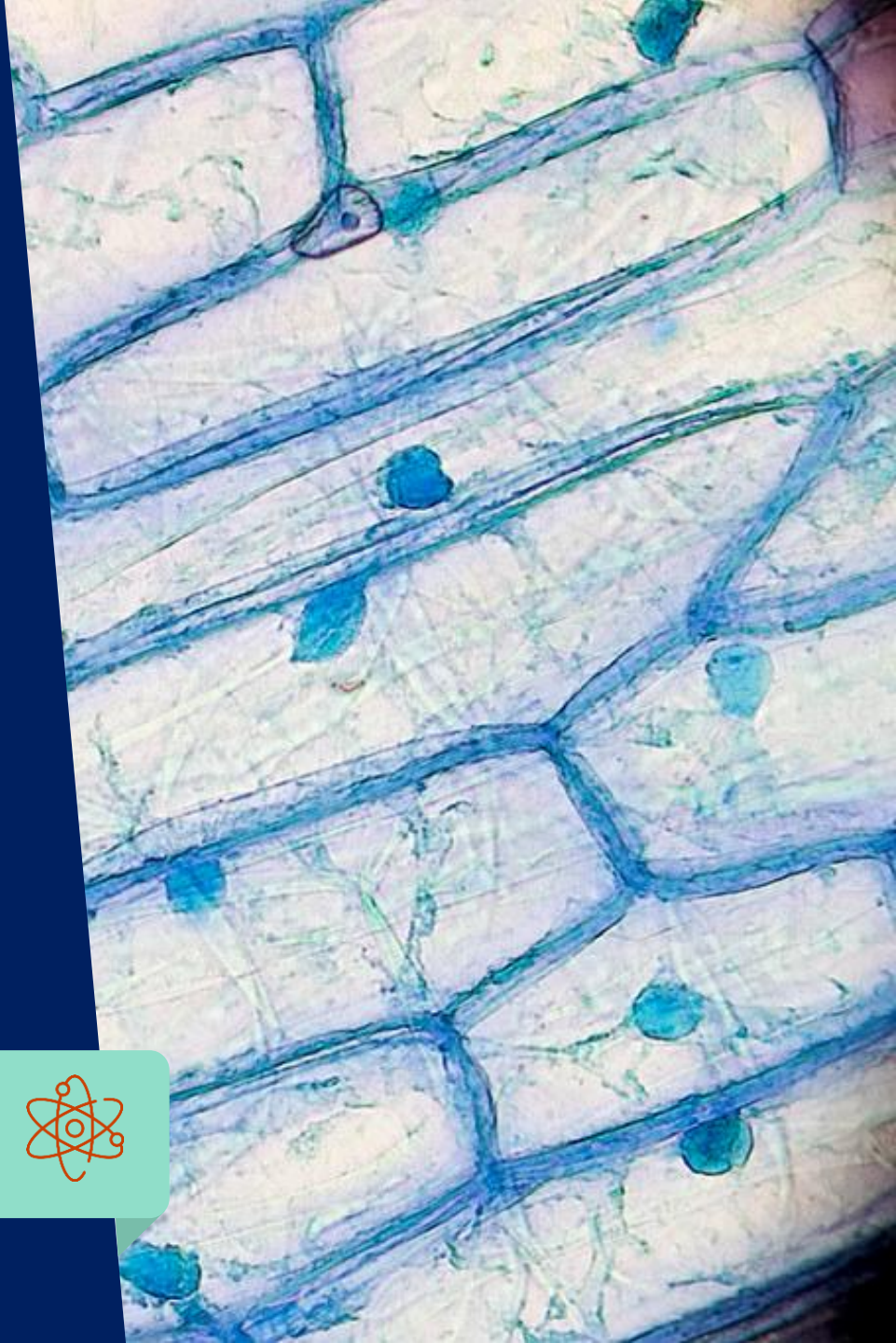


Lesson 2

The Chemistry of Life

Zoology





Learning Objectives

By the end of the lesson, you should be able to:

- Identify the major chemical elements essential for life.
- Explain the biological importance of these elements.
- Define biological macromolecules.
- Identify the four major types of macromolecules.
- Describe their basic functions and examples.

Have you ever wondered what you are made of?



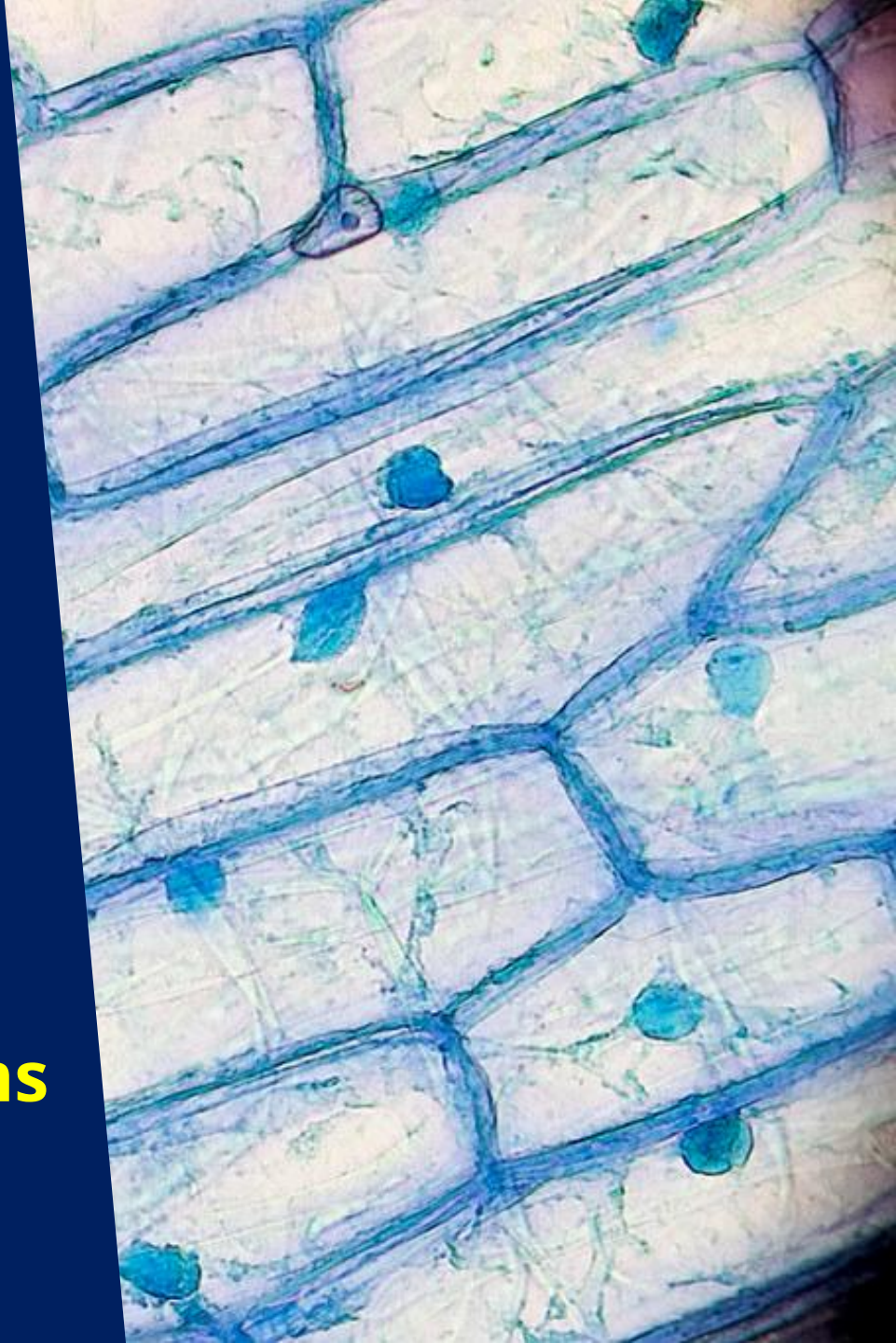
Think About This

Your body contains:

-  Bones
-  Muscles
-  Brain
-  Heart
-  Blood
-  DNA

But what are these made of?

Atoms → Molecules → Cells → Organisms



The Chemical Foundation

These six elements are the ultimate building blocks of all living things.



Carbon

Hydrogen

Nitrogen

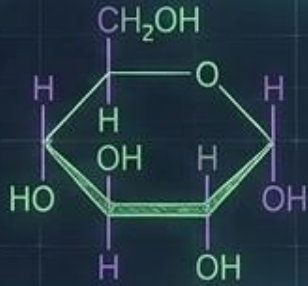
Oxygen

Phosphorus

Sulfur

The Molecules of Life

Elements combine into the structural macromolecules that build and run our bodies.



Carbohydrates



Lipids



Proteins



Nucleic Acids [DNA]

From Chemistry to Biology

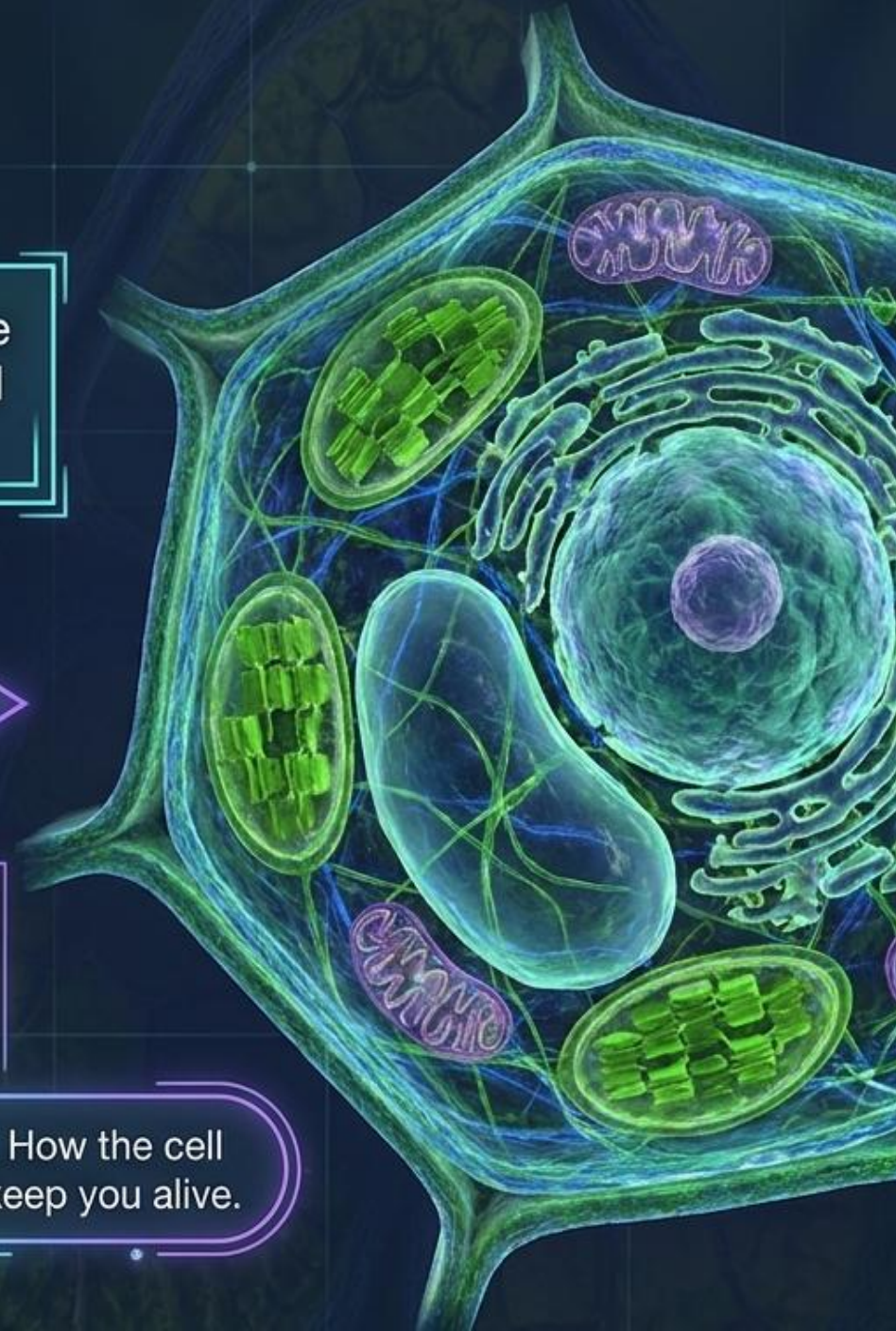


Chemicals assemble to build the cell—the fundamental structural and functional unit of life.

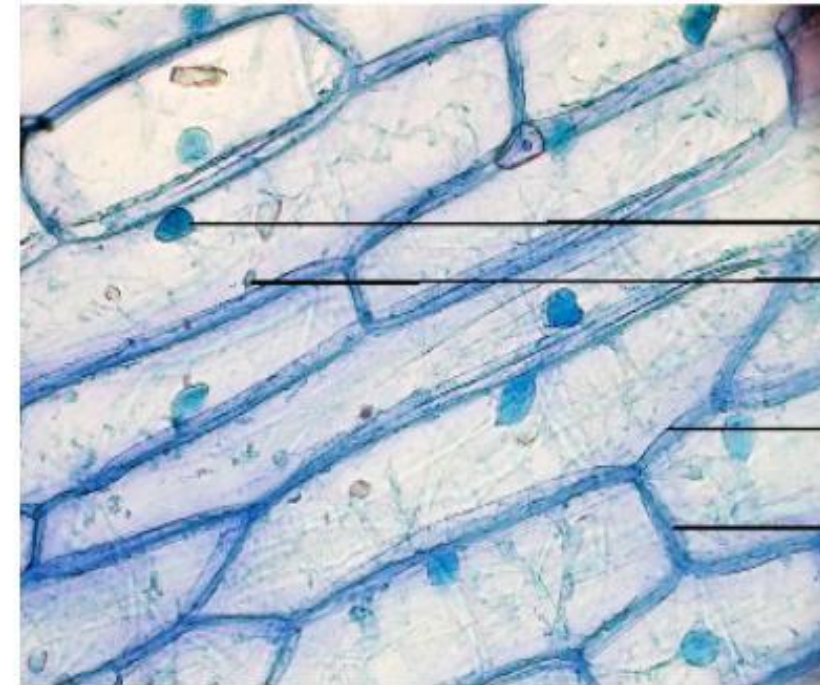
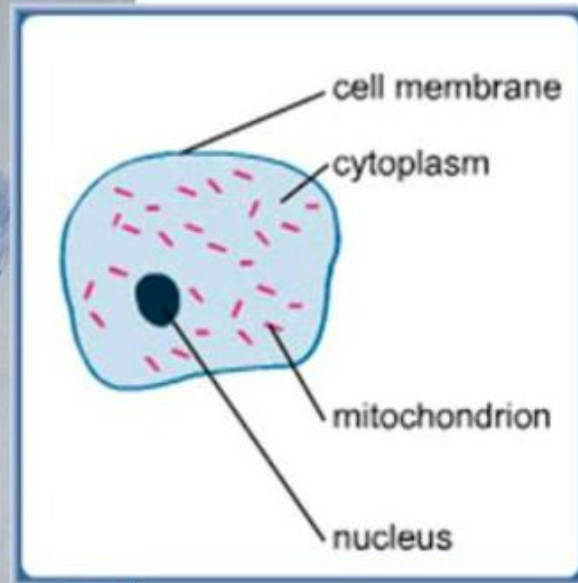
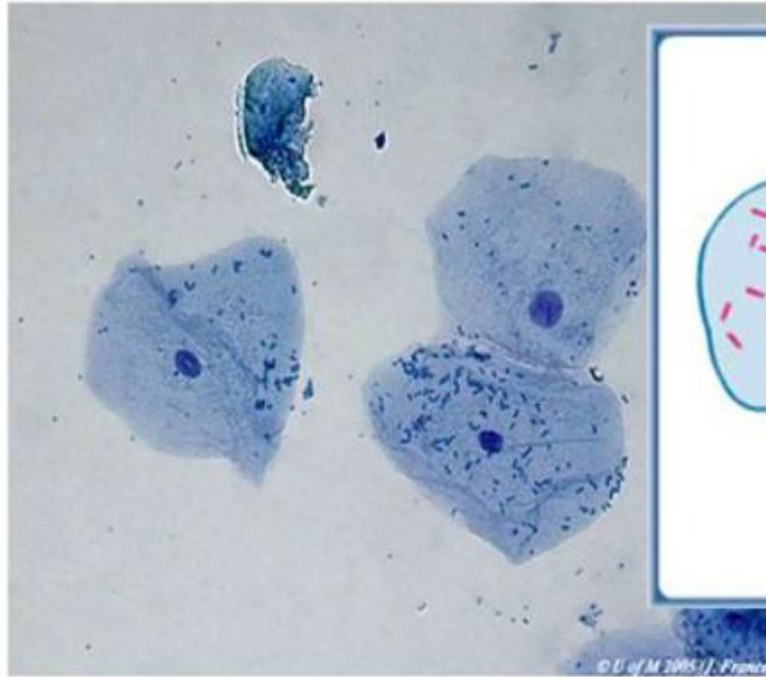


Anatomy: The structure of the cell.

Physiology: How the cell functions to keep you alive.

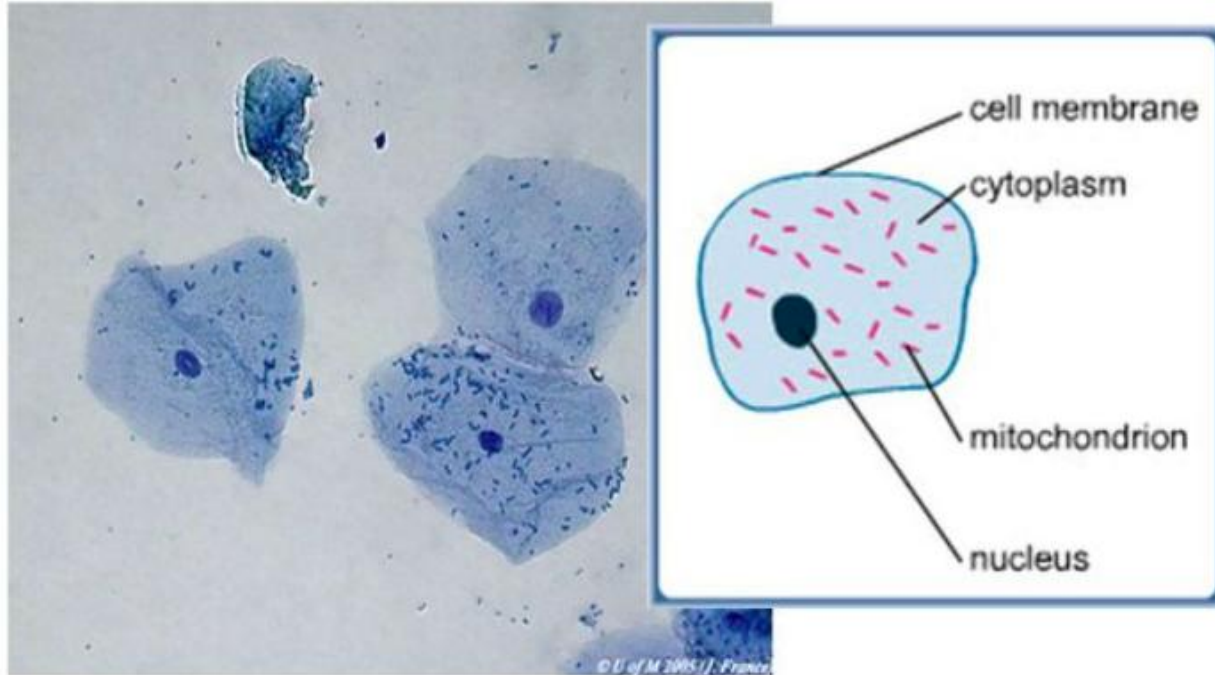


Cells come in different types,
each of which has different functions.

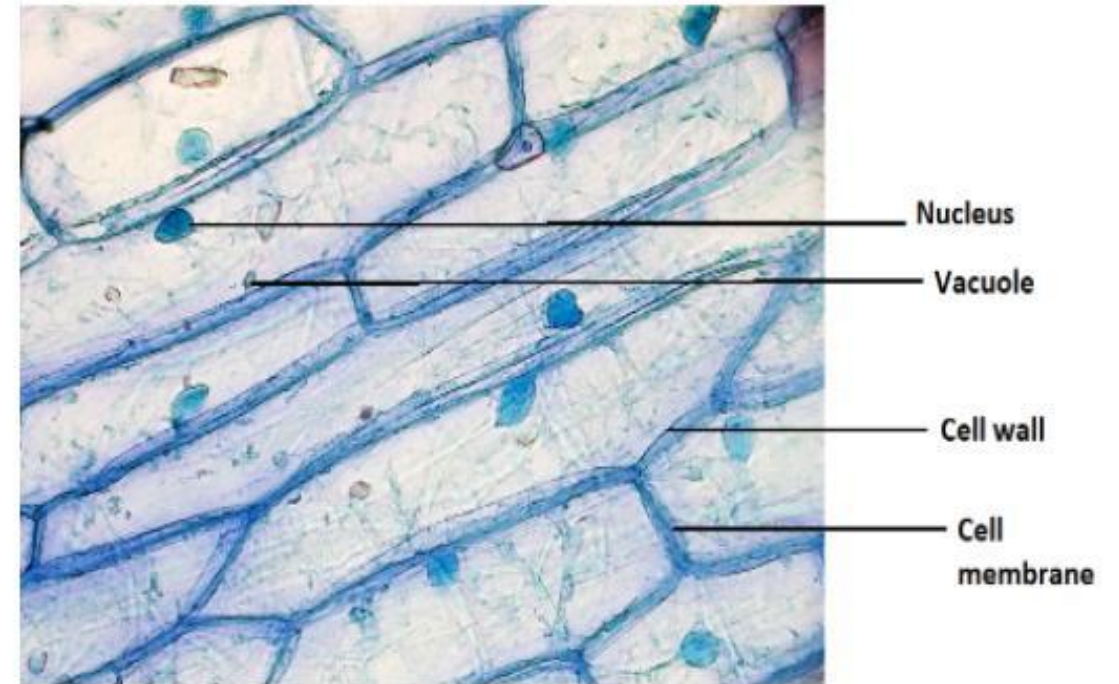


Nucleus
Vacuole
Cell wall
Cell membrane

Can you name or describe what you see in these images?



Cheek Cells



Onion Cells

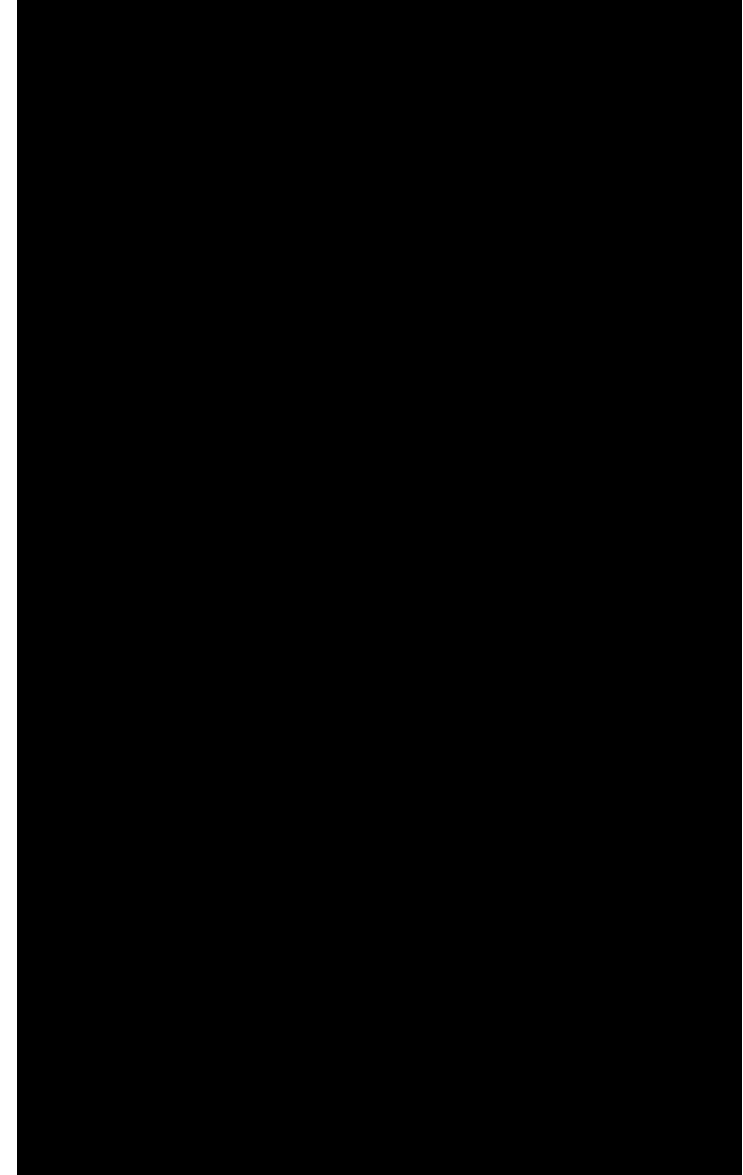
How does a cell's size affect how well it takes in nutrients and gets rid of wastes?

Essential Question



Tiny Cell Experiment

Do you know what happens to a cell when you placed it in a salty environment?



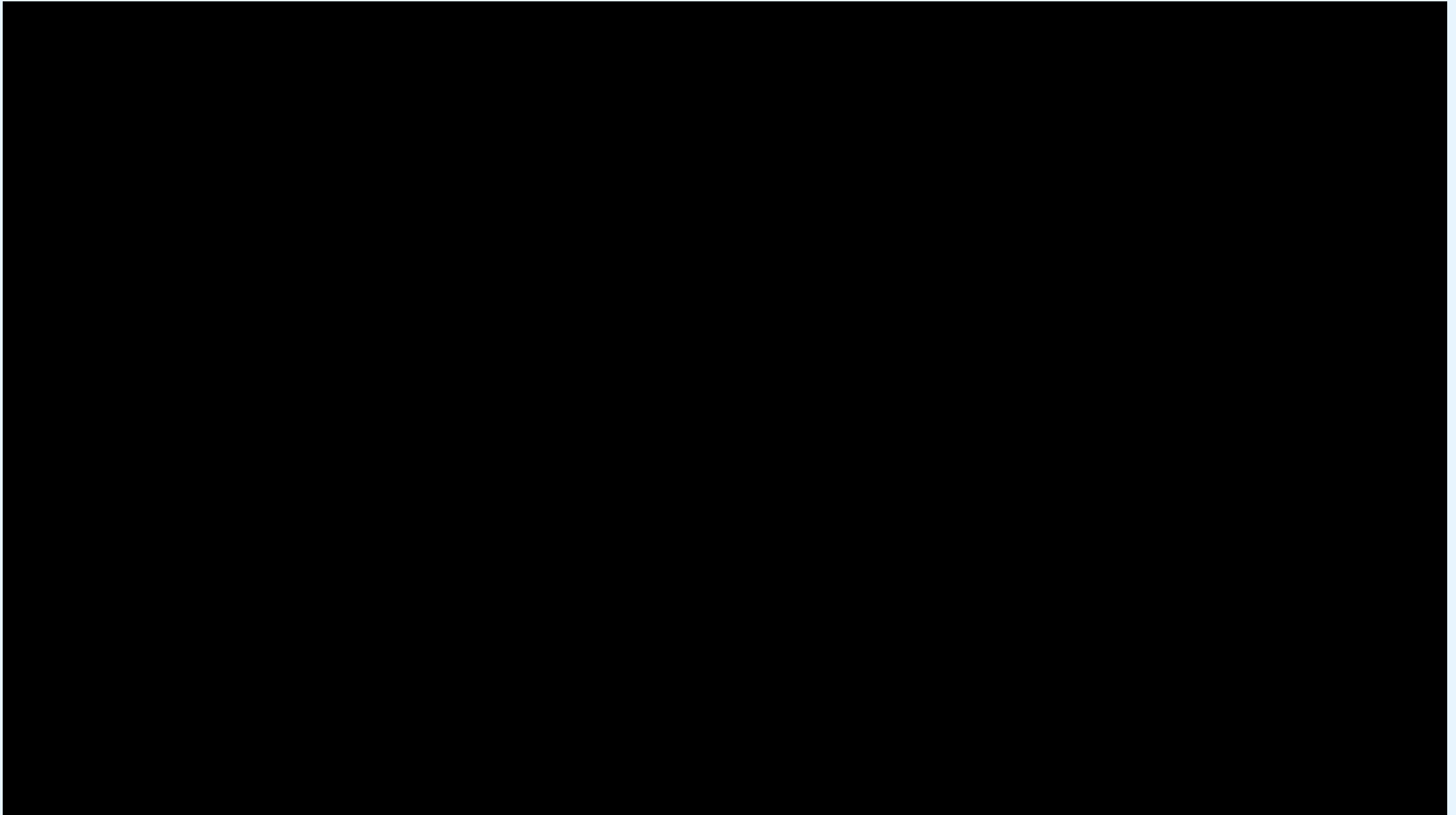
Let Us Watch!

First, let us review about cells. Watch the videos carefully, and let us answer this question afterward:

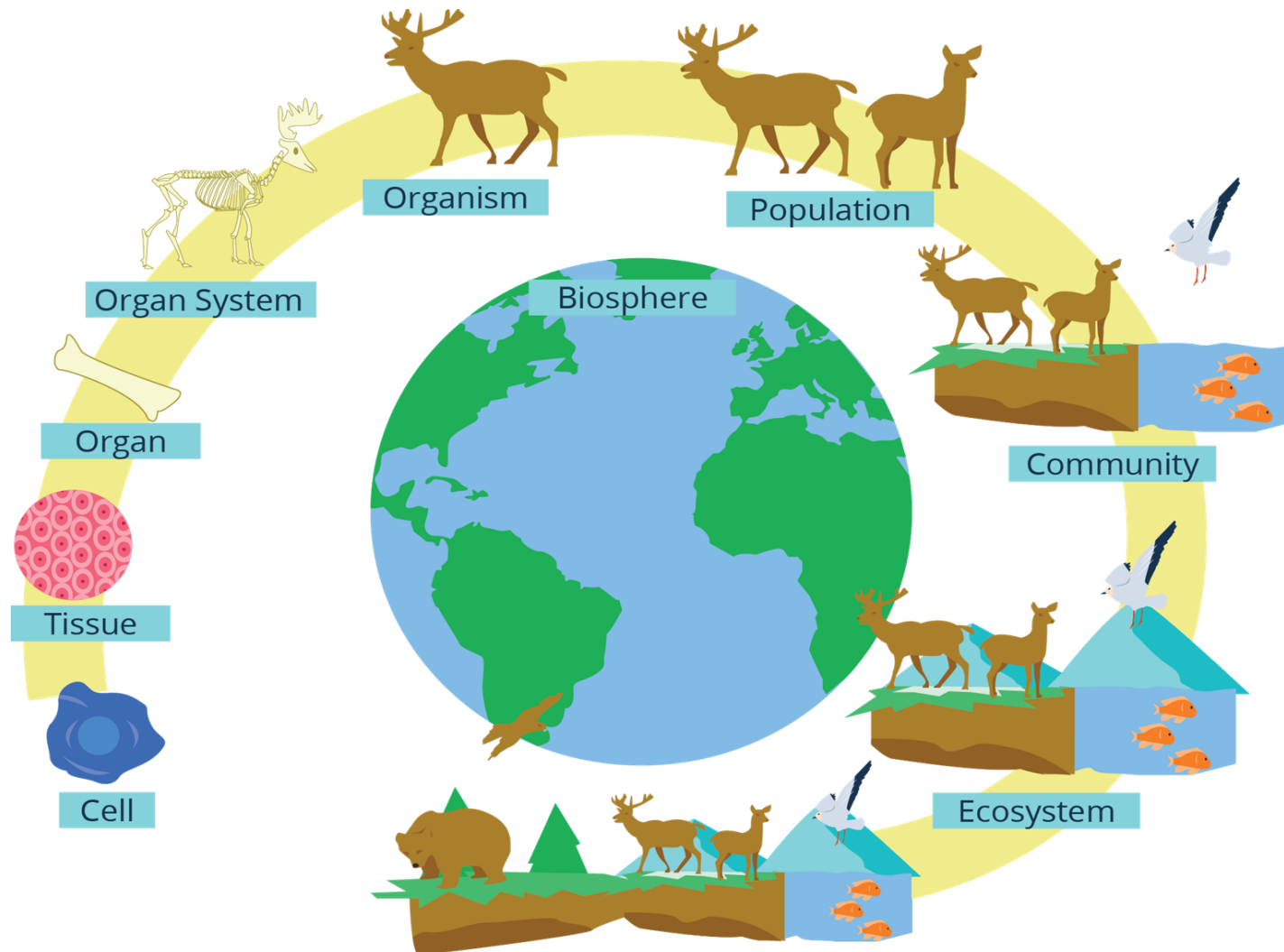
Why are cells considered the fundamental units of life?



Let Us Watch!

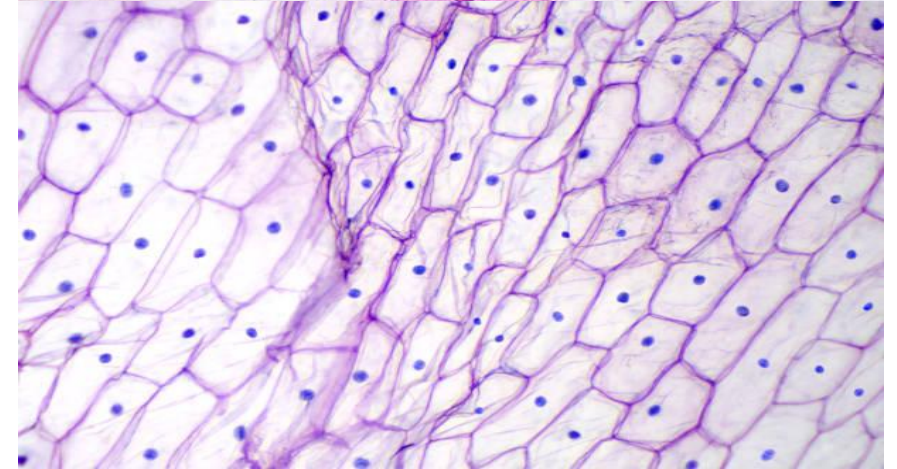
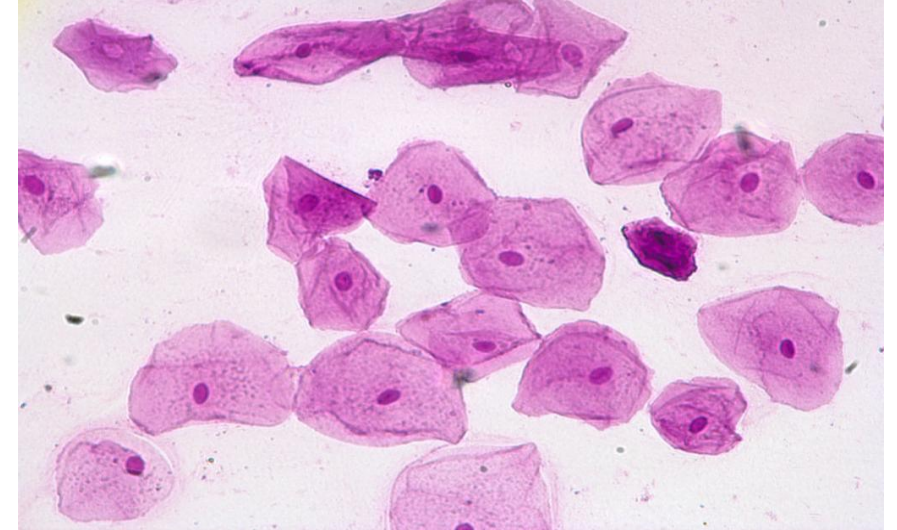
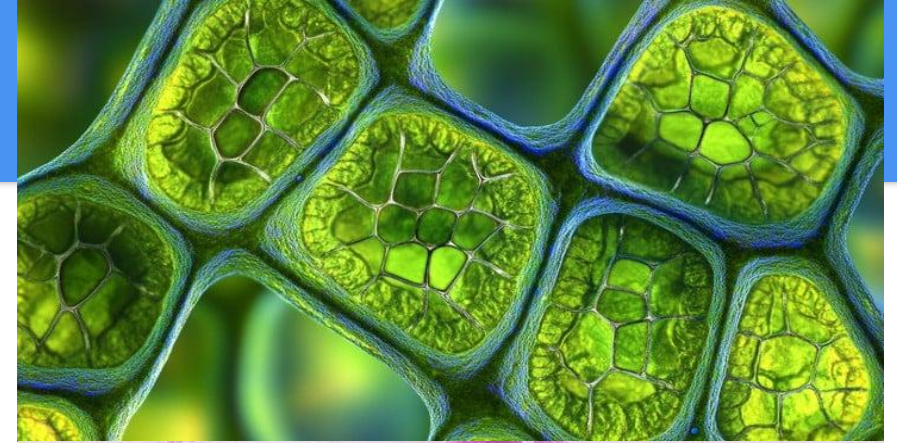


The Hierarchical Organization of Biological World



What is a cell?

- A cell is the smallest unit of life that can carry out all the basic functions of living things, such as growth, reproduction, and responding to the environment.
- It's like the building block of all living organisms — just as bricks make up a building, cells make up plants, animals, and people.



Development of the Cell Theory

1665

1838

1839

1855



Robert Hooke discovered a cell by observing very thin slices of cork under a microscope



Matthias Schleiden stated that all plants are made up of cells



Theodore Schwann also stated that all animals are made up of cells



Rudolph Virchow observed cells dividing into new cells and he theorized that cells come from existing living cells

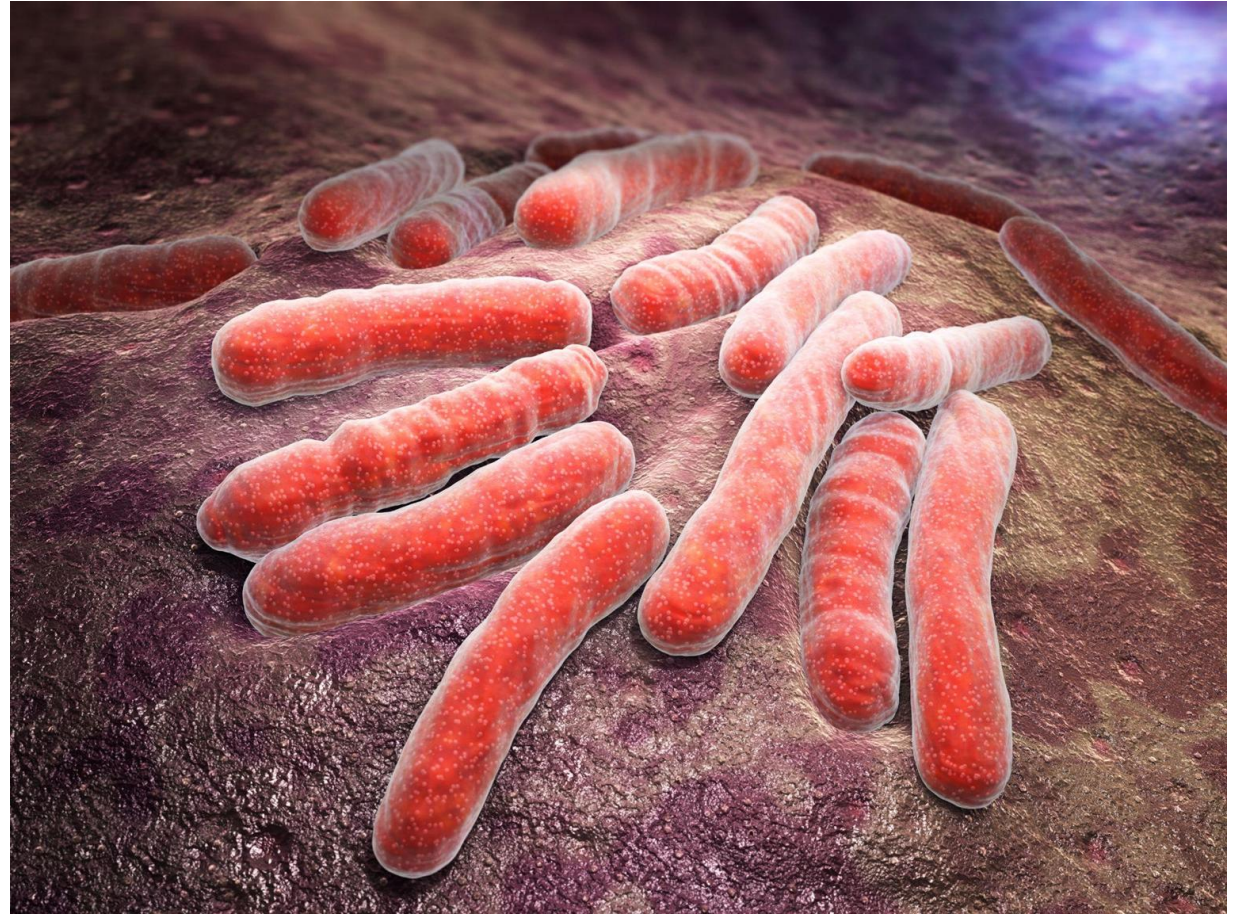
Cell Theory

- All living things are made up of cells.
- Cells are the smallest units of life.
- New cells come from pre-existing cells through cell division.



Cell Theory

- All living things are made up of cells.
- Cells are the smallest units of life.
- New cells come from pre-existing cells through cell division.



Bacteria are made up of cells.

Cell Theory

- All living things are made up of cells.
- Cells are the smallest units of life.
- New cells come from pre-existing cells through cell division.



Genetically modified crops

Cell Theory

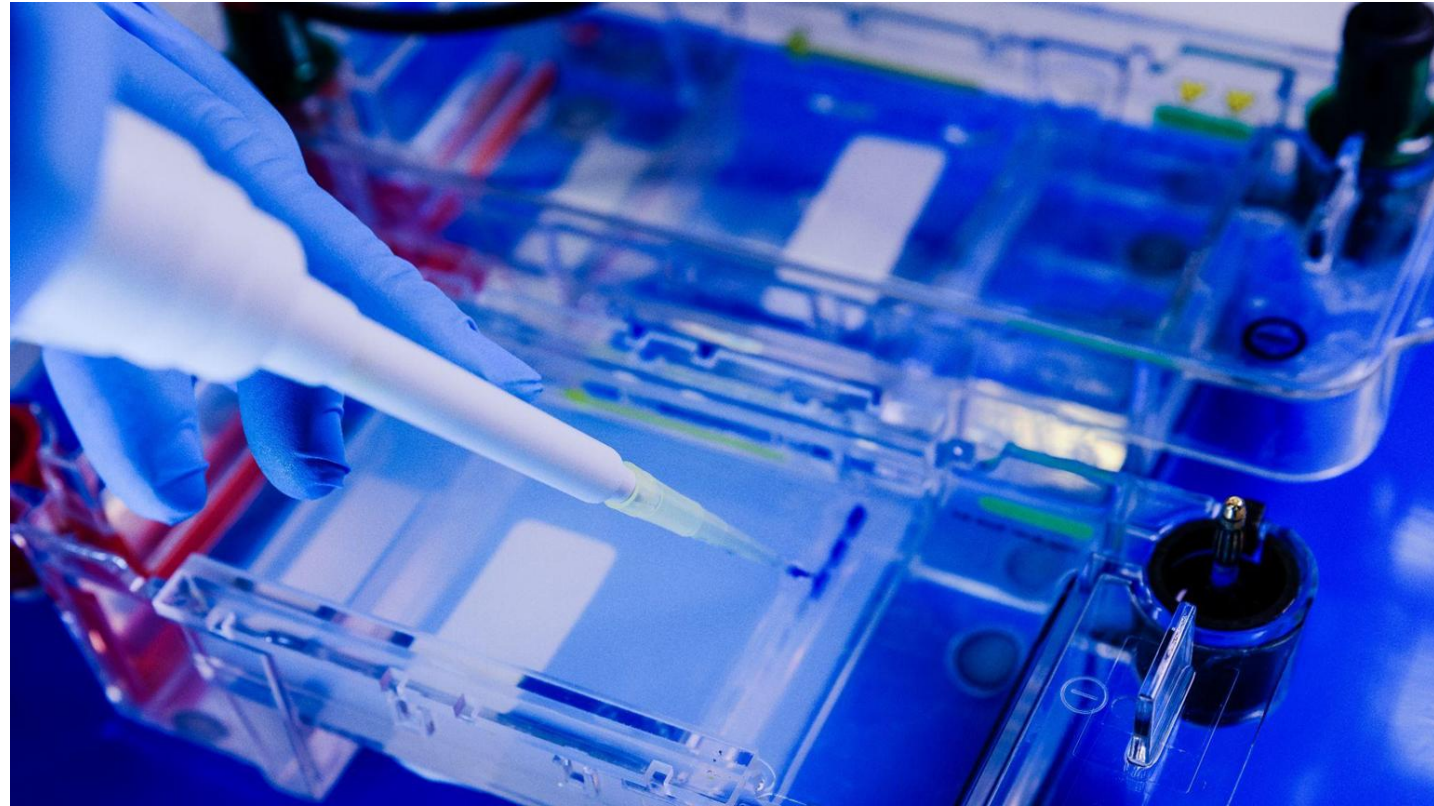
- All living things are made up of cells.
- Cells are the smallest units of life.
- New cells come from pre-existing cells through cell division.



A cancer patient

Cell Theory

- All living things are made up of cells.
- Cells are the smallest units of life.
- New cells come from pre-existing cells through cell division.



DNA Fingerprinting

Cell Theory

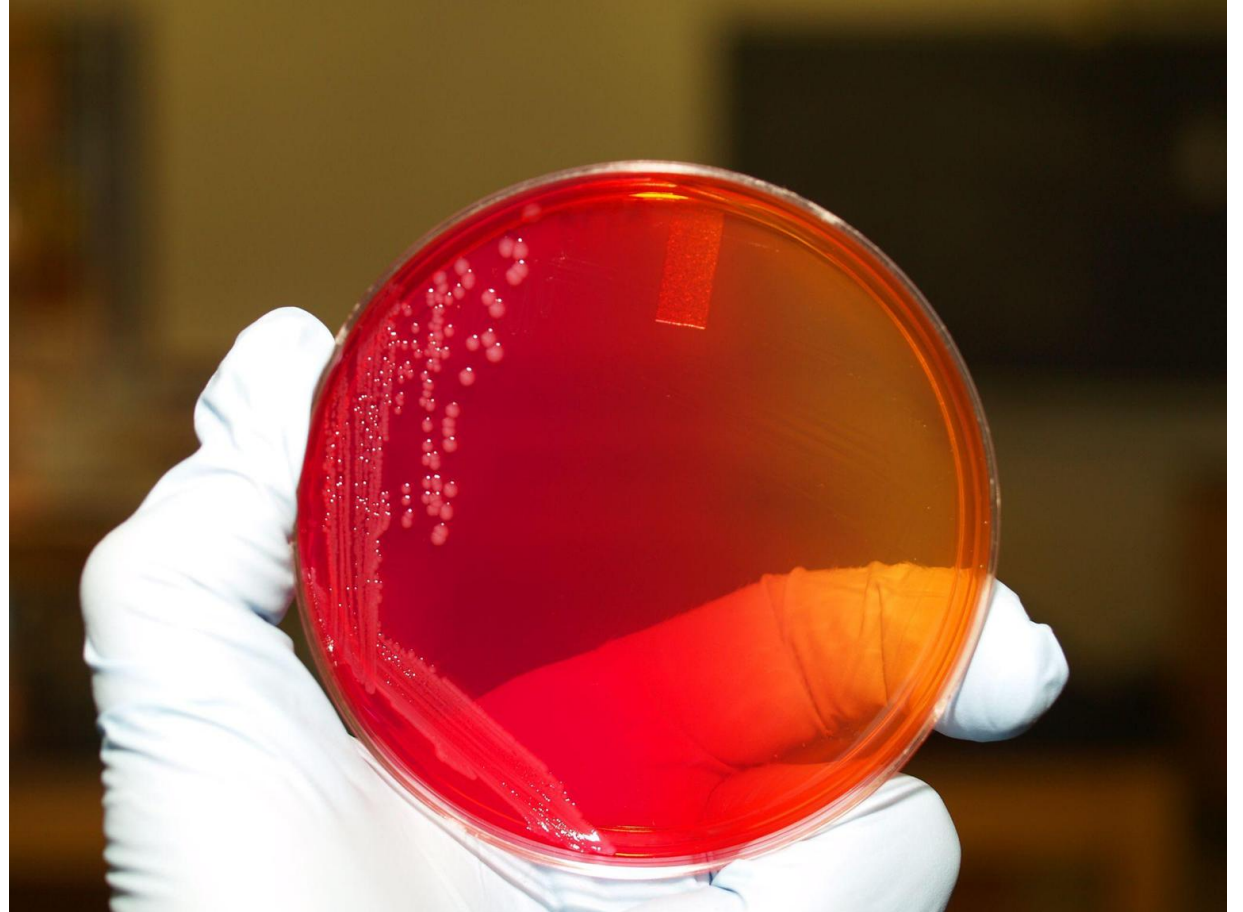
- All living things are made up of cells.
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Stem cell research

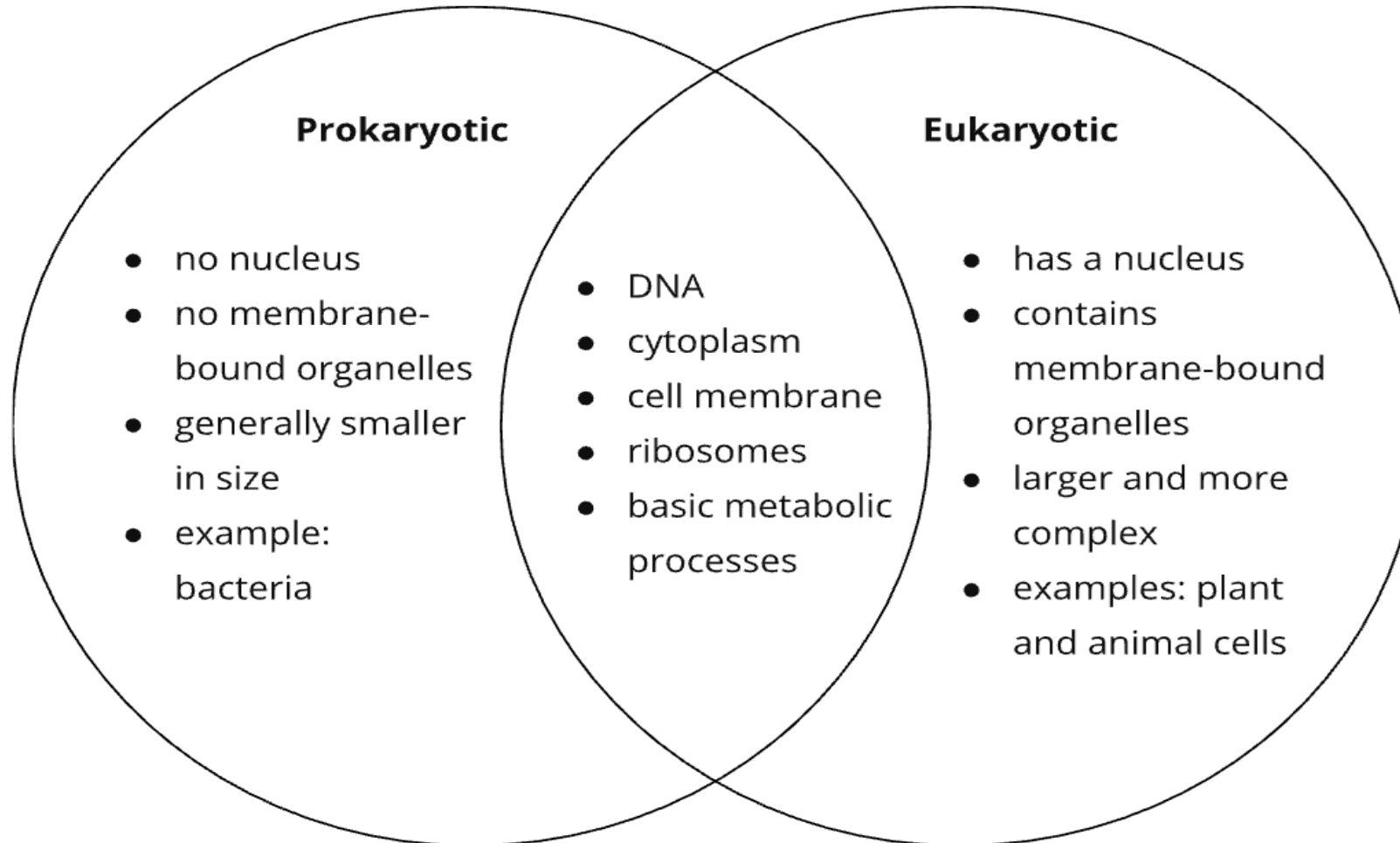
Cell Theory

- All living things are made up of cells.
- Cells are the smallest units of life.
- New cells come from pre-existing cells through cell division.



Microbial cultivation

Types of Cells



Cell Structures and Functions

Exterior Group

- interact with the cell's external environment, protection, and movement
- includes cell membrane and cytoplasm

Interior Group

- includes components that manage cellular processes like energy production, genetic material storage, and protein synthesis
- includes cytoplasm, nucleus, ribosomes, centrioles, mitochondria, and chloroplasts

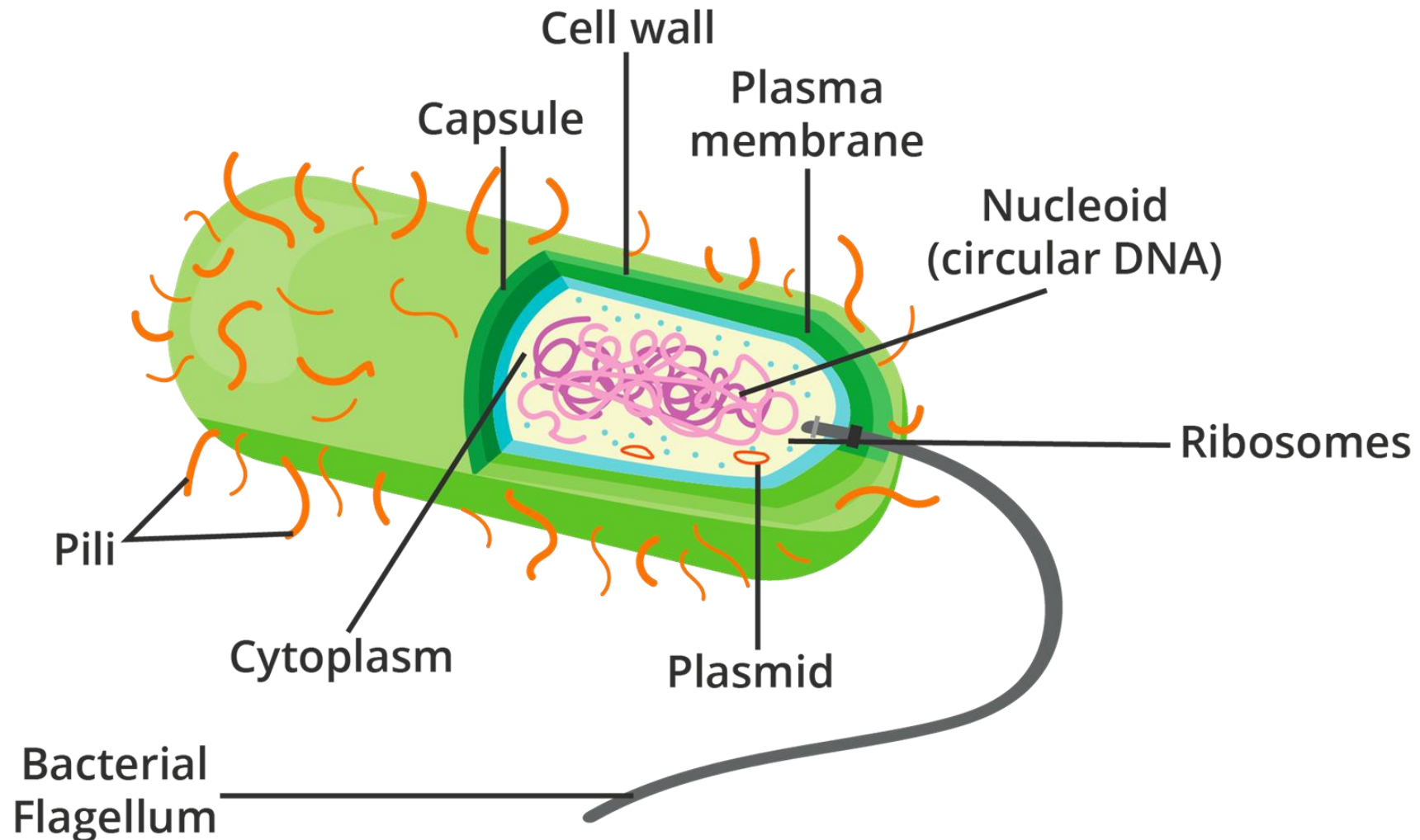
Cell Structures and Functions

Endomembrane System

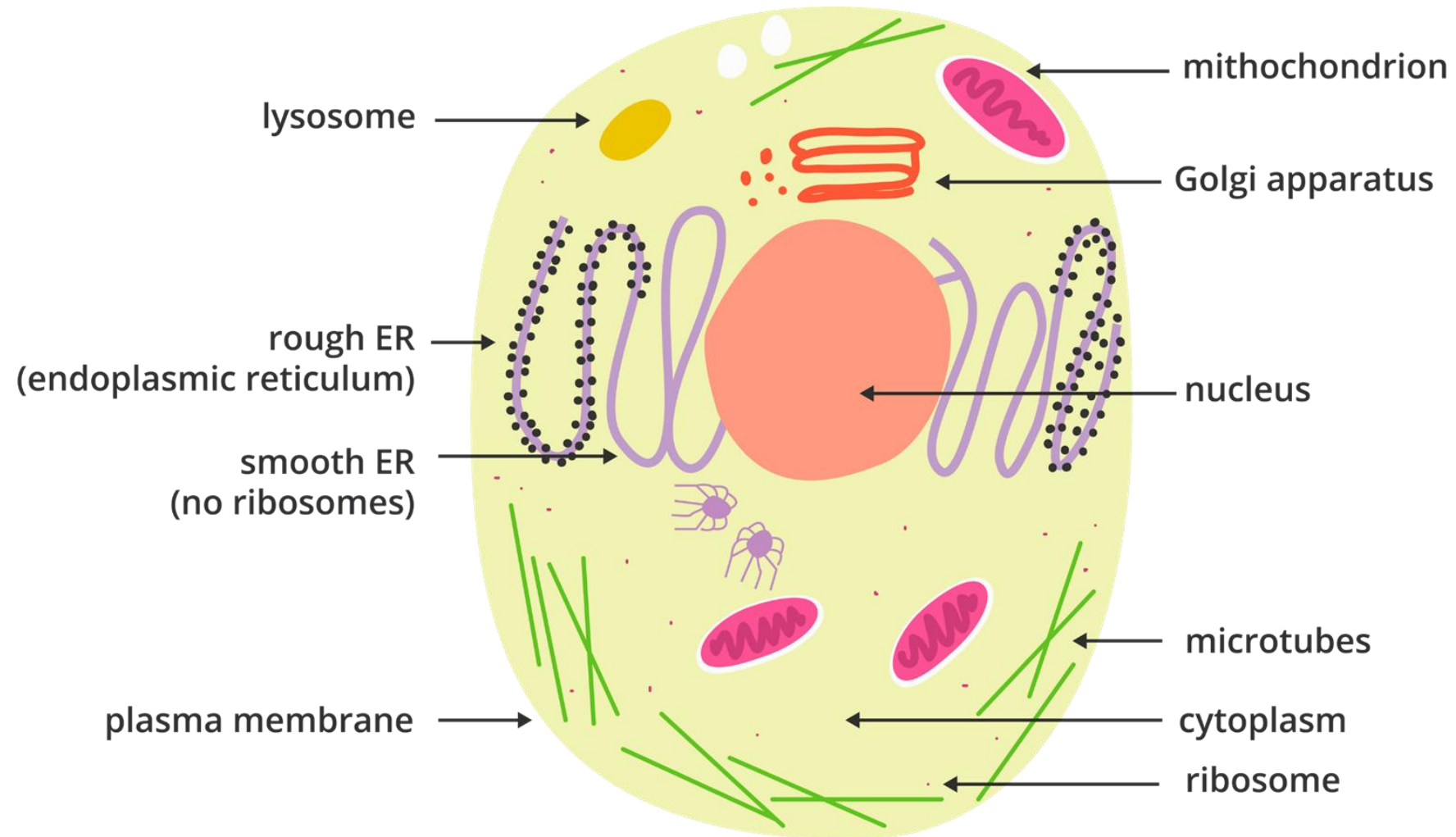
- involved in the synthesis, modification, and transport of cellular materials and waste processing
- comprises the endoplasmic reticulum, Golgi apparatus/body, lysosomes, and vacuoles



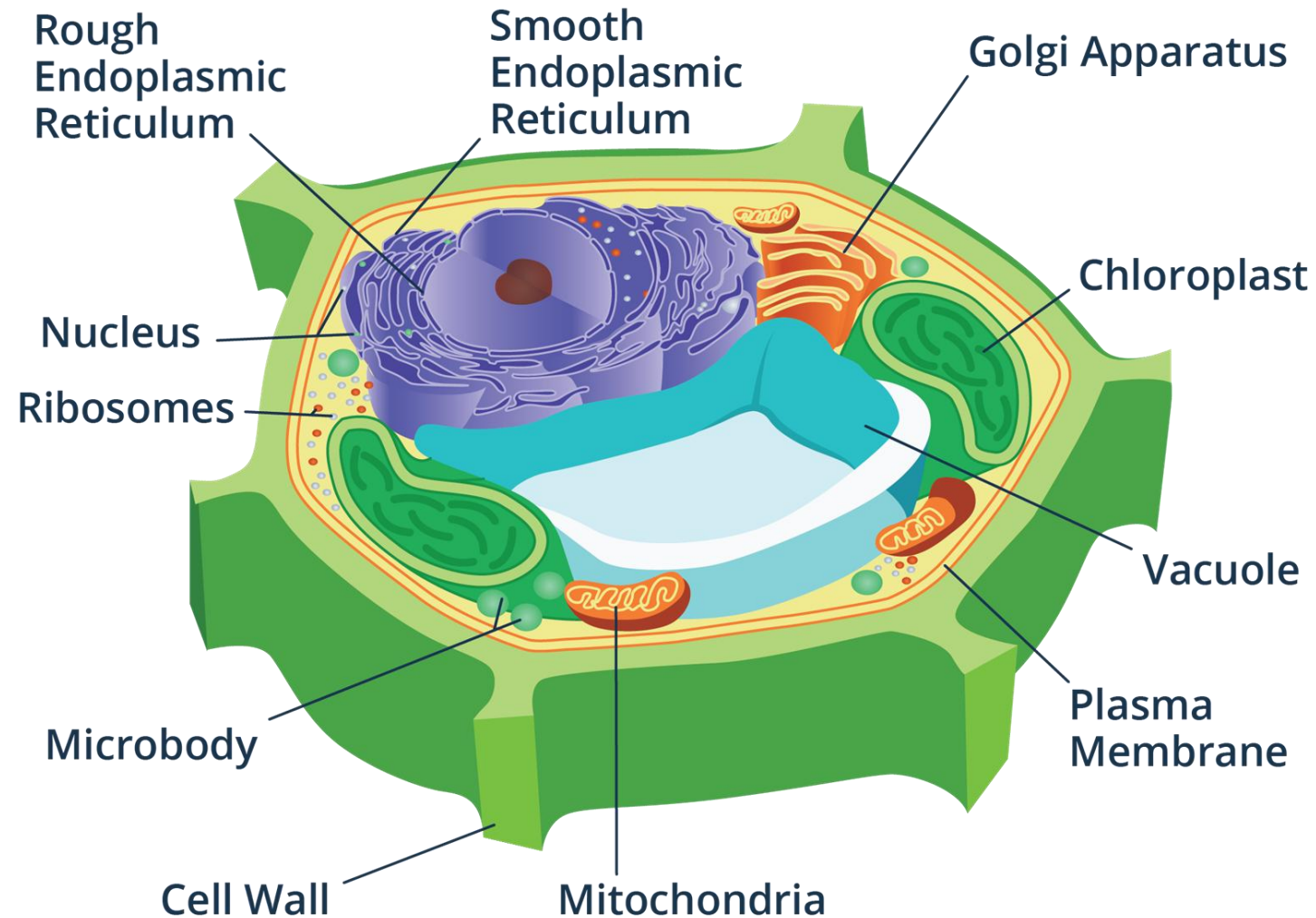
Cell Structures and Functions: Bacteria



Cell Structures and Functions: Animal Cell



Cell Structures and Functions: Plant Cell





The largest cell in the world is the ostrich egg,
while the smallest is the *Mycoplasma genitalium*, a type of bacteria.

The Efficiency Check: Why Are Cells Microscopic?

Smaller cells have a massive **Surface Area to Volume (SA:V) ratio**, allowing for rapid, efficient exchange.



Large Cell (Low SA:V)



Many Small Cells (High SA:V)

Larger cells = slower exchange = less efficient.

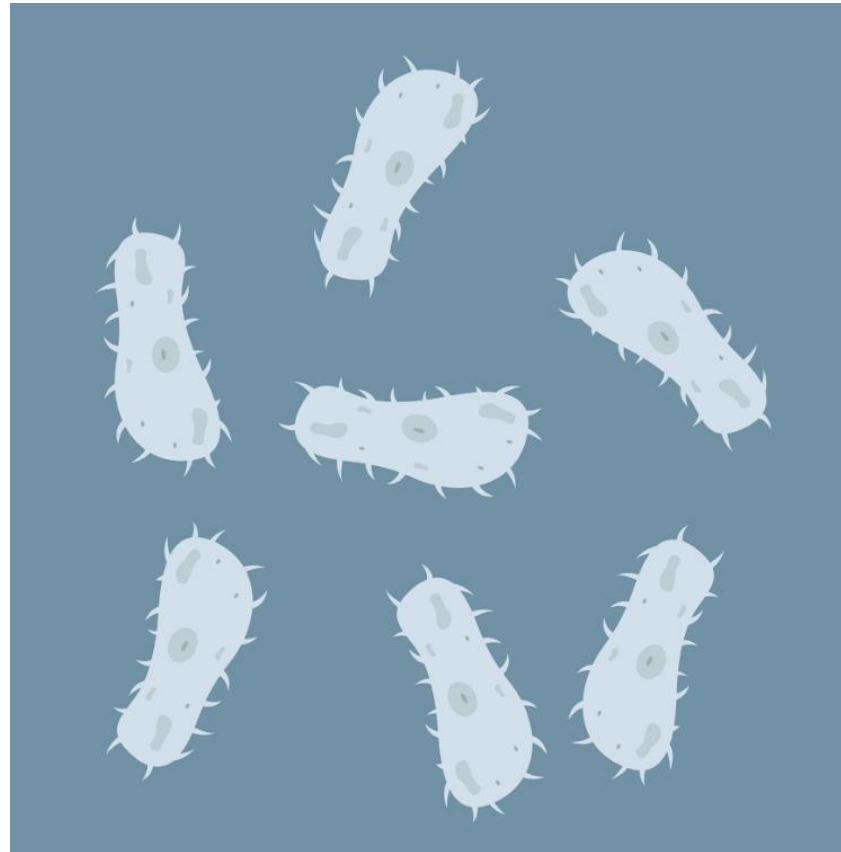
Smaller cells = faster exchange = more efficient.

Surface Area to Volume Ratio in Cells

- smaller gelatin cubes (smaller cells) reacted more quickly to salt due to their larger surface area relative to their volume
- small cells have a higher surface area to volume ratio
- makes them more efficient in transporting nutrients and waste materials

In short:

- Smaller cells = faster exchange = more efficient
- Larger cells = slower exchange = less efficient



Why might smaller organisms have an advantage in certain environments compared to larger organisms?



Key Points

- **Cells** are the basic units of life, discovered by Robert Hooke in 1665.
- **Cell theory** states that all living things are made of cells, cells are the smallest units of life, and new cells come from existing cells.
- Cells have **a high surface area-to-volume ratio**, making them efficient in transporting nutrients and waste.
- There are two main types of cells: **prokaryotic** (like bacteria, without a nucleus) and **eukaryotic** (like plant and animal cells, with a nucleus).
- Cells have different parts, called **organelles**, each with its own function.



After viewing cells under the microscope, how did your understanding of the complexity of life change? What lessons can you learn from the organization and harmony among the parts of a cell that can apply to your personal growth and your role in your family or community?



How do you think understanding cell efficiency can help us in medical science or environmental conservation?



What recent technological advancements have been made in studying cell structures, and how might these impact our understanding of environmental challenges?