

## **Evolution**

- Based on the principle of decent with modification
  - Organisms become more perfectly adapted to their environment over time
- Genes better suited to the environment are passed down but more ill suited genes do not get passed on and instead die off

No organism becomes completely perfect because the environment changes as well

- Every adaptation is a compromise
  - Adapting to a certain pressure may negatively effect how an organism reacts to other pressures

## **Taxonomy**

- Taxonomy is the methods of naming and classifying life
- Systematics is the study of biodiversity
- Phylogenetics is the study of the evolutionary history of a species or group of species

### **Prokaryotic and Eukaryotic cells**

- Prokaryotes and eukaryotes are the two kinds of cells that all living things are composed of
  - Prokaryotes have no nucleus or other internal cell structures
    - These are the kinds of cells that single cell organisms such as bacteria and archea are composed of
  - Eukaryotes have a nucleus, internal cell structures and are the kind of cells that plants and animals are composed of

### **Classification**

- Binomial classifications are the classifications of Latin names for each species
  - Binomial means two names, and all species have two names, for the genus and species

## **Cells**

Cells are the smallest living biological unit, ranging in size from 1-10 microns

Cell fractionation: breaking down a cell in order to study its structure and function

- This is done by putting a cell in a centrifuge and spinning it to separate the particles
  - The harder the centrifuge is spun, the finer particles that settle will be
  - This is done only on eukaryotic cells as prokaryotic cells do not have true organelles

### **Prokaryotes**

- Prokaryotes have a non-membrane-bound nucleoid region wherein the chromosome is found
- Most prokaryotes have a capsule, a thick, tough, outer cover atop of the cell wall
- Ribosomes, plasma membranes, flagella and fimbriae are also found in various prokaryotic cells

### **Eukaryotes**

- Both plant and animal cells are eukaryotic
  - Animal cells contain various membrane bound organelles as well as a true nucleus
  - Plant cells have a rigid cell wall and chloroplasts in addition to a plasma membrane, nucleus and other membrane bound organelles

Chromosomes are house the genetic material found in all cells

- Chromosomes can only be seen when a cell is ready to divide
- When a cell divides the chromosomes unwind so they can be evenly divided between the new cell
- Chromosomes contain chromatin, proteins and house the deoxyribonucleic acid (DNA) found in eukaryotic cells
  - DNA is a double helix made of four different base pairs that code for all the genetic components of the organism
  - DNA is held together by hydrogen bonds, which are extremely strong

Nucleosomes are a small part of protein surrounded by DNA

Nucleic acid is one half of a DNA molecule

Nucleotides are one base found in DNA

### **Cell Division**

Three vital biological processes rely on cell division:

1. Reproduction
2. Growth and development
3. Renewal and repair of tissues

## **Mitosis**

Mitosis is the division of the nucleus of a cell that produces two daughter nuclei, each with a chromosome pair identical to that of the original nucleus.

- As a chromosome replicates it creates identical chromatids that are connected at the centromere
- Chromatids are separated at the centromere and split between the daughter cells, with each cell inheriting an identical copy of each chromosome

Cells containing paired chromosomes are called diploid ( $2n$ ) cells (di meaning two)

- Mitosis creates diploid cells
- Somatic cells are all of the various cells found in the body

Cells containing half of the genetic material are called haploid ( $n$ ) cells (hap as in half)

- Haploid cells are a result of meiosis
- Gametes (sperm and egg cells) are haploid cells

## **Cell Cycle**

**G1 Phase**

**S Phase**

**G2 Phase**

**Cytokinesis**

**Mitosis**

**Interphase**

- Centrosomes develop
- Chromatin has duplicated

**Prophase**

- Chromosomes have condensed
  - Centromeres are visible
- Centrosomes have moved to opposite ends of the cell in preparation for separating the chromatids

**Metaphase**

- Nuclear envelope fragments
- Microtubules of the centrosomes attach to the centromeres to split the chromatids