6th Grade
Cells and Heredity

Chapter 1: Introduction to Cells

Lesson 1 (Discovering Cells)

Cell – the basic unit of structure and function in living things

– forms the parts of an organism and carries out all its functions

Structure – describes what something is made of and how its parts are put together.

Functions – processes that enable something to live, grow, and reproduce

Examples: Taking in oxygen, nutrients, and water.
Making new cells.

Hooke – developed the first idea of cells by viewing sections of cork

Leeuwenhoek – discovered unicellular organisms

Schleiden – the first to decide plants were made of cells

Schwann – the first to decide that animals were also made of cells

Virchow – decided that cells must come from cells that already exist

All their work helped develop what is called **The Cell Theory**.

The Cell Theory

1. All living things are made of cells.
2. Cells are the basic unit of structure and function in living things.
3. All cells are produced from other cells.

Lesson 2 (Looking Inside Cells)

Organelles – tiny structures within a cell that carry out specific functions

Animal Cells:

Cell membrane – the flexible outside boundary of all cells

– Controls what substances can come in and out of the cell (like a door screen).

– Allows oxygen, nutrients, and water in and lets waste products such as carbon dioxide (CO_2) out.

Nucleus – the "control center" of a cell that directs all the cell's activities

– surrounded by its own membrane

Inside the Nucleus:

Chromatin – thin strands in the nucleus that contain genetic material that serve as "blueprints", or instructions to direct the cell's activities.

– **Chromosomes** are made of chromatin.

Nucleolus – dense center of the nucleus where **ribosomes** are made

Cytoplasm – a clear, thick, gel-like material that makes up the rest of the cell

– constantly moving to deliver materials to the rest of the organelles

Mitochondria – rod-shaped structures in the cytoplasm that convert energy in food to energy the cell can use to carry out its functions

– known as the 'powerhouses" of the cell that produce energy

Endoplasmic Reticulum – forms passageways in the cytoplasm to carry proteins and other materials from one cell part to another

Ribosomes – small grain-like structures attached to the outside of endoplasmic reticulum

– produce proteins used by the cell

Golgi apparatus – receive proteins and other materials, packages them, and sends them to other parts of the cell. (Like a mailroom.)

Vacuoles – sac-like structures in the cytoplasm that act as storage areas

– Store food and other materials until needed by the cell.

Lysosomes – small round structures in the cytoplasm that contain chemicals to break down things for the cell

– breaks down large food particles into smaller ones

– breaks down old cell parts to be used again

Plant Cells:

Plant cells have all of the same features as an animal cell, but also have a cell wall and chloroplasts.

Animal cells do not have cell walls or chloroplasts.

Cell wall – a **very rigid** layer of nonliving material that surrounds the cell membrane in the cells of **plants** and some other organisms

– protects and supports the cell

Chloroplasts – large **green** structures found in the cells of **plants** and some other organisms

– capture energy from sunlight and use it to produce food for the plant

Chlorophyll – green pigment inside chloroplasts that collects sunlight

Photosynthesis – the process in which plants use water, carbon dioxide, and sunlight to make their own food.

Unicellular – made of a single cell

Multicellular – made of many cells that are specialized to do certain tasks

– Each type of cell (muscle, skin, nerve, bone) has a different appearance and has a different job.

Levels of Organization in the Body

1. **Cells** – smallest unit of organization in which life processes take place
2. **Tissues** – a group of similar cells that work together to perform a similar function
   – Each type of tissue performs a specific job.
3. **Organs** – a structure made of different groups of tissue that work together to perform a similar function
   – Each organ performs a special job that is more complex than the job of tissues.
4. **System** – the largest unit of organization that is a group of organs that work together to perform a major body function (job)

Lesson 3 (Chemical Compounds in Cells)

Element – any substance that cannot be broken down into simpler substances

– The smallest unit of an element is an **atom**.

Examples: Iron, Carbon, Hydrogen, Oxygen, Sulfur

Compound – two or more elements chemically combined

– The smallest unit of a compound is a molecule.

Examples: Water (H_2O)
Carbon dioxide (CO_2)
Hydrogen peroxide (H_2O_2)

Organic compound – a compound that contains carbon as one of its elements

Inorganic compound – a compound that does not contain carbon

Compounds in Living Things :

1. Carbohydrates (organic)
2. Lipids (organic)
3. Proteins (organic)
4. Nucleic Acids (organic)
5. Water (inorganic)

Carbohydrates – (sugars and starches) **energy-rich** organic compounds in all living things

– Sugars are produced by plants during photosynthesis.

– Plants store extra sugars by combining them into large molecules called **starch**.

– When we eat foods that contain starch (potatoes, rice, bread, pasta), our bodies break starch down into **glucose**, a sugar our cells use to produce energy.

Lipids – (fats and oils) also **energy-rich** organic compounds in all living things

– Contain even **more energy** than carbohydrates.

– Cells store extra energy in lipids (fats and oils) to use later.

Proteins – very **large** organic molecules found in all living things

– Much of a cell's structure and function depends on proteins.

– They make up cell membranes and organelles.

– They are made of smaller molecules called **amino acids**.

– There are only 20 amino acids.

– These amino acids join in many different ways to form thousands of proteins in living things. (Just like we can spell thousands of words from only 26 letters.)

Enzymes – special proteins that speed up chemical reactions

– Without enzymes, many chemical reactions would take too long or not happen at all.

Example: Enzymes in saliva speed up digestion by breaking down starches into sugars.

Nucleic Acids – very **long** organic molecules found in all living things

– are located in the nucleus of a cell

– contain instructions the cell needs to carry out all the functions of life

Examples: DNA and RNA

DNA – genetic (inherited)material that contains information about an organism and is passed from parents to offspring

– directs all the cell's functions

RNA – plays an important role in the production of proteins

Water – inorganic molecule needed by all living things

– Most chemical reactions in living things take place in water.

– Dissolves chemicals the cells need.

– Helps cells keep their shape. (Cytoplasm is mainly water.)

– Helps keep the temperature in cells from changing too much.

– Helps carry substances in and out of cells.

Lesson 4 (The Cell in Its Environment)

Cell membrane – controls what can enter and leave the cell (Like a filter)

Selectively permeable – also called semi-permeable
– a property of a cell membrane that allows some things to pass through, while others cannot

Two Ways Substances Move Into and Out of a Cell :

1. Passive Transport
2. Active Transport

Passive Transport– movement of material through a membrane without using the cell's energy
– happens automatically

Forms of Passive Transport :

Diffusion – when **any** molecule moves on its own from an area of **high** concentration to an area of **low** concentration

Osmosis – the diffusion of **water** molecules through a cell membrane

Diffusion and osmosis take place automatically and do not require any energy from the cell.

Active Transport– movement of material through a membrane using cellular energy
– Sometimes molecules must move in a direction they would not naturally move.
– Molecules move from an area of **low** concentration to an area of **high** concentration.
– Cells need to supply energy to force them to do this.

Transport proteins– grab materials and move them through the membrane

Moving Large Particles:

1. **Endocytosis** – the cell membrane changes shape to engulf large molecules
2. **Exocytosis** – allows large particles to leave the cell
3. Both require energy from the cell.