

Mendel's law of Segregation & Independent Assortment



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Mendel's law of segregation



Gregor johann menel (1822 - 1884):

- He experimented with pea plants , by crossing various strains and observing the characteristics of their offspring .
- He thought that 'heritable factors' (genes) retained their individuality generation after generation.
- Principles of genetics were developed in the mid 19th century

Mendel's law of segregation



- Mendel deduced the underlying principles of genetics from his experiments:

1. Law of Dominance
2. Law of Segregation
3. Law of Independent assortment

Mendel's law of segregation



Law of segregation:

- Mendel's Law of Segregation, states that allele pairs separate or segregate during gamete formation and randomly unite at fertilization.
- It states that allele pairs **segregate** equally into gametes during meiosis.

Mendel's law of segregation



Law of segregation(contd...)

- This means that a gamete will have only one allele of any given gene, and that the probability of a gamete having one allele or the other is equal (and therefore $\frac{1}{2}$, or 50%, for either allele).
- In other words ,a parent plant passes on only one gene of each pair to its offspring.
- A gamete will receive one allele or the other.

Mendel's law of segregation



Law of segregation(contd...):

- Mendel formulated the law of segregation as a result of performing monohybrid cross experiments on plants.
- The specific traits that he studied exhibited complete dominance.

For example

- the gene for seed colour in pea plants exists in two forms.
- There is one form or allele for yellow seed colour (Y) and another for green seed colour (y).

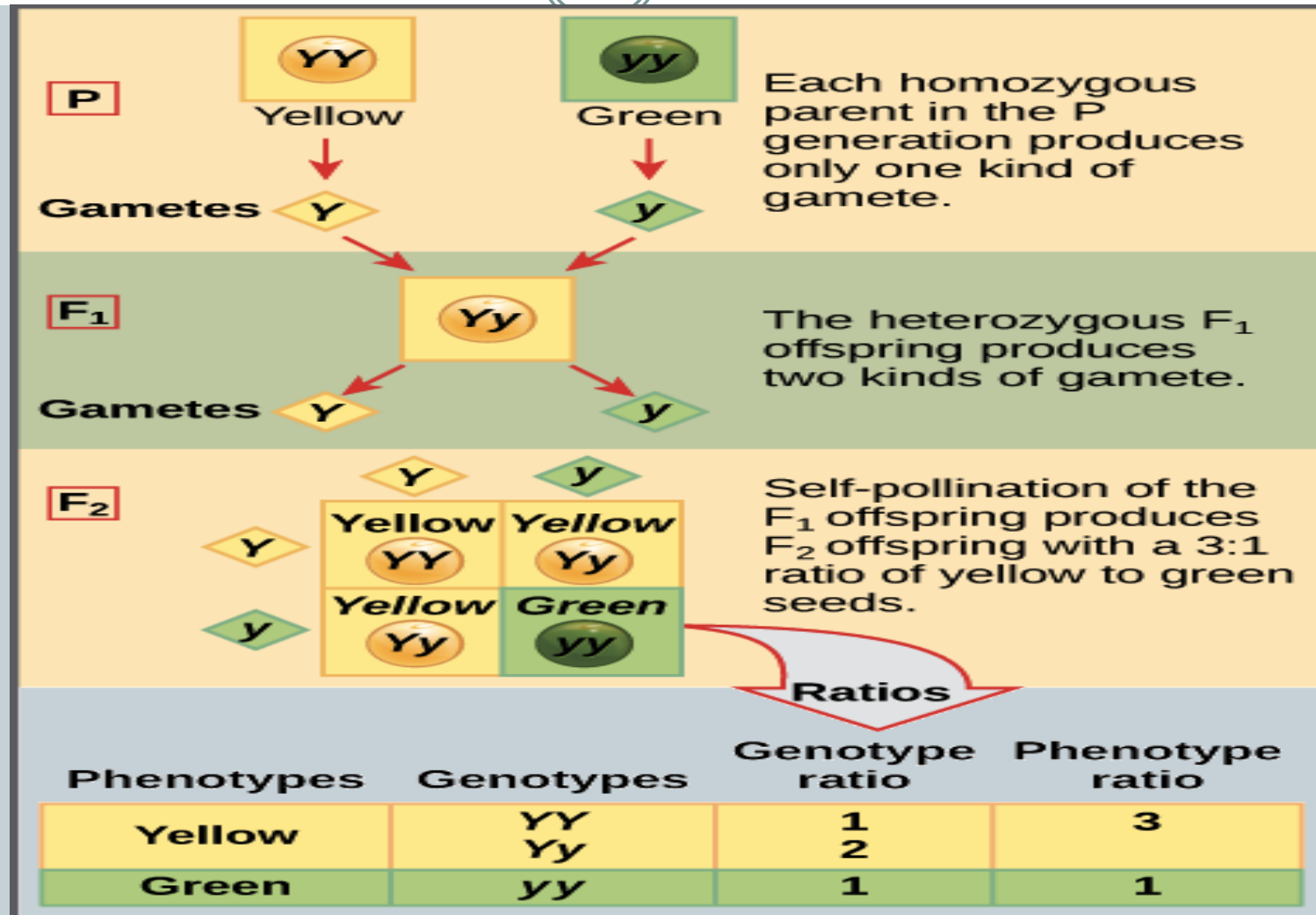
Mendel's law of segregation



For example(contd...):

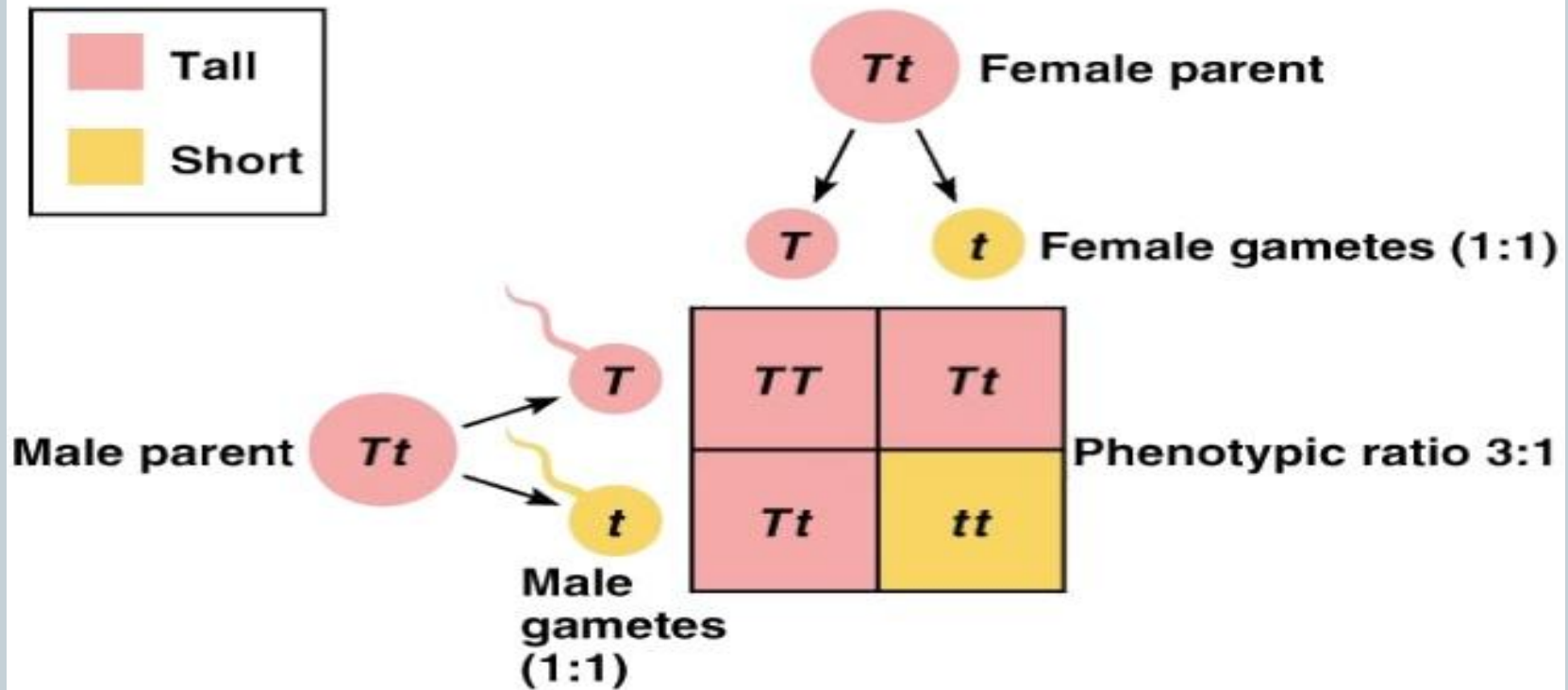
- In this example, the allele for yellow seed colour is dominant, and the allele for green seed colour is recessive.
- When the alleles of a pair are different (heterozygous), the dominant allele trait is expressed, and the recessive allele trait is masked.
- Seeds with the genotype of (YY) or (Yy) are yellow, while seeds that are (yy) are green.
- Yellow and green appear in the ratio of 3:1(in f₂ generation).

Mendel's law of segregation



Mendel's law of segregation

Applying the Law of Segregation



Law of independent assortment



Mendel's law of independent assortment:

- The Law of Independent Assortment states that during a dihybrid cross (crossing of two pairs of traits), an assortment of each pair of traits is independent of the other.
- In other words, during gamete formation, one pair of trait segregates from another pair of traits independently.
- This gives each pair of characters a chance of expression.
- The allele a gamete receives for one gene does not influence the allele received for another gene.

Law of independent assortment



Example-

- Dihybrid cross, between round-yellow seed and wrinkled green seed .
- He obtained only round yellow seeds in the F_1 generation. Later, self-pollination of F_1 progeny gave four different combinations of seeds in the F_2 generation.
- He obtained round-yellow, wrinkled-yellow, round green and wrinkled green seeds in the phenotypic ratio 9:3:3:1.

Law of independent assortment



Example(contd...)

- This dihybrid crosses between the parental genotype RRY Y (round yellow seeds) and rryy (green wrinkled seeds) explains the law.
- Here the chances of formation of gametes with the gene R and the gene r are 50:50.
- Also, the chances of formation of gametes with the gene Y and the gene y are 50:50.
- Thus, each gamete should have either R or r and Y or y.

Law of independent assortment



Example(contd...)

- Because each parent is homozygous, the law of segregation indicates that the gametes for the green & wrinkled plant all are yr,
- while the gametes for the yellow & round plant are all YR.
- Therefore, the F_1 generation of offspring all are YyRr.

Law of independent assortment



Example(contd...)

- For the F₂ generation, the law of segregation requires that each gamete receive either an R allele or an r allele along with either a Y allele or a y allele.
- The law of independent assortment states that a gamete into which an r allele sorted would be equally likely to contain either a Y allele or a y allele.
- There are four equally likely gametes are formed when the YyRr heterozygote is self-crossed as follows: YR, Yr, yR, yr

Law of independent assortment



Example(contd...)

- Thus the Law of Independent Assortment states that the segregation of R and r is independent of the segregation of Y and y.
- This results in four types of gametes RY, Ry, rY, and ry.
- These combinations of alleles are different from their parental combination (RR, YY, rr and yy).
- This shows that genes do not influence each other with regard to the sorting of alleles into gametes:

Law of independent assortment



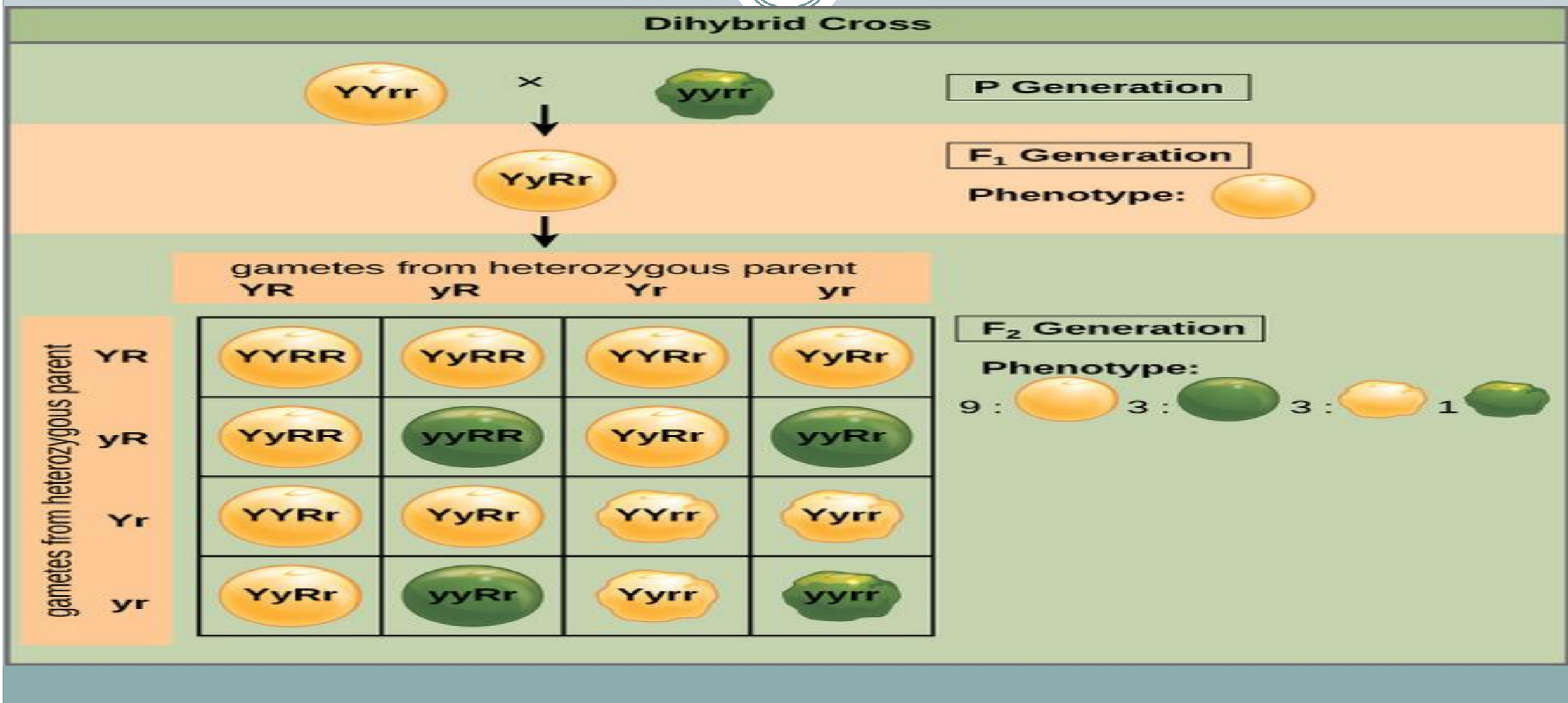
Example(contd...)

- . Arranging these gametes along the top and left of a 4×4 Punnett square gives us 16 equally likely genotypic combinations.
- From these genotypes, we infer a phenotypic ratio of 9:3:3:1

Such as-

- 9 round & yellow
- 3 round & green
- 3 wrinkled & yellow
- 1 wrinkled & green.

Law of independent assortment



Law of independent assortment



Main points:

- Mendel's law of independent assortment states that genes do not influence each other with regard to the sorting of alleles into gametes; every possible combination of alleles for every gene is equally likely to occur.
- **independent assortment:** separate genes for separate traits are passed independently of one another from parents to offspring

Thank You

