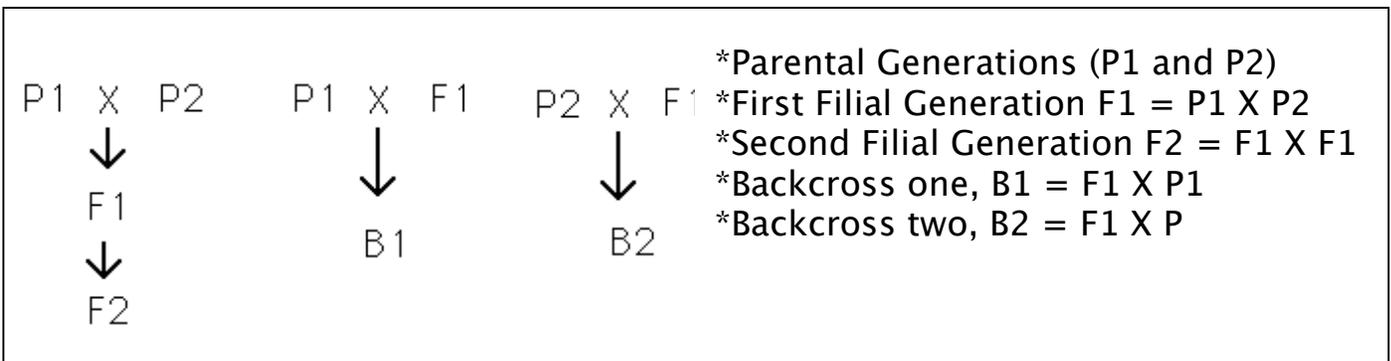
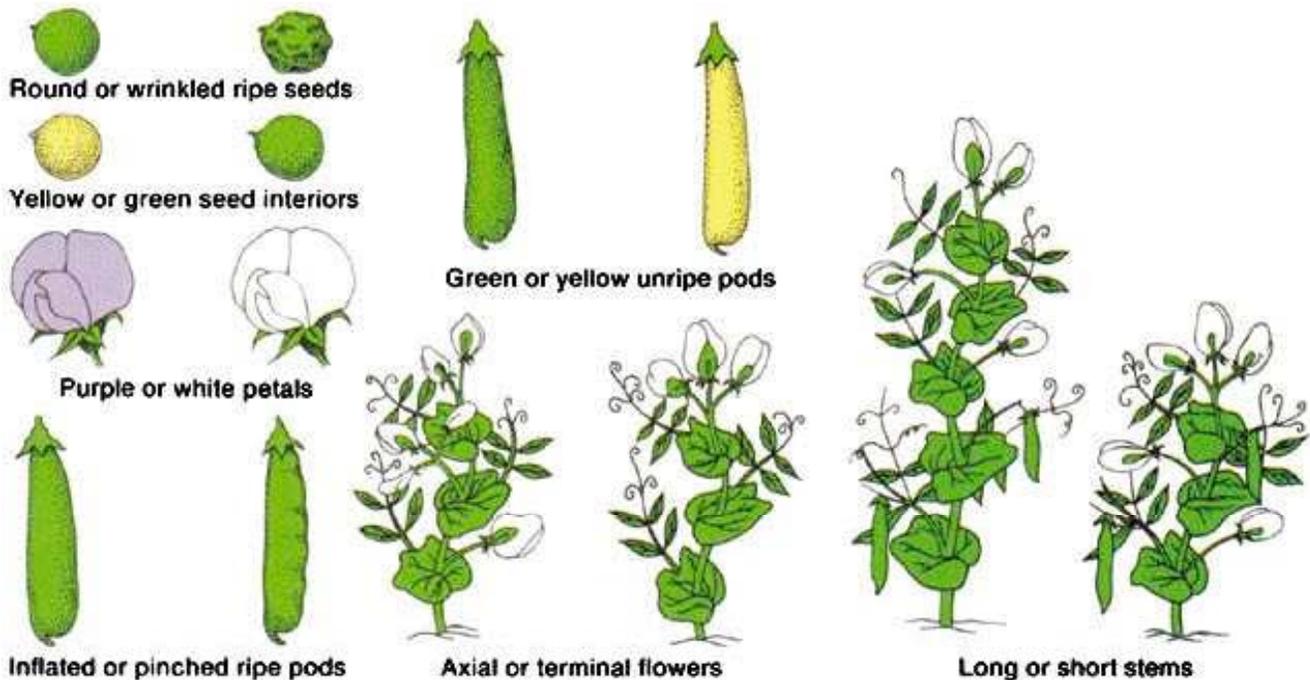


Lectures 1: Mendelian Genetics

Particulate Inheritance – discrete units of heredity (genes) that are inherited intact through the generations

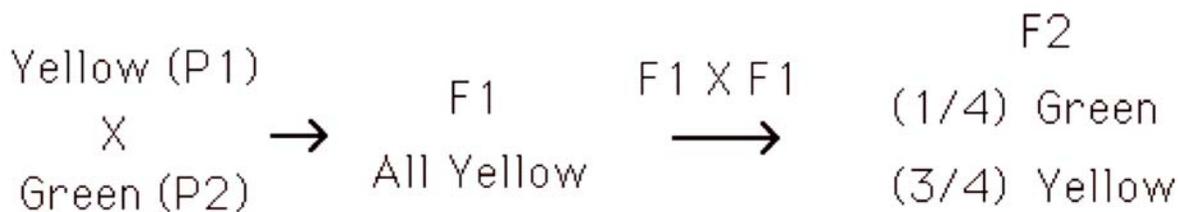
Mendel's Experiments

- * Used pure-breeding (genetically identical) lines of garden peas
- * Examined crosses involving seven different characters



Monohybrid cross

- * Cross between pure lines differing in a single character of interest. i.e., Seed color -- Yellow versus Green: what Mendel observed
- The F1 were all Yellow. However, Green Segregated out in F2 – strong evidence for discrete units of heredity, as "green" unit obviously present in F1, appears in F2 (3:1 ratio of Yellow: Green in F2).



Mendel also found that Parental, F1, and F2 Yellow peas behaved quite differently:

P1 Yellow
 X
 Green (P2) → All Yellow

F1 Yellow
 X
 Green (P2) → 1/2 Yellow
 1/2 Green

F2 Yellow
 X
 Green (P2) → 2/3 Yellow
 1/3 Green

When he examined each F2 yellow family separately, Mendel found:

* 2/3 of the F2 yellows give 1/2 yellow, 1/2 green

* 1/3 of F2 yellows gave all yellow progeny

Mendel's explanation:

* Genetic information exists as discrete units occurring in pairs

* YY is the genotype of the pure Yellow line

* yy the genotype of pure Green line

Y dominant to y (y is recessive to Y)

YY, Yy (denoted by Y-) = Yellow

yy = green

The discrete units segregate out in the F2.



Genetic Notation

* **Phenotype:** Seed color

Yellow **phenotype** is dominant to green phenotype

* **Genotypes**

YY homozygous dominant

Yy heterozygous

yy homozygous recessive

* **Alleles**

Y is dominant

y is recessive

Dihybrid crosses

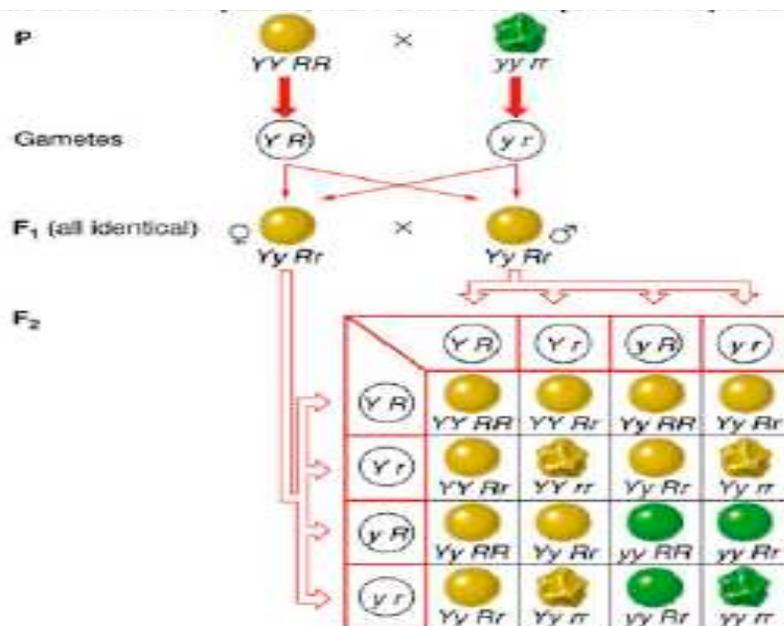
* **Crossing pure**-breeding lines differing in two characters

Example: for Seed shape

RR, Rr = round

rr = wrinkled

Cross yellow, wrinkled pure line with round green



Type	Genotype	Phenotype	Number	Phenotypic ratio
Parental	Y-R-	yellow round	315	9/16
Recombinant	yy R-	green round	108	3/16
Recombinant	Y-rr	yellow wrinkled	101	3/16
Parental	yy rr	green wrinkled	32	1/16

Ratio of yellow (dominant) to green (recessive) = 12:4 or 3:1

Ratio of round (dominant) to wrinkled (recessive) = 12:4 or 3:1

Mendel observed Independent Assortment:

* How are these ratios computed?

$$\Pr(R-) = \Pr(RR) + \Pr(Rr) = 1 - \Pr(rr) = 3/4$$

Same for $\Pr(Y-) = 3/4$

$$\begin{aligned}\Pr(R-, Y-) &= \Pr(R-) * \Pr(Y-) \\ &= 3/4 * 3/4 = 9/16\end{aligned}$$

Assumes R and Y are independent, i.e., Independent assortment

$$\circ \Pr(R-, yy) = 3/4 * 1/4 = 3/16$$

$$\circ \Pr(rr, Y-) = 1/4 * 3/4 = 3/16$$

$$\circ \Pr(rr, yy) = 1/4 * 1/4 = 1/16$$

**Mendel cheated (or was very lucky):
The seven characters he used to show independent assortment were all on different chromosomes. Hence they are not linked.**