JAIPUR EDUCATION PLUS

Not Just Education but Education Plus….
(P.No. 51, First floorLane No. 3, Moti Nagar, Queen's Road)
Mob. : 7615012588, 9929544574
Email: jaipureducationplus@gmail.com
www.jaipureducationplus.com

HERIDITY AND EVOLUTION

BASIC TERMINOLOGY

HEREDITY : - The transmission of characters from the parents to their offspring's is called heredity.

VARIATION : - The differences in the characters among the individuals of a species in called variation. The great advantage of variations to a species is that it increases the chance of its survival in a changing environment.

CHROMOSOME : - Chromosome is a thread-like structure in the nucleus of a cell formed of DNA which carries the gene.

GENE : - A gene is a unit of DNA on a chromosome which governs the synthesis of one protein that controls a specific characteristic of an organism. Genes are actually units of heredity which transfer characteristics from parents of their offspring's during reproduction.

DOMINANT GENE : - The gene which decides the appearance of an organism even in the presence of an alternative gene is known as a dominant gene. It dominated the recessive gene for the same characteristic on the other chromosome of the pair.

RECESSIVE GENE : - The gene which can decide the appearance of an organism only in the presence of another identical gene is called a recessive gene.

GENOTYPE : - Genotype is the description of genes present in an organism and a pair of letters TT, Tt or tt.

PHENOTYPE : - The characteristic which is visible in an organism is called its phenotype and 'tall' or 'dwarf'.

FIRST FILIAL GENERATION OR F_1 GENERATION : - When two parents to produce progeny, then their progeny is called first filial generation or F1 generation.

SECOND FILIAL GENERATION OR F_2 GENERATION : - When the first generation progeny cross among themselves to produce second progeny, then this progeny is called second filial generation or F_2 generation.

HYBRID : - A new form of plant resulting from a cross of different varieties of a plant is known as a hybrid.

HOW ARE CHARACTERISTICS TRANSMITTED TO PROGENY : -

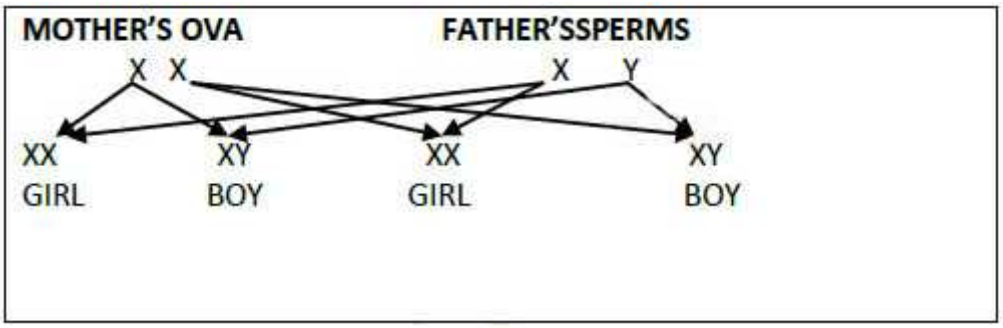
The characteristics of traits of parents are transmitted to their progeny through genes present on their chromosomes during the process of sexual reproduction.

HOW BLOOD GROUPS ARE INHERITED : -

A person has one of the four blood groups: A, B, AB or O. This blood group system is controlled by a gene which has three different forms denoted by the symbols IA, IB and IO. The genes IA and IB show no dominance over each other, that is, they are co dominant. However, genes IA and IB both are dominant over the gene IO.

SEX DETERMINATION : -

A person can have a male sex or a female sex. The process by which the sex of a person is determined is called sex determination. There are two types of sex chromosomes: X and Y chromosomes.



ACQUIED IRED TRAITS : -

A trait of an organism which is 'not inherited' but develops in response to the environment is called an acquired trait. Example: If a beetle does not get sufficient food for a considerable time. The acquired traits of organism cannot be passed on to their future generations.

INHERITED TRAIT : -

A trait of an organism which is caused by a change in its genes is called an inherited trait.

EVOLUTION : -

Evolution is the sequence of gradual changes which take place in the primitive organisms over millions of years in which new species are produced.

EVIDENCES FOR EVOLUTION : -

1. HOMOLOGOUS ORGANS PROVIDE EVIDENCE FOR EVOLUTION : -

Those organs which have the same basic structure but different functions are called homologous organs. Example: the forelimbs of a man, a lizard (reptile), a frog (amphibian), a bird and a bat (mammal).

2. ANALOGOUS ORGANS PROVIDE EVIDENCE FOR EVOLUTION : -

Those organs which have different basic structure but have similar appearance and perform similar functions are called analogous organs.

3. FOSSILS PROVIDE EVIDENCE FOR EVOLUTION : -

The remains of dead animals or plants that lived in the remote past are known as fossils.

SPECIATION : -

The process by which new species develop from the existing species is known as speciation.

Class 10 Heredity and Evolution

Genetics : Branch of science that deals with Heredity and variation.

Heredity : It means the transmission of features / characters/ traits from one generation to the next generation.

Variation : The differences among the individuals of a species/population are called variations.

Mendel and His Work on Inheritance

Gregor Johann Mendel started his experiments on plant breeding and hybridization. He proposed the laws of inheritance in living organisms. Mendel was known as Father of Genetics

Plant selected by Mendel : Pisum sativum (garden pea). Mendel used a number of contrasting characters for garden pea.

Following are the seven pairs of contrasting characters in Garden Pea

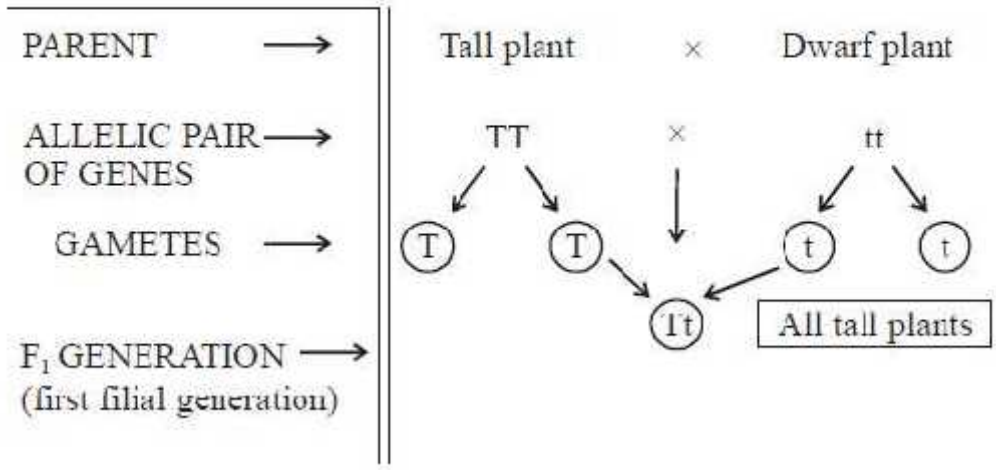
(TABLE OF CONTRASTING CHARACTERS. SEVEN PARTS)

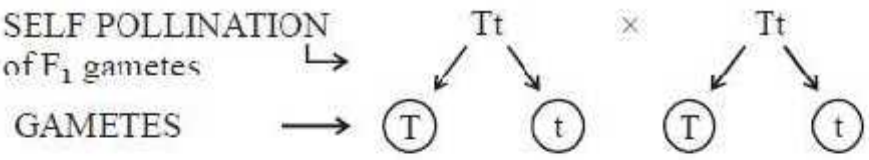
CHARACTER	DOMINANT TRAIT	RECESSIVE TRAIT
Flower colour	Violet	White
Flower position	Axial	Terminal
Seed colour	Yellow	Green
Seed shape	Round	Wrinkled
Pod shape	Inflated	Constricted
Pod colour	Green	Yellow
Height of plant	Tall	Dwarf/Short

Mendels Experiments : Mendel conducted a series of experiments in which he crossed the pollinated plants to study one character (at a time)

Monohybrid Cross : Cross between two pea plants with one pair of contrasting characters is called a monohybrid cross. Example : Cross between a tall and a draft plant (short).

MONOHYBRID CROSS





F_2 GENERATION →

Gametes →	T	t
T	TT tall	Tt tall
t	Tt tall	tt dwarf

Phenotypic ratio → 3:1

Genotypic ratio → 1:2:1

TT, tt → Both dominant traits / Both recessive alleles → Pure or homozygous conditon

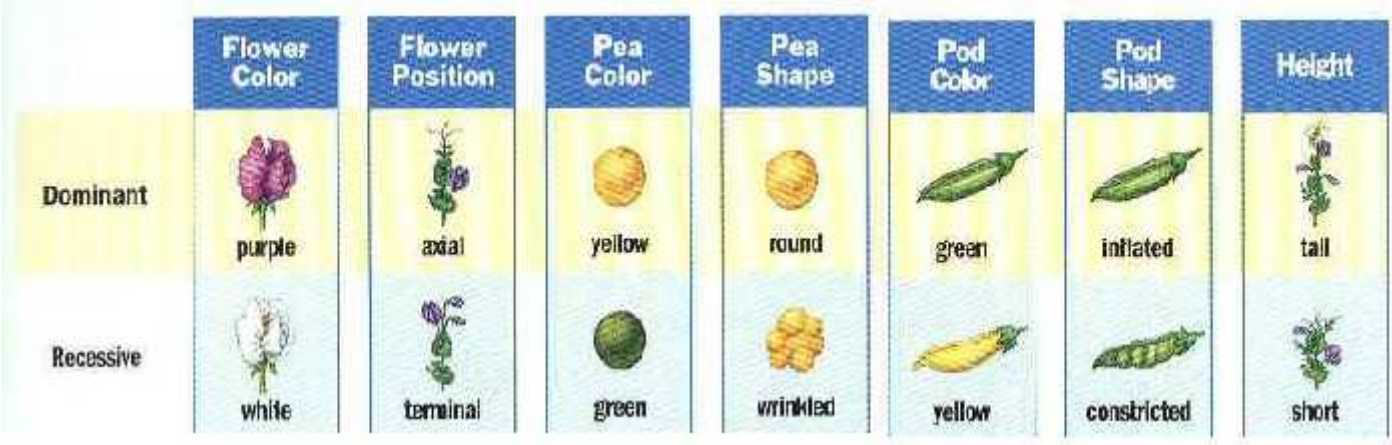
Tt → One dominant, one recessive trait → Hetrozygous condition - Hybrid

Phenotypic ratio : 3:1

Genotypic ratio : 1:2:1

Phenotype → Physical appearance [Tall or Short]

Genotype → Genetic make up [TT, Tt or tt]



Observations of Monohybrid Cross

1. All F1 progeny were tall (no medium height plant (half way characteristic)

2. F2 progeny ¼ were short, ¾ were tall

3. Phenotypic ratio F2 – 3:1 (3 tall : 1 short)

Genotypic ratio F2 – 1 : 2 :1 = TT : Tt : tt

Conclusions

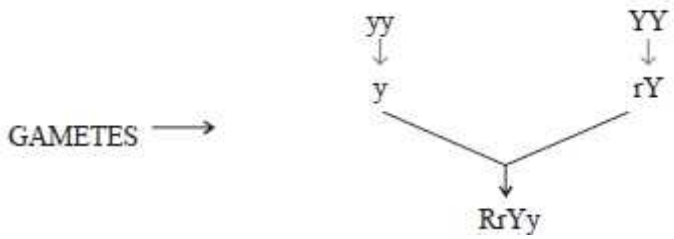
1. TT and Tt both are tall plants while tt is a short plant.

2. A single copy of T is enough to make the plant tall, while both copies have to be 't' for the plant to be short.

3. Characters/Traits like 'T' are called dominant trait (because it express itself) and 't' are recessive trait (because it remains suppressed)

Dihybrid Cross : A cross macle between two plants having two pairs of contrasting characters is called dihybrid cross.

PARENT GENERATION ---> ROUND GREEN SEEDS x WRINKLED YELLOW SEEDS



Phenotypic Ratio

9	3	3	1
Round Yellow	Round green	Wrinkled Yellow	Wrinkled green

Observations

1. When RRyy was crossed with rrYY in F1 generation all were Rr Yy round and yellow seeds.

2. Self pollination of F1 plants gave parental phenotype and two mixtures (recombinants round yellow & wrinkled green) seeds plants in the ratio of 9:3:3:1

9	3	3	1
Round Yellow	Round green	Wrinkled Yellow	Wrinkled green

Conclusions

1. Round and yellow seeds are DOMINANT characters

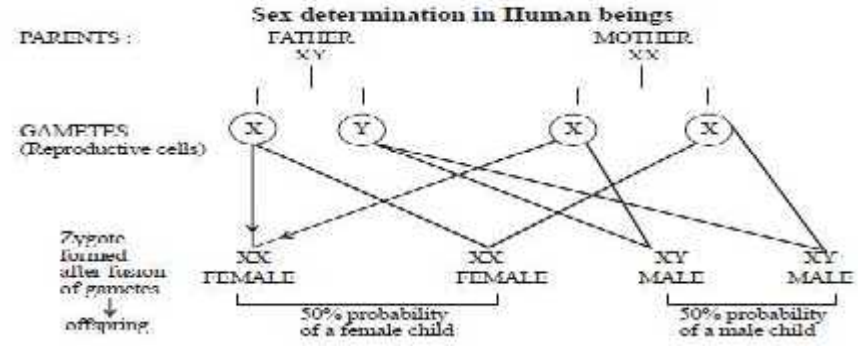
2. Occurrence of new phenotypic combinations show that genes for round and yellow seeds are inherited independently of each other

SEX DETERMINATION : Phenomenon of decision or determination of sex of an offspring

FACTORS Responsible for Sex Determination

1. Environmental : In some animals the temperature at which the fertilised eggs are kept decides the gender. eg. in Turtle

2. Genetic : In some animals like humans gender or individual is determined by a pair of chromosome called sex chromosome XX – Female and XY – Male



This shows that half the children will be boys and half will be girls. All children will inherit an X chromosome from their mother regardless whether they are boys or girls. Thus sex of children will be determined by what they inherit from their father, and not from their mother.

EVOLUTION

Evaluation is the sequence of gradual changes which takes place in the primitive organisms, over millions of years, in which new species are produced.

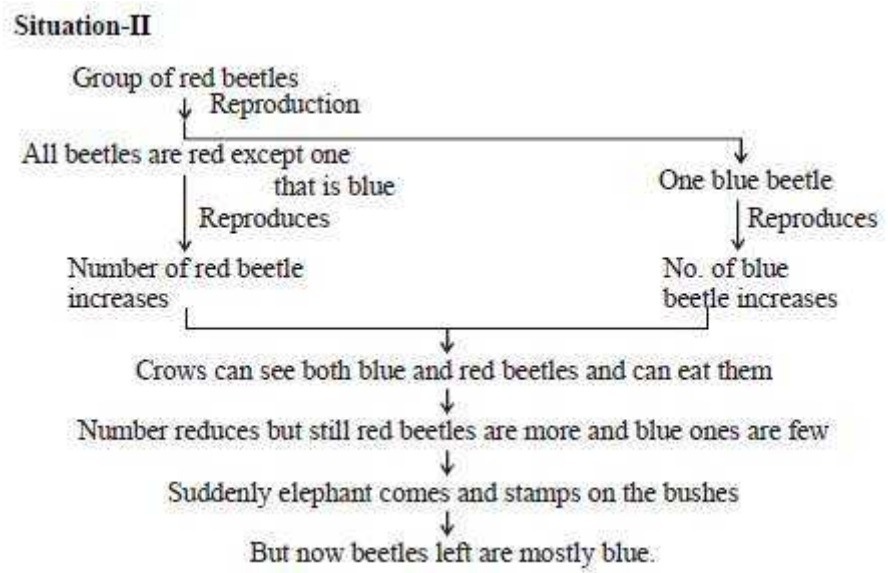
Situation-I

Group of red beetles

Colour variation arises during reproduction

All beetles red except one that is green	One beetle Green Reproduction
Crows feed on red beetle	Progeny beetles green
No. of beetles reduces	Crow could not feed on green beetles as they got camouflaged in green bushes
	Number of green beetles increases

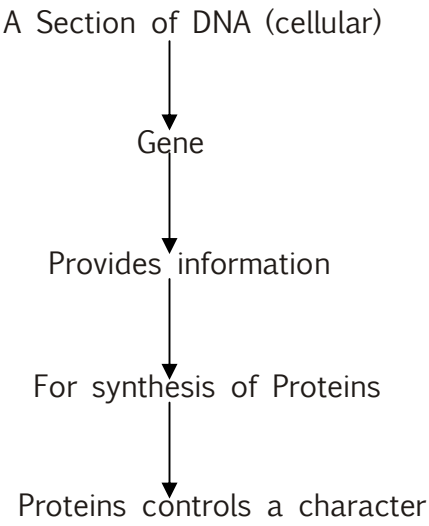
Situation 1 : Green beetles got the survival advantage or they were naturally selected as they were not visible in green bushes. This natural selection is exerted by crows resulting in adaptations in the beetles to fit better in their environment



Situation 2 : Blue beetles did not get survivals advantage. Elephant suddenly caused major havoc in beetle population otherwise their number would have been considerably large.

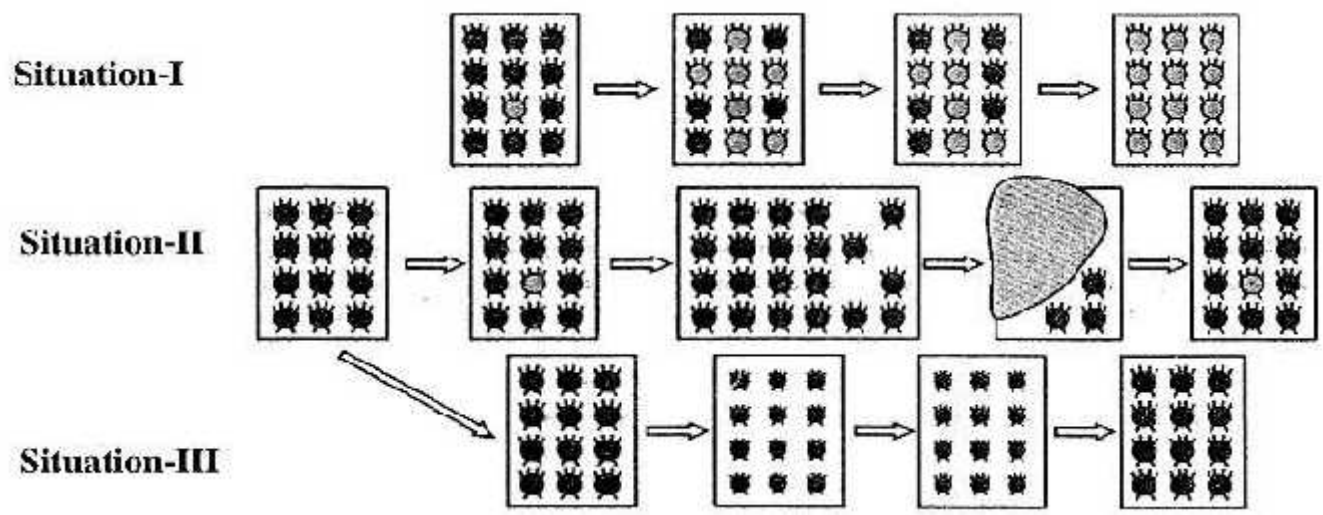
From this we can conclude that accidents can change the frequency of some genes even if they do not get survival advantage: This is called genetic drift and it leads to variation.

Characters or traits of an organism are controlled by the genes



Example :

Gene T	→	responsible for synthesis of efficient enzyme (Protein)	→	More production of growth hormone	→	Results in Tall Plants
Gene t	→	responsible for synthesis of less efficient enzyme	→	Less production of growth hormone	→	Results in short Plants



Genetic drift. It leads to diversity without any adaptation

SITUATION-III Group

of red beetles

↓

Habitat of beetles (bushes)

↓

Suffer from plant disease

↓

Average weight of beetles

↓

decreases due to poor nourishment

↓

Number of beetles kept on reducing

↓

Later plant disease gets eliminated

↓

Number and average weight of the beetles increases again

Situation 3 : No genetic change has occurred in the population of beetle. The population gets affected for a short duration only due to environmental changes.

ACQUIRED AND INHERITED TRAITS

Acquired Traits	Inherited Traits
1. These are the traits which are developed in an individual due to special conditions	1. These are the traits which are passed from one generation to the next.
2. They cannot be transferred to the progeny	2. They get transferred to the progeny.
3. They cannot direct evolution eg. Low weight of starving beetles.	3. They are helpful in evolution. eg. Colour of eyes and hair

SPECIATION

Micro evolution : It is the evolution which is on a small scale. eg. change in body colour of beetles.

The process by which new species develop from the existing species is known as speciation.

Speciation : it is the process of formation of new species.

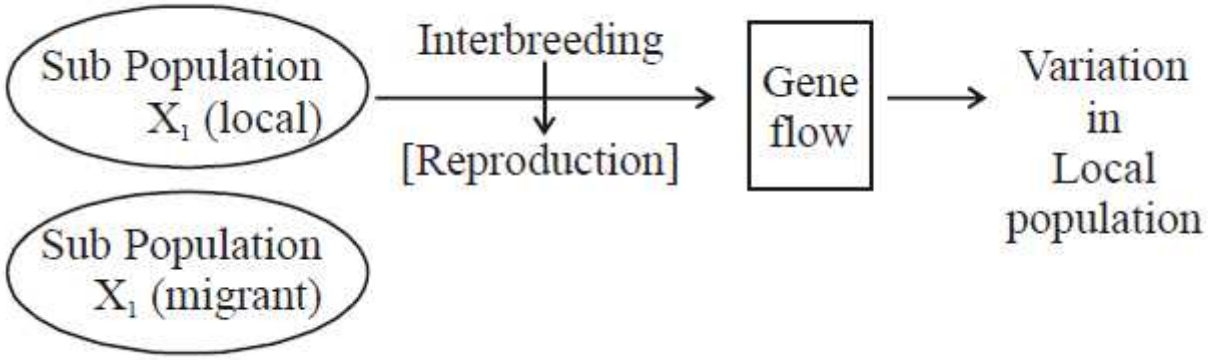
Species : A group of similar individuals within a population that can interbreed and produce fertile offspring.

Geneflow : It is exchange of genetic material by interbreeding between populations of same species or individuals

WAYS BY WHICH SPECIATION TAKES PLACE

Speciation takes place when variation is combined with geographical isolation.

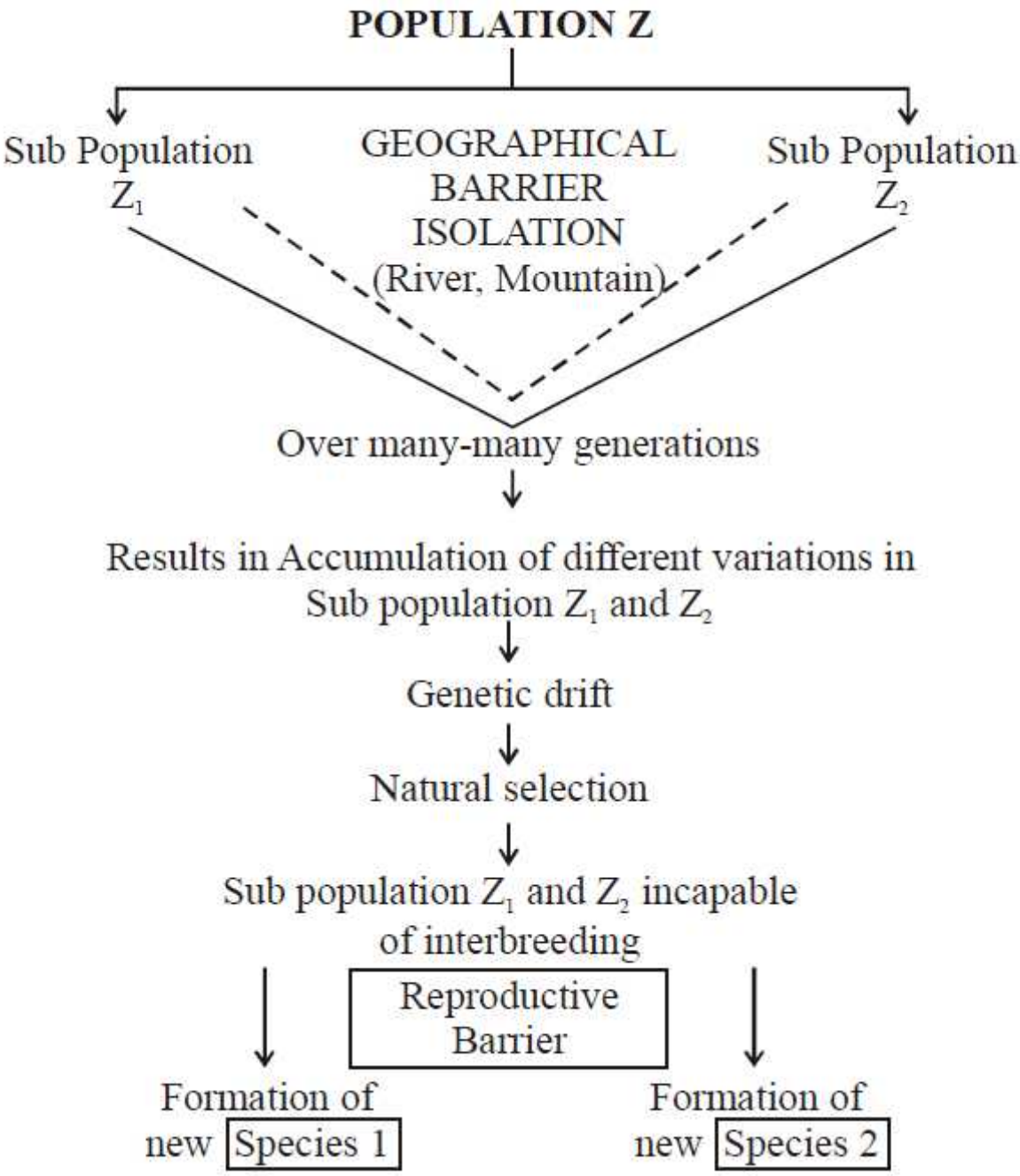
Gene flow : occurs between population that are partly but not completely separated



GENETIC D

It is the random change in the frequency of alleles (gene pair) in a population over successive generations.

*Natural Selection : The process by which nature selects and consolidate those organisms which are more suitably adapted and possesses favorable variations



Genetic drift takes place due to

(a) Severe changes in the DNA (b) Change in number of chromosomes

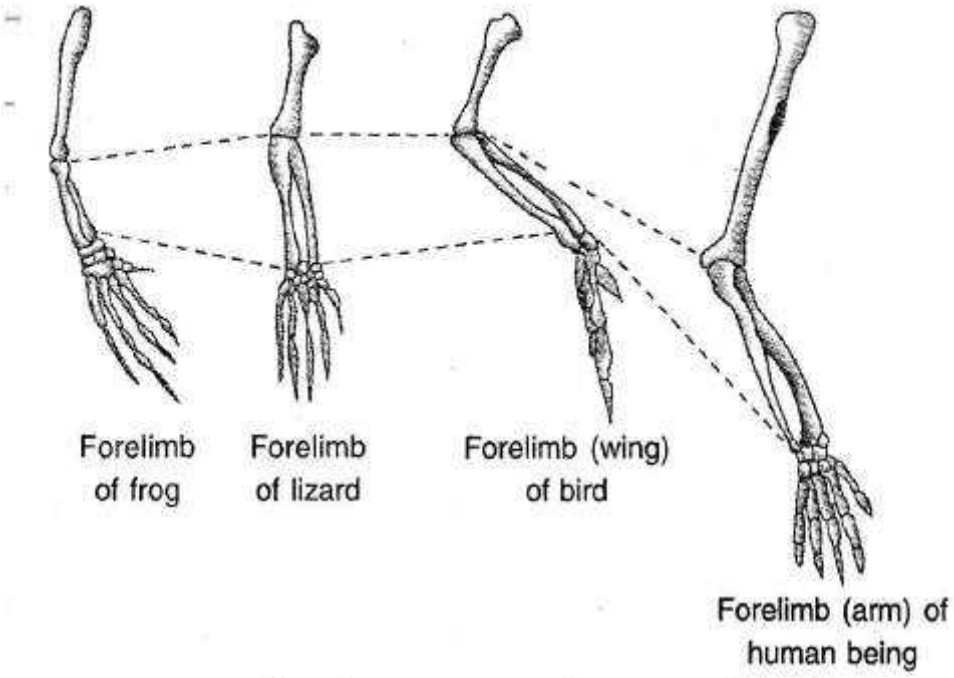
Both evolution and classification are interlinked.

1. Classification of species is reflection of their evolutionary relationship.

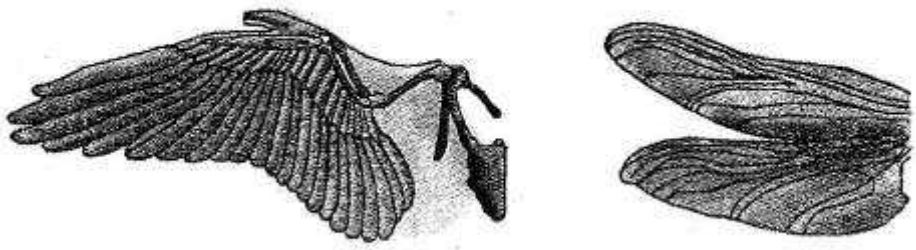
2. The more characteristic two species have in common the more closely they are related.

3. The more closely they are related, the more recently they have a common ancestor.

4. Similarities among organisms allow us to group them together and to study their characteristic.



Homologus organs of some vertebrates



(a) Wing of bird (b) Wing of insect

Analogous organ of flying birds

TRACING EVOLUTIONARY RELATIONSHIPS

(Evidences of Evolution)

I. Homologous Organs : (Morphological and anatomical evidences. These are the organs that have same basic structural plan and origin but different functions.

Homologous organs provides evidence for evolution by telling us that they are derived from the same ancestor.

Example :

Forelimb of Horse	(Running)	Same basic structural but
Winds of bat	(flying) plan,	different functions perform.
Paw of a cat	(walk/scratch/attack)	

II. Analogous Organs : These are the organs that have different origin and structural plan but same function example :

Example : Analogous organs provide mechanism for evolution.

Wings of bat	elongated fingers with skin folds	Different basic structure, but perform similar function i.e., flight.
Wings of bird	Feathery covering along the arm	

III. Fossils : (Palaeontological evidences) : The remains and relics of dead organisms of the past.

FOSSILS ARE PRESERVED TRACES OF LIVING ORGANISMS

Fossil Archaeopteryx possess features of reptiles as well as birds. This suggests that birds have evolved from reptiles. Examples of Fossils

AMMONITE - Fossil-invertebrate

TRILOBITE - Fossil-invertebrate

KNIGHTIA - Fossil-fish

RAJASAURUS - Fossil dinosaur skull

AGE OF THE FOSSILS

I. Deeper the fossil, older it is.

II. Detecting the ratios of difference of the same element in the fossil material i.e. Radio-carbon dating [C-(14) dating)

Evolution by stages : Evolution takes place in stages ie bit by bit over generations.

I. Fitness advantage

Evolution of Eyes

Evolution of complex organs is not sudden it occurs due to minor changes in DNA, however takes place bit by bit over generations.

Flat worm has rudimentary eyes
Insects have compound eyes
Humans have binocular eyes
} enough to give fitness advantage

II. Functional Advantage

Evolutions of feathers :

Feathers provide insulation in cold weather but later they might become useful for flight.

Example : Dinosaurs had feathers, but could not fly using feathers. Birds seem to have later adapted the feathers to flight.

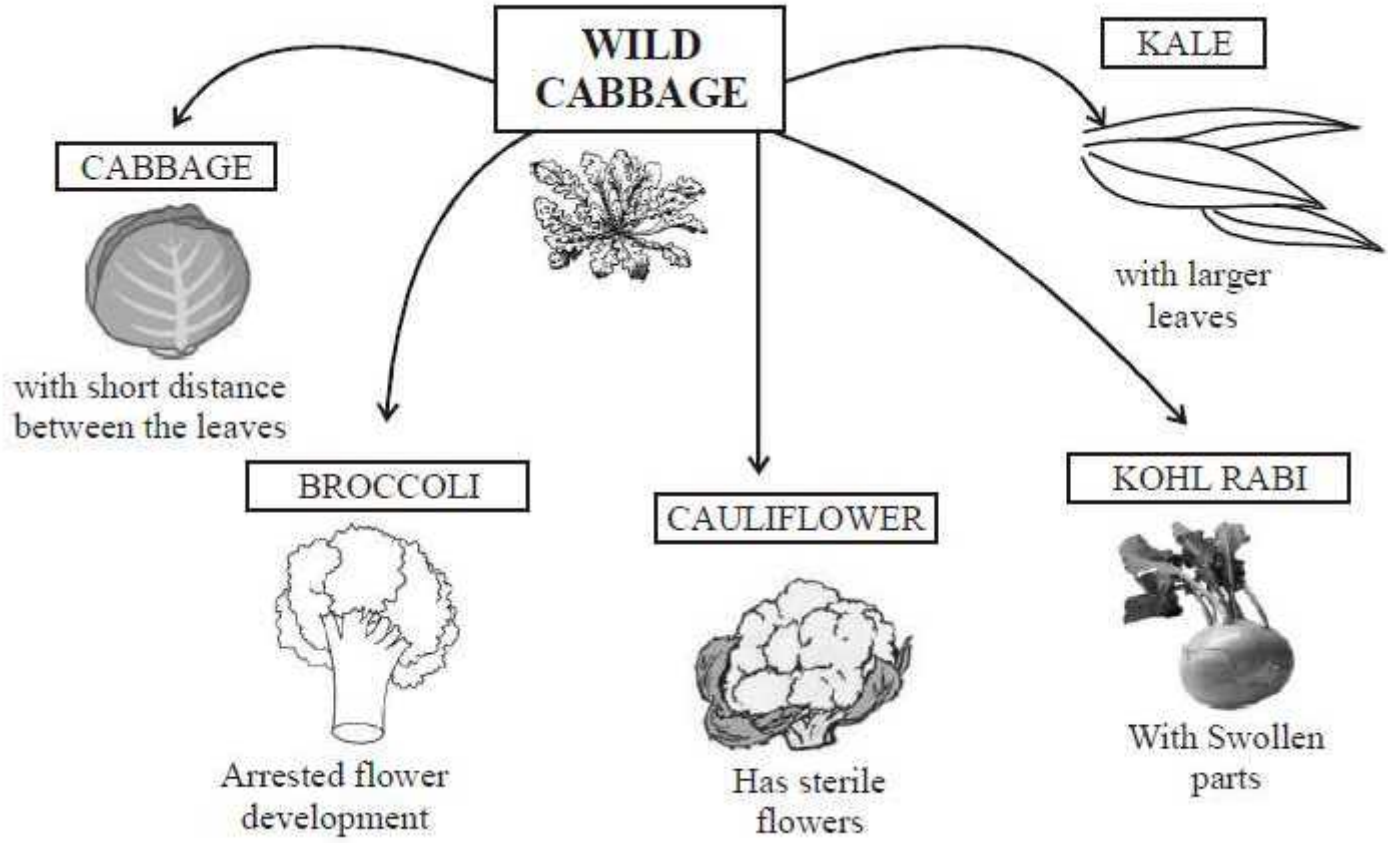
Evolution by Artificial Selection :

Humans have been a powerful agent in modifying wild species to suit their own requirement throughout ages by using artificial selection. eg

(i) From wild cabbage many varieties like broccoli, cauliflower, red cabbage, kale, cabbage and kohlrabi were obtained by artificial selection.

(ii) Wheat (many varieties obtained due to artificial selection).

Evolutic



Molecular Phylogeny

⇒ It is based on the idea that changes in DNA during reproduction are the basic events in evolution

⇒ Organisms which are more distantly related will accumulate greater differences in their DNA HUMAN EVOLUTION

Tools to Study Human Evolutionary Relationship

Excavating | Time dating | Fossils | Determining DNA

Evolution by stages : Evolution takes place in stages ie bit by bit over generations.

Sequences

Although there is great diversity of human forms all over the world get all humans are a single species.