The Work of Gregor Mendel

- Inheritance:
  - Money or property left by relatives
  - Something we receive from our parents (like blood type, color of our eyes or hair)

- **Genetics:** the scientific study of biological inheritance

- Gregor Mendel:
  - Austrian scientist and priest
  - He worked in a monastery and taught local students
  - He also worked in the monastery garden and changed biology forever
  - He worked with peas because they are small, easy to grow, and can produce hundreds of offspring

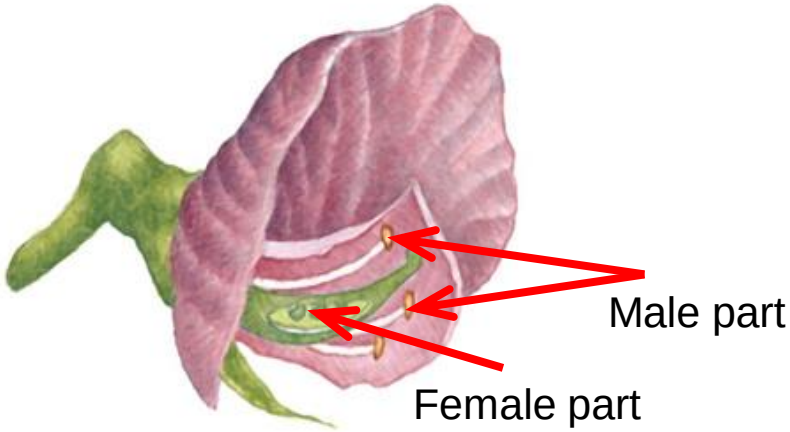
Mendel's Experiments

- Fertilization: a process in which during sexual reproduction, male and female reproductive cells join to produce a new cell
  - Male reproductive cells are called sperm
  - Female reproductive cells are called eggs
- Pea plants are mostly self-pollinating
  - Reproduce from the same flower
- Started with "true breeding" plants – meaning the pea plants were self-pollinating and produced offspring with traits identical to the parents
- **Trait:** specific characteristic (e.g., seed color, plant height) of an individual

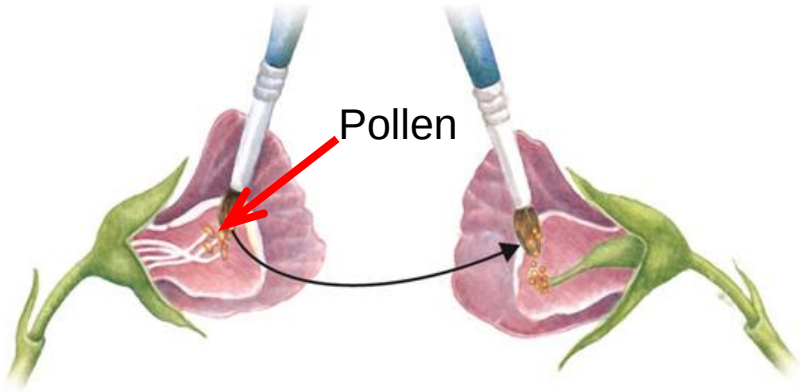
Pollination in Pea Plants

- Mendel crossed his stocks of true-breeding plants
  - He dusted pollen from a different plant onto the female part of a flower
  - This allowed Mendel to cross plants with different traits and then study the results.
  - Mendel examined 7 different traits of pea plants
    - For example, green or yellow pod color

Self-Pollination



Cross-Pollination



Cross-Pollination and Pea Characteristics

- Mendel crossed plants with each of the 7 contrasting characteristics and then studied the offspring.
- The offspring's were a hybrid of the parents.
- **Hybrid:** created from a cross of true-breeding individuals

Seed Shape	Seed Color	Flower Color	Pod Shape	Pod Color	Flower Position	Plant Height
 Round	 Yellow	 Purple	 Smooth	 Green	 Axial	 Tall
X	X	X	X	X	X	X
 Wrinkled	 Green	 White	 Constricted	 Yellow	 Terminal	 Short

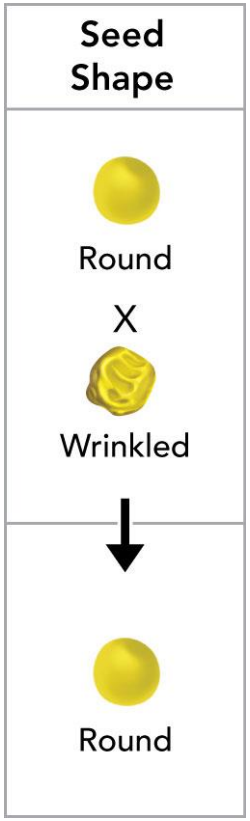
Genes and Alleles

- When doing genetic crosses, the original pair of plants are called P, or parental, generation.
- Their offspring are called the F_1, or first filial, generation
  - *Filius* and *filia* are Latin for “son” and “daughter”

- To Mendel’s surprise, the offspring had the characteristics of only one of its parents.
  - The traits of the other parent seemed to have disappeared.
  - From this, Mendel proposed 2 conclusions.
    - An individual’s characteristics are determined by factors that are passed from one parental generation to the next (we call these factors genes)
    - Some alleles are dominant and some alleles are recessive

Genes and Alleles

- **Genes:** passed from one generation to the next; determine an individual's characteristics (seed shape)
- **Alleles:** the different forms of a gene (round or wrinkled)



Characteristics such as seed shape are determined by genes.

Round and wrinkled seed shapes are determined by alleles.

The allele for round seeds is dominant to the allele for wrinkled seeds.

Principle of Dominance

- Some alleles are dominant, some recessive.
- An organism with at least one dominant allele will exhibit that trait.
- An organism with a recessive allele will exhibit the trait only in the absence of a dominant allele.
- Mendel found the allele for tall plants was dominant over the recessive allele for short plants.
- The allele for green pods was dominant over the recessive allele for yellow pods.

Mendel's F_1 Crosses

When Mendel crossed plants with contrasting traits, the hybrid offspring showed traits of only one parent.

Mendel's Seven F_1 Crosses on Pea Plants

	Seed Shape	Seed Color	Flower Color	Pod Shape	Pod Color	Flower Position	Plant Height
P	Round X Wrinkled	Yellow X Green	Purple X White	Smooth X Constricted	Green X Yellow	Axial X Terminal	Tall X Short
F_1	Round	Yellow	Purple	Smooth	Green	Axial	Tall

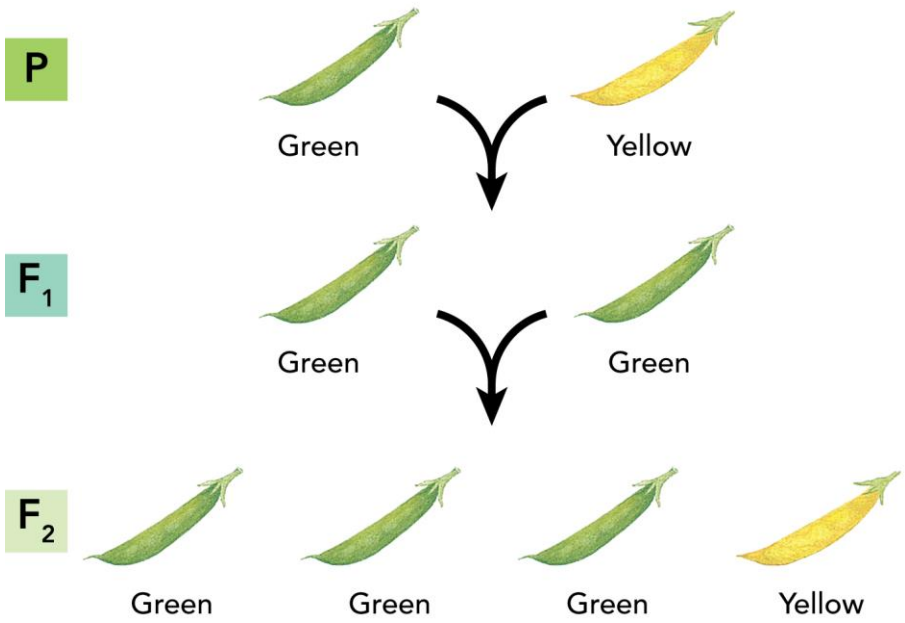
Segregation

Segregation: separation of alleles during gamete formation

- The allele of the yellow pod separated from the allele for the green pod

Gametes: the formation of reproductive cells

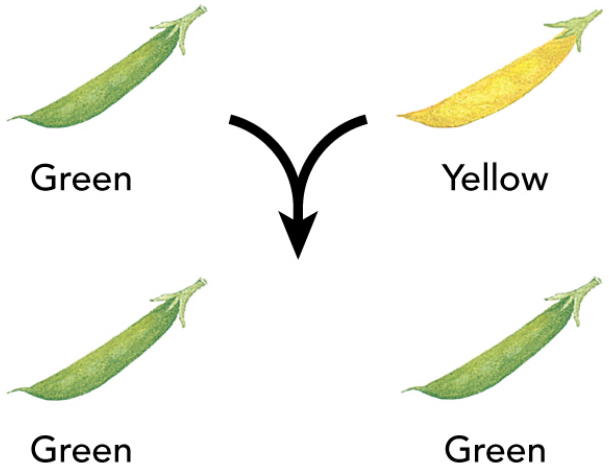
- During gamete formation, the alleles for each gene segregate from each other, so that each gamete carries only one allele for each gene
- Thus, a green pod allele and yellow pod allele were produced



The F_1 Generation

P parent

F_1 offspring



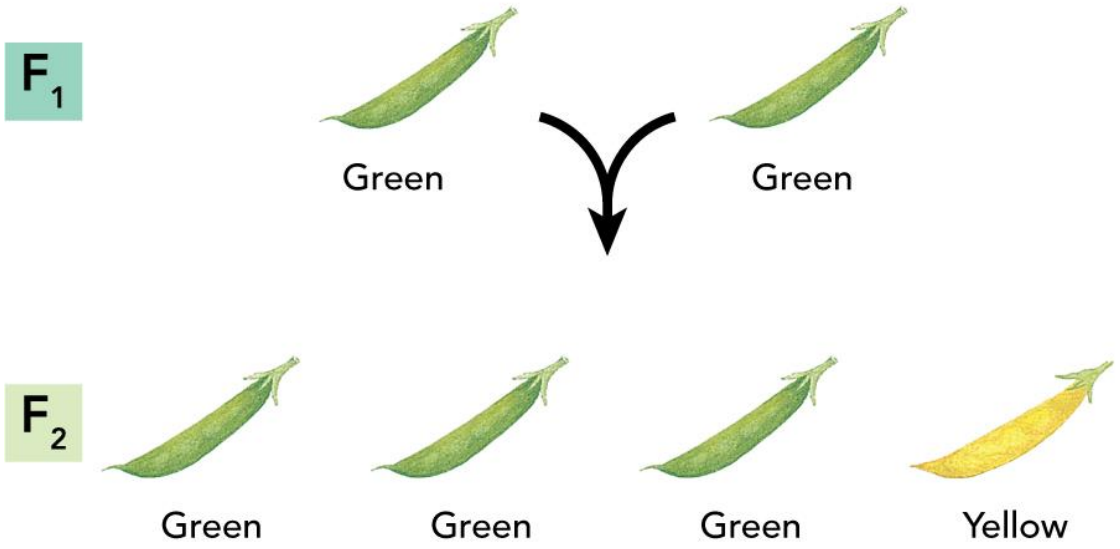
The F_2 Generation

What proportion of F_2 offspring were yellow?

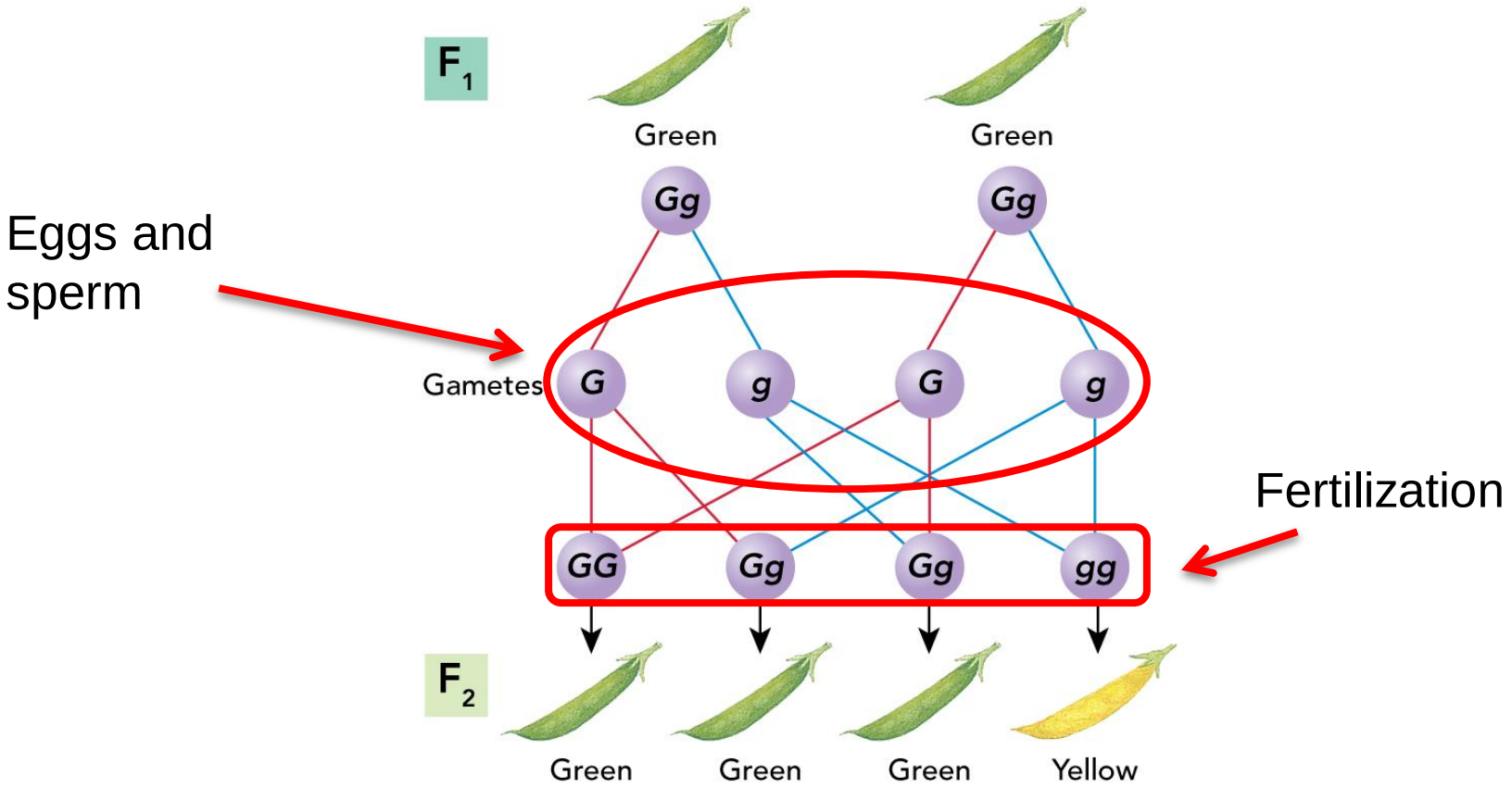
1/4

What proportion of F_2 offspring were green?

3/4



The Formation of Gametes



The Formation of Gametes

- A **capital** letter represents a **dominant** allele.
- A *lowercase* letter represents a *recessive* allele.
- In order for a yellow pod to reappear, each gamete had to provide a "*g*" allele.
- In order for a green pod to appear, one of the gametes had to have a "*G*" allele.