CLASS X - LIFE SCIENCE

Q Explain the laws of Heredity.

Ans. Gregor Mendel, with the help of his experiments on garden pea, was able to formulate Laws, called as the Laws of Heredity, which explain the manner of inheritance of characters.

Mendel analysed the result of monohybrid crosses by assuming that each parent transmitted a 'factor' to their progeny. Each character (trait) of the parent plant dependent on a specific factor & the two contrasting characters possess two factors that remain in pair – tall (TT) & dwarf (tt). (Modern scientists designated these factors as genes). Tall & dwarf parents transmitted their tall & dwarf factors to each offspring of the F_1 generation through their gametes – that is each offspring received both tall factor (T) as well as the dwarf factor (t) from their parents. But the factor responsible for tallness is dominant over the factor responsible for dwarfness & so all the plants of F_1 generation are tall (Tt) so offsprings of F_1 generation possess both the factors (Tt) for the height of the plant. But these two factors are separated in the F_2 generation, so both the tall as well as dwarf plants have been developed in the experiment. So reappearance of both the characters in F_2 suggests that alternative factors of a character have not been blended with each other, but they stay together, and only one is expressed. At the time of formation of gametes, these two factors obviously separate or segregate, otherwise recessive type would not

appear in F_2. The gametes which are formed are always pure for a particular character. A gamete may carry either the dominant or the recessive factor but not both as we find in F_1 individuals. This is why it is called either as "Law of Segregation" or as "Law of purity of gametes". This concept of segregation is called Mendel's First Law.

In dihybrid cross experiment, as the seeds of F_1 generation are all Yellow & round, so it can be assumed that Yellow is dominant over the green, & round is dominant over the wrinkled. F_1 hybrid plants will produce male & female gametes by meiosis, when one pair of alleles Yy will be separated into Y & y, another pair of alleles Rr will be separated into R & r. These four genes combines independently in such a way that each gamete contain one gene for seed shape & one gene for cotyledon colour, that is Y gene can combine with R gene or Y gene can combine with r gene, & in the same way y gene combine with R gene or y gene can combine with r gene (random combination). Thus F_1 hybrid plants produce four types of male (pollens) & four types of female (ova) gametes in equal proportions, such as male gametes YR, Yr, Ry, yr & female gametes YR, Yo, yR, yr. This is possible when two genes assort (distribute) independently & one pair of genes has no influence over the another pair.

Thus Mendel observed that yellow & green pair has no influence over the round & wrinkled pair; rather they behave just like monohybrid cross. In other words, two pairs of alleles behave just like monohybrid cross. In other words, two pairs of alleles behave independent

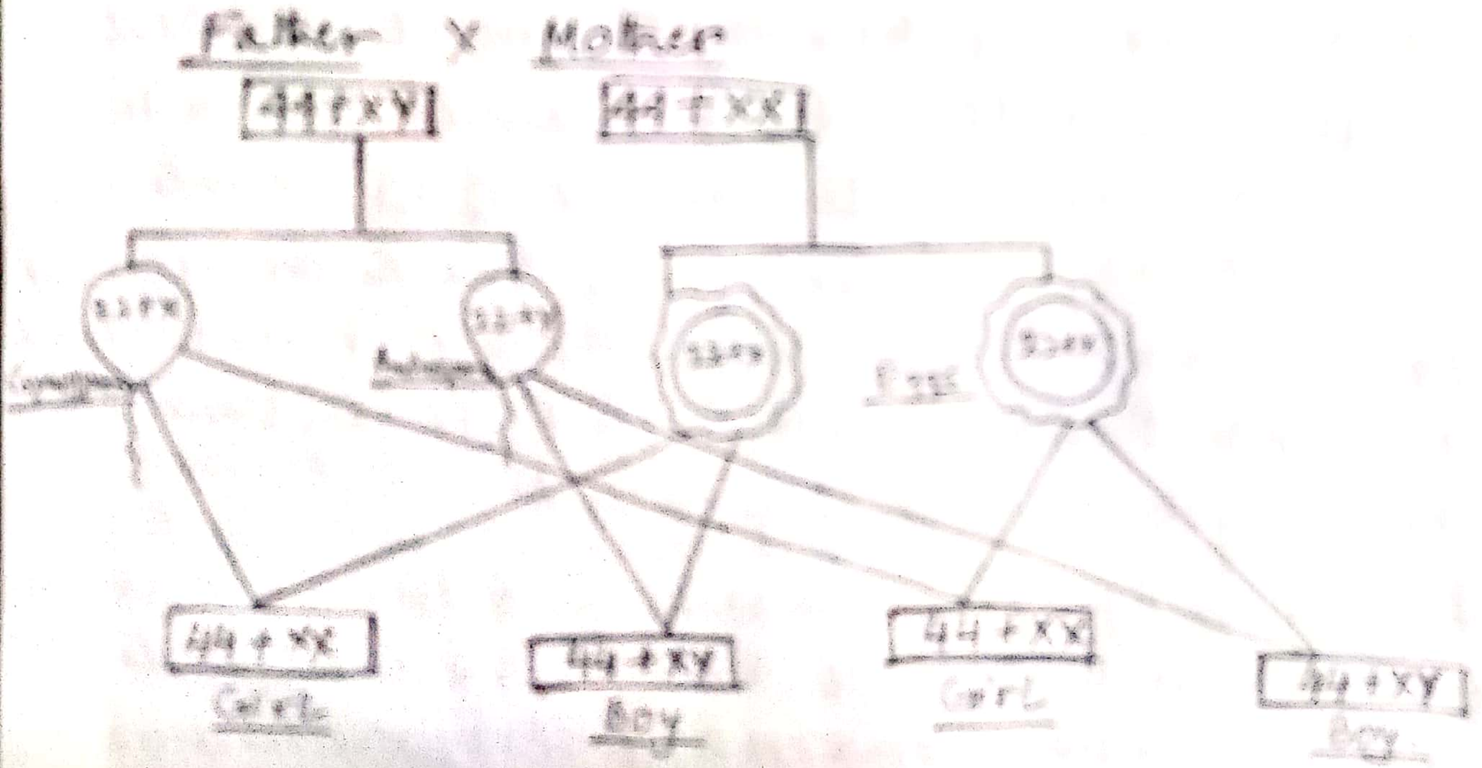
to each other. Therefore it was concluded that the two characters under consideration are assorting, that is giving rise to different combinations in an independent manner. From this principle, Mendel formulated the "Law of Independent Assortment", which states that, two or more pairs of alleles are assorted independently & may combine randomly with either of another pair, in all possible combinations, during the formation of gametes. This law is also known as Mendel's second Law.

Q. Mention the symptoms of thalassemia disease. In many families, mothers are labelled as responsible for the birth of daughter child. Demonstrate with the help of a cross, that this belief is not justified. 2+3.

Ans Main symptom of thalassemia is defect in the synthesis of haemoglobin & therefore the affected individual suffers from mild to severe anaemia. Due to less amount of haemoglobin, the size of RBC is reduced (microcytic RBC). Frequent blood transfusion is essential for the survival of the patient, that causes increased iron content of body which affect the functioning of heart, liver & endocrine glands.

Human beings have 22 pairs of autosomes & one pair of Sex-chromosomes. All the ova formed by female are similar in their chromosome type (22+X). Therefore females are **homogametic**. The male gametes or sperms

produced by by human males are of two types — gynosperms (22+X) & androsperms (22+Y), produced in equal numbers. Human males are therefore **heterogametic**. Sex of the offspring is determined at the time of fertilization. It is not dependent on any characteristic of the female parent because the latter is homogametic & produces only one type of eggs (22+X). It is a matter of chance that the ovum is fertilized by an androsperm or a gynosperm. The same chance can occur 2, 3, or more times, but for any chance, the mother cannot be blamed. It is the father, who is responsible for the sex of the child. Fertilization of the egg (22+X) with a gynosperm (22+X) will produce a female child (44+XX), while fertilization with an androsperm (22+Y) gives rise to a male child (44+XY). Therefore father plays main role in determination of sex in man.



cross demonstrating sex determination in humans & birth of a boy & girl baby