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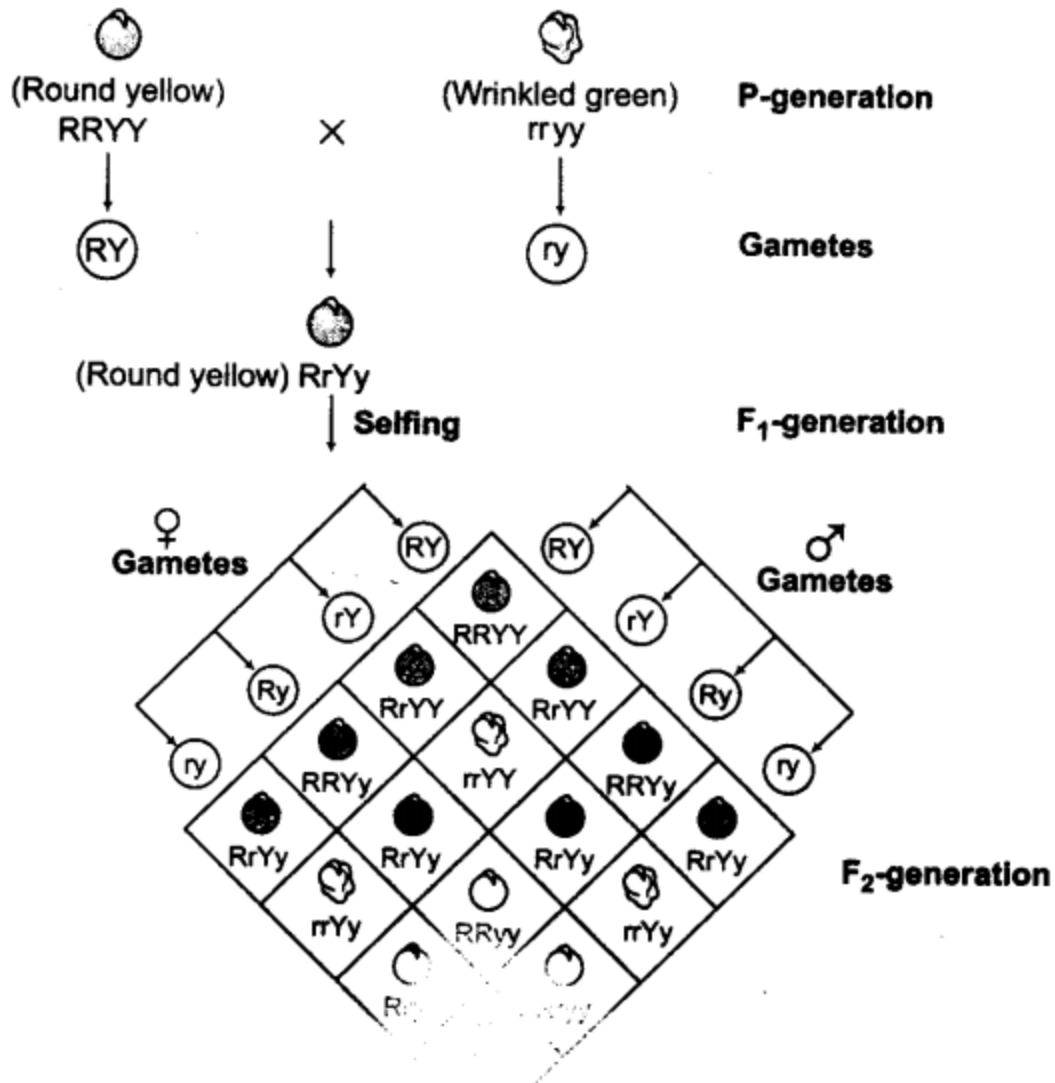
## Principles of Inheritance and Variation –

**10. Mendel's law of inheritance** are based on his observations on monohybrid and dihybrid crosses, he proposed three laws:

(i) Law of dominance (first law) States that characters are controlled by genes which occur in pair, when two alternate forms of a trait or character (genes or alleles) are present in an organism, only one factor (dominant) expresses itself in F<sub>1</sub>-generation. While, the other factor (recessive) remains hidden. It explains expression of genes in a cross and 3:1 ratio obtained in the F<sub>2</sub>-generation.

(ii) Law of segregation (second law) States that the factors or alleles of a pair segregate from each other during gamete formation, in a way that a gamete receives only one of the two factors. They do not show any blending.

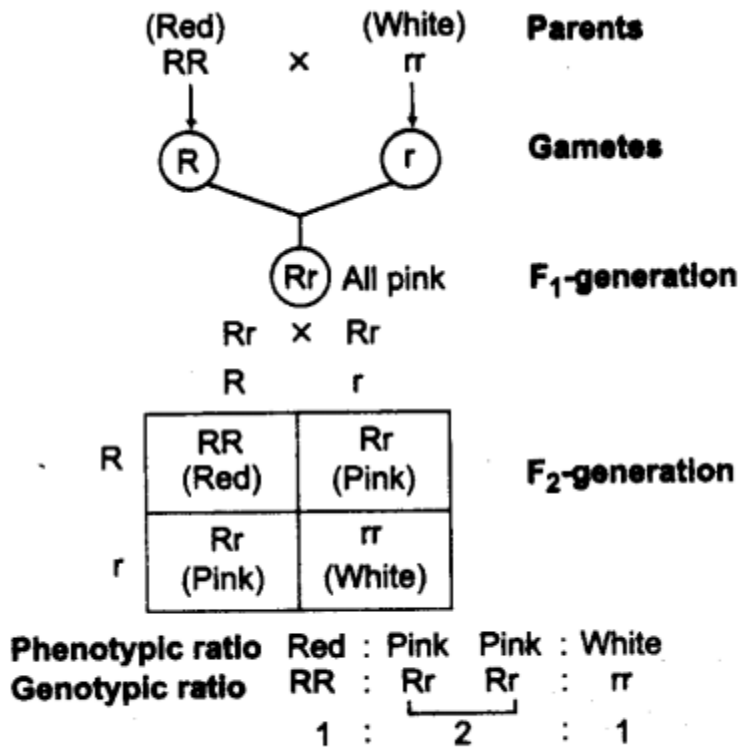
(iii) Law of independent assortment (third law) It is based on inheritance of two genes, i.e. dihybrid cross which states that when two pairs of contrasting traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters. These factors randomly rearrange in the offsprings producing both parental and new combination of characters. The Punnett square can be used to understand the independent during meiosis.



**Phenotypic ratio** Round yellow : Round green : Wrinkled yellow : Wrinkled green  
**Genotypic ratio** 9 : 3 : 3 : 1

11. **Incomplete dominance** is a phenomenon in which the F<sub>1</sub> - hybrid shows characters intermediate of the parental genes. In this process, the phenotypic ratio of F<sub>2</sub>-generation deviates from the Mendel's monohybrid ratio.  
 Example, inheritance of flower colour in the dog flower (snapdragon or *Antirrhinum* sp) and four O' clock plant (*Mirabilis jalapa*).

In a cross between red flower (RR) and white flower plant (rr), the F<sub>1</sub> (Rr) was pink (in figure).  
 When F<sub>1</sub> was self-pollinated, the F<sub>2</sub> resulted in the ratio 1: 2: 1



**Monohybrid cross in the plant snapdragon, where one allele is incompletely dominant over the other allele**

12. **Codominance** is a phenomenon in which two alleles are able to express themselves independently when present together. These alleles are called codominant alleles.

The offsprings show resemblance to both the parents.

- (i) A common example of codominance is ABO blood groups in humans.
- (ii) The gene for blood group exist in three allelic forms  $I^A$ ,  $I^B$  and  $i$ .

(iii)  $I^A$  and  $I^B$  produce RBC surface antigens A and B, respectively, whereas 'i' does not produce any antigen.

(iv)  $I^A$  and  $I^B$  both are dominant alleles, whereas  $i$  is the recessive allele.

(v) In case  $I^A$  and  $I^B$  are present together, both express equally and produce both the surface antigens A and B.

### Genetic Basis of Blood Groups in Human Population

Allele from parent 1	Allele from parent 2	Genotype of offspring	Blood types offspring
$I^A$	$I^A$	$I^A I^A$	A
$I^A$	$I^B$	$I^A I^B$	AB
$I^A$	i	$I^A i$	A
$I^B$	$I^A$	$I^A I^B$	AB
$I^B$	$I^B$	$I^B I^B$	B
$I^B$	i	$I^B i$	B
i	i	ii	O