

Welcome to this e module.

This program is designed for the

students of Bachelor of Science

Third Year in the subject of botany,

semester six, Course Code, BOC 108.

Title of this course is

cytogenetics and plant breeding.

The title of this unit is Mendelian Genetics

and its extension module name is Gregor

Mendel's experiment with pea plant.

I am Miss Emma Fernandes,

assistant professor in botany from

Dhempe College of Arts and Science.

In this module we are going to learn about

life of Gregor Mendel, Mendel's experiment

on pea plant and Mendel's observations

and result.

At the end of this module,

the student will recall the life of Gregor.

Mendel will describe Mendel's experimental.

Procedure on the plants and also

list down Mendel's observations  
and results in a plant experiment.

Now let us learn about life  
of Mendel in brief, Gregor.

John Mendel was the pioneer  
of classical geneticists.

Apart from being a scientist  
he was a priest by profession.

Mendel finished his theological  
studies in 1848 from Augustine  
Monastery at Brunn in Moravia.

Later he was then appointed as a substitute  
teacher in the Imperial Royan Gymnasium in Znaim.

On February 8, 1865,  
he delivered his first lecture on  
pea experiments to Brunn Natural Science Society.

His paper experiments on plant hybridization  
proposed some basic genetics principles.

However,  
his work was unattended  
and unappreciated up to 1900.

It was only in the beginning of  
20th century that Hugo de Vries,  
Carl Correns and Eric Von Tschermak  
were working on various flowering  
plants independently.

Drew the conclusion,  
just like Mendel.

It was William Bateson who  
confirmed Mendel's work by series  
of hybridization experiments.

Now let us see Mendel's selection  
of the experimental plant.

Mendel was very careful in selecting his  
experimental plant.

He found the plants of family Leguminosae,  
such as peas and beans most suitable  
materials for his experiments.

In his experimental plants,  
it required constant variations and  
also the hybrids of the plants must  
be protected from the influence

of foreign pollen grains.

Now let us see some reasons behind

Why pea plants were selected by Mendel,

the first reason,

Is pea plants are easy to culture

in open grounds and also in pots.

Next, pea plants showed short growth

period and life cycle. Plants assured

peculiar structure of Flowers in

which there was self-pollination.

However,

artificial cross pollination was carried

out in order to bring about fertile hybrids.

Mendel chose this plant because they

showed contrasting heritable traits.

For example,

the height of the plant,

either it is tall or short pea

plants also showed large number of

offsprings which helped Mendel in

propagating more and more pea plants.

So these are the reasons why Mendel

chose the plants for his experiment.

Now let us learn about Mendel's procedure,

how he brought about his experiment.

So Mendel cross-pollinated the flowers by

hand by simply opening the flower buds.

He then removed their

pollen-producing stamens.

As you can see in the picture

with the help of a scissor,

this operation of removal of

anthers is called as emasculation.

He then took pollen at the dehiscence

stage from a different plant and

used that plant as male parent.

With the help of a brush,

pollen was dusted on the feathery

stigma of the emasculated flower.

He then made sure,

that the stigma of the flower was

protected against any foreign pollen

with the help of a covering bag,  
as you can see here in this diagram.

After hybridization,  
the pollen should be categorized.

Seeds are to be planted or  
sowed in the succeeding season,  
and the plants are raised to  
maturity. At the beginning.

Mendel established true breeding  
varieties in which plants produce  
progeny like themselves and allowed to  
Self- fertilize.

Later on,  
when two varieties differing in  
one or two traits were crossed,  
a hybrid progeny was obtained.

In his experiment,  
Mendel chose 7 contrasting traits,  
such as the seed form was  
either round or wrinkled.

The cotyledons were yellow or green.

The color of the flower was white,  
or else purple in color.

The form of the pod was full.

Or constricted, the color of  
the pod was yellow or green.

He also took stem as one of the  
contrasting traits in which he  
chose the place of flower that  
was either axial or terminal.

He also chose the size of the plant  
as one of this characteristic traits  
that was either tall or short.

Now let us learn about Mendel's  
experimental observations and  
results. The hybrids of F<sub>1</sub>

revealed that plants contain the  
character of only one parent,

and none of them displayed any

intermediate character of both parents.

This can be explained as follows.

A phenotype of purple colored

flower was crossed with a phenotype

with white parent flower.

The result of this were all purple

color flower in F1 generation.

The characters,

which were transmitted almost unchanged

in hybridization process,

were called as dominant characters

and those which were suppressed

in the process were called as

recessive characters by Mendel.

This can be shown as follows.

So we take the previous cross and

point out this particular flower that

is purple as dominant trait or the

dominant character because in F1 generation,

although offsprings were.

seen showing purple colored Flowers.

On the other hand,

white color flower was a

recessive one because

this particular character was

suppressed in F1 generation.

He further notice that it was perfectly

immaterial whether the dominant

characters belonged to seed bearer or to

the pollen bearer parent: the form of the

hybrid remained identical in either cases.

In the first case you can see

here the purple color flower

is representing the male parent

and the white color flower is

representing the female parent.

However the all of the

offspring were short purple colored

flowers. In the second case the

purple color flower was represented

as female parent and the white

colored flower was represented as

male parent in this case as well

all the offspring showed

purple color flowers.

The dominant character of Mendel's observations of F2 progeny further revealed that the fact that the recessive character, which was hidden in F1 generation or F1 hybrids, reappear in the F2 offspring and expressed itself.

The average proportion of 3:1.

So here is the explanation

of monohybrid cross,

in which selfing was carried out in F1

offspring and in the F2 generation

75% of the offspring showed purple

colored flower and 25% of the offspring

showed white colored flower in the ratio.

3:1.

Further, when the recessive hybrids

of F2 were self-pollinated,

they always produce F3 offspring

with only recessive characters.

As you can see here these are

the F2 generation offspring

which underwent selfing  
and produce 100%  
of recessive traits offspring  
in F3 generation,  
the remaining 75% from the F2  
generation showed in F3 generation.  
About 25% hybrids,  
with only dominant characters and on  
the other hand the remaining F3  
generation were having 50% hybrids,  
which yielded dominant and  
recessive characters in the ratio.  
3:1.

On the basis of the results  
of his experiment,  
Mendel recognized the phenomenon  
of dominance and formulated  
the following two laws.

The law of segregation and the  
Law of Independent assortment.

These are my references.

Thank you.