Cell biology. Cell theory.

The methods of research in Biology. Methods of studying cells. Cell membranes and cell transport.

Biology

- Nowadays biologists are making fantastic discoveries which will affect all our lives. These discoveries have given us the power to shape our own evolution and to determine the type of world we will live in. Recent advances, especially in genetic engineering, have dramatically affected agriculture, medicine, veterinary science, and industry, and our world view has been revolutionized by modern developments in ecology.

Biology

- Adding to the complexity of this enormous idea is the fact that these fields overlap. It is impossible to study zoology without knowing a great deal about evolution, physiology and ecology. You can't study cellular biology without knowing biochemistry and molecular biology as well.
- All the branches of biology can be unified within a framework of for basic understandings about living things. Studying the details of these 4 ideas provides the endless fascination of biological research:

- **Cell Theory**: There are three parts to cell theory — the cell is the basic unit of life, all living things are composed of cells, and all cells arise from pre-existing cells.
- **Energy**: All living things require energy, and energy flows between organisms and the environment.
- **Heredity**: All living things have DNA and genetic information codes the structure and function of all cells.
- **Evolution**: This is the overall unifying concept of biology. Evolution is the change over time that is the engine of biological diversity.

Cell biology

- In the field of cell biology, systems biology has enabled the asking and answering of more complex questions, such as the interrelationships of gene regulatory networks, evolutionary relationships between genomes, and the interactions between intracellular signaling networks. Ultimately, the broader a lens we take on our discoveries in cell biology, the more likely we can decipher the complexities of all living systems, large and small.

Cell biology

- Research in cell biology is closely related to genetics, biochemistry, molecular biology, immunology.
- Cell biology focuses more on the study of eukaryotic cells, and their signaling pathways, rather than on prokaryotes which is covered under microbiology. The main constituents of the general molecular composition of the cell includes: proteins and lipids which are either free flowing or membrane bound, along with different internal compartments known as organelles.

Proteins

- Proteins are large, complex molecules that play many critical roles in the body. They do most of the work in cells and are required for the structure, function, and regulation of the body's tissues and organs.
- Proteins are made up of hundreds or thousands of smaller units called amino acids, which are attached to one another in long chains. There are 20 different types of amino acids that can be combined to make a protein.

The methods of research in Biology

Research Methods in the Biological Sciences are as numerous and varied as the diversity of questions asked and the phenomenon studied. They include the following:

The methods of research in Biology

1. **Experimental research** - experiments can be carried out in the laboratory or in the field.

- Regardless of where the research takes place, the data may be obtained using molecular techniques like Southern blots and PCR, genetic tests, cell culture and imaging, biochemical assays, physiological measurements, surveys, questionnaires, interviews, etc.

The methods of research in Biology

2. Observational research - observations are often used to generate a question and hypothesis, but can also be used to test them.

These studies are not controlled experiments, but can nevertheless be a useful first step in the answering of biological questions

Methods of studying cells.

While cell biology looks at cells as a whole and their organelles, molecular biology looks at smaller parts within the cell, such as Chromosomes and DNA. Specific techniques are needed to find out more about these molecules. The main methods you should know are polymerase chain reactions (PCR) and gel electrophoresis.

Methods of studying cells.

- This technique is used to copy small fragments of DNA so that there is enough DNA and can be further studied or used in tests that detect DNA, the Covid-19 PCR tests, for example.
- To understand a PCR, you first need to understand DNA replication.

Steps of PCR:

- **DNA denaturation** - DNA sequence is denatured into single strands.
- **Annealing** - DNA primers, nucleotides and Taq polymerase (heat stables) are added to the solution. DNA primers attach to the target nucleotide sequence.
- **Elongation** - Taq polymerase binds to the DNA primers, and the strand is copied.
- The cycle is repeated, and millions of DNA fragments are made.

Methods of studying cells:
Gel electrophoresis (GE)

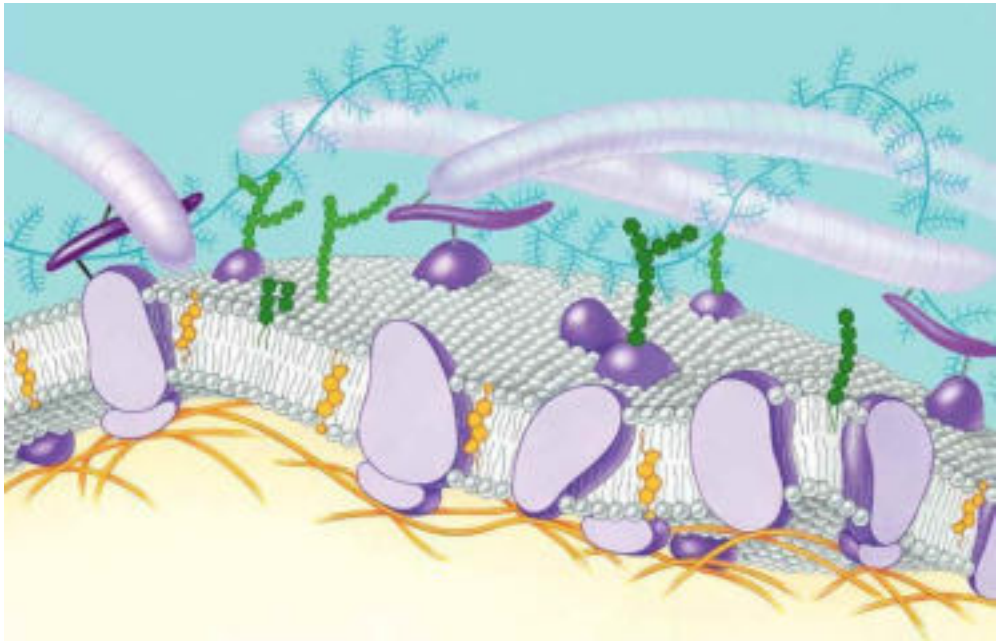
- Macromolecules (DNA, RNA, protein) play an essential role in biology. They perform a wide variety of functions and are necessary for cell survival. To do this, we developed many laboratory techniques used to isolate and purify macromolecules for further analysis. One such technique is gel electrophoresis, which you are probably very familiar with. GE is a lab technique where charged macromolecules are run through a gel with an electric field to separate them by size.

Methods of studying cells:
Gel electrophoresis

- Gel electrophoresis has been around for decades, since the 1960s. It is a ubiquitous method used to quantify and purify **macromolecules** (DNA, RNA, protein). It is widely used and very reliable. It is a fundamental part of many other important lab techniques and biotechnologies, like polymerase chain reaction (PCR), genome editing, and gene sequencing.

Function of the Cell Membrane:

- Cell membrane separates the components of a cell from its **environment**—surrounds the cell
- "Gatekeeper" of the cell—regulates the flow of materials into and out of cell—**selectively permeable**
- Cell membrane helps cells maintain **homeostasis**—stable internal **balance**

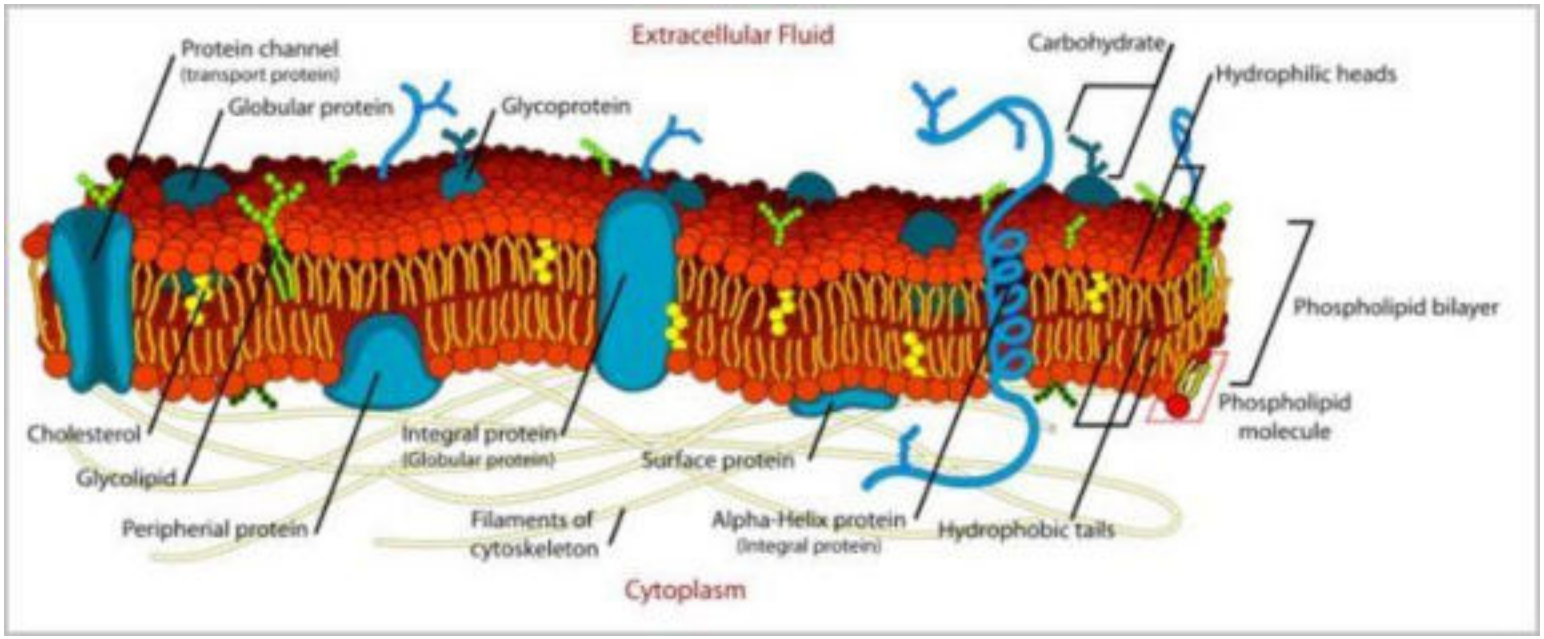


The Cell Membrane & Homeostasis

- The cell membrane is responsible for maintaining **homeostasis** (home-E-O-Stay-sis) within the cell
- **Homeostasis** is a stable, internal environment
- The cell membrane maintains homeostasis through balancing the **pH, temperature, glucose (sugar intake), water balance**

In homeostasis, everything is PERFECT

Cell Transport



Cell Transport

- movement of materials (CO_2, O_2, H_2O, glucose, proteins, etc) into or out of cell via cell membrane

THANK YOU!