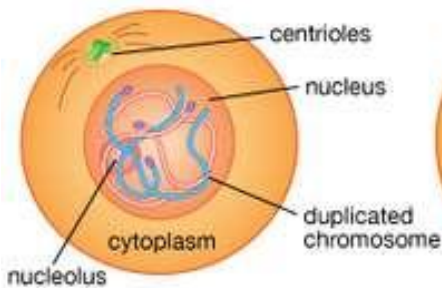


# **Genetic recombination**

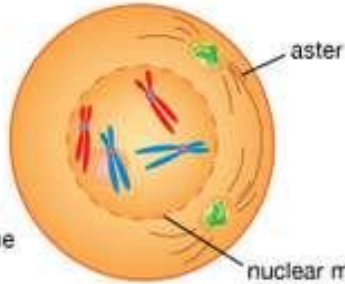
- **Genetic recombination** is the exchange of genetic material between different organisms which leads to production of offspring with combinations of traits that differ from those found in either parent.
- Genetic recombination occurs in both prokaryotes and eukaryotes
- Genetic recombination creates diversity of genomes within the same species. This creates greater adaptability of the species to changing ecological conditions in the process of evolution.
- In sexually reproducing eukaryotes genetic recombination occurs by re-assortment of chromosomes, gene conversion and chromosomal crossover.

# Mitosis – somatic cell division

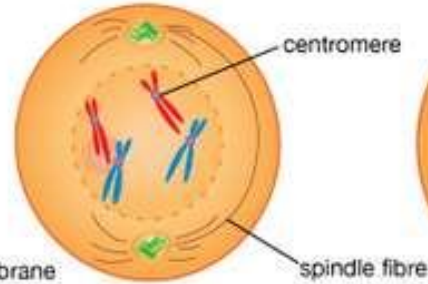
## Mitosis, or somatic cell division



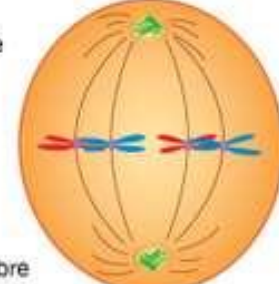
Prior to mitosis, each chromosome makes an exact duplicate of itself. The chromosomes then thicken and coil.



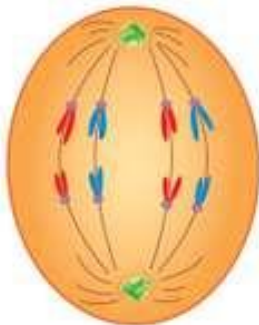
In early prophase the centrioles, which have divided, form asters and move apart. The nuclear membrane begins to disintegrate.



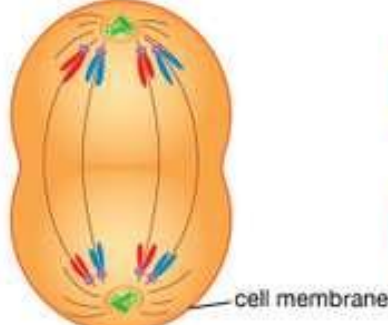
In late prophase the centrioles and asters are at opposite poles. The nucleolus and nuclear membrane have almost completely disappeared.



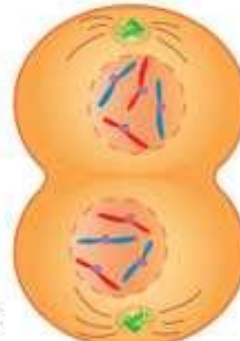
The doubled chromosomes—their centromeres attached to the spindle fibres—line up at mid-cell in metaphase.



In early anaphase the centromeres split. Half the chromosomes move to one pole, half to the other pole.



In late anaphase the chromosomes have almost reached their respective poles. The cell membrane begins to pinch at the centre.



The cell membrane completes constriction in telophase. Nuclear membranes form around the separated chromosomes.

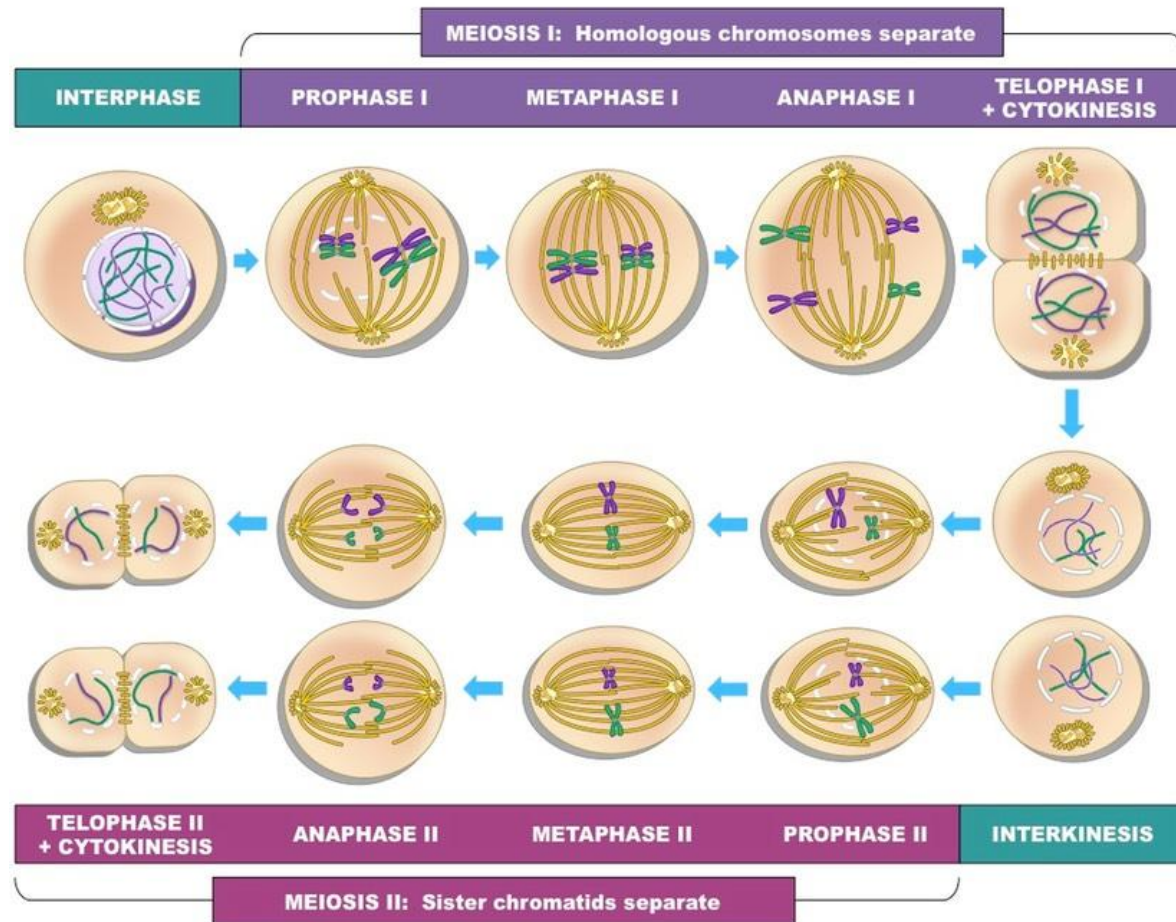


At mitosis completion, there are two cells with the same structures and number of chromosomes as the parent cell.

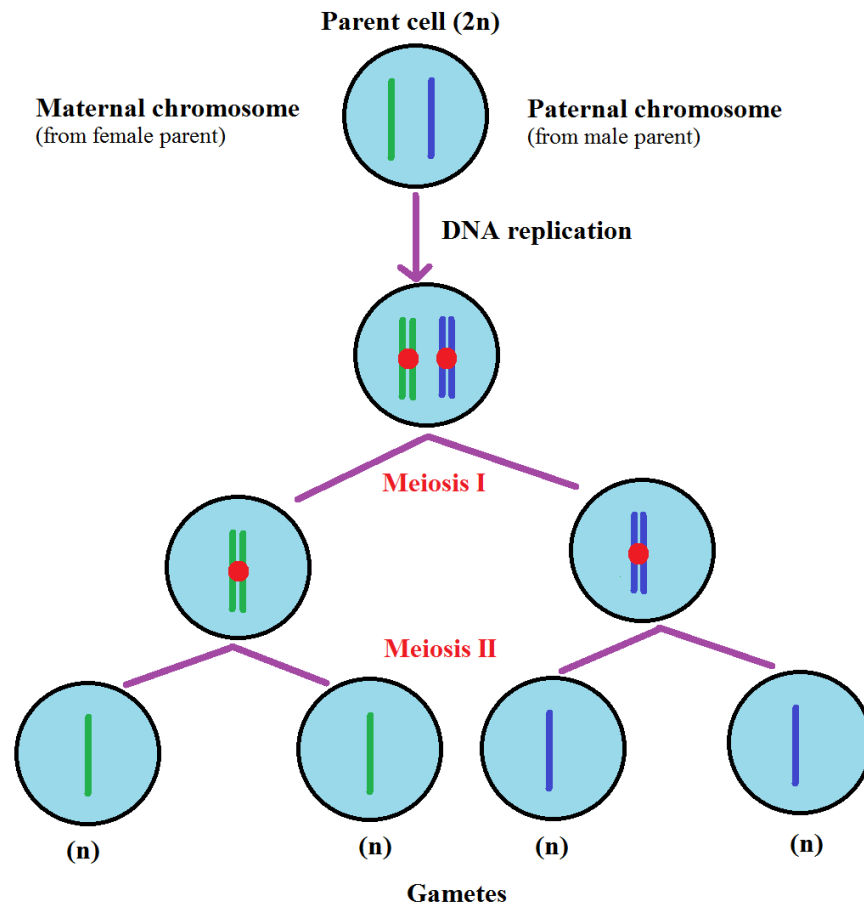
# Meiosis

- Meiosis is a specialized type of cell division that reduces the chromosome number by half, creating four haploid cells, each genetically distinct from the parent cell that gave rise to them.
- Meiosis usually occur during germ cell formation.
- Meiosis consists of two cell divisions – meiosis I and meiosis II

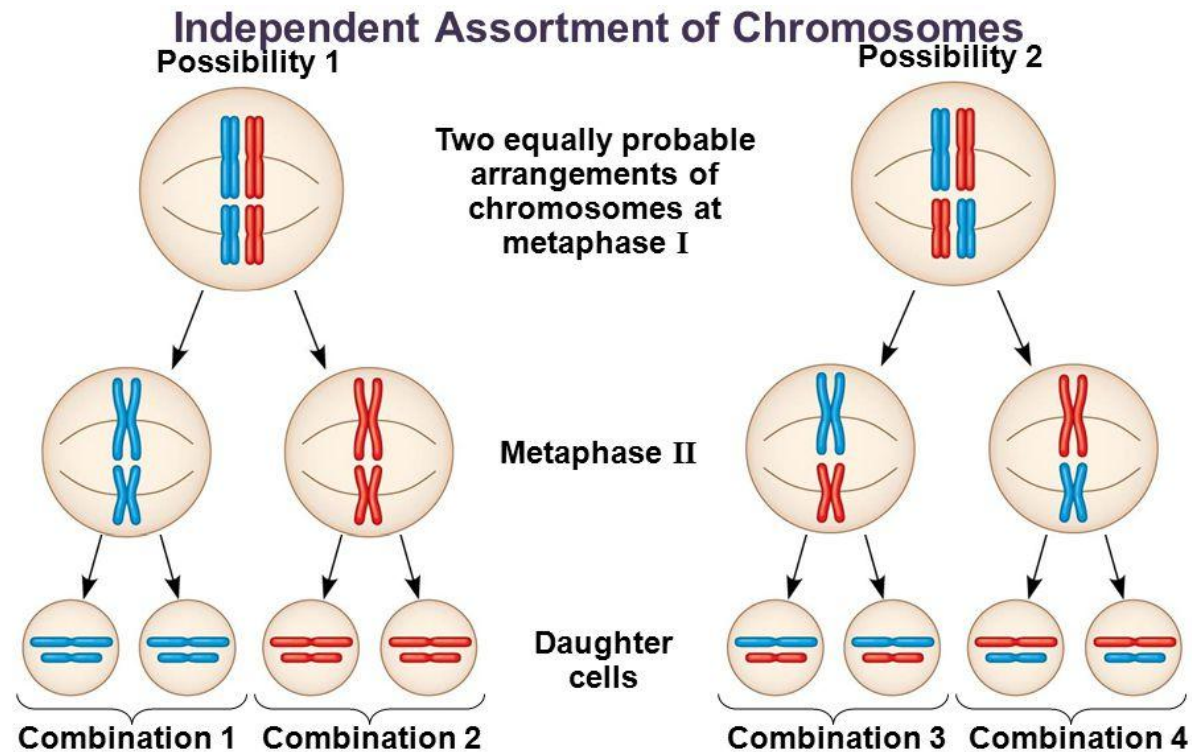
# Meiosis



# Meiosis



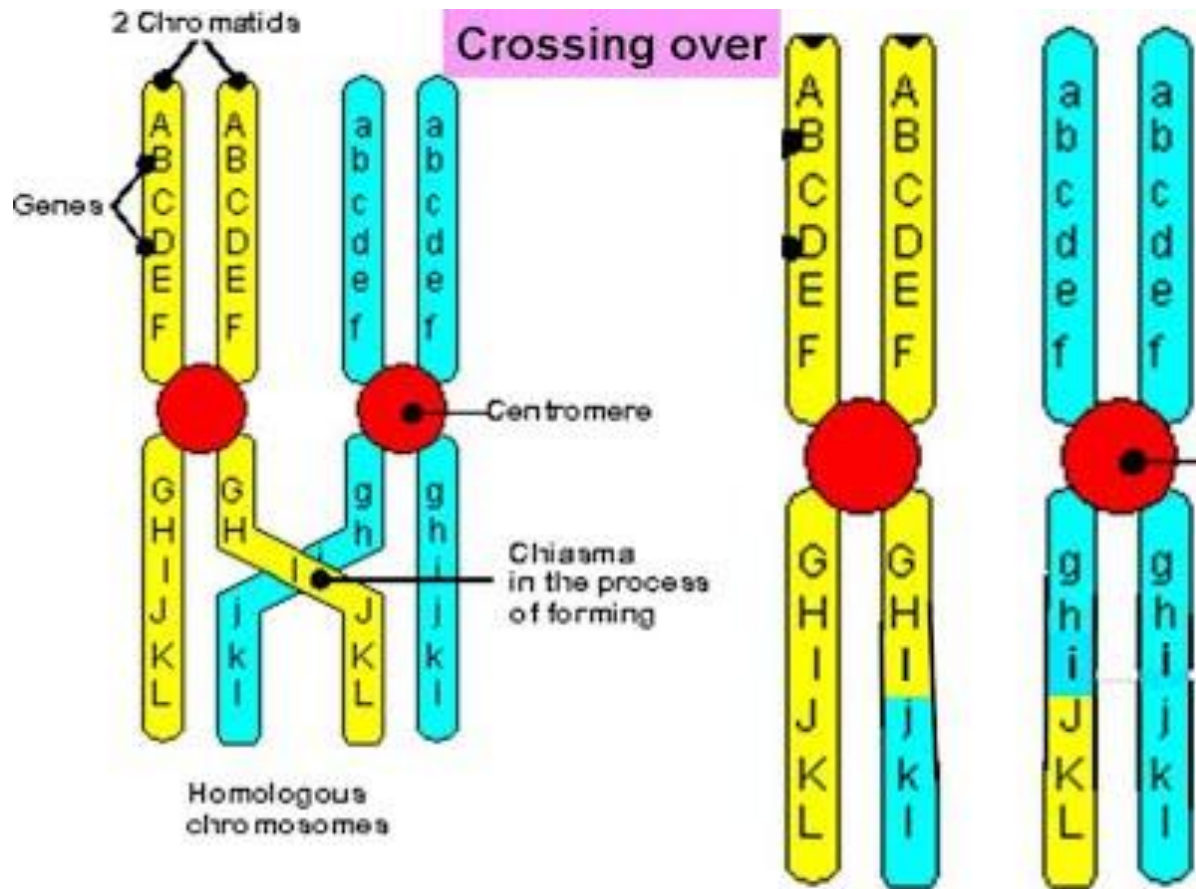
# Chromosome assortment



The number of combinations possible when chromosomes assort independently into gametes is  $2^n$ , where  $n$  is the haploid number.

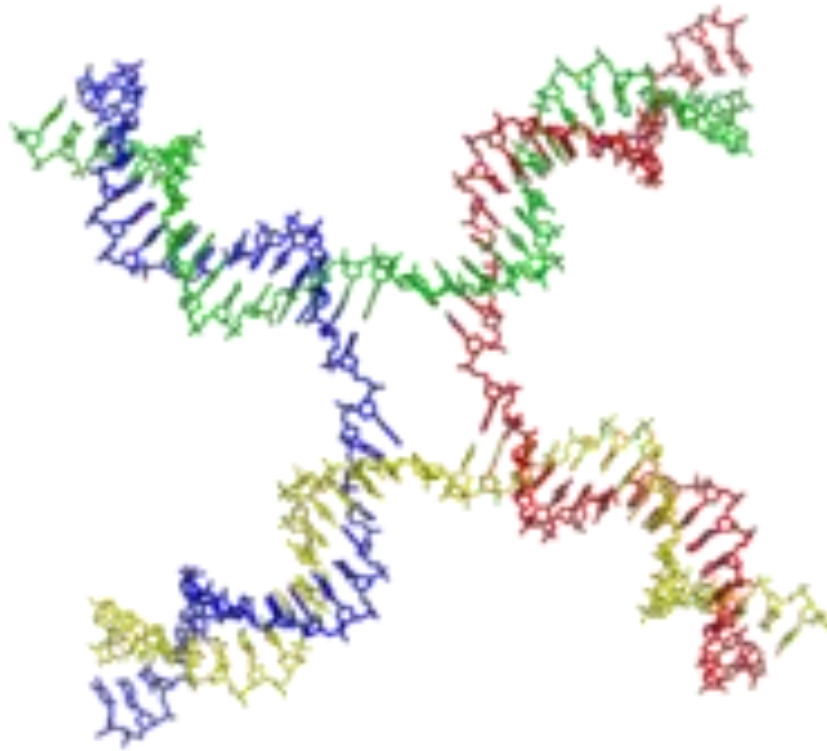


# Chromosomal crossover

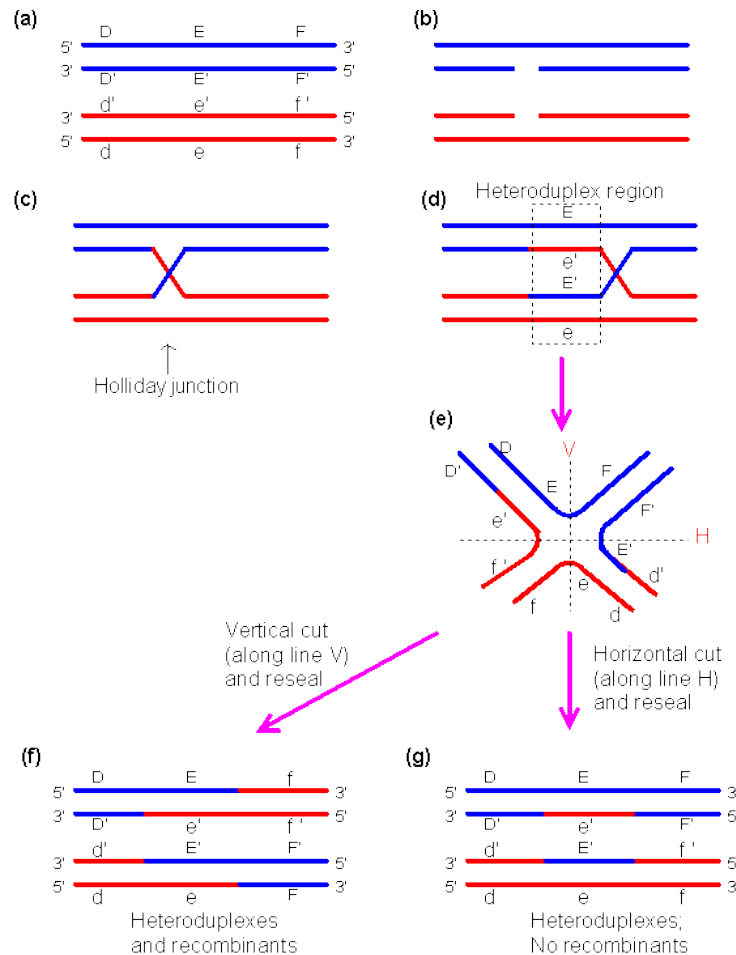




# Mechanism of crossing over – Holiday Junction formation

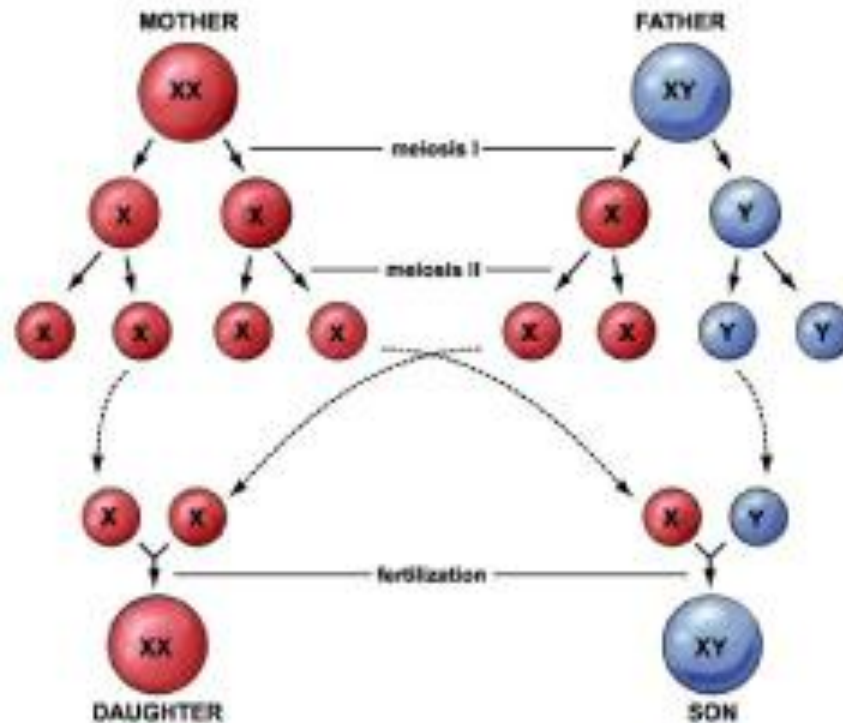


# 2 ways of Holliday junction resolution



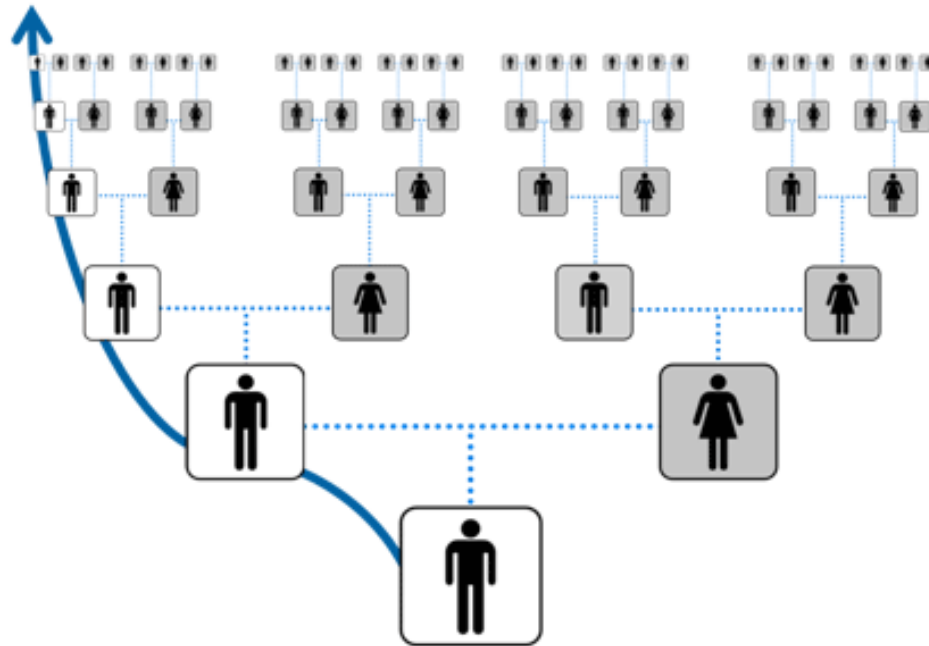
- Holiday junction could be resolved in two ways:
- Recombinant resolutions leads to crossovers
- Since the majority of genomes' sequences are identical, the products of non-recombinant resolutions are usually not detected.
- When heteroduplex region contains a genetic marker, for example an SNP, non-recombinant resolution leads to gene conversion.

# Sex chromosomes

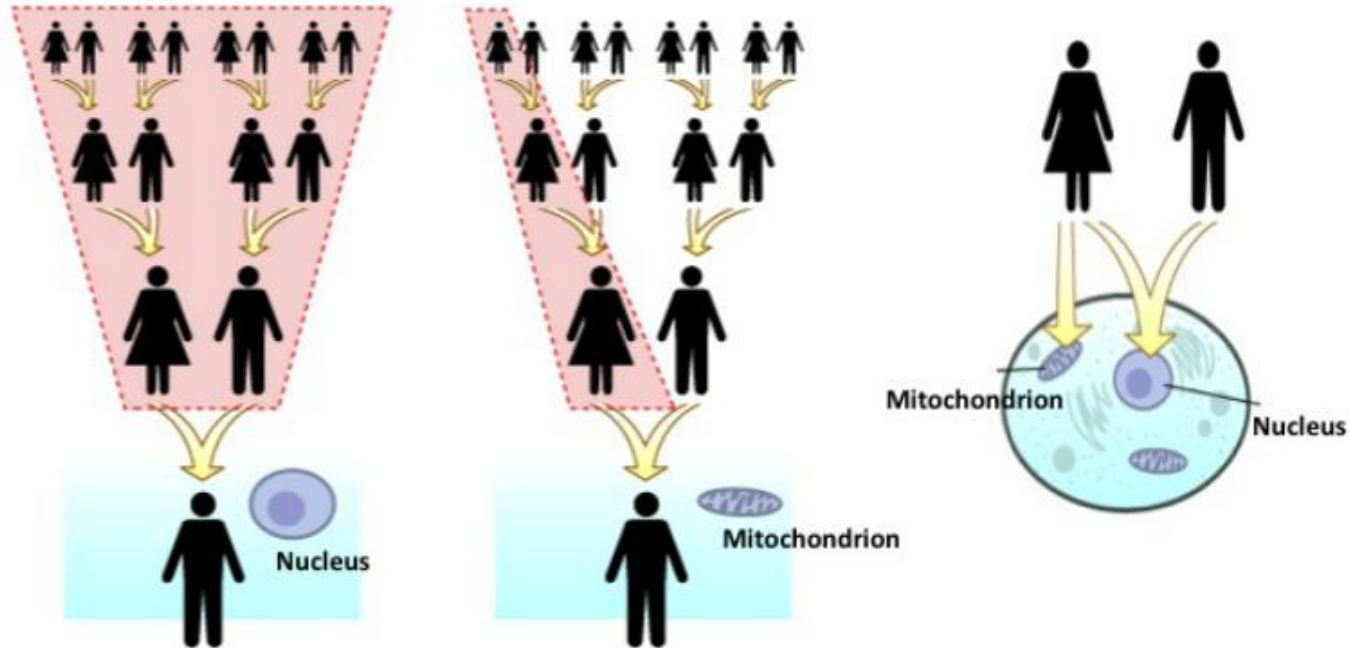


# Y chromosome

Y chromosome is inherited by boys only from a single lineage - paternal



# Mitochondrial DNA



Nuclear DNA is inherited from all ancestors (left panel); Mitochondrial DNA is inherited from a single lineage, maternal (center panel); mitochondria are passed from mother to child only, whereas the genes in the nuclei of your cells come from both parents (right panel). From the University of California Museum of Paleontology's Understanding Evolution (<http://evolution.berkeley.edu>).