HEREDITY AND EVOLUTION

- The process of transmission of characters from parents to offspring is known as inheritance. This is the basis of heredity.
- Genetics is the science that deals with heredity and variation.
- Variation: Small changes / modifications in a particular character that are visible between parents and Offsprings
- **Gregor Johann *Mendel*** is known as the **–father of genetics‖**.

Heterozygous	Two different alleles are present together. E.g.- Tt
Genotype	It is the genetic makeup of an individual. E.g.- TT, tt, Tt
Phenotype	It is an observable feature. E.g.- tall, dwarf
Monohybrid cross	Cross to observe a single character. E.g.- height of the plant
Dihybrid cross	Cross to observe two characters at the same time. E.g. colour and shape of seed

Types of Variation-

1- Somatic- occur in vegetative cell and not ionherited

E.g. Boring of pinna by Indian women, hair style etc.

II- Germinal variations:

Occur in special gamete forming cells only

Inherit in next generation

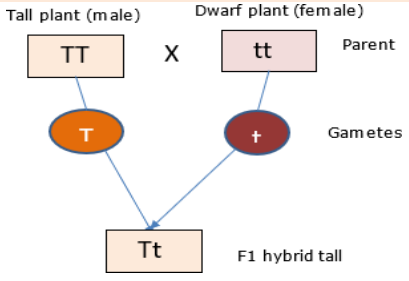
E.g.: Human skin colour, shape of nose, etc.

Importance of variations

- Variation enables organisms to adjust and adapt better according to the changingconditions of the environment (Survival advantage),.
- Different kinds of variations in organisms lead to the development of new species.

- Mendel worked on Pea plant (***Pisum sativum***).
- Advantages of using pea plant are- availability of pure line plant, clearly visible observable characters, contrast characters of same features, easily pollinated (self and cross) etc.
- He worked on 7 contrasting features of pea plant. E.g. Height of plant, flower colour, seed colour, seed shape, pod colour, pod shape and position of flower.
- He conducted monohybrid and Dihybrid cross.

MENDEL'S LAW OF INHERITANCE

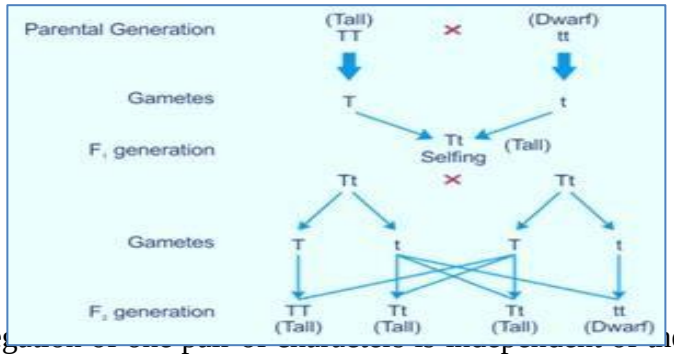


- The Law of Dominance
- The Law of Segregation
- The Law of Independent Assortment.

Law of Dominance: When parents having pure contrasting characters are crossed then only one character expresses itselfin

the F1 generation. This character is the dominant character and the character/factor which cannot express itself is called therecessive character.

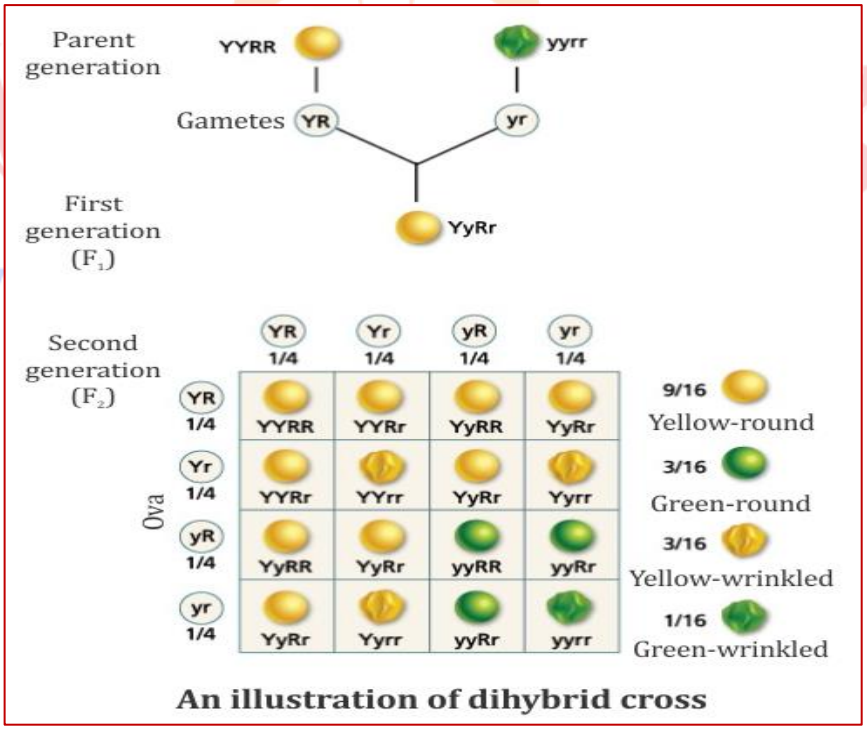
Law of segregation: The phenomenon of separation of the two alternating factors of one character, during gamete formation so that one gamete receives only one factor of a character is called as Law of Segregation.



Law of Independent Assortment-

'When two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters'.

- **Dihybrid cross**. He cross breed pea plants bearing round green seed (RRyy) with plants bearing wrinkled and yellow seeds (rrYY).
- In the F1 generation he obtained all round and yellow seeds it means round and yellow traits of seeds are dominant features while wrinkled andgreen are recessive.
- He self-crossed the plants of F1 and found that in F2 generation four different types of seeds round yellow,round green, wrinkled yellow an wrinkled green in the ratio of **9 : 3 : 3 : 1** are present.



An illustration of dihybrid cross

HOW DO TRAITS GET EXPRESSED?

DNA is regulating the authority to making of proteins in the cell.

- Gene provides information for one particular protein.
- E.g. the height of a plant depends upon the growth hormone which is in turn controlledby the gene.
- Both parents contribute equally to the DNA of next-generation during sexualreproduction.

SEX DETERMINATION IN HUMAN

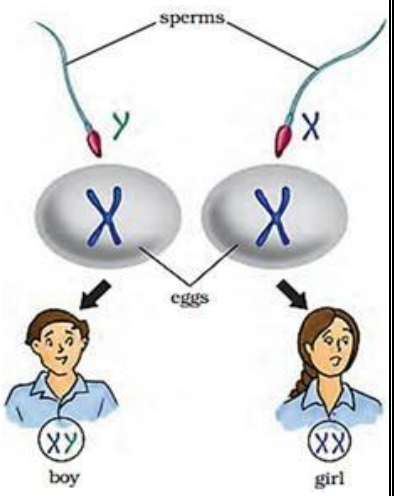
The process of determining the sex of an individual, based on the composition of the genetic makeup is called sex determination.

- Human has 23 pair of chromosomes.
- Autosome: 22 pairs (44)
- Sex chromosomes: 01 pair (02). They may be either-i- Homogametic – XX for female (44 +XX)

ii- Heterogametic XY for male (44 +XY)

In some organism-environment also plays a crucial role in the determination of sex-

- In some Reptiles: The temperature at which a fertilized egg is incubated governs the gender.
- Snails: A particular animal can change gender withinone 's lifetime.



IMPORTANT QUESTIONS

Very Short nswer Questions

1- Gene is a short segment of
   a- protein
   b- Carbohydrate
   c- DNA
   d- Polypeptides
   Ans: c

2- Which feature is considered as dominant by Mendel-
   a- Purple/ violet flower
   b- Long plant
   c- Yellow seed
   d- All of these
   Ans: d

3- In human which on of the following is heterogametic –
   a- Male
   b- Female
   c- Baby Girl Child
   d- All of these
   Ans: a

4- Which of the following is not associated with sex determination-

a- Autosome
b- Allosome
c- Sex chromosome
d- XX and XY

Ans: b

5- Mendel's dihybrid cross ratio is-

a- 1:2:1
b- 9:3:3:1
c- 1:2:2:1
d- 3:9:9:1

Ans: b

6- The sex of the children is determined by what they inherit from their father and nottheir mother." Justify

Ans: because Y sex chromosome is inherited only from the father

7- Name the scientist who established the laws of inheritance.

Ans: Gregor Johann Mendel

8- Where genes are located?

Ans: Genes are located over the chromosomes/DNA as linear segments

Short Answer Questions

9- Why did Mendel select Pea plant for his experiment?

Ans: availability of pure line plant, clearly visible observable characters, contrast characters ofsame features, easily pollinated (self and cross) etc.

10- Describe genotype and phenotype with one example of each.

Ans: The genotype of an organism is its complete set of genetic material. Eg- TT, Tt, ttThe phenotype is observable feature. E.g.- tall, dwarf

11- What is the significance of variation?

Ans: Variation enables organisms to adjust and adapt better according to the changing conditionsof the environment (Survival advantage).

Different kinds of variations in organisms lead to the development of new species. .

12- Mention the difference between the inherited and the acquired characters. Give one example of each of the characters that are inherited and the ones that are acquired in humans.

Ans: Inherited trait: obtain from parents (since the time of his birth and are passed on from onegeneration to another.

Acquired trait: gain after birth (person develops during his lifetime)Inherited: attached ear lobe, baldness

Acquired: obesity, reading skill

13- (a) Write foil form of DNA.

(b) Why are variations essential for the species?

Ans: (a) Deoxyribonucleic acid

(b) Genetic variation in a group of organisms enables some organisms to survive better than others in the environment in which they live.

Long Answer Questions

14- Make a representation of a Dihybrid cross showing a phenotypic ratio of 9:3:3:1.

Fig. 9.5; page:145,NCERT

15- **Describe law of dominance, the law of segregation and the law of segregation.**

Low of dominance: - When parents having pure contrasting characters are crossed thenonly one character expresses itself in the F1 generation. This character is the dominantcharacter and the character/factor which cannot express itself is called the recessive character.

Law of segregation: - The phenomenon of separation of the two alternating factors of onecharacter, during gamete formation so that one gamete receives only one factor of a character is called as Law of Segregation.

Law of independent assortment: the alleles of two (or more) different genes get sorted into gametes independently of one another

16- In a monohybrid cross of tall Pea plants denoted by TT and short pea plants denotedby tt, Vaibhav obtained only tall plants (denoted by Tt) in F1 generation. However, in F2 generation she obtained both tall and short plants. Using the above information, explain the law of dominance.

TT x tt Parents

T t

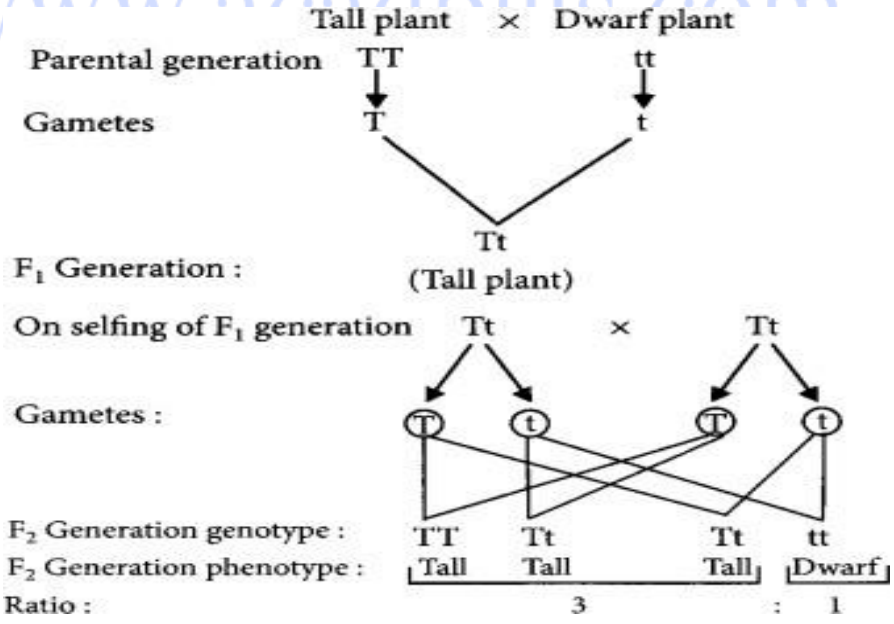
Tt…… F1

Tt x **Tt** self cross

T t T t.....Gametes

F2

	T	T
T	TT, Tall	Tt Tall
T	Tt, Tall	Tt, Dwarf



19- Mendel crossed tall pea plants with dwarf pea plants in his experiment. Write hisobservations giving reasons for the F1 and F2 generations.

In the F1 generation only tall plants are visible therefore tall (T) is dominant whereas dwarf (t) isrecessive.
In F2 generation both tall and dwarf are visible. The dwarf is visible only in homozygous conditions.

18- **How do the following provide evidence in favour of evolution in organisms? Explain with an example for each.**
(i) Homologous organs
(ii) Analogous organs
(iii) Fossils

i- Homologous organs are structures that are similar in form and function but originate from different evolutionary origins. This means that two different organisms may have the same organs, like a human arm and a bat's wing, which have the same structure, but their origin is different. This is evidence in favour of evolution since it shows that two different organisms have adapted in different ways to the same environment.

ii- Analogous organs are similar in function, but have different structures. For example, a bat's wing and a bird's wing have different structures, but both enable the organism to fly. This is also evidence in favour of evolution, as it shows that two different organisms have adapted differently to similar environments.

iii- Fossils are the preserved remains of organisms that existed in the past. By studying fossils, it is possible to determine how organisms have changed over time. This provides evidence in favour of evolution, as it shows how organisms have adapted and changed to survive in the environment.