What is DNA?

DNA- deoxyribonucleic acid, the hereditary material of life in a cell's nucleus

genes- carries codes for traits

trait- characteristic of an organism

acquired trait- from your parents

environmental trait- from the surrounding environment

chromosomes contain **genes** which are made of **DNA**

Genes are inherited from your parents. Each gene codes for 1 trait, and thousands of genes are on each chromosome. Chromosomes in humans are arranged into 23 **homologous pairs**

DNA Structure

DNA is a **double helix**, and consists of **phosphate**, **deoxyribose sugar**, and **nitrogen bases**. Phosphate and sugar make the backbone, and nitrogen bases are the rungs of the ladder.

nucleotide- a phosphate paired with a nitrogen base and deoxyribose sugar

histone- special proteins that prevent DNA from tangling

nucleosome- DNA and histone packages which resemble beads

telomere- protective end on eukaryotic cells that shortens every time DNA replicates

The 4 Nitrogen Bases

PURINES (single-ringed)	PYRIMIDINES (double-ringed)
Adenine to →	**T**hymine with **2 H-bonds**
Guanine to →	**C**ytosine with **3 H-bonds**

What Causes Genetic Diversity?

1. Crossing over in **prophase I**

2. Independent assortment in **metaphase I** and **II**. The chromosomes line up randomly each time.

Non-Disjunction

non-disjunction- a mistake that occurs during anaphase I and II, when the chromosomes do not separate and gametes end up having the wrong number

Mitosis vs Meiosis

MITOSIS	BOTH	MEIOSIS
- all daughter cells are somatic	- both for the purpose of reproduction	- all daughter cells are gametes
- 2 similar cells are produced	- both create daughter cells	- 4 different cells are produced
- 46 chromosomes		- 23 chromosomes
- DNA is not crossed over		- DNA is crossed over

Meiosis I and Meiosis II

MEIOSIS I	MEIOSIS II
Prophase I centrioles move to opposite poles, homologous chromosomes become visible and form **tetrads**, crossing over occurs, genetic material is exchanged	Prophase II - centrioles move to opposite poles, chromosome pairs become visible, crossing over does NOT occur
Metaphase I - tetrads line up along the equator of the cell (staying as a pair)	Metaphase II - each chromosome moves to the equator of the cell
Anaphase I - homologous chromosomes are pulled apart creating whole paired chromosomes on each side	Anaphase II - each chromosome splits and moves to opposite poles, the **chromatid** is now considered the chromosome
Telophase I - nuclear membrane reforms, cytokinesis occurs, creating **2 diploid cells**, which contain 46 chromosomes and are genetically different	Telophase II - nuclear membrane reforms, cytokinesis occurs, creating **4 haploid cells** called **gametes**

Prokaryotes vs Eukaryotes

PROKARYOTES	BOTH	EUKARYOTES
- no nucleus or organelles	- both forms of life	- nucleus and organelles
- simple and primitive		- complex cells

Prokaryotes vs Eukaryotes (cont)

- usually single-celled	- can be multicellular

Meiosis Definitions

zygote- cell created when egg and sperm unite

karyotype- map of chromosomes organized into homologous pairs

diploid- total # of chromosomes in an organism, **somatic cells**

haploid- half the # of chromosomes in an organism, **sex cells**

Purpose of Mitosis and Meiosis

MITOSIS	MEIOSIS
1. Asexual Reproduction - 1 parent with identical offspring	1. Create Gametes - creates egg/sperm or egg/pollen - 2 parents with genetically different offspring
2. Repair - to fix damaged cells and replace old cells	
3. Growth - nuclear division, and depends on the size and growth of the organism	

Mutation

mutation- any change made to DNA

4 Types of Mutations

1. **Translocation**	- part of a chromosome breaks off and attaches itself to a different chromosome - Translocation Down's
2. **Deletion**	- part of a chromosome is deleted - Prader Willi Syndrome➞learning disabilities, behavioural problems, obesity, short stature, etc.
3. **Duplication**	- part of the chromosome is repeated - cause of seizures
4. **Inversion**	- genetic code is flipped - linked to infertility problems

Trisomies and Traits

Trisomy **13**, Patau Syndrome	heart defects, brain and spinal cord abnormalities, extra fingers and toes, cleft lip, usu. die by 1 yr. old
Trisomy **18**, Edward Syndrome	abnormally shaped head, clenched fists, heart defects, usu. die by 1 yr. old
Trisomy **21**, Down Syndrome	mild disability, can still form relationships and interact in society
Trisomy **XXY**, Klinefelter Syndrome	infertile males, look childish, high pitched voice, learning disabilities