Systems biology

A study of the living body and how its parts all work together. Describing their connections and evaluating how all parts function to maintain life.

What is life? How do we define a living thing?

1. Made of cells - The cell theory
    a. All living things are made up of one or more cells
    b. The cell is the smallest unit of life
    c. All cells have the same basic structure
    d. All cells come from preexisting cells

2. Reproduction - produce more copies of itself
    a. Sexual - 2 organisms
    b. Asexual - 1 organism

3. Hereditary information - chemical that describe how an organism looks
    a. DNA
    b. Genes

4. Responsiveness
    a. Responds to stimulus
    b. Light, heat, touch

5. Homeostasis
    a. Respiration
    b. Digestion
    c. Excretion

6. Metabolism
    a. Energy transformation
    b. Digestion
    c. Photosynthesis

7. Respiration
    a. Gas exchange

What is a cell?

A structure made up of a thin protective layer that surrounds a variety of structures called organelles and a chemical called deoxyribonucleic acid (DNA)

Prokaryotic cells have very little organization and the DNA is found throughout the cell. These cells are limited in their ability to become specialized.

Example - Bacteria

Eukaryotic cells have more organization and the DNA is surrounded by a second protective layer (called a nucleus). These cells can become very specialized to perform unique tasks (muscle or nerve cells)

Example - plant and animal cells

Parts of a cell

Cell membrane

Cilia

Flagellum

Cytoplasm

Cytosol

Nucleus

Nucleolus

Nuclear membrane/envelope

Chromatin

Chromosomes

Mitochondria

Rough Endoplasmic Reticulum

Smooth Endoplasmic Reticulum

Ribosome

golgi bodies/apparatus

Lysosomes

Cytoskeleton

Vacuole

Vesicles

Centrioles

Chloroplasts

Cell wall

Differences between animal and plant cells

Cells can be specialized to perform specific functions. The shape and the types of organelles inside the cell help the cell perform it's specific duties

Nerve cells

White blood cells

Muscle cells

Skin cells

Intestinal cells

Red blood cells

Cell Division

1. Organisms need to grow
2. Organisms need to repair damage
3. Organisms need to replace worn out parts
4. Cells divide to become more specialized

Cell division occurs only with stem cells. They are specialized cells that have not lost the ability to divide.

Adult stem cells are specialized cells that can only divide into one type of cell like a skin stem cell

> If somebody has had a really bad burn we can replace their skin with skin grown in a lab from a skin stem cell

Embryonic stem cells have the ability to divide into different types of cells they can become red blood cells skin cells more muscle cells

> In order to replace some organs we might use an embryonic stem cells from the patient to grow different types of organs for that person

To obtain embryonic stem cells we need to create embryos and then harvest the cells. Embryos are formed when a sperm and egg unite. There is also embryonic stem cells found in the umbilical cord. This leads to lots of controversy because of the creation of embryos and then disposal of embryos in order to repair a living person.