

Practice Challenge - Subjective

Subject: Bio

Topic : Heredity and Evolution

Exam Prep Session 01

Class: X

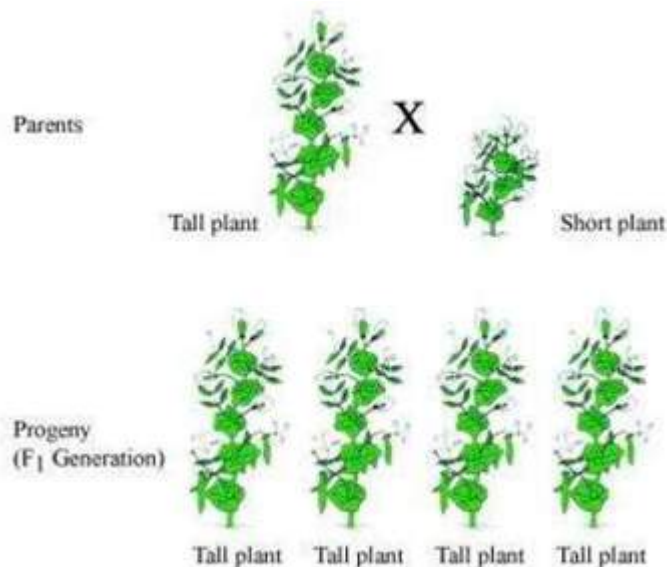
Time: 00:20 hrs

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

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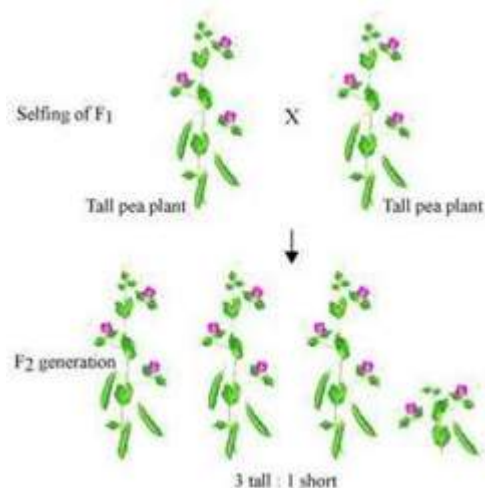
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Mendel selected true breeding tall (TT) and dwarf (tt) pea plants. Then, he crossed these two plants. The seeds formed after fertilization were grown and these plants that were formed represent the first filial or F₁ generation. All the F₁ plants obtained were tall.



Cross-pollination of tall and short plant

Then, Mendel self-pollinated the F₁ plants and observed that all plants obtained in the F₂ generation were not tall. Instead, one-fourth of the F₂ plants were short.



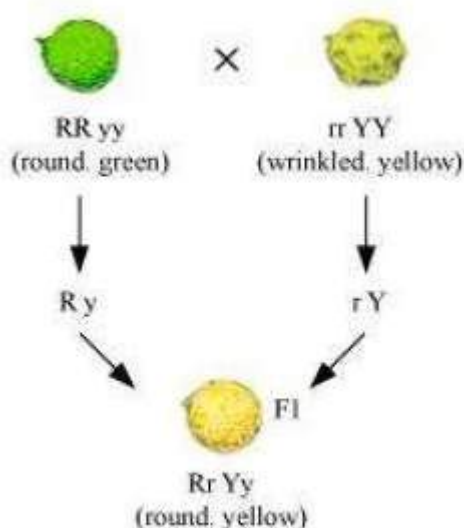
Self pollination of F₁ plants

From this experiment Mendel concluded that the F₁ tall plants were not purely tall. 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.

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

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



Since F1 plants are formed after crossing pea plants having green round seeds and pea plants having yellow wrinkled seeds, F1 generation will have both these characters in them. However as we know that yellow seed color and round seeds are dominant characters, therefore the F1 plants will have yellow round seeds.

Then this F1 progeny was self-pollinated and the F2 progeny was found to have yellow round seeds, green round seeds, yellow wrinkled seeds, and green wrinkled seeds in the ratio 9:3:3:1.

The Punnett square shows the self-pollination of an F1 round yellow pea plant (RrYy). The pollen grain (male gamete) is shown at the top, and the egg cell (female gamete) is shown on the left. The possible gametes are RY, Ry, ry, and rY. The resulting F2 progeny are shown in the cells of the square, with their genotypes and phenotypes.

Round and yellow (RrYy)		Pollen grain			
		RY	Ry	ry	rY
Egg cell	RY	RRYY Yellow Round	RRYy Yellow Round	RrYy Yellow Round	RrYY Yellow Round
	Ry	RRYy Yellow Round	RRyy Yellow Wrinkled	Rryy Green Wrinkled	RrYy Yellow Round
	ry	RrYy Yellow Round	Rryy Green Wrinkled	rryy Green Wrinkled	rrYy Yellow Wrinkled
	rY	RrYY Yellow Round	RrYy Yellow Round	rrYy Yellow Wrinkled	rrYY Yellow Wrinkled

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Independent Inheritance of two different traits:

During reproduction, the factors determining the traits get separated into reproductive cells or gametes, and reunite during fertilization.

The pair of alleles segregate from each other during gamete formation so that only one allele will be present in each gamete.

When Mendel crossed a pea plant with yellow colour, round seed with green colour wrinkled seed were two parental and two recombinant phenotypes.

The parents were yellow, round and green wrinkled. While the recombinants were yellow wrinkled and green round. This result explains that the traits are separate from their parental combinations and are inherited independently.

3. Explain how sexual reproduction gives rise to more viable variations than asexual reproduction. How does this affect the evolution of those organisms that reproduce sexually?

In sexual reproduction, two individuals having different variations combine their DNA to give rise to a new individual. Therefore, sexual reproduction allows more variations whereas in asexual reproduction, chance variations can only occur when the copying of DNA is not accurate.

Additionally, asexual reproduction allows very less variations because if there are more variations, then the resultant DNA will not be able to survive inside the inherited cellular apparatus.

However, in sexual reproduction more variations are allowed and the resultant DNA is also able to survive, thus making the variations viable.

Variation and Evolution: Variants help the species to survive in all the conditions. Environmental conditions such as heat, light, pests and food availability can change suddenly at only one place. At that time, only those variants resistant to these conditions would be able to survive. This will slowly lead to the evolution of a better adapted species. Thus variation helps in the evolution of sexually reproducing organisms.

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

Sex of a child in humans is determined by the type of male haploid gamete that fuses with the female egg. The chromosome in the 23rd pair of a male gamete can be either X or Y. The female egg always has an X chromosome. So if the male gamete with the X chromosome fuses with the female egg, the child will be female. Similarly, if the male gamete with the Y chromosome fuses with the female egg, the child will be male.

5. Define dominant and recessive traits.

Dominant Trait:

It is a character expressed by a dominant gene. Dominant gene is the one which expresses itself in the presence of its contrasting trait which is considered to be a suppressed gene.

In simple words, the traits which are expressed more often and observed more commonly in the population is called dominant trait.

Recessive Trait:

It is a character expressed by a recessive gene. Recessive gene is a gene whose expression is suppressed by a dominant gene.

In simple words, the traits which are not often expressed and commonly observed are called recessive traits.

Examples:

In pea plant,

Tallness is a dominant trait and dwarfness is a recessive trait.

6. Define inheritance and heredity.

1. The process by which all of the genetic characters or qualities are transmitted from parent to offspring is called inheritance.

2. Branch of science that deals with the study of inheritance is called heredity.

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7. Define

(i) Law of segregation

(ii) Law of independent assortment

(iii) Law of dominance

Mendel's Law of segregation states that allele pairs separate or segregate during gamete formation, and randomly unite at fertilization.

Mendel's Law of independent assortment states that allele pairs separate independently during the formation of gametes. Therefore, traits are transmitted to offspring independently of one another.

Mendel's Law of dominance states that if a cross is made between plants with contrasting pair of characters, the character that appears in the first generation is dominant and the other is recessive.

8. A certain couple got only four daughters in a row and no son. Does it mean that the husband does not produce Y-bearing sperms? Explain.

No, it does not mean that the husband does not produce Y-bearing sperms. Sex of the child depends upon the kind of sperm that fertilizes the egg. The egg contains only one X chromosome, but half of the sperms released into the female are X-bearing and the remaining half are Y-bearing. It is simply a matter of chance as to which category of sperms fuses with the ovum. If the egg (X) is fused by X-bearing sperm, the resulting combination is XX, i.e. female type, and the child produced is female (daughter). If the egg (X) is fused by Y-bearing sperm, the resulting combination is XY, i.e. male constitution, and the child produced will be a male (son).