

SOL LS.2 CELLS - 2018 STANDARDS

All living things are composed of one or more cells that support life processes, as described by the cell theory. Key concepts include

- the development of the cell theory demonstrates the nature of science;
- cell structure and organelles support life processes;
- similarities and differences between plant and animal cells determine how they support life processes;
- cell division is the mechanism for growth and reproduction;
- cellular transport (osmosis and diffusion) is important for life processes.

Central Idea: All living things are composed of cells these cells have different structures and organelles that support life processes. Cell theory describes the current understanding of cells. Theories and laws in science are used by scientists to describe natural phenomena. Theories and laws are equal in terms of scientific validity.

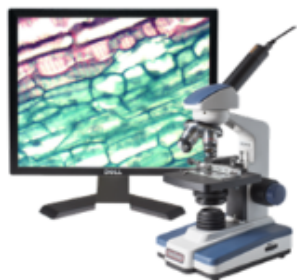
THE NATURE OF SCIENCE

The **nature of science** includes the concept that

- the natural world is **understandable**
- science is based on **evidence**—both **observational** and **experimental**
- science is a blend of **logic** and **innovation**
- scientific ideas are **durable yet subject to change** as new data are collected
- science is a **complex** social endeavor
- scientists try to remain **objective** and engage in peer review to help avoid bias.

SCIENCE AND TECHNOLOGY ARE TIGHTLY LINKED

- Science** seeks to **understand the natural world** through **observation** and **experimentation**.
- Technologies** are developed to aid in gathering data.
 - New **data** bring fresh **insights**, raise new **questions**, and prompt further investigation.
- In this way, scientific **knowledge evolves slowly** over time.
- A good example of the **link between science and technology** is how advances in **microscopes** have helped us **investigate cells**—the smallest part of living things—and how they work to sustain life processes.



THEORIES AND LAWS

Theories and laws are two different types of knowledge used by scientists to describe natural phenomena. They are equal in terms of scientific validity.

- Theories** are generally used to explain complex natural processes **not easily quantifiable** (e.g., cells, evolution).
- Laws** often use **mathematical formulas** to show relationships and make predictions about the natural world (e.g., heredity).
- The **cell theory** is a shared understanding that encapsulates our **current understanding** of the cell.
- The development of this theory illustrates the **nature of science**

Cell Theory

- > all living things are composed of cells
- > cells are the smallest unit of living things that can perform life processes
- > living cells come only from other living cells

MODELS

- Scientists and engineers use two-dimensional (2-D), three-dimensional (3-D), mathematical, and virtual **models** to **represent, predict, and elaborate** upon objects and systems and their interactions.
- Scientists use **models** when the object of investigation is **too large, too small, or too complex** to be studied directly.

CELL STRUCTURE & ORGANELLES SUPPORT

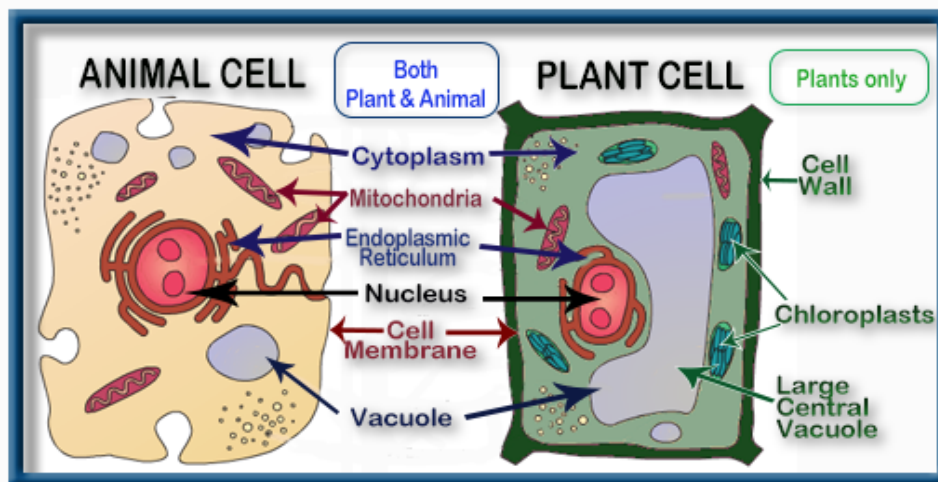
LIFE PROCESSES

Sustaining life requires substantial **energy** and **matter** inputs.

- Living cells are full of **highly organized organelles** that function as a system to **carry out life processes** within the cell.
 - **Life processes** include **growth** and **repair**, **reproduction**, **gas exchange**, **metabolism**, and **response**.
 - **Metabolism** refers to all **interactions among molecules** within the well-ordered environment of the cell.
 - **Photosynthesis** and **cellular respiration** are two important **metabolic** activities within living cells.
- The **structure** of an object or living thing determines many of its **properties** and **functions**.

- Explain the difference between scientific **hypothesis**, **theory**, and **law**.
- know the three components of the original **cell theory**.
- explain how advances in **microscope** technology have improved our understanding of **cells** and their parts.

PLANT CELLS VS. ANIMAL CELLS



- Animal and plant cells may differ in **shape**, **size**, and the **organelles** they contain.
- Most often these differences are in **structure**.
- Similarities and differences between plants and animals are evident at the **cellular level**.
- **Plant cells** differ from **animal cells** in that plant cells contain **cell walls**, **chloroplasts**, and **large, central vacuoles** to aid in **photosynthesis** that help them convert matter and energy to usable forms

- identify these organelles and know what they do - (**cell membrane**, **cytoplasm**, **nucleus**, **cell wall**, **vacuole**, **mitochondrion**, **endoplasmic reticulum** and **chloroplasts**)
- compare **plant** and **animal cells** (both structure and function)

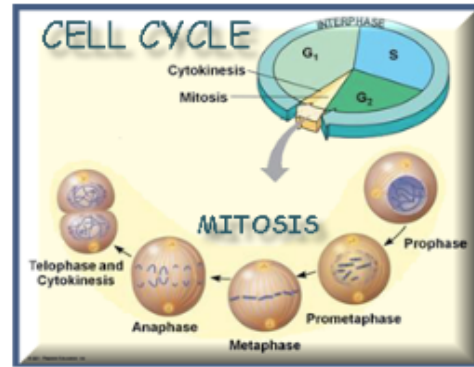
CELL DIVISION FOR GROWTH AND REPRODUCTION

- **Reproduction** is a life process by which living things **transfer genetic information** to their **offspring**.
- All living things **grow** and **reproduce**.

MITOSIS FOR GROWTH AND REPAIR

- As an organism **grows** and **repairs** itself, the number of its **cells increase**.
- For this to happen, existing **cells divide** through the process of **mitosis** so that **new cells** can be made.
- The cells which divide go through the **cell cycle**.
 - The **cell cycle** has two main components—**interphase** and **mitosis**.

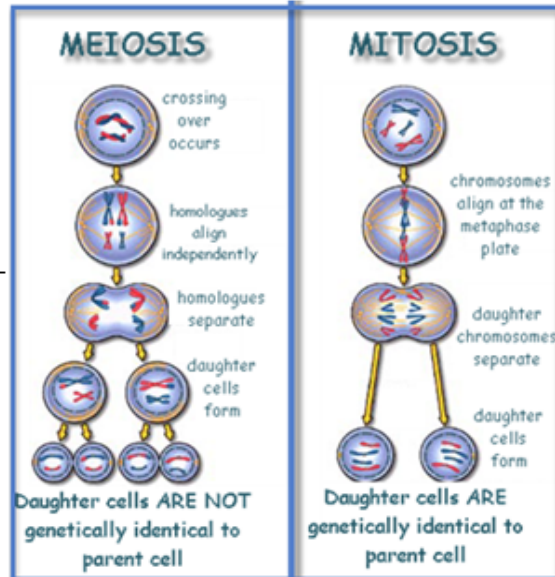
- During **mitosis**, a body cell first **duplicates its chromosomes** and then **divides into two identical daughter cells**, each one with a complete set of **chromosomes identical** to the original parent cell.
- The purpose of mitosis is to **produce new cells** for growth and repair that are **identical** to the parent cell.



MEIOSIS FOR REPRODUCTION

- The purpose of **meiosis** is to produce **reproductive (sex) cells** that carry half the genetic material of the parent.

- *sequence the steps, recognize images, and explain the role of each stage in the cell cycle, including mitosis .*
- *explain why cell division is essential to the growth and reproduction of all living things*
- *differentiate between the purpose of mitosis and meiosis*



CELLULAR TRANSPORT - OSMOSIS AND DIFFUSION

- Living things must **move materials** into, out of, and within the cell.
- Two **passive** processes that allow for this exchange of materials are **diffusion** and **osmosis**.
- These processes require **no energy** on the part of the cell.
- Substances merely move toward **equilibrium** (from an area of **high concentration** to an area of **low concentration**) .

OSMOSIS

- Osmosis is the movement of **water molecules** across a **cell membrane**.

DIFFUSION

- **Diffusion** is the movement of **substances other than water** across a cell membrane.
- Cell membranes are **selectively permeable** to various substances

- *model how materials move into and out of cells in the processes of osmosis, diffusion, and selective permeability*

