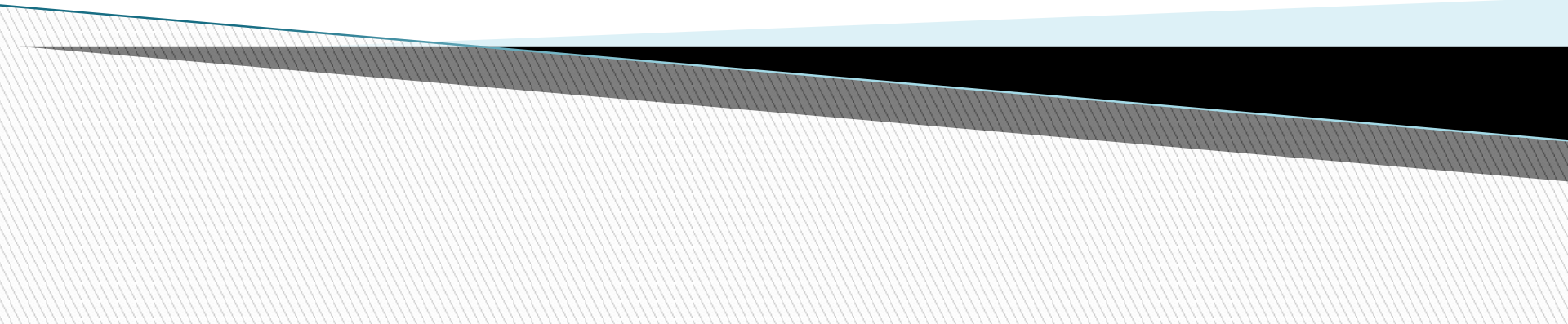
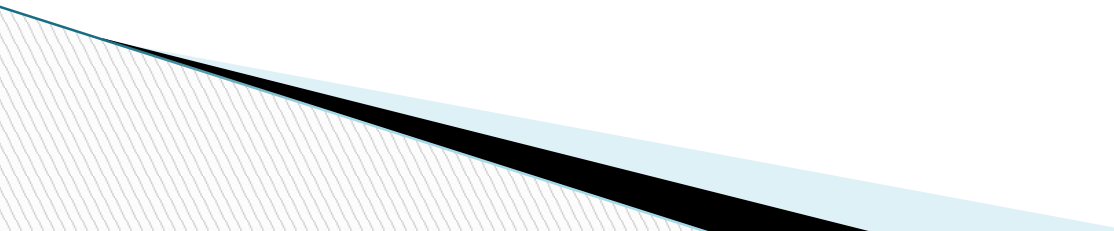


BIOLOGY Keystone Remediation

Basic Biological Principles



Seven Characteristics of Life

1. Organization and Cells
 2. Response to Stimuli
 3. Homeostasis
 4. Metabolism
 5. Growth and Development
 6. Reproduction
 7. Change through time
- 

Organization and Cells

- ▶ High degree of order within an organism's internal and external parts and its interactions with the living world.
 - Everything that exists in the world is made up of matter, and all matter is made up of atoms.
 - Elements form compounds. Organisms are made from many different compounds.
 - Living organisms also contain cells. ***Unicellular organisms*** only contain one cell, but ***multicellular organisms*** contain many cells that are specialized to perform different functions.

Organization

▶ Cell



▶ Tissue



▶ Organ



▶ Organ System

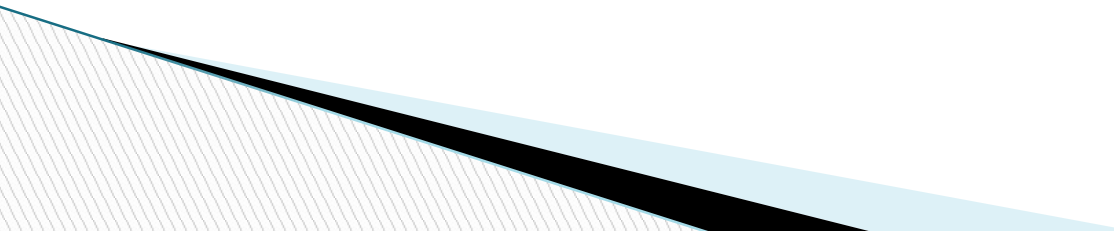


▶ Organism

Organization of the Organism

- ▶ Atom → molecule → macromolecule → organelle → cell → tissue → organ → organ system → organism
- ▶ **Organelles** are specialized subunits in the cell, which each have their own specific function. They are usually enclosed in their own lipid membrane. There are many types of organelles, such as ribosomes, nuclei, endoplasmic reticulum, and lysosomes.

Organization

- ▶ **Cells** are the structural and functional units of all living organisms. Organisms can be made up of one cell, like bacteria, or many cells, like animals. Cells specialize depending upon which part of the body they are located. All cells come from other cells, and they divide by mitosis or meiosis. Cells contain organelles and the genetic information of an organism.
 - ▶ **Tissues** are composed of many cells that work together to perform a specific function. Tissue covers most parts of an organism. There are several types of tissues, such as connective tissue, muscle tissue, nervous tissue, and epithelial tissue.
 - ▶ **Organs** are composed of several tissues and perform one or more functions in the body. In most organs there is a unique 'main' type of tissue (such as the myocardium of the heart) and several other tissues that are found in many organs (such as connective tissue). The body is made up of many organs, including the heart, lungs, liver, eyes, and brain.
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Organization

- ▶ ***Organ systems*** are groups of related organs that work together to perform a function or set of functions. The functions of the various organ systems usually overlap and are influenced by each other. There are eleven major organ systems in the human, including the respiratory, reproductive, digestive, skeletal, muscular, nervous, circulatory, endocrine, urinary, integumentary, and lymphatic systems. There are two main organ systems in vascular plants, the root system and the shoot system.
- ▶ The ***whole organism*** is composed of all of the various organ systems. Its functions are carried out by cooperation between all of the systems.

Response to Stimuli

- ▶ Living organisms are able to recognize both internal and external stimuli, and they can respond to these stimuli. For example, plants can detect light from the Sun and respond to this stimuli by bending toward the light.
- ▶ This stimulus can be physical or chemical; internal or external

Homeostasis

- ▶ Is the maintenance of a stable level of internal conditions even though environmental conditions are constantly changing
 - ▶ Many processes that occur within living organisms must occur within a certain temperature and pH range. So, living organisms must possess the ability to maintain a constant internal environment. That is, they must be able to maintain homeostasis.
 - ▶ Sweating and shivering are examples of processes that occur in order to maintain homeostasis. When a person gets too hot, they sweat, so when the sweat evaporates, heat is removed from the person. When a person gets too cold, they shiver. Shivering forces a person's body to move. This movement generates enough energy to increase the person's temperature.
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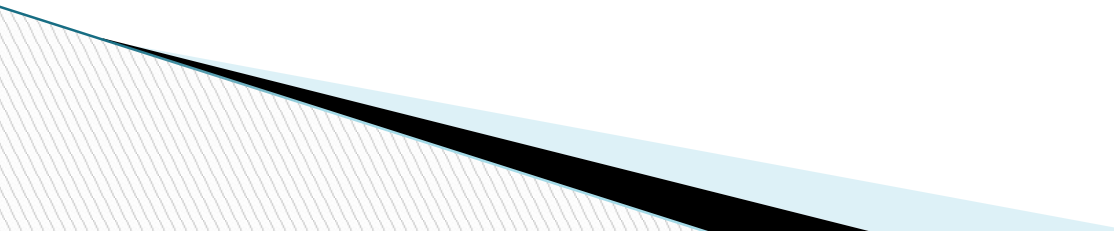
Metabolism

- ▶ Is the sum of all the chemical reactions that take in and transform energy and materials from the environment.
- ▶ The energy needed by organism for repair, growth, and movement is obtained through metabolism
 - Ex. photosynthesis

Growth and Development

- ▶ All living things grow and increase in size.
- ▶ **Cell division**- is the formation of two new cells from an existing cell.
 - Unicellular –cell division and enlargement
 - Multicellular– cell division, cell enlargement, and development
- ▶ **Development** is the process by which an organism becomes a mature adult.
- ▶ For example, humans begin as a single cell. Then, the cell divides, grows, and divides again until it forms a layered ball of cells. At this point, the cells differentiate. That is, they specialize to become different types of cells (e.g., muscle cells, skin cells, brain cells, etc.). Eventually, all of the basic human structures form, and the embryo becomes a fetus. Then, the fetus grows until it is born and becomes an infant. Finally, the infant continues to grow into a toddler, the toddler becomes a child, the child grows into a teenager, and the teenager becomes an adult.

Reproduction

- ▶ Production of new organisms and is essential for the continuation of a species.
 - ▶ Genetic material (DNA) is passed to offspring
 - ▶ ***Asexual Reproduction*** only one “parent” is needed and the offspring is genetically identical to parent
 - ▶ ***Sexual Reproduction*** hereditary information recombines from two organism of the same species. The resulting offspring contain ***genes*** (short segment of DNA that contains instructions for traits) from both parents
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Change Through Time

- ▶ Populations of living organism evolve or change through time.
- ▶ Important to survival in a changing world.
- ▶ Individual's genetic characteristics do not change during a lifetime

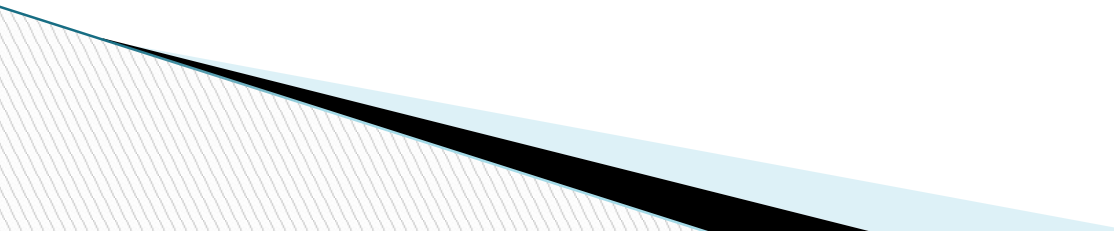
Cell Theory

- ▶ A scientific theory that serves as one of the foundations of biology is the cell theory. This theory puts forth the following:
 1. the cell is the basic building block in all living things
 2. all organisms are made up of one or more cells
 3. cells arise from other cells through a cellular division process known as mitosis
 4. cells carry genetic material that is passed on to “daughter” cells during mitosis
 5. all cells are essentially the same in chemical composition
 6. energy flow (i.e., metabolism) occurs within cells

Cell Theory

- ▶ The cell theory was gradually developed over time by many different scientists. In the late 1830's, two scientists – Theodor Schwann and Matthias Jakob Schleiden – formally proposed the first two statements in the theory, but they also erroneously thought that cells arose through spontaneous generation. Then, in the late 1850's, another scientist named Rudolf Virchow amended the cell theory by suggesting that new cells must arise from pre-existing cells. Finally, as technology and scientific knowledge improved, the other statements were added to the cell theory.

Cells

- ▶ Cells are complex “basic building blocks” of living organisms, and they all share one purpose – to organize and survive.
 - ▶ In unicellular, or single-celled, organisms, each cell contains all of the components necessary for its own survival. In multicellular, or many-celled, organisms, each cell has a different set of functions, and they are dependent on other cells for their survival.
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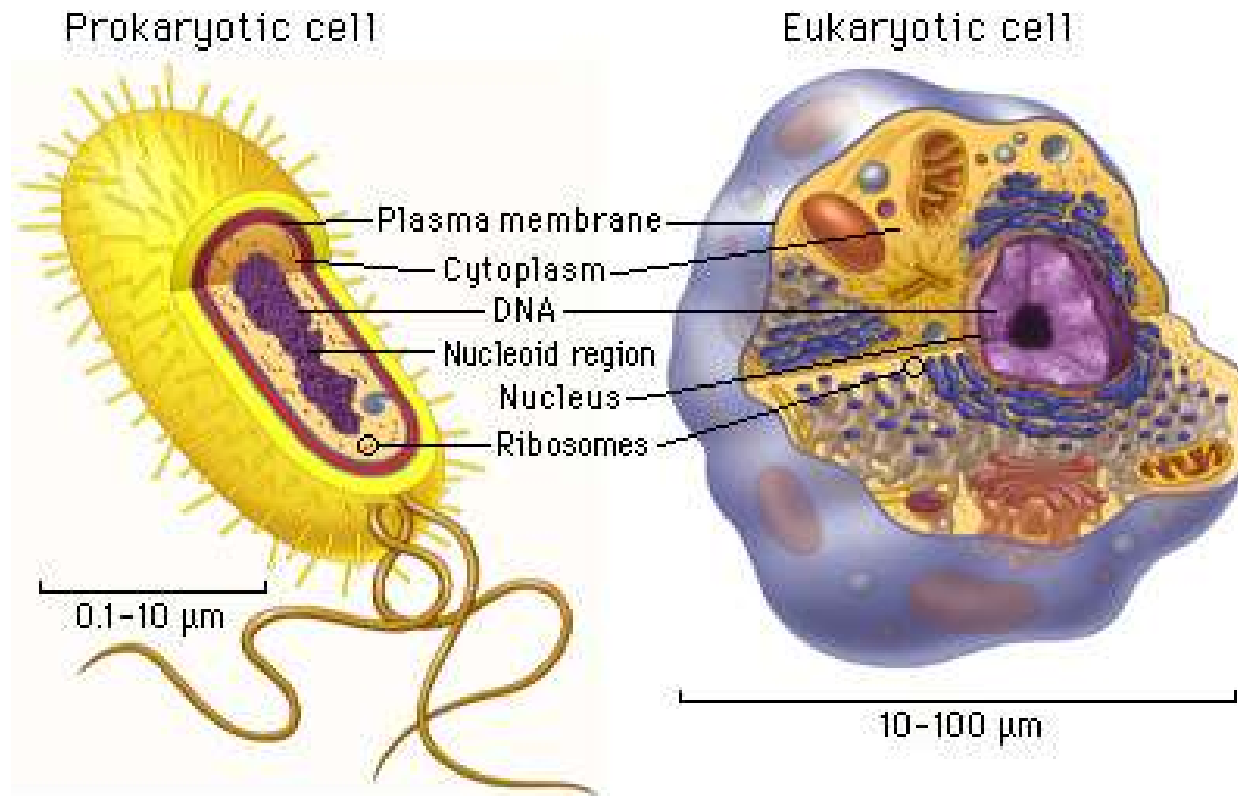
Prokaryotes

- ▶ *Prokaryotic cells do not have a true nucleus or membrane-bound organelles.*
- ▶ The word **prokaryote** comes from the combination of the Greek (**pro-**) "before" and (**karyon**) "kernel" or "nucleus."
- ▶ Prokaryotic organisms differ from eukaryotic organisms in complexity and structure. Except for a few species, most prokaryotic organisms are unicellular. All lack a well-defined nucleus, and are much smaller and simpler than eukaryotic organisms. Prokaryotes also have simpler stages of growth and development. Simple organisms such as bacteria, blue-green algae, and archaea are examples of prokaryotes.

Eukaryotes

- ▶ *Eukaryotic cells have nuclei and organelles that are separated from the cytoplasm by membranes.*
- ▶ The word **eukaryote** from the combination of the Greek (**eu-**) "true" and (**karyon**) "kernel" or "nucleus."
- ▶ Eukaryotic organisms are more complex than prokaryotes and have cells with nuclei and membrane-bound organelles. Most types of eukaryotic organisms are multicellular. Cells in multicellular eukaryotes can be organized into tissues, organs, and organ systems.
- ▶ Developmental stages of single-celled eukaryotes are more complex than prokaryotic stages. Multicellular development is even more complex. Protozoa, fungi, plants, and animals are all examples of eukaryotes.

Prokaryote Vs. Eukaryote

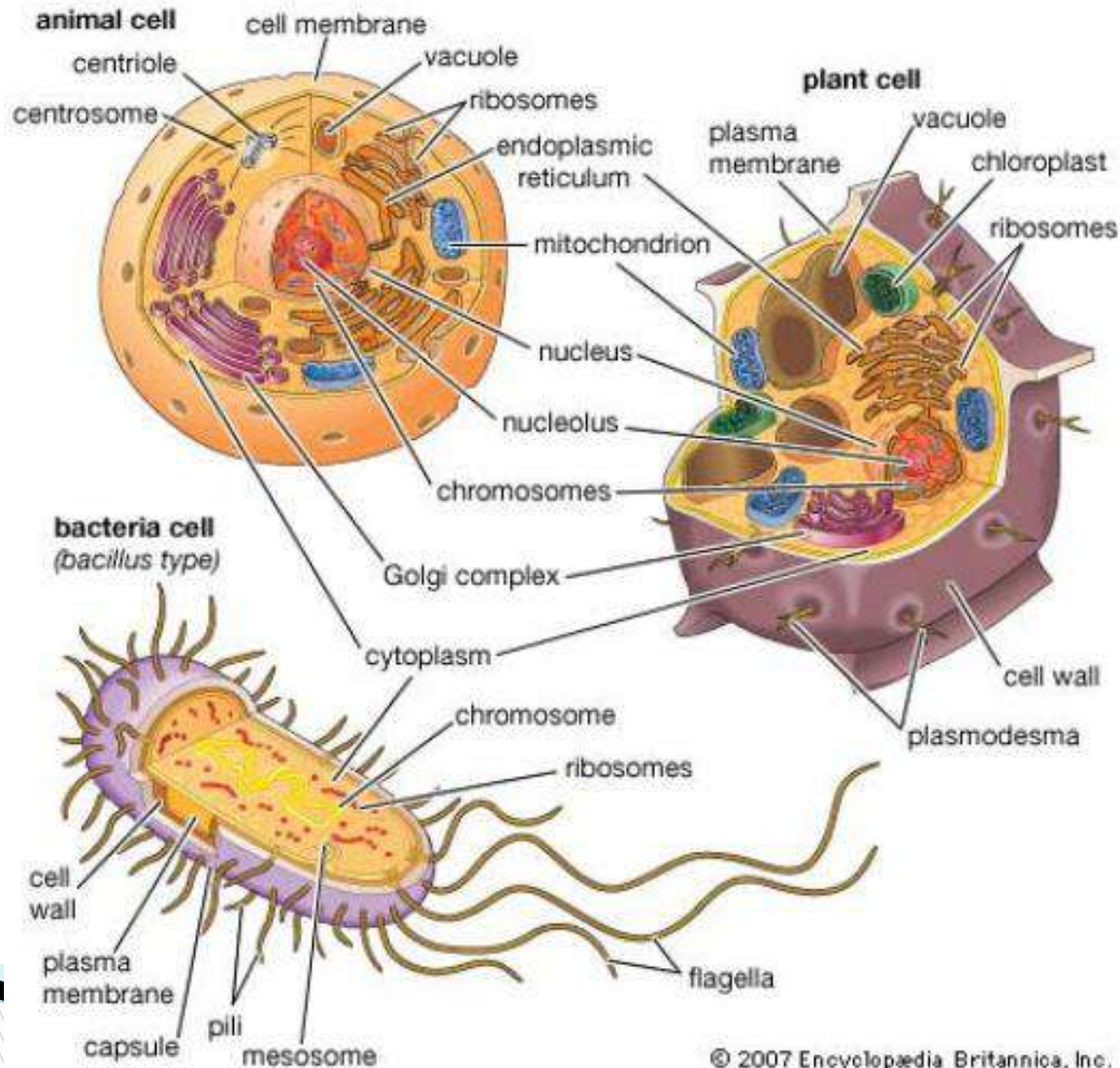


Comparison of Prokaryote and Eukaryote

Characteristic	Prokaryote	Eukaryote
Cells are enclosed within a plasma membrane	Yes	Yes
Cells contain DNA.	Yes	Yes
Cells contain ribosomes.	Yes	Yes
Cell membranes are surrounded by a cell wall.	Yes	Plants, most fungi, and some protists
Cells contain a nucleus.	No	Yes
Includes unicellular organisms	Yes	Yes
Includes multicellular organisms.	No	Yes
All cells are able to	Yes	No

Cell Structure

Some typical cells



Organelles

- ▶ ***Cytoplasm*** is a suspension fluid that houses the other organelles.
- ▶ The ***cell membrane*** (or ***plasma membrane***) acts as a boundary layer around the cytoplasm thus separating cells from their outside environments.
 - In addition to being able to recognize chemical signals, the cell membrane is selectively permeable to chemicals and controls which molecules enter and leave the cell. Nutrients first enter the cell through the cell membrane.
 - The ***cell wall*** is a secretion of the cell membrane; it provides protection from physical injury, and with the vacuole, it provides structural support.

Organelles

- ▶ A ***vacuole*** stores water and ingested food in a fluid sack. It also removes waste from cells and produces turgor pressure against the cell wall for cellular support.
- ▶ ***Lysosomes*** contain enzymes specialized to break down ingested materials, secretions, and wastes.
- ▶ The ***Golgi apparatus (Golgi complex)*** processes and transports wastes (and other materials) out of the cell.
 - processes, sorts, and modifies proteins in cells.

Organelles

- ▶ The ***nucleus*** is like the "brain" of the cell. It contains chromosomal information on chromatin.
 - The ***chromatin*** is composed of long, thin strands of DNA which contains "instructions" that control cell metabolism and heredity.
- ▶ ***Ribosomes*** are RNA and protein complexes that are found in all cells.
 - These complexes help cells during protein translation by joining amino acids together to form polypeptides.

Organelles

- ▶ ***Mitochondria*** act like a stomach for the cell; they take in nutrients, break them down and create energy for the cell.
 - Power house of the cell
 - ***Mighty Mitochondria***
- ▶ ***Chloroplasts*** are the food producers in a plant cell.
- ▶ The ***endoplasmic reticulum (ER)*** transports proteins within cells.
 - the location of lipid synthesis on the ***smooth*** side,
 - +and proteins are synthesized on the ribosome-studded, ***rough ER***.

Nutrients in the Cell

- ▶ Many organic and inorganic substances dissolved in cells allow chemical reactions that are necessary to maintain life to take place.
- ▶ Large organic food molecules, such as proteins and starches, must initially be broken down, or digested, into amino acids and simple sugars, respectively.
 - These smaller particles are then able to enter the cell through the processes of diffusion and active transport. Once nutrients enter a cell, the cell will use them as building blocks for other compounds that are necessary for life.

Plant Cell Vs. Animal Cell

Organelle	Plant Cell	Animal Cell
Cell Membrane	Yes	Yes
Nucleus	Yes	Yes
Mitochondria	Yes	Yes
Ribosomes	Yes	Yes
Golgi	Yes	Yes
Endoplasmic Reticulum	Yes	Yes
Cell Wall	Yes	No
Chloroplast	Yes	No
Lysosomes	No	Yes
Centrioles	No	Yes