GENETICS

Video#1

Video #2

** Watch both Videos before starting these notes

GENES PASS ON INHERITED TRAITS FROM PARENT TO OFFSPRING

- **Genetics:** field of biology that studies heredity, or the passing of traits from parents to offspring
- **Trait:** an inherited characteristic, such as eye colour or hair colour


Tongue Roller

Non-roller


Widow's Peak


Attached earlobes (left)


Hitch-hiker's thumb


Mid-digital hair

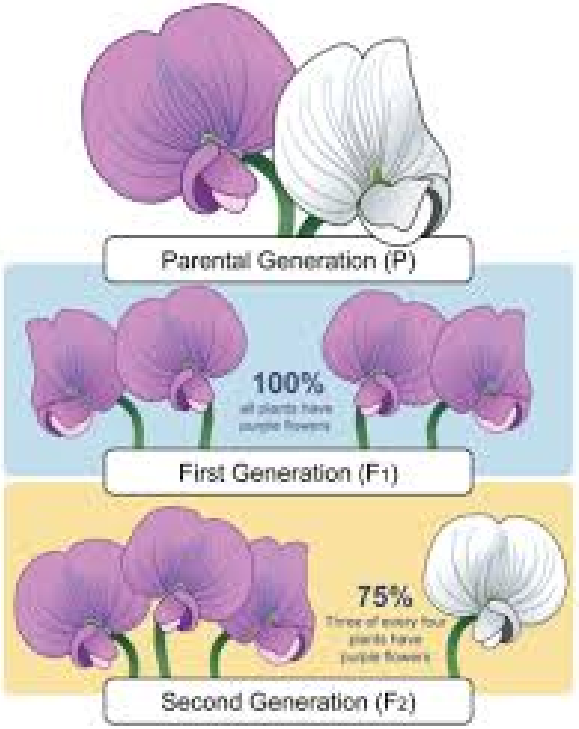

Dimple in chin


Freckles


Morton's Toe

FIRST MODERN EXPERIMENTS IN GENETICS (VIDEO)

- **Gregor Mendel** discovered how traits are inherited by experimenting with pea plants.



FIRST MODERN EXPERIMENTS

- Pea plants reproduce by sexual reproduction by self pollination
  - Self pollination occurs when the male gamete within a flower combines with the female gamete in the same flower
  - Cross pollination occurs when the male gamete of one flower is combined with the female gamete of a different flower.

- Mendel deliberately cross pollinated plants and was able to control which plants with certain traits were producing offspring.
- Through this research he formed hypotheses about how traits were inherited and became the founder of modern genetics

MENDEL'S EXPERIMENTS

- Mendel used *true-breeding* pea plants that produce offspring with only one form of a trait.
- When a purple pea plant and a white pea plant were combined, they produced new plants called *offspring* in the *first generation* (F_1).
- All F_1 *generation plants were purple*

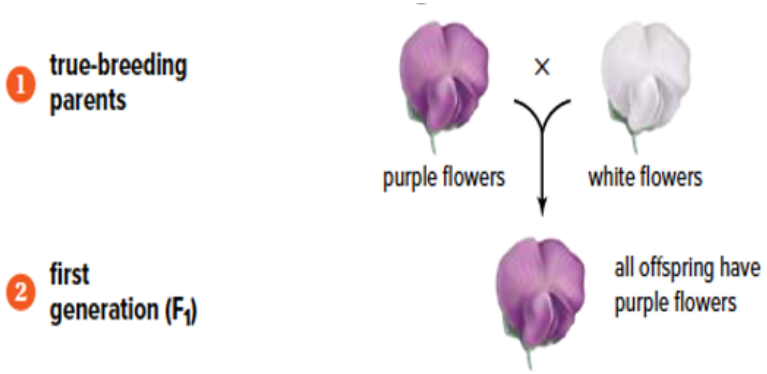


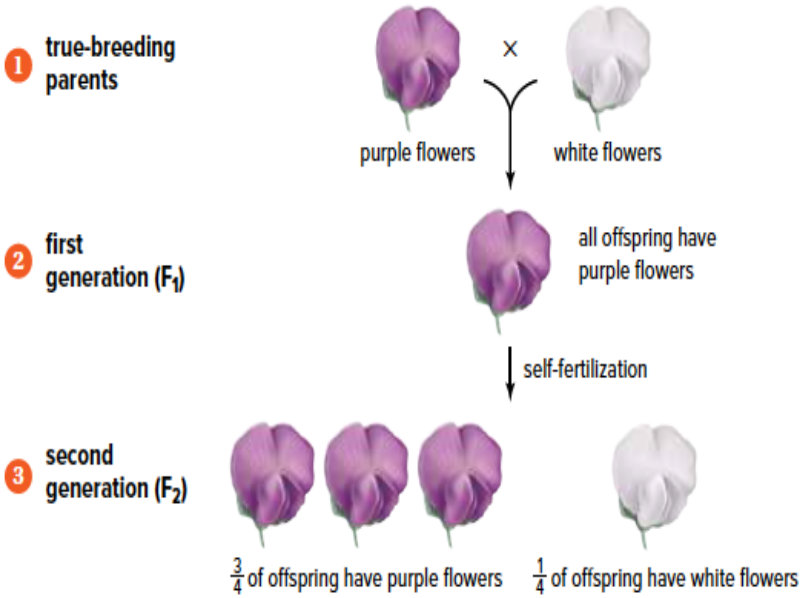
Figure 1.10: These are the results of Mendel's cross involving true-breeding pea plants with purple flowers and true-breeding pea plants with white flowers.

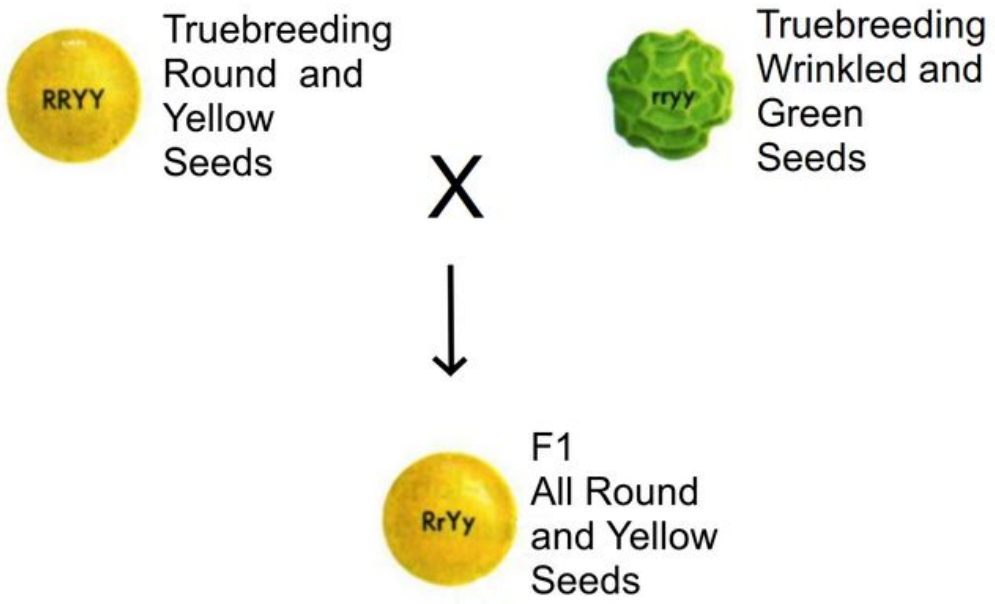
WHY WERE ALL THE FLOWERS PURPLE?

- Mendel wanted to know what happened to the white flower trait that seemed to have disappeared.
- Why were there no white flowers in the F_1 generation?
  - Brainstorm some ideas of why you think this occurred.

MENDEL'S EXPERIMENTS

- Mendel allowed the F_1 generation to self fertilize
- In the *second generation* (F_2) Mendel observed that the white flower trait reappeared.
- Each time the experiment was conducted the F_2 generation had a ratio of approx. 3:1 purple to white flowers



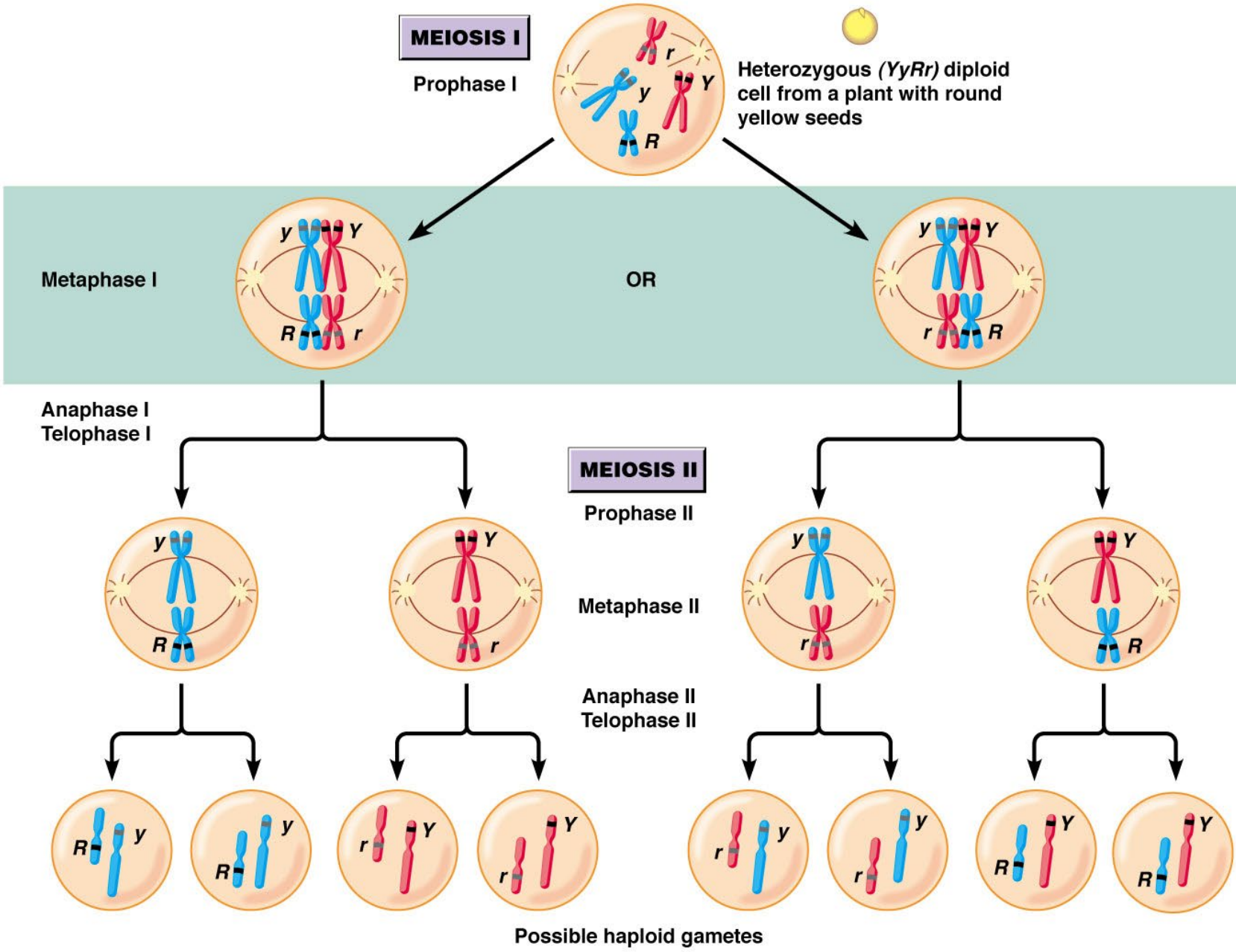


- Mendel repeated experiments with other traits such as seed colour, seed shape and stem length
- Each time one trait disappeared in the first generation and reappeared in the second

- Based on his observations, Mendel proposed:
  - Each plant has two factors for a trait.
  - Each parent gives one factor for each trait.
  - One factor dominates over the other if present.
  - The "factors" Mendel referred to in his conclusions are what we now call alleles.

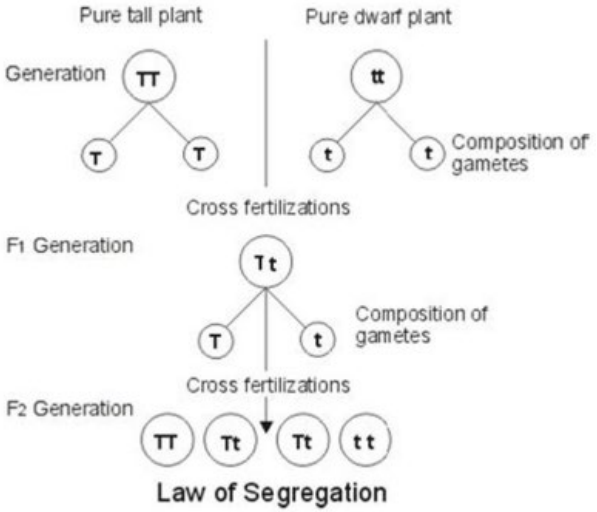
HOMOLOGOUS CHROMOSOMES AND GAMETES

- Chromosomes may carry different alleles.
- During gamete formation, pairs of homologous chromosomes separate.
- Each gamete receives one member of each pair, so it receives only one allele of each pair.
- During fertilization when the male and female gametes meet, homologous chromosomes and alleles are paired again.



THE LAW OF SEGREGATION

- **Law of segregation:** states that alleles for a trait separate during meiosis
- Each gamete carries one allele for each trait.
- During fertilization, each gamete contributes an allele for each trait.



DOMINANT AND RECESSIVE ALLELES

- Alleles that are **dominant** will always be expressed if present.
- Alleles that are **recessive** will be expressed only if there are two recessive alleles.
- To track alleles from generation to generation, geneticists have devised a system to represent alleles.
  - Dominant alleles are represented with a capital letter.
  - Recessive alleles are represented with a lower-case letter.

- Purple flower colour is dominant so it is assigned "B"
- White flower colour is recessive so it is assigned "b"
- Purple = *BB* or *Bb*
- White = *bb*

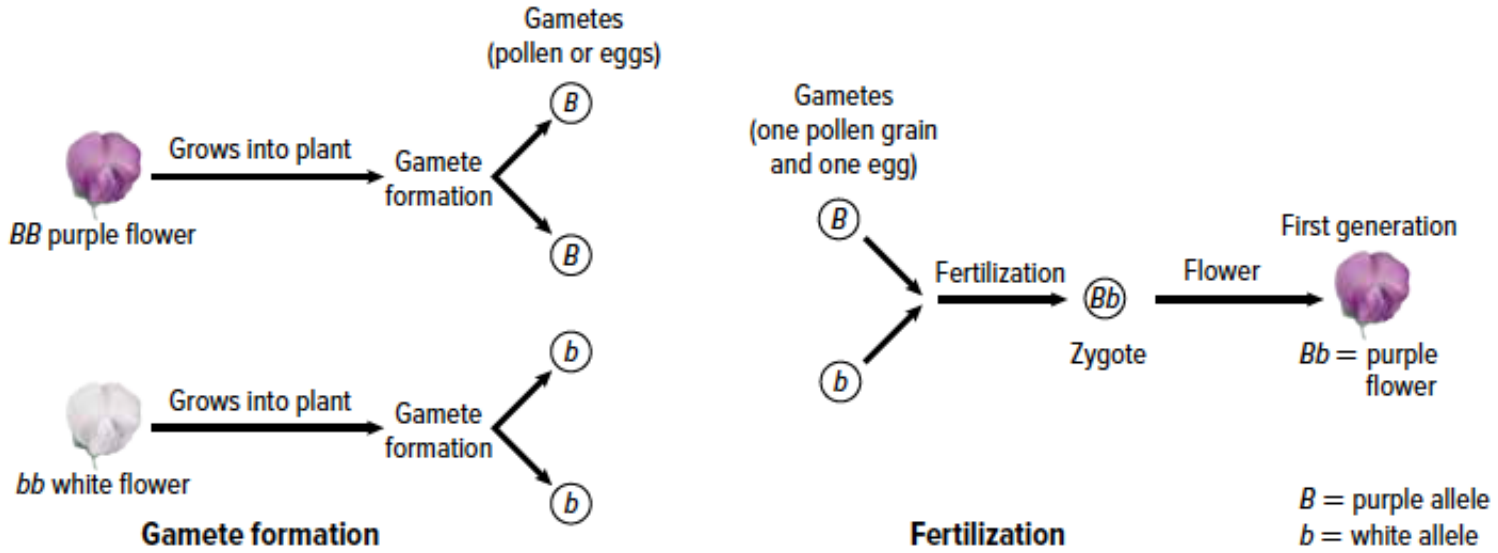
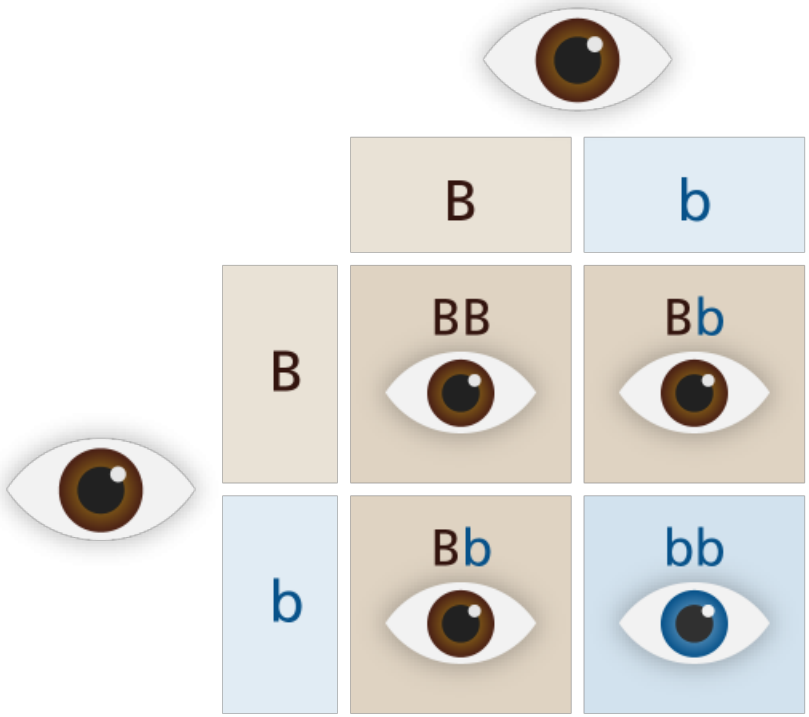
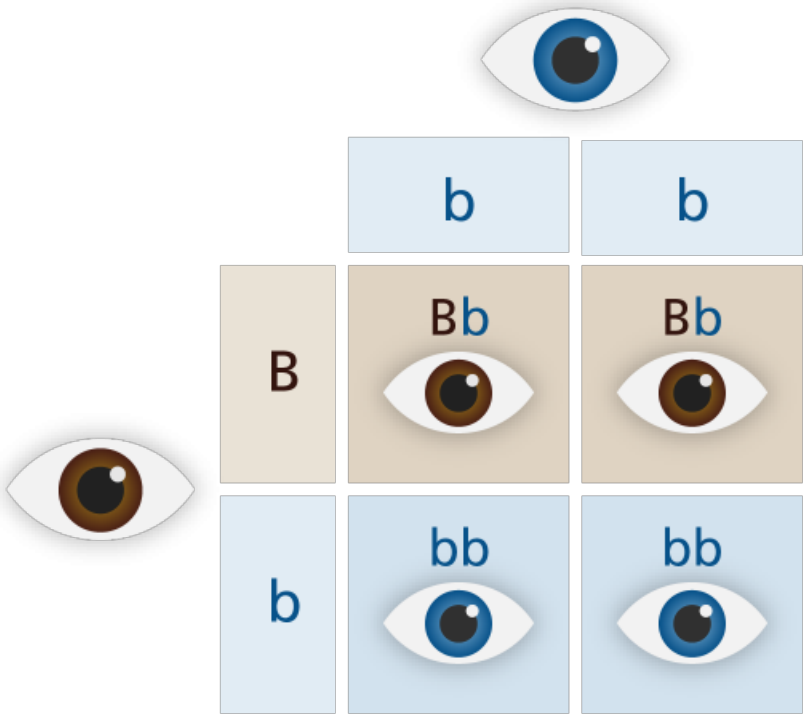


Figure 1.11: These are the results of Mendel's cross involving true-breeding pea plants with purple flowers and pea plants with white flowers.





B – dominant brown eye allele

b – recessive blue eye allele

BB brown eyes

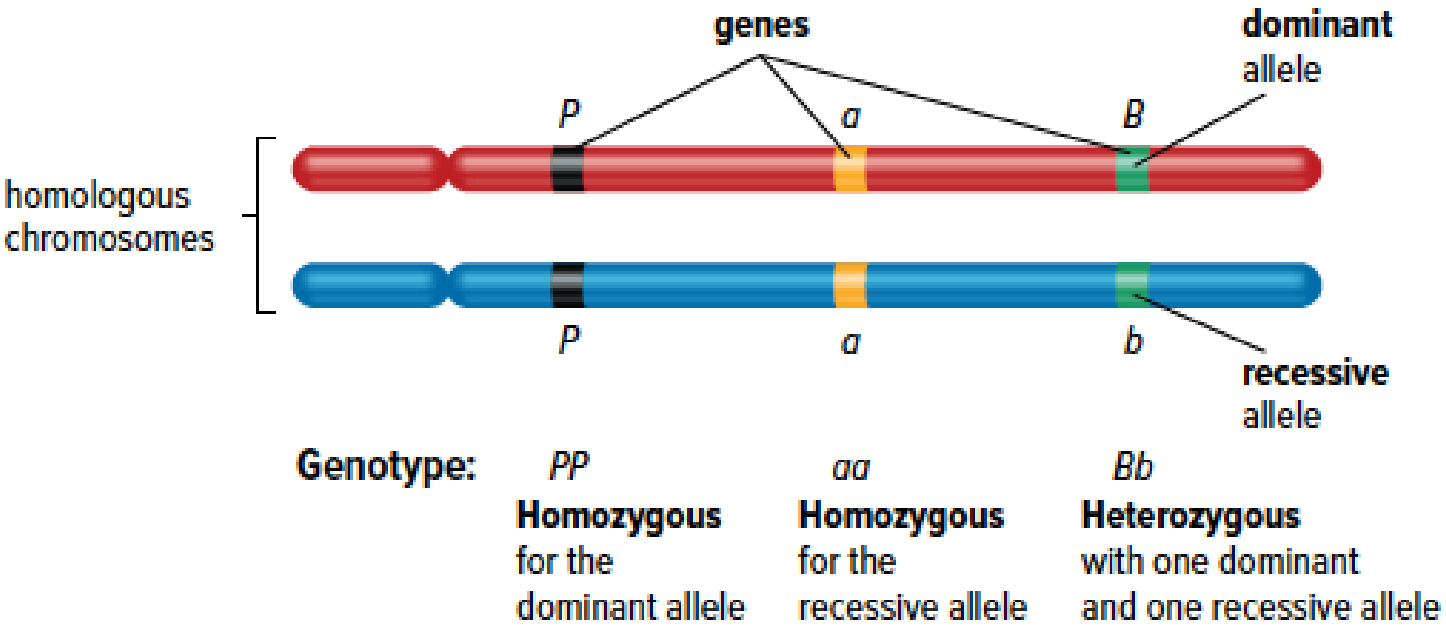
Bb brown eyes

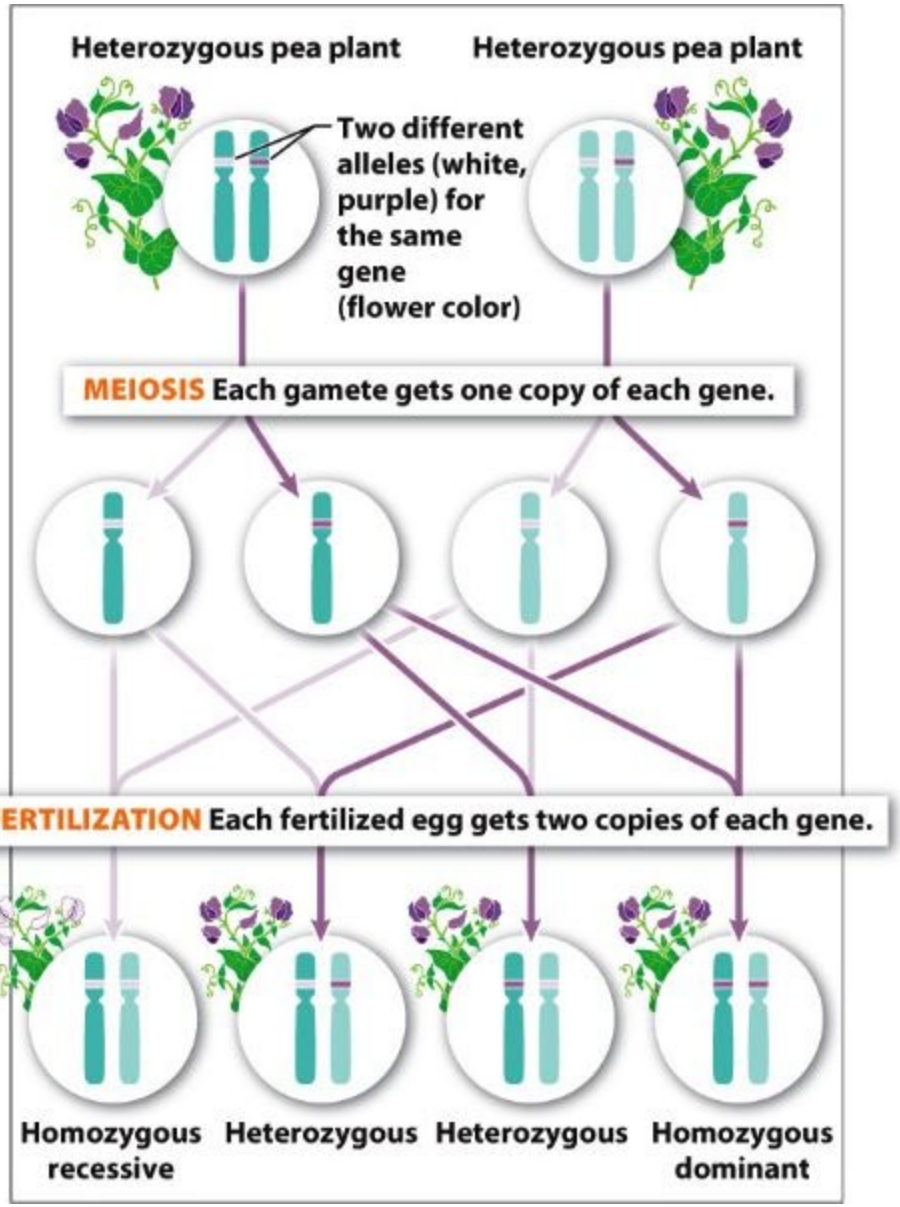
bb blue eyes

GENOTYPES AND PHENOTYPES

- As the expression of the trait doesn't necessarily indicate the alleles for a characteristic, scientists need to distinguish between the physical trait and its genetic make up
  - **Phenotype:** the physical description of an organism's trait
    - Brown eyes, brown hair etc
  - **Genotype:** the specific combination of alleles an organism has for a trait
    - Bb, BB, bb
  - **Homozygous:** an organism with two of the same alleles for a particular trait
  - **Heterozygous:** an organism with two different alleles for a particular trait

- There are three possible genotypes:
    1) *Homozygous dominant*: two dominant alleles
    2) *Homozygous recessive*: two recessive alleles
    3) *Heterozygous*: one dominant allele and one recessive allele




Heterozygous pea plant
Heterozygous pea plant
Two different alleles (white, purple) for the same gene (flower color)
MEIOSIS Each gamete gets one copy of each gene.
FERTILIZATION Each fertilized egg gets two copies of each gene.
Homozygous recessive
Heterozygous
Heterozygous
Homozygous dominant

DISCUSSION QUESTIONS

1. Write a definition for genetics in your own words.
2. Seed shape in pea plants can either be round or wrinkled. The allele for round shape is indicated by *R*. Is round seed shape dominant or recessive?
3. The allele for freckles is indicated by *F*. What is the genotype of a person who is heterozygous for freckles?

- Answers
  - 1. Answers will vary. Must reference information being passed from one generation to the next.
  - 2. Dominant, it is represented by a capital letter
  - 3. Ff

TRAIT ACTIVITY

- Determining your genotype/phenotype
  - Can we necessarily determine your genotype?
    - When can we? When can't we?
    - Alien Babies ☺