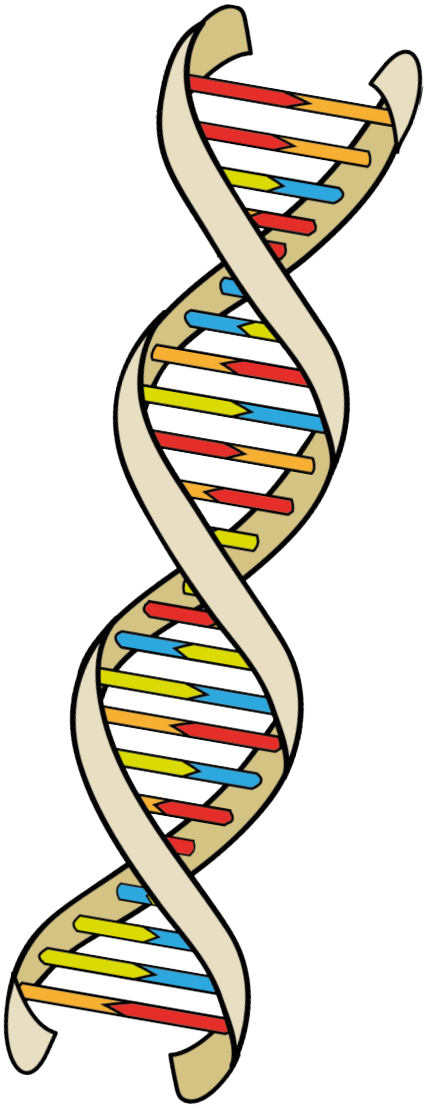
Heredity

the passing of traits from parents to offspring



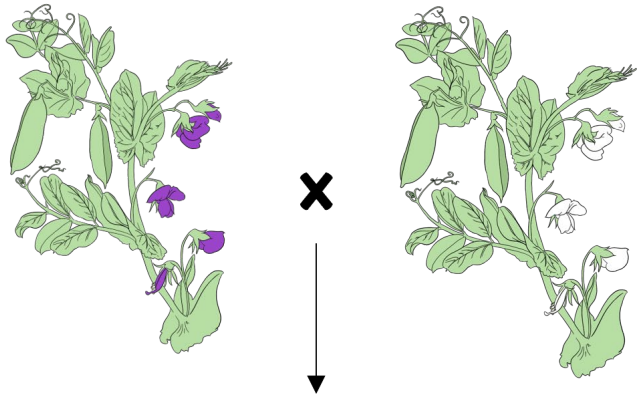
Genetics

the study of how traits are passed from parents to offspring

Gregor Mendel

- "the father of genetics"
- Austrian monk and biologist
- late 1850s: grew and studied pea plants
- work not recognized until the turn of the 20th century

Mendel's Experiments



P generation - true-breeding plants

F_1 - Two true-breeding plants produced all purple offspring.

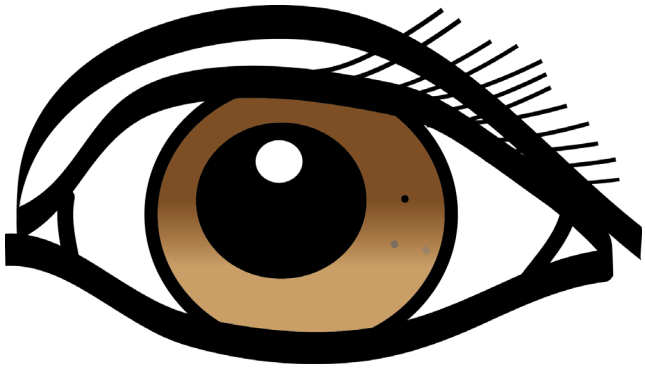
F_2 - Two hybrid plants self-fertilized and produced offspring that were 75% purple and 25% white.

Dominant Trait

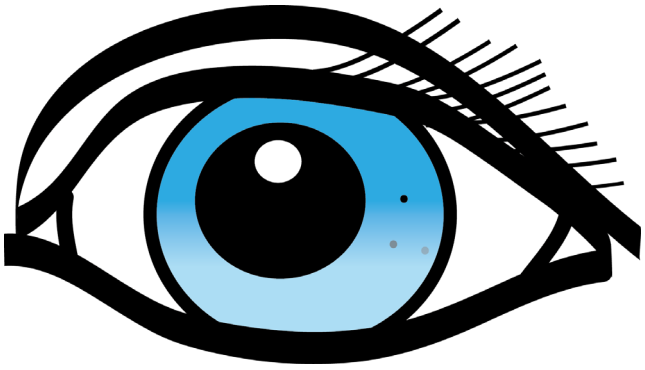
genetic factor that blocks another genetic factor

Recessive Trait

genetic factor that is blocked by the presence of a dominant factor



dominant



recessive

Homozygous

alleles are the same

WW

ww

Heterozygous

alleles are different

Ww

Genotype

combination of genes

WW

ww

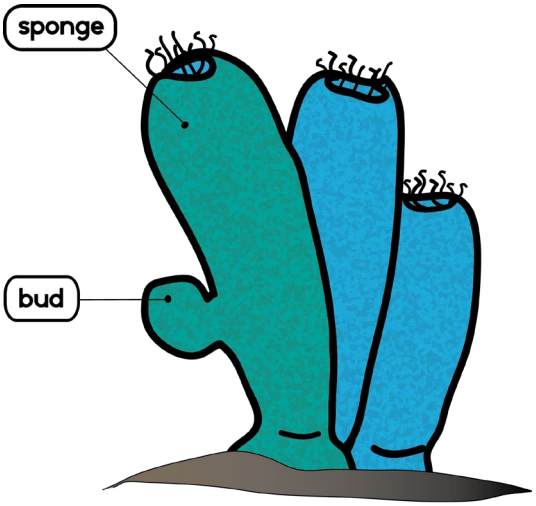
Ww

Phenotype

observable characteristics

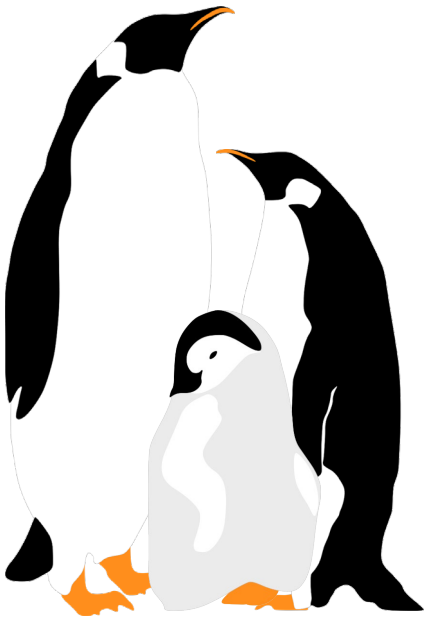
Asexual Reproduction

A single parent has offspring that are genetically identical to the parent.

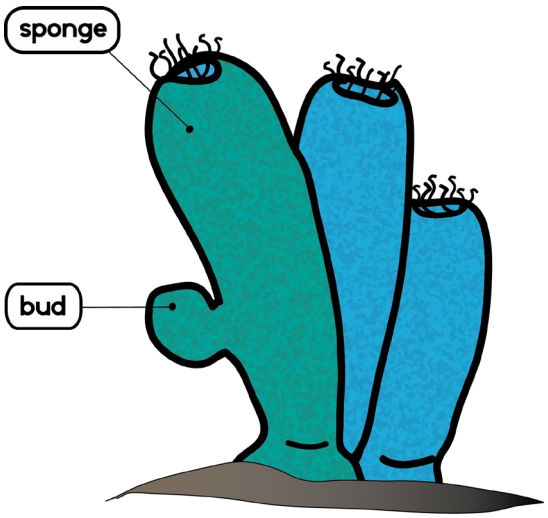


Sexual Reproduction

Reproduction in which sex cells from two parents unite to produce offspring that share traits from both parents.



Asexual Reproduction



A single parent has offspring that are genetically identical to the parent.

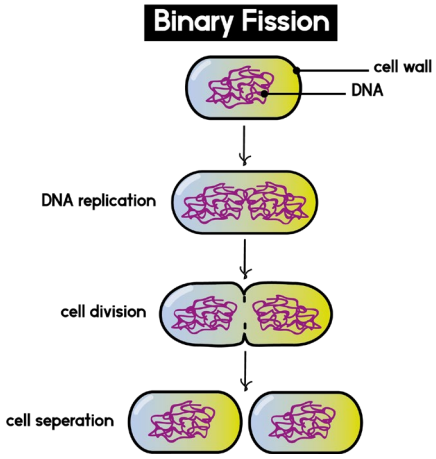
Advantages:

- fast and efficient
- does not require a male and a female organism

Disadvantages:

- no genetic diversity

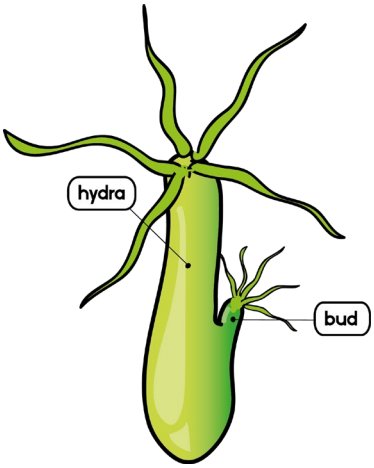
Binary Fission



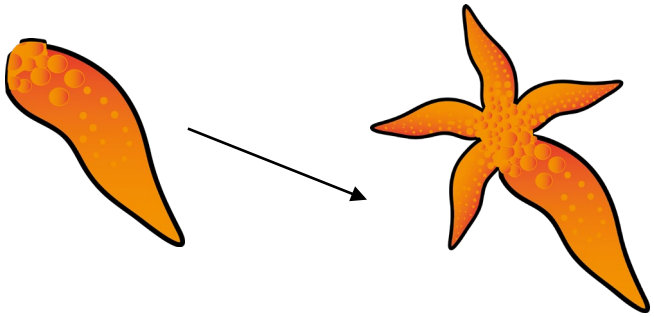
one cell divides into two equal parts

Budding

when part of the parent organism pinches off and forms a new organism

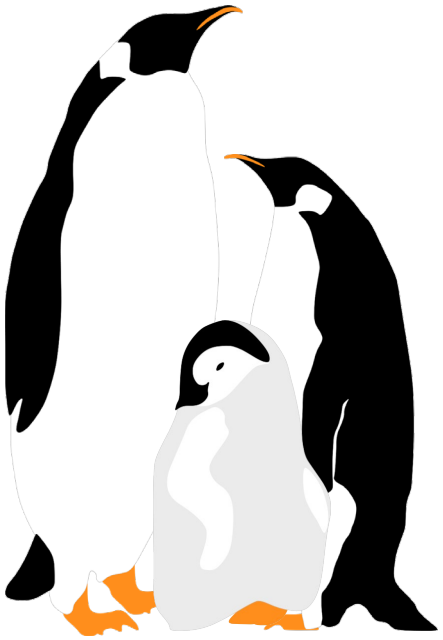


Fragmentation



Parts of an organism break off and then develop into a new individual that is identical to the original one.

Sexual Reproduction



reproduction in which sex cells from two parents unite to produce offspring that share traits from both parents

Advantages:

- genetic diversity
- allows for the adaptations in species

Disadvantages:

- takes a lot of energy

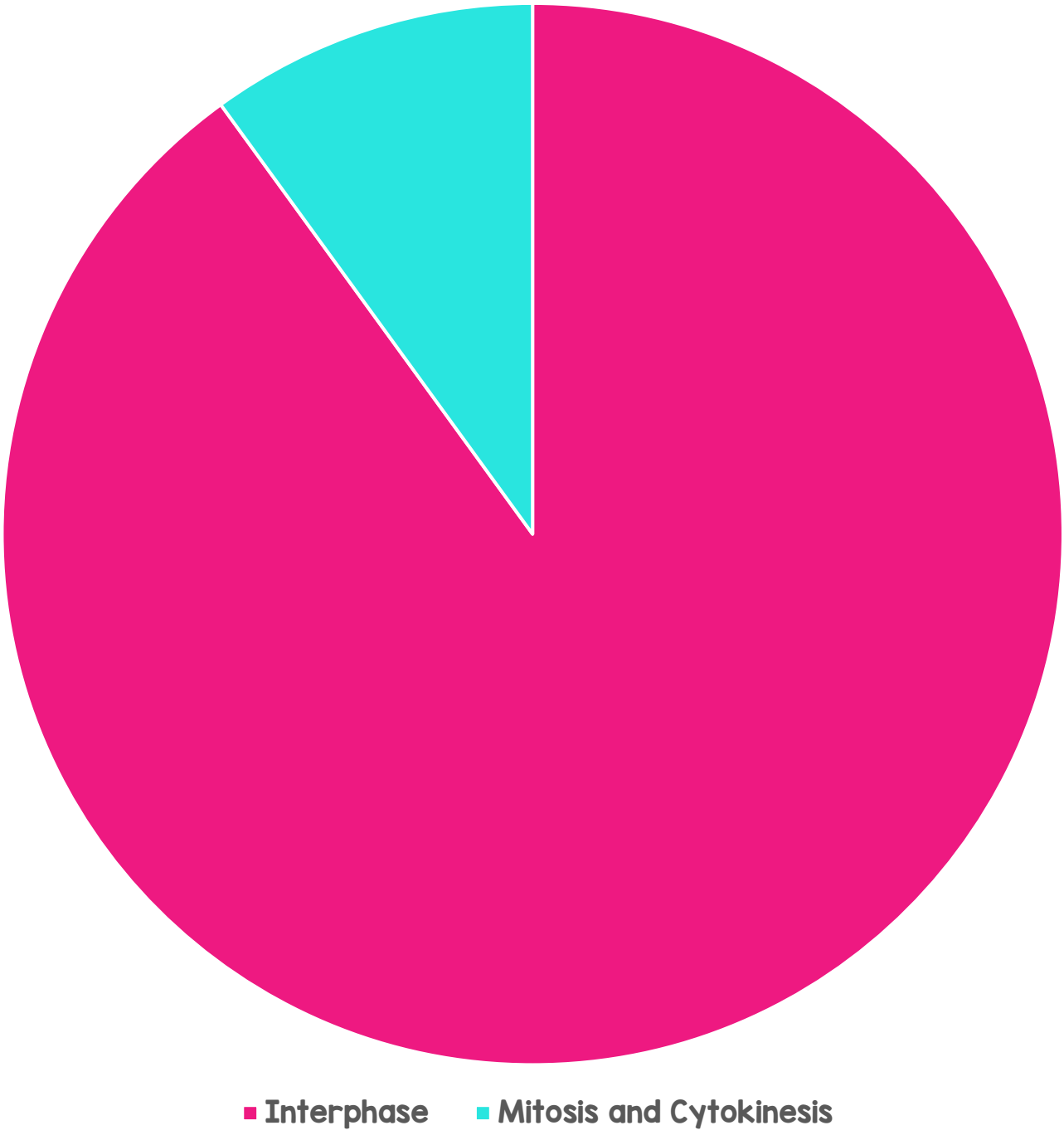
Fertilization (in humans)

Occurs when male (sperm) and female (egg) sex cells (gametes) unite.

The fertilized egg is called a zygote (46 chromosomes).

Through mitosis, the offspring continues to grow.

The Cell Cycle

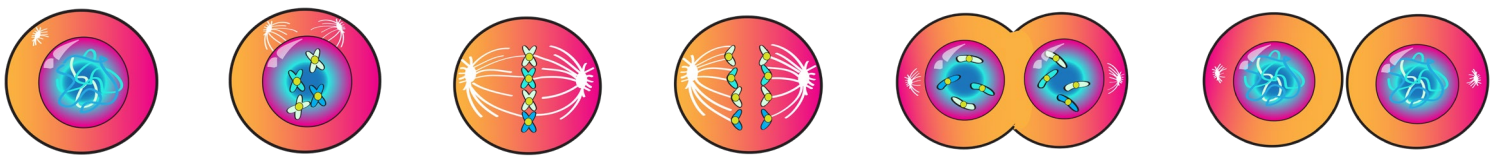


Major Stages of the Cell Cycle

growth, replication, and division of a cell

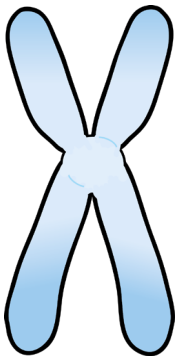
1. Interphase

2. Mitotic Phase (Mitosis and Cytokinesis)



The DNA in a cell is organized into structures called chromosomes.

DNA

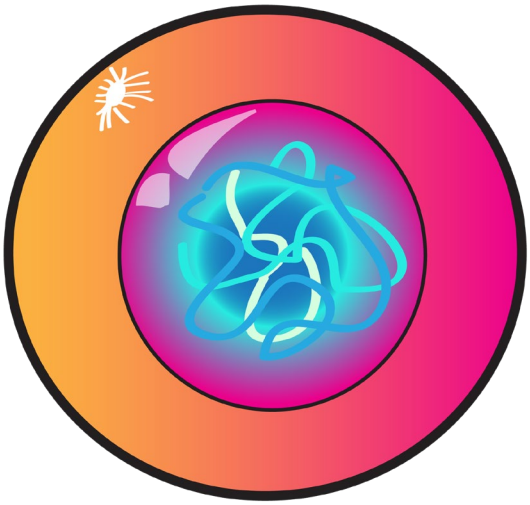


chromosome

Human body cells have 46 chromosomes (23 pairs).

Interphase

growth, DNA replication, cell functions

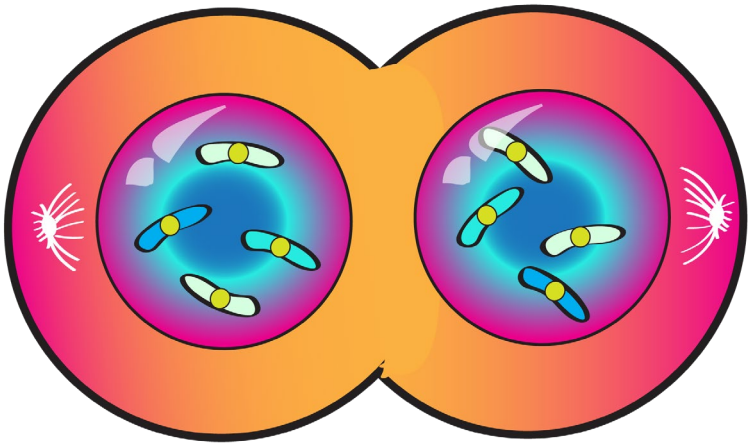


- during cell cycle → cell is usually in the interphase stage

The cell carries out its normal activities and genetic material is duplicated.

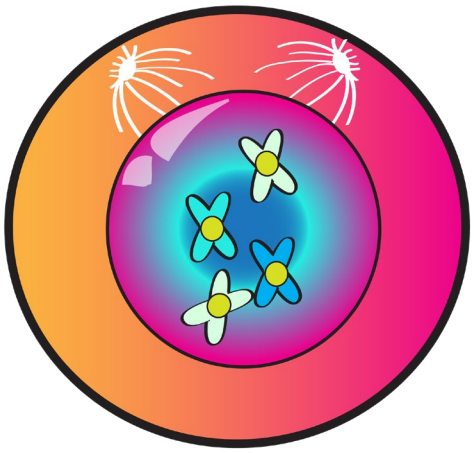
Mitosis

repair and growth

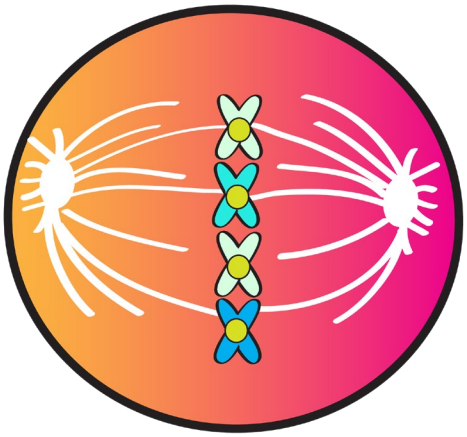


- makes body cells
- makes identical cells
- stages: prophase, metaphase, anaphase, telophase
- One cell becomes 2 daughter cells.

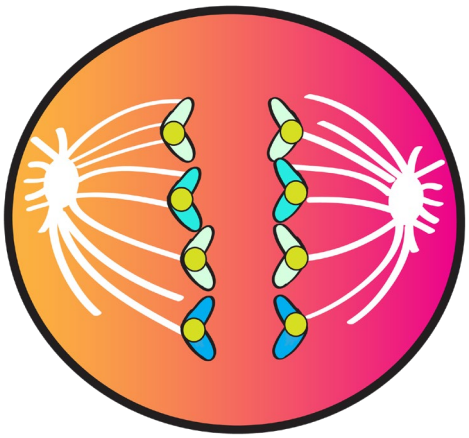
Prophase



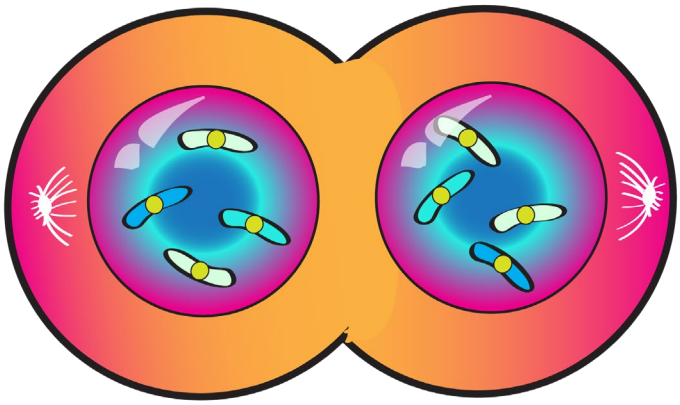
Metaphase



Anaphase

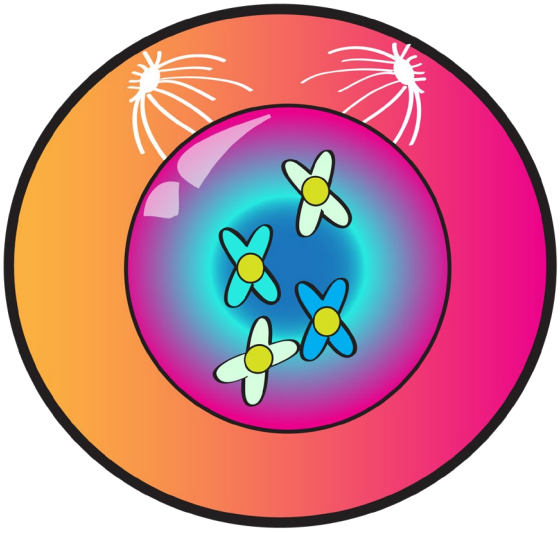


Telophase



Prophase

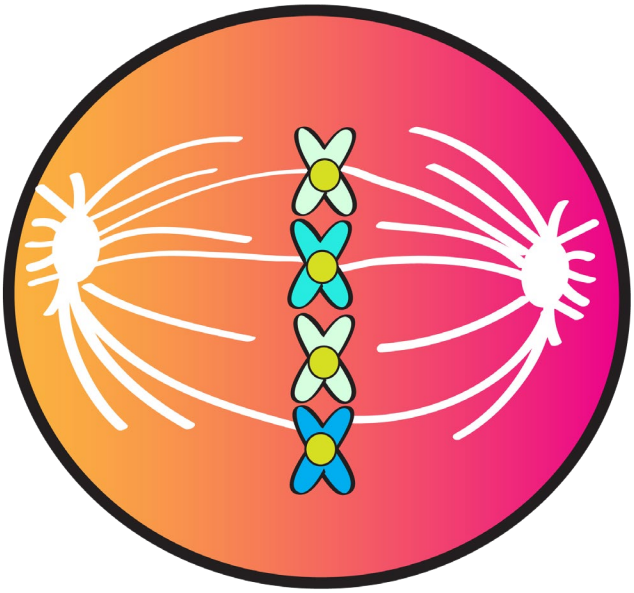
1st phase of mitosis



- cell is beginning to get ready to divide
- duplicated DNA (chromosomes) are visible and condensed; nuclear membrane and nucleolus break down
- mitotic spindle also formed
- nucleus begins to disappear

Metaphase

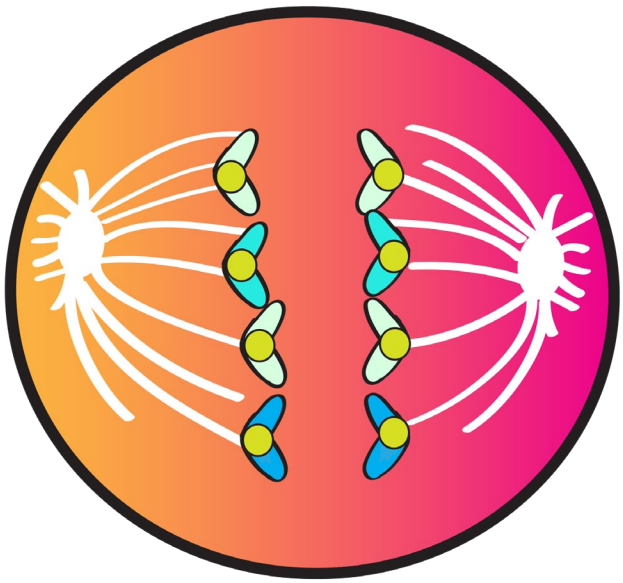
2nd phase of mitosis



- DNA (chromosomes) align in the middle of the cell in order to prepare to split
- nucleus is no longer in the cell
- chromosomes pulled by spindle fibers

Anaphase

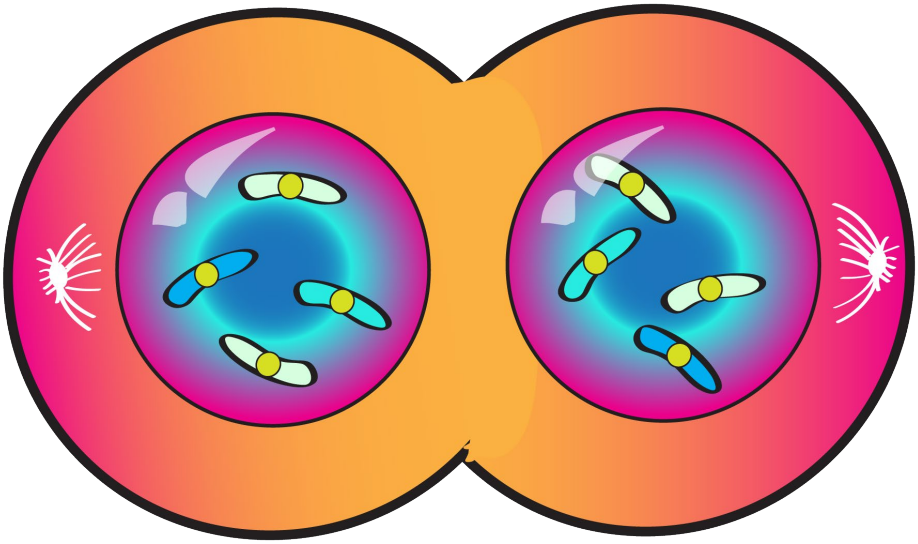
3rd phase of mitosis



- separation of cells begins
- sister chromatids separated and pulled to opposite poles by spindle fiber - moving away from center
- cell begins to stretch out

Telophase

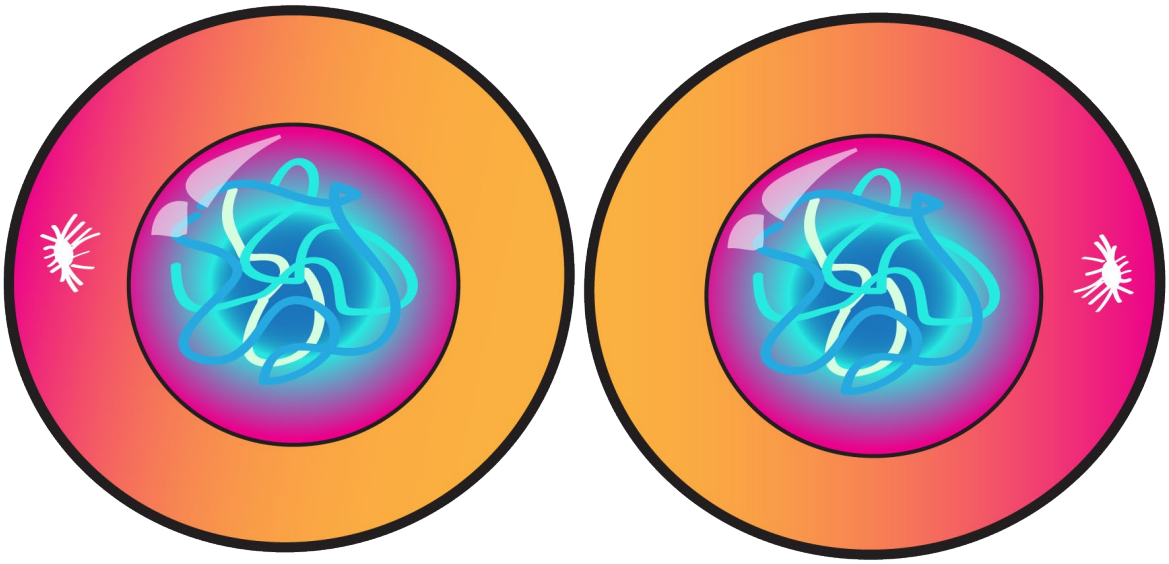
4th phase of mitosis



- chromosomes are at complete opposite ends of cell
- new nuclei form on each of these sides around the chromosomes; chromosomes uncoil
- goal of mitosis → form two identical cells; cells begin to split

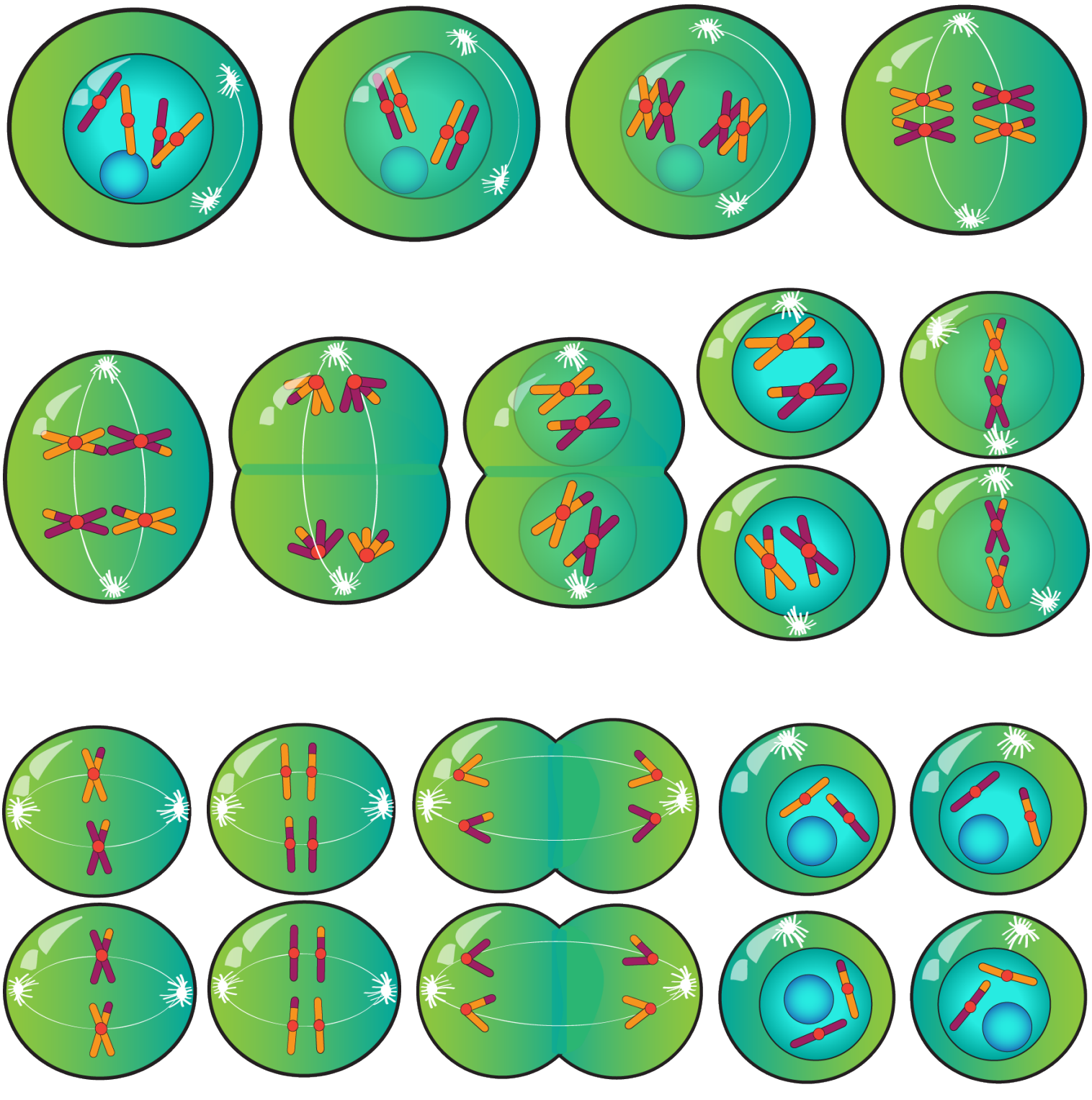
Cytokinesis

two daughter cells formed



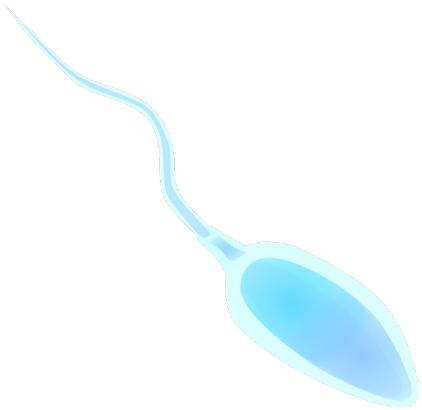
- final separation of the two identical daughter cells
- cells turn into two by splitting the cytoplasm after four mitosis stages
- new cells both contain a new nucleus

Meiosis

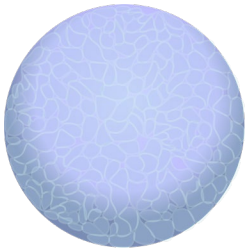


Meiosis

cell division that produces gametes (sex cells)



sperm

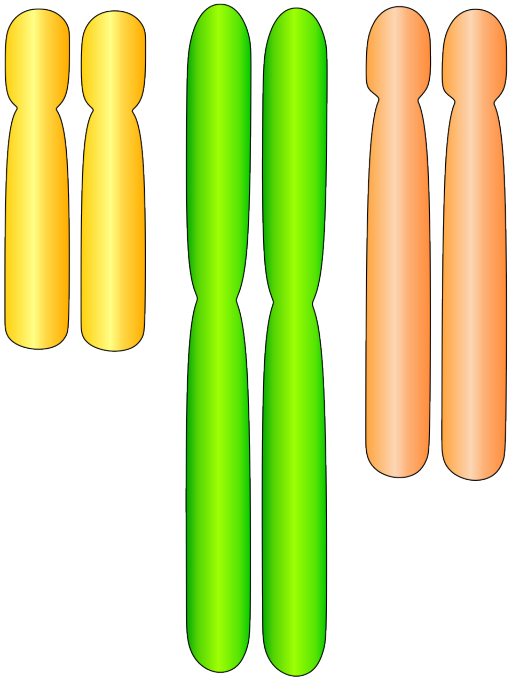


egg

makes 4 non-identical gametes that are important for genetic variety

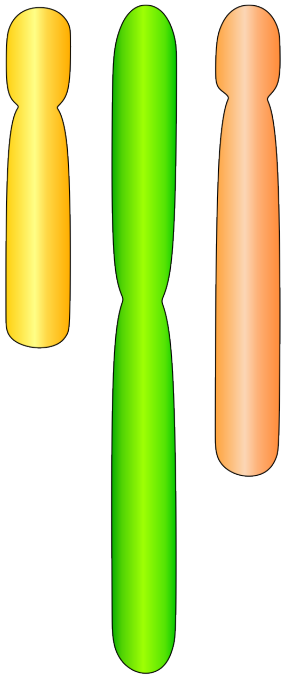
Haploid and Diploid

Diploid (2n)



two sets of chromosomes

Haploid (n)

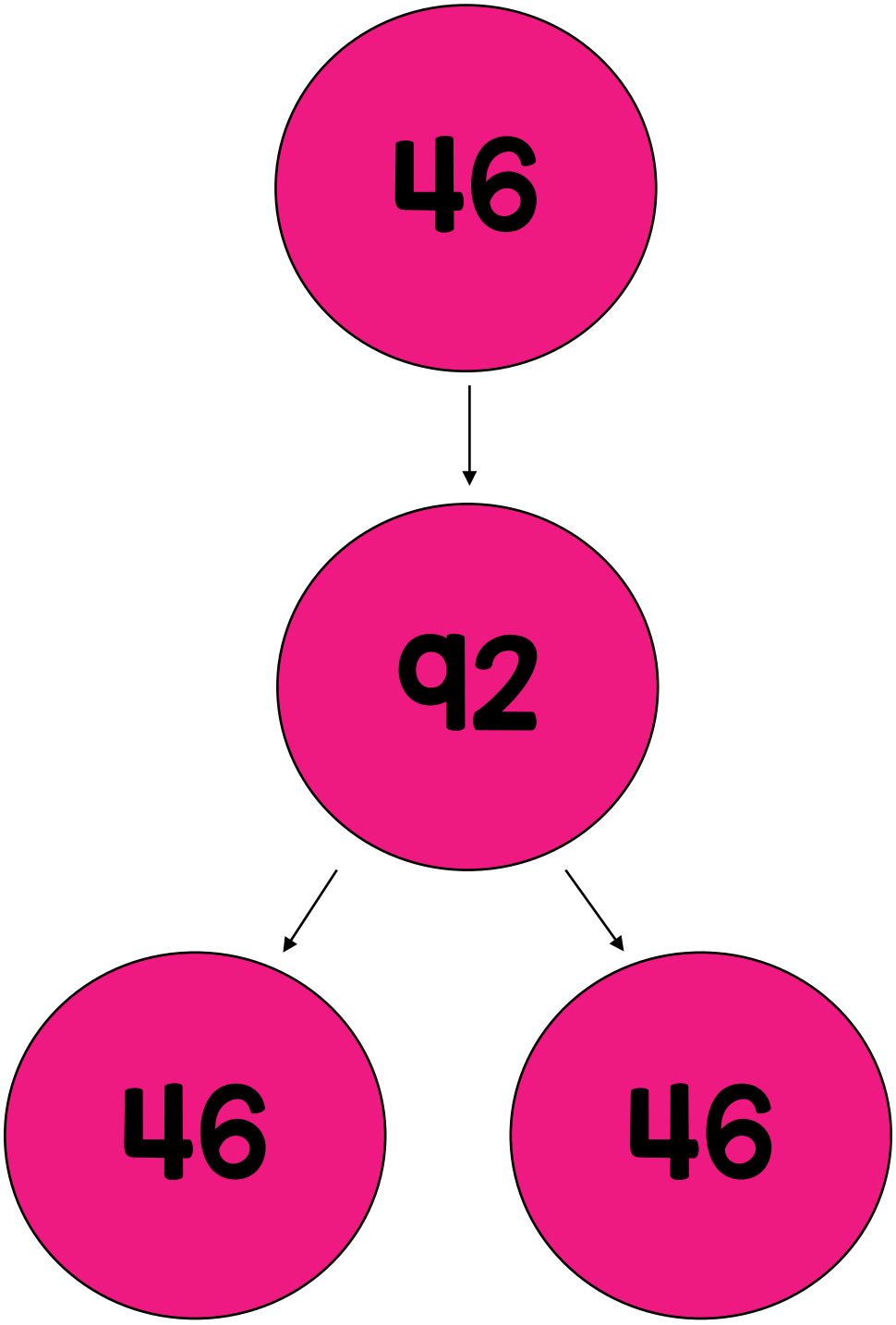


one set of chromosomes

Both mitosis and meiosis begin with a diploid cell (2n). This means that it has two sets of chromosomes.

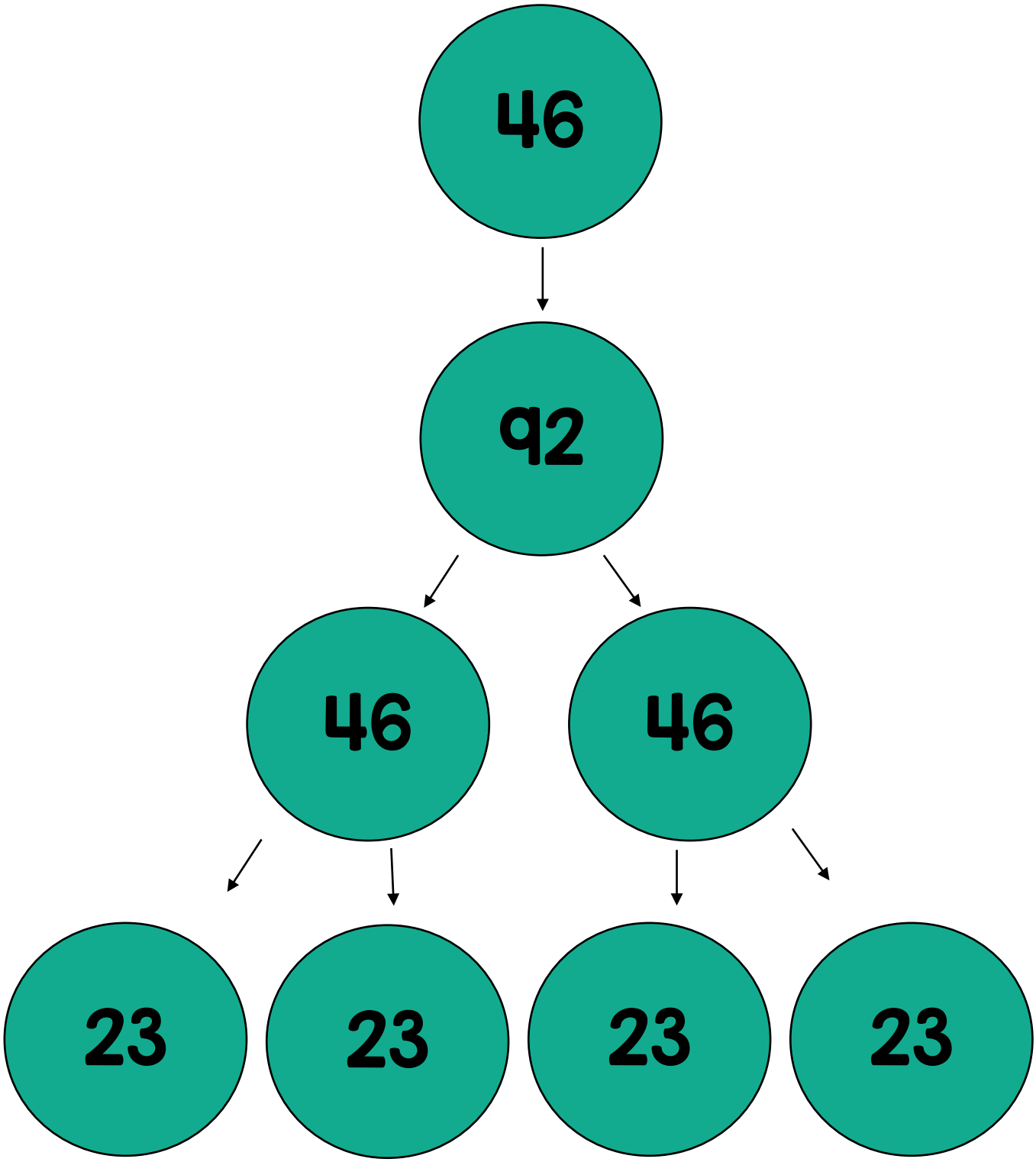
Mitosis

PMAT x 1



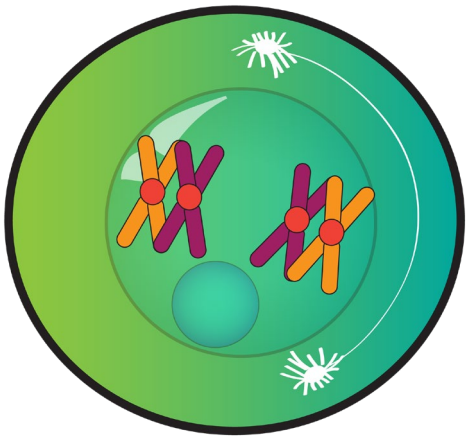
Meiosis

PMAT x 2

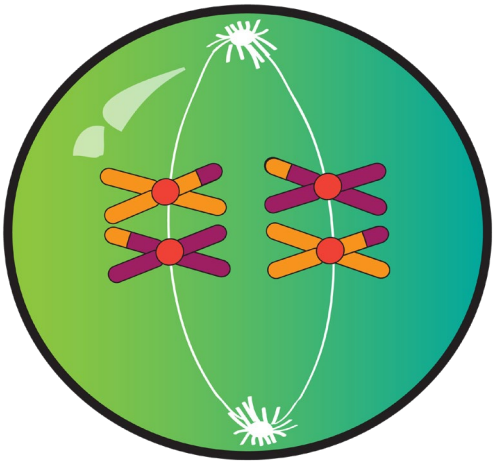


Meiosis I

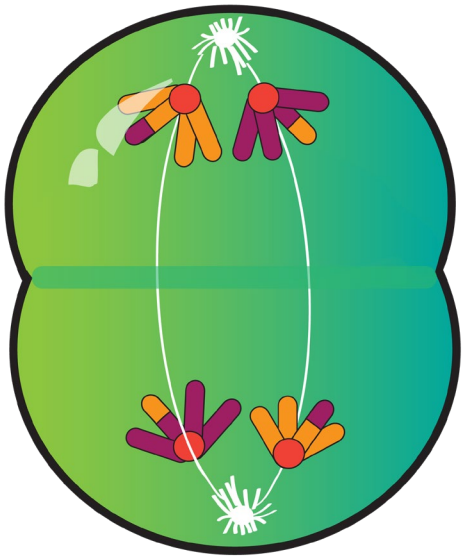
Prophase I



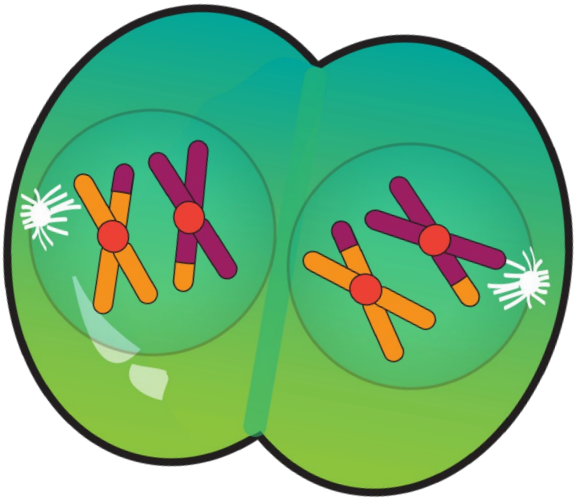
Metaphase I



Anaphase I

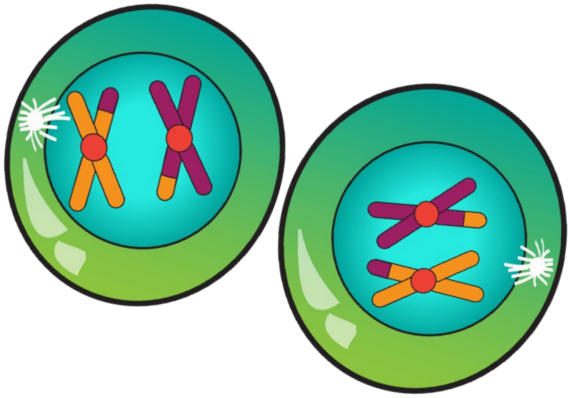


Telophase I and Cytokinesis

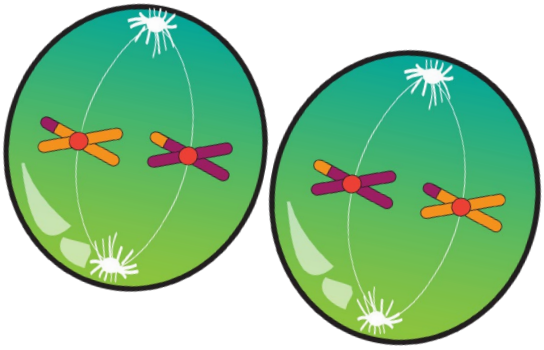


Meiosis II

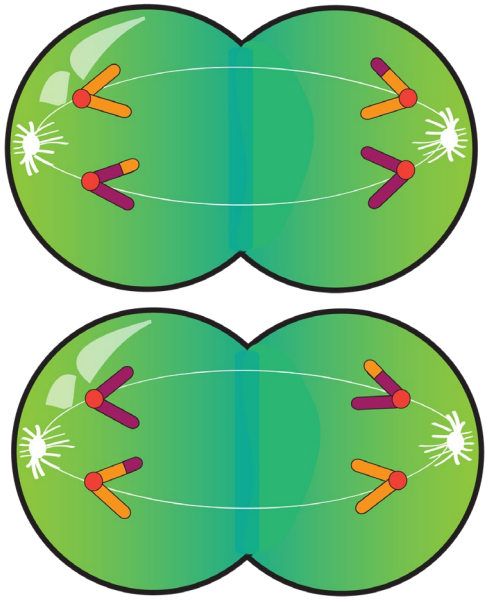
Prophase II



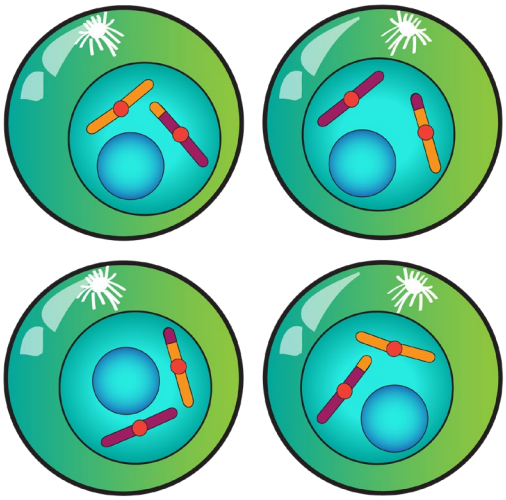
Metaphase II



Anaphase II



Telophase II and Cytokinesis



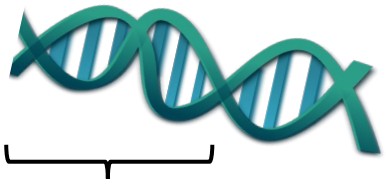
Key Differences

	Mitosis	Meiosis
Types of Cells Produced	makes identical body cells	makes non-identical sex cells (gametes)
Number of Cells Produced	2	4
Function	growth and repair	genetic variety/ reproduction
PMAT	x 1	x 2
Haploid or Diploid?	diploid (2n)	haploid (n)
Chromosome # in Daughter Cells	46	23

Gene

one set of instructions for an inherited trait

Example:
genes that code for your eye color



gene

Allele

different forms of a gene

Example:
dominant allele for brown eye color

Example

Bb

brown

blue

Steps to Creating a Punnett Square

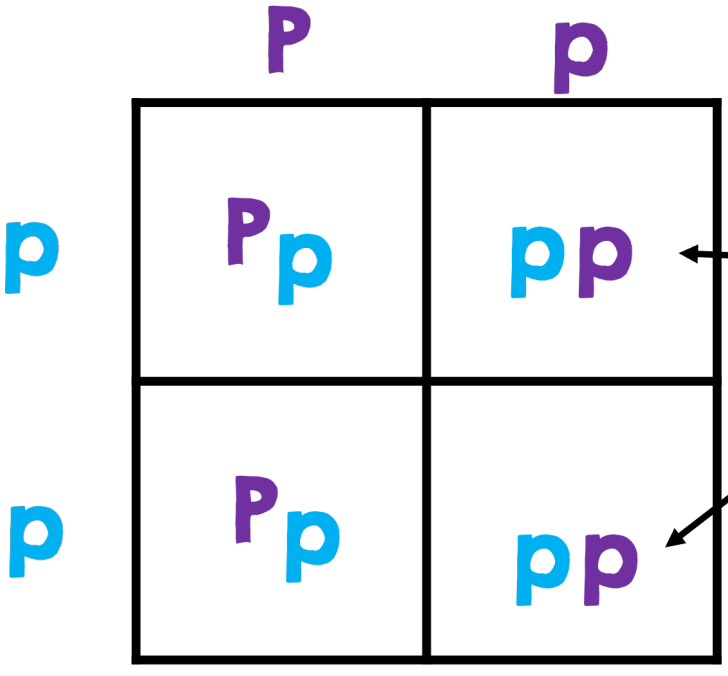
1. Determine the genotypes of the parent organisms and write down the "cross".
2. Draw a 2 x 2 square.
3. "Split" the genotypes, and place one on the top of the square and the other on the left of the square.
4. Boxes will inherit the letter from their row and column.
5. Interpret the Punnett square → each square is worth 25%.

Punnett Square Example

P: purple flower p: white flower

Cross Pp x pp

What is the probability the offspring will have white flowers?

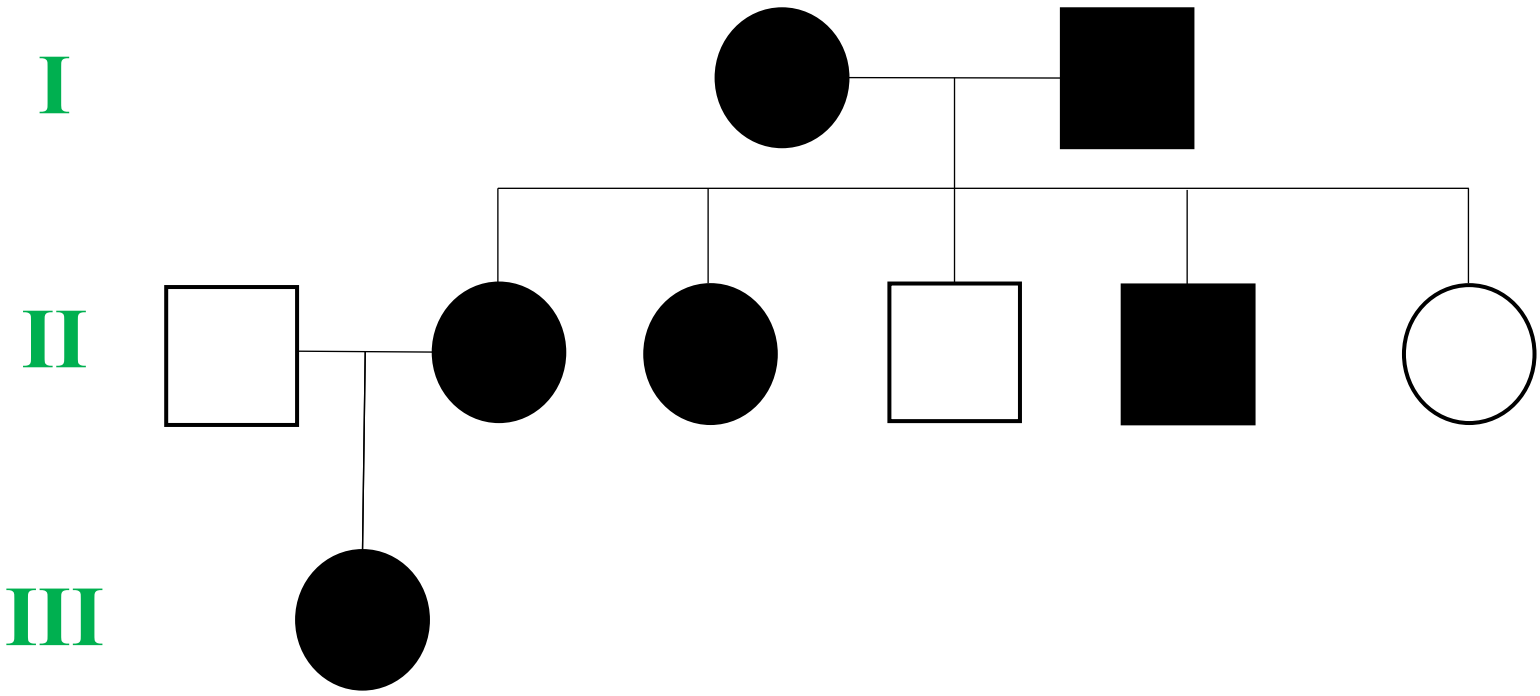


These two genotypes represent white flowers.
25% + 25% = 50%

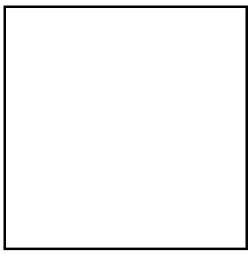
50% of the offspring will have white flowers.

Pedigree Chart

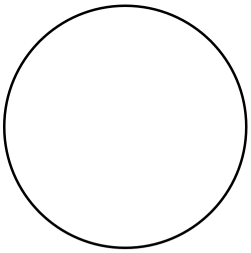
uses symbols to represent people to show the inheritance of a single trait over generations



Pedigree Chart Symbols

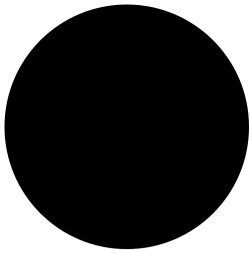


unaffected male



unaffected female

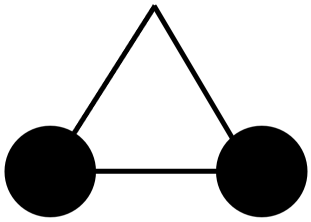
affected male



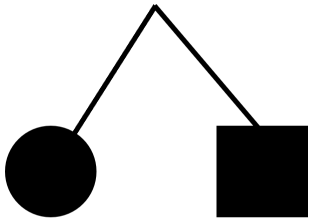
affected female

marriage line/ reproduction

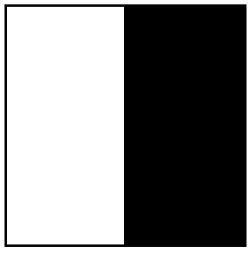
connects parents to children



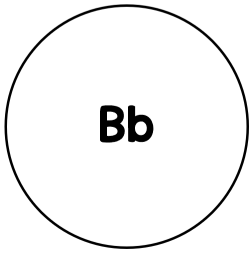
represents identical twins



represents non-identical twins



male that carries the trait



heterozygous female

II

represents 2nd generation

I2

represents 1st generation, 2nd individual

Inherited Traits

are passed from parents to offspring by genetic transmission

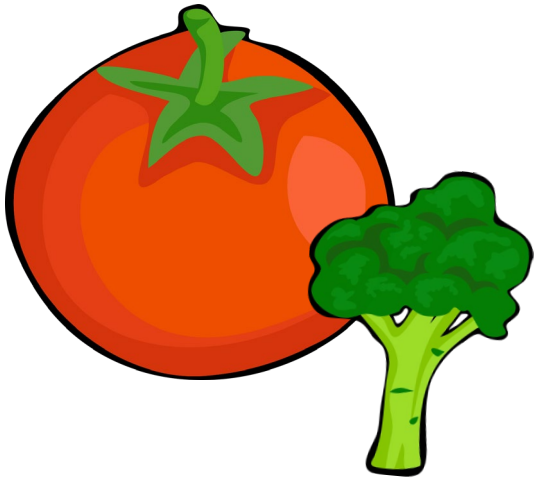
Inherited traits are determined before birth and cannot be changed permanently.

Some examples include: eye color, skin color, dimples, and toe length.

Learned Traits

People receive learned traits, also called acquired traits, through choices and their interactions with the environment.

Some examples include: dislikes of certain foods, mannerisms, and speech.



Mutations

a change in a living things DNA

- gene mutations: change in one or more DNA bases
- chromosome mutations: change in the structure or number of chromosomes