FUNDAMENTALS OF GENETICS

Leucism in the American Alligator

GREGOR MENDEL

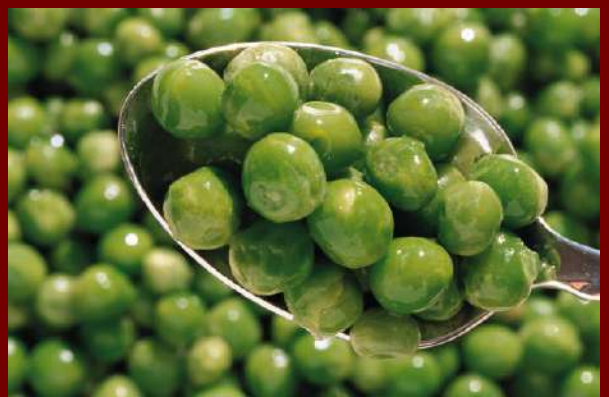
Monastery at Brno where he grew his peas.

- ***Genetics is the field of biology devoted to understanding how characteristics are transmitted from parents to offspring.***
- ***Genetics was founded with the work of Gregor Johann Mendel in the mid 1800's.***

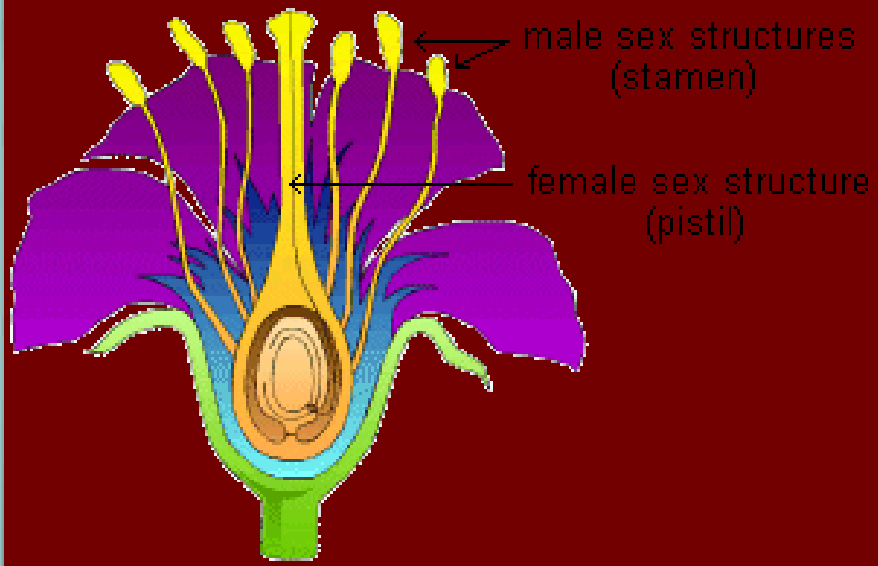
- ***Austrian monk who experimented with garden peas.***
- **Mendel's knowledge of statistics later proved valuable in his research on heredity—the transmission of characteristics from parents to offspring.**

Why pea plants?

- Contrasting traits
- Quick growth
- Produce a lot of offspring
- Pollination can be controlled: self-pollination and cross-pollination.



- **Mendel observed seven characteristics of pea plants:**
  - **Plant Height: Tall/Short**
  - **Flower Color: Purple/White**
  - **Flower Position: Axial/Terminal**



4. Seed Color: Yellow/Green
5. Seed Texture: Smooth/Wrinkled
6. Pod Shape: Inflated/Constricted
7. Pod Color: Green/Yellow

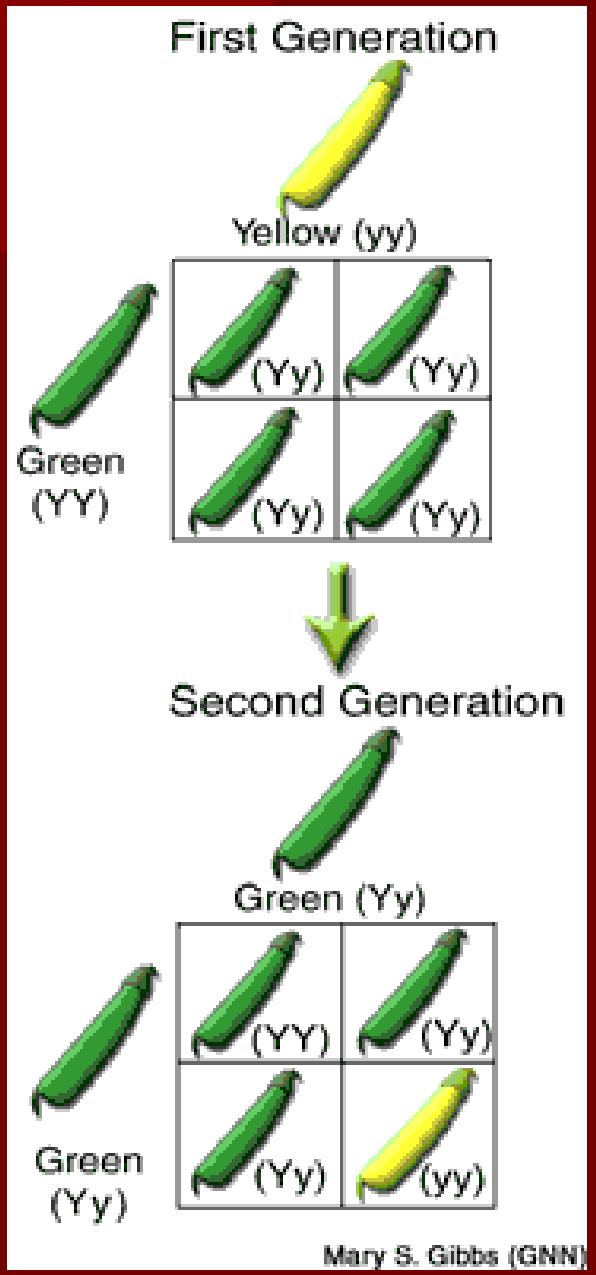
MENDEL'S EXPERIEMENTS

- He began by growing plants that were pure for each trait.
- Through self-pollination, Mendel developed 14 pure strains.
- He called each strain a parental generation, or P1 generation.

- Mendel then cross-pollinated these strains.
- When the plants matured, he recorded the number of each type of offspring produced by each P1 plant. Mendel called the offspring of the P1 generation the first filial generation, or F1 generation.

- He then allowed the flowers from the F1 generation to self-pollinate and collected

the seeds. Mendel called the plants in this generation the second filial generation, or F2 generation.

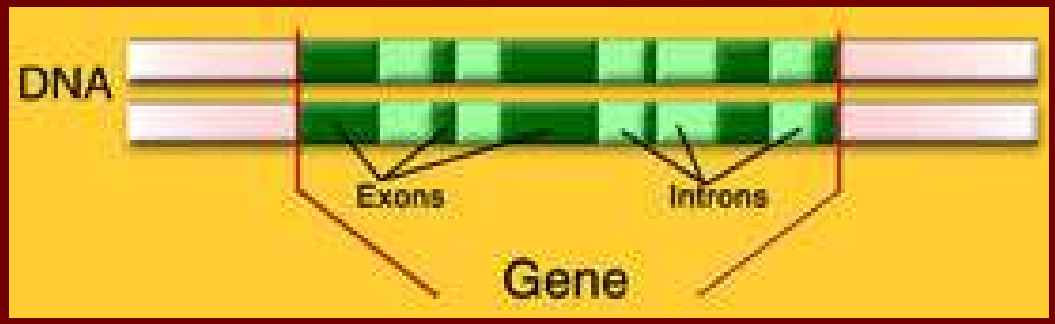


Characteristic	P cross	F_1 generation	F_2 generation	Actual ratio	Probability ratio
Flower color	 purple × white	purple	705 purple 224 white	3.15:1	3:1

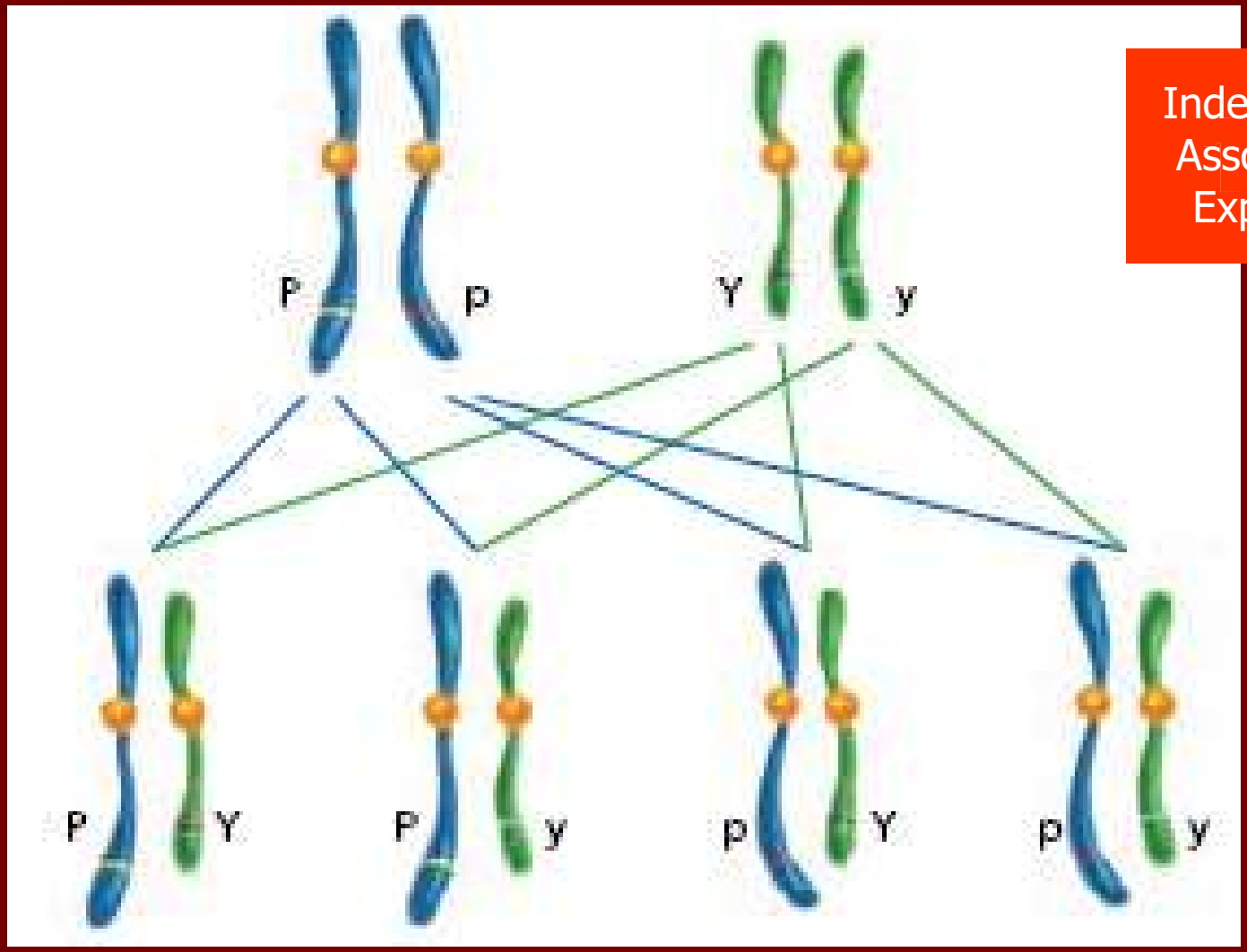
MENDEL'S CONCLUSIONS

1. Traits are controlled by factors: Alternate forms of genes called alleles.
2. Some factors are dominant and some recessive: G or g

Terms with Pictures



3. Law of Segregation
4. Law of Ind. Assortment



Independent Assortment Explained

GENETIC CROSSES

- The genetic makeup of an organism is its genotype: gg OR GG
- The appearance of an organism as a result of its genotype is called its phenotype: green or yellow seeds.

- When both alleles of a pair are alike, the organism is said to be homozygous for that characteristic: GG
- When the two alleles in the pair are different, the organism is heterozygous for that characteristic: Gg

- **Probability** is the likelihood that a specific event will occur.

$$\text{Probability} = \frac{\text{number of times an event is expected to happen}}{\text{number of opportunities for an event to happen}}$$

$$\frac{6{,}022}{8{,}023} = 0.75$$

75%

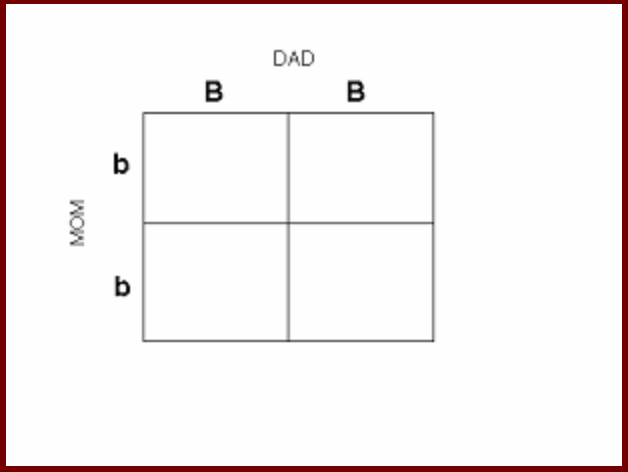
¾ or 3:1 ratio

RATIOS

- The ratio of the genotypes that appear in offspring is called the genotypic ratio.
- The ratio of the offsprings' phenotypes is called the phenotypic ratio.

MONOHYBRID CROSSES

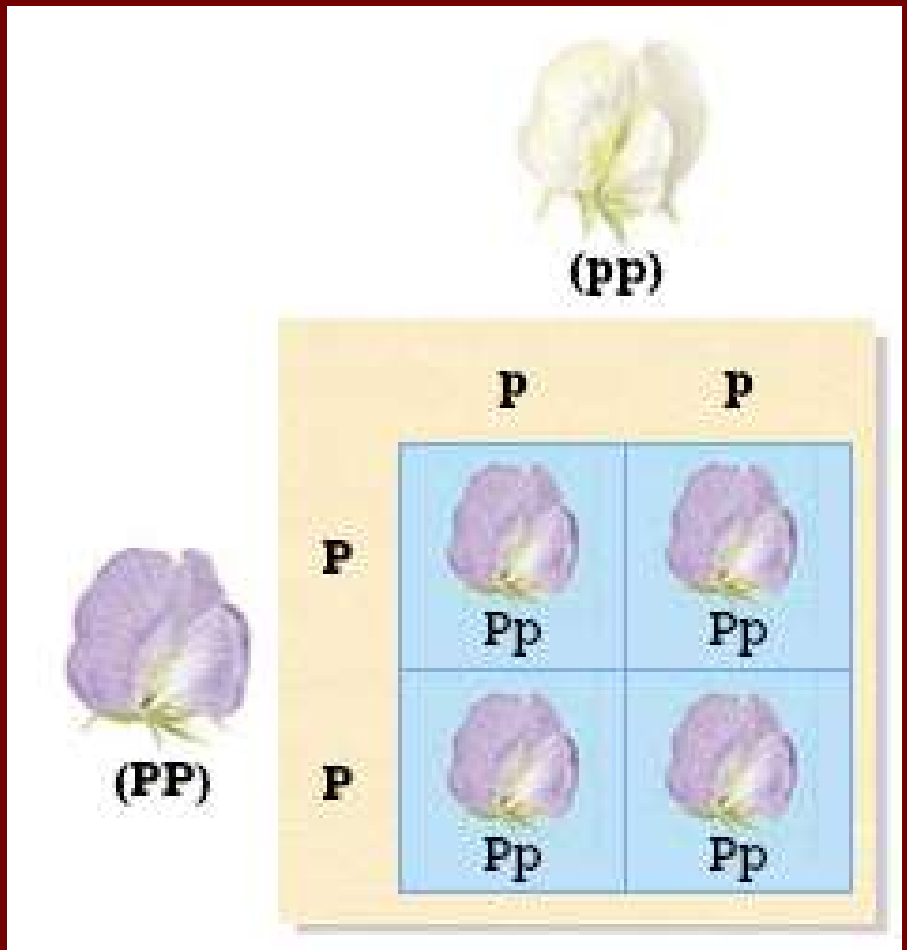
- A cross between individuals that involves one pair of contrasting traits is called a monohybrid cross.



- **Punnett squares aid in predicting the probability that certain traits will be inherited by offspring.**

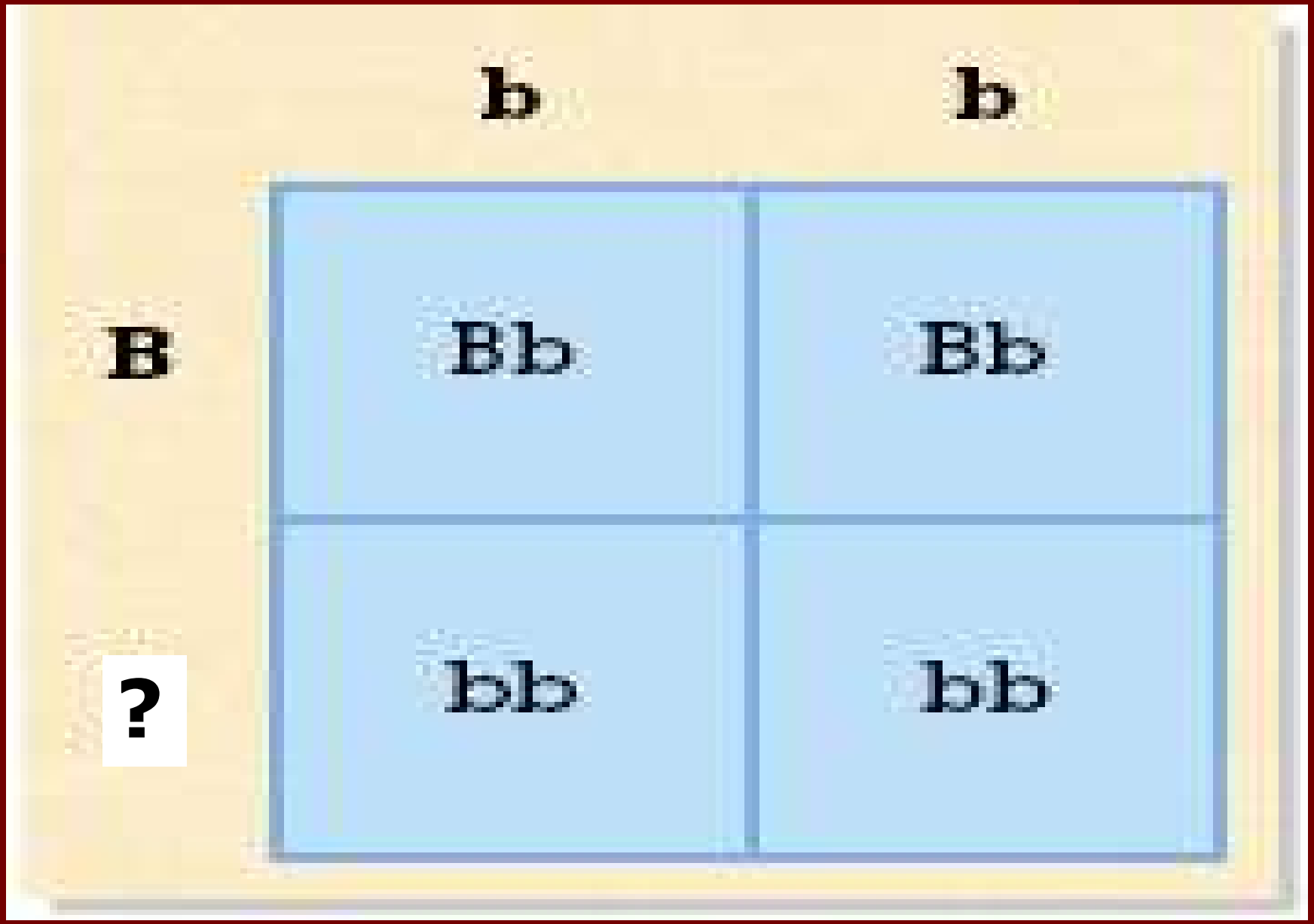
Practice the monohybrid cross

More practice



TEST CROSSES

- A testcross can determine the genotype of any individual whose phenotype is dominant.


b
b
B
Bb
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?
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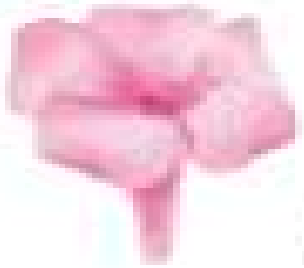
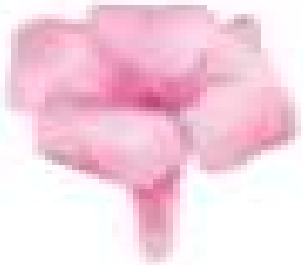
INCOMPLETE DOMINANCE

- Sometimes the F1 offspring will have a phenotype in between that of the parents, a relationship called incomplete dominance.



(Rr)



(Rr)

	R	r
R	RR	Rr
r	Rr	rr

CODOMINANCE

- Codominance occurs when both alleles for a gene are expressed in a heterozygous offspring.

DIHYBRID CROSSES

- A dihybrid cross is a cross between individuals that involves two pairs of contrasting traits.

Dihybrid Practice

rryy

RRYY

	ry	ry	ry	ry
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy
RY	RrYy	RrYy	RrYy	RrYy