

Life Science Chapter 3

Life and Cells

3A Living Organisms

Two types of objects:

Animate: "possessing life"

Inanimate: "not living"

organism: a complete, living thing

Attributes of Life (Characteristics of Life)

These characteristics are not actually "life" itself, but things that are alive possess these characteristics.

(1) *Organisms have life spans (cycles)*

life cycle: the sequence of stages during an organism's life (usually include: birth, growth, reproduction, death)

(2) *Organisms can reproduce.*

Life comes from life.

Living things reproduce after their own kind

(3) *Organisms grow*

The grow by assimilation (the process by which living cells convert nutrients into cellular structures).

Your cells have the ability to take nonliving materials and make them into living substances.

(4) *Organisms are made of cells*

cell: a tiny unit of living material surrounded by a thin membrane (basic units of structure and function in living things)

cytoplasm: the living material in a cell (it's made up of mostly water and has many organic compounds)

organic compounds: substances that have carbon in them and are normally made by living cells
examples: sugars, starches, fats, proteins

Two cell types:

prokaryotic: cells without membrane-bound structures

eukaryotic: cells with membrane-bound structures

unicellular: composed entirely of one cell

multicellular: composed of more than one cell

colonial: composed of a group of similar cells living together (each cell functions like a unicellular organism)

tissue: a group of similar cells that together perform a specific function

organ: two or more tissues that work together to perform a specific function

(5) *Organisms require energy*

energy: the ability to do work

Plants obtain energy from the sun.

Animals obtain energy from plants.

(6) *Organisms move*

Movement inside their bodies. (movement of fluids through plant vascular tissue; movement of substances across cell membranes)

(7) *Organisms respond to their environment*

Viruses are not considered living organisms because they cannot reproduce without a host and are not composed of cells. Viruses are segments of DNA or RNA wrapped in a protein coat.

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physical life: (a characteristic produced when organized systems of nonliving substances use energy and maintain the characteristics of living things)

spiritual life: man's relationship with God (John 17:3)

Often God describes spiritual life by comparing it to physical life. (born again; growth/food; reproduce/witnessing)

The Gaia Theory

Proposed by James Lovelock in 1969

“The theory asserts that living organisms and their inorganic surroundings have evolved together as a single living system that greatly affects the chemistry and conditions of Earth’s surface.”

This theory is believed by many environmentalists. This theory removes humans from the special place God gave them in creation. The word *gaia* comes from Gaia, the Greek goddess of the earth.

-----Quiz 3A

3B The Basic Unit

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cytology: the study of cells

Cytology can be traced back over 300 years to the English scientist **Robert Hooke**.

In 1665 he published *Micrographia* - a report of his use of simple compound microscopes capable of magnifying approximately 30 times.

He observed a thin slice of cork.

The neat rows of little boxes reminded him of rows in a prison, honeycomb or a monastery - he therefore named the "cells." (“coined”)

In 1665 Robert Hooke was the first to use the term cell.

He saw only the dead, empty walls of cells (comes from bark of cork tree – a type of oak)

Anton van Leeuwenhoek

About the same time that Robert Hooke made his discovery, Anton van Leeuwenhoek also began to observe tiny objects with microscopes. He looked at drops of lake water, scrapings from teeth and gums, and water from rain gutters. He observed tiny moving organisms which he called “animalcules,” meaning “little animals.”

In 1838 German botanist, **Matthias Schleiden** said, "All plants are composed of cells."

In 1839 **Theodor Schwann**, a German zoologist, made a similar statement about animals.

In 1855 **Rudolf Virchow** proposed that new cells are formed only from cells that already exist.

The Cell Theory

The three basic principles of the cell theory:

- (1) All cells come from preexisting cells.
- (2) All living things are made of cells and of the products of cells.
- (3) The functions of living things are performed by the cells they are made of.

Basic Cellular functions:

- (1) Use energy
- (2) manufacture materials
- (3) respond to environment
- (4) reproduce

If the new cells are produced faster than the old cells die, the organism will grow. Some cells, such as certain human brain cells, lose their ability to divide when they become mature.

-----Quiz 3B

3C Molecules and Life (biochemistry)

What do all the things in the room have in common? Matter & energy

matter: anything that has mass and takes up space

energy: anything that brings about change (can hold matter together or break it apart)

food you eat is matter held together by chemical energy

element: when something is made up of only one kind of atom (any substance that cannot be broken down into simpler substances) (arranged in a chart called the periodic table of elements)

The cell is the smallest unit that can be alive, but there are smaller structures inside the cell.

The smallest of these structures are particles called **molecules** which are made up of smaller units called **atoms**. An atom is the smallest unit of an element.

molecule: a group of atoms held together by the energy of chemical bonds

Four categories of molecules that are essential to life:

- ◆ **Carbohydrates** – made up of CHO; (supply energy for cell processes and some are important parts of cell structures)
examples: sugars & starch (glucose, cellulose, glycogen)
glucose – 6 carbon sugar
cellulose – found in plant cell walls
starch – a storage material in plants
glycogen – a storage material in animals and humans
- ◆ **Proteins** – made up of amino acids
There are 20 commonly occurring amino acids.
Proteins are involved in almost everything that happens in a living cell.
Building blocks of many structures in organisms (your muscles contain large amounts of protein; proteins are scattered throughout cell membranes)
Enzymes are proteins and they regulate nearly all chemical reactions in cells.
- ◆ **Nucleic Acids** – made up of nucleotides
Contain all the instructions that living cells need to make proteins and maintain life
Two major types of nucleic acids: DNA & RNA
DNA – carries information that directs each cell's activities
RNA – needed to make enzymes and other proteins
- ◆ **Lipids** (fats) – do not mix with water; store and release even larger amounts of energy than carbohydrates do.

Are important to maintain good health

Function – energy storage

Membranes are made largely of lipids (phospholipids)

-----**Quiz 3C**