

## PRINCIPLE OR LAW OF SEGREGATION

(LAW OF PURITY OF GAMETES)

(MONOHYBRID CROSS)

This law is based upon monohybrid cross. (monohybrid cross is the study of inheritance of a pair of gene.)

This law states that "The two factors of a character which remain together in an individual do not get mixed up but keep their identity distinct, separate at the time of gametogenesis or sporogenesis, get randomly distributed to different gametes and then get paired again in different offspring as per the principle of probability."

Mendel crossed the round seeded plant and wrinkled seeded plant. All the plant are round seeded in F<sub>1</sub> generation. <sup>(100%)</sup> In the first generation (P<sub>1</sub>) in Mendel's experiments the characters (phenotypes) produced were uniform i.e. all the plants were heterozygous and showed dominant character only. ~~Round~~ (Round seeded)

Round seeded plant X Wrinkled seeded plant  
(RR) (rr) — P

Round seeded plant — F<sub>1</sub>  
(Rr)



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PRINCIPLE OR LAW OF SEGRIGATION

New plants of the  $F_1$  generation were selfed to produce  $F_2$  generation. In  $F_2$  generation 2 different phenotypes appeared

- (a) Round seeded, like parent, and
- (b) wrinkled seeded, like the other one.

This shows that traits have separate from  $F_1$  hybrid. Though  $F_1$  plant shows only one or dominant alternative of a trait, it actually carries factors or alleles of both the alternatives of the trait because the second or recessive alternative appears in the  $F_2$  generation. Therefore,  $F_1$  plants are genetically hybrid ( $Rr$ ).

$F_1$  plants are a product of fusion of male and female gametes. As they carry the gene complement of  $Rr$ , the fusing gametes must bring in only one factor each ( $R$  from  $RR$  and  $r$  from  $rr$  parent)

$F_2$  generation consists of 3 types of plants - pure round, hybrid round and wrinkled seeded-plant. This is possible when (a).

- (a) The two mendelian factors present in the  $F_1$  plants segregate during gamete formation



Some workers call the principle of segregation as the principle of purity of gametes, because segregation of the 2 median factors of a trait (in  $F_2$ ) results in gametes receiving only 1 factor (either dominant or the recessive factor but not both (like  $F_1$ )) out of a pair. As result gametes (which are formed) are always pure for a particular character.

(b) Gametes carry a single factor or allele for a trait, 50% of one type and 50% of the second type

(c) The factors get distributed randomly in the offspring due to random of chance fusion of gametes during fertilization.

Since, only one of the two factors passes into a gamete, 50% of the male and female gametes formed by  $F_1$  plant possess the factor for round while the remaining 50% carry the factor for wrinkled.

Mendel further elaborated his observation by a checker board (Punnett square)

$RR$  X  $rr$  — P

♂	R	r
r	Rr (round)	Rr
r	Rr	Rr

—  $F_1$

100% Round seed plant (Hybrid)

♀	R	r
R	RR (round)	Rr
r	Rr	rr (wrinkled)

—  $F_2$

75% round and 25% wrinkled seeded plant (25% pure, 50% hybrid)

In  $F_2$  generation Phenotype ratio = 3:1

Genotype ratio = 1 RR : 2 Rr : 1 rr  
(Pure round) (hybrid round) (pure wrinkled)