Reproduction and Meiosis

Asexual organisms reproduce differently than sexual organisms. As multicellular organisms develop, their cells differentiate.

There are thousands of different species of organisms.
- Each species produces more of its own.
  - A species of bacteria splits to make two identical bacteria.
  - A palm tree produces more palm trees.
  - Humans produce more humans.
- The formation of new organisms of the same species is called reproduction.

There are two types of reproduction: asexual and sexual.

Asexual reproduction is reproduction that requires only one parent.
- Most single-celled organisms, like bacteria and protozoans, reproduce this way.

Cell division is a type of asexual reproduction.
- Your body cells reproduce this way.
- In asexual reproduction, the DNA and internal structures are copied.
- Then the parent cell divides, forming two cells that are exact copies of the original.

To understand sexual reproduction, you first need to know about human body cells.
- Each cell in your body, except for sex cells, has 46 chromosomes.
- These chromosomes are called homologous chromosomes.
Homologous chromosomes have pairs of matching information, are usually the same size and shape, and have the same number of chromosomes as their parent cells.

Unlike body cells, human sex cells only have 23 chromosomes.
- In males, these sex cells are called sperm; in females, they are called eggs.

So, how do these sex cells end up with only half the number of chromosomes?
Through sexual reproduction.

This process is called meiosis.
- Meiosis is the process of cell division in which sex cells (eggs and sperm) are formed.
- Eggs and sperm are gametes that unite to produce a cell zygote that may develop into an embryo.

During meiosis, a cell undergoes two divisions to produce four sex cells, each with half the number of chromosomes of the parent cell.

The chromosomes are copied once and then the nucleus divides twice.
- 4 daughter cells are created from each parent cell.
Each sex cell has half the number of chromosomes found in the parent cell - one of the chromosomes from each homologous pair.

Diploid and Haploid Chromosomes
- A complete set of chromosomes is called a diploid set.
- A half set of chromosomes is called a haploid set.
- Most animal cells have a diploid set of chromosomes except in sex cells.

Fertilization is the union of egg and sperm to form a new organism.
- When an egg is fertilized by a sperm, the haploid set of chromosomes from the father unites with the haploid set of chromosomes from the mother.

Fertilization

Will the offspring will be male or female?
- Human sex chromosomes carry genes that determine whether the offspring is male or female.
  - Females have two X chromosomes.
  - Males have one X chromosome and one Y chromosome.

During meiosis, one of each chromosome pair ends up in a sex cell.
- During human sexual reproduction egg and sperm combine to form either the XX or XY combination.
  - XX = female
  - XY = male.
A fertilized egg, called a zygote, has a diploid set of chromosomes.

- For each homologous pair, one chromosome comes from the mother, and one from the father.
- After fertilization, the zygote rapidly divides by mitosis and becomes an embryo.

An embryo is an organism in its earliest stages of development.

In the developing embryo, cells begin to differentiate.

The final outcome is a multicellular organism with many different types of specialized cells.

- You have brain cells, stomach cells, skin cells, and muscle cells to name just a few.
- All of those cells can be traced back to the zygote.

Cell differentiation is the term used to describe the process of cell specialization.

- For example, cells that eventually divide to become part of the stomach are different from those that will become part of the nervous system.
- As cells differentiate, they give rise to different tissues.
- These tissues eventually form the organs.

Cell differentiation

As the embryo continues to develop, some cells become even more specialized.

- For example, some cells in the retina of your eye become rod cells (for vision in dim light) and others become cone cells (for color vision).
After differentiation is complete, most cells lose the ability to become other types of cells.

Mnemonic Device:

- miTosis mainTains the chromosome number, while mEiosis rEduces the number