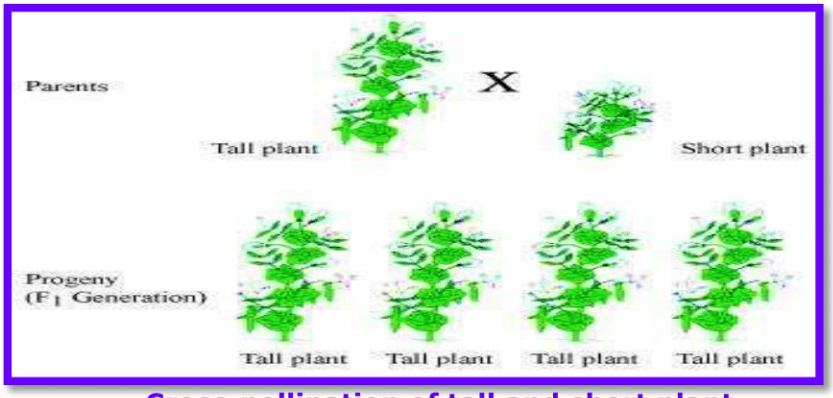
Page 147

Question 1:

How do Mendel's experiments show that traits may be dominant or recessive?

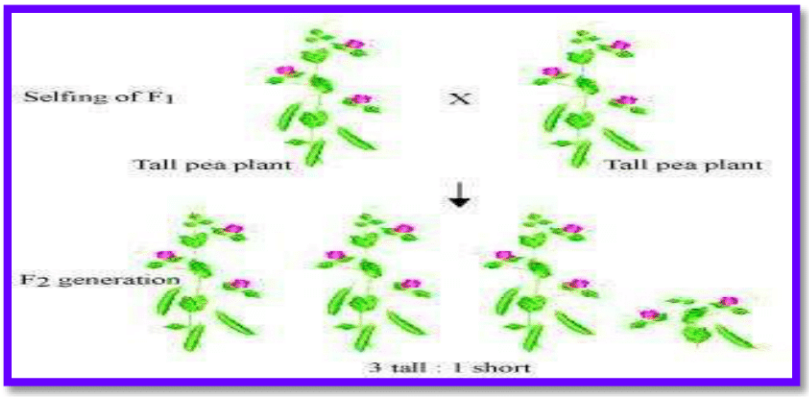
Answer 1:

Mendel selected true breeding tall (TT) and dwarf (tt) pea plants. Then, he crossed these two plants. The seeds formed after fertilization were grown and these plants that were formed represent the first filial or F_1 generation. All the F_1 plants obtained were tall.



Cross-pollination of tall and short plant

Then, Mendel self-pollinated the F_1 plants and observed that all plants obtained in the F_2 generation were not tall. Instead, one-fourth of the F_2 plants were short.



Self-pollination of F_1 plants

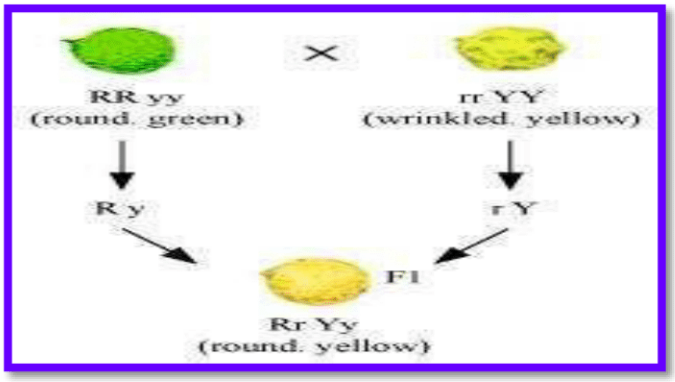
From this experiment, Mendel concluded that the F_1 tall plants were not true breeding. They were carrying traits of both short height and tall height. They appeared tall only because the tall trait is dominant over the dwarf trait.

Question 2:

How do Mendel's experiments show that traits are inherited independently?

Answer 2:

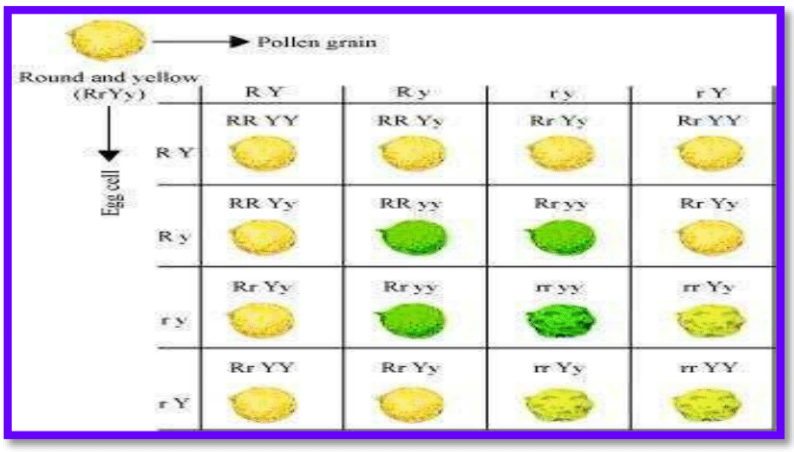
Mendel crossed pea plants having round green seeds (RRyy) with pea plants having wrinkled yellow seeds (rrYY).



An example of dihybrid crosses

Since the F_1 plants are formed after crossing pea plants having green round seeds and pea plants having yellow wrinkled seeds, F_1 generation will have both these characters in them. However, as we know that yellow seed colour and round seeds are dominant characters, therefore, the F_1 plants will have yellow round seeds.

Then this F_1 progeny was self-pollinated and the F_2 progeny was found to have yellow round seeds, green round seeds, yellow wrinkled seeds, and green wrinkled seeds in the ratio of 9:3:3:1.



Independent inheritance of two different traits

In the above cross, more than two factors are involved, and these are independently inherited.

Question 3:

A man with blood group A marries a woman with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits – blood group A or O – is dominant? Why or why not?

Answer 3:

No. This information is not sufficient to determine which of the traits – blood group A or O – is dominant. This is because we do not know about the blood group of all the progeny. Blood group A can be genotypically AA or AO. Hence, the information is incomplete to draw any such conclusion.

Question 4:

How is the sex of the child determined in human beings?

Answer 4:

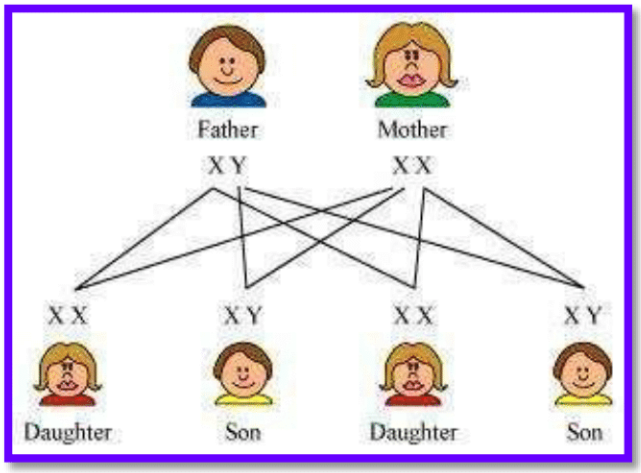
In human beings, the females have two X chromosomes and the males have one X and one Y chromosome. Therefore, the females are XX and the males are XY.

The gametes, as we know, receive half of the chromosomes. The male gametes have 22 autosomes and either X or Y sex chromosome.

Type of male gametes: 22+X OR 22+ Y.

However, since the females have XX sex chromosomes, their gametes can only have X sex chromosome.

Type of female gamete: 22+X



Sex determination in humans

Thus, the mother provides only X chromosomes. The sex of the baby is determined by the type of male gamete (X or Y) that fuses with the X chromosome of the female.