through the cell.
The Golgi apparatus is a series of membranes shaped like pancakes.

# What are vesicles, and how do they work?

Vesicles are tiny sacs that transport material within or outside the cell. There are several types of vesicle, including transport vesicles, secretory vesicles, and lysosomes.

Each vesicle type has a different function, and different vesicles are necessary for different biological processes.

Vesicles can help transport materials that an organism needs to survive and recycle waste materials. They can also absorb and destroy toxic substances and pathogens to prevent cell damage and infection.

Although they are similar to vacuoles, which also store materials, vesicles have their own unique functions and abilities. For example, they can fuse with the membranes of other cells to carry out a specific role, such as breaking down another cell.

Vesicles also help store and transport materials such as proteins, [enzymes](https://www.medicalnewstoday.com/articles/319704), hormones, and [neurotransmitters](https://www.medicalnewstoday.com/articles/326649). They are a small but essential part of biological systems and processes such as:

* [digestion](https://www.medicalnewstoday.com/articles/320014) and [metabolism](https://www.medicalnewstoday.com/articles/8871)
* the [nervous system](https://www.medicalnewstoday.com/articles/307076)
* [kidney](https://www.medicalnewstoday.com/articles/305488) and [liver function](https://www.medicalnewstoday.com/articles/305075)

### Transport vesicles

Transport vesicles help move materials, such as proteins and other molecules, from one part of a cell to another.

When a cell makes proteins, transporter vesicles help move these proteins to the [Golgi apparatus](https://www.medicalnewstoday.com/articles/320878%22%20%5Cl%20%22inside) for further sorting and refining. The Golgi apparatus identifies specific types of transport vesicle then directs them to where they are needed.

Some proteins in the transporter vesicles could, for example, be antibodies. So, the Golgi apparatus would [package them into secretory vesicles](https://ghr.nlm.nih.gov/primer/basics/cell) to be released outside of the cell to fight a pathogen.

Watch this film.

Some scientists refer to the Golgi apparatus as the cell’s “post office.”

### Lysosomes

Lysosomes are vesicles that contain digestive enzymes. They are only present in animal cells. They function as part of the cell’s recycling system and can also help initiate cell death.

When a cell needs to recycle large molecules, lysosomes release their enzymes to break down these bigger molecules into smaller ones. When they have broken up the larger matter, the cell can recycle what is left.

If a cell has absorbed something harmful, such as a pathogen, it can use its lysosomes to ingest those bacteria and destroy them with enzymes.

Scientists are still not sure why lysosomes can survive, given that they are filled with enzymes that can break down cells just like themselves.

### Secretory vesicles

Secretory vesicles play an important role in moving molecules outside of the cell, through a process called exocytosis. They are crucial for healthy organ and tissue function. For example, secretory vesicles in the stomach will transport protein-digesting enzymes to help break down food.

Synaptic vesicles are another example of a secretory vesicle, and they are present at the end of nerve cells (neurons).

These vesicles help transmit signals from one nerve cell to another by releasing or secreting neurotransmitters that activate receptors in the next cell along. They are a tiny [30–40 nanometers](https://www.sciencedirect.com/science/article/pii/S0960982207005519) in diameter.

### Peroxisomes

Like lysosomes, peroxisomes contain digestive enzymes. They use enzymes to digest excess nutrients in a cell, such as fatty acids. Peroxisomes also break down alcohol.

Peroxisomes also use an enzyme to break hydrogen peroxide into water and oxygen, which are both harmless and useful to the cell’s function.

Peroxisomes can vary in shape and size, depending on the needs of the cell they serve. They will sometimes increase in number and size if, for example, they have a lot of alcohol to break down.

# Vacuoles

Vacuoles are contained in plant cells and perform mainly the function of storing water and carbohydrates in the form of a sugar solution

All of the microfilaments and microtubules combine to form the cytoskeleton of the cell. The cytoskeleton connects to every organelle and every part of the cell membrane.

Microfilaments are able to contract. There are many of them in muscle cells

Microtubules provide cell elasticity

 They are also very important in cell division. They connect to chromosomes, help them with their first split, and then move to each new daughter cell. They are a part of a small pair of organelles called centrioles that have the specific purpose to help a cell divide. Once the cell has finished dividing, the microtubules are put to work in other places.

Every animal-like cell has two small organelles called centrioles.

Cell inclusions are considered various nutrients or pigments that can be found within the cell, but do not have activity like other organelles. Examples of cell inclusions are glycogen, lipids, and pigments such as melanin

Starch granules in potato tubers perform energy and storage function. Watch a film on how to make a temporary microslide, consider starch granules.

 Task №5. Draw a starch granules in your notebook.

What color will the starch granules become if a drop of iodine is applied to the microslide? Why?

## Show your picture on camera

Your home tasks are:

Find the answer to the question yourself

In winter sleeping marmots and winter bats, the number of mitochondria in cells of cardiac muscle is sharply reduced. What is the reason for this phenomenon? What other animals have the same phenomenon?