

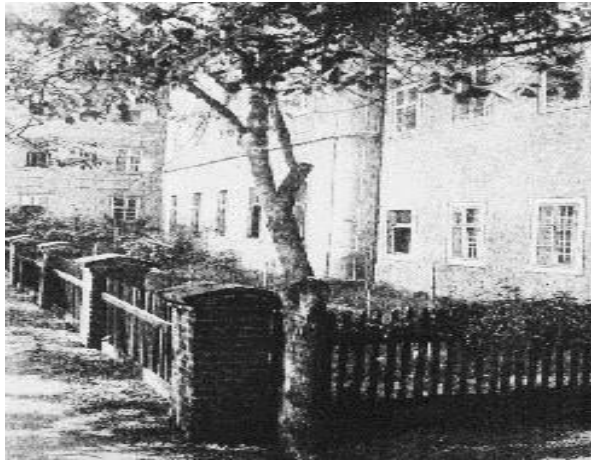


Introduction to Genetics

11.1, 11.2

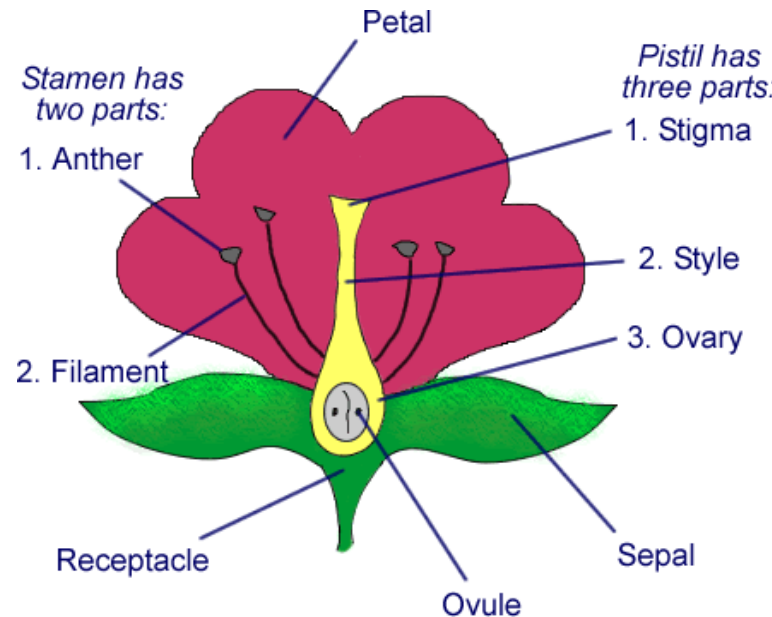
Gregor Mendel's Peas

- Austrian monk, born 1822 in Czech Republic
- Taught high school and kept a garden
- Studied peas



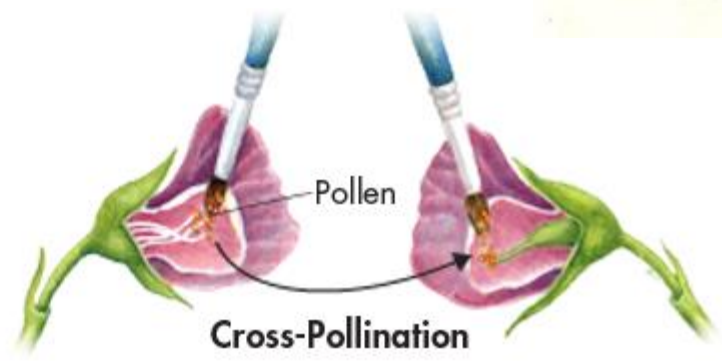
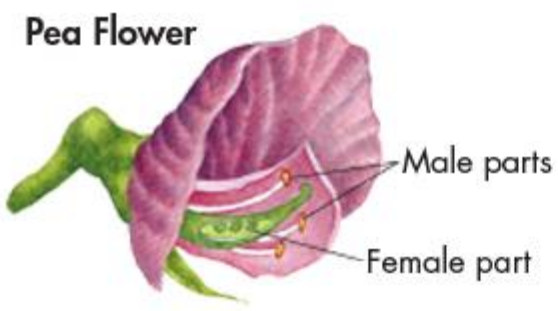
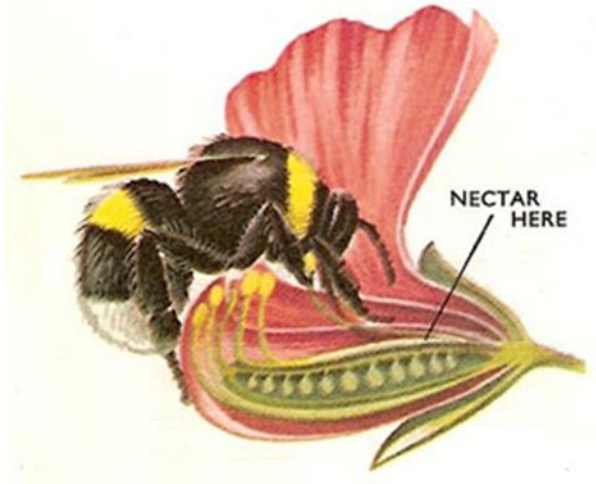
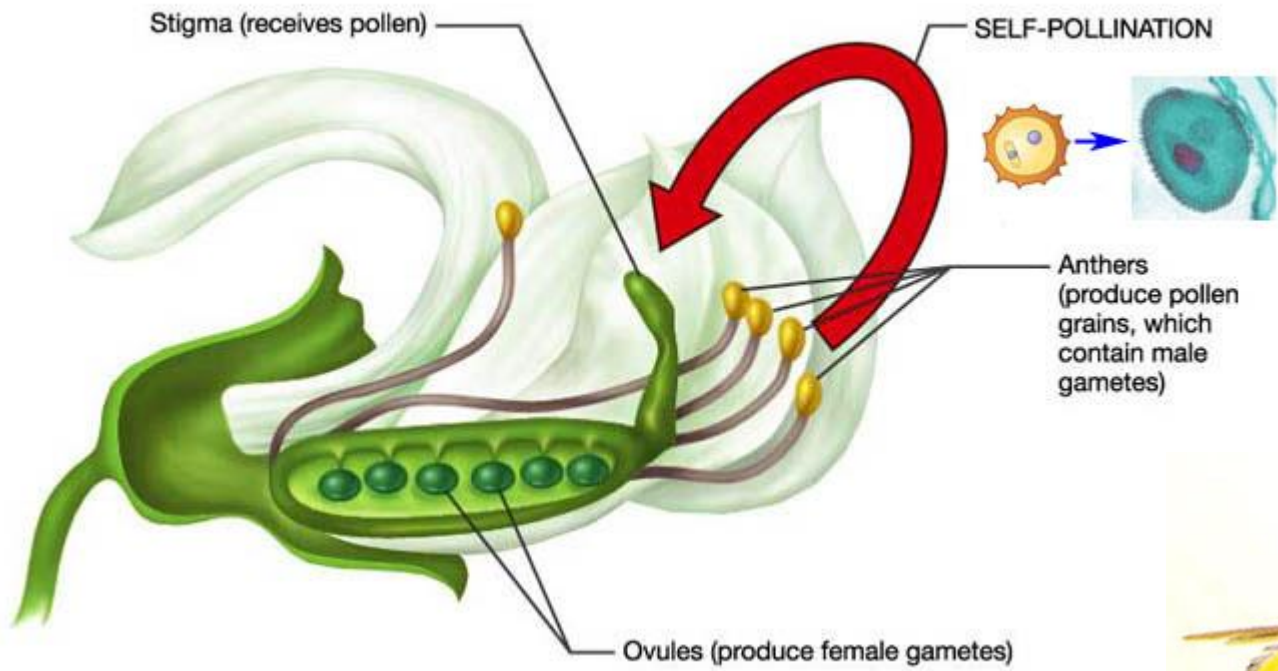
Pea flower pollination

- Stamen produces pollen (male part)
- Pistil produces eggs (female part)
- Seed is produced when pollen fertilizes an egg cell
- Ovary becomes fruit



Type of pollination

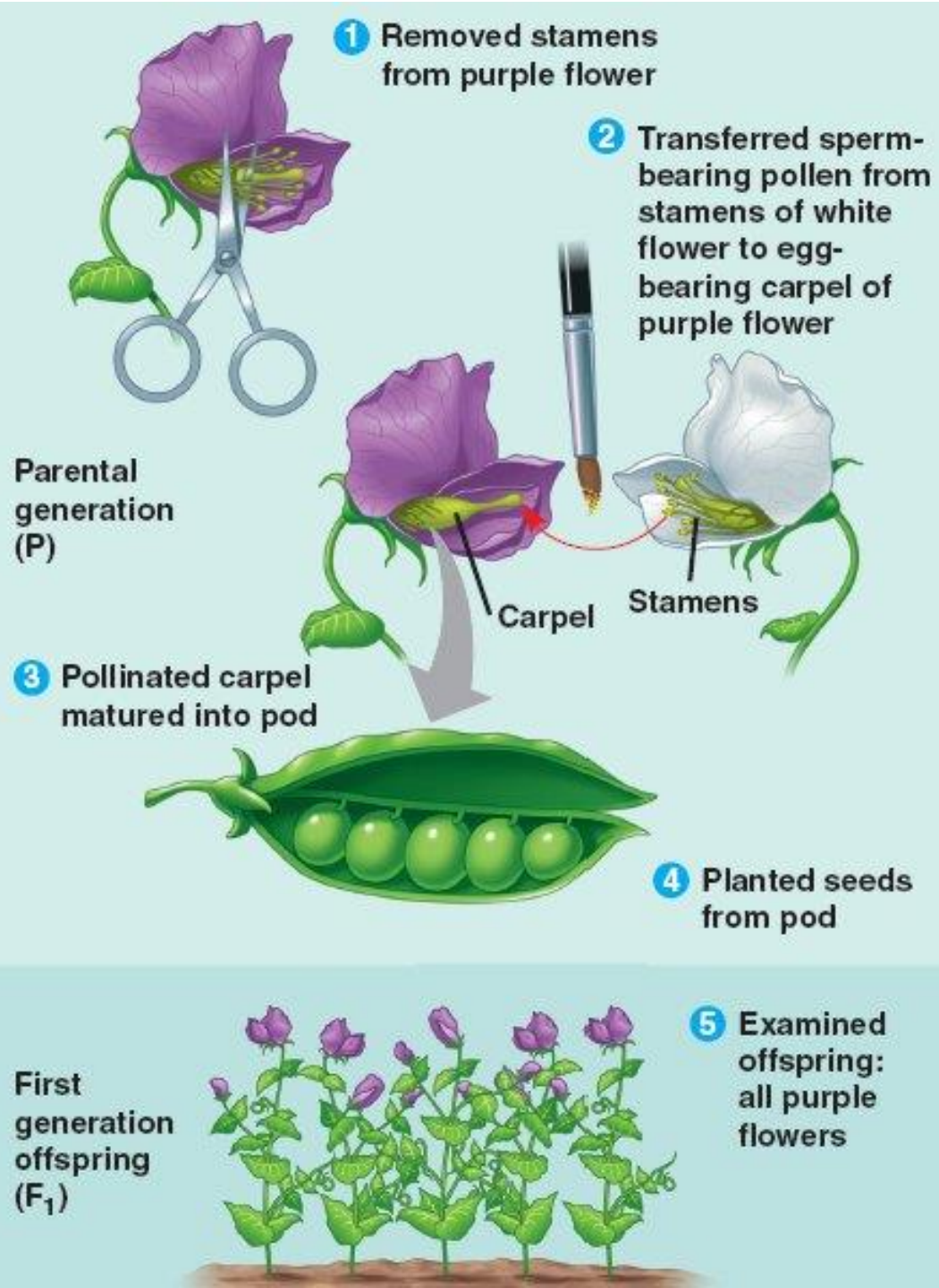
- Self pollination – pollen fertilizes egg cell in same flower
 - One parent plant
 - True breeding plants self pollinate to make identical offspring
- Cross pollination – pollen fertilizes egg cell of a different flower on a different plant
 - Two parent plants
 - Sexual reproduction





Mendel's experiments











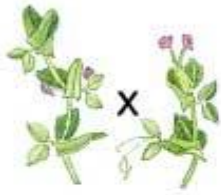










- Mendel prevented flowers from self pollinating
- Controlled how plants cross-pollinated
- Cut the anthers off of one flower
- Pollinated that flower with pollen from a different flower





Traits

- Mendel studied 7 traits
- Wanted to know how traits were inherited
- Crossed parents with contrasting traits
- Studied traits of offspring
- Recorded data

	Seed Shape	Seed Color	Seed Coat Color	Pod Shape	Pod Color	Flower Position	Plant Height
P	Round  X 	Yellow  X 	Gray  X 	Smooth  X 	Green  X 	Axial  X 	Tall  X 
F₁	 Round	 Yellow	 Gray	 Smooth	 Green	 Axial	 Tall

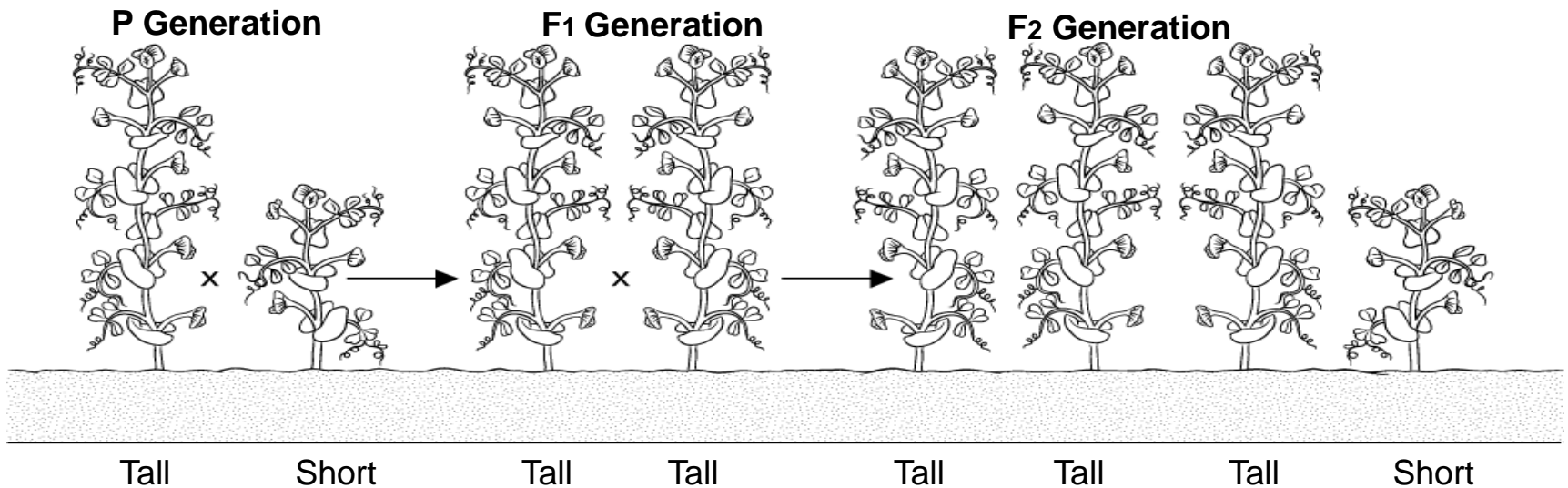
- P = parent

- F₁ = first filial generation (offspring)

- Hybrid = offspring of cross between parents with different traits

F₂ Generation

- Allowed plants from F₁ generation to self pollinate
- Saw that recessive traits resurfaced.

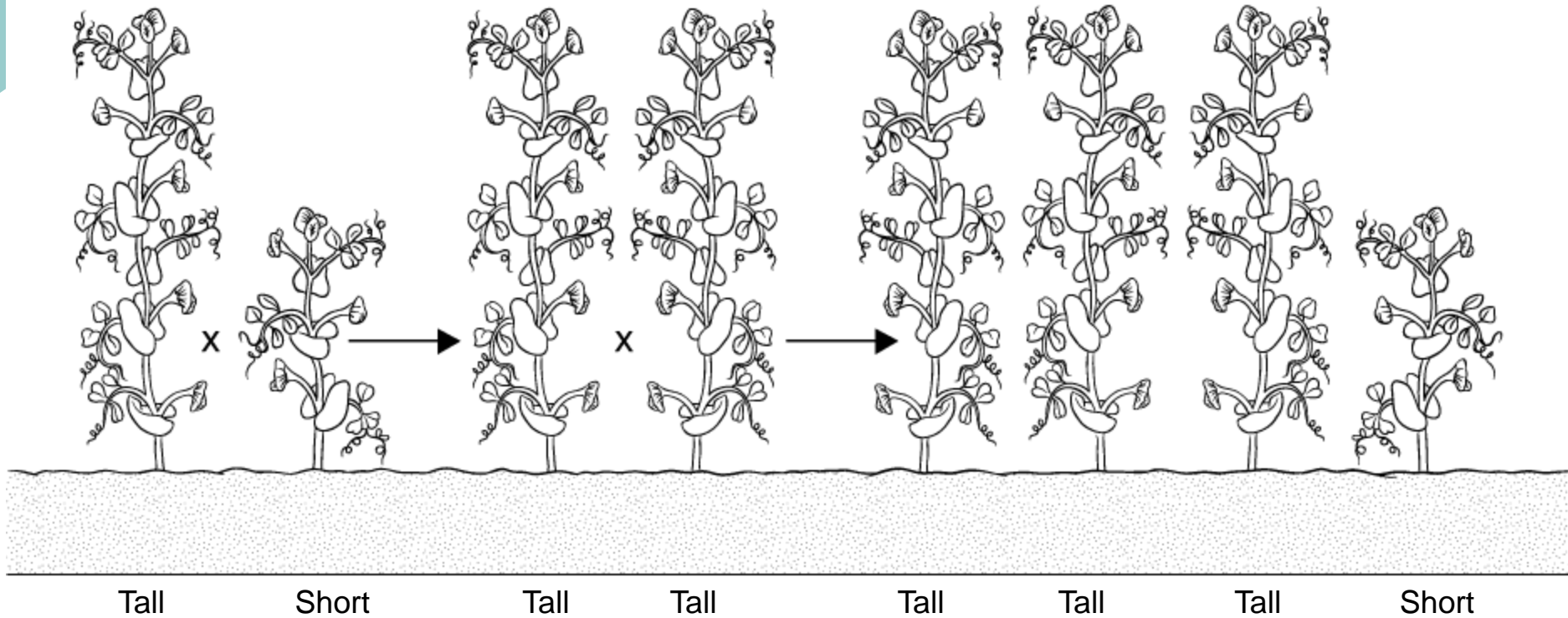


F2 Generation

P Generation

F1 Generation

F2 Generation



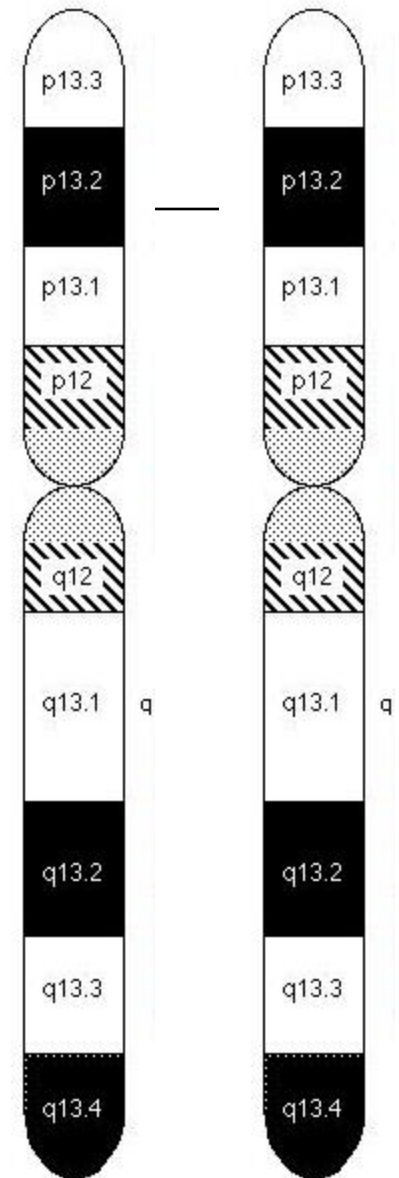


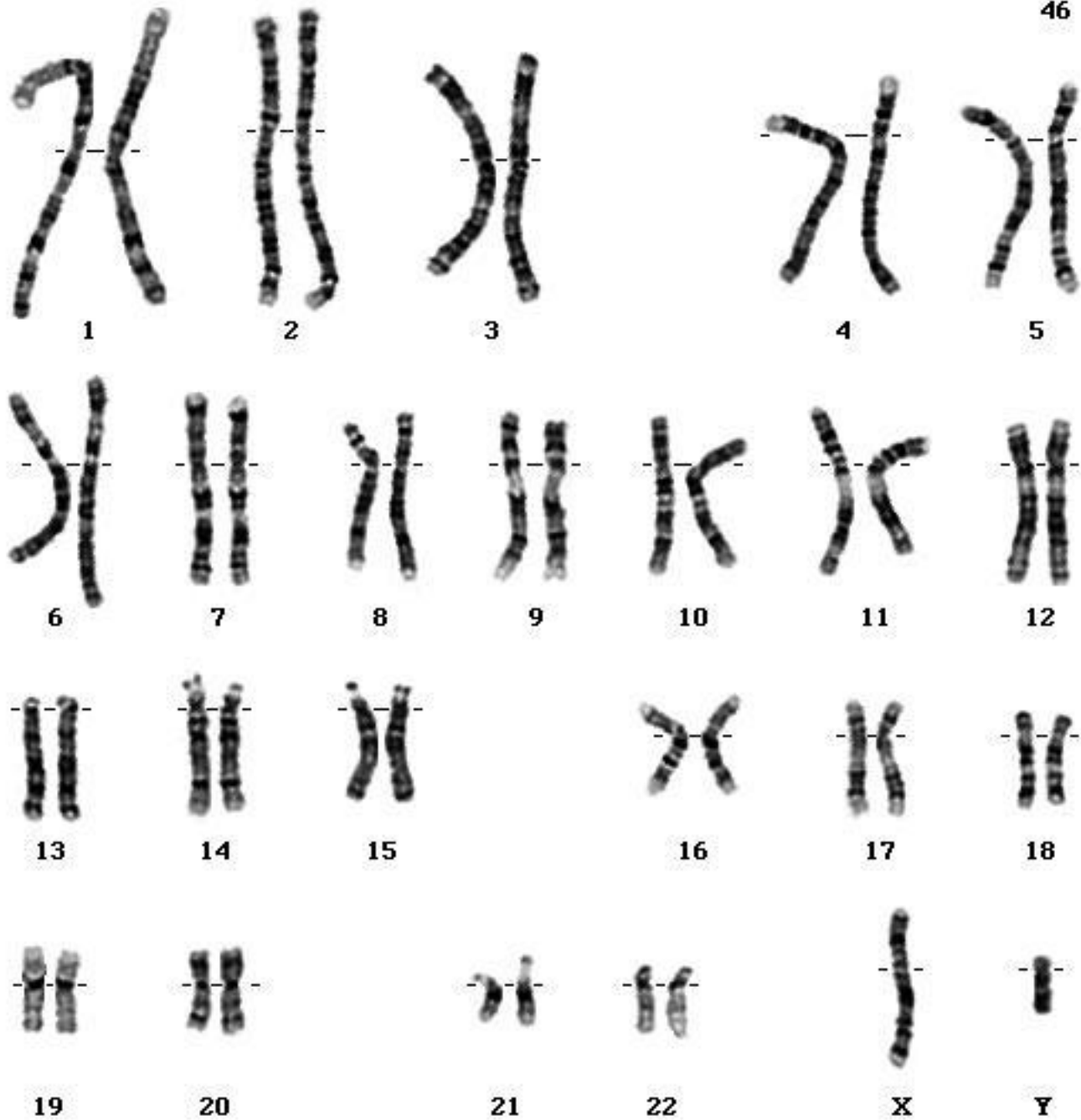
Mendel's Conclusions

- Traits are controlled by genes
- Genes are inherited from parents
- Genes have different forms
 - Alleles
- Some alleles are dominant and others are recessive
- Dominant alleles overpower recessive alleles

Chromosomes

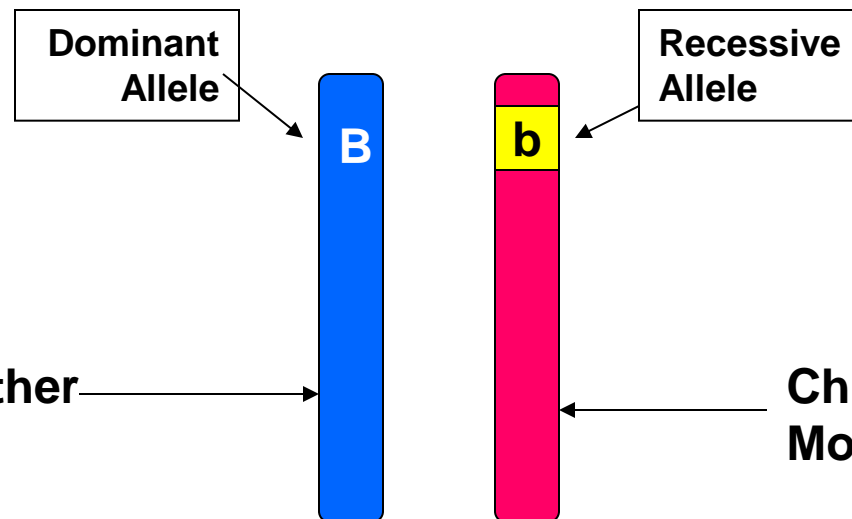
- Made of DNA
- Contain genes
- Humans have 46 in each cell
 - 23 pairs
 - 23 from mom,
 - 23 from dad





Genes

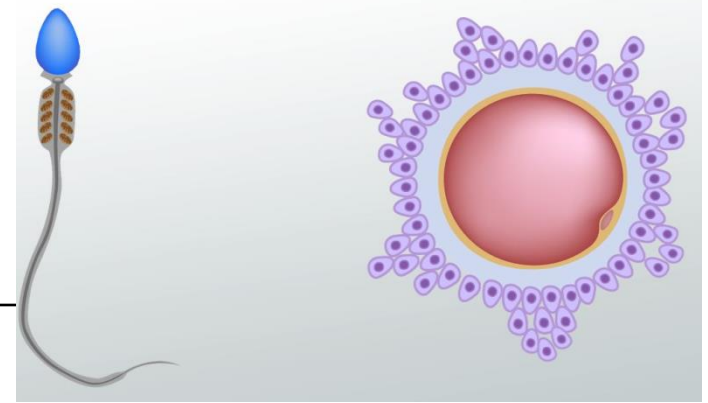
- Determine physical characteristics (traits)
- Come in different forms (alleles)
- Dominant alleles overpower recessive alleles



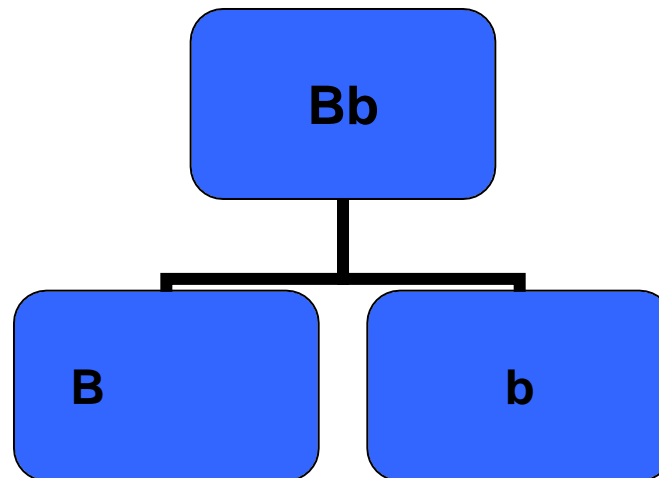
Chromosome from Father

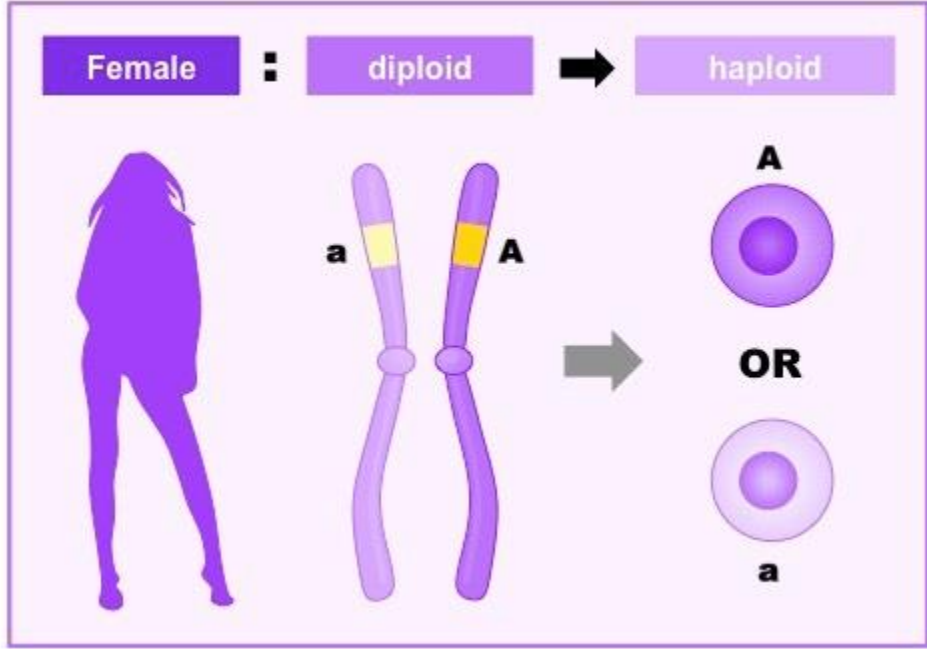
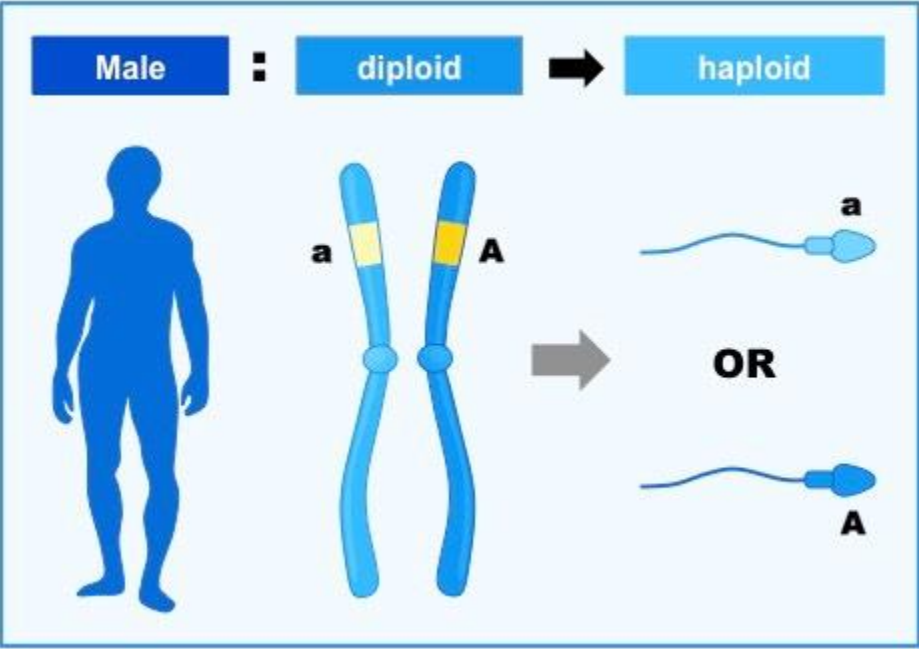
Chromosome from Mother

Gametes



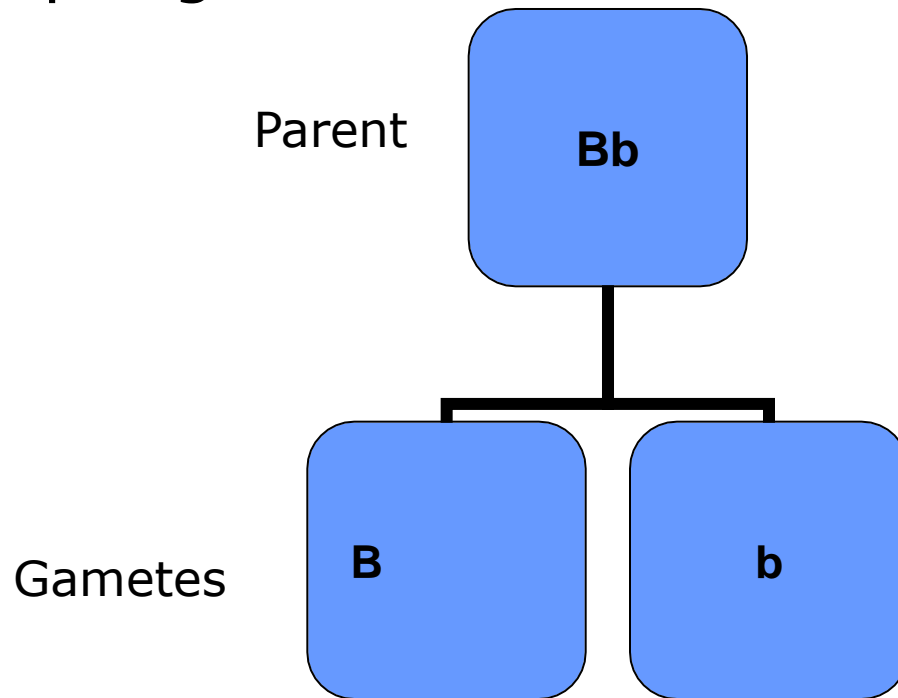
- Male gamete – sperm
- Female gamete – egg cell or ovum/ovule
- Each gamete carries 1 allele for each gene






Segregation

- The alleles for each trait separate into different gametes
- Gametes contain only one allele for each gene
- Offspring inherits one allele from each parent



- 
-
- Genotype – which alleles the offspring has
 - Phenotype – physical characteristics
 - TT
 - Genotype – homozygous dominant
 - Phenotype – tall
 - Tt
 - Genotype – heterozygous
 - Phenotype – Tall
 - tt
 - Genotype – homozygous recessive
 - Phenotype -- short

Punnett Squares

Round RR

Wrinkled rr

	R	R
r		
r		

- F₁ Genotype – 100% heterozygous
- F₁ phenotype – 100% round

Punnett Squares F₂ generation

Round Rr

Round Rr

	R	r
R		
r		

Punnett Squares F₂ generation

○ F₂ Genotype

- 25% ($\frac{1}{4}$) homozygous dominant
- 50% ($\frac{1}{2}$) heterozygous
- 25% ($\frac{1}{4}$) homozygous recessive
- 1:2:1

○ F₂ Phenotype

- 75% ($\frac{3}{4}$) Round
- 25% ($\frac{1}{4}$) Wrinkled
- 3:1

Seed Color

Yellow Yy

Yellow Yy

	Y	y
Y		
y		

Punnett Squares F₂ generation

○ F₂ Genotype

- 25% ($\frac{1}{4}$)homozygous dominant
- 50% ($\frac{1}{2}$)heterozygous
- 25% ($\frac{1}{4}$)homozygous recessive
- 1:2:1

○ F₂ Phenotype

- 75% ($\frac{3}{4}$)Yellow
- 25% ($\frac{1}{4}$) Green
- 3:1

Seed Coat Color

Gray Gg

White gg

	G	g
g		
g		

- Genotype

- 50% ($\frac{1}{2}$) Gg, 50% ($\frac{1}{2}$) gg

- Phenotype

- 50% ($\frac{1}{2}$) Gray, 50% ($\frac{1}{2}$) white

Seed Coat Color

Gray GG

Gray Gg

	G	G
G		
g		

- Genotype
 - 50% ($\frac{1}{2}$) GG, 50% ($\frac{1}{2}$) Gg
- Phenotype
 - 100% gray

Practice

- On a separate sheet of paper, complete a punnett square for each cross. State the percentage of each phenotype and genotype.
- Pod color
 - G = green, g = yellow
 1. homozygous dominant x heterozygous
 2. Homozygous dominant x homozygous recessive
 3. Heterozygous x heterozygous
 4. Homozygous recessive x heterozygous

Practice

- Plant Height
 - T = tall, t = short
-
- 1) If the phenotype of a plant is short, what must its genotype be?
 - 2) If the phenotype of a plant is tall, can you be sure of its genotype?
 - 3) How could you figure out the genotype of a tall plant?
 - 4) A tall plant is crossed with a short plant. The phenotype of the offspring is 1:1, 50% tall and 50% short. Use a punnett square to determine what the genotype of each parent must be.
 - 5) A tall plant is crossed with a short plant. All offspring have the phenotype tall. Use a punnett square to determine what the genotype of each parent must be.



Homozygous Dominant:

Heterozygous:

Homozygous Recessive:

Genotype: 25% GG, 50%Gg, 25% gg
Phenotype: 75% green, 25% yellow

	G	g
G	GG	Gg
g	Gg	gg