chromosomes

STRUCTURE & NUMBERS

DNA & GENOMES

quick notes:

QUICK NOTES:

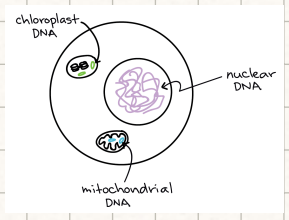
- DNA (deoxyribonucleic acid) is the genetic material of living organisms. In humans, DNA is found in almost all the cells of the body & provides the instructions they need to grow, function, & respond to their environment.

- When a cell divides, it passes on a copy of its DNA to each of its daughter cells. DNA is also passed on at the level of organisms, w/ the DNA in sperm & egg cells combining to form a new organism that has genetic material from both parents (XX and XY)

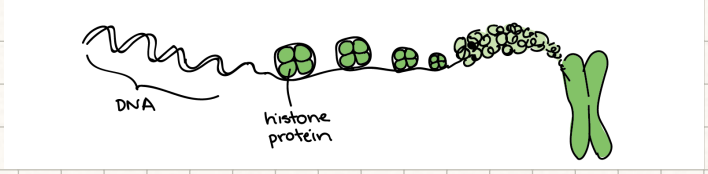
- DNA is a long string of paired chemical units aka nucleotides that come in 4 different types (ATCG) and it carries info organized into genes
  - genes provide instructions for making proteins
    - give cells and organisms their functions & characteristics

note

WHEN A CELL DIVIDES, ONE OF ITS MAIN JOBS IS TO MAKE SURE THAT EACH OF THE TWO NEW CELLS GETS A FULL, PERFECT COPY OF GENETIC MATERIAL. MISTAKES DURING COPYING, OR UNEQUAL DIVISION OF THE GENETIC MATERIAL BETWEEN CELLS, CAN LEAD TO CELLS THAT ARE UNHEALTHY OR DYSFUNCTIONAL (AND MAY LEAD TO DISEASES LIKE CANCER)



- nuclear DNA = DNA solely found in the nucleus (in eukaryotes like plants & animals)
- mitochondrial DNA = found in mitochondria (organelles that harvest energy)
- chloroplast DNA = in chloroplast (organelles that carry out photosynthesis)
- In bacteria, most of the DNA is found in a central region of the cell called the nucleoid, which functions similarly to a nucleus but is not surrounded by a membrane.
- genome = a cell's set of DNA
- DNA associates w/ specialized proteins that organize it and give it structure. In eukaryotes, these proteins include the histones (a group of basic [+ charged] proteins that form "bobbins" around which negatively charged DNA can wrap.
  - histones determine which genes are active; the complexity of DNA + histones and other structures = chromatin



CHROMATIN

- chromatin is decondensed (it exists in long, thin strings) In this state, the DNA can be assessed relatively easily by cellular machinery (like proteins that read & copy DNA), which is important in allowing the cell to grow & function

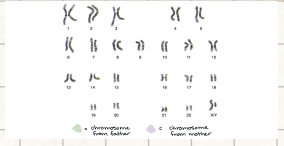
- chromatin can also be condense
  - condensation takes place when the cell is about to divide. When chromatin condenses, you can see that eukaryotic DNA is not just one long string but is broken into separate, linear pieces called chromosomes

CHROMOSOMES

quick notes:

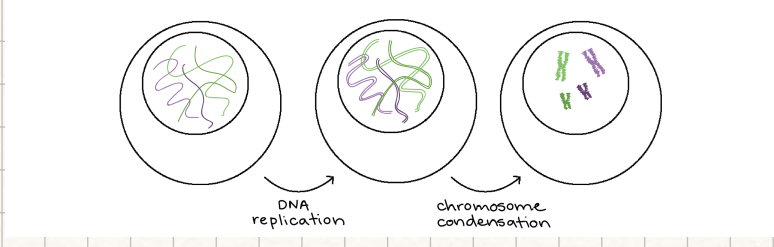
QUICK NOTES:
- homologus pair have the same genes at the same location (loci), but will possibly have different alleles (genetic sequences)

- each species has its own characteristic number of chromasomes.
- humans have 46 chromosomes in a somatic cell, while dogs have 78
- humans are diploid (2n)
  - means that most of their chromosomes come in matched sets
    - homogeneous pairs
- the 46 chromosomes of a human cell are organized into 23 pairs, and the two members of each pair are homologues of each other
- human sperm and eggs (only have 1 homologous chromosome from each pair), are haploids (1n)
  - when a sperm and egg fuse, their genetic material combines to form one complete diploid set of chromosomes.
    - for each homologous pair of chromosomes in your genome, one of the homologues comes from your mom & the other from dad.

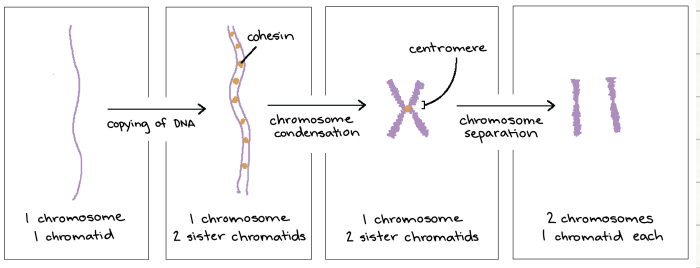


- the sex chromosomes, X and Y, determines a person's biological sex: XX = female and XY = male. These chromosomes aren't true homologues and are an exception to the rule of the same genes in the same places.
- the X and Y chromosomes are different & carry different genes.
- autosomes = 44 non-sex human chromosomes

CHROMOSOMES AND CELL DIVISION



- as a cell prepares to divide, it must make a copy of each of its chromosomes
- sister chromatids = are identical to one another & are attached to one another by proteins called cohesions
- the attachment between sister chromatids is the tightest at the centromere (a region of DNA that is important for their separation during later stages of cell division)
- as long as the sister chromatids are connected @ the centromere, they are still considered to be one chromosome. However, as soon as they are pulled apart during cell division, each is a separate chromosome.



THE CELL CYCLE

- THE MITOTIC PHASE

- Includes 2 overlapping processes:
  1. mitosis = the nucleus and its contents divide evenly into 2 daughter nuclei
  2. Cytokinesis = the cytoplasm (along w/ all the organelles is divided in 2.
- the combination of mitosis and cytokinesis produces 2 genetically identical daughter cells.

QUESTION:

WHY DO CELLS PUT THEIR CHROMOSOMES THROUGH REPLICATION, CONDENSATION AND SEPARATION?

↳ To make sure that, during cell division, each new cell gets exactly one copy of each chromosome.