MENDELISM

By
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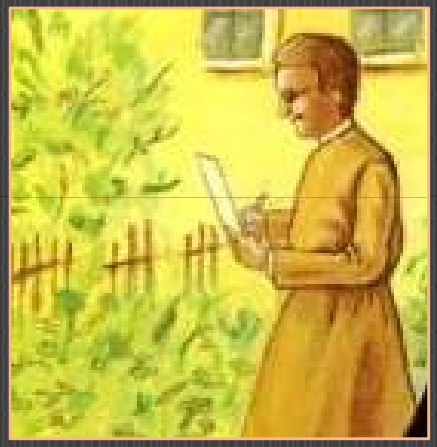
- Mendel was primarily a monk in a monastery. In addition to his normal duties of preaching in the church, Mendel evinced a keen interest in the maintenance of the garden in the premises of the church. In the course of his routine rounds in the garden, Mendel was keenly observing the pattern of inheritance of certain characters in some of the plants.
- He became interested in investigating the mechanism by which the characters are transferred from the parent plants to their offspring. He decided to conduct some experiments in this direction. After careful examination and thinking, Mendel selected the pea plants (*Pisum sativum*) for his experiments



MENDELS WORK

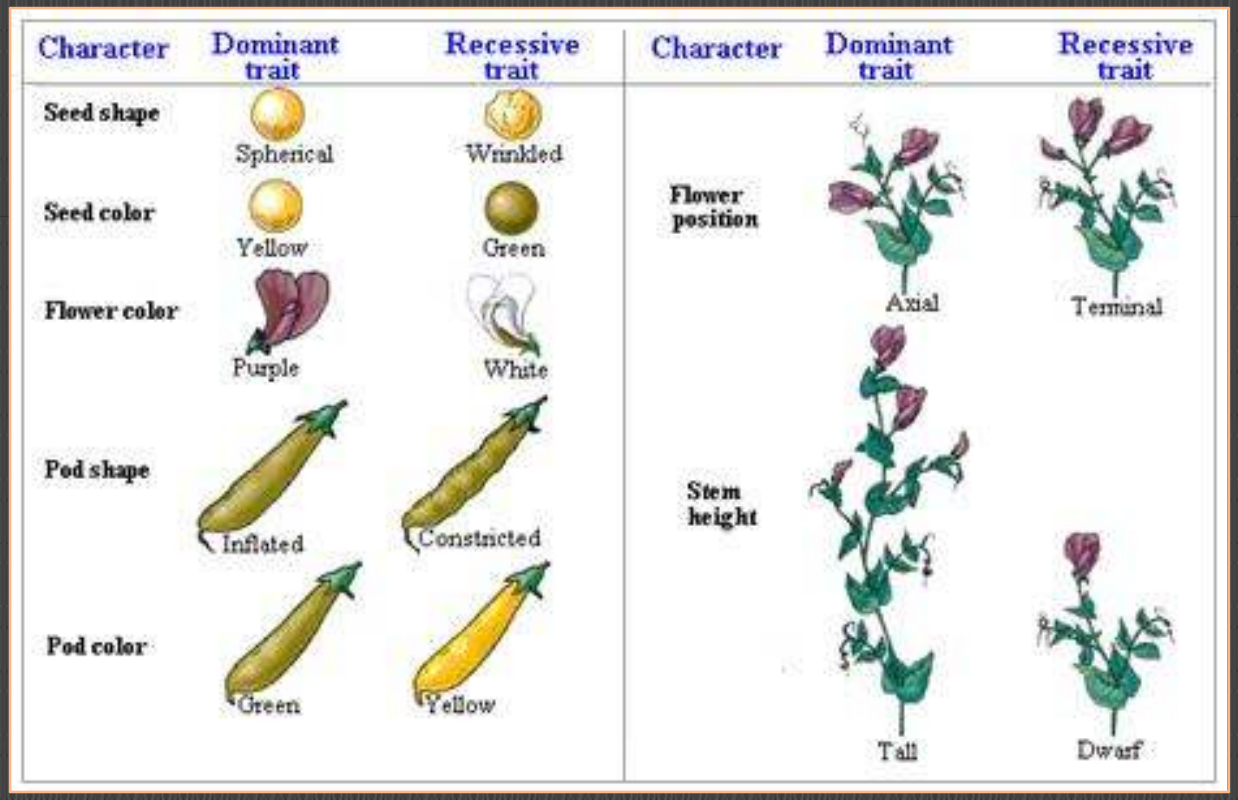
- Between 1856 and 1863, he cultivated and tested some 29,000 pea plants. From these experiments, he deduced some finding which later became known as Mendel's Principles of Heredity or Mendelian inheritance.

- He described these principles in a two-part paper, Experiments on Plant Hybridization, that he read to the Natural History Society of Brno on February 8 and March 8, 1865, and which was published in 1866.

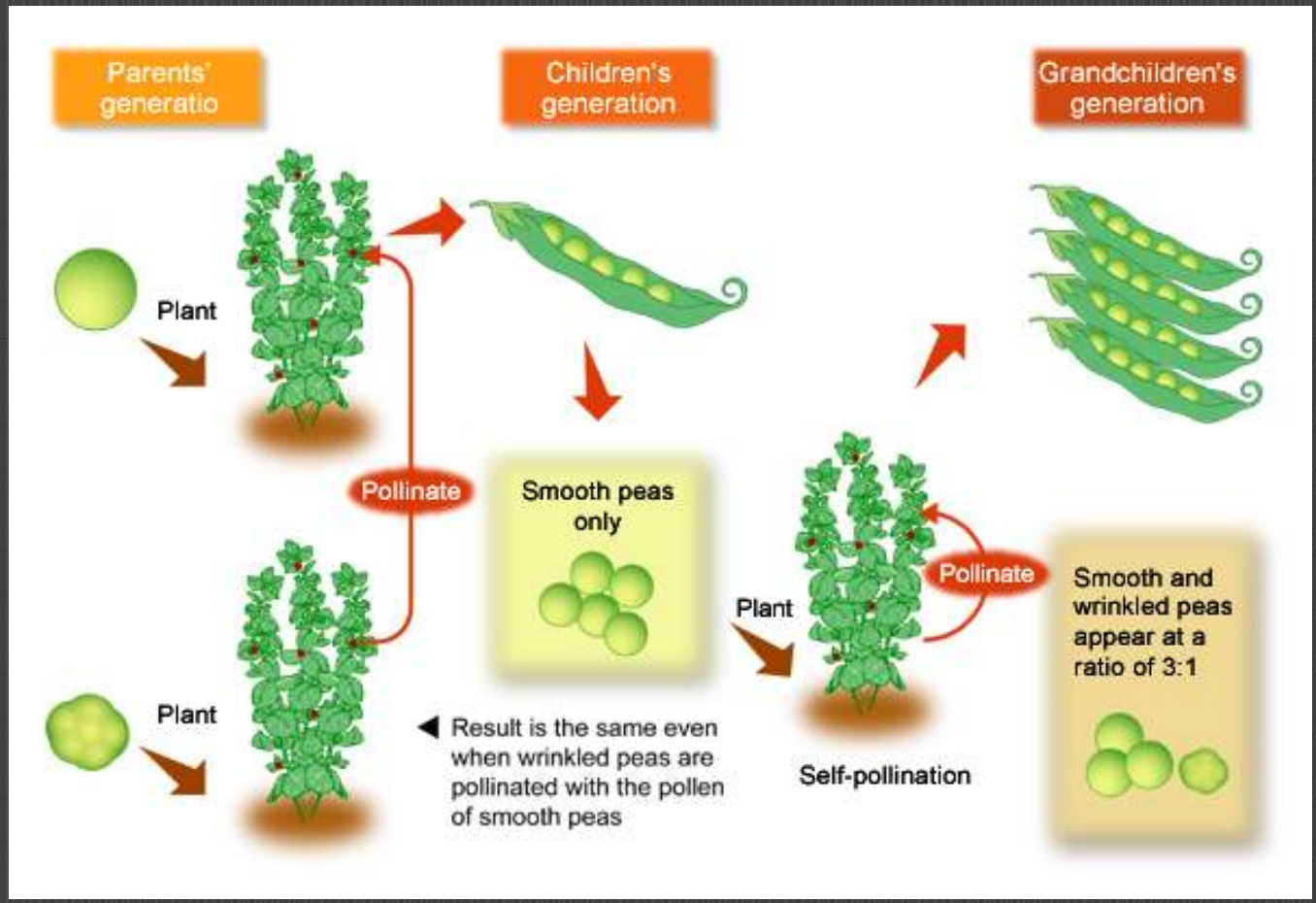
Selection of Pea plant

- The duration of life cycle in the pea plants was very short.
- Every pea plant produced a large number of seeds.
- It was possible to conduct cross pollination by transferring pollen grains from one plant to another.

Characters of Pea plant selected by Mendels



Law of Dominance

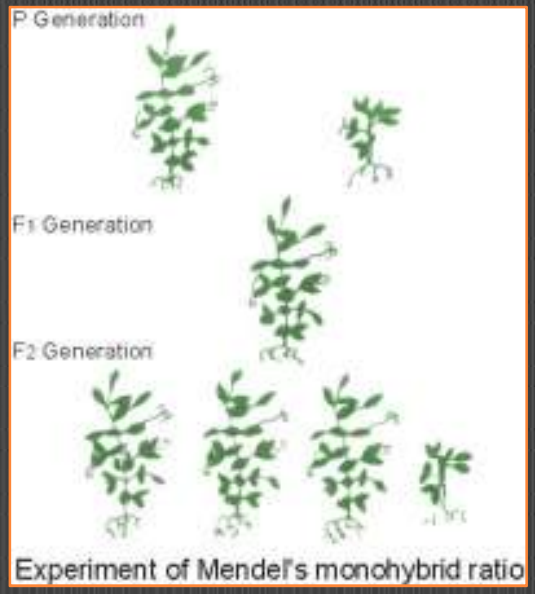


Law of Segregation

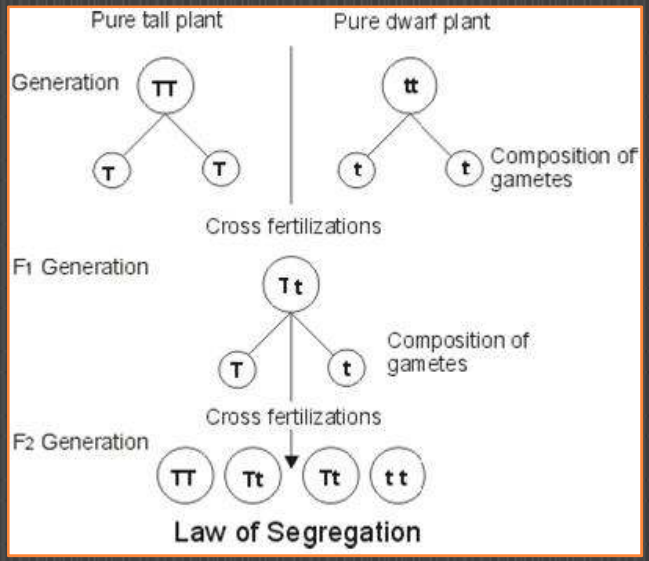
The Law of Segregation states that every individual possesses a pair of alleles trait and that each parent passes a randomly selected copy (allele) of only one of these to its offspring.

The offspring then receives its own pair of alleles for that trait.

law states that when any individual produces gametes, the copies of a gene separate so that each gamete receives only one copy (allele).



Experiment of Mendel's monohybrid ratio



Law of Segregation

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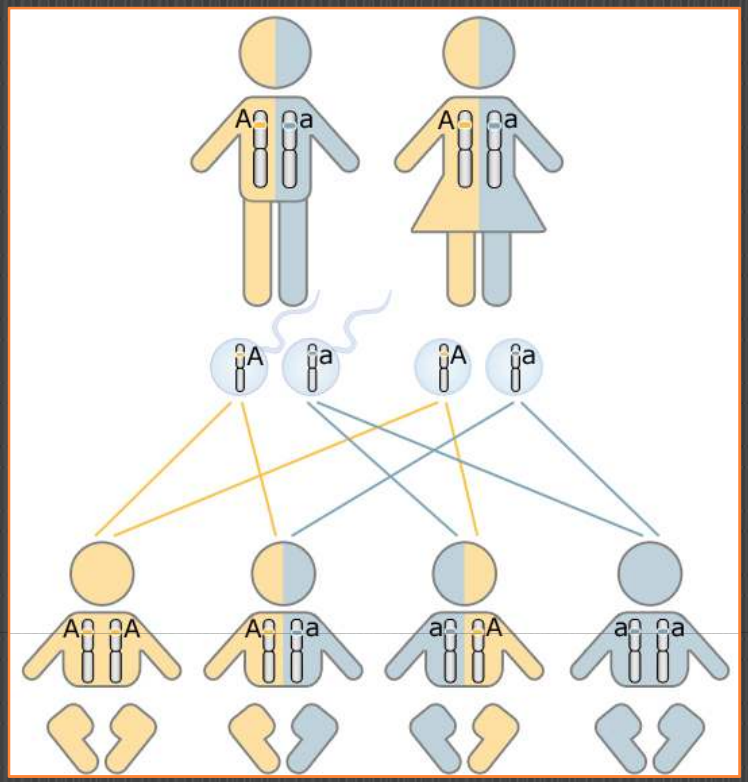
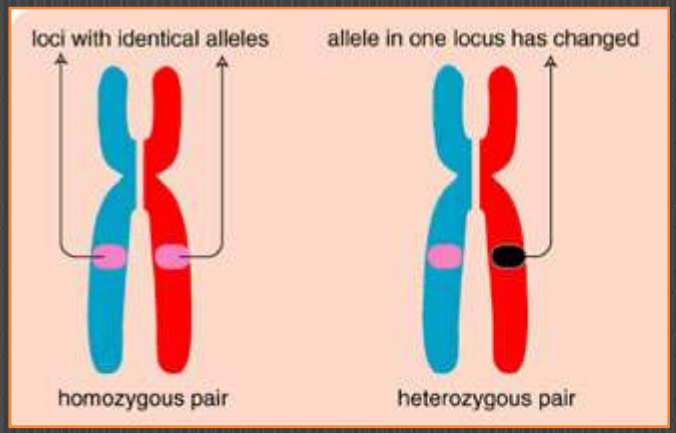
ALLELE

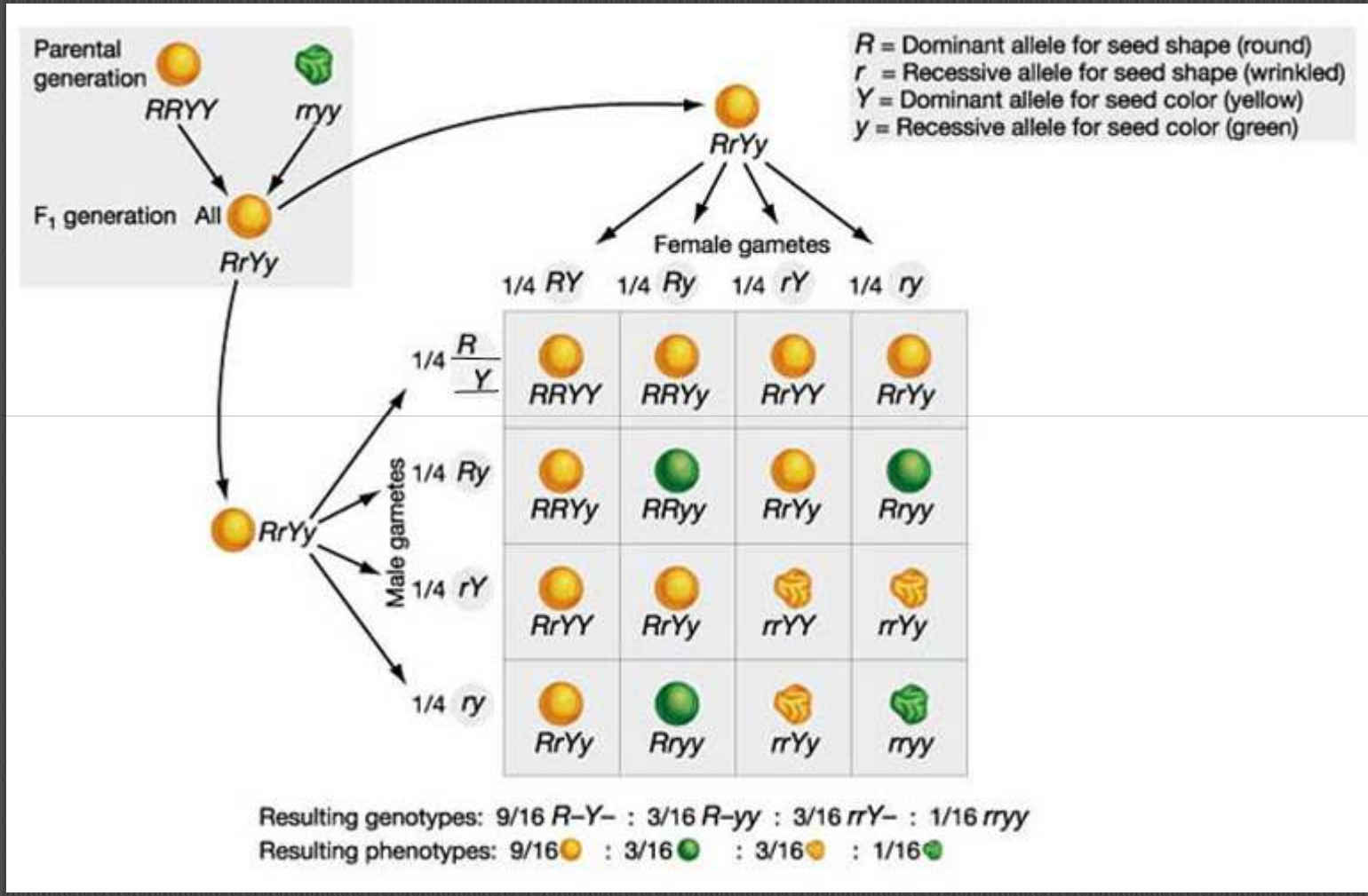
- Multicellular organisms have two sets of chromosomes, that is, they are diploid.
- These chromosomes are referred to as homologous chromosomes.
- Diploid organisms have one copy of each gene (and therefore one allele) on each chromosome. If both alleles are the same, they are homozygotes. If the alleles are different, they are heterozygotes.





Law of Independent Assortment

- The Law of Independent Assortment, states that separate genes for separate traits are passed independently of one another from parents to offspring.
- Alleles of different genes assort independently of one another during gamete formation. While Mendel's experiments with mixing one trait always resulted in a 3:1 ratio between dominant and recessive phenotypes, his experiments with mixing two traits (dihybrid cross) showed 9:3:3:1 ratios.


Parental generation
RRYY
rryy
F1 generation All
RrYy
RrYy
R = Dominant allele for seed shape (round)
r = Recessive allele for seed shape (wrinkled)
Y = Dominant allele for seed color (yellow)
y = Recessive allele for seed color (green)
Female gametes
1/4 RY
1/4 Ry
1/4 rY
1/4 ry
Male gametes
1/4 R/Y
1/4 Ry
1/4 rY
1/4 ry
RrYy
RRYY RRYy RrYY RrYy
RRYy RRyy RrYy Rryy
RrYY RrYy rrYY rrYy
RrYy Rryy rrYy rryy
Resulting genotypes: 9/16 R–Y– : 3/16 R–yy : 3/16 rrY– : 1/16 rryy
Resulting phenotypes: 9/16 : 3/16 : 3/16 : 1/16

LINKAGE

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LIKNAGE

- Genetic linkage is the tendency of genes that are located proximal to each other on a chromosome to be inherited together during meiosis.
- Genes whose loci are nearer to each other are less likely to be separated during chromosomal crossover, and are therefore said to be genetically linked.

THE NORMAL MEIOSIS

- At the beginning of normal meiosis, a homologous chromosome pair (called a bivalent, made up of a chromosome from the mother and a chromosome from the father) intertwine and exchange sections or fragments of chromosome.
- The pair then breaks apart to form two chromosomes with a new combination of genes that differs from the combination supplied by the parents.
- Through this process of recombining genes, organisms can produce offspring with new combinations of maternal and paternal traits that may contribute to or enhance survival.

GENETIC LINKAGE

- The latter is known as genetic linkage. This occurs as an exception to independent assortment, and develops when genes appear near one another on the same chromosome.

- This phenomenon causes the genes to usually be inherited as a single unit. Genes inherited in this way are said to be linked, and are referred to as "linkage groups".

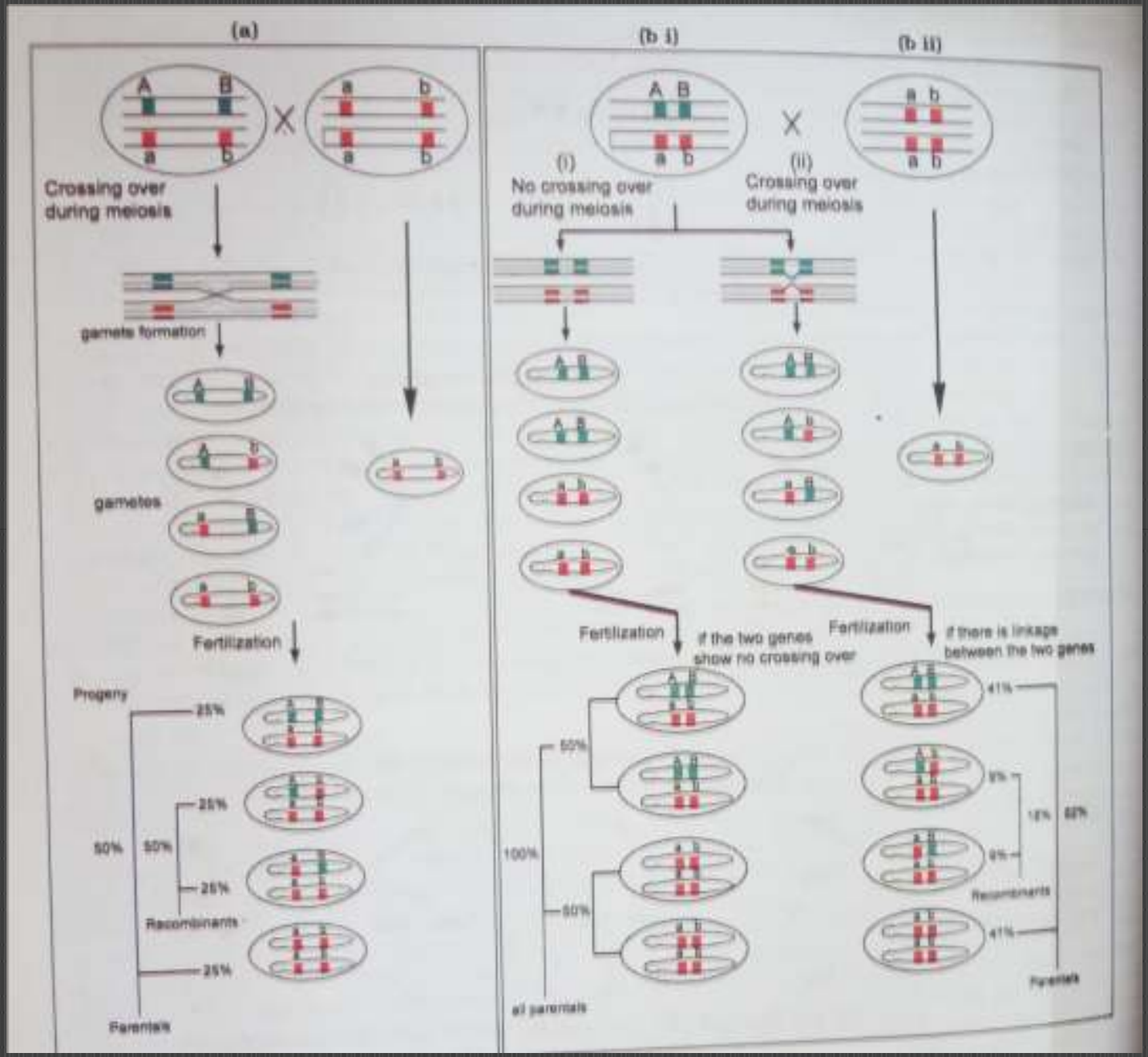
DISCOVERY

- Genetic linkage was first discovered by the British geneticists William Bateson and Reginald Punnett shortly after Mendel's laws were rediscovered.

- The understanding of genetic linkage was expanded by the work of Thomas Hunt Morgan. Morgan's observation that the amount of crossing over between linked genes differs led to the idea that crossover frequency might indicate the distance separating genes on the chromosome.

STURTEVANT'S WORK

- Alfred Sturtevant, a student of Morgan's, first developed genetic maps, also known as linkage maps. Sturtevant proposed that the greater the distance between linked genes, the greater the chance that non-sister chromatids would cross over in the region between the genes.
- By working out the number of recombinants it is possible to obtain a measure for the distance between the genes. This distance is expressed in terms of a genetic map unit (m.u.), or a centimorgan


(a)
(b i)
(b ii)
A B
a b
Crossing over during meiosis
gamets formation
gametes
Fertilization
Progeny
25%
25%
25%
25%
50%
50%
Recombinants
Parentals
(i)
No crossing over during meiosis
(ii)
Crossing over during meiosis
Fertilization
if the two genes show no crossing over
Fertilization
if there is linkage between the two genes
100%
50%
50%
41%
9%
9%
41%
18%
82%
Recombinants
Parentals
all parentals

Thankyou