Vidhyarthi
PAGE NO.:
DATE: / /20

Heredity & Evolution

Genetics :- Branch of science that deals with heridity and variation.

Heredity :- It means the transmission of characters from one generation to the next generation.

Evolution :- Formation of new species from their ancister or due to the gradual changes

Variation :-

- The differences among the individuals of a species / population are called variations.
- It takes place due to environment changes, crossing over & recombination of genes and mutation.

Genotype :~ The complete set of genes in an organism's genome is called genotype.

Phenotype :~ The observable characters in an organism make the phenotype.

Vidhyarthi
PAGE NO.:
DATE: / /20

Clones :- Those organisms which are exact copies of each other.

Mendel and His Work on Inheritance

Gregor Johann Mendel started his experiments on pisum Sativum (pea plant)
He proposed the laws of Inheritance :

1. Law of Dominance.
2. Law of Segregation.
3. Law of Independent Assortment.

Monohybrid Cross

The cross which involves the study of one pair of contrasting trait.

- Mendal showed inheritance of dominant and recessive characters in this cross.
- It follow 1st law of inheritance OR Law of dominance.

MONOHYBRID CROSS

Tall plant Dwarf plant] Parents

TT X tt

[T] [t]] Gametes

Tt] F1 (Heterozygous Tall)

Tt X Tt] F1 on Selfing

[T] [t] [T] [t]] Gametes

Checker Board

♀ \ ♂	(T)	(t)
(T)	TT Homozygous Tall	Tt Heterozygous Tall
(t)	Tt Heterozygous Tall	tt Homozygous Dwarf

Monohybrid cross Ratio

Phenotypic ratio :-
3 : 1 (3 Tall : 1 Dwarf

Genotypic ratio :-
1 : 2 : 1 (1TT : 2Tt : 1tt)

- He took pure tall (genotype TT) and pure dwarf (genotype tt) pea plants and cross them to obtain first generation.
- F1 generation, he obtained only tall plants.
- F2 generation, now all plants were not tall.
- He obtained 75% tall plants and 25% dwarf plants phenotypic ratio = 3 : 1
- Tallness is a dominant trait and dwarfness is a recessive trait.
- F2 generation.
  Phenotypic ratio = 3 : 1 (3 tall : 1 dwarf)
  genotypic ratio = 1 : 2 : 1 (1TT : 2Tt : 1tt)

Law of Dominance

When parents having pure contrasting characters are crossed then only one character expresses itself in the F1 generation. This character is the dominant character and the character which cannot express itself is called the recessive character.

Vidhyarthi
PAGE NO.:
DATE: / /20

Dihybrid Cross :-

Mendel also carried out experiments to observe inheritance of two pairs of contrasting characters, which is called dihybrid cross.

Round and Green Wrinkled and yellow

$RRyy$ $rrYY$ Parents

Ry rY Gamets

F1 generation All Round Yellow seeds

$RrYy$

Self Pollination

Gametes	RY	Ry	rY	ry
RY	$RRYY$	$RRYy$	$RrYY$	$RrYy$
Ry	$RRYy$	$RRyy$	$RrYy$	$Rryy$
rY	$RrYY$	$RrYy$	$rrYY$	$rrYy$
ry	$RrYy$	$Rryy$	$rrYy$	$rryy$

Round and yellow seeds - 9
Round and green seeds - 3
Wrinkled and yellow seeds - 3
Wrinkled and green seeds - 1

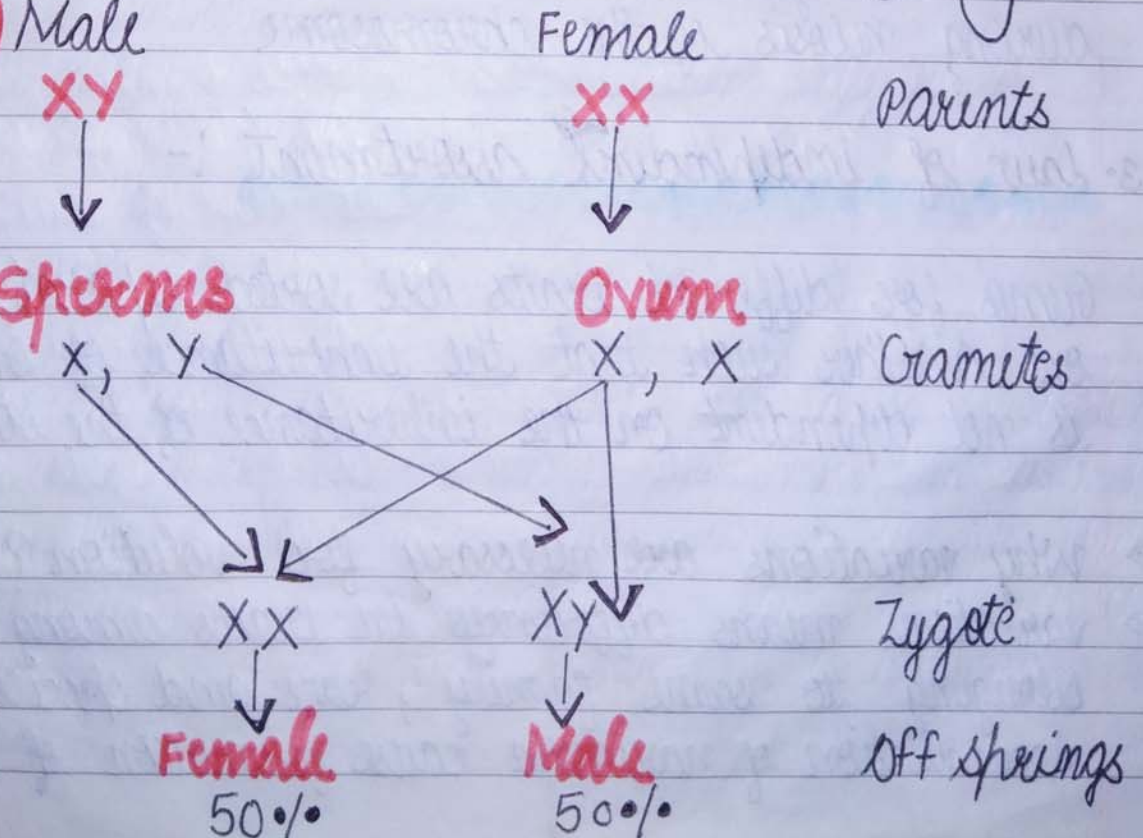
Phenotypic ratio - 9 : 3 : 3 : 1
Genotypic ratio - 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1

Vidhyarthi
PAGE NO.:
DATE: / /20

How is the sex of a newborn individual determined in humans?

- In human beings, 22 chromosomes are paired but one pair called chromosome.
- Females have homozygous chromosome XX.
- All gametes formed by the homoginetic female are similar i.e have X chromosome
- Males heterogenetic form two types of sperms i.e half with X chromosome.
- There are two possibilities.

Sex determination in human being



Vidhyarthi
PAGE NO.:
DATE: / /20

1. Law of dominance :-

A dominant gene will express itself over the recessive gene.

OR

When parents having pure contrasting characters are crossed then only one character expresses itself in the F1 generation. This character is the dominant character and the character whic cannot express itself is called the recessive character.

2. Law of segregation :-

This law states that when two traits come together in one hybrid pair, the two characters do not mix with each other and are indipendent of each other. Each gamete receives one of the two alleles during meiosis of the chromosome

3. Law of indipendent assortment :-

Genes for different traits are sorted separately from one another such that the inheritance of one trait is not dependent on the inheritance of the other trait

Ques → Why variations are necessary for evolution?
Ans → variations means differences in traits among individuals belonging to same family, race and species. Accumulation of variation cause formation of new

species different from their ancestors.
The formation of new species is called evolution.
Link That's why, we can say that variation leads to evolution process.

Advantages of variations :-

1. Evolution of a new species.
2. Sometimes, harmful characters are eliminated in a population.
3. By chance, beneficial character are occured in individuals.

Heredity :- The transmission of genetic characters from parents to their offspring.

Difference between Heredity & variation :-

	Heredity	Variations
Nature :-	It is the transmission of characters from parents to offspring	• They are differences in combination of traits amongst members of a species.
Cause :-	Heredity occurs due to passage of chromosomes or DNA from parents to offspring.	• They are caused by reshuffling of genes, mutations as well as environment.
Use :-	It keeps the identity of population intact.	• They help in adaptation to changing environment as well as natural selection.

★ Difference between acquired and inherited traits :-

Acquired	Inherited
1. These traits are developed by an organism after birth.	• These traits are develop in an organism from birth time.
2. They are not present in germ cells.	• These are present in germ cells.
3. They help in better adaptation of an organism.	• These traits comes from parents, they may be benificial or harmful.

★ Difference between Homodogus and Analogus origin :-

Homologus	Analogus
1. Those organs which have same origin but different functions.	1. Those organs which have diffirent origin but having same functions.
2. Example → Forlimbs of lizards and humans, forlimbs of birds and bat.	Example → Wings of insects and birds, eye of octopus and human.

Vidhyarthi
PAGE NO.:
DATE: / /20

★ Fossils :- Fossils are remains of dead plant and animal that live in ancient time.

(i) Fossils linked with evolution.
for e.g → fossils give evidence about the evolution of birds after reptiles

(ii) Fossils tells about age of an organism that lived in past time.

Deep :- The presence of fossils of an organism that older it is.

Fossils of Archaeopteryx tells a link between reptiles and birds.

★ Artificial Selection :- The process of selecting genetically improved variety from a wild life variety for human purpose.
For example :- Wild cabbage

From the species, broccoli, Kolhrabi, Kale, cabbage and cauliflower are selected artificially by farmers according to their desire.

★ Speciation :- The formation of new species due to suddenly change.
Speciation occurs due to mutation, geneflow and genetic drift and natural selection.

1.) ★ Natural selection : e.g. Red beetles change into green to hide itself from crow.

2. ★ Mutation :- It is alternation of DNA sequence in an organism
eg → UV radiation, re-radiation

3. ★ Gene flow :- The transfer of genetic material by inter breeding between population of same species occurs in individual of species but different geographical area.

4. ★ Genetic drift :- The process of change in allele frequency of a particular gene by chance over a time period. e.g. → Red beetles change into blue beetles.

Darwin's Theory of Evolution :-

Darwin gave the theory of evolution in 'the origin of species' book.

(Imp)

Postulates :-

1. Within any population, their is a natural variation.
2. A population with large number of individual remains stable in nature.
3. Numbers of same or different population struggle for food and shelter and mate.

Natural Selection →

4. The organism who is fit in nature it is naturally selected organism and unfit organism is eliminated by the nature.
5. Accumulation of variation give rise to a new species.

Experiment :-

Miller and Urey two scientist conduct an chemical experiment in 1953. They create an atmosphere with conditions thought similar to be existed on early earth.
the two scientist sealed water, ammonia, ~~flask~~.
Methane, Hydrogen sulphide in a sterile flask.
They heated the mixture of the flask to evaporate water into water vapours.
They concluded that life on earth comes from biomolecules. This was possible when they maintain a temperature just below 100°C and sparks were pass through mixture to stimulate lightning.

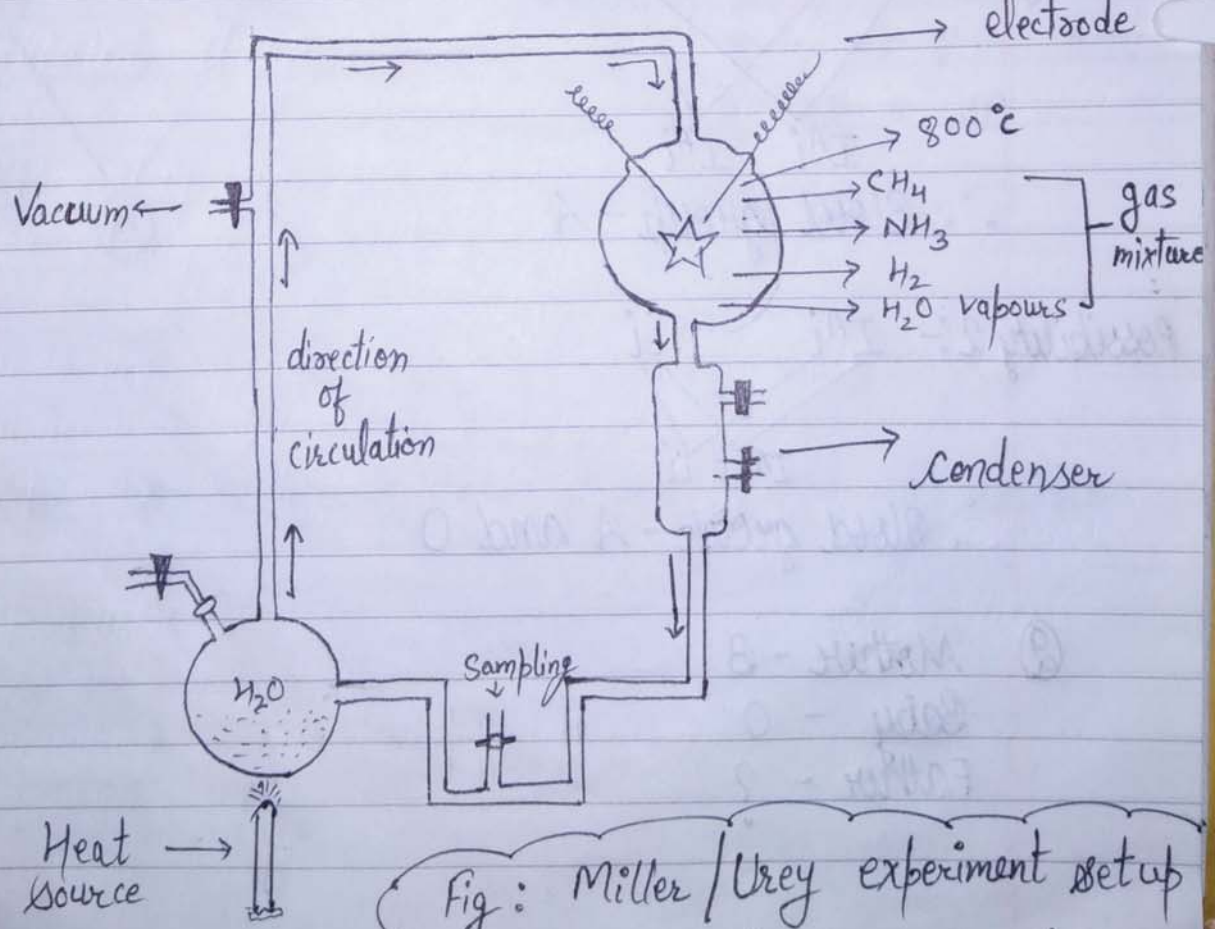


Fig: Miller / Urey experiment setup

Blood groups :-

A person has one of 4 blood groups : A, B, AB or O

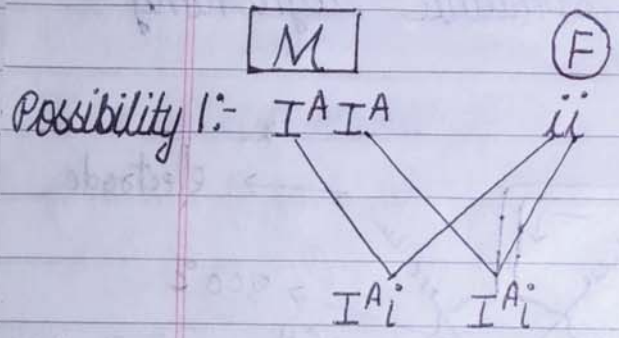
Genes → I^A, I^B, i (I^o)

There are 3 genes forms (called alleles) for blood.

★ Problems On Blood group :-

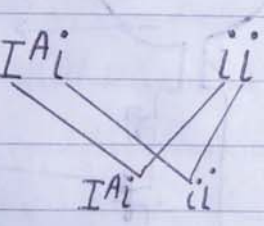
① Mother's blood group - A

Father = O
Baby = ?



∴ Blood group - A

Possibility 2:- $I^A i$ ii



∴ Blood group - A and O

② Mother - B
Baby - O
Father - ?

Vidhyarthi
PAGE NO.:
DATE: / /20

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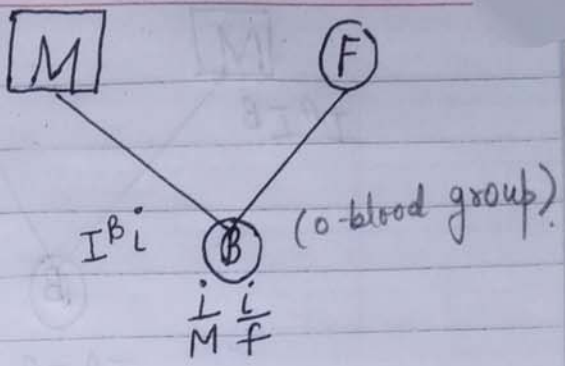
Possibility I:- $I^B I^B$

B

ii

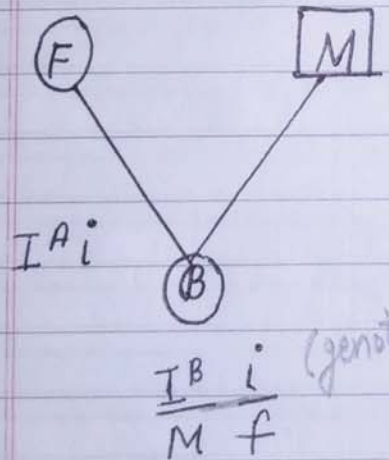


Father → ii → O
$I^B i$ → B
$I^A i$ → A

O, B or A be the blood group of father.

③ Father - A Mother - ?
Baby - B

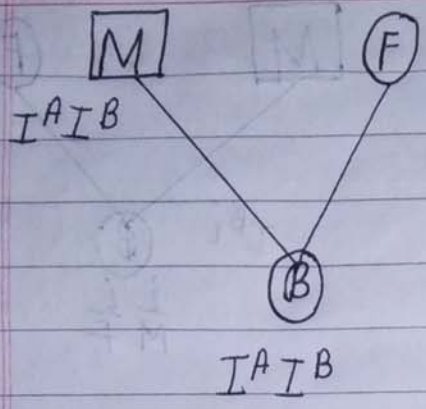
Solution



Mother → $I^B I^B$ → B
$I^B i$ → B
$I^A I^B$ → AB

B or AB may be the blood group of Mother.

④ Father → AB Baby → AB
Mother → ?



A -> $I^A I^A$, $I^A i$
B -> $I^B I^B$, $I^B i$
Mother's blood is A, AB or B