



NEET Biology

Short Notes

Powered by :



Check **Notes for Principles Of Inheritance and Variation NEET 2019 exam!** Every year about 3-4 questions have been asked in NEET, AIIMS, JIPMER and various Medical Exams. This is one of the important and Conceptual Unit. In this article, we are providing Short notes on Principles Of Inheritance and Variation for NEET 2019. This is one of the easiest and scoring chapters from the Unit **Genetic and Evolution**. So, let's begin with a brief introduction of Principles Of Inheritance and Variation.

PRINCIPLES OF INHERITANCE AND VARIATION

One might have noticed or studied asexual reproduction results in the offspring, which are genetically identical to each other, while the process of sexual reproduction results in the offspring that differs from each other. This difference in the offspring arises from the variation, which occurs during the process of meiosis that occurs prior to the sexual reproduction, in order to form gametes and the different possible combinations of the gametes.

- **Mendel's law of inheritance:**

Gregor Mendel, also known as the father of genetics performed experiments for several years, from 1856 to 1863 on the pea plants and made several conclusions based on it. He proposed the law of inheritance on the basis of the experiments he performed. Mendel was the first person to perform investigations in a statistical way. The pea plant has two contrasting traits for each character, which further made the observation easier. He performed an experiment on the pea plant due to the following mentioned reasons:

- Availability of different characters to be observed in the pea plant (flower colour, stem height, pod shape, flower position, pod colour, seed colour, and seed shape).
- The ability of the pea plant to self-fertilize.
- The short reproductive time of the pea plant.

- **Inheritance of one gene:**

In order to study the inheritance of one gene, Mendel performed a cross of the tall and dwarf pea plant.

- The first line of the progeny obtained after the cross is often referred to as **Filial₁ progeny** or **F₁ progeny**.
- The F₁ progeny had all the offspring tall. This made him conclude that the F₁ always tend to resemble one of the parents.
- Further, he self-crossed the F₁ progeny and found that in the F₂ progeny **1/4th** of the progeny obtained was **Dwarf**, while **3/4th** still remained **Tall**.

Further, based on his observations:

- Mendel proposed that there was something, which was passing down from the parents to the offspring in the successive progenies. This was termed as a **Factor**, which is now termed to as **Genes**. These factors or genes are referred to as the units of inheritance.
- The information is contained within these genes, which expresses a particular trait. The contrasting traits that are expressed by a gene are due to the presence of **alleles**, which is referred to as the contrasting forms of a particular gene.

If one considers representing a gene by an alphabet, say gene for the character height is T then the contrasting pair of alleles would be represented as 'T' and 't', wherein '**T**' represents the trait '**tall height**' and '**t**' represents the '**Dwarf height**'.

- Thus, the different possible combination of these alleles is 'TT', 'Tt', and 'tt'. 'TT' and 'tt' represents the **homozygous pair** due to the presence of a similar allele, while 'Tt' represents the **heterozygous pair** due to the presence of different alleles.



No.1 site & app

for NEET, JEE, BITSAT, SSC, Banking
& other competitive exams preparation

ATTEMPT NOW

- Also, alongside Mendel observed that the expression of the heterozygous pair was similar to that of the 'TT' homozygous pair, that is, tall height; he further proposed one of the factors be **dominant**, while other to be **recessive**.
- Since allele 'T' was expressed in the heterozygous condition, the allele 'T' was considered to be of the dominant form and allele 't' was considered to be of the recessive form.

The cross performed by Mendel can be better explained via a Punnett Square. The diagram proposed in a tabular form, which describes the gametes of the parents and the offspring is referred to as Punnett Square. The Punnett Square for the cross between the parents for height character has been shown below:

Parental Gametes	T	T
T	Tt	Tt
T	Tt	Tt

In the above Punnett square, 'T' and 'T' are the gametes produced by the homozygous tall parent, while 't' and 't' are the gametes produced by the homozygous dwarf parent.

The gamete of the resulting F₁ progeny is 'Tt'.

- The **phenotypic ratio** (ratio of the plants expressing a particular character) is 1:1, while the **genotypic ratio** (ratio of the plants expressing a particular genotype) is also 1:1.
- Further, performing the second cross, wherein the F₁ progeny are crossed with an identical F₁ progeny is referred to as **self-cross** and has been described below:

Parental Gametes	T	t
T	TT	Tt
T	Tt	tt

In the above Punnett square:

- **The phenotypic ratio is 3:1**, as three of the pea plants, are tall height, while 1 of the pea plant is short heighted.
- Also, the genotypic ratio changes for the F₂ progeny, as it has one pea plant with 'TT' genotype, 2 pea plant with 'Tt' genotype, and one pea plant with 'tt' genotype. **Hence, the genotypic ratio would be 1:2:1.**
- A **back cross** is defined as the crossing of the hybrid progeny with one of its parent or an individual having the genotype similar to one of its parent.
- A **test cross** is defined as the crossing of the F₁ progeny with its homozygous recessive parent. It is performed, in order to identify the type of genotype, the progeny is having.

Laws as described by Mendel:

On the basis of different experiments performed by Mendel, he devised the following laws:

1. **Law of dominance:** According to the law of dominance, one of the alleles from the contrasting pair is dominant, while another is recessive. Further, if both the alleles are present together the dominant allele will mask the phenotypic effect of the recessive allele.
2. **Law of segregation:** According to the law of segregation, the alleles do not blend in with each other and that both of the characters are able to be recovered in the F₂ progeny in spite of having no expression in the F₁ progenies. This suggests that the pair of alleles separate from each other prior to its inheritance into the offspring.



No.1 site & app

for NEET, JEE, BITSAT, SSC, Banking
& other competitive exams preparation

ATTEMPT NOW

Exception from Mendel's law:

When the experiments with pea plant were repeated for another plant, the result diverted from as described by Mendel.

For Example The cross between a red and a white flower plant resulted in the progeny with pink flower colour (***Antirrhinum* species or snapdragon plant**). The following Punnett Square describes the cross:

Parental Gametes	R	R
R	Rr	Rr
R	Rr	Rr

- All the plants in the above cross were of pink colour and the self-cross of the pink colour flower plants (described in the following Punnett Square) resulted in pink, red, and white colour flower.

Parental Gametes	R	r
R	RR	Rr
R	Rr	rr

- **The phenotypic and genotypic ratio for the F₂ progeny were 1:2:1 and 1:2:1 respectively.**

On the basis of this another law was described and has been mentioned below:

- **Law of incomplete dominance:** The phenomenon, wherein the dominant trait of a particular character is not able to completely mask the phenotypic expression results in the expression of an intermediate character.
- **Multiple alleles:**

There are certain cases, wherein a particular gene consists of 3 or more alleles and represents the phenomenon of multiple allelism. One common example is the ABO blood grouping of the humans, wherein two of the alleles of a character equally express itself. The following table details the phenotypic expression in the human ABO blood group:

Allele from Parent 1	Allele from Parent 2	Offspring genotype	Offspring blood type
I^A	I^A	$I^A I^A$	A
I^A	I^B	$I^A I^B$	AB
I^A	i	$I^A i$	A
I^B	I^A	$I^B I^A$	AB
I^B	I^B	$I^B I^B$	B
I^B	i	$I^B i$	B
i	i	ii	O

- **Law of Co-dominance:** The phenomenon, wherein neither of the two alleles for a particular character is able to completely mask the phenotypic expression, in turn, resulting in the expression of both the alleles, describes the law of co-dominance.
- **Inheritance of two genes:** Mendel also crossed traits for two different characters at a time and proposed conclusions based on it. The proposed results, however, were based on the law of segregation, the law of dominance and **law on independent assortment**.
- The following Punnett Square describes the cross between parents with two characteristics, wherein the seed shape and colour are taken into consideration. The seed shapes are round (R) and wrinkle (r) and the colour of the seeds are yellow (Y) and green (y).



No.1 site & app

for NEET, JEE, BITSAT, SSC, Banking
& other competitive exams preparation

ATTEMPT NOW

- The round shape is considered to be dominant over wrinkle shape and the yellow color is considered to be dominant over green color. Cross between two F₂ progeny with parental gametes as RrYy and RrYy has been shown below:

Parental gametes	RY	Ry	rY	ry
RY	RRYY (round yellow)	RRyY (round yellow)	rRYY (round yellow)	rRyY (round yellow)
Ry	RRYy (round yellow)	RRyy (round green)	rRYy (round yellow)	rRyy (round green)
rY	RrYY (round yellow)	RryY (round yellow)	rrYY (wrinkle yellow)	rryY (wrinkle yellow)
ry	RrYy (round yellow)	Rryy (round green)	rrYy (wrinkle yellow)	rryy (round green)

- **The Phenotypic ratio and the Genotypic ratio as obtained are 9:3:3:1 (round yellow : round green : wrinkled yellow : wrinkled green) and 1:2:1:2:4:2:1:2:1 respectively.** Further, based on this another law was devised by Mendel as mentioned below:

Law of independent assortment: According to this law, the inheritance of one pair of character from parent to the offspring is independent of the inheritance of another character.

All about NEET examination: <https://gradeup.co/medical-entrance-exams/neet>

All the best!
Team Gradeup



No.1 site & app

for NEET, JEE, BITSAT, SSC, Banking
& other competitive exams preparation

ATTEMPT NOW



NEET, JEE, GATE, SSC, Banking & other Competitive Exams

- Based on Latest Exam Pattern
- NTA based NEET Preparation
- Get your doubt resolved by mentors
- Practice questions and get detailed solutions
- Previous year paper detailed solution

