7.14A – Define heredity as the passage of genetic instructions from one generation to the next generation.

7.14B – Compare the results of uniform or diverse offspring from sexual or asexual reproduction.

7.14C – Recognize that inherited traits of individuals are governed in the genetic material found in the genes within chromosomes in the nucleus.
• **Genetics**: The scientific study of heredity

• **Heredity**: The process in which traits pass from parents to offspring

• **Traits**: Characteristics of organisms; determined by genetic code
• Organisms have traits that are similar to those of their parents.

• Advantageous traits are **MORE** likely to get passed on (due to natural selection)
Gregor Mendel

- Father of Genetics
- 1860s
- Studied traits of pea plants through many generations of breeding
- Found patterns in the way traits were inherited
- Still no idea how traits were passed on
DNA IS GENETIC MATERIAL

• 1928 – Griffith
• 1944 – Avery, MacLeod, McCarty
• 1952 – Hershey & Chase
• Determined that DNA is the genetic material, not some other molecule, like Protein
WATSON & CRICK

- 1950s
- Discovered the structure of DNA
  - Made of nucleotides, double helix shape
The genetic material of an organism is found in rod-like structures called **chromosomes**, located in the **nucleus** of the cell.

**Chromosomes** are made partly of long-chain molecules called **DNA**, which is made of segments called **genes**.

So… a **gene** is a segment of a **DNA molecule** that contains information that governs a specific **trait**.
Eukaryotic cells have a nucleus

Chromosomes are inside the nucleus

Chromosomes are made of long strands of DNA coiled up very tight

Each strand of DNA is made up of MANY sections, called genes, that code for individual traits
There are 100 trillion cells in the human body.

Inside each human cell is a nucleus (except red blood cells).

Each nucleus contains 46 chromosomes, arranged in 23 pairs.

One chromosome in every pair comes from each parent.

The chromosomes contain tightly coiled strands of DNA.

Genes are sections of DNA that contain the code for making proteins—the building blocks of life.
REPRODUCTION

- Organisms reproduce either sexually or asexually.
  - **Asexual reproduction** is the reproductive process in which offspring have only one parent.
  - **Sexual reproduction** involves two parents who combine their genetic material to produce a new organism.
ASEXUAL REPRODUCTION

• Because the offspring inherit genes from only one parent, they are identical genetically to that parent.

• One-celled organisms such as bacteria reproduce asexually by dividing in two.

• Hydra reproduce asexually in a process called budding.
SEXUAL REPRODUCTION

• In sexual reproduction, an egg cell and a sperm cell, each containing half the number of chromosomes that are in the other cells, combine to form a zygote with the full number of chromosomes for that organism.
SEXUAL REPRODUCTION

• Unlike asexual reproduction, sexual reproduction results in offspring that are not exactly like either parent. The offspring of sexually reproducing organisms are more diverse, or different, than the offspring of those that reproduce asexually.
GENES AND ALLELES

- The factors that control traits are called **genes**.
- The different forms of a gene are called **alleles**.
- Individual alleles control the inheritance of traits. Some alleles are dominant, while other alleles are recessive.
DOMINANT AND RECESSIVE ALLELES

- A **dominant** allele is one whose trait always shows up in the organism when the allele is present.

- A **recessive** allele is masked, or covered up, whenever the dominant allele is present.
  - A trait controlled by a recessive allele will only show up if the organism inherits two recessive alleles for the trait.

Mendel: Experiment 1
• Probability is the likelihood that a particular event will occur.

• The laws of probability predict what is likely to occur, not necessarily what will occur. The result of one coin toss does not affect the results of the next toss. Each event is independent of another.
PUNNETT SQUARE

• A tool that applies the laws of probability to genetics

• A chart that shows all the possible combinations of alleles that can result from a genetic cross.

• Geneticists use Punnett squares to show all the possible outcomes of a genetic cross and to determine the probability of a particular outcome.
All the possible alleles from one parent are written across the top. All the possible alleles from the other parent are written down the left side. The combined alleles in the boxes of the Punnett square represent all the possible combinations in the offspring.
• An organism’s **phenotype** is its physical appearance, or its visible traits.
• An organism’s **genotype** is its genetic makeup, or allele combinations.
• When an organism has two identical alleles for a trait, the organism is said to be **homozygous**.
• An organism that has two different alleles for a trait is said to be **heterozygous**.