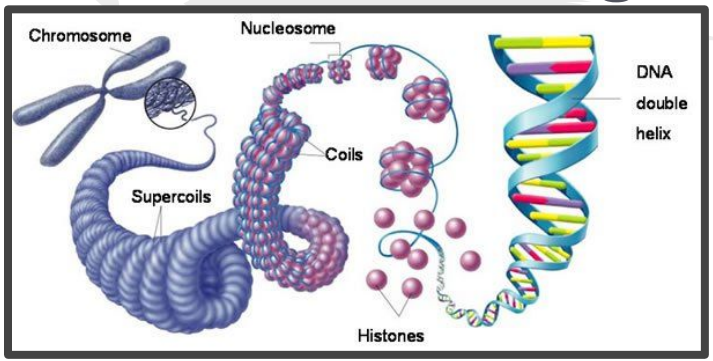
TOPIC 5: DNA & CHROMOSOMES

I Can…

- Describe the role and relationship of chromosomes, genes and DNA
- Distinguish between mitosis and meiosis
- ~~Provide examples of genetic technologies and identify~~ questions & issues related to their application

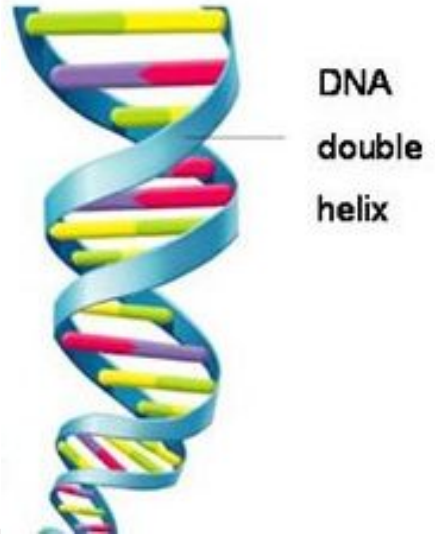
DNA

DNA (deoxyribonucleic acid) is the molecule passed on from parents to offspring which controls a cell's function; it is the *heritable material* where genes are stored.



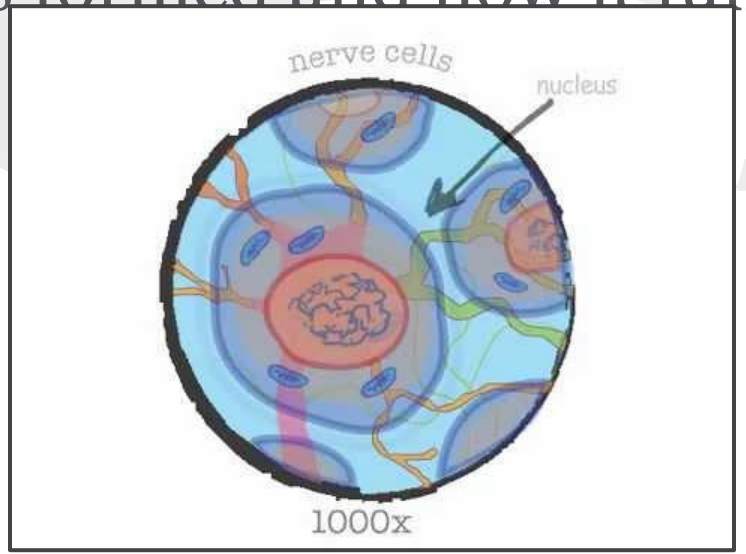
- DNA is tightly coiled into structures called *chromosomes*, which are found in pairs in the nucleus of every cell in your body
- Each human cell (other than eggs & sperm)

- DNA is shaped like a coiled ladder, known as a *double helix*
- The sides of the ladder are composed of alternating sugar and phosphate molecules
- The rungs of the ladder consist of four nitrogen bases: adenine (A), thymine (T), guanine (G), and cytosine (C)
- A always bonds with T, and G al
- The arrangement of these bases lueprint", coding for different proteins



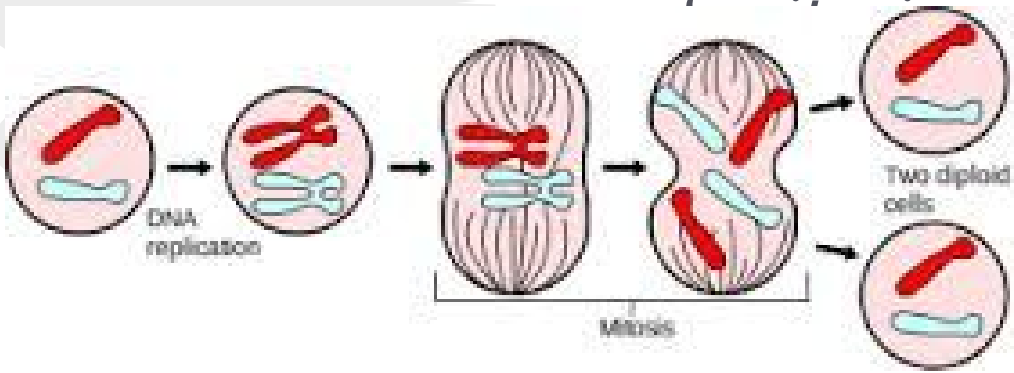
Genes

A section of a DNA molecule that codes a specific protein is called a *gene*. Proteins control how a cell is formed and how it functions…



Cell Division: Mitosis

Cells that make up the human body are known as *somatic cells*. As the body grows, somatic cells make exact copies of themselves and divide through the

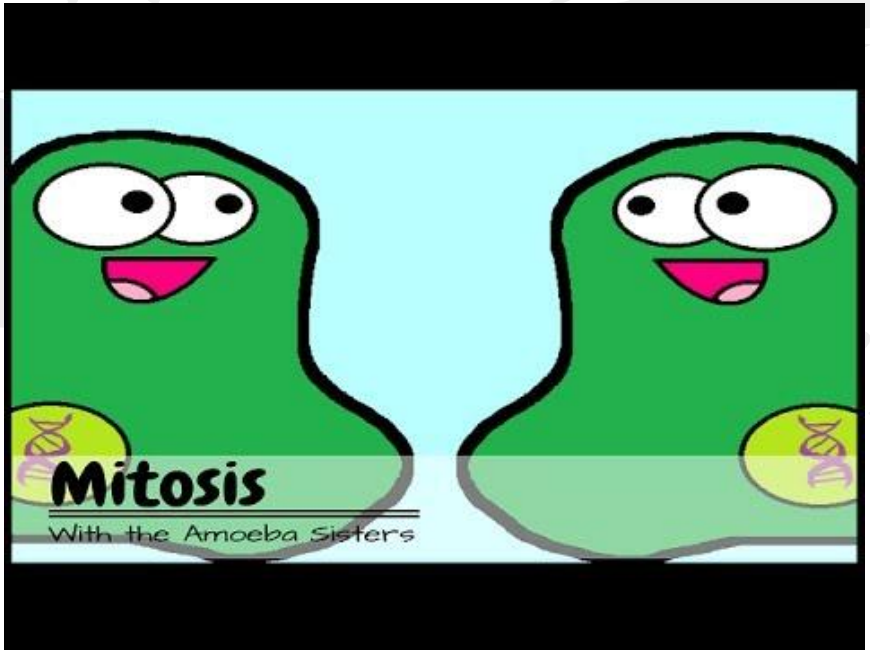


During mitosis, DNA is replicated and splits into two. As a result, cells end up with the same number of chromosomes they started out with (in humans, mitosis produces cells with 46 chromosomes)

Mitosis serves three main functions:

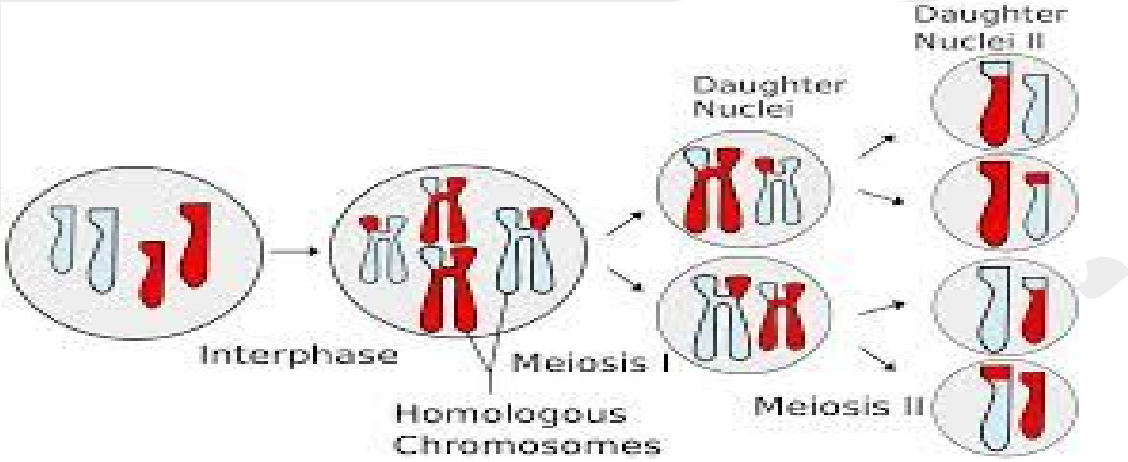
1) Growth
2) Maintenance
3) Repair

Overview of Mitosis:



Cell Division: Meiosis

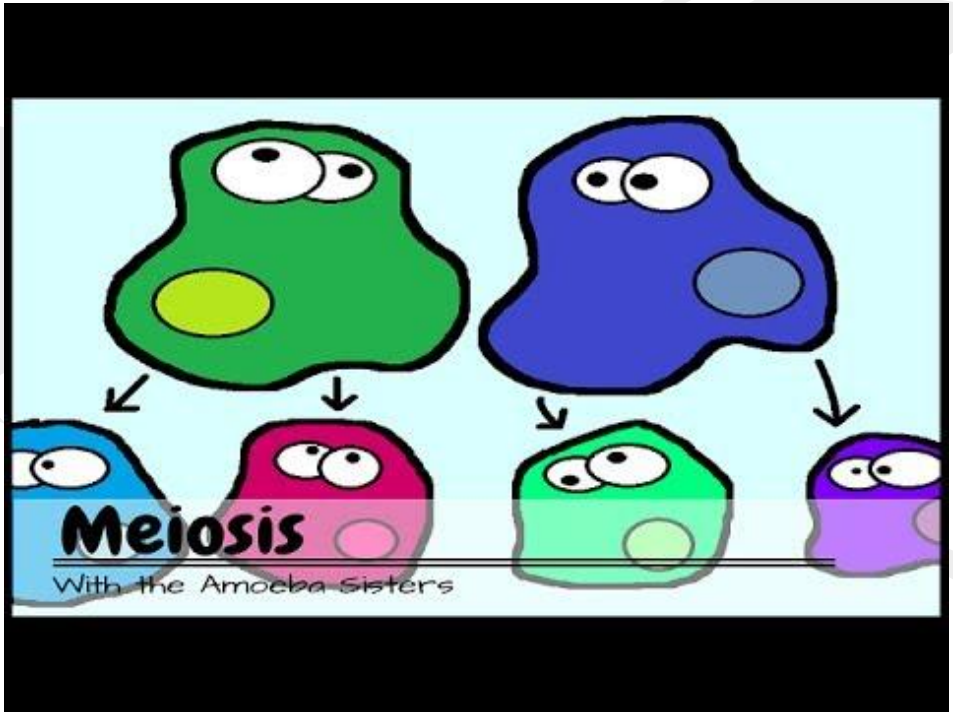
Sex cells, or sperm and eggs, are also known as *gametes*. Gametes are formed through the process of *meiosis*.



During meiosis, DNA is replicated and undergoes TWO rounds of division. As a result, cells end up with the HALF the number of chromosomes they started out with (in humans, mitosis produces gametes with 23 chromosomes)

- When the sperm and egg meet during fertilization, they form a *zygote*
- The zygote thus has a full complement of 46 chromosomes
- Once formed, the zygote undergoes mitosis to become an embryo, a fetus, and eventually, a full-grown human

Overview of Meiosis:



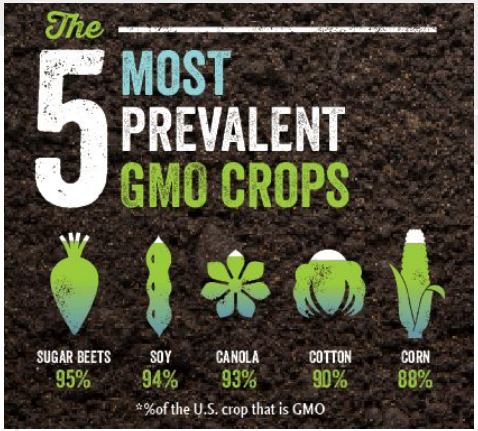
Genetic Engineering

An understanding of DNA and gene expression has allowed scientists to develop solutions to a number of issues in the fields of medicine and agriculture.

By turning genes on or off, or even transferring genes from one species to another, we can produce desirable traits in a target organism. This is known as *genetic engineering*.

Genetically Modified Crops

What might be some desirable traits that we would want to see in our crops?



GMO's: The Golden Rice Project

In areas of Southeast Asia and Africa where people rely largely on rice as the basis of their diet, vitamin A deficiency has led to afflictions such blindness, reduced immune response, and impaired skeletal growth in children.

- Golden Rice is a form of rice that has been genetically modified to produce beta-carotene (the precursor for vitamin A) and a number of other essential nutrients that unaltered rice does not normally contain.
- Since the introduction of Golden Rice, the incidence of these ailments has fallen significantly.

GMO's: Are They Dangerous?

Anti-GMO propaganda is often based on some pretty significant misconceptions about what genetic modification actually is…

"What scares me most about the loud arguments and misinformation about plant genetics, is that the poorest people who most need the technology may be denied access because of the vague fears and prejudices of those who have enough to eat"


KEEP
CALM
Genetically Modified
FOOD IS
SAFE

In case that's still unclear…

Genetic Engineering in Medicine

A few medical applications of biotechnology…

- Insulin production
  - human insulin gene is inserted into bacteria, which produce it in large quantities for use by individuals with diabetes
- Cancer treatment
  - stem cells are used to “re-program” cancerous cells
- Embryo analysis
  - embryos are tested for various genetic diseases before implanting into a mother

“Designer Babies”???