Holy Faith Presentation School

CLASS: 10TH

SUBJECT: BIOLOGY

SESSION 2024-2025.

TERM 2ND

TOPIC: HEREDITY AND GENETICS

Trait: - A recognizable feature of a human being (or any other organism) like height, complexion, shape of hair, color of eyes, and shape of nose and chin etc are called characters or traits.
Any morphological, anatomical, biochemical or behavioral feature of an organism is termed as character or trait.
The transmission of characters (or traits) from the parents to their offsprings is called heredity. In simple terms, heredity means continuity of features from one generation to the next.
Inherited traits are those traits which are obtained from the parents and pass from generation to generation. The acquired traits are those traits which are developed during the life of an organism and these die with the death of an organism.
Heredity: - Transmission of characters (resemblance as well as variations) from parents to the offsprings, i.e. from one generation to the next generation is called heredity.
Variations: - The differences in the traits shown by the individuals of a species, and also by the offsprings (siblings) of the same parents are referred to as variations.
Genetics: - In brief genetics is the branch of biology that deals with the study of heredity and variations. The term genetics was coined by William Batson in 1906.

ACCUMULATION OF VARIATIONS DURING REPRODUCTION: -

Asexual reproduction involves single parent. When a single individual reproduces asexually, the resultant two individuals again after some time reproduce to form four individuals. In this way, large number of individual are formed after many generations. All these individuals would be similar. However, there would be only very minor differences between them. These minor differences arise due to inaccuracies in DNA copying. Asexual reproduction generates little diversity.
Sexual reproduction, on the other hand, generates even greater diversity. This is so because sexual reproduction involves two parents (father and mother) and every offspring receives some characters of their parents (father and mother), they show distinct differences (variations) among themselves as well as from their parents. During sexual reproduction the variations are caused by-
(i) Chance separation of chromosomes during gamete formation (gametogenesis)
(ii) Crossing over during meiosis.
(iii) Chance coming together of chromosomes during fertilization.
(iv) Mutations, i.e. alterations in the genetic material.
[To understand these points refer to class lecture]

MENDEL'S EXPERIMENT:

Gregor Johann Mendel (1822-1884) is known as the father of genetics. Mendel had conducted breeding experiments on garden pea.
Mendel choose garden pea (Pisum sativum) because the pea plant is small, easy to grow and cross bred artificially. This plant, being bisexual, is self-fertilizing in nature but can be easily cross pollinated experimentally. It reproduces a large number of offspring and completes its life cycle in one season.
Mendel selected seven visible characters, each with two contrasting traits.

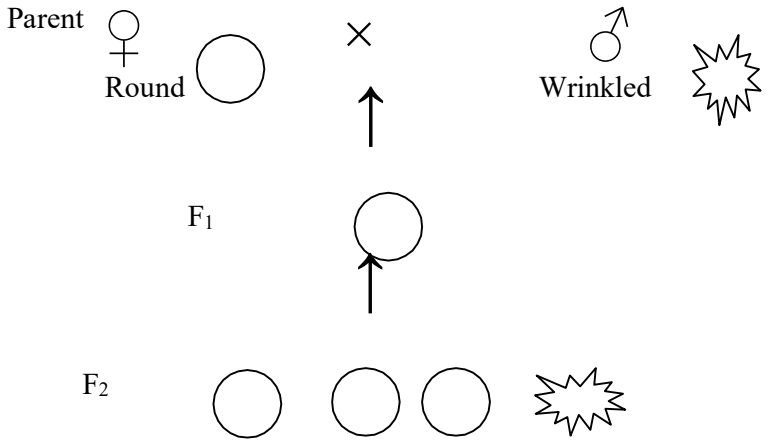
S.No.	Character.	Contrasting Traits.	
		Dominant.	Recessive.
1.	Plant size or height.	Tall.	Dwarf.
2.	Position of flower on the stem.	Axial.	Terminal.
3.	Color of unripe pod.	Green.	Yellow.
4.	Shape of pod.	Inflated.	Constricted.
5.	Shape (form) of seed.	Round (smooth).	Wrinkled.
6.	Color of seed.	Yellow.	Green.
7.	Color of flower.	Violet.	White.

From his studies in pea, Mendel proposed the following two laws of genetics:
1. Law of segregation and
2. Law of independent assortment.
These two laws provided the foundation on which the science of genetics has developed.
*** Mendel' s Experimental Technique.** Mendel conducted breeding experiments in three steps:
(i) Selection of pure parent plant (plants producing similar traits in every generation).
(ii) Production of first generation of plants by crossbreeding (hybridization).
(iii) Raising second and subsequent generations by self fertilization of hybrids.

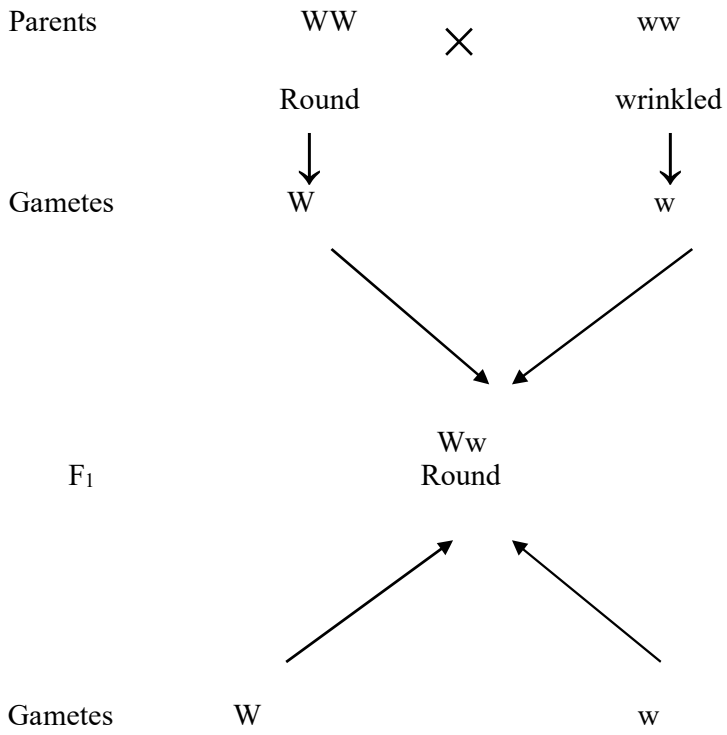
1. MONOHYBRID CROSS: - Based on this Mendel proposed first law of genetics i.e. law of segregation.
A breeding experiment dealing with a single character is called a monohybrid cross.
In this experiment, Mendel crossed a variety producing round seeds with another having winkled seeds. The seeds resulting from hybridization (F_1 seeds) were all round. The F_2 seeds, i.e. seeds produced by selfing of F_1 plants, were of the following two kinds: (1) on an average 3 out of every four seeds were round, while (2) one out of every 4 seeds was wrinkled. On the basis of these findings Mendel proposed the law of segregation which states that the two alleles separate and pass into different gametes, producing two different types of gametes in equal frequencies; this is known as segregation. The 3:1 ratio is known as the phenotypic ratio, while as, 1:2:1 is known as the genotypic ratio.

Some basic terms:
**** Allele: -*** Alternative forms of gene; denoted by the same letter of groups; e.g. W and w; alleles govern the contrasting forms of the same trait.
**** Dominant and recessive allele: -*** Mendel found that in the heterozygous (Ww) state only one of the two alleles of a gene was able to express itself, i.e. produce the character. This allele is referred to as the dominant allele (W). Recessive allele on the other hand, is unable to express itself in the heterozygous state (w).
**** Phenotype: -*** The observable characteristics of an organism; may refer to a single character or a group of characters, e.g. round and wrinkled (pea seed).
*** Genotype:** - The genetic make-up of an organism; may refer to one or more genes; e.g. WW, Ww and ww.
**** Homozygous: -*** An individual that has two copies of the same alleles, e.g. WW and ww.
**** Heterozygous: -*** An individual that has two different alleles of a gene, e.g. Ww.

Mendel's monohybrids cross.



(3) ROUND (1) WRINKLED



♀ ↗	W	w
W	WW Round	Ww Round
W	Ww Round	ww wrinkled

The ratio came out to be 3:1 as 3 out of 4 were round and 1 out of 4 was wrinkled.

2. MENDEL'S DIHYBRID CROSS: - Based on dihybrid cross Mendel proposed law of independent assortment.

A breeding experiment dealing with two characters at the same time is called a dihybrid cross.

Let us consider a cross in which plants producing round and yellow seeds were crossed with plants producing wrinkled and green seeds. The F_1 generations were all yellow and round seeded, suggesting that yellow is dominant over green and round seed is dominant over wrinkled seed.

When these F_1s are selfed, Mendel postulated that the segregation of one pair of unit factors will occur independently of the other pair or they will assort independently.

Accordingly, the gametes must carry all possible combinations of the unit factors in equal frequency. In this example gametes with random distribution of unit factors will give following combinations;

(i) Yellow & Round
(ii)Yellow & Wrinkled
(iii) Green & Round
(iv) Green & Wrinkled.

These combinations will result in a phenotypic ratio of 9:3:3:1 and this ratio are same for all dihybrid crosses.

Mendel's dihybrids cross.

P generation Round Yellow RRYY × Wrinkled green rryy

Gametes RY × ry

F_1 **RrYy** × RrYy **RrYy**

RY Ry rY ry × RY Ry rY ry

These are all gametes

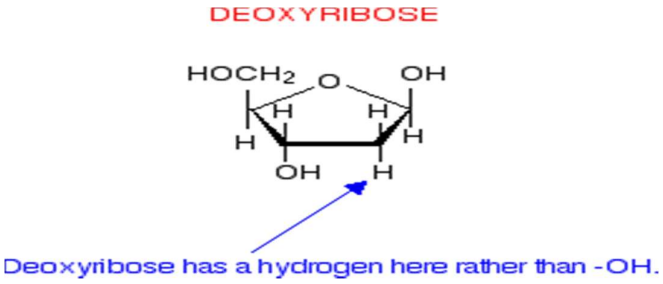
	RY	Ry	rY	ry
RY	RYRY Round Yellow	RYRy Round Yellow	RYrY Round Yellow	RYry Round Yellow
Ry	RyRY Round Yellow	RyRy Round Green	RyrY Round Yellow	Ryry Round Green
rY	rYRY Round Yellow	rYRy Round Yellow	rYrY Wrinkled Yellow	rYry Wrinkled Yellow
Ry	ryRY Round Yellow	ryRy Round Green	ryrY Wrinkled Yellow	ryry Wrinkled Green

In F_2 generation the combinations are as;
Round & Yellow = 9
Round & Green = 3
Wrinkle & Yellow = 3
Wrinkled & Green = 1
Thus, the phenotypic ratio of all dihybrid crosses is 9:3:3:1.
And the genotypic ratio of dihybrid cross is 1:2:1:2:4:2:1:2:1.

STRUCTURE OF DNA

The expanded form of DNA is deoxyribonucleic acid. It was first isolated by the scientist Frederick Meisher from the nucleus of the pus cells in 1869. It is a nucleic acid, a polymer of deoxyribonucleotides, which is found mostly in the form of a double helix. Each deoxyribonucleotide is composed of three components.

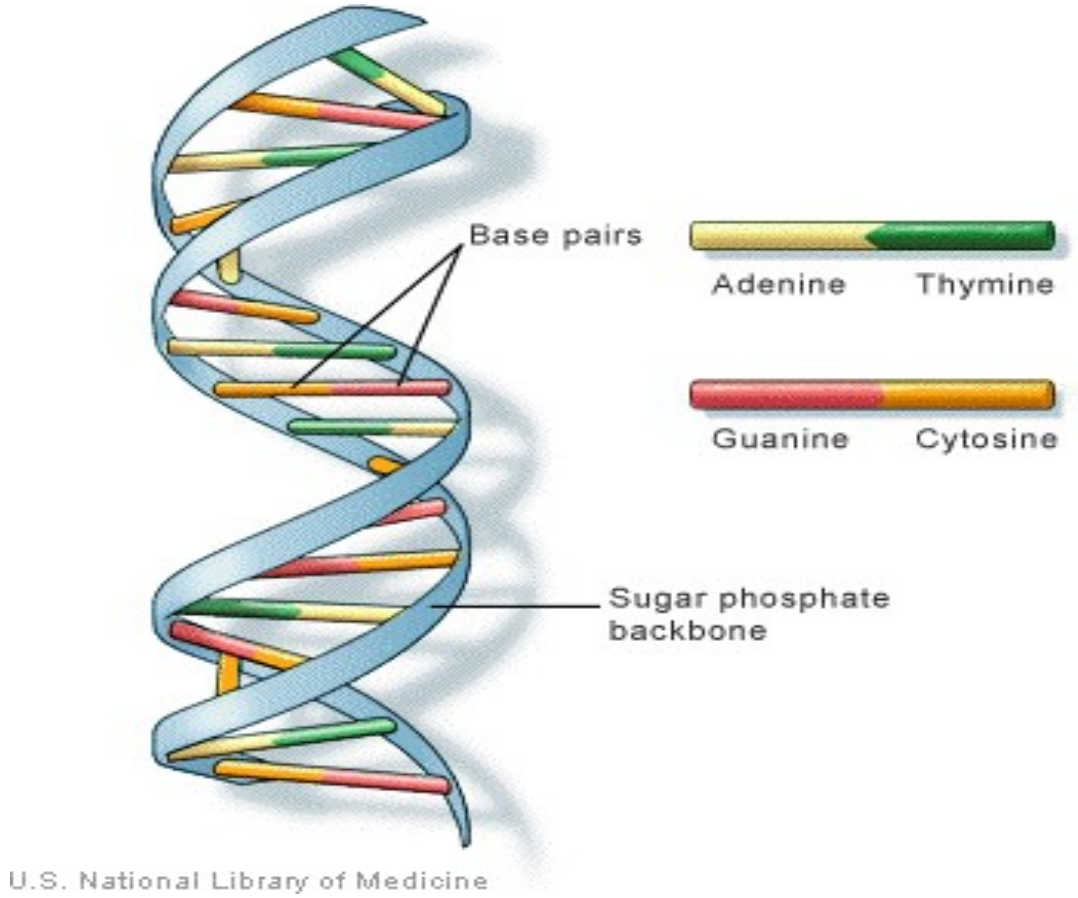
1. A pentose sugar-that is Deoxyribose: - The sugars of nucleic acids-called pentose sugars-have five carbon atoms, numbered 1' , 2' , 3' , 4' , 5' . Four of the carbons are joined by an oxygen atom to form a five-sided ring; the fifth (5') carbon atom projects upward from the ring. Hydrogen atoms or hydroxyl groups (OH) are attached to each carbon atom. Unlike RNA the DNA contains only hydroxyl group attached with 2' carbon atom.



2. The phosphate group consists of a phosphorus atom bounded to four oxygen atoms. Phosphate groups are found in every nucleotide and frequently carry a negative charge, which makes DNA acidic. The phosphate group is always bonded to the 5' carbon atom of the sugar in a nucleotide.

3. Nitrogen containing bases may be of two types-a **purine** (six membered ring attached to five membered ring) or a **pyrimidine** (six membered ring only).The purines in the DNA are- Adenine (A) and Guanine (G). The pyrimidines in the DNA are- Cytosine (C) and Thymine (T).

One purine always bond with one pyrimidine and in DNA, A combines/bonds always with T with a double hydrogen bond (A= T), similarly G combines with C with a triple hydrogen bond (G ≡ C). The **sequence of bonding** is such that for every A, G, T, C in one strand there would be T, C, A, G on other strand.
Therefore, the two chains are complementary to each other.



GENE: - This sequence of bonding of nitrogenous bases constitute gene i.e. the segment of DNA is known as gene and this sequence contains a code for protein synthesis and every protein has specific sequence of nitrogenous bases. Thus gene is known as the unit of inheritance.
These sequences when inherited, actually inherits trait and thus traits are expressed in organisms.

CHROMOSAL BASIS OF SEX DETERMINATION

It refers to the condition where the genes involved in the sex determination are located on specific chromosomes known as the sex chromosomes. The sex is determined by the last pair of chromosomes which is known as sex chromosome, for example in human beings there are 23 pair of chromosomes. Out of 23 pair 22 pairs are autosomal chromosomes and are same in both male and female while as the last pair i.e. 23rd pair is different in male and female and thus this pair determines sex, thus known as sex chromosome.
The difference in chromosomes which determines the sex may be of three types.
1. Difference in number.
2. Difference in shape.
3. Difference in size of the sex chromosome.

1. Difference in Number: -

In grasshopper, the number of chromosomes in female is 24 i.e. 2n. It has been observed that male grasshopper contains only 23 chromosomes i.e. 2n─1. This difference in number determines the sex. When spermatogenesis occurs, 23 chromosomes separate in such a way that one of the sperm receives 12 chromosomes while the other receives only 11. On fertilization the number becomes 24 in one and 23 in the other giving rise to female and male grasshopper respectively.

2. Difference in Shape: -

T.H. Morgan, a Noble Prize winner biologist selected *Drosophila* fruit fly for his experiments on inheritance. He noted that there are 4 pairs of chromosomes in the nucleus of Drosophila, 3 of the pairs are alike in male and female flies (Autosomes) while one of the chromosomal pair differs in shape. The fourth pair is the pair of Sex chromosomes. This 4^{th} pair was found to be composed of Rod shaped chromosomes in female flies while in male the 4^{th} chromosome pair was Hook shaped. This similar rod shaped chromosomes in female was designated as X while hook shaped chromosomes in male as Y. Therefore female contains XX pair of chromosomes and Male contains YY pair.

3. Difference in Size: -

Human cells contain 23 pairs of chromosomes (i.e. 46 in whole) of chromosomes. Out of these, 22 pairs are alike and are Autosomes while 23^{rd} pair is composed of sex chromosomes. In female this pair of sex chromosomes contains two similar chromosomes while in male one of the chromosomes is similar in size as of female and the other is smaller in size. The smaller chromosome is labeled as Y and the chromosome similar to each of the female sex chromosome is labeled as X. Therefore females are homozygous XX while males are heterozygous XY.

TOPIC: OUR ENVIRONMENT:

(A) Environment: - The aggregate of all the external conditions and influences affecting the life and development of an organism in its natural habitat is called environment (environ=around). It can also be defined as an immediate surrounding of an organism.

The external conditions and influences affecting the life of an organism in its natural habitat are called environmental factors and are of two types i.e. Biota (biotic factors) and Abiota (physical factors).

(i) **BIOTA (BIOTIC FACTORS):** The term biota refers collectively to the flora (plant life) and the fauna (animal life) existing together in a region, e.g. terrestrial biota, marine biota (G. bios=life).

Regarding the mode of obtaining food, the organisms occurring in an environment are classified into three main types:

1) PRODUCERS: These are mainly green plants. They synthesize organic food from simple inorganic compounds, namely CO_2 and water, with the help of chlorophyll and sunlight, hence they are called as producers and the process is called photosynthesis. It may be briefly represented as under

$6CO_2+6H_2O$ ----- → $C_6H_{12}O_6+6O_2$

The producers are also called transducers as they utilize solar energy and convert it into chemical energy of organic compounds.

Some bacteria, such as colorless, sulphur bacteria, iron bacteria capture energy released during certain inorganic chemical reactions and prepare organic food with it. They are called chemoautotrophs. The producers (i) provide food and oxygen to animals and (ii) reduce CO_2 and H_2O contents from the environment. Thus, they influence animals as well as the environment.

2) CONSUMERS: They are mainly the animals. They are unable to prepare or synthesize their own food, so they take other organisms or their parts, hence they are called consumers. The consumers are called herbivores when they consume plants and carnivores if they feed on other animals. Grasshopper, rat, rabbit are common herbivores. Frog, wolves, tiger are familiar carnivore. Cat, dog, bear and man take both plant and animal food. They are termed omnivores.

The consumers are also called Heterotrophs and are of following types:

(i) Primary or first-order consumers: These include the animals which eat plants or plant products. They are called herbivores or primary (first-order) consumers. E.g. goat, rabbit, snails, tortoises etc.

(ii) Secondary or second order consumers: These include the animals which feed on the flesh of herbivores. They are called secondary carnivores or secondary (second order) consumers. e.g. cats, dogs, foxes, frogs, small fishes.

(iii) Tertiary or third order consumers: These are larger carnivores which feed on primary carnivores (secondary consumers). These are termed as tertiary carnivores or third order consumers. e.g. large fish, wolves, snakes etc.

(iv) Quaternary or fourth order consumers: These are the largest carnivores which feed on secondary carnivores (tertiary consumers). They are not eaten by other animals and are also called top carnivores. Tigers, lions and eagles/hawks are examples of quaternary or fourth order consumers.

3) DECOMPOSERS (REDUCERS): These are mainly the bacteria and fungi of decay. They obtain their food from the dead producers (plants) and consumers (animals) and latter's waste products. They decompose these materials into (i) small organic molecules which they utilize themselves, and (ii) inorganic compounds that are released into the environment for reuse as raw materials by the producers. They are also called saprotrophs.

(ii) Abiotic (physical) factors: These include the non-living physio-chemical factors of the environment. They are of two main types: climatic and edaphic. The climatic factors include temperature, light, wind, humidity, precipitation and water. The edaphic factors pertain to soil. They include soil texture, substratum, minerals. Abiotic factors influence the distribution, structure, behavior and interrelationships of organisms.

(B) ECOSYSTEM:

An ecosystem can be defined as structural and functional unit of biosphere, comprising living organisms and their non-living environment that interact to form a stable, self supporting system. The interaction between a biotic community and the non-living environment is always a mutual one. That is, not only does environment effect the community but the community also modifies the environment.

TYPES OF ECOSYSTEMS:

Ecosystems may be classified on the basis of their nature , duration and size -

1) **Nature**: on the basis of nature ecosystem may be natural or artificial.

i) Natural ecosystem:- These ecosystems operate in the nature by themselves without any human interference. Common examples are a pond, a lake, a desert, a forest etc.

ii) artificial ecosystems: These are maintained by man and hence also termed as man-made or man-engineered ecosystems. Common examples are flower bed or kitchen garden, an aquarium, a pot of house plants etc.

2. **DURATION:** An ecosystem may be temporary or permanent.

I) Temporary ecosystems: These are short-lived ecosystems which may be natural or man-made. Common examples include rainfed pond and laboratory culture of protozoans.

ii) Permanent ecosystems: These are self supporting natural ecosystems that maintain themselves for relatively long duration e.g. a lake, a forest, a desert etc.

3) SIZE: An ecosystem has no size limit. It may be very small, called micro ecosystem or very large, termed macro ecosystem.

(I) Micro ecosystem: These are small ecosystems. E.g. a flowerpot, water in a dish, site under a stone.

(ii) Macro ecosystem: These are large-sized ecosystems. E.g. an ocean, a forest etc.

COMPONENTS OF AN ECOSYSTEM:

The various components of an ecosystem may be grouped under two main types:

* Abiotic (non-living) components.

* Biotic (living) components.

[already explained under environment]

(C) FOOD CHAIN:

DEFINITION: Food chain is a food relationship between a series of different organisms, each of which eats the previous one and is eaten up by the succeeding one. The food chains transfer materials and energy as food through organisms of an ecosystem. It can also be defined as “who eats whom”.

Food chains are of three types:

(i) Grass land food chain:

Food chain that operates in grass lands (meadows) is termed as grass lands food chain e.g.

Green plants -----→ insects (grasshopper) ------ →frog

↓ ↓ ↓

(producers) (pry. consumer) (top order consumers)

ii) Forest food chain:

Food chain that operates in forests is termed as forest food chain e.g.

Green plants--------→deer----------→lion

↓ ↓ ↓

(producers) (pry. consumers) (top order consumers).

(iii) Aquatic food chain:

Food chain that operates in water is called aquatic food chain e.g.

Algae----------→zooplanktons----------→small fish --------- →large fish

↓ ↓ ↓ ↓

(producers) (pry. Consumers) (sec. consumer) (top order consumers)

LENGTH OF FOOD CHAIN:

A food chain may end at the (i) primary consumer (herbivore) level, e.g. plants- elephant; (ii) secondary consumer (primary carnivore) level, for instance, plants→ rabbit→ bear, (iii) tertiary consumer (secondary carnivore) level, such as plants→ rabbit→ wild cat→ tiger, or (iv) quaternary consumer (tertiary carnivore) level, say plants→ rabbit→ cat→ wolf→ tiger.

There is perhaps no living thing that does not serve as a trophic level in some food chain. Some animals may form a link in more than one food chain.

Food chains may be longer or shorter than those cited above, but usually there are only four or five successive trophic levels.

TROPHIC LEVELS (NUTRITION LEVELS):

The distinct sequential steps in the food chain where transfer of energy occurs are referred to as different trophic level. E.g. green plants (producers) form the first trophic level; the plant eaters (herbivores), also called primary consumers, belong to second trophic level; and the flesh eaters (carnivores), also called secondary consumers, represent the third consumer level and so on.

CHARACTERISTICS OF FOOD CHAIN:

(i) The shorter the food chain, the more efficient it is. The more step it has, the greater wastage of energy.

(ii) In any food chain, the successive members are larger in size though fewer in number.

(iii) A food chain is always straight and progress in straight line.

(iv) A food chain involves repeated eating i.e. each group eats the other group and subsequently is eaten by some other group of organisms.

(v) In a food chain, there is unidirectional flow of energy from sun to producers and then to series of different types of consumers.

(vi) At each transfer, generally 80-90% of energy is lost as heat in accordance with second law of thermodynamics.

(vii) Usually, there are 3 or 4 trophic levels in the food chain, there may be maximum of 5 trophic levels.

D) FOOD WEB:

Food chains are not strictly linear. They may have branches that may link one food chain with another. Thus, there may be several interlinked food chains in a community and one animal may be a link in more than one food chain. The various interlinked food chains in a community constitute a food web, or food cycle.

Examples:

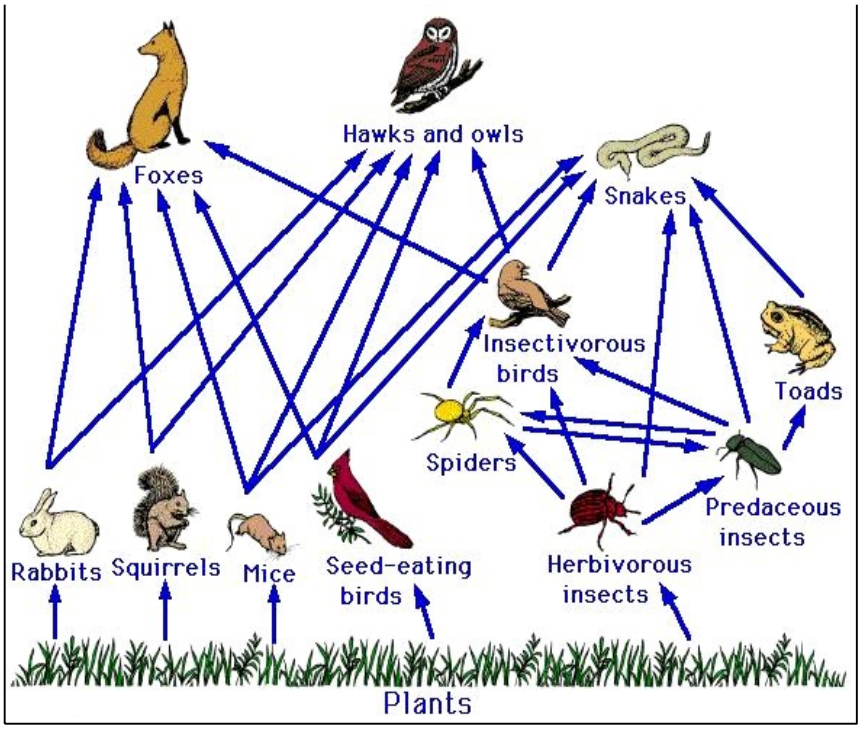


Image of food web.

CHARACTERISTICS OF FOOD WEB:

(i) Food web are never straight. Instead, each food web is formed by interlinking of food chains.

(ii) They provide stability to the ecosystem.

(iii) There are atleast seven food chains in a food web.

(iv) A food web provides alternative pathways of food availability.

(v) Food webs also help in checking the over population of highly fecundive species of plants and animals.

(vi) Food webs also help in ecosystem development.

E) ECOLOGICAL PYRAMIDS:

Ecological pyramid is a graphical representation of a specific parameter (aspect) of a food chain, such as the number of individuals in the trophic levels. The ecological pyramids are also called Eltonian pyramids because these were first developed by an eminent British animal ecologist, Charles Elton, in 1927.

There are three types of ecological pyramids.

1) **Pyramid of number:** It is a numerical arrangement of the animal populations per unit areas at various trophic levels of food chain in a community at a given time, with producers at the base.

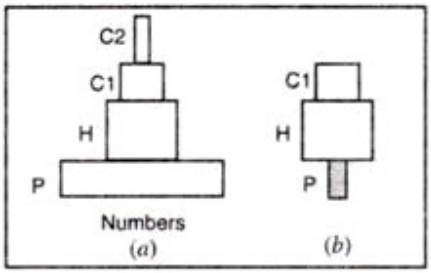


Fig. 5.3. (*a*) Upright pyramid of numbers, the number of organisms decreasing in successive trophic levels. (*b*) Inverted pyramid of numbers (for example a single tree on which many birds feed, which may be having numerous parasites)

The shape of pyramid may be upright or inverted.

2) **Pyramid of biomass:** Biomass is the amount of living matter in an organism. A pyramid of biomass is a quantitative arrangement of the animal populations per unit area of various trophic levels of a community at a given time, with producers at the base. It may be upright or inverted.

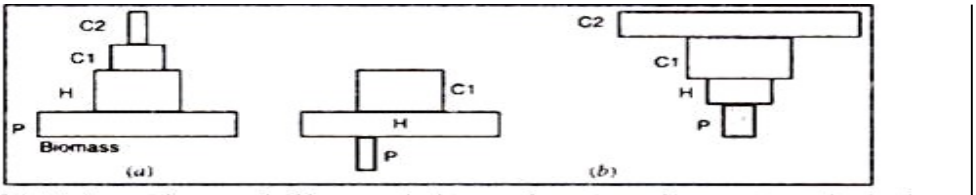


Fig. 5.4. (*a*) An upright pyramid of biomass, the biomass decreasing with successive trophic levels. (*b*) The inverted pyramid of biomass as in the sea is due to low biomass of primary producers. P producer, H herbivore (primary consmer) , C1 and C2, small carnivore and large carnivore respectively

3) **Pyramid of energy:** It represents the amount of energy per unit time and area at various trophic levels of a food chain in a community with producers at the base.

There is gradual decrease in available energy at successive trophic levels. Therefore, the pyramid of energy is always upright.

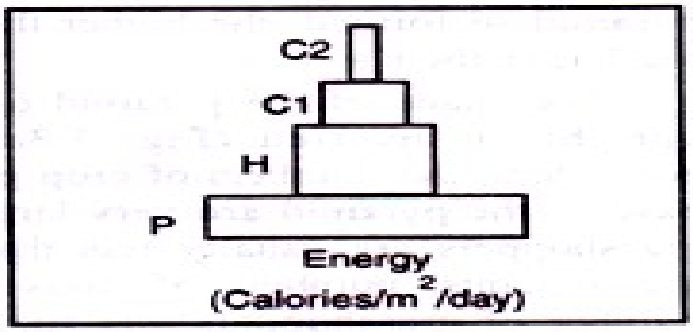


Fig. 5.5. The pyramid of energy. There is always a drop in the amount of energy at each level of a food chain.

F) FLOW OF ENERGY IN AN ECOSYSTEM:

Each organism needs energy for carrying on vital activities and for building up and repairing the body tissues. The ultimate source of entire energy used by living things is sunlight. Solar energy received by an ecosystem depends on the latitude, slope, cloud cover, air pollutants etc.

The radiant energy of sunlight is converted into the chemical energy of the bonds of the organic substances prepared by the green plants by the process of photosynthesis. Only 1% of the total energy is captured by green plants and converted into chemical energy of food. When an animal eats a plant, the organic substance of the plant are oxidized in the animal's body to liberate energy for synthesizing cellular constituents of the animal. It is only 10% energy which is transferred from plants to the primary consumer and 80-90% is lost as respiration and heat.

It is according to 10% law that only 10% of the total energy available to lower trophic level is available to the next high trophic level.

In other words only 10% of energy is available to the next trophic level from the total energy of first trophic level.

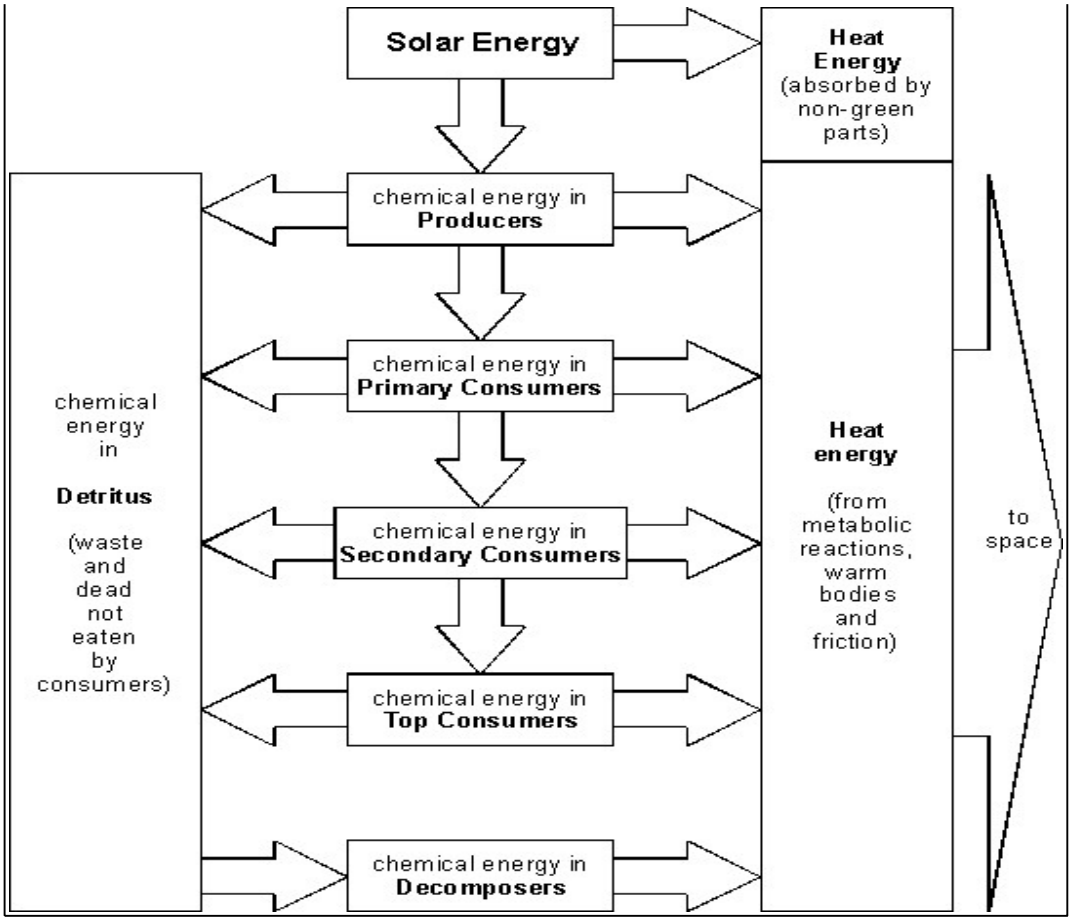
Decomposition of dead animals also releases chemical energy. Eventually, whole of the energy originally entrapped in plants by photosynthesis is converted into heat and lost, and all carbon of the organic substances ends up as carbon-dioxide.

CHARACTERISTICS OF ENERGY FLOW:

(i) Constant unidirectional flow or transfer of energy from sunlight through plants and plant eating animals to flesh eating animals in the form of food.

(ii) A decrease in useful energy at each successive level of nutrition due to loss of some energy as heat at each transformation of energy, and

(iii) Return of entire solar energy that entered the living systems back to the non-living world as heat but not as light.



ENERGY FLOW DIAGRAM.

TEN PERCENT LAW:

This law was given by Lindman in 1942. It is also termed as second law of thermodynamics or law of entropy.

This law states that during the transfer of energy from one trophic level to the next level, only 10% energy is available to the higher trophic level and the remaining 90% is lost in respiration and heat.

In other words, 'whenever energy is transformed from one form into another , there is a decrease in the amount of useful energy; some energy is degraded into heat and dissipated'.

This law can be understood by the following examples .

Suppose 10000J of energy come from sun. As we know producers use only 1% of solar energy i.e. 100J. Now we shall apply 10% law and conclude that only 10J from this 100J is available to herbivores. Now, from this 10J of energy only 1J is available to carnivores . The energy which is not used by organisms is reflected back to the environment.

sun

10,000j

Producer----------→ Herbivores----------→ Carnivores

(100j) (10j) (1j)

10%law

HOW IS EARTH KEPT WARM:

Our earth is surrounded by atmosphere which keeps it warm. The average temperature of the earth's surface is about 15^0c .The atmospheric cover around the earth acts like glass walls of a green house. The clouds, dust-particles, gases and water vapours, present in atmosphere, filter and scatter large quantity of solar radiation falling on the earth. Only about 48% of solar radiation actually reaches the surface of the earth and only 1% is absorbed by plants. Most of the remaining radiation is used up in warming the surface of earth. This remaining radiation is reflected or emitted back as infra-red radiations into the atmosphere . Most of infra-red radiations is trapped by some gases in the atmosphere, in particular water vapour and carbon-dioxide. These are called green house gases and they re-emit the radiations in all directions . It is called green house flux. It is due to green house flux that mean annual temperature on earth is about 15^oC, otherwise without these gases the surface of the earth would be at -40^oc (A green house is a glass house often used in cold climates to grow plants in warmer climates). Thus, atmosphere around the earth acts as a green house, trapping the heat. Life is possible on earth due to this green house effect .

The green house gases are CO_2, CH_4, CFC_S and Nitrous-oxide(N_2O)

The phenomenon of rise of average atmospheric temperature due to continuous increase in concentration of green house gases in the atmosphere is called global warming.

G. WASTES:

Wastes are useless left over or discarded materials. The waste materials can be gaseous (e.g. automobile exhaust, smoke from chimneys of industries and houses), liquid(e.g. effluents from industries, sewage water) or solid(e.g. food waste, cow dung and human excreta, industrial and chemical wastes)

SOLID WASTES :

Solid wastes generally come from residences, vegetables and fruit markets, cattle sheds, industries, agricultural fields and many other places. Solid wastes include peelings of fruits and vegetables, other kitchen wastes, ash, paper, cow dung, human excreta, glass, leather, plastics, worn out clothes, hospital wastes etc.

The different solid wastes that accumulate in the environment due to human activities can be categorized into two types:

1. Biodegradable wastes

2. Non-biodegradable wastes

1. **Biodegradable wastes:-** These are those solid wastes which can be degraded by the natural means (i.e., by the action of micro organisms such as bacteria and fungi of decay) into simpler, harmless substances in due course of time. The examples of biodegradable wastes are household garbage, human urine and faecal matter (sewage), agricultural residues, cattle dung, wood, paper etc.

Harmful effects of biodegradable wastes:

* Decomposition of biodegradable wastes result in production of foul smell which makes life miserable in the surrounding areas.

* Flies breed at huge heaps of solid wastes containing biodegradable wastes, carry the germs and spread diseases such as diarrhea, typhoid, cholera, etc.

* These biodegradable wastes may also block the drains, creating pools of water which become the breeding sites of mosquitoes. The latter are the carriers of diseases like malaria and dengue.

* Dumping of industrial wastes reduces the fertility of soil leading to reduction in crop yields.

2. **Non-biodegradable wastes:** These are those solid wastes that cannot be degraded by natural means. Only physical processes such as heat and pressure can affect such type of waste substances. They are mainly man-made.

Harmful effects of non-biodegradable wastes:

* These enter into food chains and get biologically magnified.

* They make soil acidic or alkaline thus affecting the fertility of soil.

BIOLOGICAL MAGNIFICATION:

It is the phenomenon that involves progressive increase in concentration of harmful non-biodegradable chemicals at different trophic levels in a food chain is called bio-magnification.

Modes of waste disposal:

Disposal literally means 'to get rid of ' so, to get rid of waste, we have many methods. These methods depend upon the nature of wise and are as under:-

1) **Land fills :-** It is the method in which solid wastes are buried in low lying areas to level uneven surface of land.

2) **Recycling of wastes:** Most of the solid wastes can be recycled by sending them to respective recycling units. For instance, paper is sent to plastic processing factories where these are melted and remoulded.

3) **preparation of compost:** Household waste such as peeling of fruits and vegetables, left –over food, fallen dead leaves of kitchen garden plants etc can be converted into compost and used as manure.

4) **Incineration of burning at high temperature:-** Incineration is the process of burning of substances at high temperature (usually more than 1000^0c) and ultimately converting them into ashes. It is carried out in an incinerator examples are: household waste, chemical waste, hospital waste etc.

5) **Production of biogas and manure:-** Biodegradable wastes can be used in biogas plants to generate biogas and manure. Biogas is a cheap source of fuel, and manure, a cheap fertilizer.

(H) OZONE:

Ozone is a form of oxygen. It is a triatomic molecule made up of three atoms of oxygen, O_3. Very little quantity of ozone is present in the lower part of atmosphere, called troposphere. However, good amount of ozone is present in the upper part of atmosphere called stratosphere.

The rich zone of ozone in stratosphere is called ozone layer or ozonosphere. Ozone present in ozonosphere has a concentration of about 10ppm. It is protective in nature because it filters U.V-B radiations. It is, however, under severe stress due to ozone depleting substances(ODS) being released by high flying jets and rockets.

Ozone depleting substances are those chemicals which react with ozone and change the same into oxygen. The important ones are chlorofluorocarbons, halons, nitrogen-oxides, chlorine, methyl chloroform and carbon tetrachloride. The maximum depletion has been caused by chlorofluorocarbon (14%) though halons are 10 times more powerful in depleting ozone. Nitrogen-oxides (depletion 3.5%) directly react with ozone converting it into oxygen.

NO_2+O_3------- $\rightarrow 2O_2+NO$

Chlorofluorocarbons undergo photo dissociation to produce chlorine. Chlorine catalyses conversion of ozone into oxygen. It is estimated that one chlorine molecule can convert one lakh molecules of ozone into oxygen.

$CFCl_3$ ---$\rightarrow$$CFCl_2$+Cl

$CFCl_2$ ------ $\rightarrow$$CF_2Cl$+Cl

Cl+$2O_3$ -------$\rightarrow$ Cl+$3O_2$.

Due to distribution of ozone in the ozonosphere, its concentration has fallen down all over in the ozonosphere. There is 8% thinning of ozone in stratosphere above 30^0-50^0 North. This thinning of ozone was noticed in 1980s.

Over Antarctica chlorine continues to accumulate during the winter. In early spring (August-September) it causes severe depletion of ozone so that a large area of stratosphere comes to have very low ozone concentration. This area is called ozone hole and was discovered in 1985 by Farman and his co-workers.

EFFECTS OF OZONE LAYER DEPLETION:

(i) **SKIN CANCERS:** There is an increase in incidence of skin cancers. 1% fall in ozone conc. Increases U.V B load of earth by 2% that causes addition of 50,000 cases of skin cancer. In Australia every second middle aged person suffers from skin cancer while in old persons the incidence is nearly 100%.

(ii) **Blinding:** Many land animals would lose their eye sight and become blind. 1% fall in ozone conc. In stratosphere will blind another 1 lakh persons.

(iii) **Immune system:** it is partially suppressed. Incidence of herpes and other immune system related diseases are likely to increase.

(iv) **Larval stages:** More larval stages and young ones of aquatic animals will die.

(v) **Terrestrial plants:** productivity will decrease by 10-25%.

(vi) **Aquatic ecosystem:** productivity is going to decrease by 6-22%.

(vii) **Global warming:** Decreased photosynthesis would result in increase in the conc. Of CO_2. This will result in global warming.

INTERNATIONAL EFFORTS TO CHECK OZONE DEPLETION:

1) **MONTREAL PROTOCOL:** It is also known as "ozone treaty". It came into force from January 1, 1989. It was decided that all the signing nations would take necessary steps to decrease the use of all ODS, particularly CFCs.

2) **Helsinki declaration:** In 1989, majority of the nations pledged to phase out CFCs by the year 2000. Productions of CFCs have been stopped since than and CFCs have been replaced by HFC (hydro fluorocarbons) and HClFC (hydro chlorofluorocarbons).

3) **Kyoto protocol:** The Kyoto protocol to the united nations framework convention on climate change strengthens the international response to climate change. It was adopted by consensus at the third session of the conference of the parties (COP_3) in December 1997.