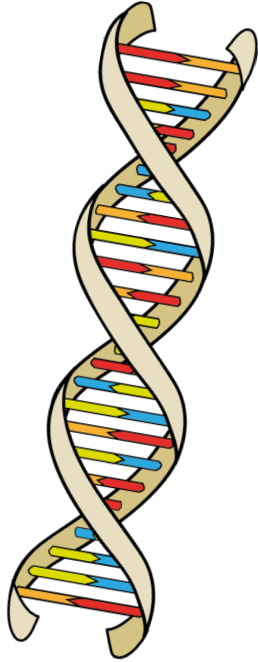


**Heredity**  
the passing  
of traits  
from parents  
to offspring



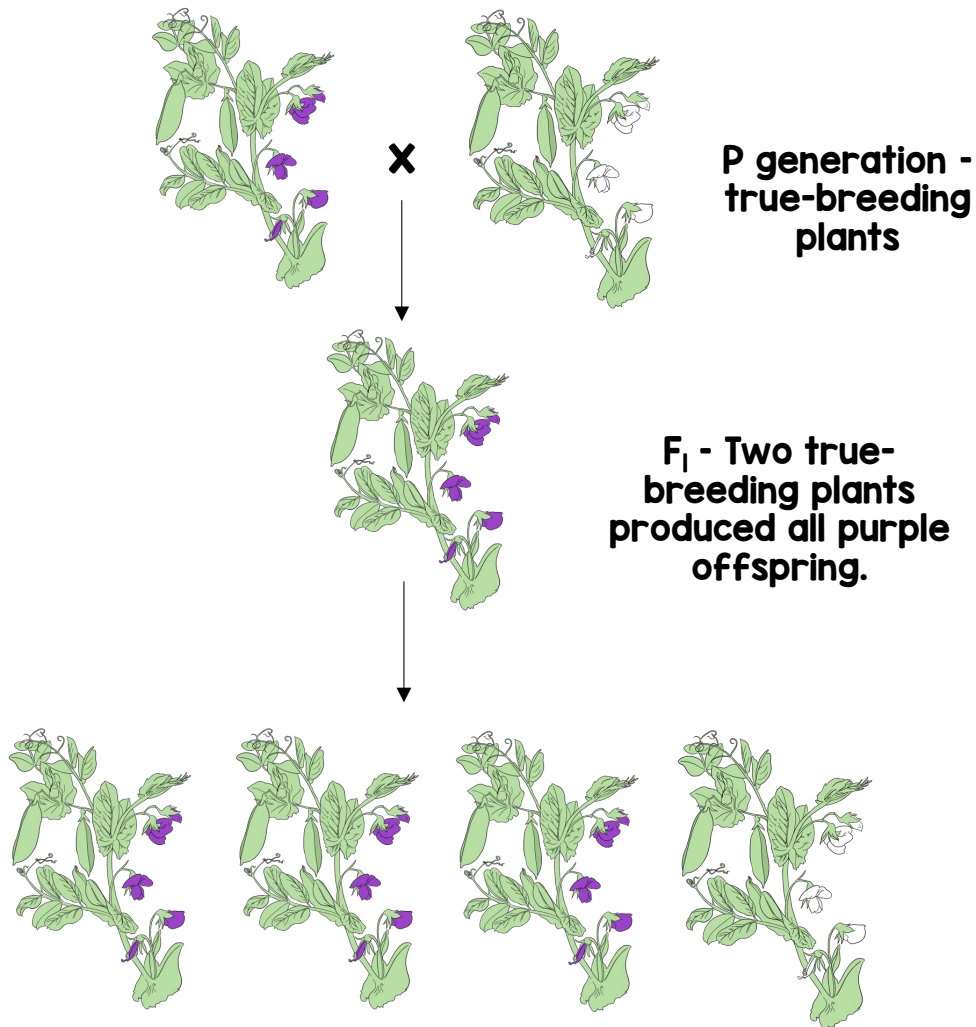
**Genetics**  
the study of  
how traits are  
passed from  
parents to  
offspring

# 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 20<sup>th</sup> century

# Mendel's Experiments



P generation - true-breeding plants

F<sub>1</sub> - Two true-breeding plants produced all purple offspring.

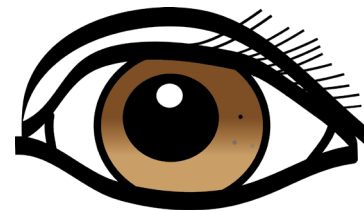
F<sub>2</sub> - Two hybrid plants self-fertilized and produced offspring that were 75% purple and 25% white.

## 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**

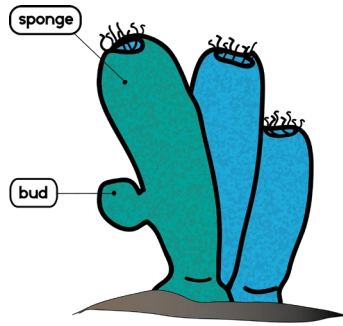
# Phenotype

observable characteristics



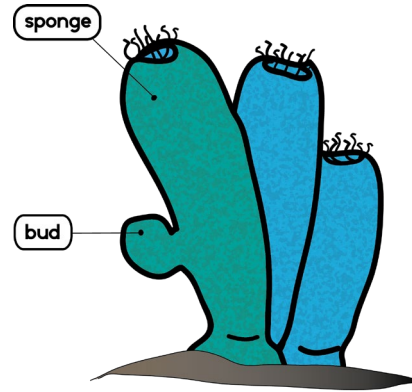
# Asexual Reproduction

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



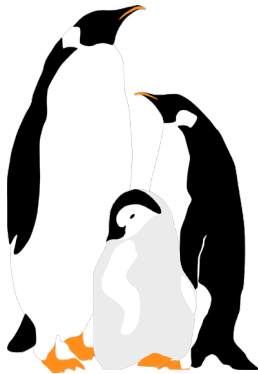
# Asexual Reproduction

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.



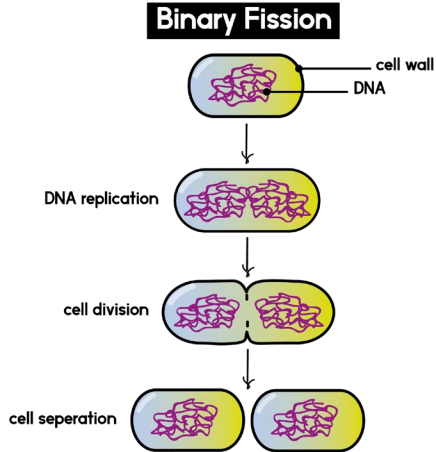
## Advantages:

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

## Disadvantages:

- no genetic diversity

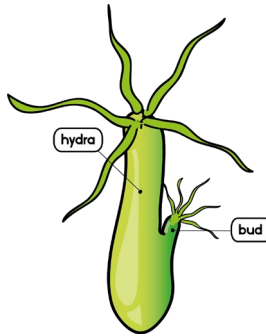
# Binary Fission



one cell divides into two equal parts

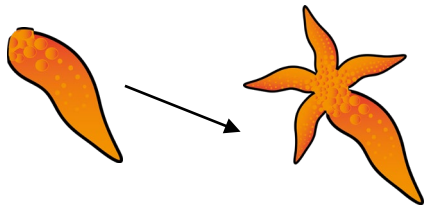
# Budding

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

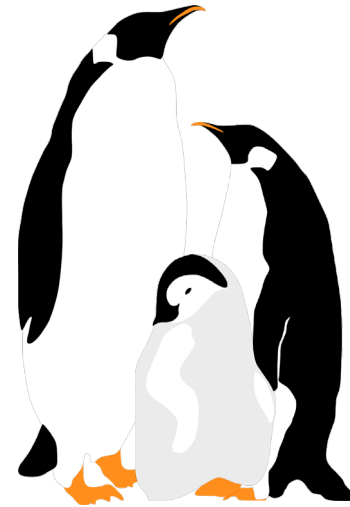


# Fragmentation

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.**

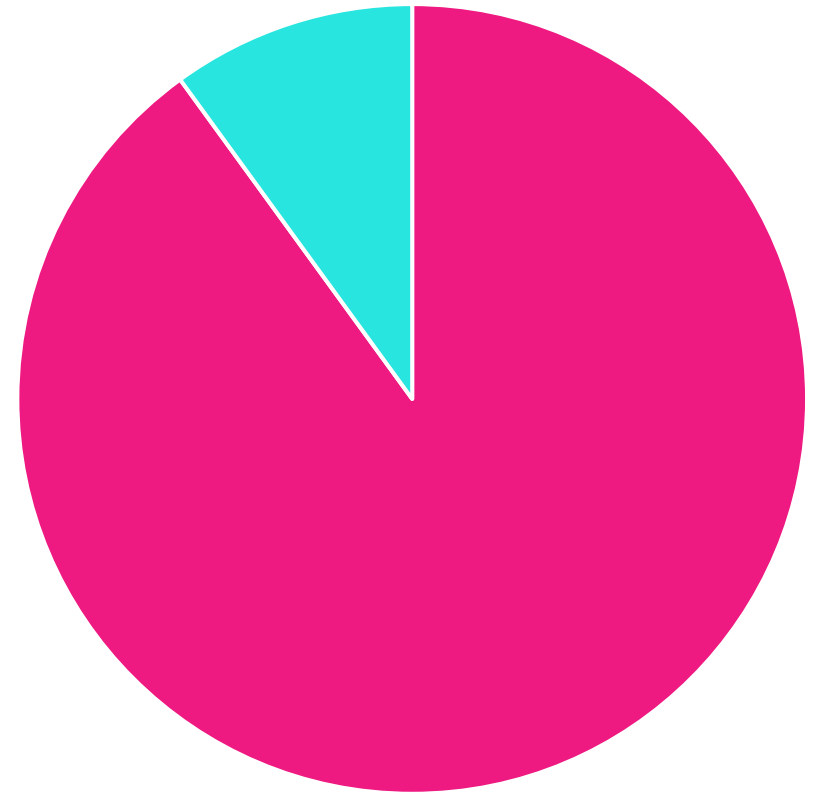


The fertilized egg is called a **zygote (46 chromosomes).**



Through mitosis, the offspring continues to grow.

## The Cell Cycle



■ Interphase    ■ Mitosis and Cytokinesis

# Major Stages of the Cell Cycle

growth, replication,  
and division of a cell

## 1. Interphase

## 2. Mitotic Phase

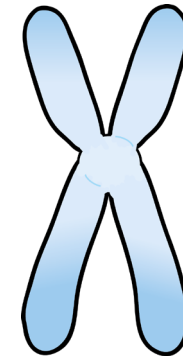
(Mitosis and  
Cytokinesis)



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



DNA

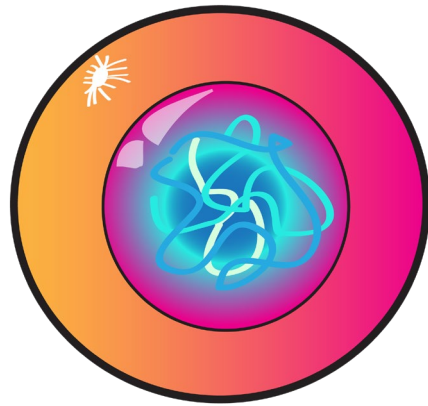


chromosome

Human body cells have  
**46 chromosomes**  
(23 pairs).

# Interphase

growth, DNA replication,  
cell functions

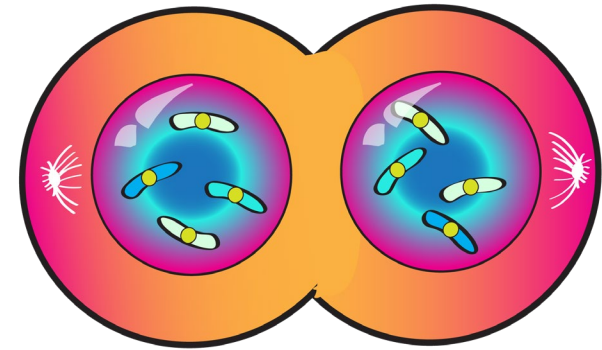


- during cell cycle → cell is usually in the interphase stage

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

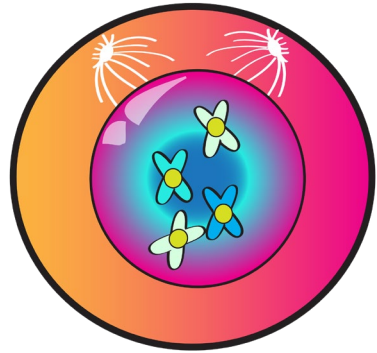
# Mitosis

repair and growth

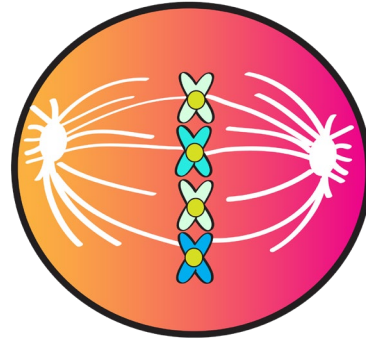


- makes body cells
- makes identical cells
- stages: prophase, metaphase, anaphase, telophase
- One cell becomes 2 daughter cells.

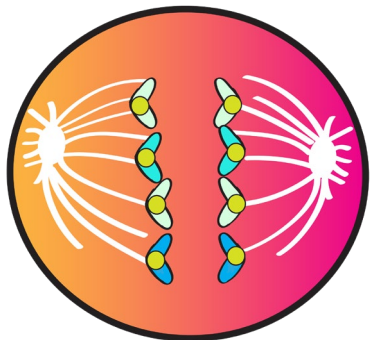
## Prophase



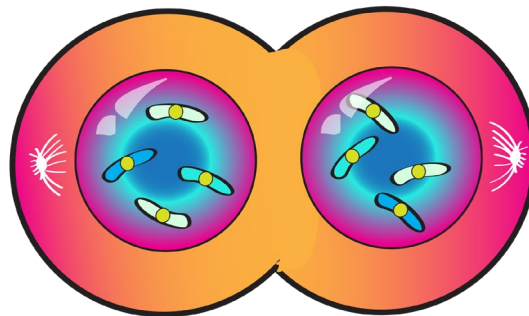
## Metaphase



## Anaphase

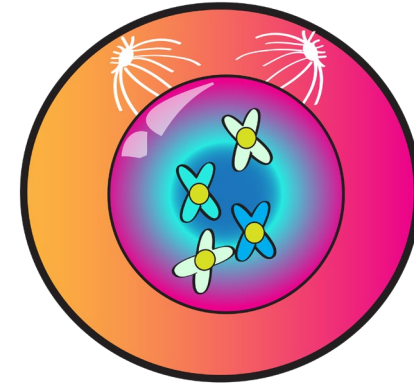


## Telophase



# Prophase

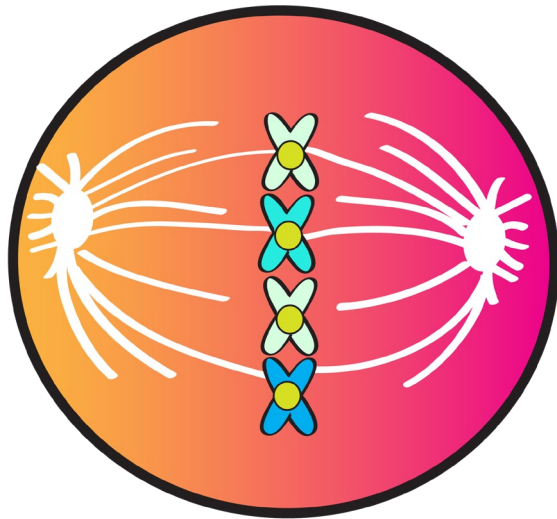
## 1<sup>st</sup> phase of mitosis



- 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

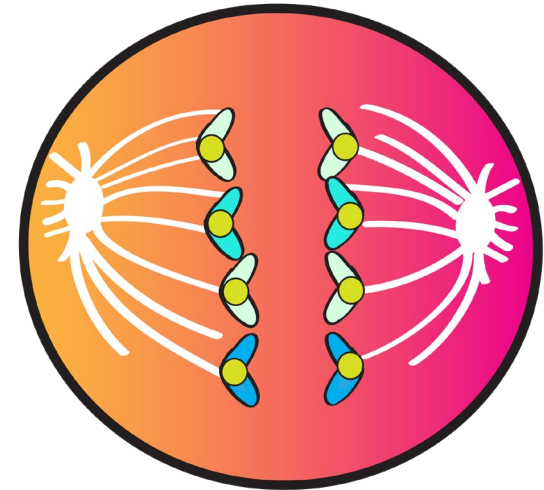
2<sup>nd</sup> phase of mitosis



- 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

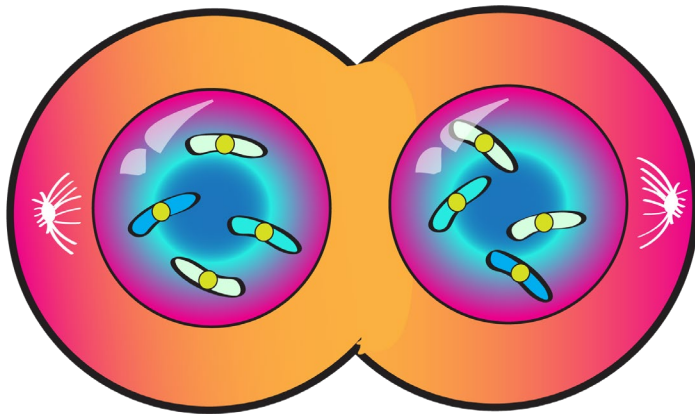
3<sup>rd</sup> phase of mitosis



- 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

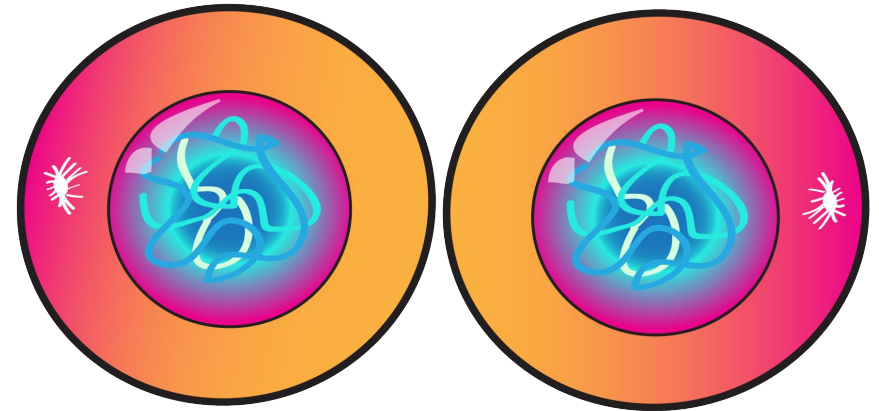
4<sup>th</sup> phase of mitosis



- **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**

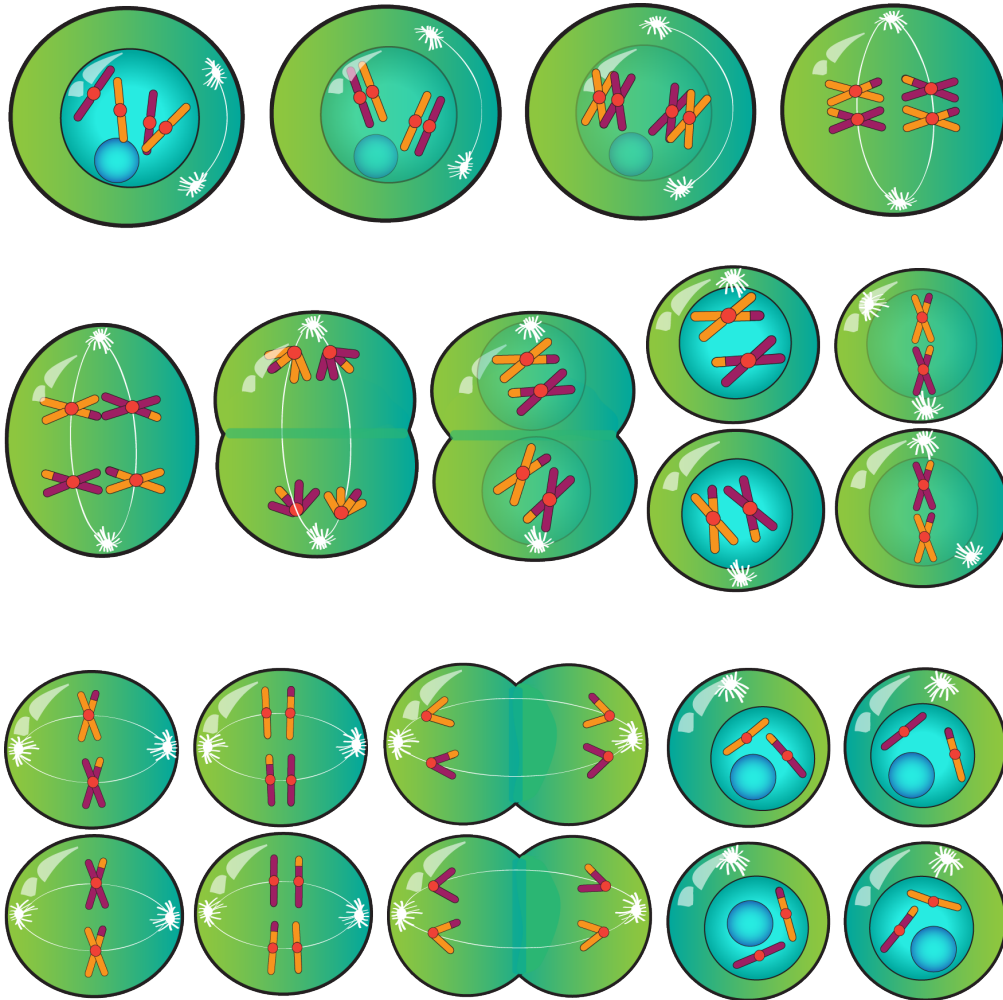
# Cytokinesis

two daughter cells formed



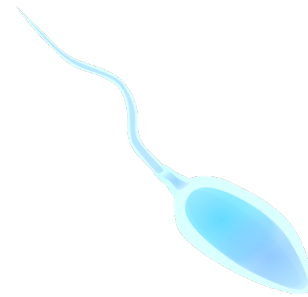
- **final separation of the two identical daughter cells**
- **cells turn into two by splitting the cytoplasm after four mitosis stages**
- **new cells both contain a new nucleus**

# Meiosis

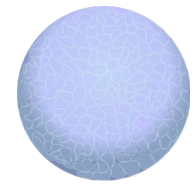


# Meiosis

cell division that  
produces gametes  
(sex cells)



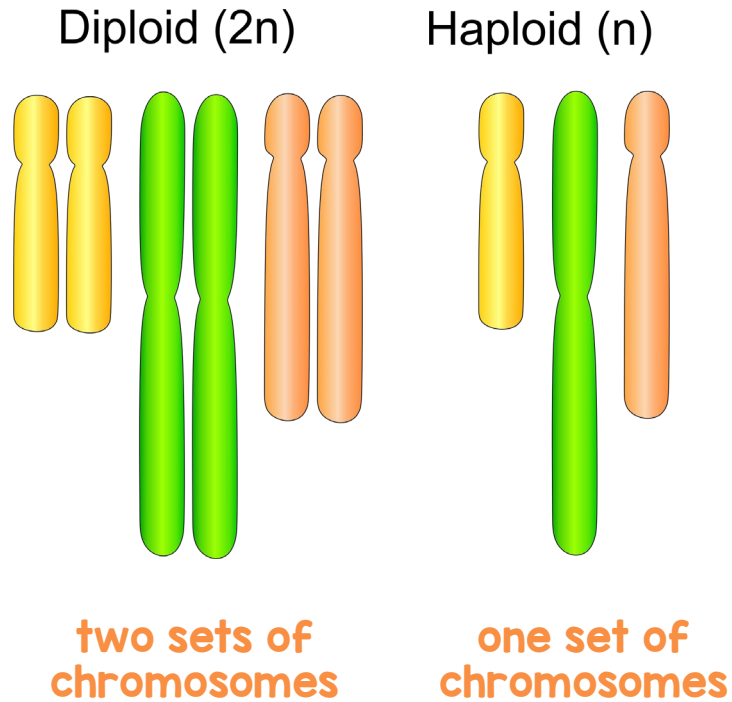
sperm



egg

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

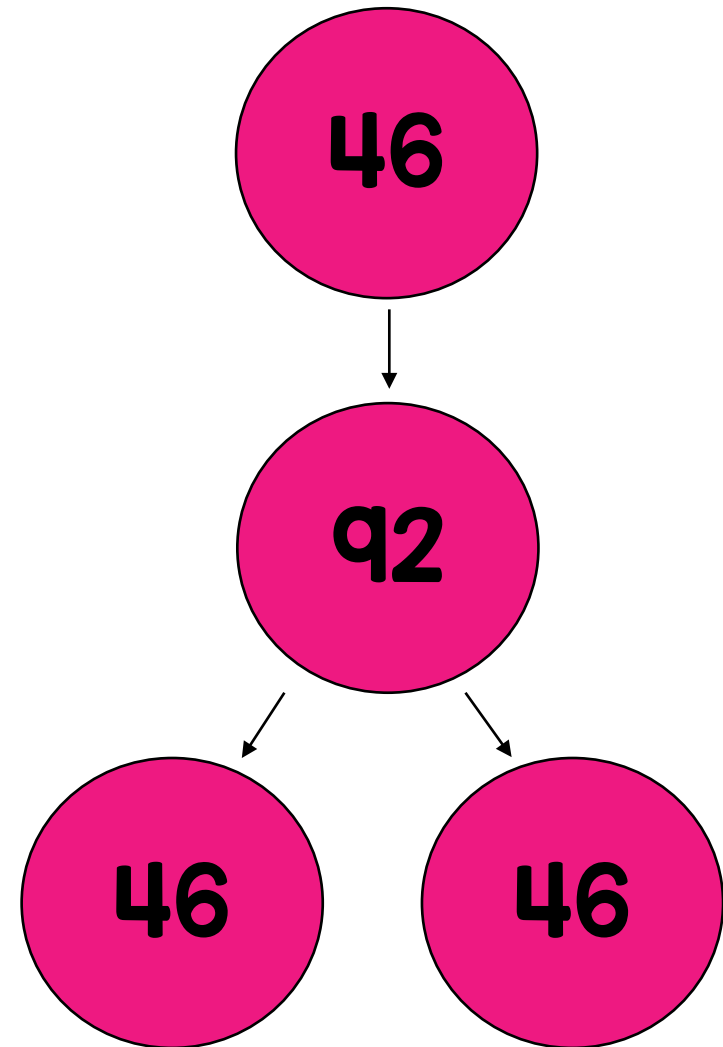
# Haploid and Diploid



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

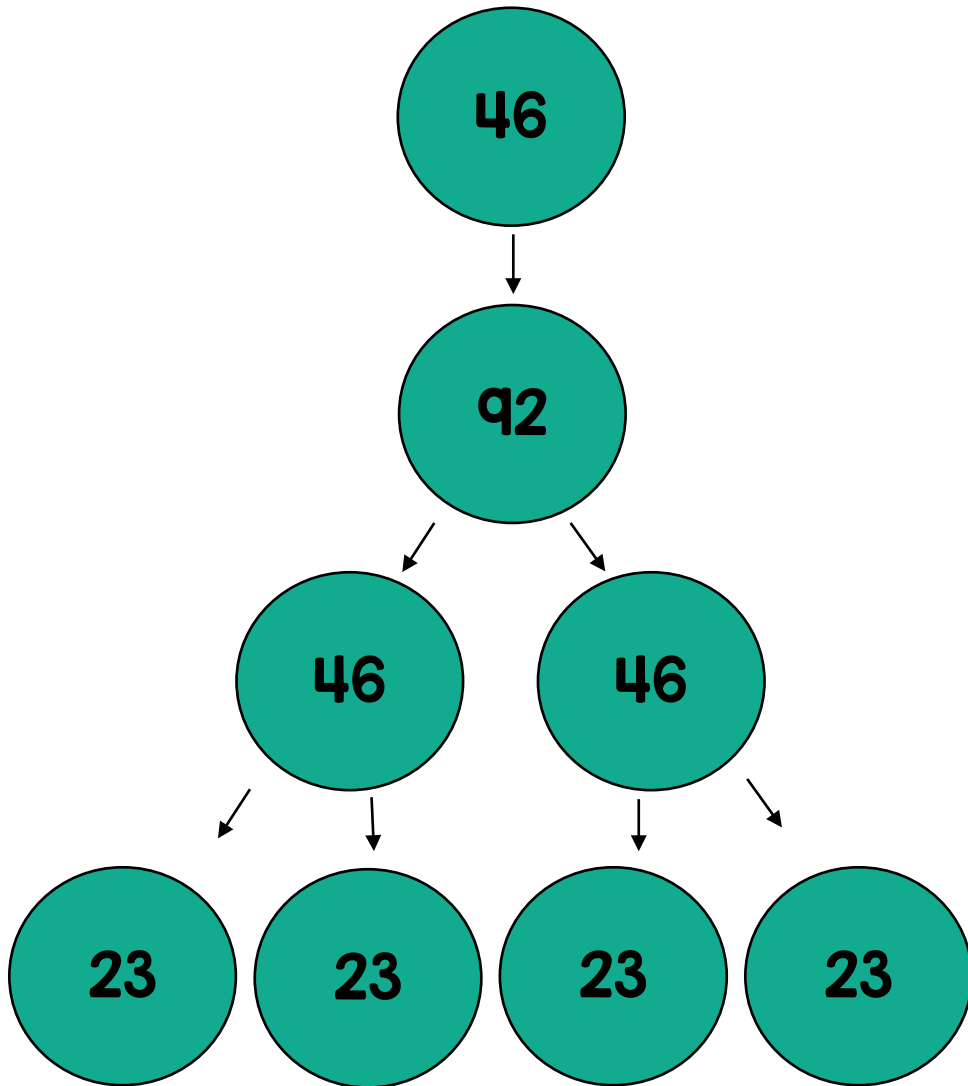
# Mitosis

PMAT x 1



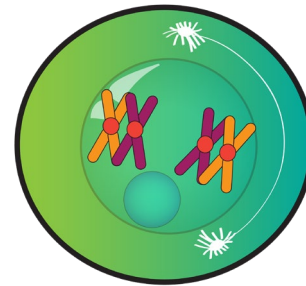
# Meiosis

PMAT x 2

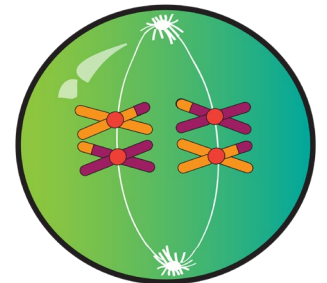


# Meiosis I

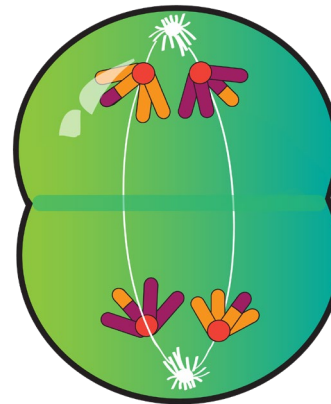
Prophase I



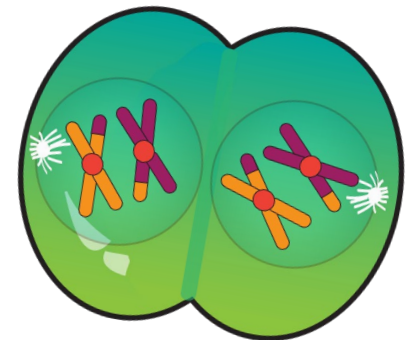
Metaphase I



Anaphase I

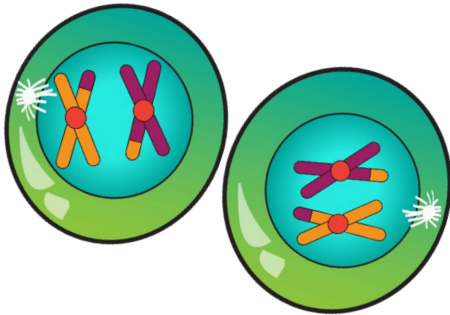


Telophase I and Cytokinesis

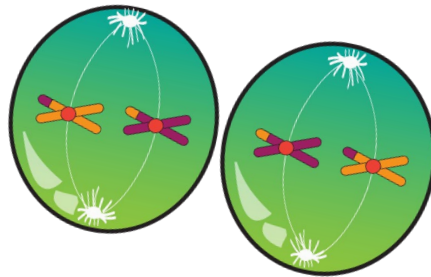


# Meiosis II

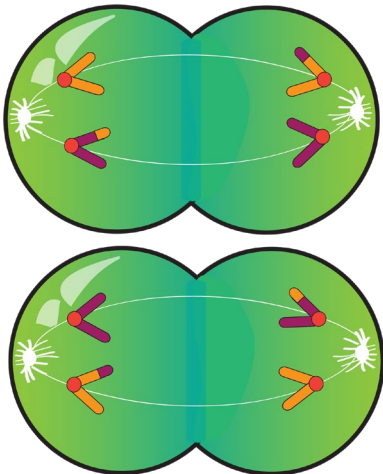
## Prophase II



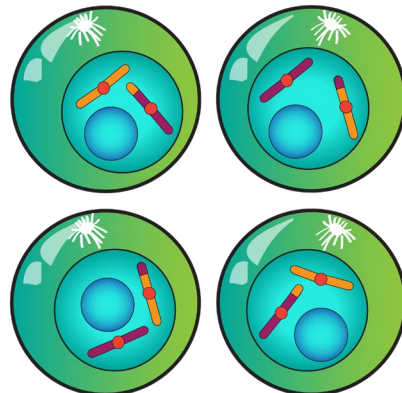
## Metaphase II



## Anaphase II



## Telophase II and Cytokinesis



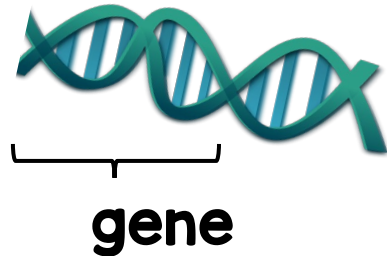
# Key Differences

	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

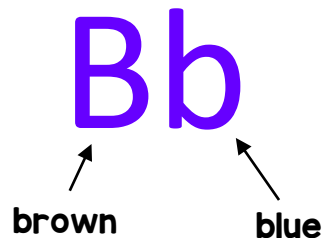


# Allele

different forms of a gene

Example:  
dominant  
allele for  
brown eye  
color

Example



# Steps to Creating a Punnett Square

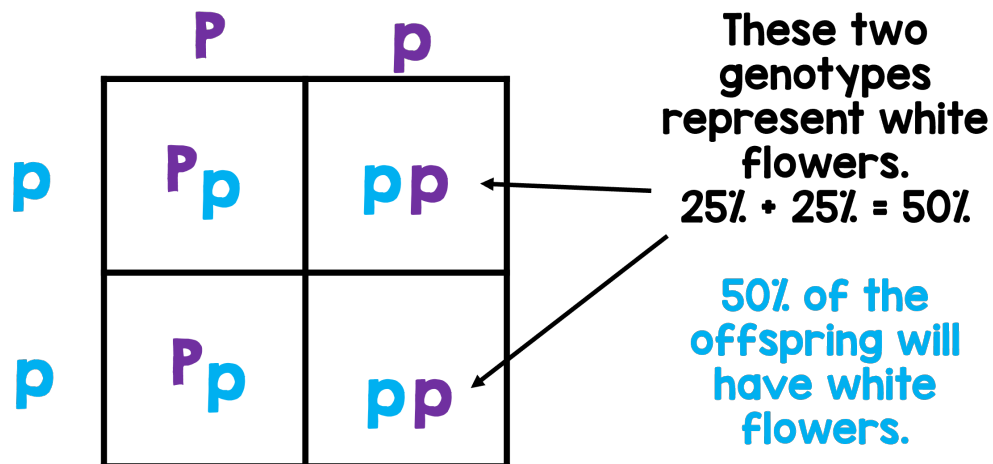
1. Determine the **genotypes of the parent organisms** and write down the “cross”.
2. Draw a **2 x 2 square**.
3. “**Split**” the **genotypes**, and place one on the top of the square and the other on the left of the square.
4. Boxes will **inherit the letter** from their row and column.
5. Interpret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

# Punnett Square Example

P: purple flower p: white flower

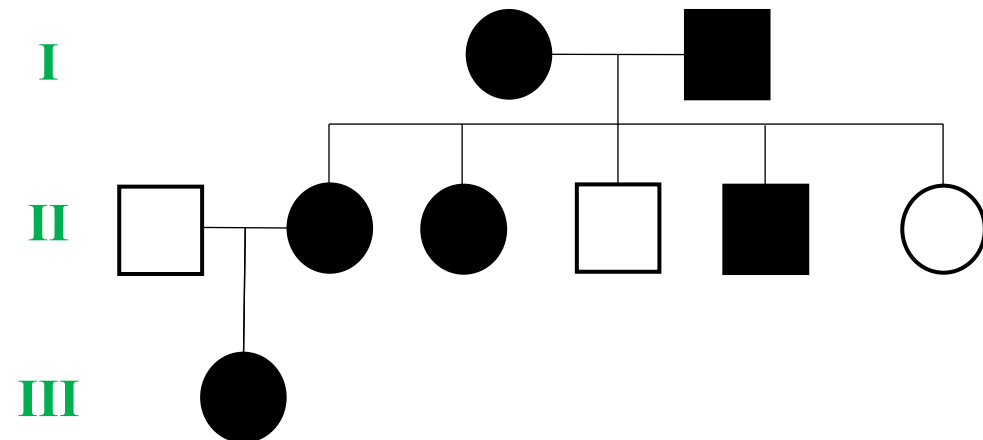
Cross Pp x pp

What is the probability the offspring will have white flowers?



# Pedigree Chart

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



# Pedigree Chart Symbols

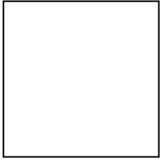
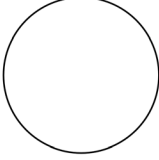
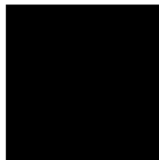
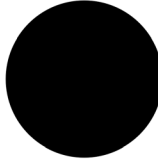

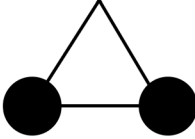
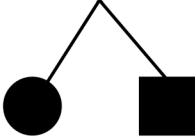
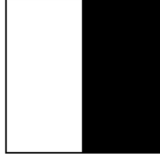
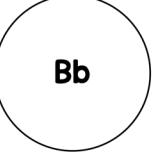
# Inherited Traits

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.



			
unaffected male	unaffected female	affected male	affected female
			
marriage line/ reproduction	connects parents to children	represents identical twins	represents non-identical twins
		<b>II</b>	<b>I2</b>
male that carries the trait	heterozygous female	represents 2 <sup>nd</sup> generation	represents 1 <sup>st</sup> generation, 2 <sup>nd</sup> individual

# 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

