Memndel's Studies

Gregor Mende published the results of his genetic studies on the garden pea in 1866 and thereby laid the foundation of modern genetics. In this paper Mendel proposed some basic genetic principles.

One of these is known as the principle of **Segregation**. He found that from any one parent, only one allelic form of a gene is transmitted through a gamete to the offspring. For example, a plant which had a factor (or gene) for round-shaped seed and also an allele for wrinkled-shaped seed would transmit only one of these two alleles through a gamete to its offspring.

Mendel knew nothing of chromosomes or meiosis, as they had not yet been discovered. We now know that the physical basis for this principle is in first meiotic anaphase where homologous chromosomes segregate or separate from each other. If the gene for round seed is on one chromosome and its allelic form for wrinkled seed is on the homologous chromosome, then it becomes clear that alleles normally will not be found in the same gamete.

Mendel's principle of independent assortment states that the segregation of one factor pair occurs independently of any other factor pair. We know that this is true only for loci on non-homologous chromosomes.

For example, on one homologous pair of chromosomes are the seed shape alleles and on another pair of homologues are the alleles for green and yellow seed color. The segregation of the seed shape alleles occurs independently of the segregation of the seed color alleles because each pair of homologues behaves as an independent unit during meiosis.

Mendel's experiments :

1- Mendel used the garden pea (*Pisum sativum*) as his experimental organism.
2- He examined the inheritance of clear traits like purple flower versus white ,and he study seven antagonistic pairs of traits .
3- He isolated lines of peas that pure .
4- Worked with large number of plants and used statistical analysis .

Mendel's laws :

1- Law of segregation
2- Law of Independent Assortment

Law of segregation :

Mendel carried out many of monohybrid crosses : mating between individuals that differ in one trait such as seed color , in each monohybrid cross one parent carries one form of trait and the other parent carries the alternative form of the same trait . Mendel planted pure breeding green peas and pure breeding yellow peas and allow them to grow into the parental (P) generation . Later when the plants flowered , he dusted the female stigma of green – pea plant flowers with pollen from yellow pea plant , he also performed reciprocal cross (reversing the traits of male and female parents) by dusting yellow pea plants stigma with green pea pollen .

He found that in both cases the peas were yellow . These yellow peas , progeny of the P generation called first filial (F1) generation .To learn whether the green trait had disappeared entirely or remained intact but hidden in these (F1) yellow peas , he planted them and allowed the (F1) to self – fertilization , he then counted the peas of the second filial (F2) generation , progeny of the (F1) generation . among the progeny there were 6022 yellow and 2001 green , the ratio 3 yellow to 1 green .

Parental (pure) ♂ yellow peas × ♀ green peas

↓

First filial (F1) all yellow

↓

Self – fertilization

↓

Second filial (F2) yellow : green

He called the trait that appeared in all (F1) hybrids , yellow seeds (dominant) and the green pea trait that hidden in the (F1) but reappeared in the (F2) is (recessive)

Law of segregation : the two alleles for each trait separate or segregate during gamete formation , then unite at random , one from each parent at fertilization .

We write dominant alleles with capital Y and recessive alleles with small y the pure parent YY yellow or yy green . YY can produce only **Y** gametes, yy produce **y** gametes , the cross between YY and yy produce Yy hybrid . If you know the genotype and the dominance relation of the alleles you can predict the phenotype .

Phenotype : observable characteristic , color of seed.
Genotype :alleles of an organism , YY .
Homozygous : YY or yy the two copies of gene are the same .
Heterozygous (hybrid) : Yy two copies are different .

Parental (P1) ♂ yellow peas × ♀ green peas

YY ↓ yy

Gametes(G1) Y ↓ y

First filial (F1) Yy 100% yellow (hybrid)

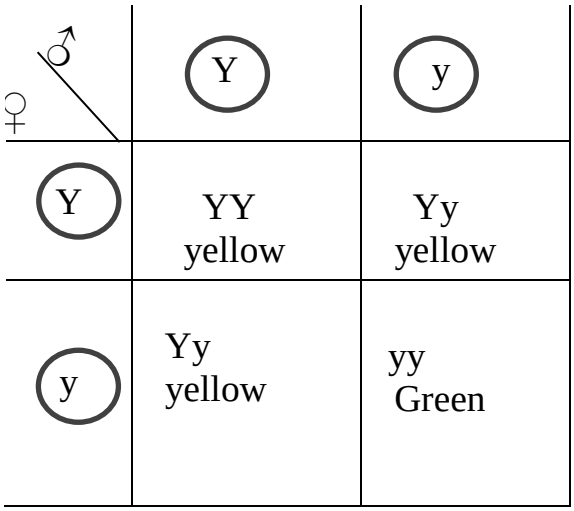
P2 F1 Yy yellow × F1 Yy yellow

↓

G2 Y y Y y

↓

Punnett square



F2 yellow green

3 : 1

Law of independent assortment

Mendel explained the inheritance of two traits and how two pairs of alleles would segregate by dihybrid cross , he mated pure plants yellow round seeds YYRR with pure plants green wrinkled seeds yygg . F1 generation YyRr showing only the dominant phenotype , yellow and round F1 dihybrid self – fertilizer produce F2 generation .He found 315 yellow round , 101 yellow wrinkled ,108 round green and 32 wrinkled green .there were new combination of phenotype such yellow wrinkled or green round these called recombination types . Mendel found the second law of genetics .

Law of independent assortment : during gamete formation different pairs of alleles segregate independently of each other.

The gene for seed and for seed shape assort independently , Y or y with R or r in any gamete . Each dihybrid of F1 generation can make four kinds of gametes : YR ,Yr , yR and yr ,they appear in ratio 1 : 1 : 1 : 1 .

Fertilization produce 16 possible zygote ,use punnett square there were four phenotypes yellow round , yellow wrinkled , round green and wrinkled

green in ratio 9:3:3:1 . this means that the inheritance of the gene for color of seeds is unaffected by the inheritance of the gene for shape.

P1 ♂ yellow round YYRR × ♀ wrinkled green yygg

↓

G1 YR yr

F1 YyRr yellow round 100%

P2 F1 YyRr yellow round × F1 YyRr yellow round

↓

G2 YR Yr yR yr YR Yr yR yr

↓

♂ \ ♀	YR	Yr	yR	yr
YR	YYRR yellow round	YYRr yellow round	YyRR yellow round	YyRr yellow round
Yr	YYRr yellow round	YYrr yellow wrinkled	YyRr yellow round	Yyrr yellow wrinkled
yR	YyRR yellow round	YyRr yellow round	yyRR round green	yyRr round green
yr	YyRr yellow round	Yyrr yellow wrinkled	yyRr round green	Yyrr wrinkled green

F2: yellow round yellow wrinkled round green wrinkled green

9 : 3 : 3 : 1