

Meiosis

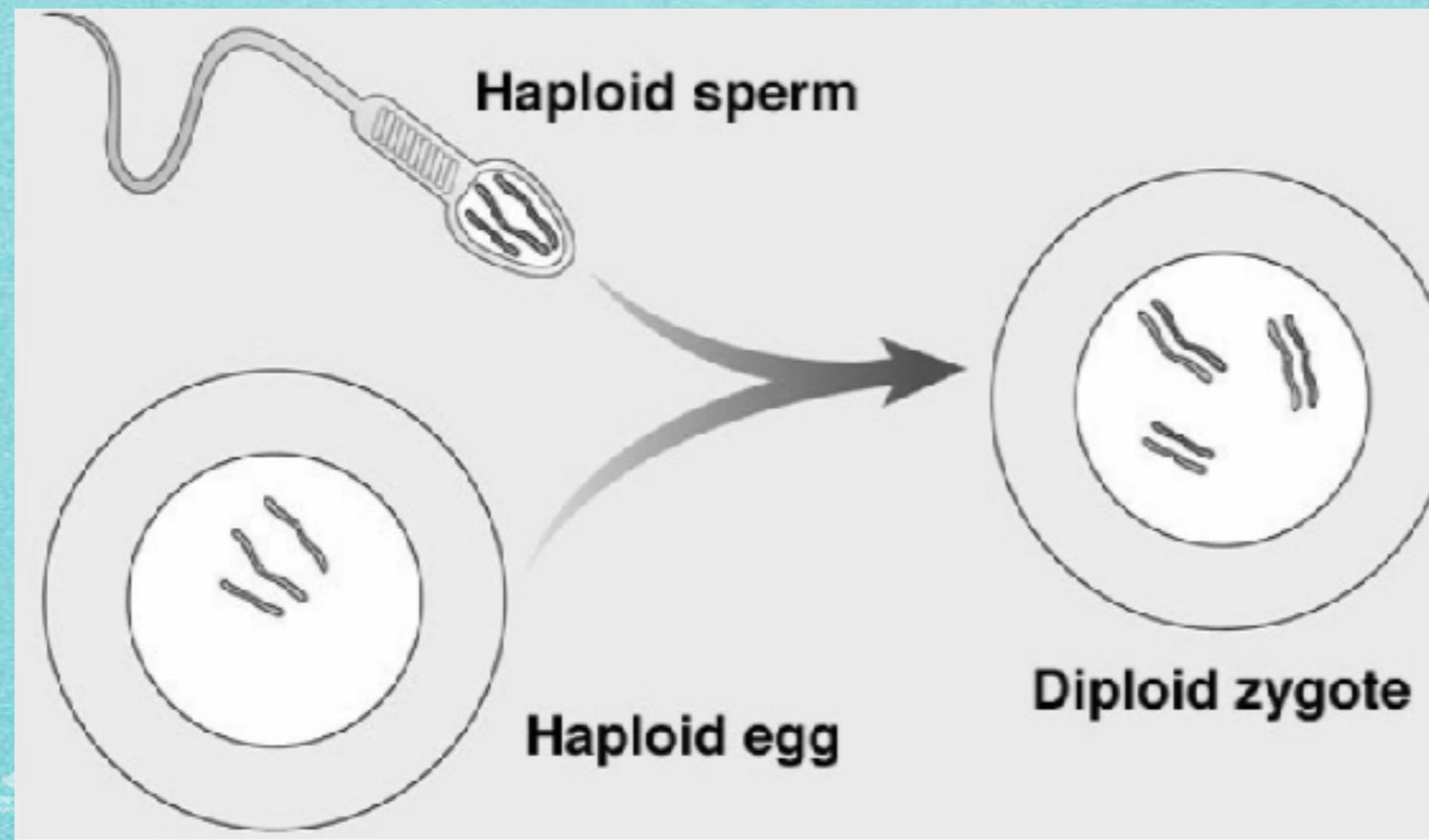
- ▶ Formation of gamete = egg & sperm
- ▶ Occurs only in ovaries and testes
- ▶ Makes cells with haploid chromosome number

Meiosis

- ▶ Diploid= Full set of chromosomes
 - ▶ 46 chromosomes in humans
 - ▶ Found in most body cells (somatic cells)
- ▶ Haploid = Half the normal amount of chromosomes
 - ▶ 23 chromosomes in humans
 - ▶ Found only in gametes (sperm and egg)

Meiosis

- ▶ Allows one random copy of each chromosomes to be placed in each egg cell and each sperm cell
- ▶ Results in genetic diversity



Meiosis

- ▶ DNA replication occurs first
- ▶ Two sets of genetic divisions follow
- ▶ Homologous chromosomes pair, then are separated as part of the process
 - ▶ Homologous = Chromosomes which carry the same traits/genes as another
 - ▶ One from mother and one from father

Two Types of Human Chromosomes

Unduplicated



**Chromosome with
One Chromatid**

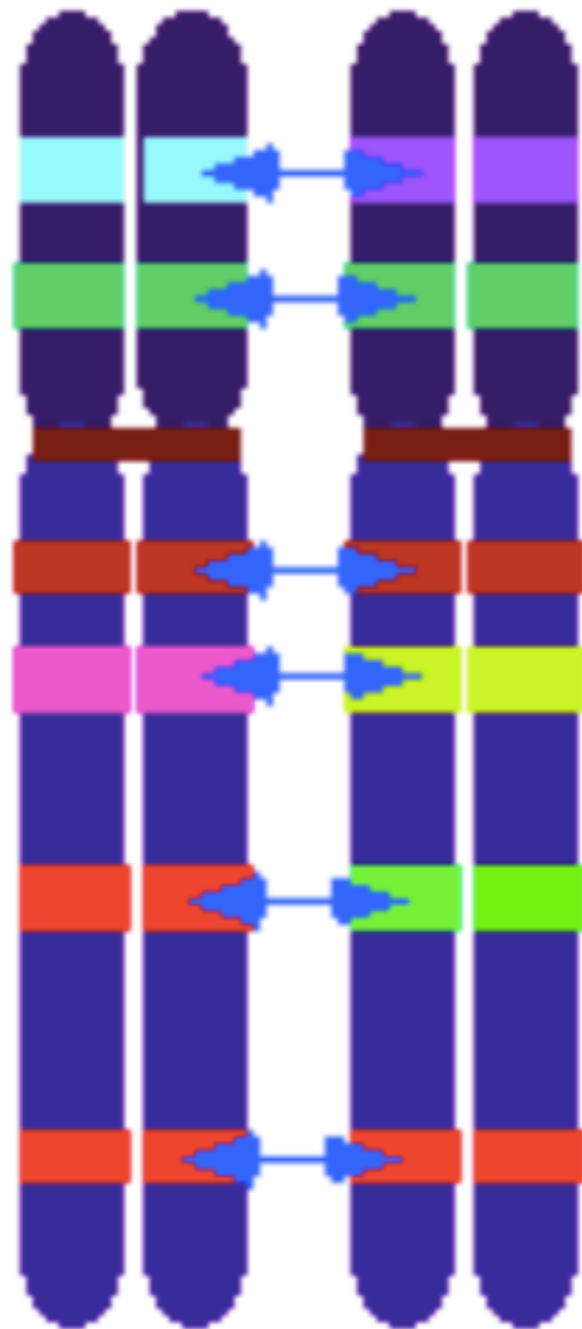
Duplicated



**Chromosome with
Two (Sister) Chromatids**

Two Pairs of Homologous Chromosomes

Allele A



Allele a



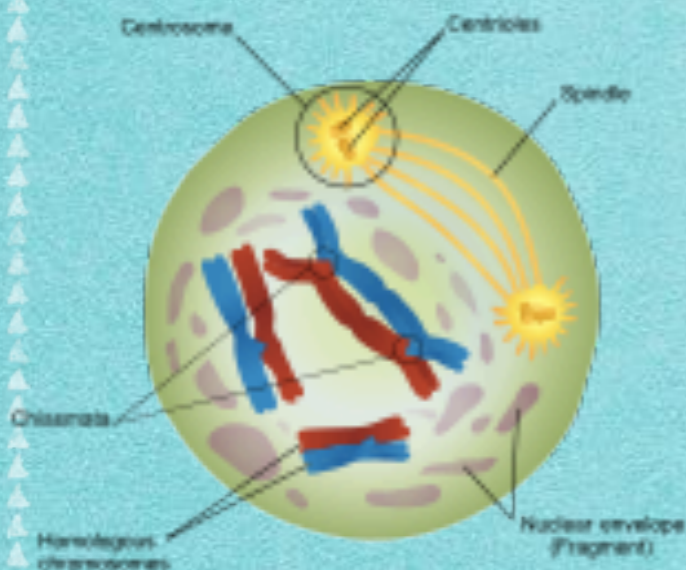
The arrows point to corresponding genes.

Stages- First division

- ▶ Prophase I - Chromosomes condense, crossing-over occurs
- ▶ Metaphase I- Homologous chromosomes line up in center
- ▶ Anaphase I- Homologous chromosomes pulled to opposite ends of the cell
- ▶ Telophase I- Two separate nuclei form (full set DNA)

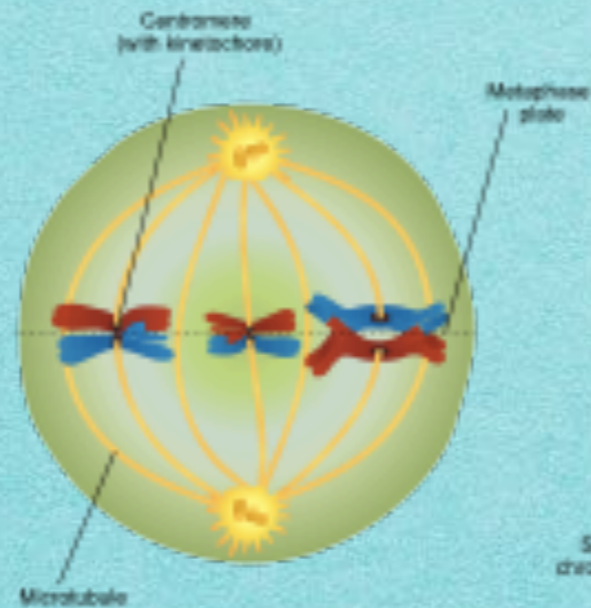
Meiosis I- First division

Prophase I



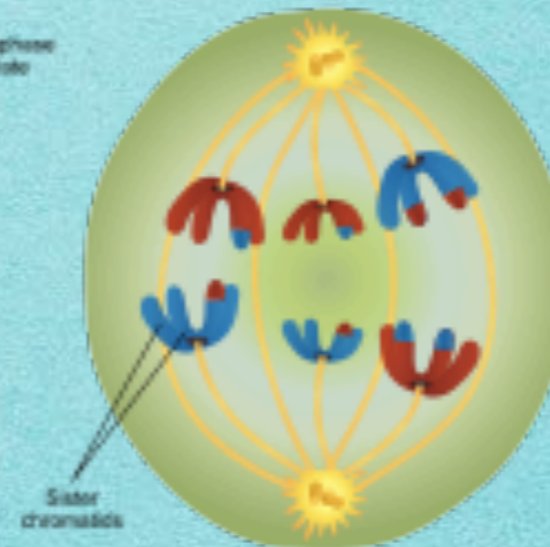
The chromosomes condense, and the nuclear envelope breaks down. Crossing-over occurs.

Metaphase I



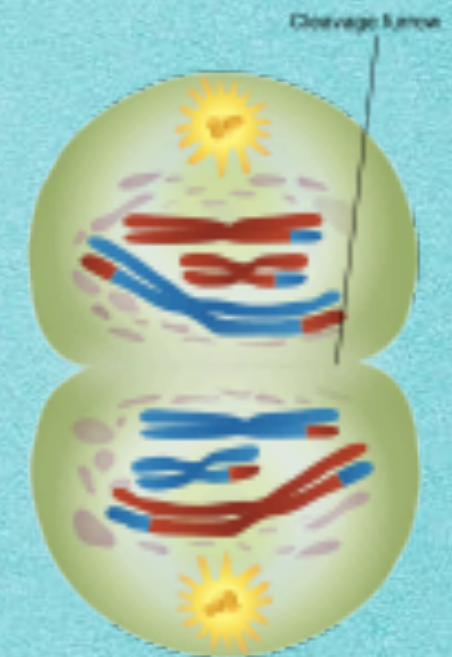
Pairs of homologous chromosomes move to the equator of the cell.

Anaphase I



Homologous chromosomes move to the opposite poles of the cell.

Telophase I & cytokinesis



Chromosomes gather at the poles of the cells. The cytoplasm divides.

Stages- Second division

- ▶ **No interphase II!!**
- ▶ Prophase II - Chromosomes condense
- ▶ Metaphase II- Chromosomes line up in center
- ▶ Anaphase II- Chromosomes pulled to opposite ends of the cell
- ▶ Telophase II- Two separate nuclei form (half set DNA)

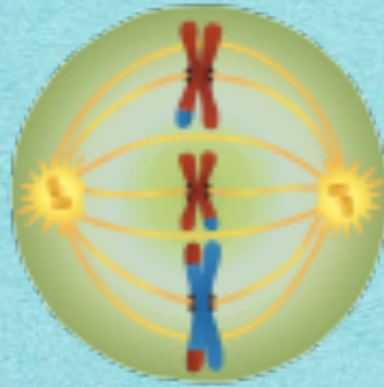
Meiosis II- Second division

Prophase II



A new spindle forms around the chromosomes.

Metaphase II



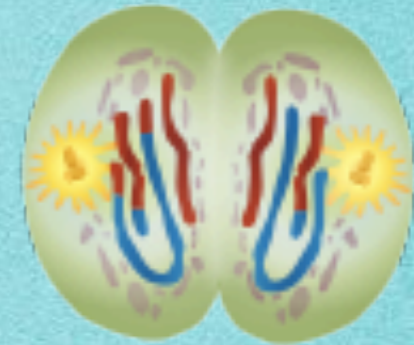
Metaphase II chromosomes line up at the equator.

Anaphase II

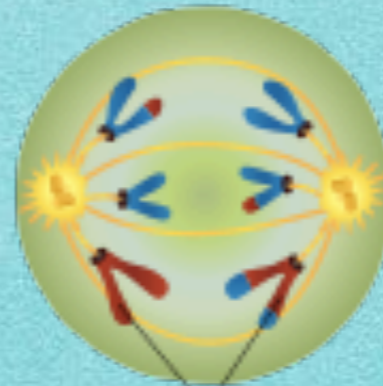
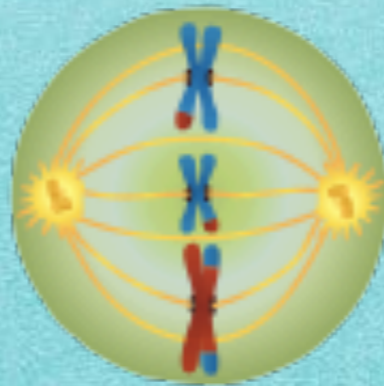


Centromeres divide. Chromatids move to the opposite poles of the cells.

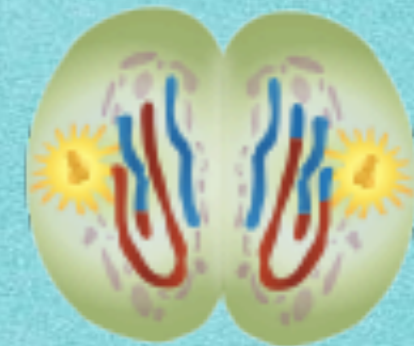
Telophase II & cytokinesis



A nuclear envelope forms around each set of chromosomes. The cytoplasm divides.



Sister chromatids separate



MEIOSIS

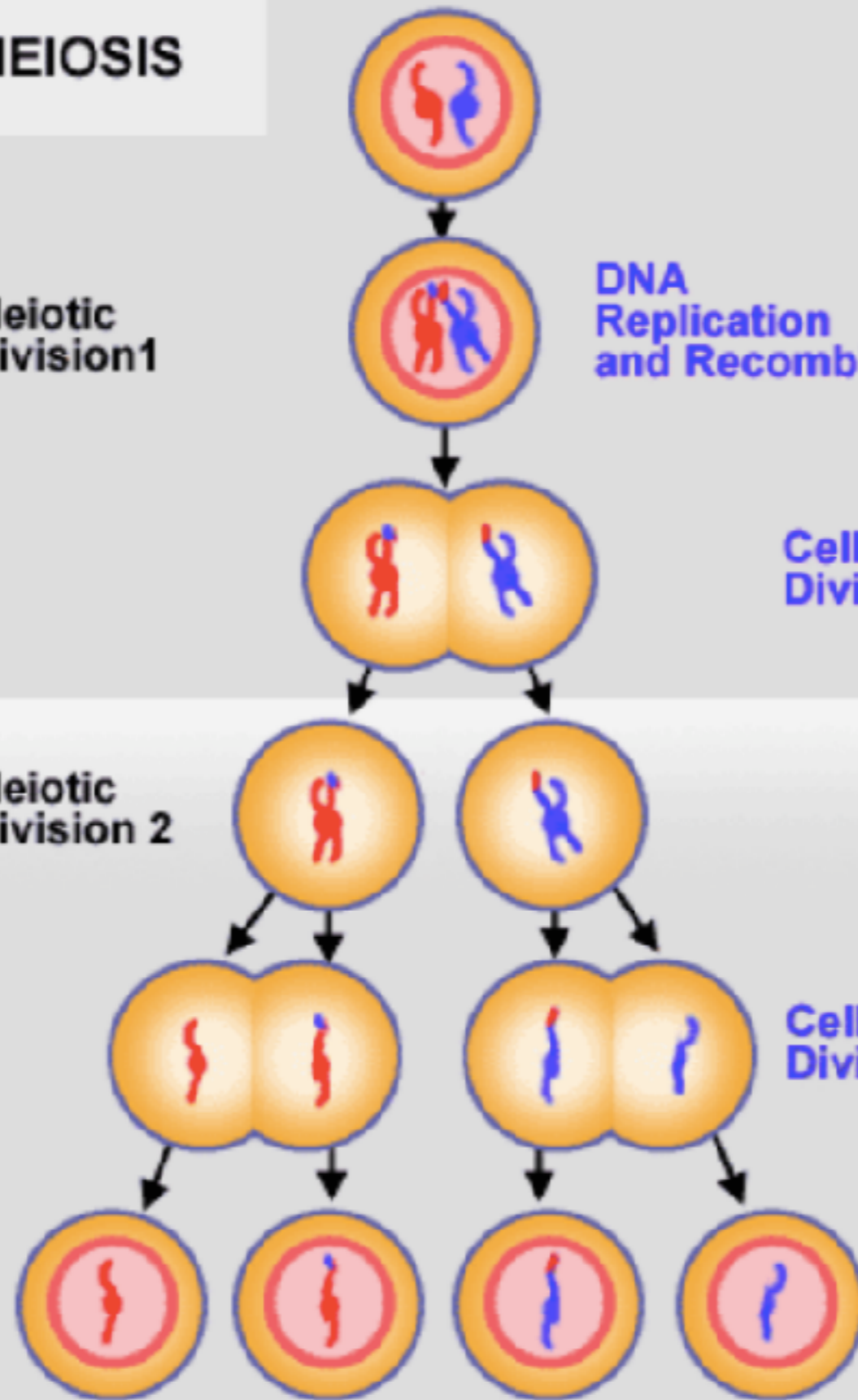
Meiotic Division 1

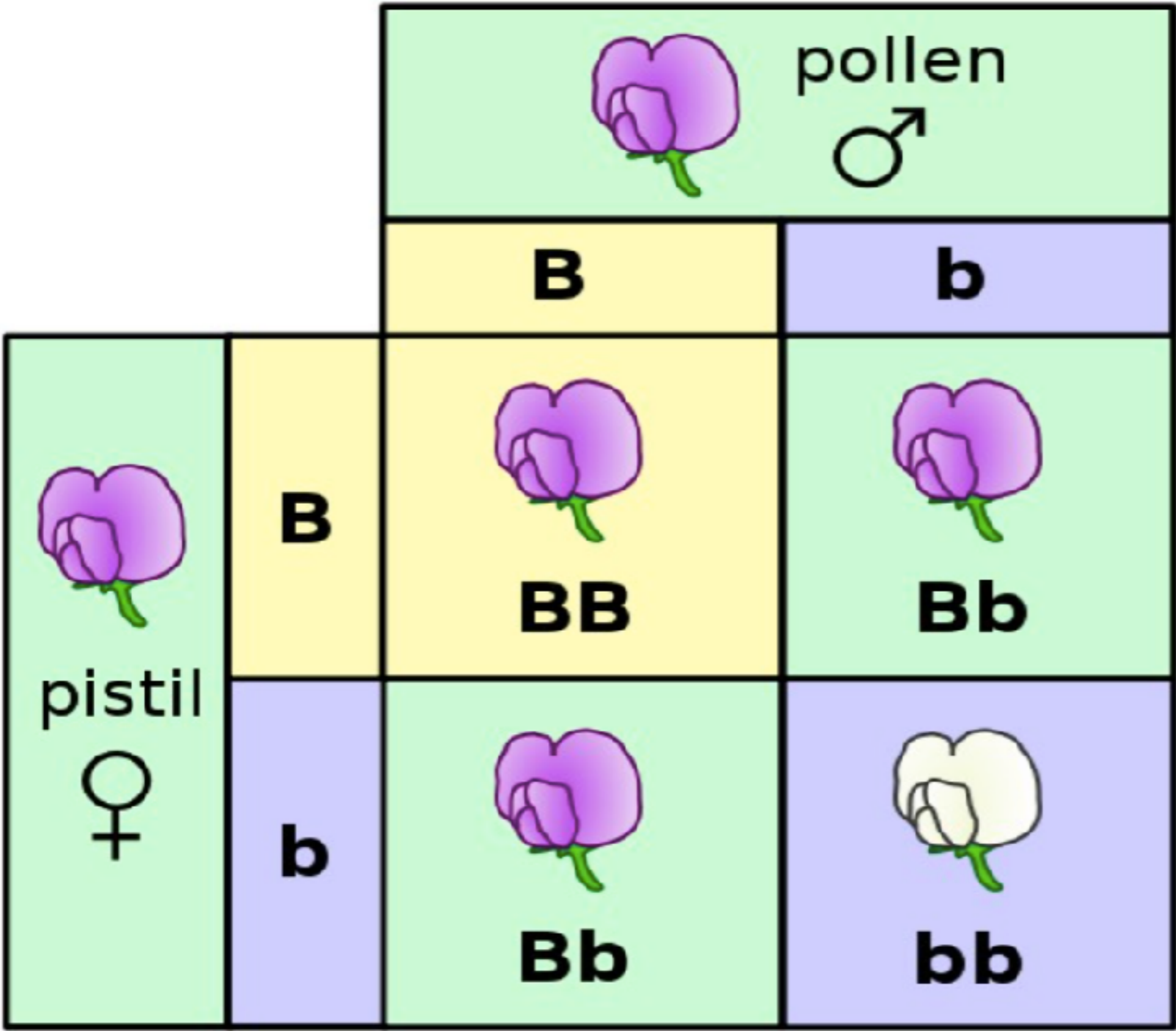
DNA Replication and Recombination

Cell Division 1

Meiotic Division 2

Cell Division 2





Meiosis practice

- ▶ <https://www.youtube.com/watch?v=MNq015d03MU>
- ▶ **Meiosis quiz Friday!**

Stages- First division

- ▶ Prophase I - Chromosomes condense, crossing-over occurs
- ▶ Metaphase I- Homologous chromosomes line up in center
- ▶ Anaphase I- Homologous chromosomes pulled to opposite ends of the cell
- ▶ Telophase I- Two separate nuclei form (full set DNA)

Stages- Second division

- ▶ **No interphase II!!**
- ▶ Prophase II - Chromosomes condense
- ▶ Metaphase II- Chromosomes line up in center
- ▶ Anaphase II- Chromosomes pulled to opposite ends of the cell
- ▶ Telophase II- Two separate nuclei form (half set DNA) x2!

Meiosis Wrap-up

- ▶ Amoeba Sisters Overview

- ▶ <https://www.youtube.com/watch?v=VzDMG7ke69g>

Chromosomal conditions

- ▶ Chromosomal conditions are caused by two kinds of changes in chromosomes:
 - ▶ Number of chromosomes— too many or too few
 - ▶ Structure of chromosomes— part of a chromosome may be missing, repeated or rearranged.

Results of chromosomal abnormalities

- ▶ Miscarriage before birth
- ▶ Intellectual disabilities and developmental defects
- ▶ Can cause conditions with few effects

Down Syndrome

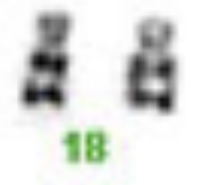
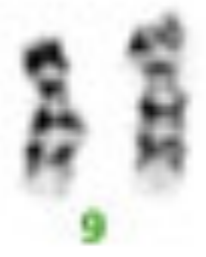
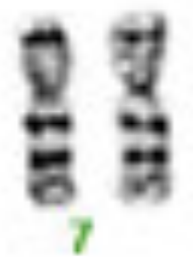
- ▶ Also called trisomy-21 (extra chromosome 21)
- ▶ Symptoms: delayed physical/mental development, specific head and facial features, short stature
- ▶ Can be diagnosed before birth

Turner's syndrome

- ▶ One X chromosome in females (monosomy X)
- ▶ Symptoms: early loss of ovarian function, infertility, possible heart and developmental defects
- ▶ Majority of women maintain normal intelligence

Klinefelter's syndrome

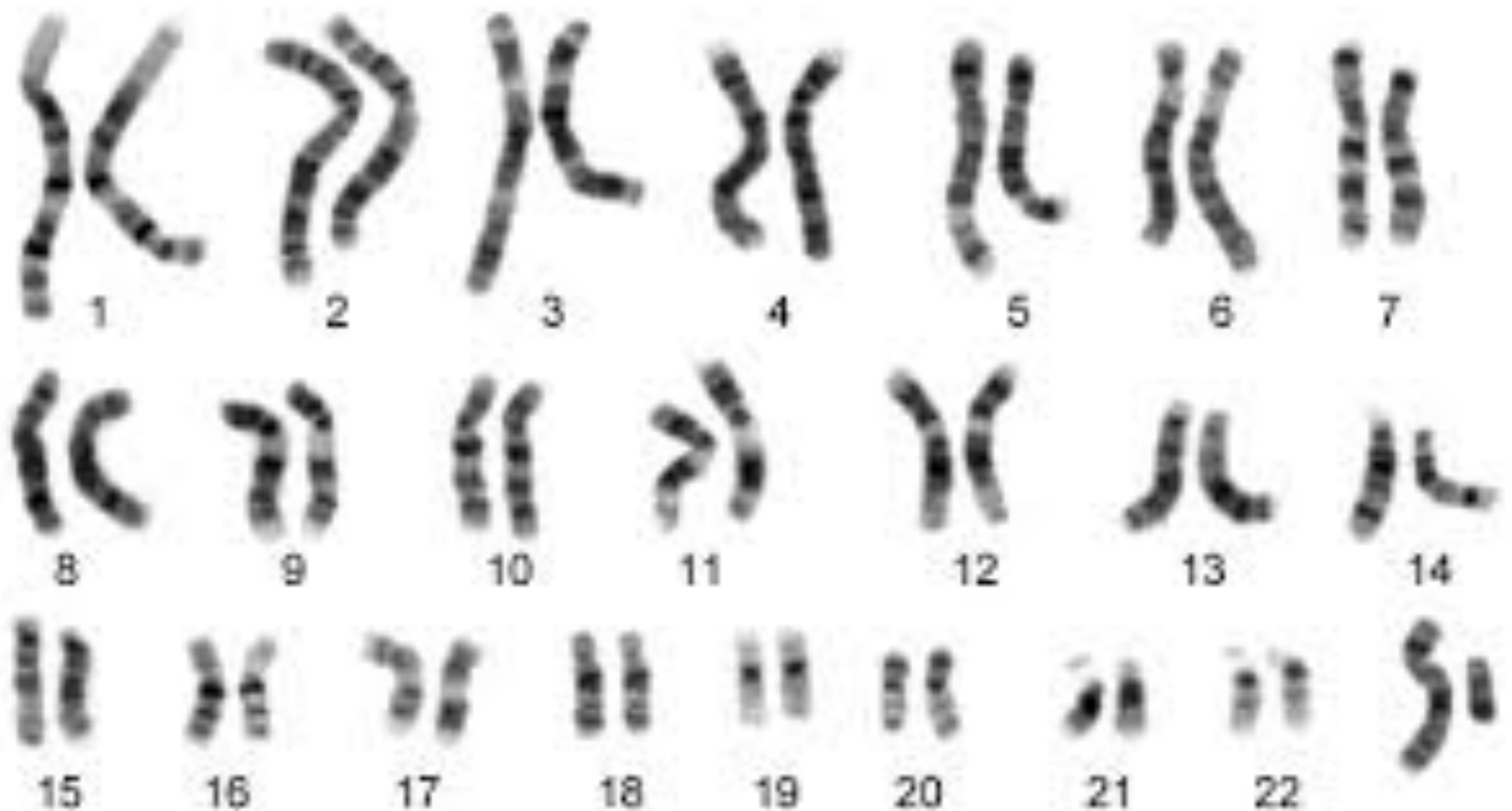
- ▶ Additional X chromosome in males
- ▶ Symptoms: Lack of testosterone production (small testes), infertility, tend to be taller when older, may have learning disabilities



Karyotype

- ▶ Definition: Photomicrograph of chromosomes in a dividing cell
 - ▶ Usually a white blood cell
- ▶ Length, position of the centromeres, banding pattern, sex chromosomes, and other physical characteristics are monitored

Normal Karyotype

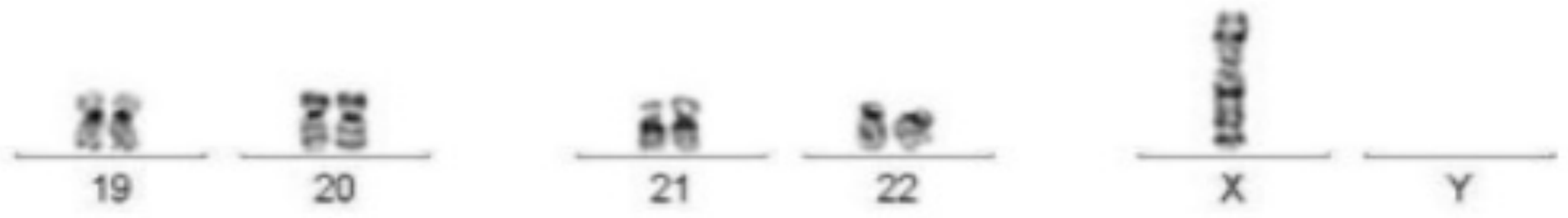


Process

- ▶ Blood sample is treated to stimulate mitosis
- ▶ Mitosis is frozen in metaphase, has two sets of chromosomes
- ▶ Chromosomes are photographed, cut out, and arranged in pairs

Review

- ▶ <https://www.youtube.com/watch?v=q8errsr4FE>





1



2



3



4



5



6



7



8



9



10



11



12



13



14



15



16



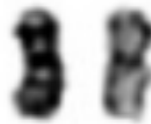
17



18



19



20



21



22



X



Y