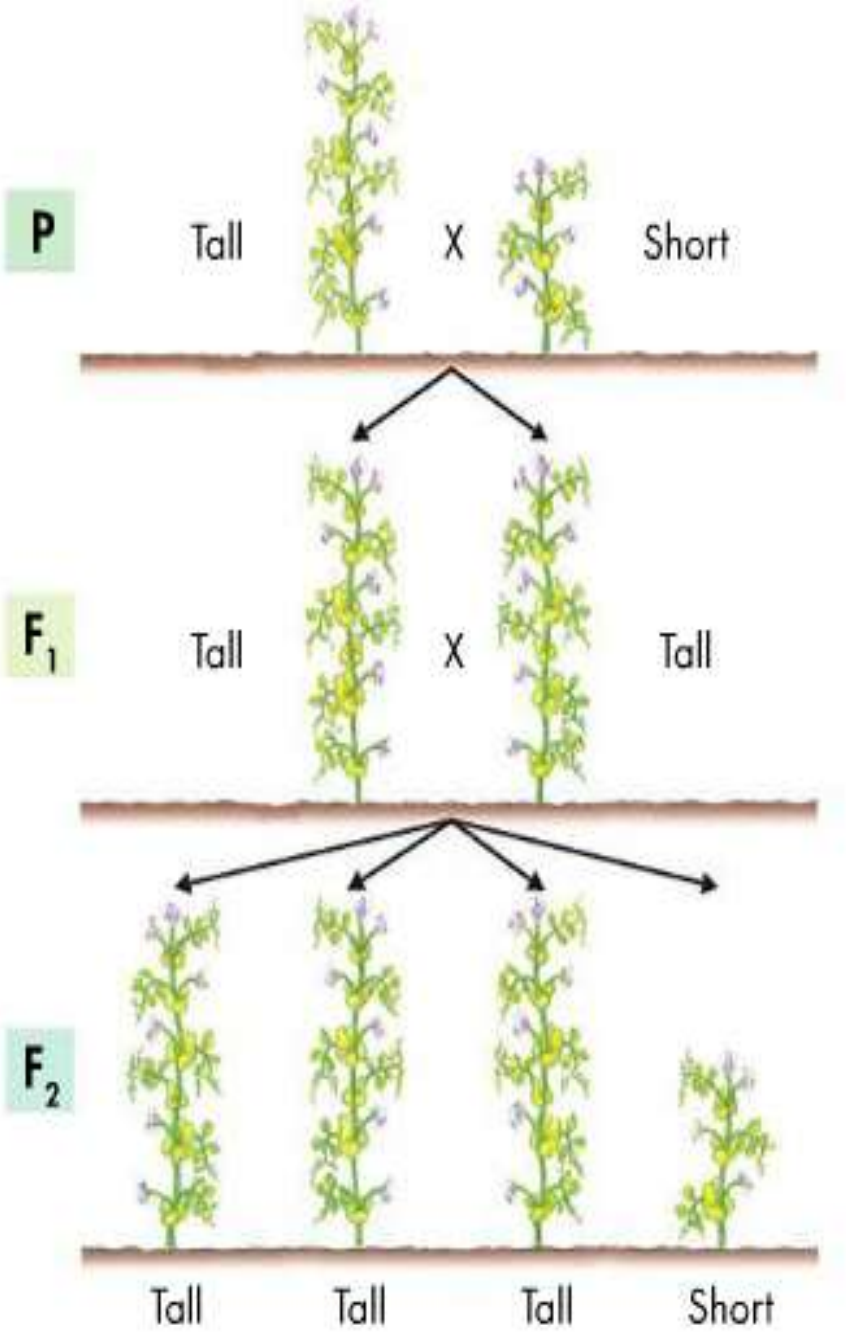
# MENDELIAN GENETICS

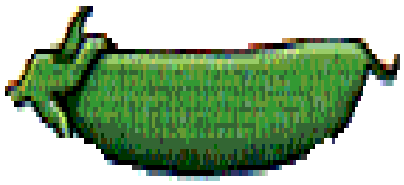
# Mendelion first low



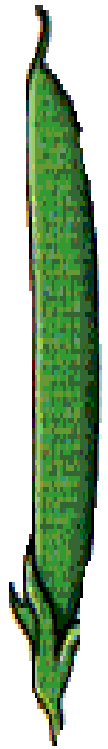

# Segregation

- Mendel didn't stop crossing after the parents.
- Mendel asked himself if the traits the parents had simply disappeared or would they show up again.
- So Mendel crossed the first filial and got new results.
- The new results were the second filial group.

# The F1 Cross



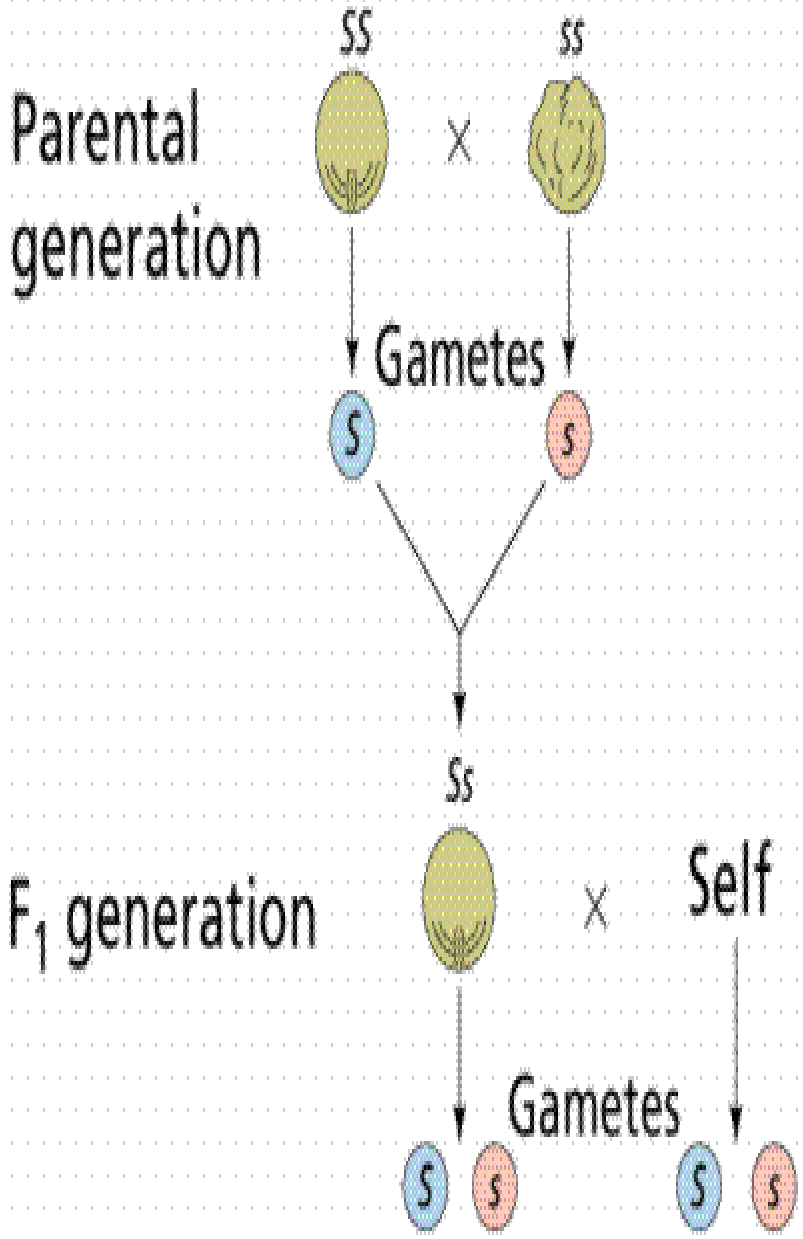
F1
Green



F1
Green

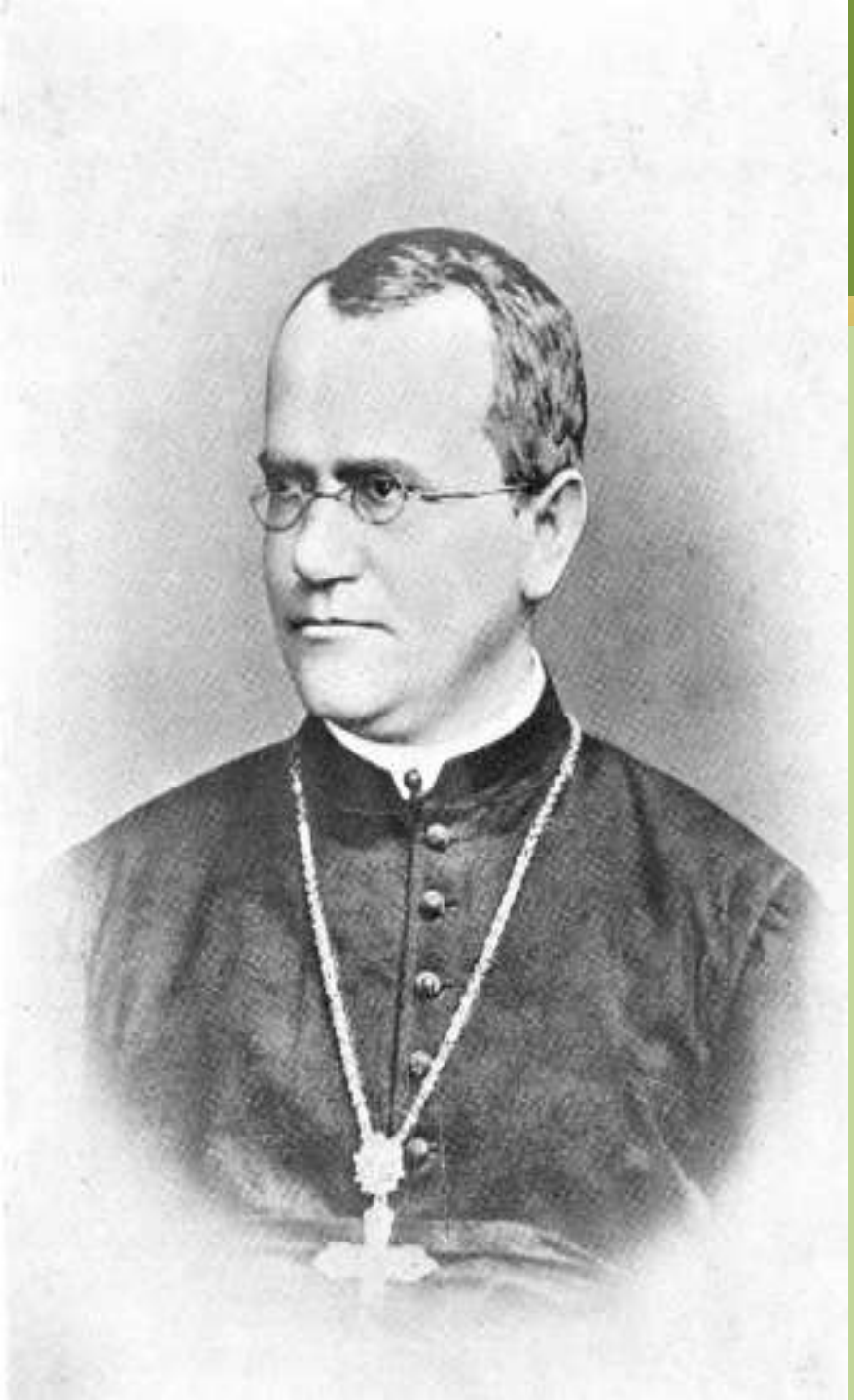
| | G | g |
|---|---|---|
| G | GG | Gg |
| g | Gg | gg |

- When Mendal crossed the first filial he was shocked to discover that in the F2 generation, the recessive traits were present.
- Only ¼ of the F2 plants showed the recessive traits.




# Explaining the F1 Cross

- **Segregation:** separation of alleles during gamete formation.
- **Gametes:** Sex cells.
- Mendel concluded that the alleles for tallness and shortness segregated during the formation of the gametes.



# The Formation of Gametes

- During Gamete formation, the alleles for each gene segregate from each other, so that each gamete carries only on allele for each gene.
- The F1 plants produces only two kinds of gametes; tall allele and short allele.
- A capital letter represents a dominant allele.
- A lower case letter represents a recessive allele.

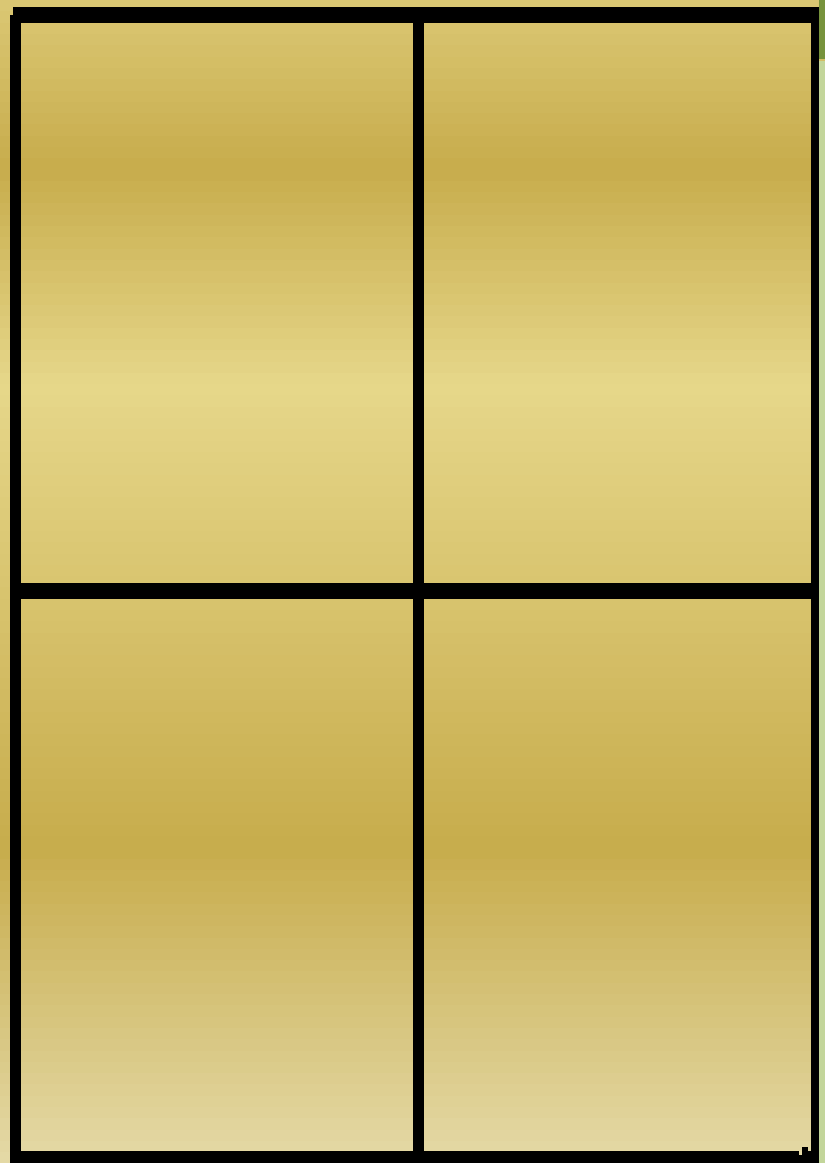
# Applying Mendel's Principals

- **Probability:** the likelihood a particular event will occur.
- Probability in genetics is what the phenotype of the said organism or thing will come out to be.
- This could be compared to flipping a coin.
- When Mendel crossbred his pea plants, he had a lot of different outcomes and data in store.

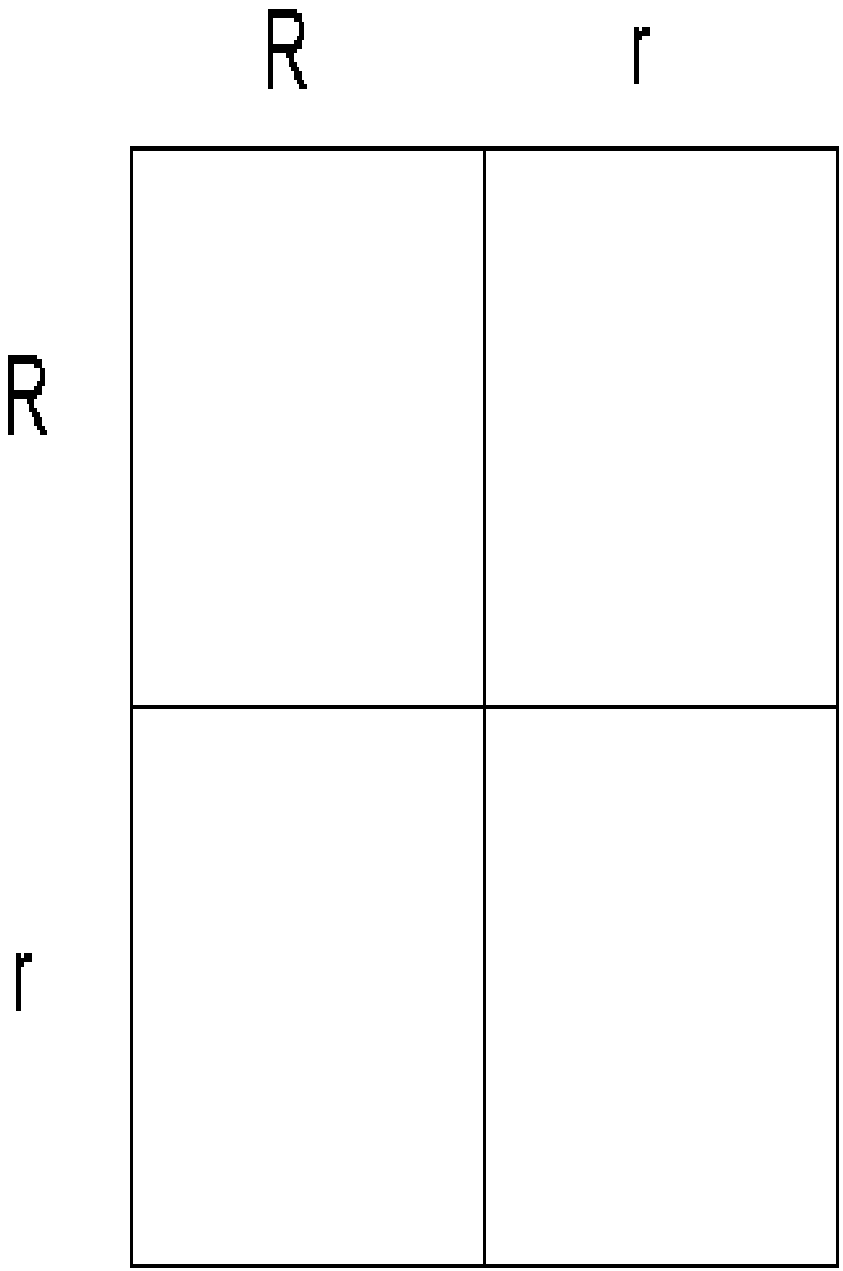
# Using Segregation to Predict Outcomes

- **Homozygous:** Organisms that have to identical alleles.
- **Heterozygous:** Organisms that have two different alleles for the same gene.
- The way that alleles segregate during gamete formation is as random as a coin flip.
- The principles of probability can be used to predict the outcomes of a genetic cross.

# Probabilities Predict Averages



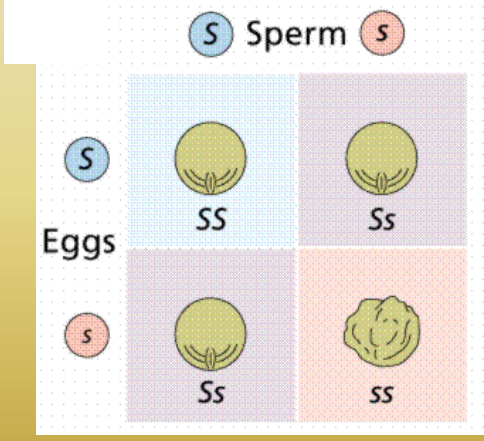
- Probabilities predict the average outcome of a large number of events.
- The larger number of offspring, the closer the results will be to the predicted values.




# Using Punnett Squares

- Punnett squares use mathematical probability to help predict the genotype and phenotype combinations in genetic crosses.
- Constructing a punnett square is easy, just draw a square with four sections.
- The possible genotypes are written in the boxes.
- The outcomes are your possible outcomes.

# Punnett Squares




- Step 1. **State the key** by using the capital letter of the dominant trait to represent the dominant gene and the small letter of the dominant trait to represent the recessive gene.
- Step 2. **Write the cross** and show the gametes.
- Step 3. **Draw the Punnett square** and place the letters for the egg alleles on one side of the square and the letters for the sperm alleles on the other side of the square.
- Step 4. **Write the results** next to the square.

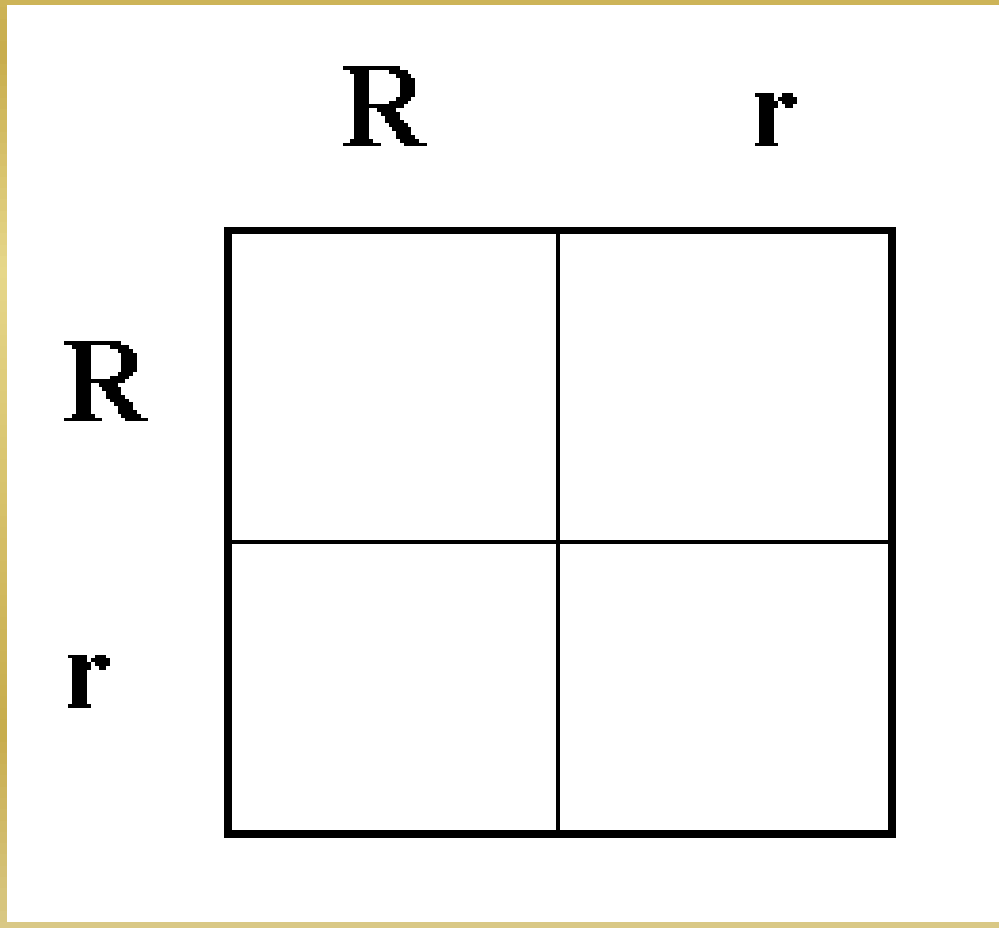
# Try This Punnett Square

In roses, red is dominant over white.

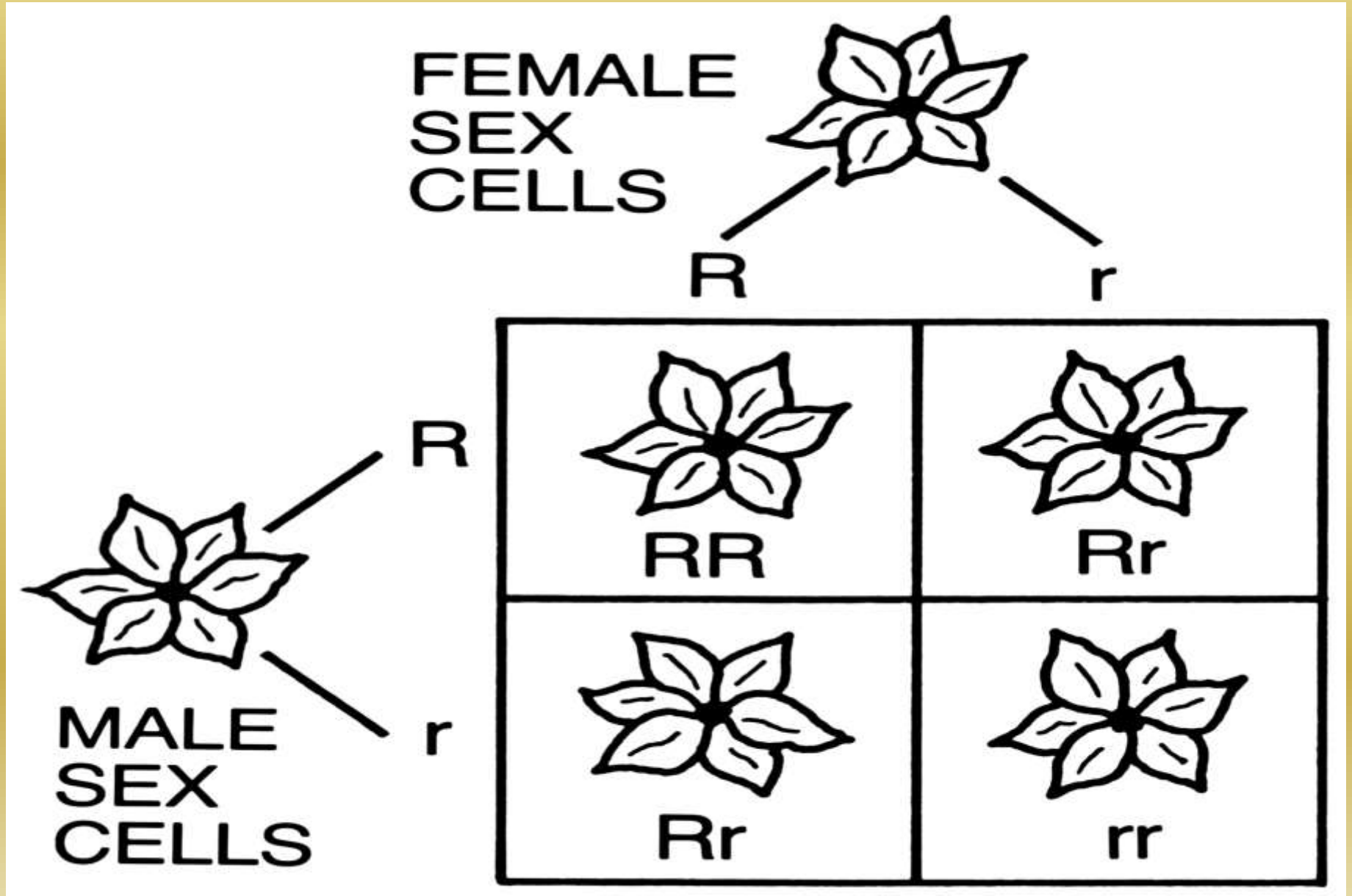
1. What letter represents the red gene?

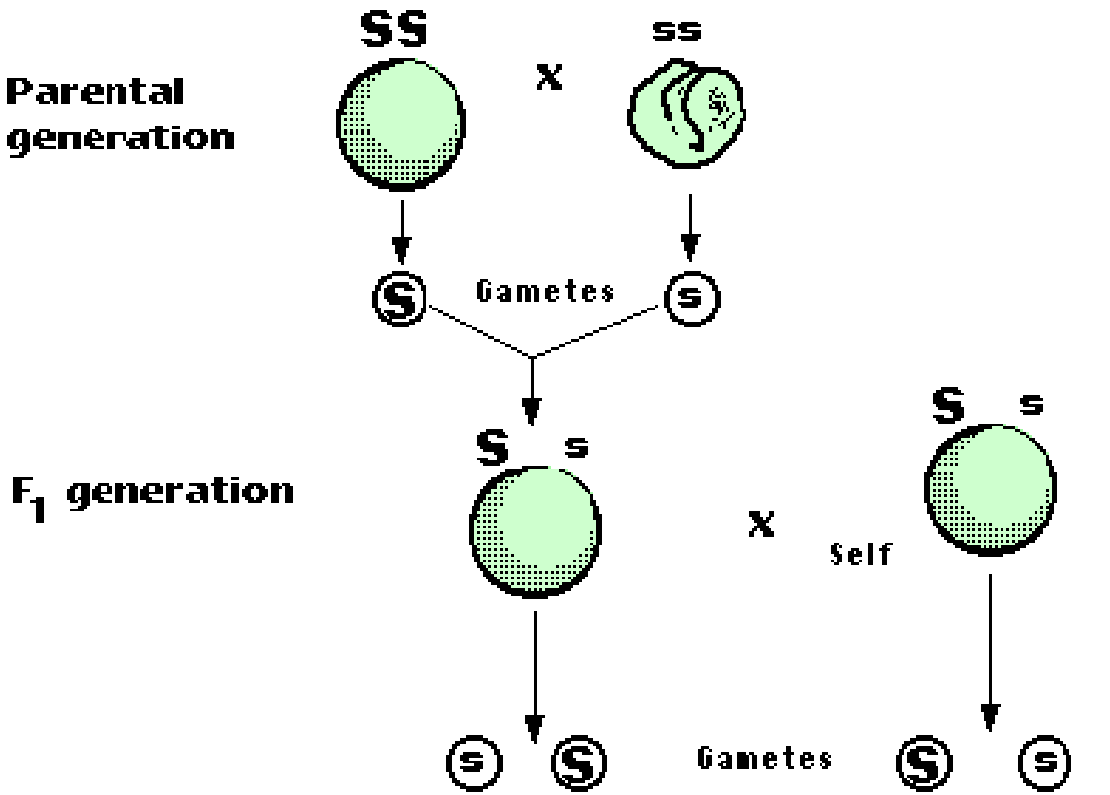
2. What letter represents the white gene?

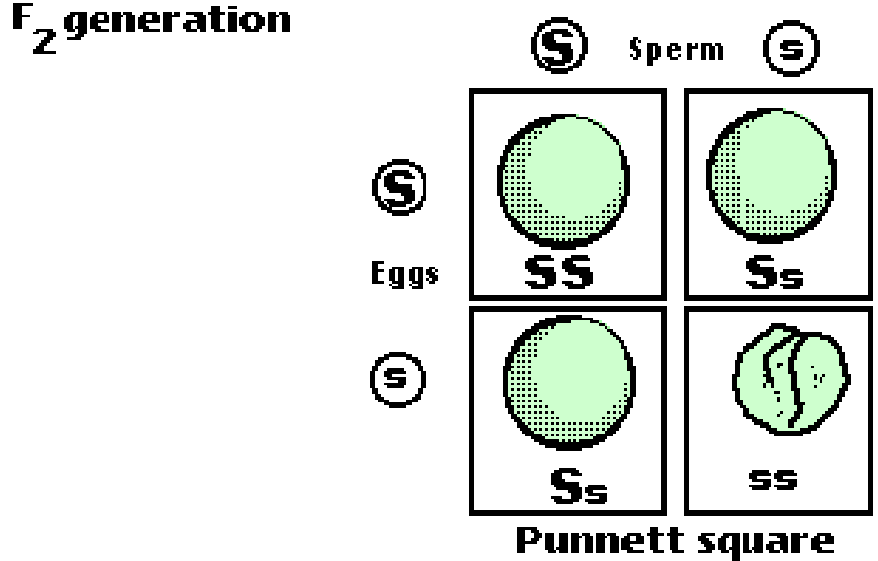
3. Cross two heterozygous red roses. Describe the phenotype of the offspring.



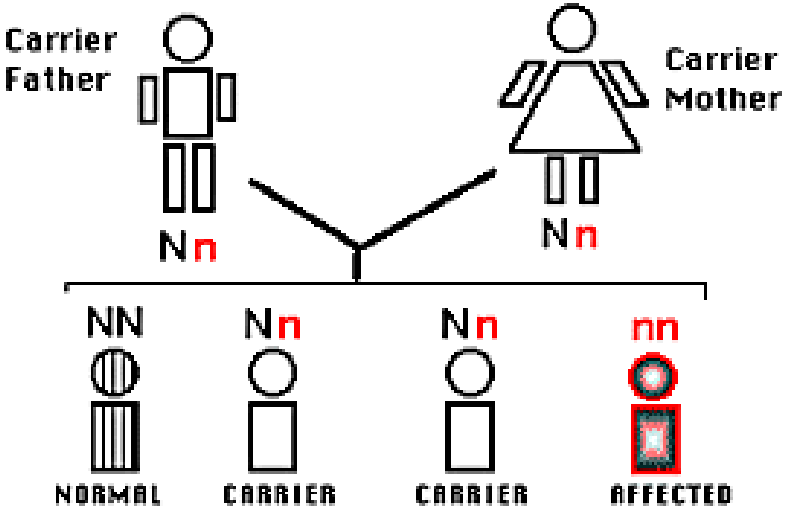
# Punnett Square

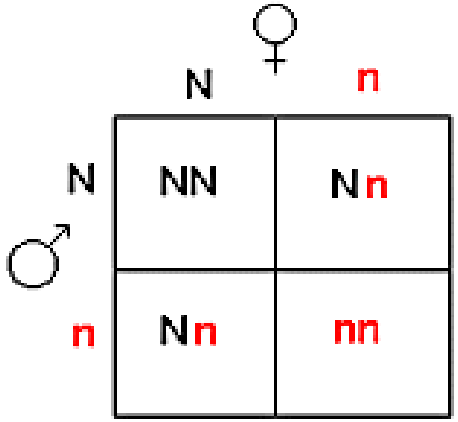



Parental generation
SS
x
ss
Gametes
S
s
F1 generation
S s
x
Self
S s
Gametes
S
s

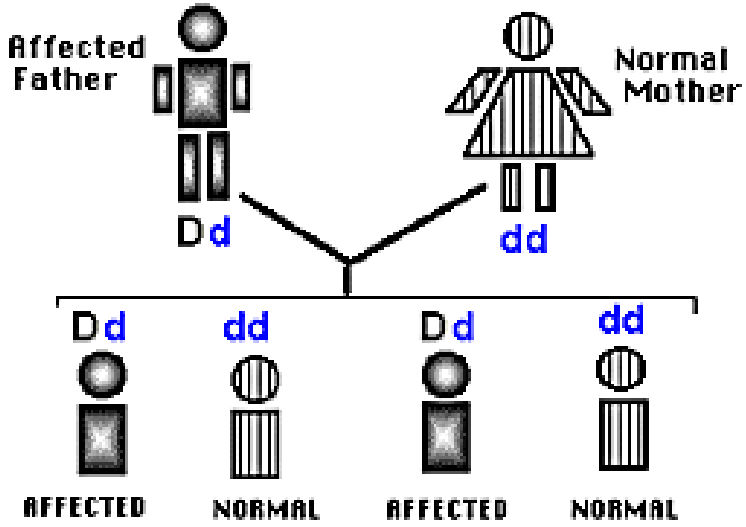

F2 generation
Sperm
S
s
Eggs
SS
Ss
Ss
ss
Punnett square

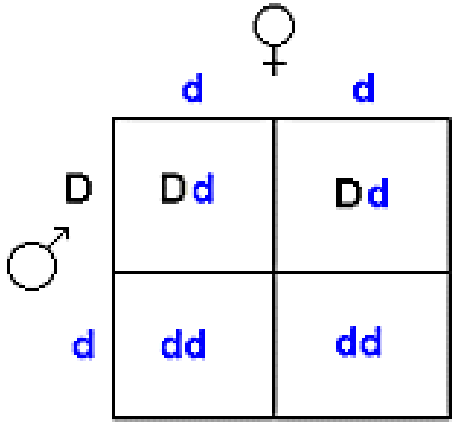
# Recessive inheritance




# Dominant inheritance



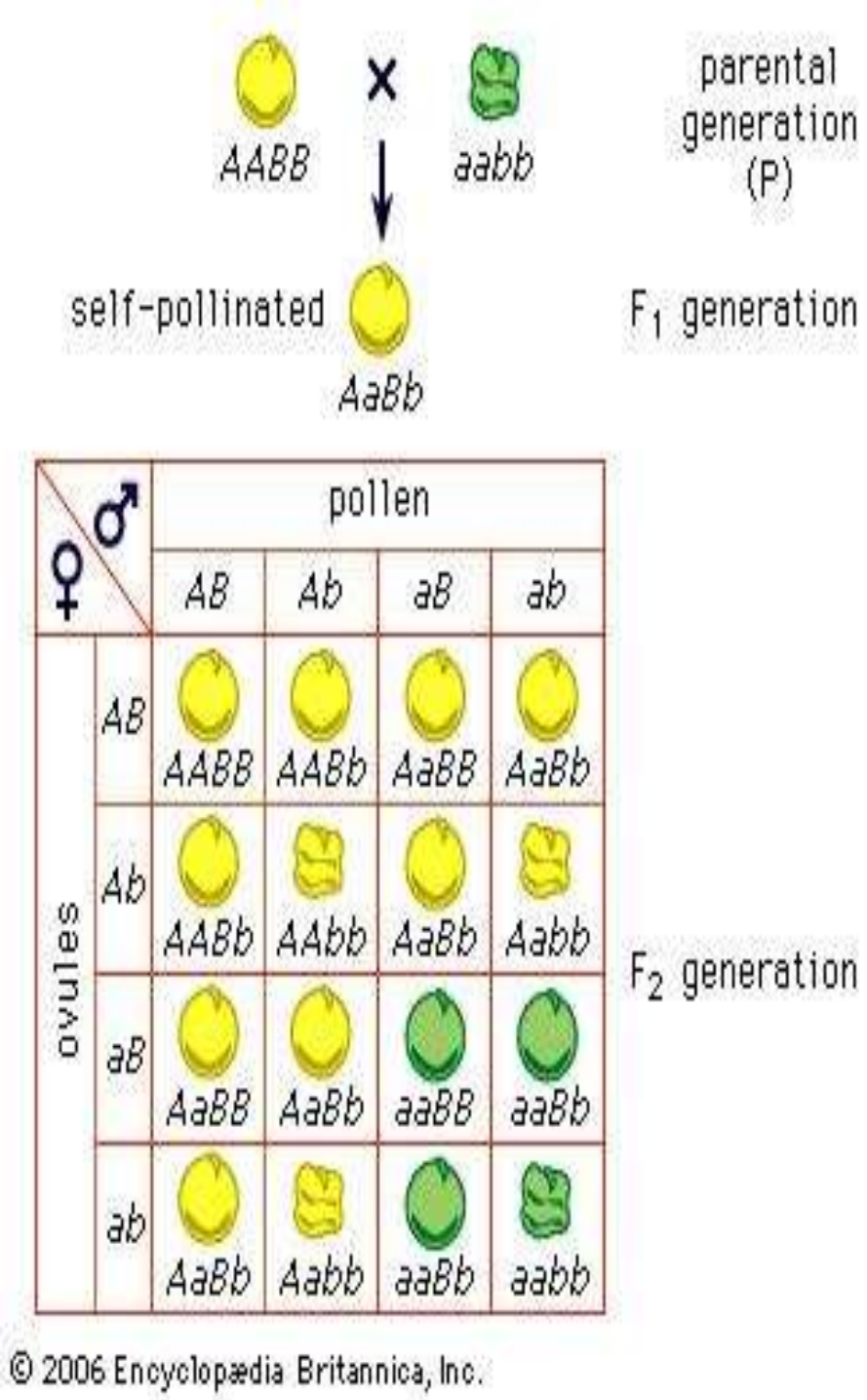



# Mendelion second low


# Independent Assortment

- How do alleles segregate when more than one gene is involved?
- Mendel wanted to know if the factor of one trait affected another.
- Example: Would the shape of the seed effect seed color?

# The Two Factor Cross: F1

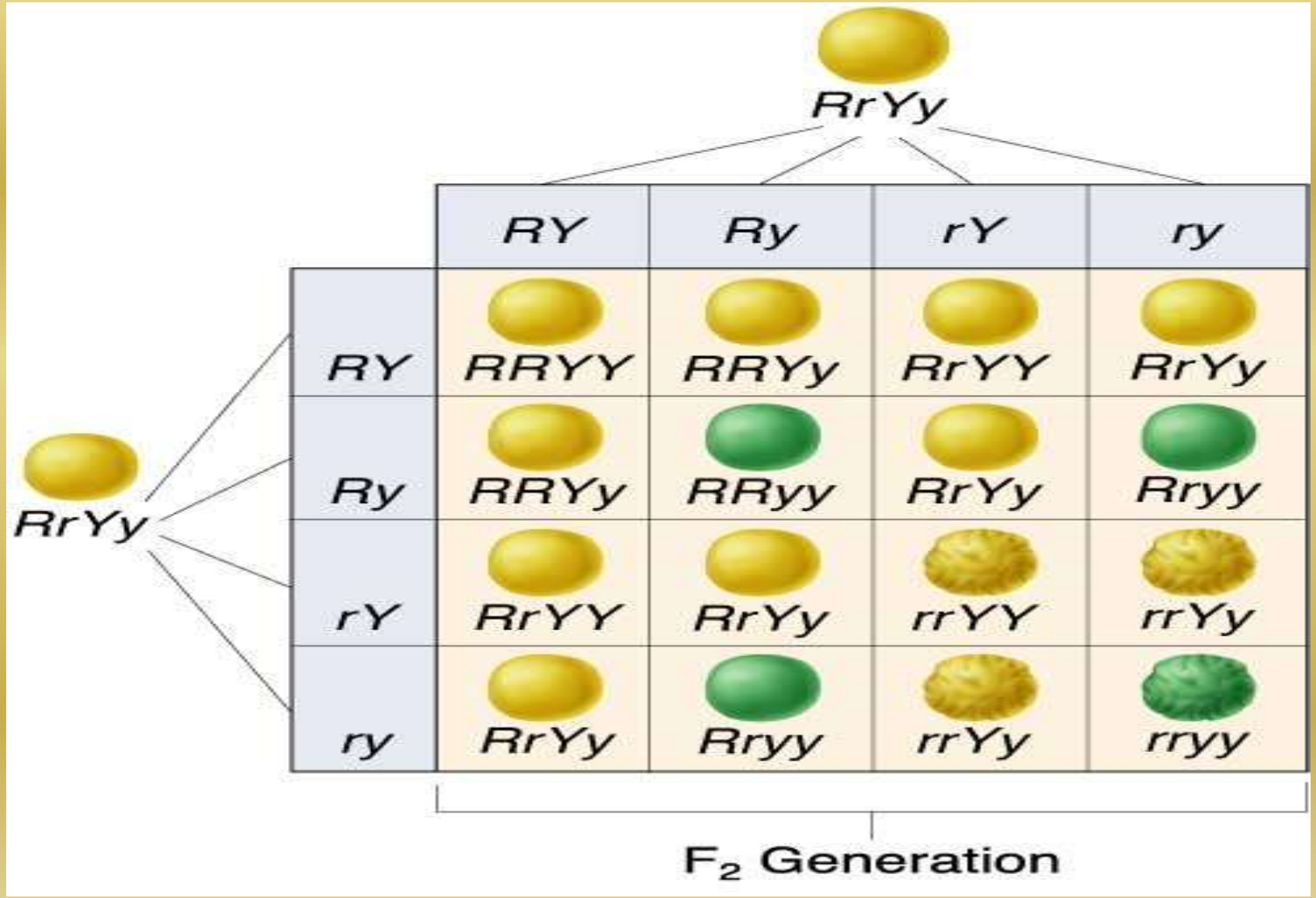



- Mendel crossed only true breeding plants in this one.
- They came up with only round, yellow seeds.
- However, these seeds were all hybrids having a heterozygous genetic make-up.

# The Two Factor Cross: F2

- The principle of independent assortment states that genes for different traits can segregate independently during the formation of gametes.
- In the second part of Mendel's experiment, he crossed the F1 plants to produce the F2 offspring.
- Each F1 offspring was heterozygous.
- The F12 plants, in Mendel's experiment, produced 556 seeds.

# Independent Assortment in Peas



# A Dihybrid Cross

- In mice, black is dominant over tan and short tails are dominant over long.
- Write the genotype for a heterozygous black, short- tailed mouse.
  - **B = black**
  - **b = tan**
  - **S = short tails**
  - **s = long tails**

# A Dihybrid Cross

- B b S s = heterozygous black, short
- What are the possible gametes for this mouse?
- Each gamete must have one “B” and one “S”

**BbSs x BbSs**

| | BS | Bs | bS | bs |
|---|---|---|---|---|
| **BS** | | | | |
| **Bs** | | | | |
| **bS** | | | | |
| **bs** | | | | |

# A Dihybrid Cross

- **Describe the phenotype of the offspring.**

**Black, Short-tail**
**9**
**Black, Long-tail**
**3**
**Tan, Short-tail**
**3**
**Tan, Long-tail**
**1**

**BbSs x BbSs**

| | BS | Bs | bS | bs |
|---|---|---|---|---|
| **BS** | BBSS | BBSs | BbSS | BbSs |
| **Bs** | BBSs | BBss | BbSs | Bbss |
| **bS** | BbSS | BbSs | bbSS | bbSs |
| **bs** | BbSs | Bbss | bbSs | bbss |

# QUESTIONS