

Methods in behavioral genetics

What are genes and how
do they work?

The human **genome** contains the **genetic information required to build the human body**. This information is held in code on tightly coiled threads of deoxyribonucleic acid (DNA).

DNA (desoxyribonucleic acid), **RNA** (ribonucleic acid) and **hystonic proteins** are components of **chromatin** which establish chromosomes.

Chomosomes is a stick-like structures in a nucleus of eukaryotic cell which are responsible to saving hereditary information about body features.

A **gene** is a sequence of nucleotides in DNA or RNA that codes for a molecule that has a function (a specific protein or RNA).

Karyotype is a specific set of chromosomes typical to a species or an individual.

Genotype is a gene system of an individual.

Phenotype is a complex of ovservable individual traits.

DNA structure

A DNA molecule consists of two strands that wrap round each other to resemble a twisted ladder - the famous double helix.

Each strand of DNA is made up of a string of units called nucleotides, or bases.

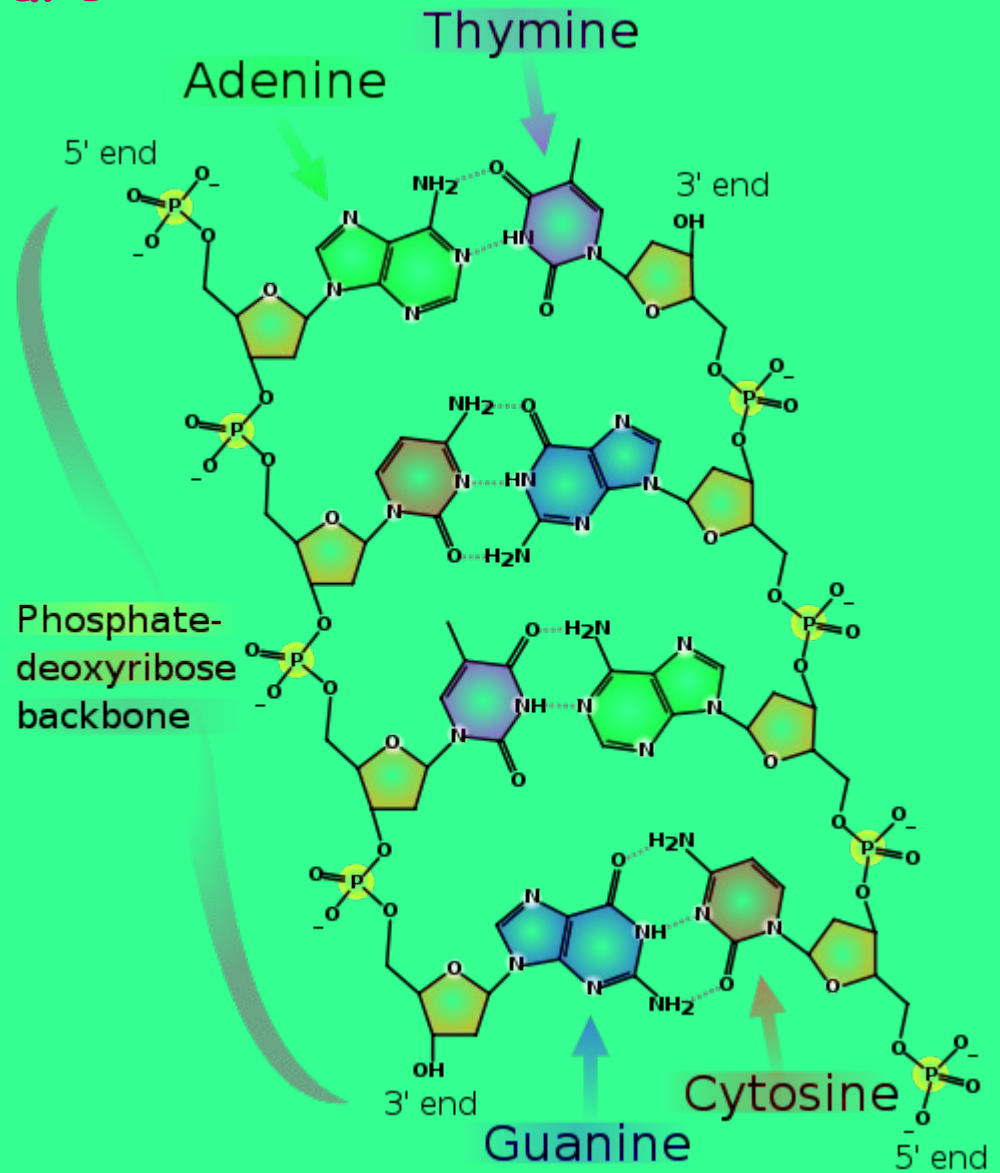
There are four different nucleobases: adenine (A), thymine (T), guanine (G) and cytosine (C).

These bases pair together: A with T (A_nT), and C with G (C_oG).

Each base pair forms a rung of the ladder.

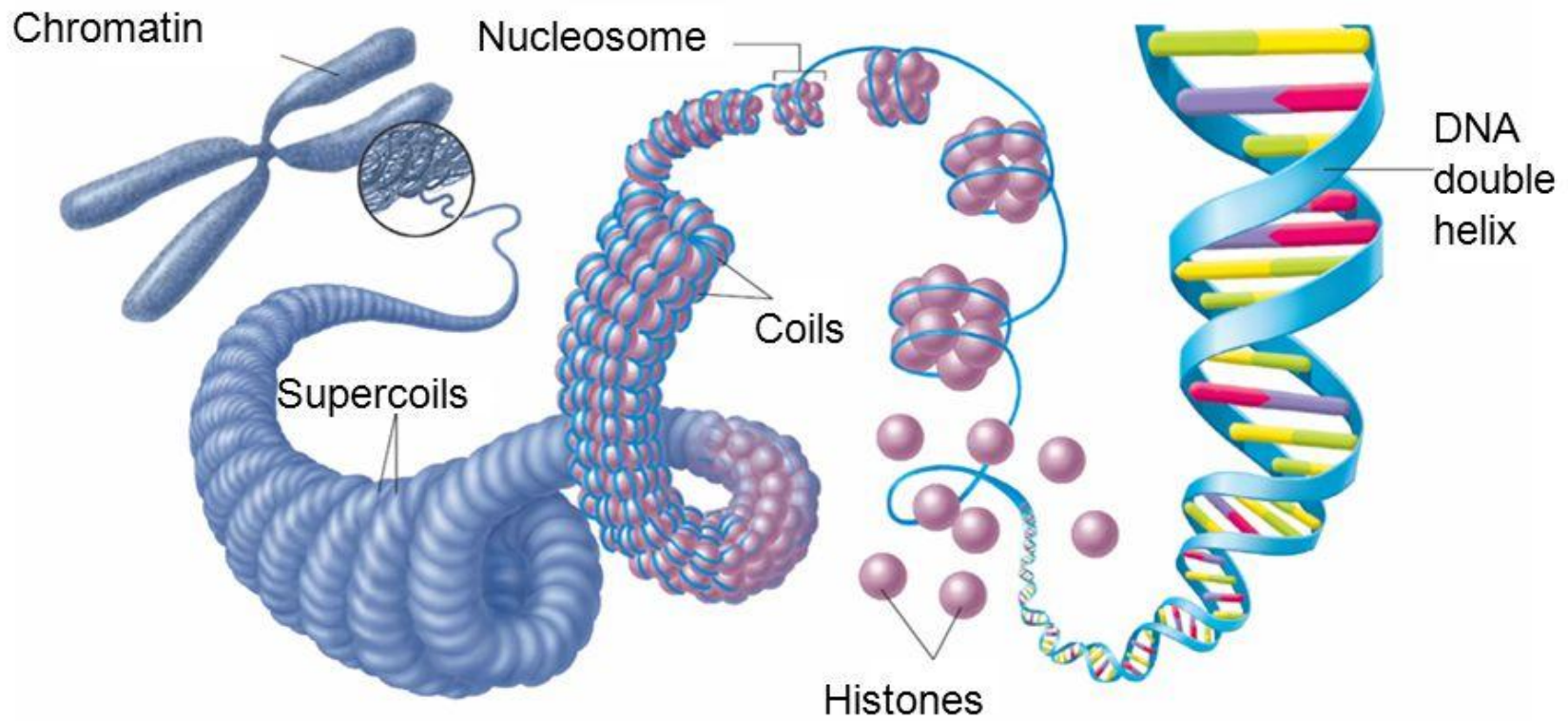
The way these pair together causes the strands to coil up into the spiral twisted ladder.

It also allows the DNA to replicate, or copy itself.

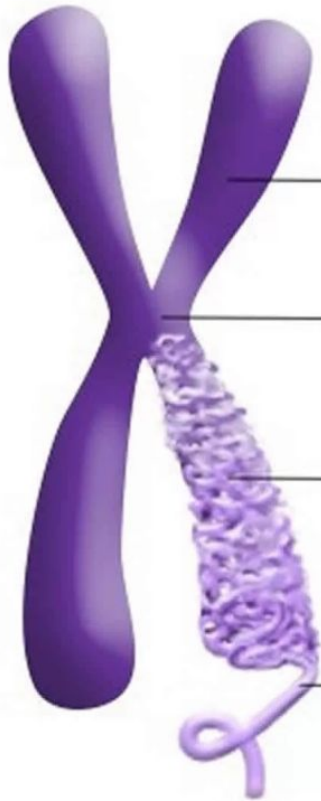
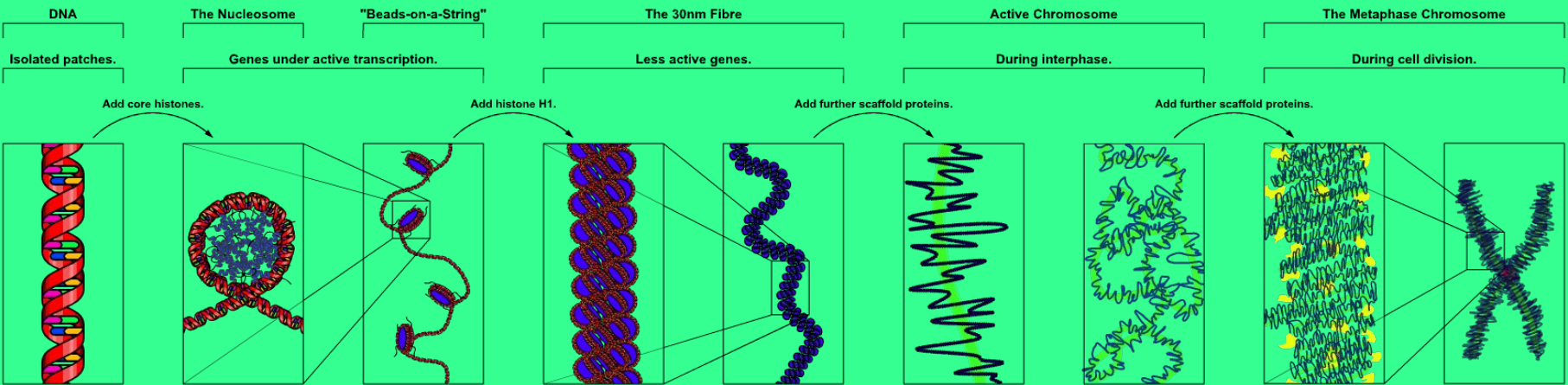


Chromatin structure

Chromatin



Levels of DNA package in chromosome



Chromosome

p arm (short arm structure)

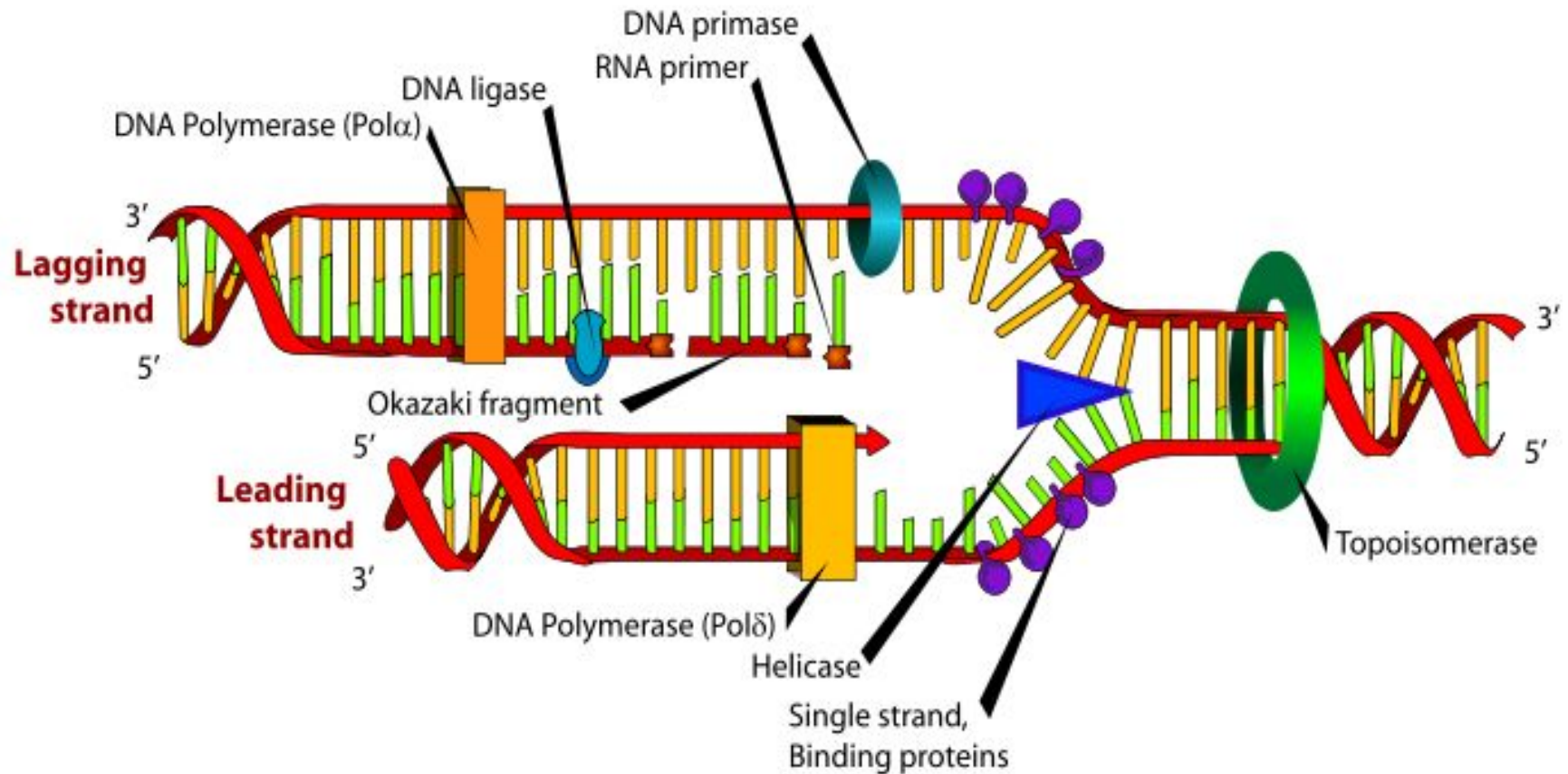
Centromere (constricted point where the two chromatids are held together)

q arm (long arm structure)

DNA molecule (strands of DNA are formed into compact structures inside of the chromosome by proteins called histones)

Chromosome structure

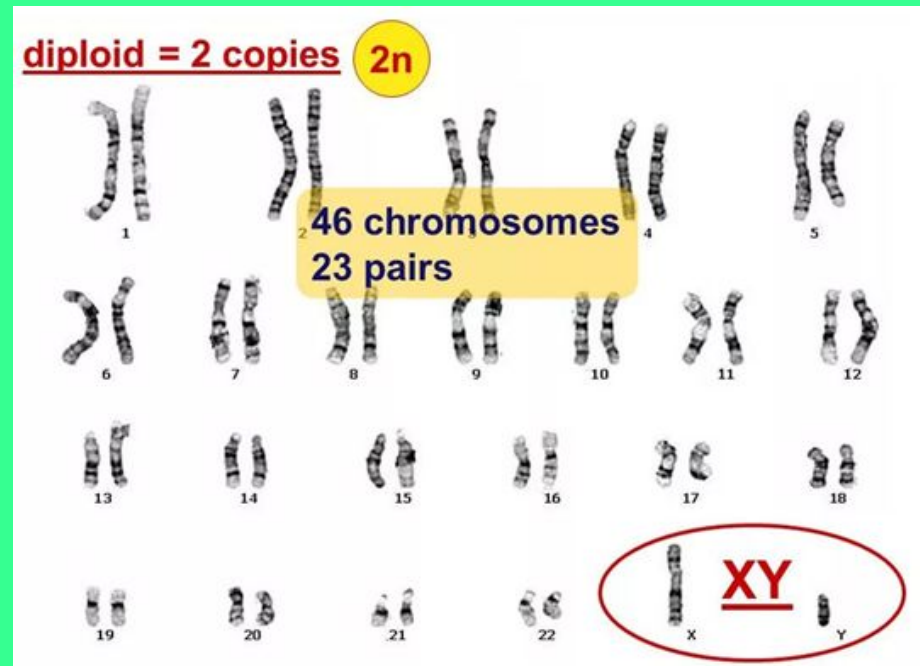
DNA replication or self-copying



Humans have **22 pairs of chromosomes** plus the sex chromosomes (**XX** in the female, **XY** in the male). One set is from the mother and one from the father. Together, **these 23 pairs** make up the human genome. It is estimated that each human has **about 22,500 -25,000 genes**, and **around six billion base pairs of DNA**.



Human karyotype
(microscopic view)



Human male karyotype

Proteins carry out the work of a cell. They are made of various combinations of 20 chemical building blocks, called amino acids.

Different proteins have various specialised functions, such as making muscle, binding oxygen from the air, transmitting nerve impulses, and breaking down food substances.

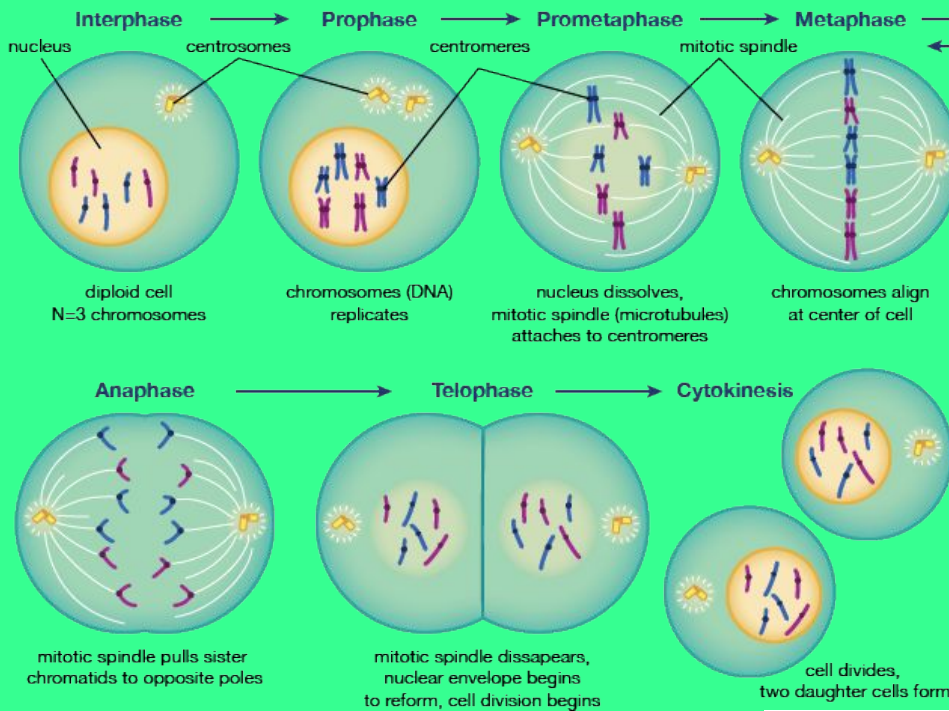
Many proteins are **enzymes**, with the specialised function of synthesising, breaking down or altering other chemical molecules.

Some of the products of genes, and some of the substances made by these products, are 'messengers' exported by cells to have effects on other cell types. For example, **hormones** are made in specialised endocrine glands, and can stimulate or suppress the functions of other cells in distant organs.

Chromosomes, Chromatids, Chromatin, etc. (20)

https://www.youtube.com/watch?time_continue=5&v=s9HPNwXd9fk

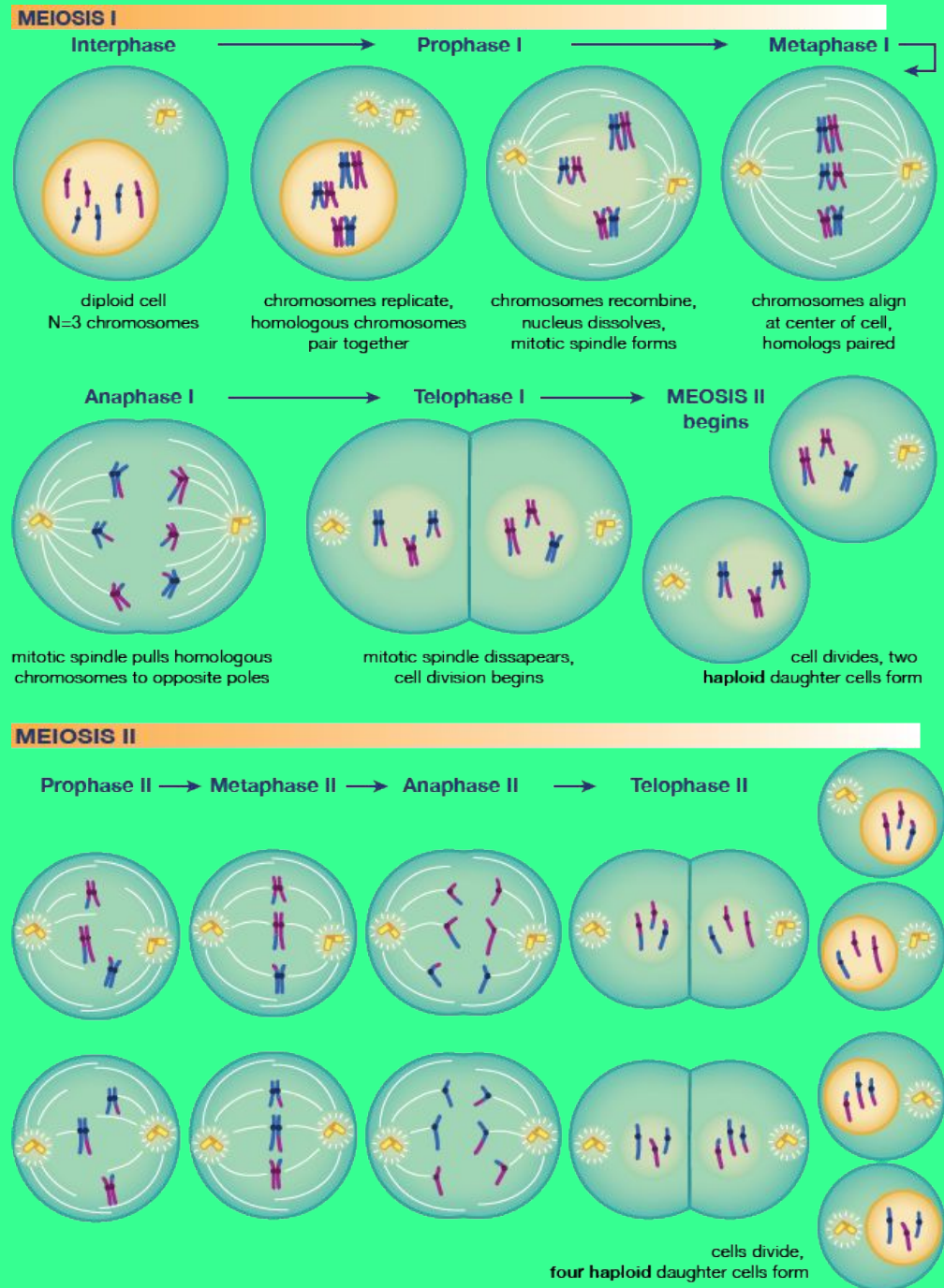
Mitosis



- Prophase** – mitotic spindle forming, aster centrosomes migrate, 2 sister chromatids joined at centromere, nuclear envelope and nucleoli disperse/disappear
- Metaphase** – chromosomes aligned single file on the metaphase plate
- Anaphase** – chromosomes (sister chromatids) separate from the centromere, dividing to arrive at opposite ends of the cell
- Telophase** – the reverse of prophase; chromatids unwind, nucleus divides into 2 genetically identical daughter nuclei

Meiosis

- In (**meiosis I**), homologous chromosomes separate
- Meiosis I results in *two* haploid daughter cells with *replicated* chromosomes
- In the second cell division (**meiosis II**), sister chromatids separate
- Meiosis II results in *four* haploid daughter cells with *unreplicated* chromosomes



Mitosis, Meiosis and Sexual Reproduction (19)

<https://www.youtube.com/watch?v=kaSIjIzAtYA>

Phases of Meiosis (27)

<https://www.youtube.com/watch?v=ijLc52LmFQg>

