

Welcome to this e module.

This program is designed for the
students of Bachelor of Science third year.

The subject of botany,
semester six Course Code BOC 108

and the title of this course is
cytogenetics and plant breeding.

The title of this unit is Mendelian Genetics.

and it's extension, module name

principles of inheritance,

Mendel's law. I'm Emma Fernandes,

assistant professor in the Dhempe

College of Arts and Science.

In this module we are going to

learn about genetic terminologies,

law of dominance, law of segregation,

or law of purity of gametes

and law of independent assortment.

At the end of this module,

students will define genetic terms

used to understand Mendel's laws.

State Mendel's law of inheritance

explain Mendel's laws of inheritance

and recall the law of dominance,

Law of segregation

and law of independent assortment.

Mendel crossed different varieties

of pea plants in which his intention

was to find the relationship between

the hybridization and the history

of evolution of organic forms.

He discovered the basic laws of heredity.

They are law of dominance,

law of segregation,

or it is also called as law of

purity of gametes and law of

Independent assortment. Before we

learn about various laws of Mendel's,

we shall learn about some genetic

terminologies which will help us in

understanding the laws in a better way.

First, we have gene locus.

Gene locus is the specific position

of a gene on a chromosome.

Here you can see a chromosome on which

the locus is labeled in blue color.

So this is the gene locus.

Allele- an allele is a variant

form of a gene.

Some genes have a variety of different forms,

which are located at the same position

or genetic locus of on a chromosome.

Here we have three chromosomes,

and each of these chromosomes

have alleles marked,

which are different forms of the

same gene which are marked in blue,

orange and green in color.

A Hybrid Cross is a cross

between two parents.

Differing in only one pair

of alternating characters,

for example,

purple colored flower is crossed
with white color flower.

A dihybrid cross is a cross between
two parents differing in two
pairs of contrasting characters.

For example,

the height of the plant which is tall
and the color of the flower which
is purple crossed with the height
of the plant which is short and the
color of the flower which is white.

A phenotype is any measurable
characteristic or distinctive
trait possessed by an Organism.

For example, the color of a flower.

It can be either purple or
white in pea plants.

Also,

we can take the example
of texture of hair. Genotype
is the genetic constitution

of an individual. A homozygous individual is an individual with identical alleles at both gene loci for a particular phenotypic.

Heterozygous individual is an individual with different alleles for a particular phenotypic trait on both gene loci.

Now we are in a better position to learn about various laws of Mendel.

First we shall see the law of dominance.

It states that when parents with pure contrasting traits are crossed together, only one form of trait appears in the next generation.

Further, the hybrid offspring will exhibit only the dominant trait in the phenotype.

Let us understand this law with the help of a monohybrid cross. A cross is carried out between the tall plant, which is represented as capital T

with a short plant which is represented as.

Small t.

After undergoing cross pollination,

the F1 generation produced all tall plants,

so the law of dominance explains

that in a monohybrid cross between

a pair of contrasting traits,

only one parental character will

be expressed in the F1 generation,

the parental character which is

expressed is called as the dominant

trait and the parental character which

is suppressed is called the recessive trait.

In simple words,

the law of dominance states that

recessive traits are always dominated

or masked by the dominant trait.

And let us learn about the second law,

that is law of segregation or which is

also called as law of purity of gametes.

It states that in a heterozygote,

a dominant and a recessive allele remain together throughout the life without contaminating or mixing with each other, and finally separate or segregate from each other during gametogenesis so that each gamete receives only one allele, either dominant or recessive.

Let us consider the example of monohybrid cross again, so when we cross two individuals, in the F1 generation, we got all tall plants.

Later on, the offspring of the F1 generation were selfed together and in F2 generation what they found was mixture of plants that is tall plants as well short plants in the ratio 3:1.

It means that tall and dwarf alleles, though remained together for a long time, but they did not contaminate

or mix with one another.

Both alleles segregated to produce gametes which either had dominant allele or recessive allele.

Since in F₂ generation recessive types reappeared, it was apparent to Mendel that heredity constitution of an individual was not necessarily revealed by its external appearance.

And so Mendel concluded that gametes from each parent carried something which was responsible for the appearance of a particular character.

When the segregation takes place in F₁ hybrids, two types of gametes are formed and a gamete contains only one unit character of each allelomorph pair. Therefore, half of the gametes will have dominant factor, and the remaining half will

carry recessive factor,

and this rule applies to both

male and female gametes.

You can see over here a heterozygous

plant or an offspring will produce half

of dominant factors gametes and half of

it will produce recessive factor gametes. Thus

the gamete formed from the F1

hybrids are always pure for

a particular character,

and one may carry either dominant

or recessive factor,

but not both.

This is why law of segregation is

also known as law of purity of gametes.

Now let us learn about the third law,

that is law of independent assortment.

It stated that when the gametes are formed,

the members of the different pairs

of factors or genes segregate quite

independently of each other and that all

possible combinations of the factors

concern will be found among the progeny.

To better understand this law we shall

consider example of a dihybrid cross.

Carried out between round and

yellow seed with wrinkled and

green seed. In F₁ generation,

all the offspring produced

round and yellow colored seeds.

So it was immaterial which of the

parents provided the pollen which

acted as a pistillate parent.

It also made no difference whether

both dominant traits had originally been

in one parent or each of the parents

had contributed one of the dominant

trait when the selfing was continued.

In F₂ generation between a heterozygous

gamete of 1 set one parent and the

heterozygous gametes of another parent.

They are represented here in the

horizontal row and vertical column.

Mendel found that there were nine

round and yellow color seeds.

There were three round and green color

seeds so also there were three

wrinkled and yellow colored seeds,

and only one green and wrinkled seed

which was coming to ratio 9:3:3:1.

Mendel saw that the ratio

would be obtained if the two sets of

traits inherited independently of each other.

Since two independent 3:1

ratio would be combined to simplify

mathematical probability.

These are my references,

thank you.