BRYOPHYTES

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INTRODUCTION

- Bryophytes is derived from a Greek word BRYON means Mosses and PHYCA Means plant.
- Types of Plants:
- Non-vascular Plants.

  Bryophytes
- Vascular Plants

  Pteridophytes

  Gymnosperms

  Angiosperms

BRYOPHYTES

- Bryophytes are small, non-vascular plants, such as **mosses, liverworts and hornworts**. They play a vital role in regulating ecosystems because they provide an important buffer system for other plants, which live alongside and benefit from the water and nutrients that bryophytes collect

CLASSES OF BRYOPHYTES

The three main groups

Liverworts

Hornworts

Mosses.

CHARACTERISTICS OF BRYOPHYTES

- Occur in damp and shaded areas
- The plant body is thallus like, i.e. prostrate or erect
- It is attached to the substratum by rhizoids, which are unicellular or multicellular.
- They lack true vegetative structure and have a root-like, stem-like and leaf-like structure.

LIFE CYCLE OF BRYOPHYTE

- The life cycle of bryophytes consists of an alternation of two stages, called the sporophyte and the gametophyte. Each generation has a different physical form.
- Their life cycles are dominated by a multicellular gametophyte stage. Their sporophytes are unbranched. They do not have a true vascular tissue containing lignin (although some have specialized tissues for the transport of water

VEGETATIVE AND SEXUAL REPRODUCTION IN BRYOPHYTES

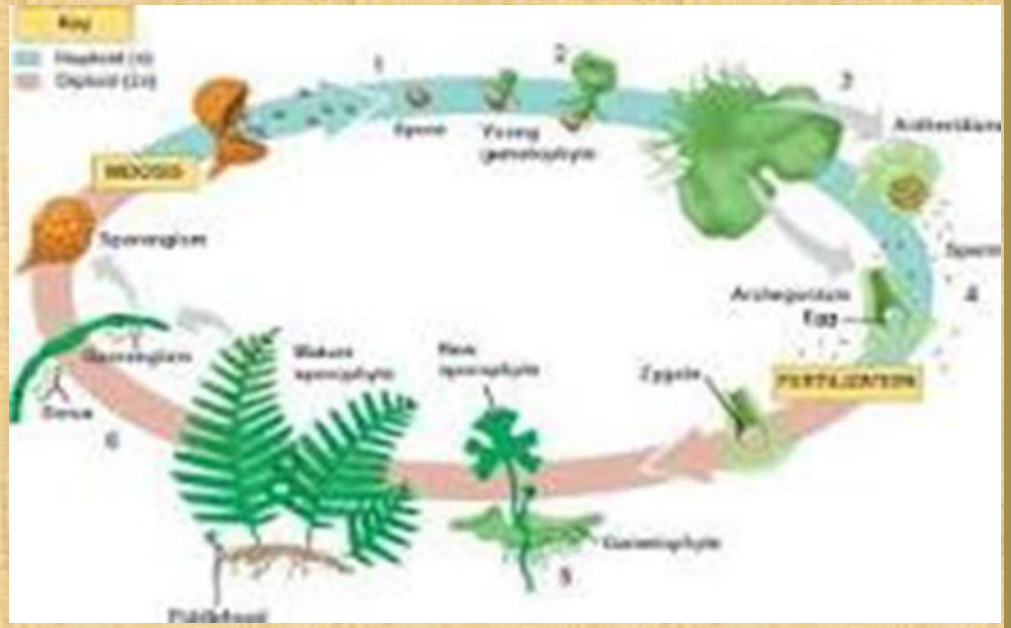
- Many bryophytes reproduce vegetatively by means of tubers. The tubers are formed on the margins of the thalli of Riccia discolor, R. billardieri, Anthoceros Hali
- Bryophyte reproduction happens in two ways

Asexual reproduction occurs when a sporophyte releases spores

Sexual reproduction happens when gametes fuse and form a zygote.

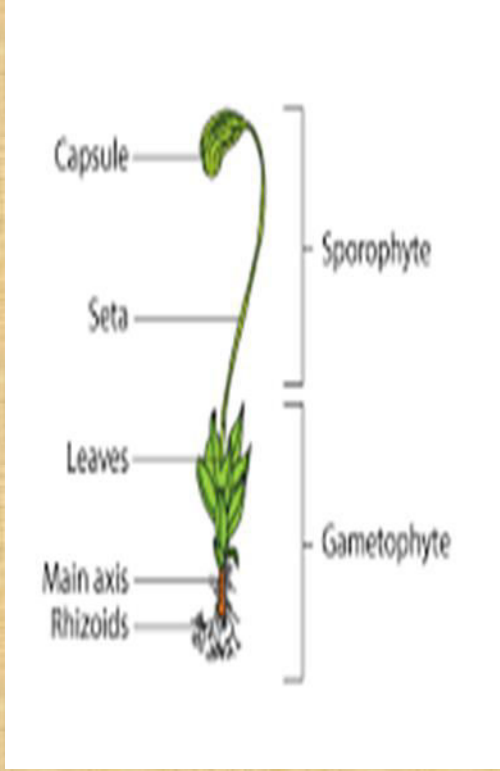
ALTERNATION OF GENERATION IN BRYOPHYTES

- Alternation of generations is **a life-cycle involving two phases of life, which regularly alternate with each other**. In Bryophytes, the first phase is the gametophytic phase, in which gametes are produced, that contain half the number of chromosomes.



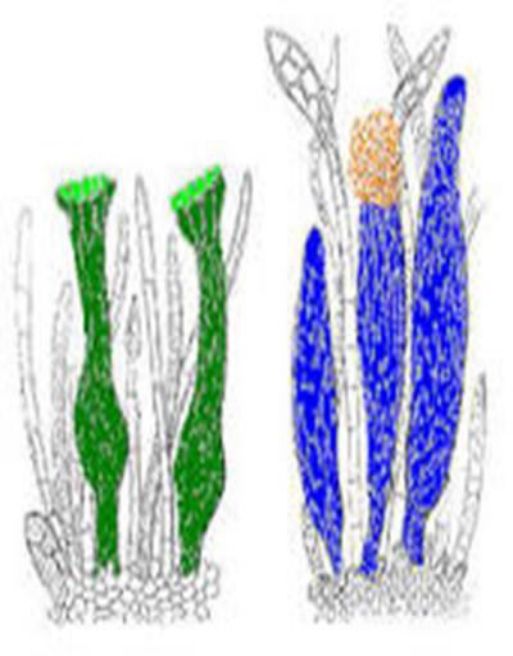
FEMALE REPRODUCTIVE STRUCTURE IN BRYOPHYTES

- The female sex organ is usually a flask-shaped structure called **the archegonium**. The archegonium contains a single egg enclosed in a swollen lower portion that is more than one cell thick.



SPERM PRODUCED IN BRYOPHYTES

- The sperm are produced **within tiny, typically stalked, club-shaped structures called antheridia** . The stalk anchors the antheridium to the gametophyte. Each antheridium produces numerous sperm.



Thank you

Govt Dr. Shyama Prasad Mukherjee Science and Commerce College. Bhopal

TOPIC :- BIO-INFORMATICS

Presented by
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WHAT IS BIOINFORMATICS?

A more precise definition of bioinformatics is the application of information science (mathematics, statistics, and computer science) to increase our understanding of biology.

Bioinformatics is a multidisciplinary science which aims to use the benefit of computer technology in understanding the biology of life.

THE THREE MAIN CORE AREAS OF BIOINFORMATICS ARE:

1. **Molecular Biology Database.**
2. **Sequence Comparison & Sequence Analysis .**
3. **The Emerging Technology Of Microarray.**

What Is Database?

A database is a repository of sequence (DNA amino acids) which provides a centralised and homogenous view of it's contents. the repository is created and modified through a database management system (DBMS). Every data item in the database is structured according to a scheme defined as a set of pre – specified rule through the data definition language. The contents of database can be assessed trough a graphical user interface (GUI).

That allows browsing through the contents of repository very much similar as one may browse through the book library.

Did You Know?

- ***IN 1987*** *, When the human genome project was conceived of the field of bioinformatics has become a recognised discipline on it's own, born out of the necessary to bring together the information science in understanding the wealth of data that has been created through various projects around the world.*

Historical Background

Historically, The protein database were prepared first then nucleotide database. IN 1959 V.M INGRAM first attempt to compare sickle cell hemoglobin , and demonstrated there homology. in due course of time the other proteins associated with similar biological function were also compared. This result in more protein sequencing and accumulation of vast information. hence, it is realized to have database so that using computation software the proteins can be quickly compared .

In 1980, The advent of the DNA sequence database led to the next phase in the database sequence information through establishment data library was to collect, organize and distribute data on nucleotide sequence and other information related to them. The european bioinformatics institute (EBI) is its successor that is situated at hinxton, Cambridge, United Kingdom.

In 1984, The National Biomedical Research Foundation (NBRF) *established the* ***Protein information Resource(PIR)*** *. The NBRF helps the scientists in identifying and interpreting the information of protein sequences.*

In 1988, The National Institute Of Health (NLH)*, U.S.A Developed* ***The National Center For Biotechnology Information (NCBI). As A Division Of The National Library Of Medicine (NIM)*** *to develop information system in a molecular biology. The* ***DNA Data Base Of Japan (DDBJ)*** *at mishima joined the data collecting collaboration few year later.*

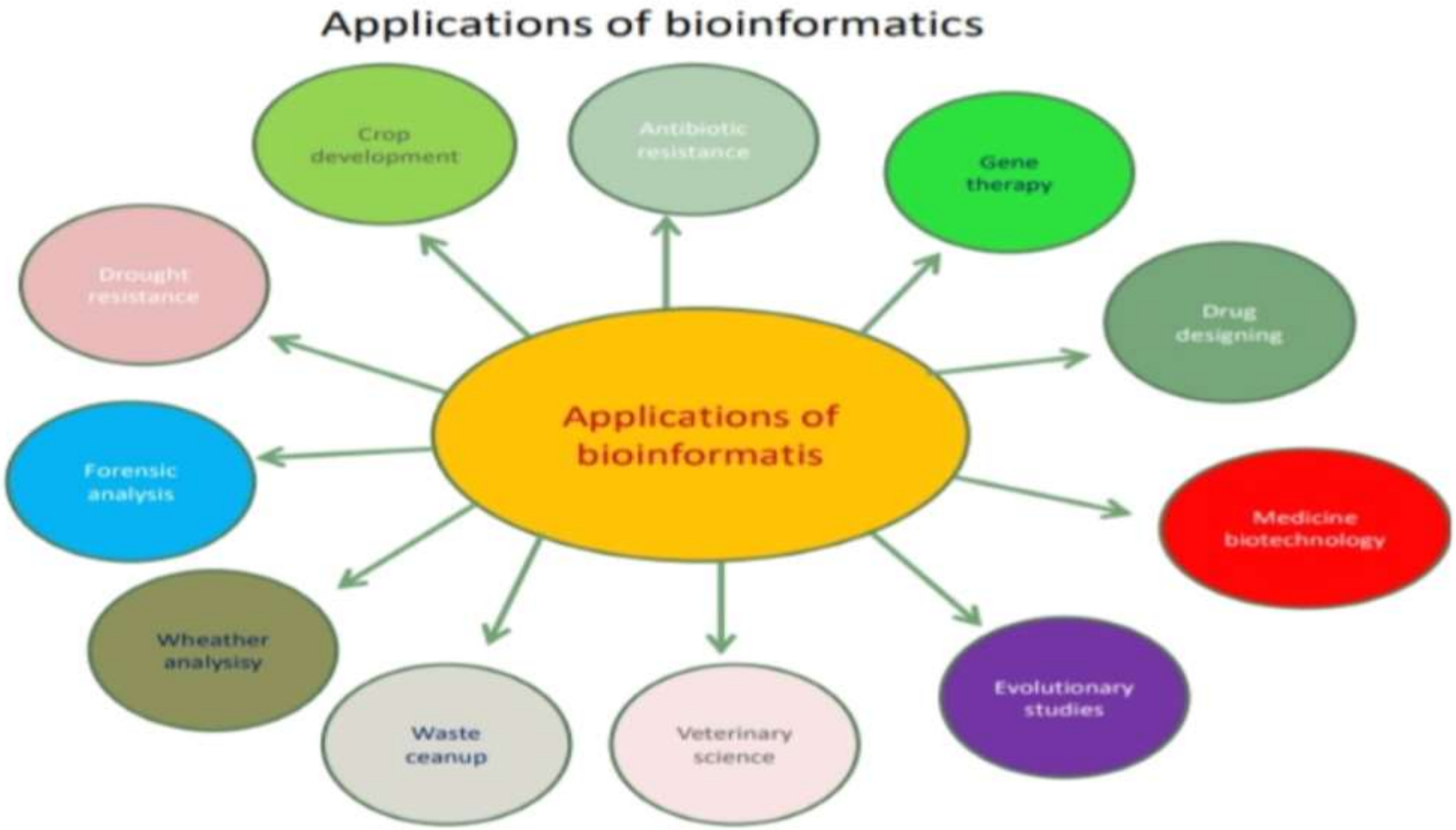
New sequence data are accumulating day by day therefore, there is a need of powerful software so that sequence can be analyzed. for the development of algorithms {any sequence of action (example computational steps) that performed a particular task} firm basis of mathematic is needed. now, mathematicians, biologists and computer scientists are taking much interest in bioinformatics.

- *More Over Biologist, Are Curious Ask Reservoir Of All Such Information Because They Are Widely Interconnect Through Network.Thus Bioinformatics Is Aimed At*
- ***(I) The Development Of Powerful Software Of Data Analysis And***
- ***(II) Benefit The Researcher Through Disseminating The Scientifically Investigated Knowledge Extra***
- The Nucleotide and amino acid monomers and represented by a limited alphabets. The properties of Biopolymers example /- Macro Molecules (Example DNA, RNA Proteins) and such that they can be transformed in to sequence having digital symbols. Genetic data and other Biological data are differentiated by these digital data. This resulted in the process of Bioinformatics.

WHY BIO INFORMATICS IS NECESSARY?

- *The need of bioinformatics has arrived from the recent explosion of publicity available genomic information, such as resulting form the human genome project.*
- *Gain a better understanding of gene analysis, taxonomy and evolution.*
- *The work on the rational drug designs and reduced the time taken for the development of the drug manually.*

APPLICATIONS OF BIO-INFORMATICS



THE USE OF BIOINFORMATICS TOOLS IN ANALYSIS.

- ***Processing raw information**: The Biological information hidden in DNA/ RNA and protein sequences and generated experimentally. These are called raw information using Bioinformatics tools these information are processed into genes and proteins and in a relationship is establish between a gene and a protein. Phylogenetic relationship can also be established among the species of organisms.*
- ***Genes**: Using Bioinformatics tools such as a Genmark (for bacteria), and GeneScan (For eukaryotes) Gene prediction is carried out in organism. GenSCAN can identify intros, exons, promotor and poly a signals and other genes identification algorithms.*
- ***Proteins**: By using computer programmers protein can be deduced from the predicted genes.*
- ***Regulatory sequences**: Using computer programs the regularity sequences can also be identified and analysed.*
- ***Phylogentic relationship**: These are a few web base application that will allow you to carry out phylogenetic analysis over the web by aligning multiple sequences, calculating evolutionary distance and constructing phylogenetic trees, you can establish phylogenetic analysis capabilities between two organism.*

- *Internet base application that provide physogenetic capabilities are WEBPHYLIP, phyloBLAST, GENTREE and BLAST2 and orthologue search service the cluster of orthologous groups (COGS) data base simplifies the evolutionary studies of computer genomes and improve function assignment of individual protein.*
- ***Reconstruction of metabolic pathways*** *: reconstruction of metabolic pathways is one of the indispensable final step of all genome analysis it is also a convergence point for the data. Produced by the enzyme data base lists name and catalyzed reaction for all the enzymes that have being assigned official enzyme commission (EX)numbers.*
- ***Prediction of function of unknown genes****: by using the bioinformatics tool and database you can predict the function of unknown genes.*

SEQUENCES AND NOMENCLATURE

As mentioned earlier that the sequences of the digital symbols are the transformed biopolymers. Indirectly the sequence data means the structure of biopolymer, structure expresses the function. It shows a reductionist. Therefore, the sequence data can be used as context free.

THE IUPAC SYMBOLS.

- *The international union of pure and applied chemistry (IUPAC) has made certain recommendation. The nomenclature system is bioinformatics is bases on these recommendations*
- *Different laboratories of the world fellow nomenclature system of IUPSE so that there data can be uniformly and easily be compared.*
- *For rapid reproducibility and uniformity, the database institution and editor (who published journals and research findings) also follow the recommendations of IUPAC.*
- *For routine work, the basic IUPAC nomenclature system of nucleic acids and proteins has been discussed in this section . For detail you should go through the IUPAC web sight .*

LANGUAGE USED IN BIOINFORMATICS

THE FOLLOWING LANGUAGE IS USED IN BIOINFORMATICS

Alphabets	→	Nucleotides
Word	→	Gene(prokaryotes) Introns(Eukaryotes)
Sentence	→	Operon (prokaryotes) Gene (Eukaryotes)
Punctuation	→	Regulatory Region
Chapter	→	Chromosome

NOMENCLATURE OF DNA SEQUENCES

- *It is obvious that nucleotides are the building blocks of DNA and the nucleotides are constituted by four basis(A,G,T, and C). Symbols of these four bases and basis of there nomenclature are used as much as they are split. There meaning and basis of nucleic acid sequences often they identity of sequences at specific positions is not clearly identifiable when sequences data are experimentally determined. It happens due to the problem related to other secondary structure or "comparison "Artifacts in compression of secondary structure in DNA fragments causes them to move in the gel so that more than one size of fragments may migrate to the same position.*
- *Generally by repeating the experiment and sequence the complimentary stand, this problem can be solved however , If ambiguities persist is some cases, the probable possibility that deducted from the gel reads example forward and reverse reading given data from opposite stand of DNA they provide information about the relative orientations of the read pairs example pair of reading. From the same template of fragments.*

Symbol	Meaning	Base
G	G	Guanine
A	A	Adenine
T	T	Thymine
R	A or G	purine
Y	C or T	Pyrimidine
M	A or C	Amino
K	G or T	Keto
S	G or C	Strong(3 hydrogen bonds)
W	A or T	Weak (two hydrogen bonds)
H	A or C or T	Not G, H follows G in the alphabet
B	G or T or C	Not A, B follows A in the alphabet
V	G or C or A	Not T(NOT U), V follows U in the alphabet
D	G or A or T	Not C, D follows C in the alphabet
N	G or A or T or C	Any

NOMENCLATURE OF PROTEIN SEQUENCES

- *You know that there are twenty amino acid which build the protein. But there are few symbols which represent more that one amino acid these symbol representing amino acid are given is this table.*

Symbols	Amino acids	Symbols	Amino acids
A	Ala	M	Met
R	Arg	F	Phe
N	Asn	P	Pro
D	Asp	S	Ser
C	Cys	T	Thr
Q	Gln	W	Trp

Table continues in slide no.17

E	Glu	Y	Tyr
G	Gly	V	Val
H	His	B	Asx
I	Ile	Z	Glx
L	Leu	X	Xaa
K	Lys		

DID YOU KNOW?

If you have a sequence without any label, how will you search what ever this sequences DNA or RNA or protein? You will search sequence search program which scan twenty symbols switch between any of 4 basis, the sequence is DNA. If there is U instead of T it is RNA sequence if the symbols switches more than 4 basis, it is proteins sequence.

Directionality of sequences

- *In nucleic acids (DNA and RNA) the nucleotide sequences are synthesised in 5'_3'directions*
- *The three letter alphabets of the nucleotide act as code. Each code represent an amino acid. In nature each cell synthesizes proteins from N–terminus to C terminus (N->C') where N represents - NH_2 group and C represent COOH group of the amino acids. These fundamental phenomenon are universal in all organisms Hence this conventional sequence of protein is entered in database. The concept of directionality is a universal fundamental process which is uder by different database institutions.*

TYPE OF SEQUENCES USED IN BIOINFORMATICS:

- Genomic DNA
- CDNA
- Organelle DNA
- ESTC Expressed sequence tags
- Gene sequencing tags (GSTS)

Information sources

There are several well developed data repositories that have facilitated dissemination of genome and protein resources of human and other organisms. The most comprehensive resources are the Genome data base (GDB), NCBI and mouse and genome database(MGD)

- *The GDB*

It is the official central repository for the genome mapping data created by human genome project. Its central mode is located at the hospital for sick children. The GDB holds a vast quantity of data submitted by hundreds of investigators. The GDB has many useful genome resource Web links on its resource page.

Major Biological databases

DATABASE NAME	LINK	INFORMATION AVAILABLE
NCBI'S GenBANK	Http://www.ncbi.nlm.gov/Genbank	All known nucleotides and proteins sequences International nucleotides sequences data collections.
EMBL Nucleotide Sequence database	Http:// www.edi.ac.uk/embl	All known nucleotide protein sequences International nucleotides sequences data collections.
DNA Data Bank Of japan(DDBJ)	Http:// www.ddbj.nig.ac.jp	All known nucleotide protein sequences International nucleotides sequences data collections.
SWISS-PROT	Http:// expasy.ch/sport	Annotated protein sequences
B. Major mutation database		
NCBI's dbsnp	Http:// www.NCBI.NLM.NIH.GOV/SNP/	Database of single nucleotide polymorphism
OMIM	Http:// www.NCBI.NLM.NIH.GOV/OMIM/	Catalogue of human genetic and genemic disorder.
C. Major Gene expression database		
GENE Expression	Http:// www.NCBI.NLM.NIH.GOV/GEO	NCBI"s repository for gene expression.

D. Major microbial Genemic database.		
NCBI's Microbial	Http:// www.NCBI.NLM.NIH.GOV/	?
Genome Geteway Escherichia Coli	Http:///PMGIFS/GENOMIC/MICR.HTML.HTTP://ECOLI.AIST-NARA.ACJP	?
E. Major Organism Geneme Database.		
Mouse Genome database(MGD)	Http://www.informatics.jax.org/	Mouse genetics and genemics
Saccharomyces genome database (SDG)	Http://Genome.www.Stanford.eduSaccharomyces//	S.Cerevisiae genome information
Rice genome project (RGP)	http:// 1 rgp.Dna.affrc.go.jp/	Reporting current in rice genome project
F. Major Protein database.		
Protein Database(PDB)	http://www.rcsb.org/pdb	Structure data determined by X-ray crystallography and NM.

THE MGD

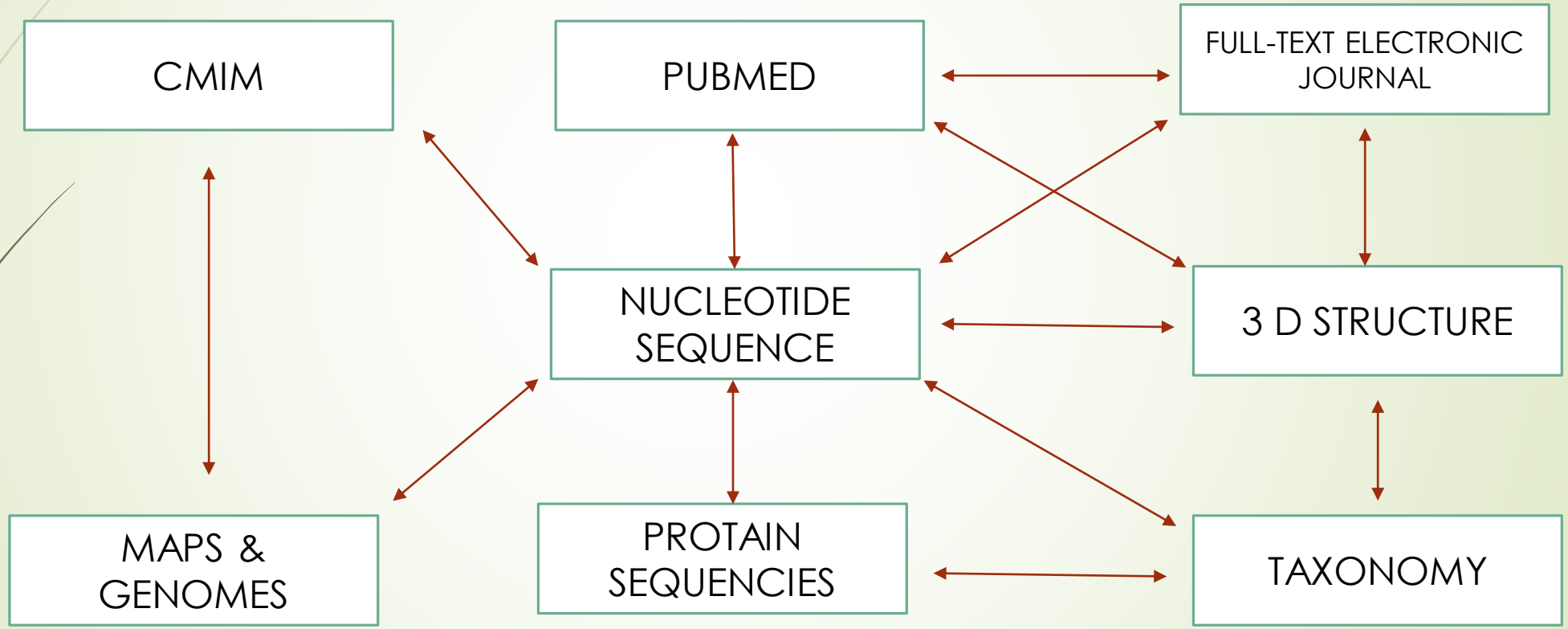
- *It is the primary public mouse genomic catalogue recourses. The MGD includes information on mouse genetics markers and nomenclature, molecular segments, phenotypes, comparative data, graphical display, cytogenetic and physical maps.*
- *The national center of Biotechnology information NCBI*
- *On November 4 1988, for the development of molecular biology the NCBI was established at the national institute of health, (USA). The NCBI is foremost repository of publically available genomic and proteomic data. After the establishment the service at NCBI has fully expanded . The NCBI makes available the three different kind of Biological data computational resources for analysis of GenBank data and data retrieval system.*

The NCBI Has developed many useful resources and tools. It may be group in the following type:

- ***Database retrival tools.***
- ***Blast family – For search of DNA sequence.***
- ***ePCR***
- ***Gene level sequences***
- ***Chromosomal sequences***
- ***Genome analysis***
- ***Analysis of gene expression patterns***
- ***Molecular structure***
- ***Locuslink: Use in geneme catalog information about gene&gene-based markers***
- ***OMIM***
- ***Unigene***

These tools have there own websites which may be used free of cost. You will learn the practical aspects of some of there tools in your practical's out of the above sources and tools, three set of recourses are discussed in this regards using there recourses most of the cases of biometrics activity can be carried out by doing advance studies, the other resources can be used.

Data retrieval tools



- ***The database are easily searched and enters retrieved in a usable and meaningful format, the biological database serve a little purpose. Moreover, efforts made on sequencing will not be meaningful if the biological community as a whole cannot make use of the information within million of basis and amino acids. There are several data base retrieval. ENTEREZ, LOCUSLINK, TAXONOMY BROWSER, etc.***

End of Presentation. Thank you!

Deptt. of Higher Education, MP

- E- Content for Postgraduate Classes
- MSc Botany
- Semester- MSc Ist Sem
- Paper- 103
- Paper Title: SALIENT FEATURES OF BRYOPHYTES

Algae
General characteristics, Diversified habitats and Thallus

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INTRODUCTION

- The study of Algae is called Phycology.
- Phykos was the Greek word for an algae.
- The word alga was for the first time coined by Linnaeus[1954].

Definitions of Algae

- Fritsch, F. (1935) defined algae as the holophytic organisms (as well as their numerous colourless derivatives) that fail to reach the higher level of differentiation characteristic of the archegoniate plants.
- Smith, G. M. (1955) defined algae as simple plants with an autotrophic mode of nutrition.

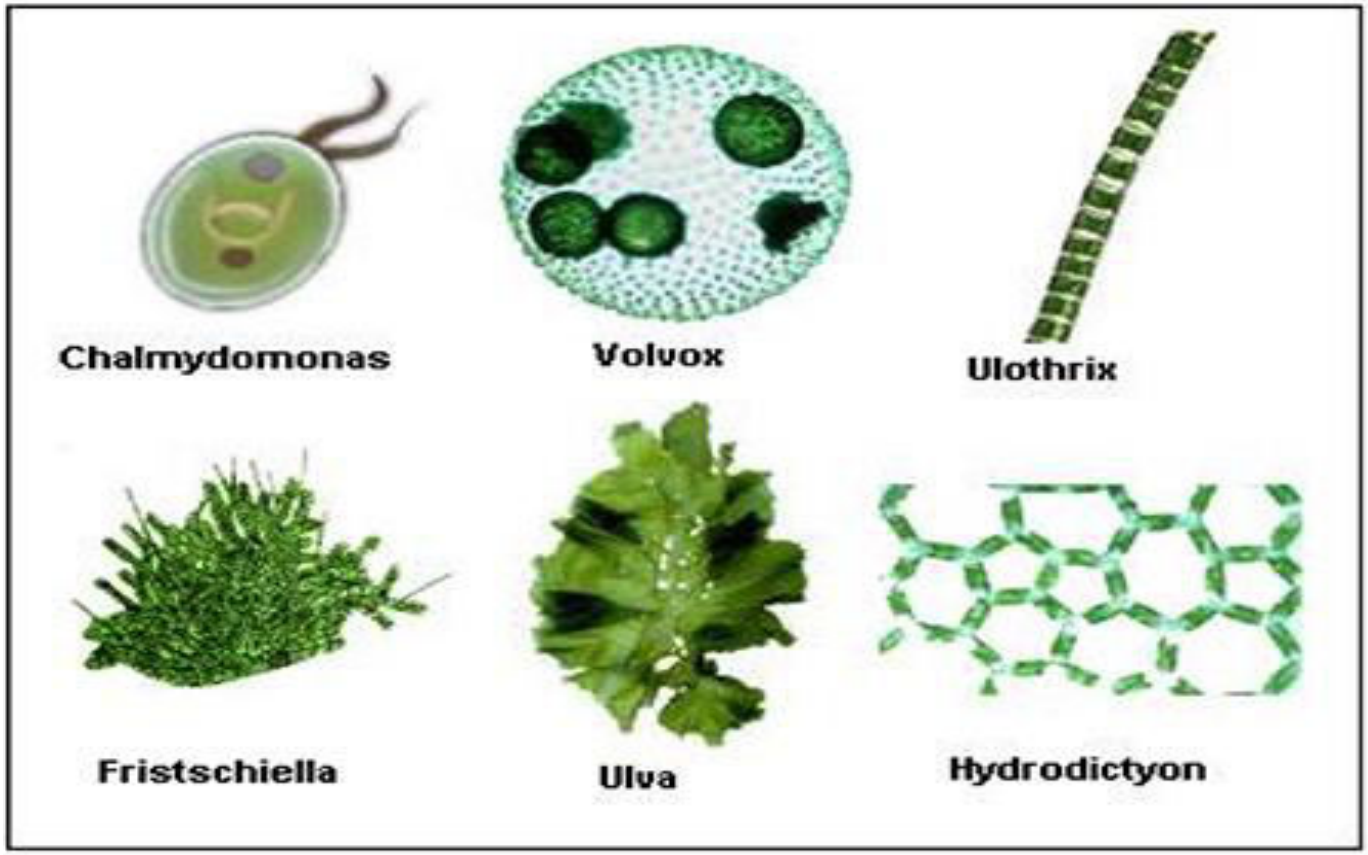
- Prescott, G. W. (1969) defined algae as those chlorophyll-bearing organisms (and their colourless relatives) which are thalloid, i.e., having no true roots, stems and leaves or leaf-like organs.

- Sharma (1987) defined algae as an assemblage of chlorophyll bearing autotrophic thallophytes bounded byacell wall made up of pure or mixed carbohydrates.

Characteristics of Algae

- Algae are chlorophyll-bearing autotrophic thalloid plant body.
- Almost all the algae are aquatic.

- The plant body may be unicellular to large robust multicellular structure.



MULTICELLULAR

- The plant body is thalloid & filamentous.
- Chlorophyll is always present.
- They are autotophic as they can manufacture their own food material.
- The cell wall is made of cellulose
- Plants are aquatic but are terrestrial, epiphytic, or symbiotic also.

- Vascular tissues and epidermis with stomata are absent.
- Reproduction is of three kinds- vegetative, Asexual, &Sexual
- As the complexity in the plant structure increases from simple to complex, complexity in the sexual reproduction also increases.

- The sex organs are generally unicellular but, when multicellular, all cells are fertile and in most cases the entire structure does not have any protection jacket.

- The zygote undergoes further development either by mitosis or meiosis, but not through embryo formation.

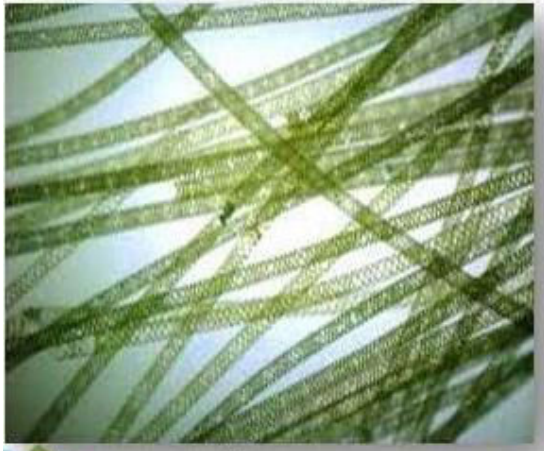
- Plants having distinct alternation of generations. Both gametophyte and sporophyte generations — when present in the life cycle are independent

Thallus Diversity

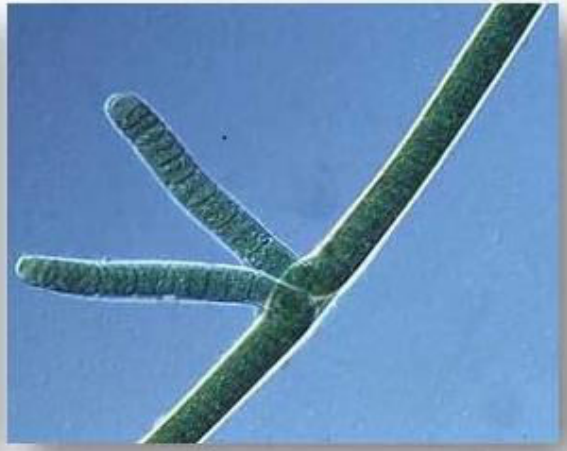
Desmids

Cladophora

Oscillatoria



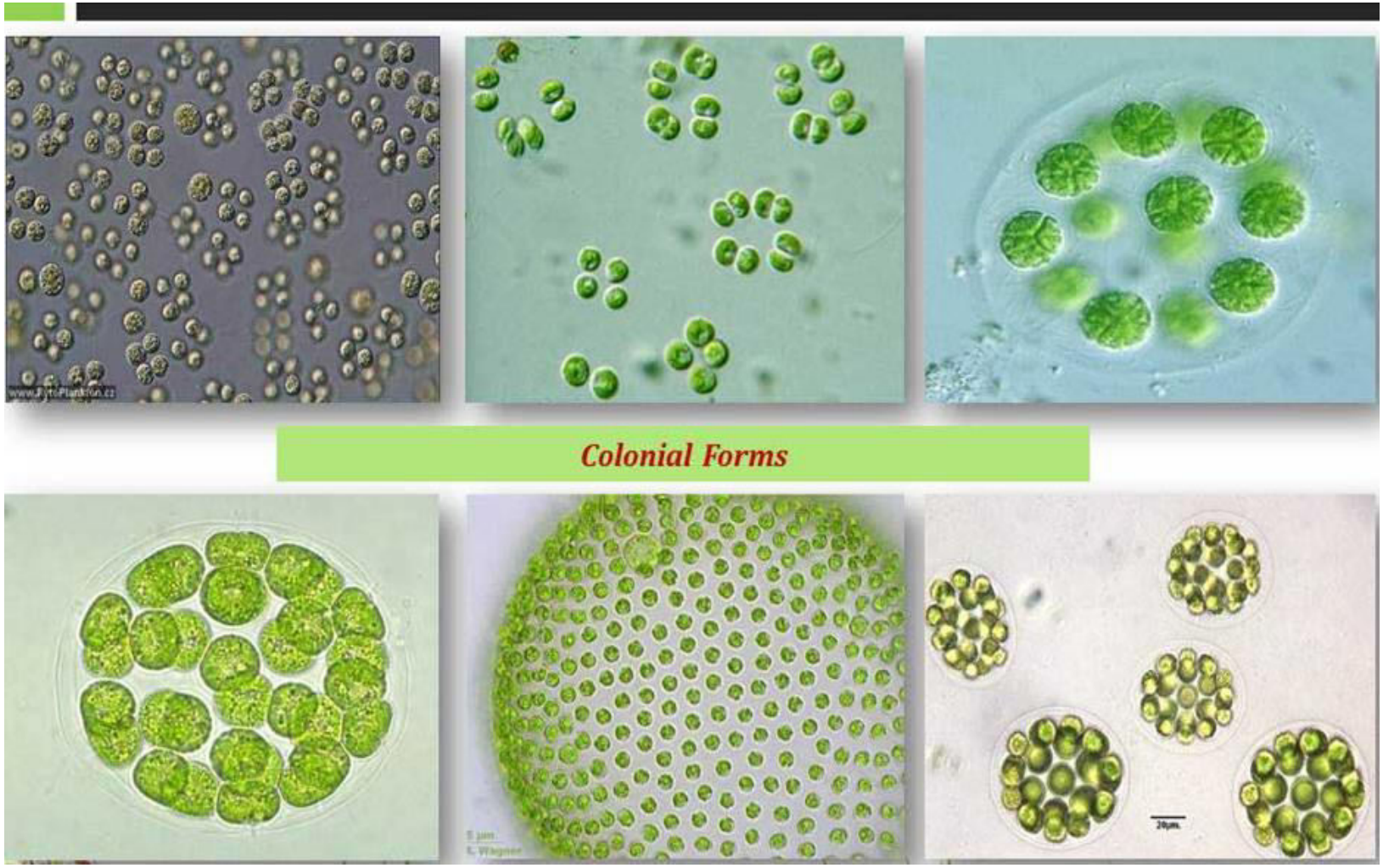
Spirogyra



Scytonema

Cladophora

Conti….



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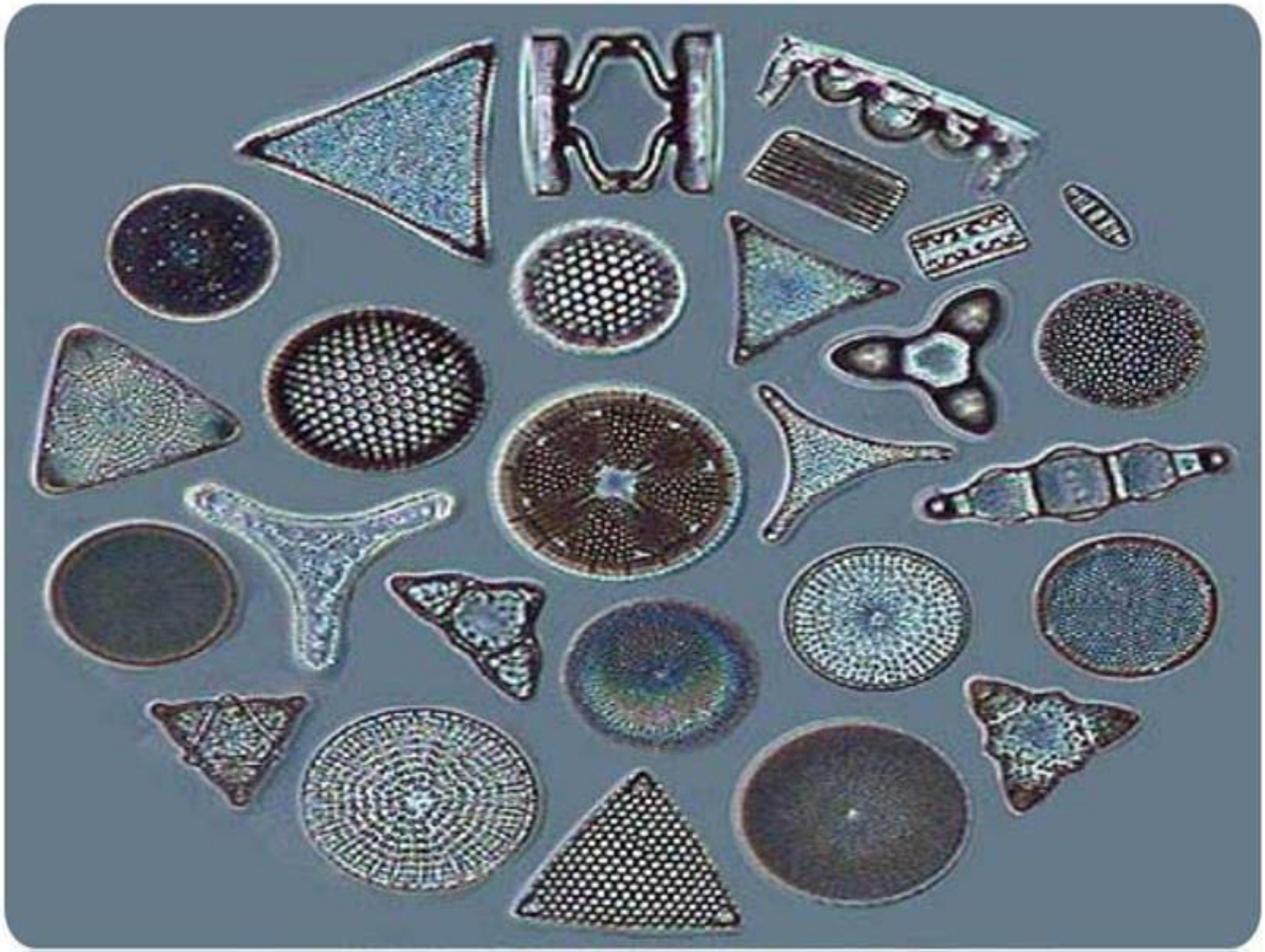

Diatoms

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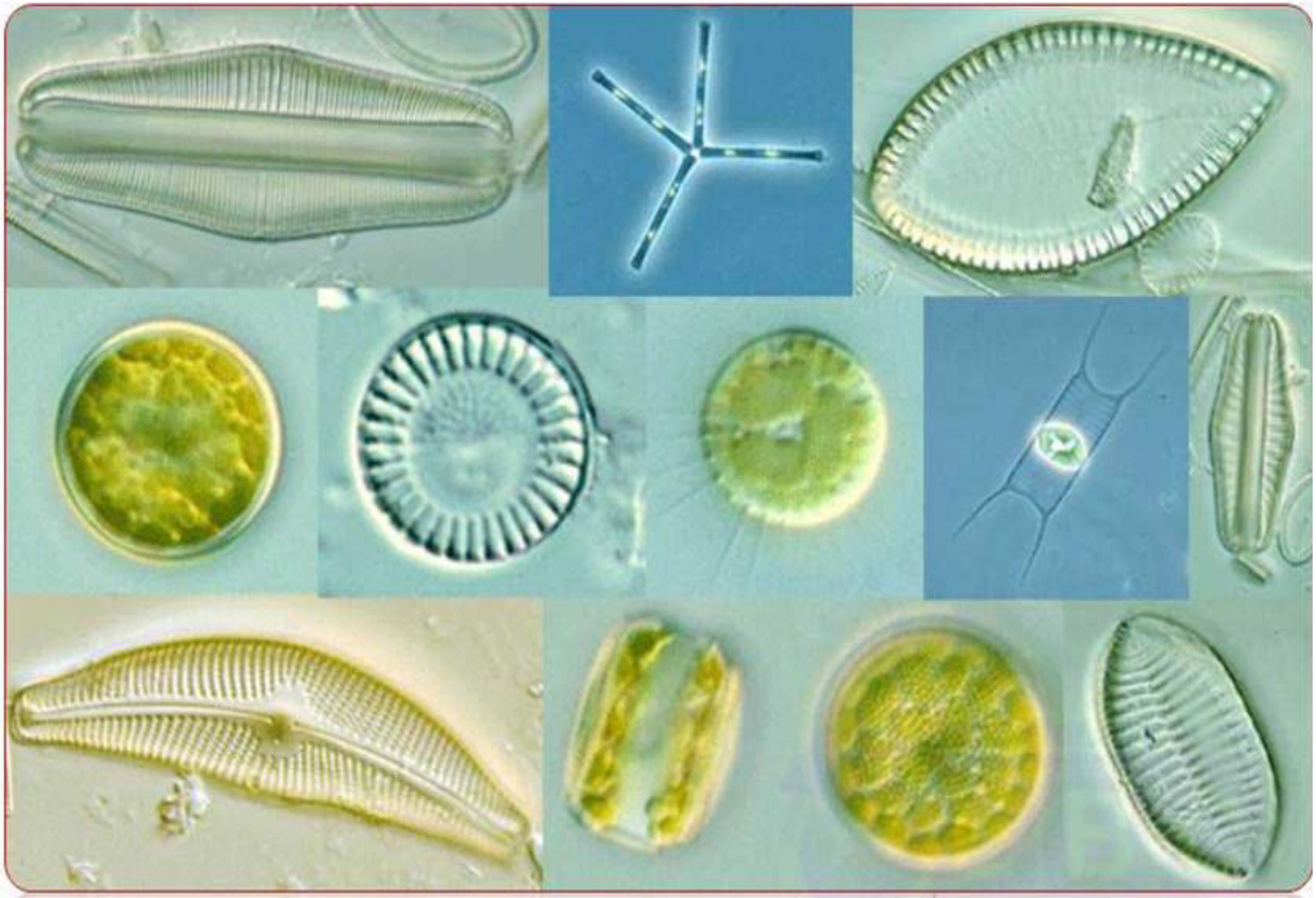


Diatoms

Conti….

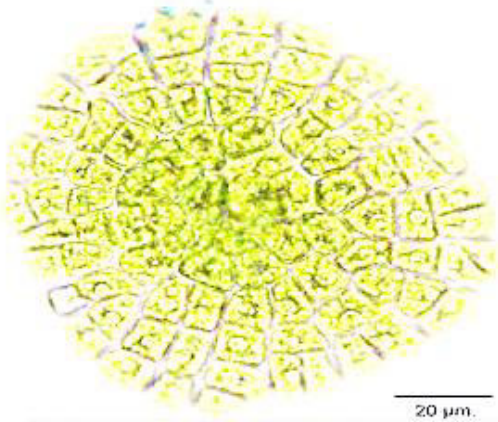
Sargassum

Macrocystis

Fucus

Scytosiphon

Ulva



Coleochaete

ALGAE: GENERAL CHARACTERS

- **Habitat**: majority are aquatic, Universal occurrence
- Sex organs are unicellular
- Sex organs lack jacket cells around them
- If jacket cells are present, they have different origin
- There is a progressive complexity in reproduction
- Embryos is not formed after zygote formation
- Show distinct alternation of generation
- Cellular organization may be prokaryotic or eukaryotic

ALGAE: GENERAL CHARACTERS

Occurrence of algae:

- Found in a variety of habitats
- Fresh water, marine, on rocks, with in plants or animals
- Aquatic forms are most common
- On the basis of habitat, algae are classified into three groups

1. ***Aquatic forms***
2. ***Terrestrial forms***
3. ***Algae of unusual habitats***

ALGAE: GENERAL CHARACTERS

(1). Aquatic algae:

- Two types: Fresh water and marine
  - ***Fresh water:*** Occurs in ponds, lakes, river etc. (*Spirogyra*)
  - ***Marine water:*** Occurs in saline condition (seas and oceans)
    - Mainly members of brown algae and red algae (*Sargassum*)

Spirogyra

Sargassum

ALGAE: GENERAL CHARACTERS

(3). Algae of unusual habitat:

- ***Halophytic algae:*** found in highly saline water (*Dunaliella*)
- ***Epiphytic algae:*** on surface of other plants/algae (*Oedogonium*)
- ***Epizoic algae:*** on animals - snails, fishes (*Cladophora* grow on snails)
- ***Endozoic algae:*** grow inside animals (*Zoochlorella* inside *Hydra*)
- ***Symbiotic algae***: Symbiotic association with fungi in lichen, in bryophytes, pteridophytes, gymnosperms and angiosperms.
- ***Parasitic algae:*** parasite on pants/animals (*Cephaleuros* red rust)
- ***Thermophytic algae:*** grow in hot springs. (Heterohormogonium)

- ***Halophytic algae:*** found in highly saline water (*Dunaliella*)

THALLUS ORGANIZATION

- Plant body of Algae is called as Thallus.
- It is not differentiated into root, stem and leaves.
- Thallus may be unicellular or multicellular.

UNICELLULAR THALLUS

- All vital functions of life are performed by a single cell. It is of 3 types

1. Motile or Flagellate forms

a. One flagella: Trachelomonas, Chromulina.

b. Isokont flagella : Chlamydomonas,

c. Heterokont flagella : Gonyostomum

2. Amoeboid or Rhizopodial form

Have Pseudopodia : Chrysamoeba

3. Non motile or Coccoidal forms

Lacks cell wall and have no locomotry organ, example Chlorella.

MULTICELLULAR THALLUS

1. Colonial form

a. Coenobium

Fixed no. of cells and the colonies may be motile and non motile. Example : Volvox, Hydrodictyon.

b. Palmelloid

Irregular shape and size of colony with non motile vegetative cells embedded in mucilaginous matrix. Example : tetraspora, Palmella.

c. Dendroid

Tree like colony. Example : Ecballocystis.

d. Rhizopodial

Cells are linked by pseudopodia. Example : chrysidiastrum.

2. Filamentous form

Multi celled, thread like structures

a. Unbranched filaments.

Example : Spirogyra, Ulothrix, Oedogonium.

b. Simple branch filament.

Example : cladophora.

c. Heterotrchous filamentous- it have prostrate and erect system of branched filaments.

Example : Ectocarpus, Fritschiella, Stideoclonium.

3. Siphonous form

Coenocytic, aseptate, multinuclear thallus.

Example : Vaucheria, Protosiphon.

4. Parenchymatous form

Leaf like or foliose thallus with loosely arranged cells.
Example : Sargassum, Enteromorpha, Ulva.

ALGAE: GENERAL CHARACTERISTICS

Pigmentation in algae:

- Great diversity in pigmentation of algae
- Different groups of algae have different pigments
- Distribution pattern of pigments has great taxonomic significance
- All major algal groups have at least one characteristic pigment
- Pigments in algae belongs to three major categories:

1. ***Chlorophylls***
2. ***Carotenoids***
3. ***Phycobilins***

ALGAE: GENERAL CHARACTERISTICS

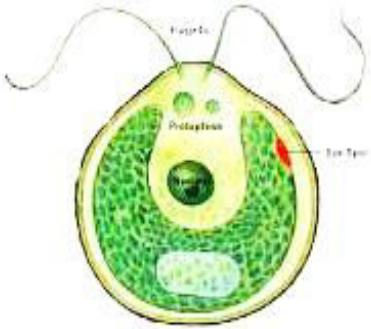
Plastids in algae:

- Except Cyanophyceae (blue green algae, BGA) pigments in algae are found in membrane bound organelles called plastids
- In BGA, plastids are absent, pigments located at peripheral cytoplasm (chromoplasm)
- Plastids are two types:
  - Leuoplast: - Colourless plastids
  - Chromoplast: - Coloured plastids

ALGAE: GENERAL CHARACTERISTICS

Plastid forms in algae:

- Cup shaped: *Clamydomonas, Volvox*
- Discoid: *Voucheria, Chara*
- Girdle shaped: *Ulothrix*
- Reticulate: *Oedogonium, Hydrodictyon, Cladophora*
- Spiral: *Spirogyra*
- Stellate: *Zygnema*



Clamydomonas

Voucheria

Ulothrix

Oedogonium

Spirogyra

Zygnema

ALGAE: GENERAL CHARACTERISTICS

Pyrenoids:

- They are proteinacious bodies present in chromatophores
- Considered as the organelle of synthesis and storage of starch
- In some Chlorophyceae pyrenoids are surrounded by starch grains
- Pyrenoids arise *de-novo* or by the division of pre existing pyrenoids
- Pyrenoids absent in blue green algae

ALGAE: GENERAL CHARACTERISTICS

Reserved food materials in algae:

- Also called as food reserve
- Stored form of food function as an important store of energy that can be released and used in ATP production when required.
    - **Cyanophyceae**: cyanophycean starch
    - **Chlorphyceae**: Starch
    - **Rhodophyceae**: Floridean starch
    - **Phaeophyceae**: Laminarin, manitol and oil

ALGAE: GENERAL CHARACTERISTICS

Reproduction in algae:

- Algae reproduce by three methods:

1. ***Vegetative reproduction:*** Cell division, fission, fragmentation, Hormogonia, formation of adventitious branches, tubers, buddings etc

2. ***Asexual reproduction:*** By a variety of motile or non motile spores (Zoospore, aplanospore, hypnospore, tetraspore, autospore, akinetes)

3. ***Sexual reproduction:*** (union of gametes involved): Autogamy, ·hologamy, isogamy, anisogamy and oogamy

ALGAE: GENERAL CHARACTERISTICS

Alternation of generation:

- Alternation of generations (also known as alternation of phases) is a term primarily used to describe the life cycle of plants
- Most algae have an alternation of many celled haploid gemetophytic generation with many celled diploid sporophytic generation, which alternate regularly

ALGAE: GENERAL CHARACTERISTICS

Life cycle in algae:

- The growth and development consists of a number of distinct morphological and cytological stages
- The sequence of these orderly changes is called life cycle
- Life cycle: sequence of all deferent phases or events through which an organism passes from zygote (diploid) of one generation to the zygote of the next generation through gametes (haploid)
- There are five types of life cycles in algae based on the number of haploid and diploid generation

ALGAE: GENERAL CHARACTERISTICS

Life cycle in algae:

- *Haplontic*
- *Diplontic*
- *Haplobiontic*
- *Diplobiontic*
- *Haplodiplontic*

ALGAE: GENERAL CHARACTERISTICS

Algal classes:

1. **Cyanophyta**: Blue green algae (BGA), prokaryotes
2. **Euglenophyta**: Motile, protozoan like algae lack true cell wall
3. **Crysophyta**: Golden-brown algae = diatoms
4. **Pyrrophyta**: Dinoflagellates
5. **Chlorphyta**: Green algae
6. **Rhodophyta**: Red algae
7. **Paeophyta**: Brown algae

For further reading please refer

- E-Content from various website like wikipedea,
- Fritsesh - Algae.
- G M Smith, Cryptogamic Botany
- College Botany, Ganguly, Kar, and Dutta

Ecosystem

For

B.A/ B.Sc/ B.Com/B.H.Sc/B.C.A Semester- IV

Foundation Course

Paper-II

Enviromental Studies

By

Dr. Aruna Jain

Professor

Department of Botany

Govt Dr Shyama Prasad Mukerjee Science & Commerce College, Bhopal

WHAT IS ECOLOGY ¼ikfjfLFkfrdh½ ?

The term Ecology **(Greek Oikos-house, logos-study)** was coined by German biologist **Ernst Haeckel** in 1869.

Ecology deals with the study of interactions between **living organisms and their physical environment.**

Ecology is defined as the study of ecosystems.

WHAT IS ECOSYSTEM¼ikfjfLFkfrd rU=½ ?

The term Ecosystem was proposed by **A.G. Tansley** in 1935.

Ecosystem

Eco ***(the environment)*** **+** System ***(interacting, interdependent, integrated complex).***

DEFINITION OF ECOSYSTEM

Ecosystem may be defined as the system resulting from the integration of all living and non-living factors of the environment.

Any structural and functional unit of biosphere where the **organisms interact with the physical environment** so that a **flow of energy** leads to clearly defined trophic structure, biotic diversity and material cycle (i.e., exchange of materials between living and non-living components) within the system is known as an **ecological system or ecosystem.**

CONCEPT OF ECOSYSTEM

Earth is a giant ecosystem. which is referred to as **biosphere or ecosphere.**

Abiotic and biotic components are constantly acting and reacting with each other bringing structural and functional changes in it.

This vast ecosystem-biosphere is subdivided into **units of smaller ecosystems** such as terrestrial and aquatic ecosystems.

Types of Ecosystem
¼ikfjfLFkfrd rU= ds izdkj½

Natural ¼izkd`frd½ Ecosystems (Self-operating)

Terrestrial ¼LFkyh;½ Ecosystem

Forests

Grasslands

Deserts

Aquatic ¼tyh;½ ecosystem

(a) Fresh water

-Lotic (running water as springs, streams or rivers)

-Lentic (standing water as lakes, ponds, pools, ditches, puddles, swamps etc.).

(b) Marine water such as oceans (deep bodies) or seas or estuaries (shallow ones).

Types of Ecosystem

Artificial ¼d`f=e½ aor Man-engineered Ecosystems

Crop land Ecosystem
(maize, wheat, rice fields etc.,)

Space Ecosystem

The common features of all ecosystems — **terrestrial, aquatic and agricultural fields** are the interactions of the **autotrophic and heterotrophic components.**

)

Structure of Ecosystem ¼ikfjfLFkfrd rU= dh lajpuk½

The Ecosystem has 2 components **biotic and abiotic**

Biotic (Living) Component (tSfod ?kVd)

Producers ¼mRiknd½ or Autotrophs.

Green plants (photo autotrophs).

Photosynthetic bacteria.

Chemosynthetic organisms or chemo-autotrophs can also synthesize some organic matter by the oxidation of certain chemicals in absence of sunlight.

Biotic (Living) Component

Consumers ¼miHkksDrk½

(Heterotrophs or Phagotrophs)

Consumers consume the matter built up by the producers. They utilise, rearrange and decompose complex materials.

Herbivores ¼'kkdkgkjh tho½

They feed directly on producers and hence are known as **primary consumers**, e.g., rabbit, deer, cattle, insects etc. **Elton (1927)** called herbivores as key industry animals because they convert plants into animal materials.

Biotic (Living) Component

Carnivores (Meat eaters) ¼eklkgkjh tho½

They feed on other consumers.

If they feed on herbivores, they are **called secondary Consumers** (e.g., frog, birds, cat).

If they prey on other carnivores (snake, peacock), they are known as **tertiary carnivores/consumers.**

Lion, tiger etc., which cannot be preyed are called **top carnivores** since they occupy top position in the food chain.

Biotic (Living) Component

Omnivores ¼loZHk{kh tho½

They feed both on plants and animals, e.g., rat, fox, birds and man.

Detritivores (Detritus feeders or saprotrophs)

They feed on partially decomposed matter such as termites, ants, crabs, earthworms etc.

Biotic (Living) Component

. Decomposers ¼vi?kVd½ or Micro-consumers

Decomposers are saprophytic (osmotrophs) micro-organisms such as **bacteria, actinomycetes and fungi.**

They derive their nutrition by breaking down **complex organic compounds and release inorganic nutrients** into environment, making them available again to producers.

The biotic components of any ecosystem may be thought of as the functional kingdom of nature, since they are based on the type of nutrition and the energy source used.

Abiotic (Non living) Component ¼vtSfod ?kVd½

Climatic regime

Sunlight

Precipitation

Humidity

Temperature

Intensity of solar flux

Wind..

etc.,

Abiotic (Non living) Component

Inorganic substances ¼vdkcZfud inkFkZ½

These are C, N, H, O, P, S involved in material cycles. Examples : carbon cycle, nitrogen cycle, water cycle, oxygen cycle, phosphorous cycle....etc.,

The amount of these substances present in an ecosystem is known as **standing state or standing quality**.

Inorganic chemicals eg. Chlorophylls.

Abiotic (Non living) Component

Organic Substances ¼vdkcZfud inkFkZ½

Carbohydrates, proteins, lipids and humic substances. **link the abiotic components with the biotic components.**

All the biotic and abiotic components of an ecosystem are influenced by each other and are linked together **through energy flow and matter cycling.**

They have strong influence on structure behaviour and inter relationship of various organisms in an ecosystem.

Structure of Ecosystem
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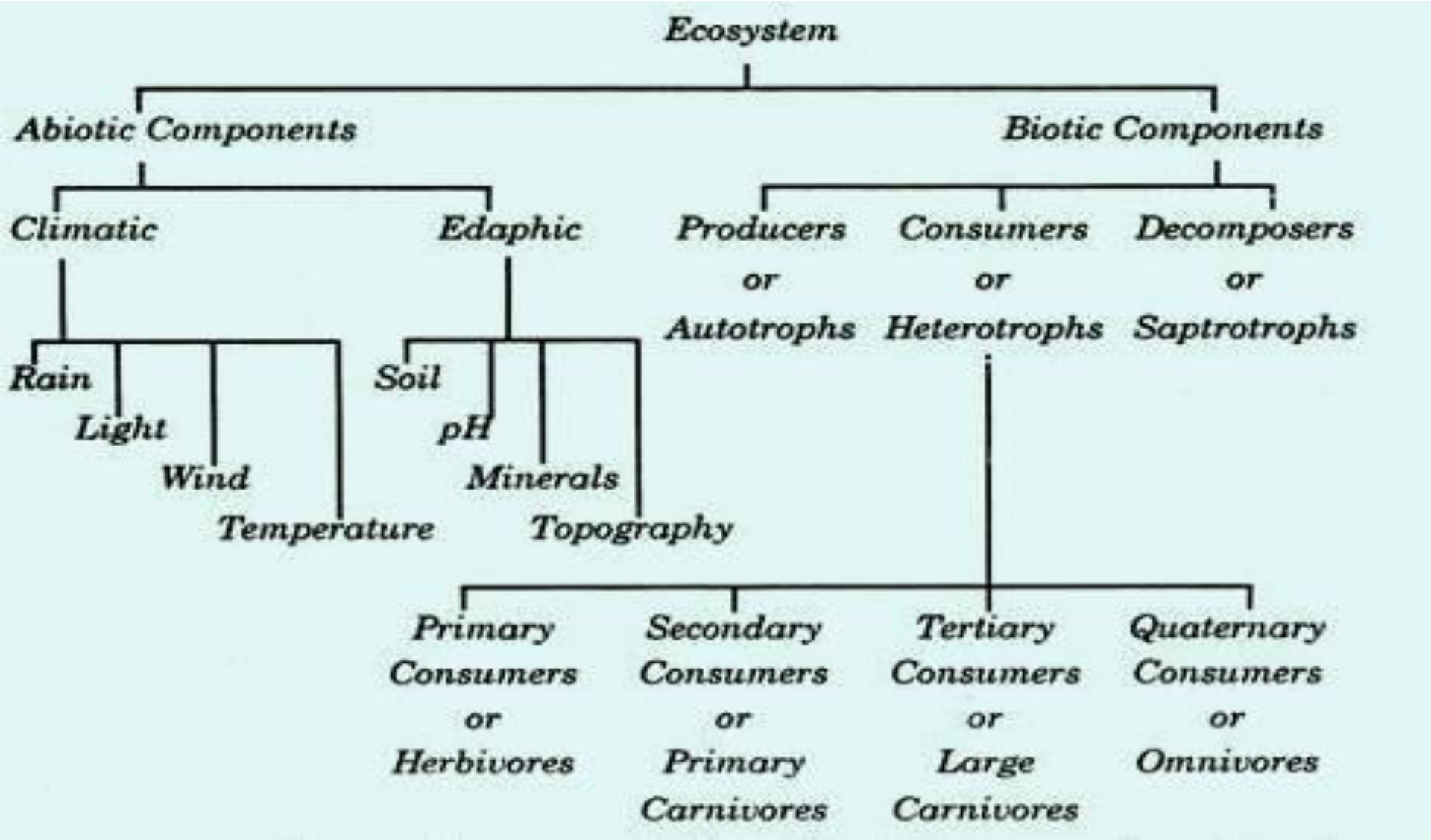

Functions of an Ecosystem
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Every ecosystem performs under natural conditions in a delicately balanced and systematic Controlled manner.

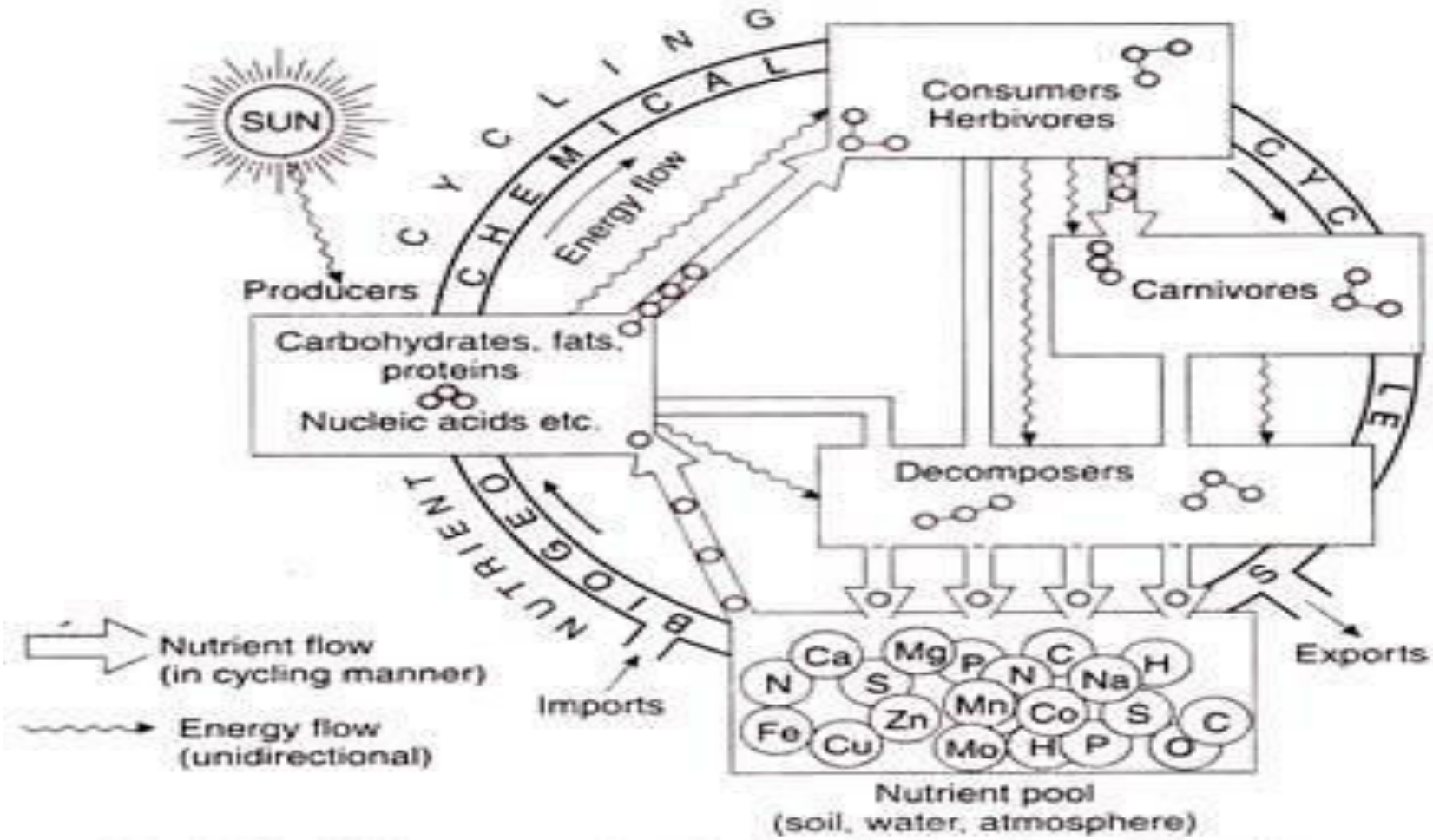
Functionally, the biotic and abiotic components of ecosystem are so interwoven into the fabric of Nature that their separation from each other is practically very difficult. Thus keep the component parts running together.

The producers, green plants, fix radiant energy and with the help of minerals (C, H, O, N, P, K,Ca, Mg, Zn, Fe etc.) taken from the soil and aerial environment (nutrient pool) they build up complex Organic matter (carbohydrates, fats, proteins, nucleic acids etc.). Herbivores feed on plants and in turn serve as food for carnivores.

Decomposers breakdown complex organic materials into simple inorganic products which can be used by the producers.

The two ecological processes of energy flow and nutrient cycling, involving interaction between The physico-chemical environment and the biotic communities constitute the heart of the Ecosystem dynamics.

The major functional features of an ecosystem



Trophic Structure¼iks"k.k lajpuk½

The trophic structure of an ecosystem is a kind of **producer-consumer arrangement** and their interaction with population size.

Each food level is known as **trophic level** and the amount of living matter at each trophic level at a given time is known as **standing crop or standing biomass.**

In the ecosystem various trophic levels are connected through **food chain**.

Food Chain ¼[kk| J`[kayk½

The transfer of food energy from the producers, through a series of organisms (herbivores to carnivores to decomposers) with repeated eating and being eaten, is known as food chain.

All organisms, living or dead, are potential food for some other organisms, hence there is no waste in the functioning of a natural ecosystem.

A single food chain should have atleast 3 links to be complete.

Plants → **Herbivore** → **Carnivore**

Simple Food chain

Grass → Grass hopper → Frog → Snake → Hawk

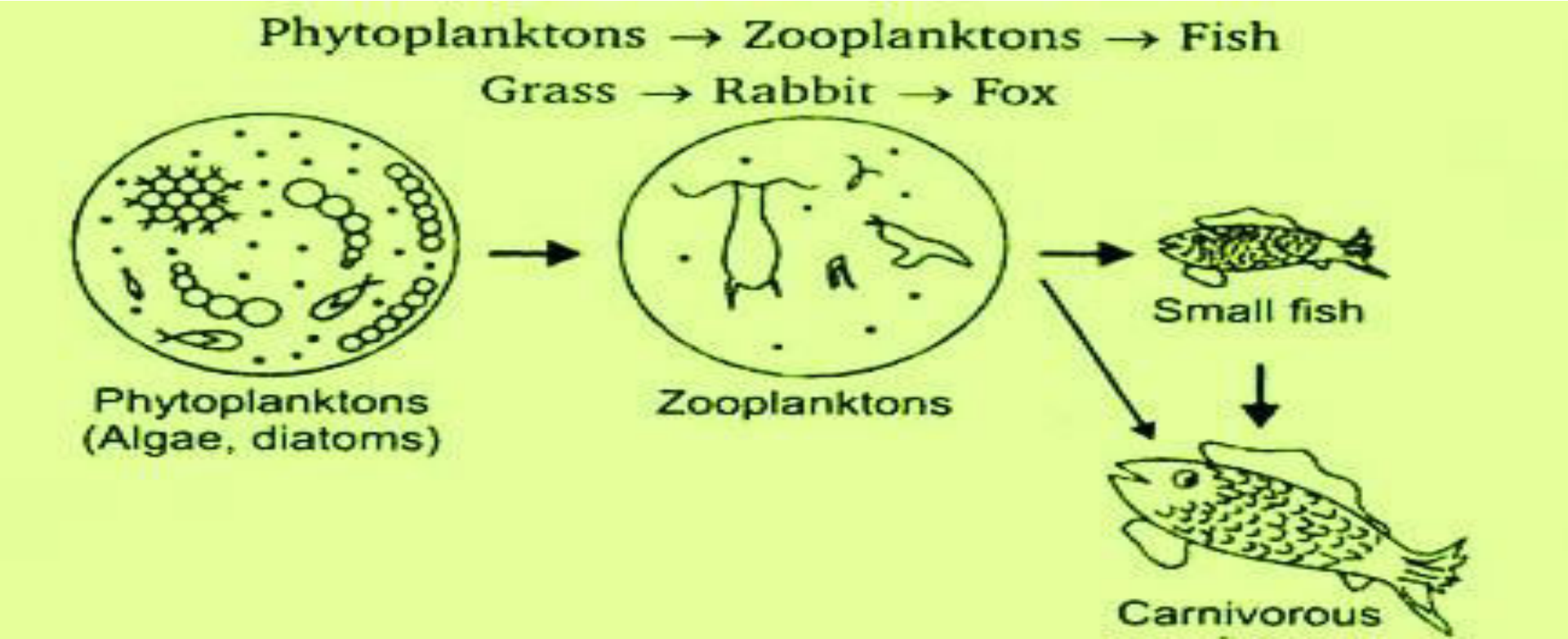
(Grassland ecosystem)

Phytoplanktons → Water fleas → Small fish → Large fish → Tuna

(Pond ecosystem)

Grazing food chain

It starts from green plants (primary producers), goes to grazing herbivores and culminates to carnivores.



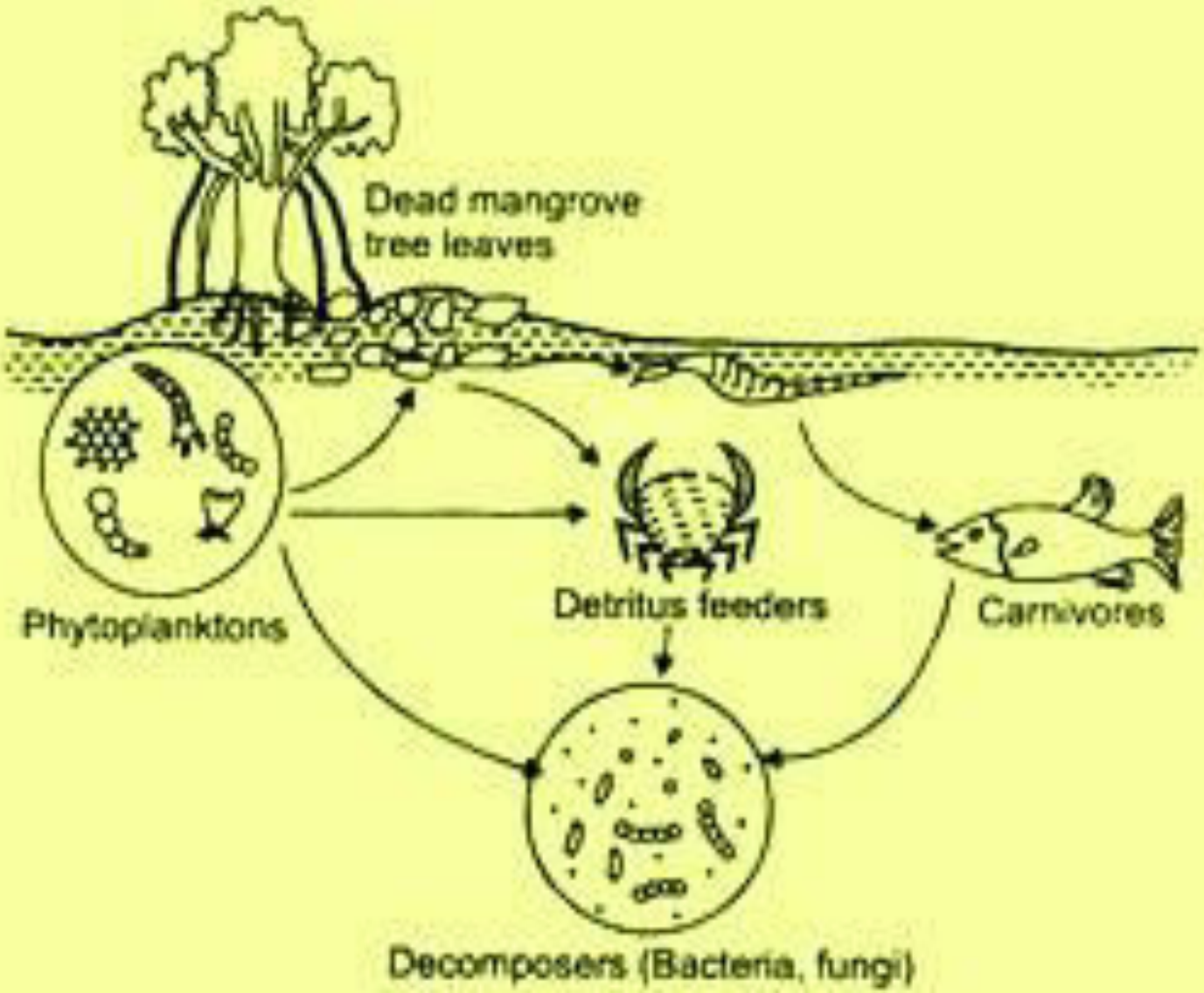
Detritus food chain

It starts from dead organic matter and passes through micro organisms to detritivores (organisms feeding on detritus), their predators and decomposers.

The ecosystems exhibiting detritus food chain are less dependent on direct solar energy.

The **grazing food chain** derives its **energy from plants** while in **detritus food chain** energy is obtained primarilyfrom **plant biomass**, secondarily from **microbial biomass** and tertiary from carnivores.

Detritus food chain



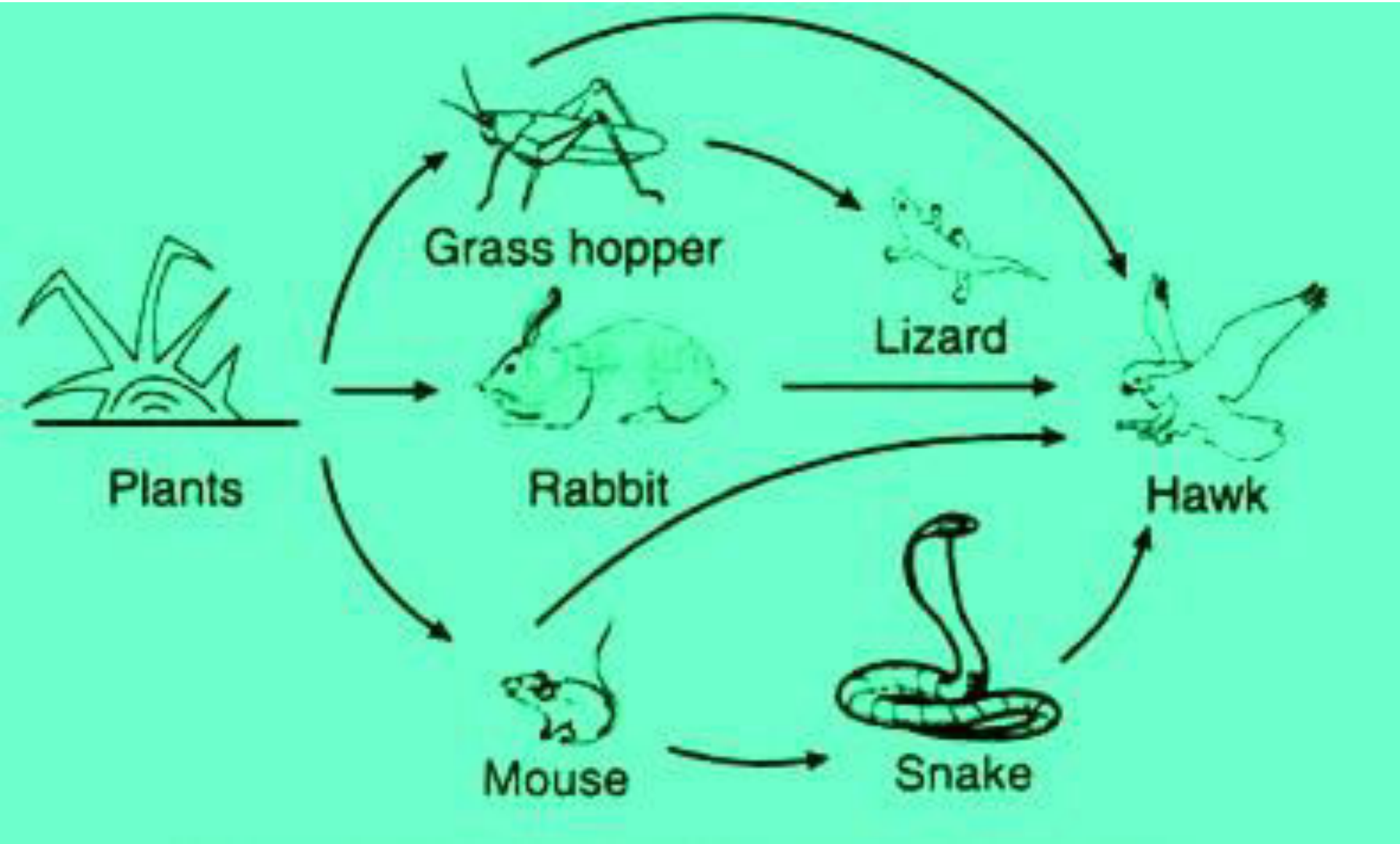
Food Web ¼[kk| tky½

Food chains in ecosystems are rarely found to operate in isolated linear sequence.

Rather, they are interconnected with several linkages forming a complex network of interlocking pattern which is referred to as **food web.**

Thus, food web is a network of food chains where different types of organisms are interconnected with each other at different trophic levels so that there are a number of options of eating and being eaten at each trophic level.

FOOD WEB IN A ECOSYSTEM



Food Web

The complexity of any food web depends upon the diversity of organisms in the system. **It would accordingly depend upon:**

Length of the food chain

More diverse the organisms in food habits, longer would be the food chain.

Alternatives at different levels of consumers in the chain

More the alternatives, more would be the interlocking pattern.

Significance of Food Chains and Food Webs

Food chains and food webs play a very significant role in the ecosystem because the most important functions of energy flow and nutrient cycles take place through them.

Food chains help in maintaining and regulating the ecological balance.

Food chains show a unique property of biological magnification of several pesticides and heavy metals which are non-biodegradable in nature. Such chemicals increase in concentration at each successive trophic level.

Ecological Pyramids ¼ikfjfLFkfrd fijkfeM½

Graphic representation of trophic structure and functions of an ecosystem, starting with producers at the base and successive trophic levels (herbivores -> carnivores) forming the apex is known as ecological pyramid.

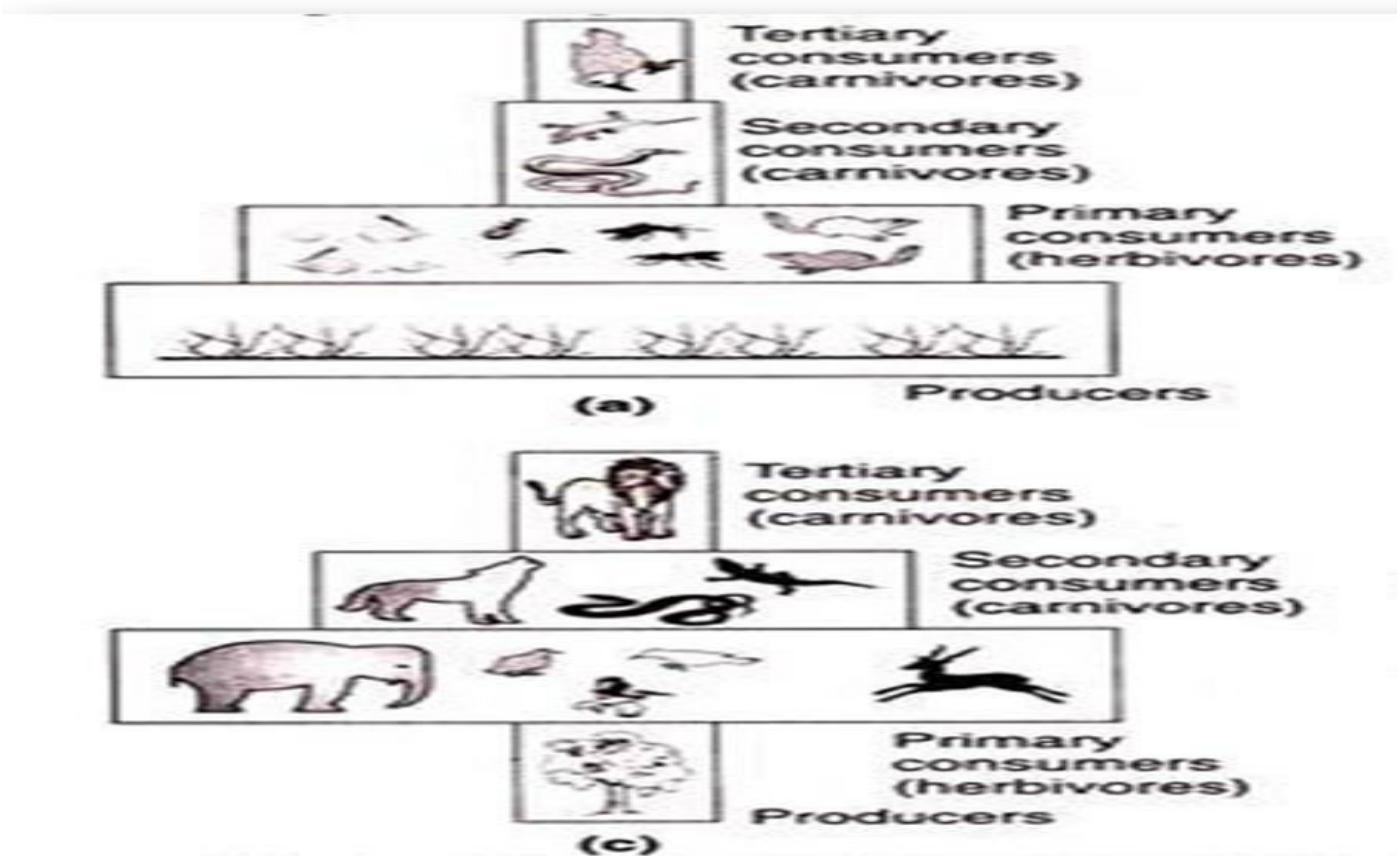
These were first devised by British ecologist Charles Elton (1927) and so are also known as Eltonion pyramids.

Pyramid of Numbers ¼la[;k fijkfeM½

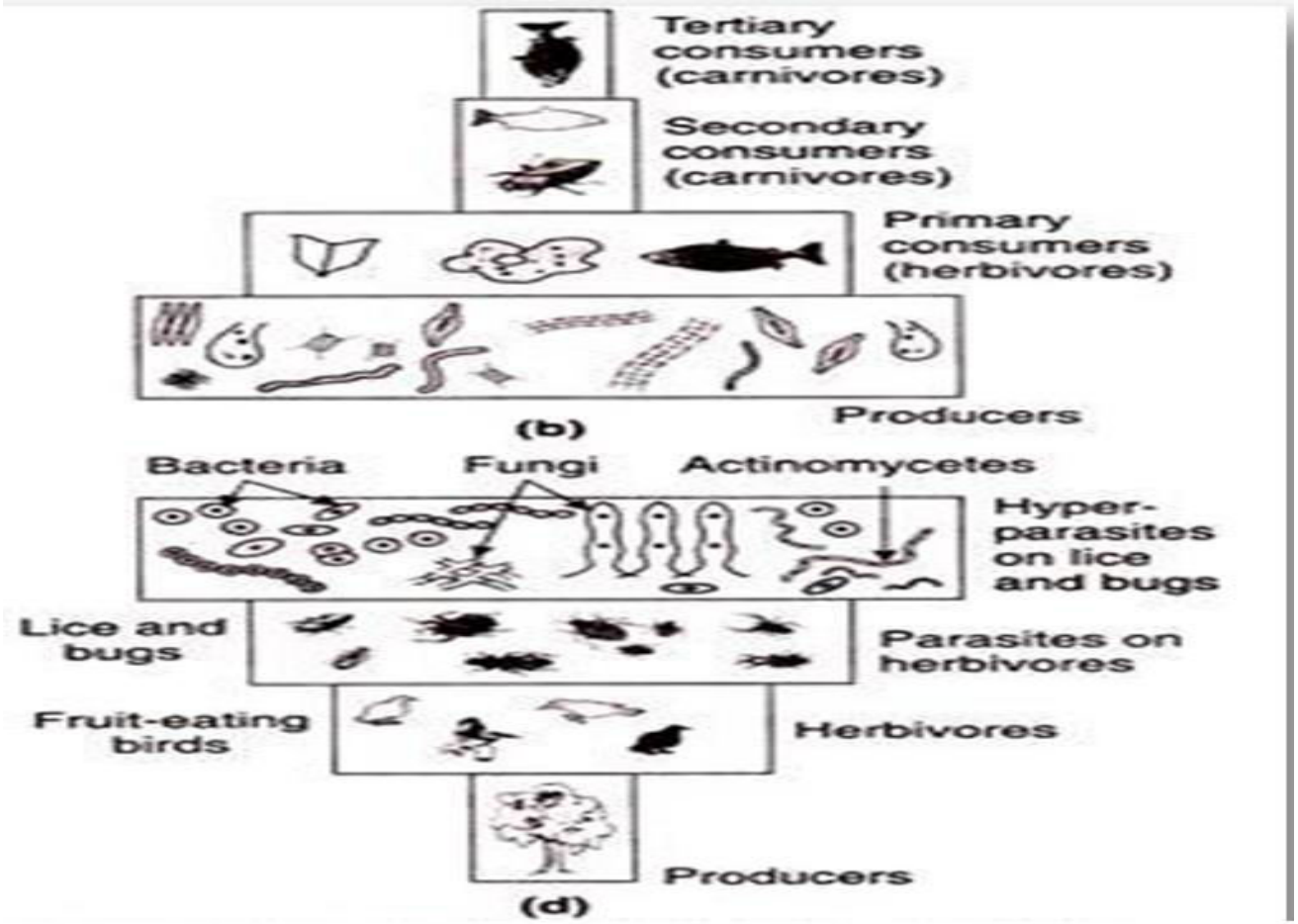
It represents the number of individual organisms at each trophic level.

There may be upright or inverted pyramid of numbers depending upon the type of ecosystem and food chain.

Pyramid of Numbers



Pyramid of Numbers



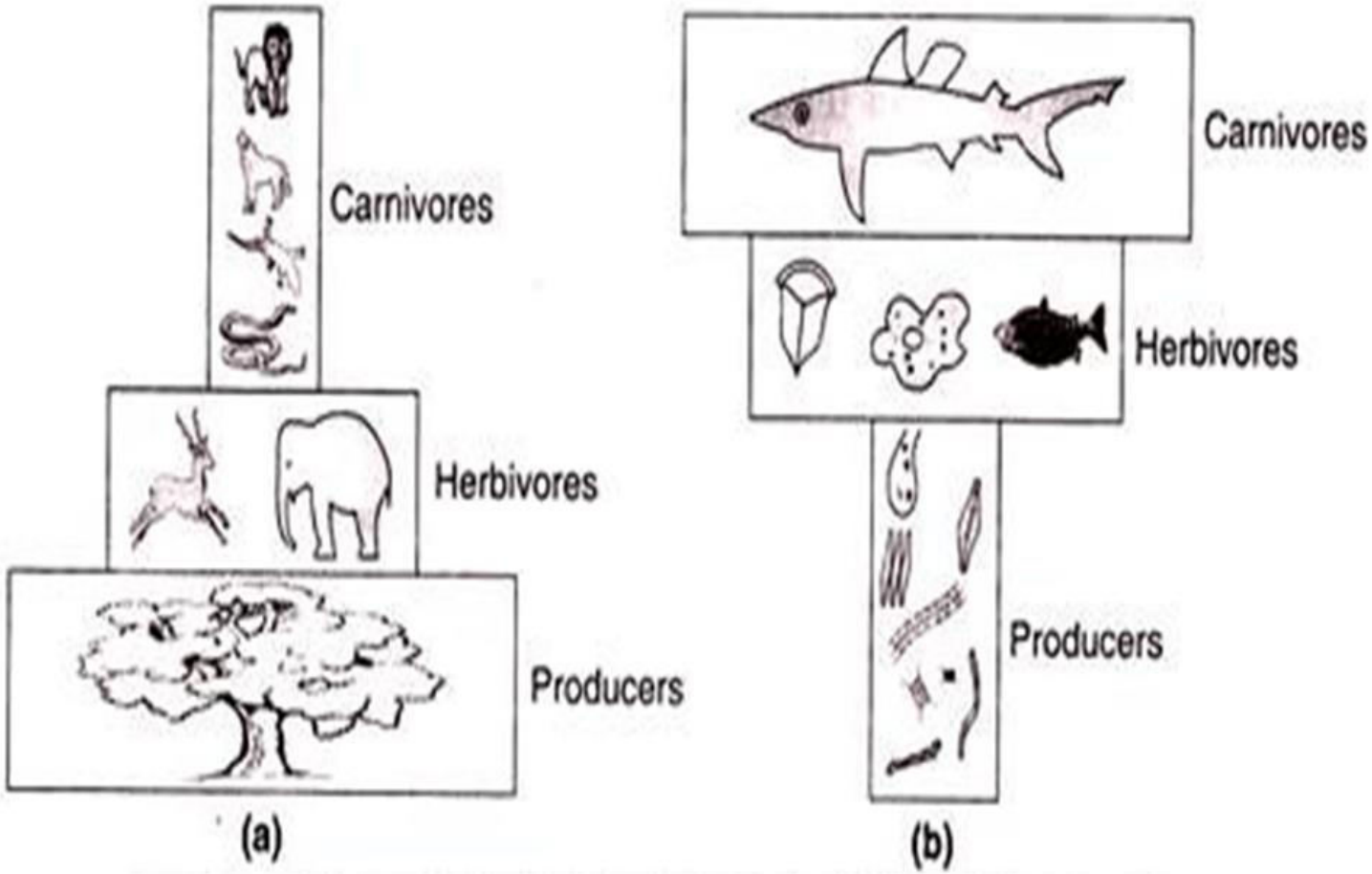
Pyramid of Biomass ¼tSo Hkkj fijkfeM½

These are comparatively more fundamental since instead of geometric factor, they show quantitative relationship of the standing crops.

Pyramid of biomass is based upon the total biomass (dry matter per unit area) at each trophic level in a food chain.

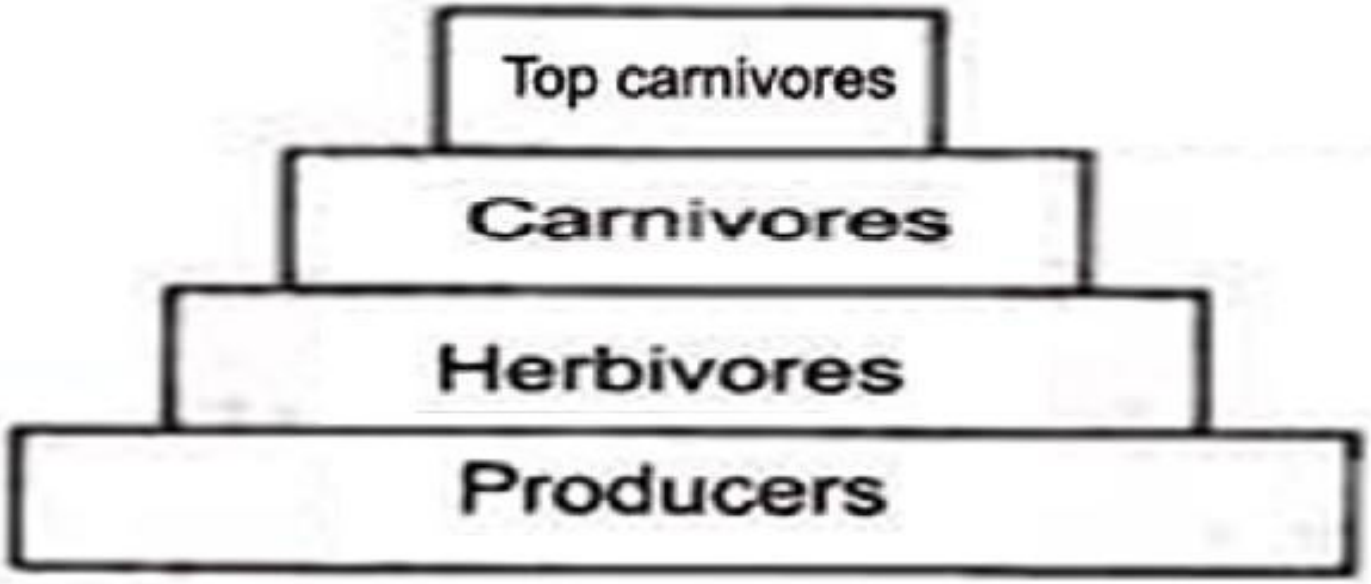
In a **forest**, the pyramid of biomass is **upright** in contrast to its pyramid of numbers.

Pyramid of Biomass



Pyramid of Energy¼ÅtkZ fijkfeM½

Pyramid of energy is based on the amount of energy trapped per unit time and area in different trophic levels of a food chain. It gives the best representation of the Trophic relationships and is always upright



Energy Flow in an Ecosystem
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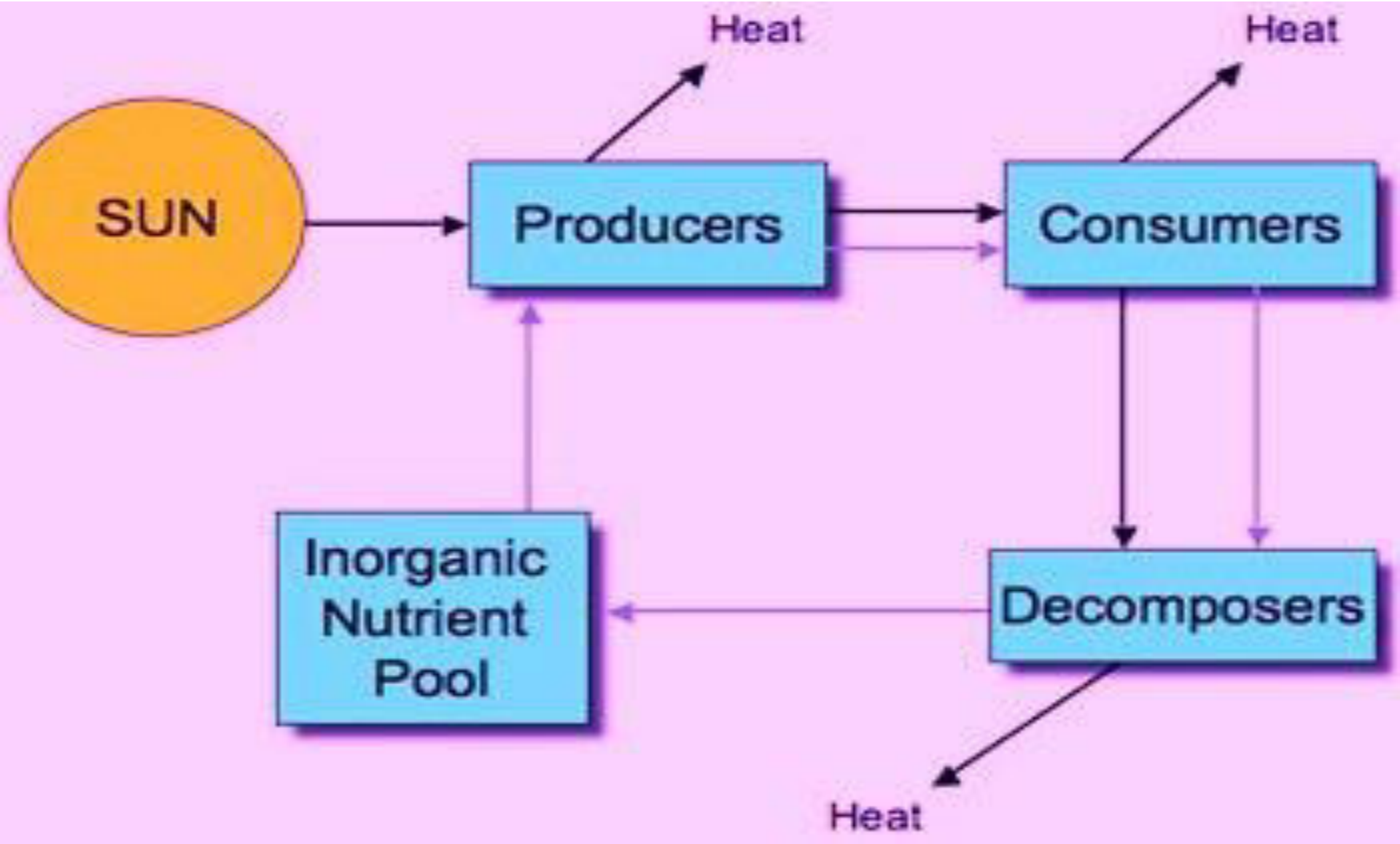
The functioning of ecosystem depends on the flow of energy through matter.

The most important feature of energy flow is that it is unidirectional or one way flow.

The energy captured by autotrophs does not revert back to solar input.

Unlike nutrients (like C, N, P) which move in a cyclic manner and are reused by the producers after flowing through the food chain, energy is not reused in the food chain.

Energy Flow in an Ecosystem



First law of Thermodynamics

Energy can neither be created nor destroyed but it can be transformed from one form into another.

The solar energy captured by green plants (producers) gets converted into biochemical energy of plants and later into that of consumers.

Second law of Thermodynamics

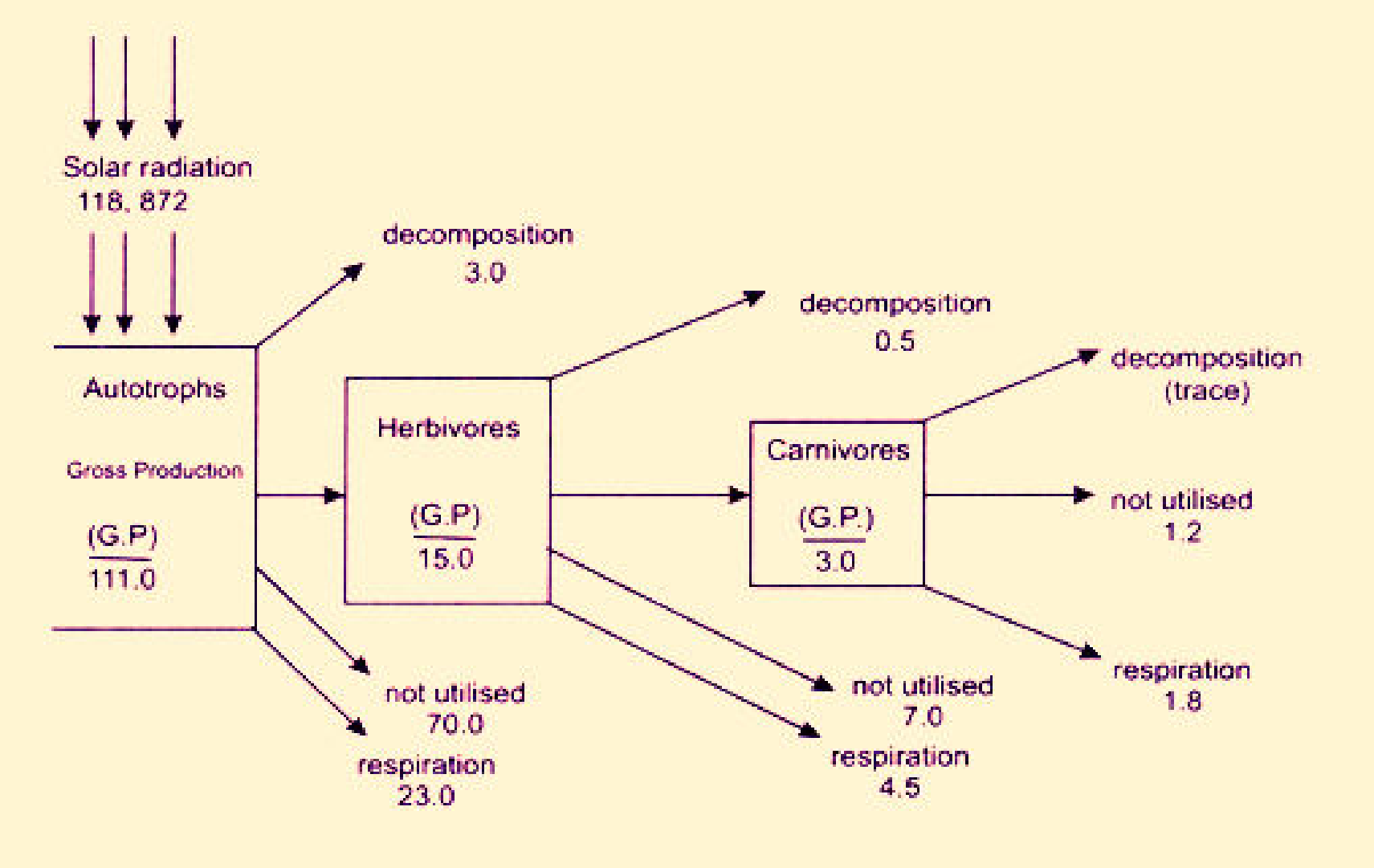
Transfer of energy is accompanied by its dispersion.

As energy flows through the food chain, there occurs dissipation of energy at every trophic level.

The loss of energy takes place through respiration or other metabolic activities.

At every trophic level there is about 90% loss of energy and the energy transferred from one trophic level to the other is only 10%.

Energy Flow in an Ecosystem



Questionnaire

What is Ecology ?

Who coined the term Ecosystem ?

What is Biosphere ?

How many types of Ecosystem are there ?

Forest Ecosystem is an artificial Ecosystem(y/n).

Space Ecosystem is a natural Ecosystem (y/n).
Classify the following into biotic and abiotic things – cat, algae, bacteria, pen, soil, rice, fertilizers, oxygen, sunlight, chlorophyll.

Questionnaire

What is food chain ?

How many types of food chains are there?

What is food web ?

Pyramid of energy is always upright (y/n).

In which Ecosystem pyramid of biomass is inverted ?

What is first law of thermodynamics ?

What is second law of thermodynamics ?

Energy flow is always unidirectional(y/n).

THANK YOU

Dr. Shyama Prasad Mukharjee College

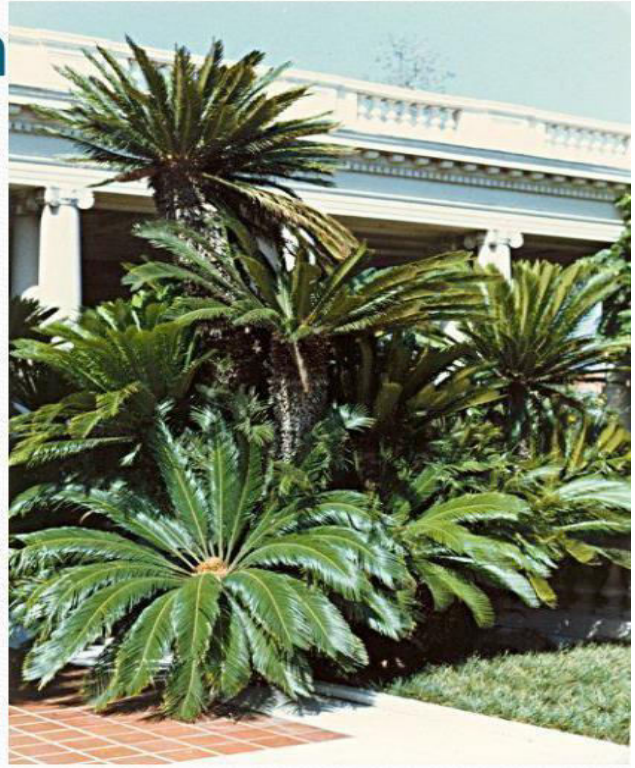
(Kolar Road Bhopal)

PPT Presentation for M.Sc. II Year- CYCAS: Structure, Reproduction and Life

Systematic Position

- GYMNOSPERMAE
- Division: CYCADOPHYTA
- Class: CYCADOPSIDA
- Order: CYCADALES
- Family: CYCADACEAE
- Genus: CYCAS

(Greek word Kycas = Cocopalm)



Distribution and Occurence

- It includes 20 species.
- Occurs wild or cultivated in tropical and sub-tropical regions.
- South of Eastern Hemisphere • e.g. S. Japan, India, China, N. Australia, E. Coasts of Africa, Myanmar, Bangladesh, Mauritius, Nepal, etc.
- It is evergreen plant in India represented with 6 species- Cycas revoluta, C. pectinata, C. siamensis, C. beddomei, C. rumphi and C. Circinali.
- The plants grow in xerophytic conditions.
- It is cultivated as ornamental plant in the garden.
- Cycas is called a living fossil.

Cycas revoluta (sago palm)

Cycas rumphi (false sago)

Cycas circinalis (queen sago)

Cycas siamensis

Cycas pectinata

Cycas beddomei

Morphology

- Sporophyte is **dioecious** i.e. male and female plants are separate.
- Plant body is differentiated into **roots, stem and leaves**.

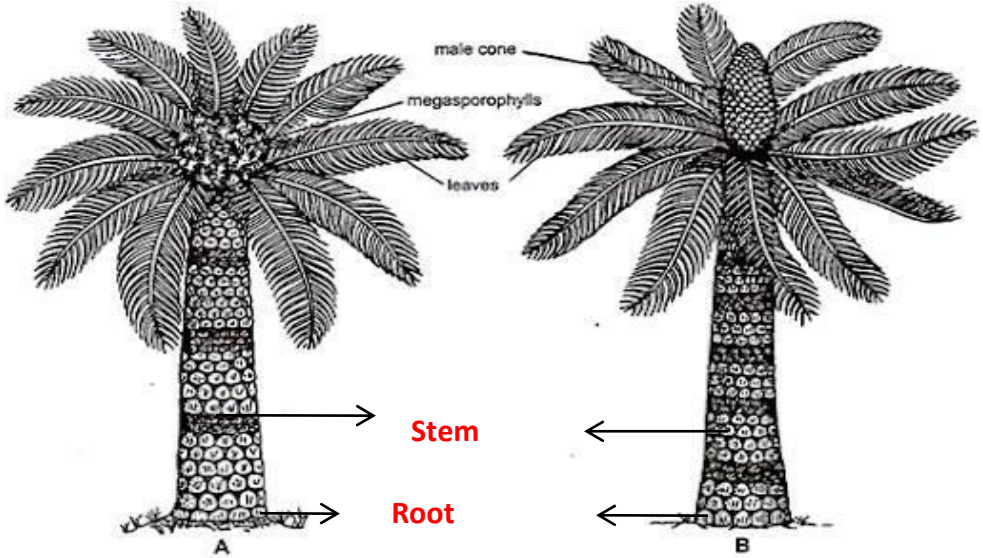
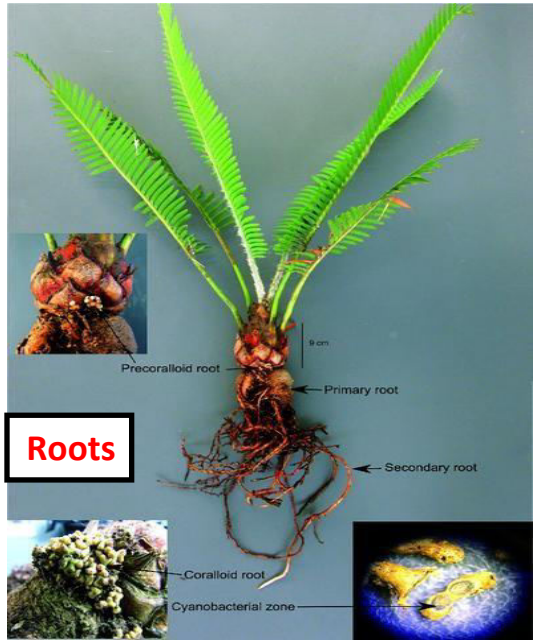


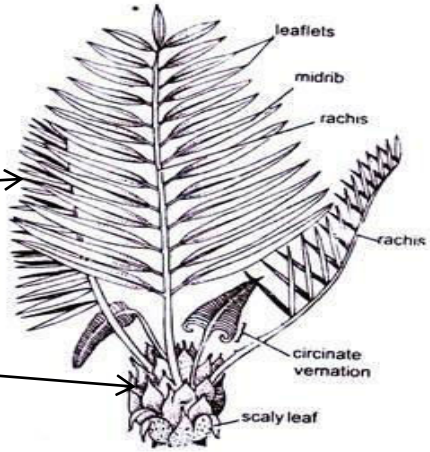
Fig. 1 (A, B), *Cycas*. External morphology (A) female plant of *C. Circinalis*, (B) *Male plant of C. Circinalis*.



- Roots are of two types – normal root and coralloid roots.
- Root hairs and rot cap are absent.
- Normal roots helps in absorption and anchorage.
- Coralloid roots helps in nitrogen fixation.

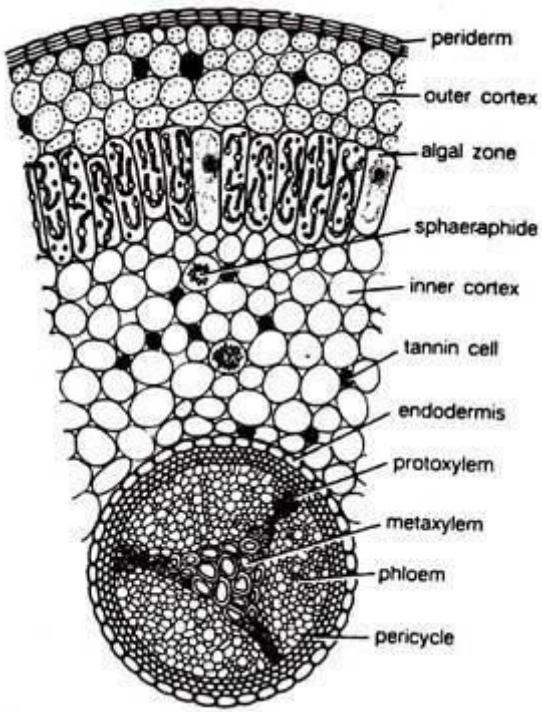
- Stem is erect, columnar, woody and unbranched, covered with alternate whorls of leaf bases of foliage and scaly leaves.

- **Leaves are dimorphic** –
  - **Foliage or assimilatory leaves**
    (1-3 mm, green, pinnately compund, photosynthetic in nature)
  - **Scaly leaves or cataphylls**
    (small, dry, brown, triangular leaves covered with ramenta, photosynthetic in nature, protect the stem apex)



Cycas leaf

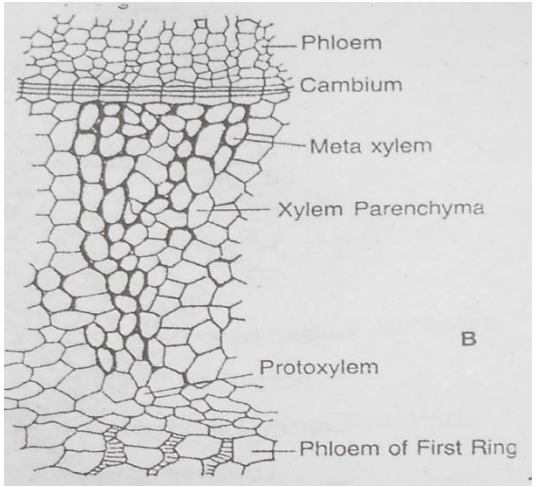
Internal structure

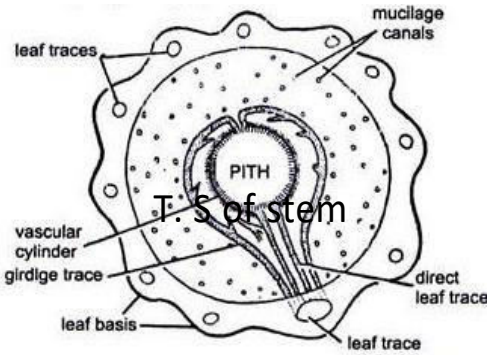


T. S of coralloid roots

1. It is circular in outline and the outermost layer is epiblema. But at maturity cork as well as cork cam•bium develops. Root hairs are normally absent.
2. Cortex is parenchymatous and divisible into outer cortex and inner cortex having a middle algal zone.
4. Vascular bundles are rare. Xylem is triarch and exarch.

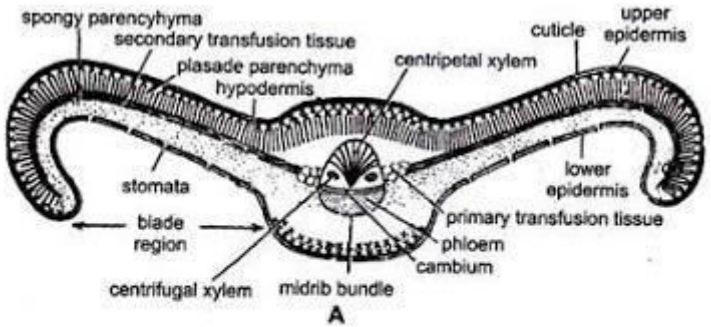
3. Seconadary growth is very rare and absent.

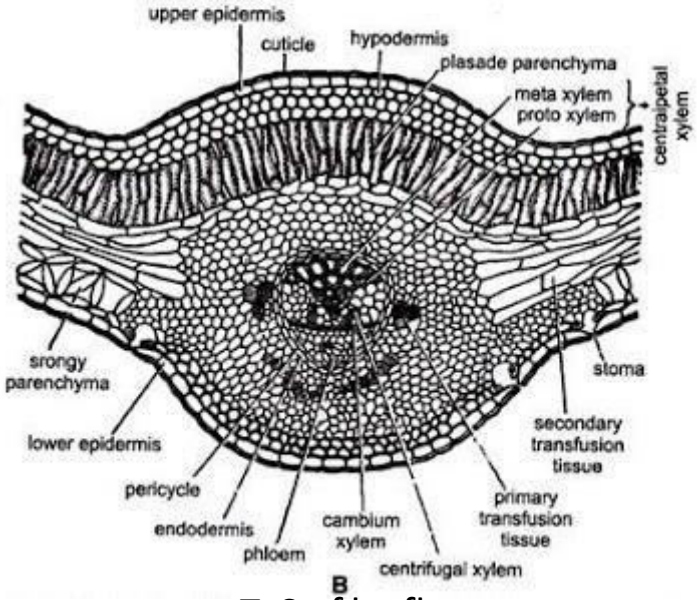




T. S of stem

1. Epidermis forms the outermost layer, followed by large cortex containing numerous mucilaginous ducts and leaf traces.
2. Vascular bundle is open, collateral and endarch.
3. Vascular bundles lie in a ring separated by medullary rays.
4. Secondary growth takes place in old stems.





T. S of leaflet

1. Presence of cutinized epidermis in upper and lower region indicate xerophytic character.
2. Mesophyll is differentiated into upper palisade layer and lower spongy layer.
3. In between these layers, transfusion tissue is present. They play role in lateral conduction.
4. Vascular bundle are surrounded by pericycle and endodermis.

Reproduction in Cycas

Sexual

Strictly dioecious plant

Vegetative

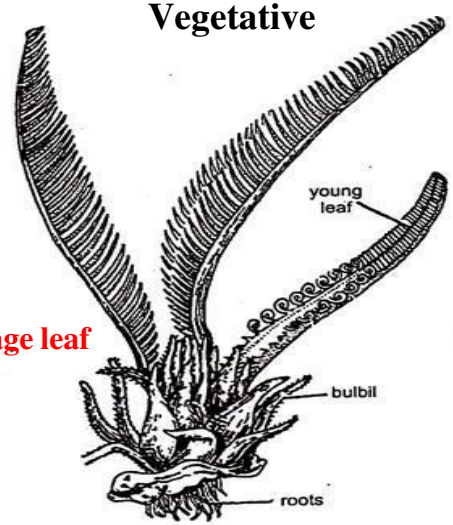
Male plant

*** Female cone is absent in Cycas**

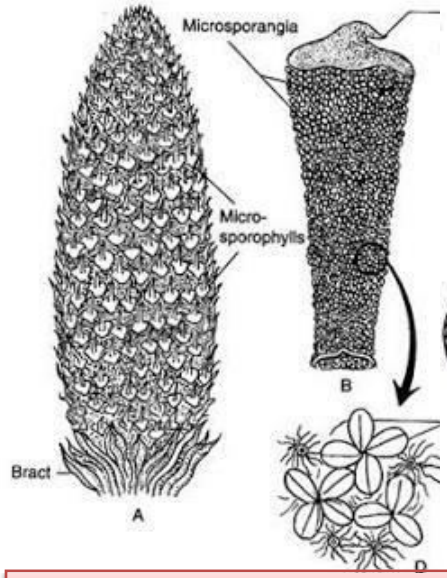
Female plant

Male cone – borne singly at the apex of trunk (reproductive organ)

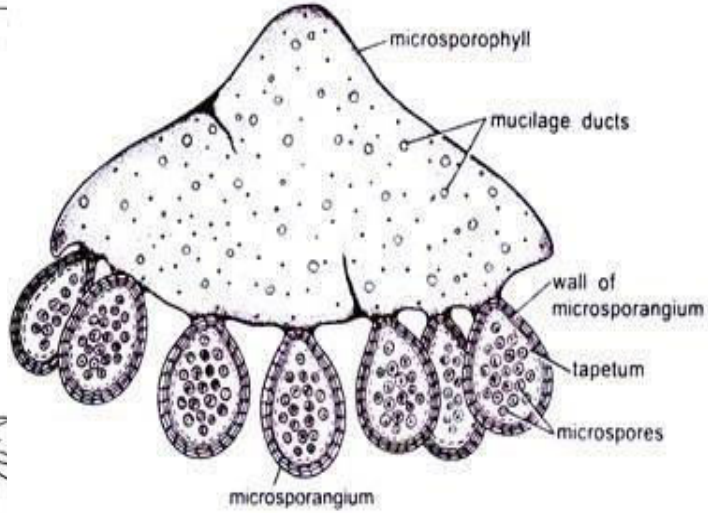
Megasporophyll –resemble foliage leaf (reproductive organ)



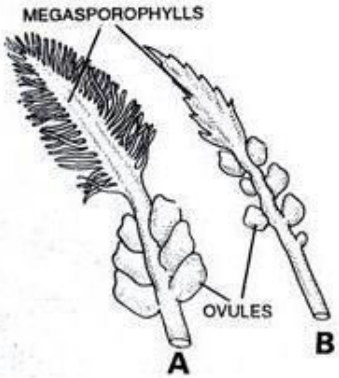
Bulbil



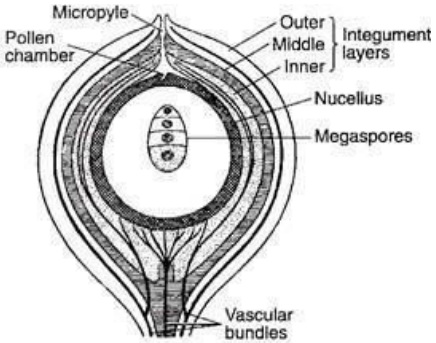
A. Adaxial surface view of microsporophyll



B. T.S of microsporophyll of Cycas

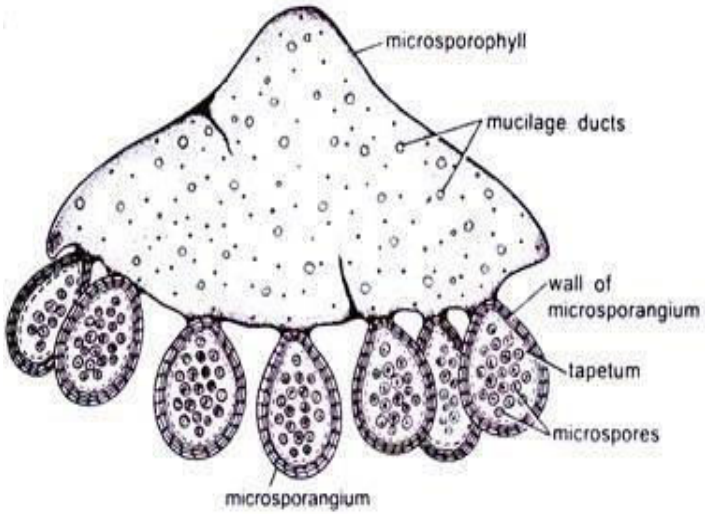


10-23 cm long

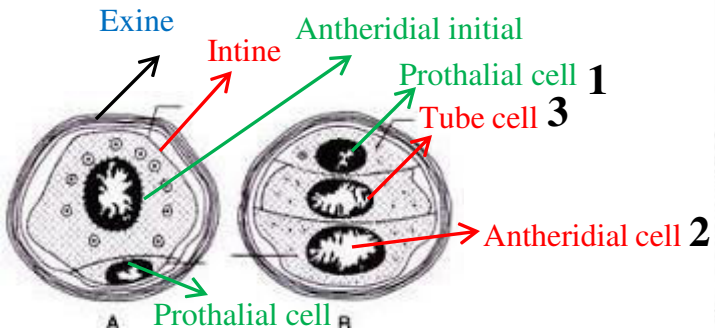


New plant

Microsporogenesis (Development of microspore / pollen grains)

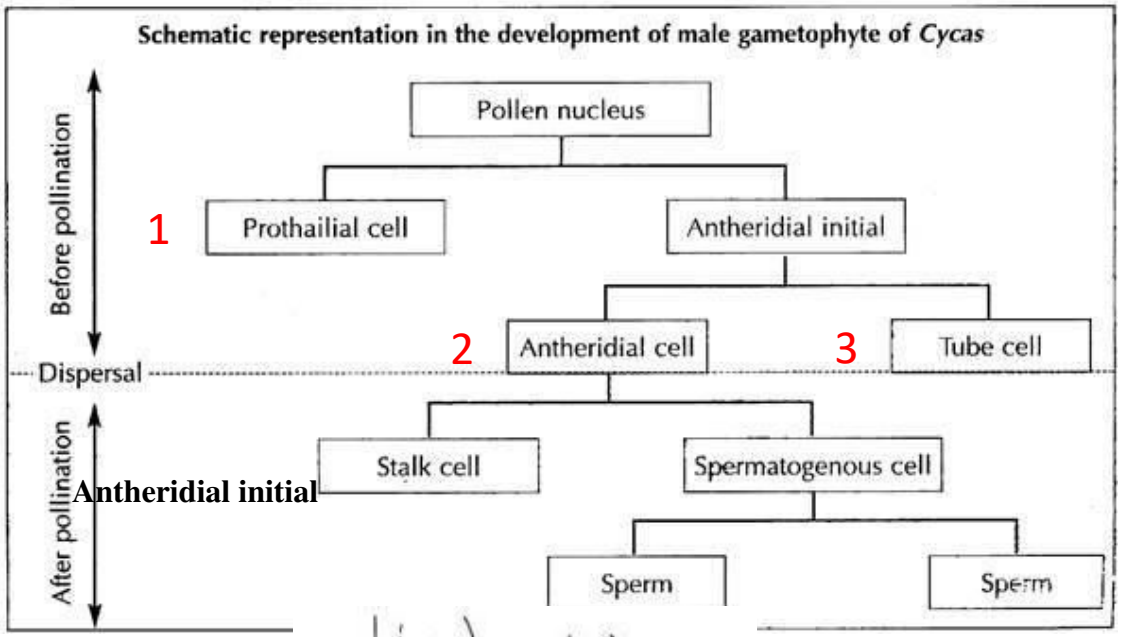


- Development of sporangia is eusporangiate type.
- Microsporangia is multilayered structured layer with a thickened epidermis and a ill-defined tapetum enclosing numerous microspore (pollen) mother cells.
- The microspore undergoes meitic division to form **four microspores** or **pollen grains**.
- Each pollen grain represents as the **male gametophyte** which is bounded by two concen•tric wall layers; the outer thick **exine** and the inner thin **intine**. In side the layer, there is larger antheridial initial and smaller **prothalial cell**.
- This pollen during germination, the prothalial cell does not divide but antheridial initial divide to form **antheridial cell** and **tube cell**.
- The pollen grains are released further from the microsporangium at 3-celled stage (prothalial cell, antheridial cell and tube cell).



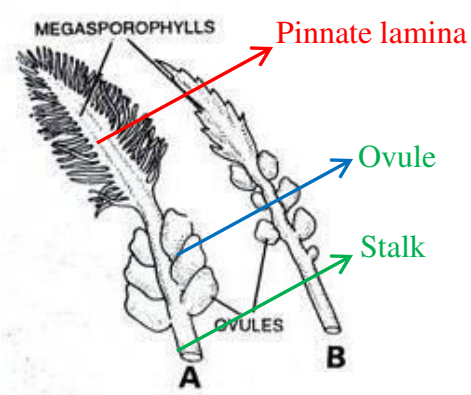
Matured gametophyte

Released from sprorangium and set on ovule through wind for pollination



Ready for pollination

Megasporogenesis (Development of megaspore)



Structure of Megasporophyll

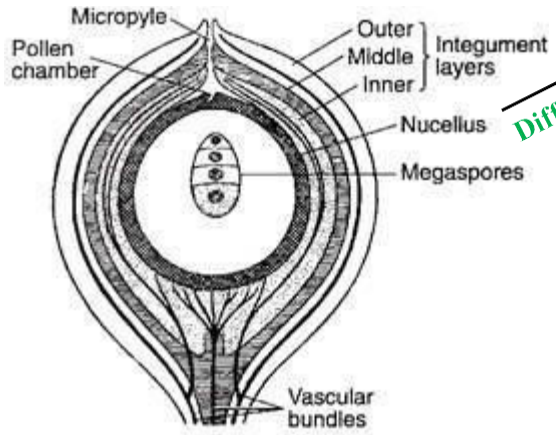
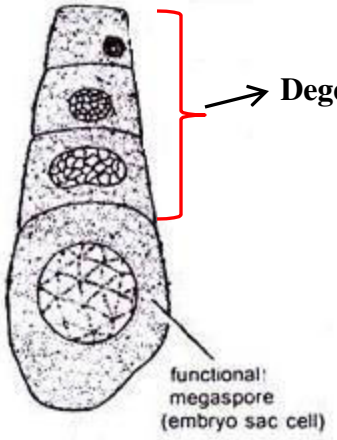


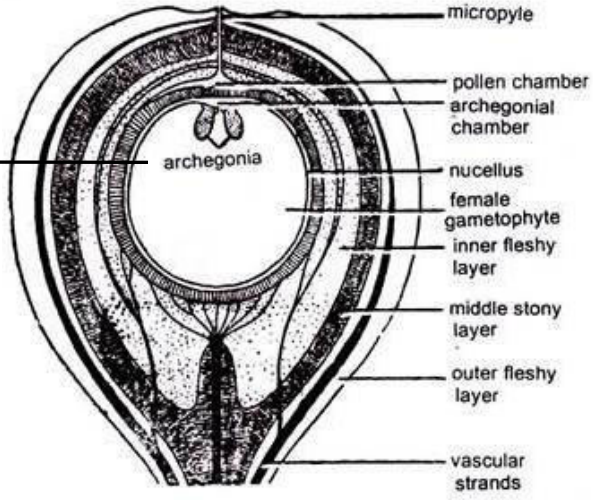
Fig. 1.19 : Vertical median section of *Cycas* ovule

Differentiated into

spore mother cell

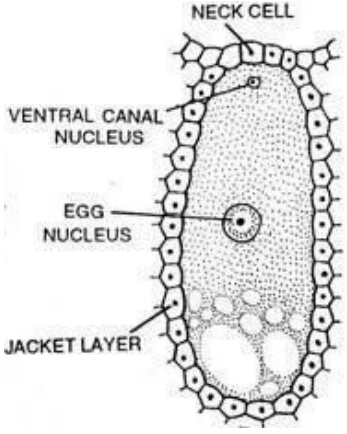


Degenerate

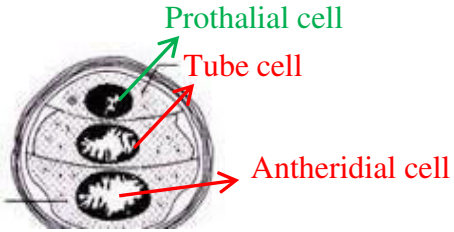


Matured gametophyte (Endosperm)

Develops into matured Archegonia



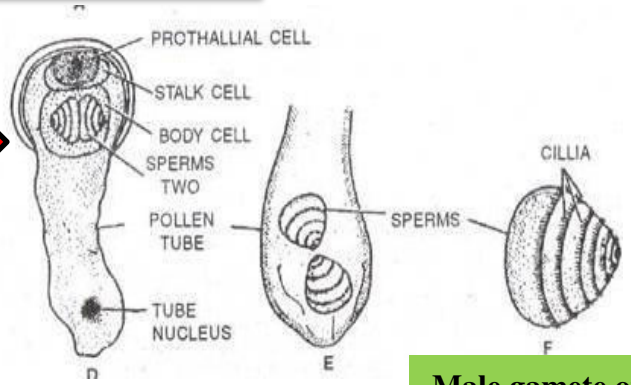
Pollination and Fertilization



Matured gametophyte

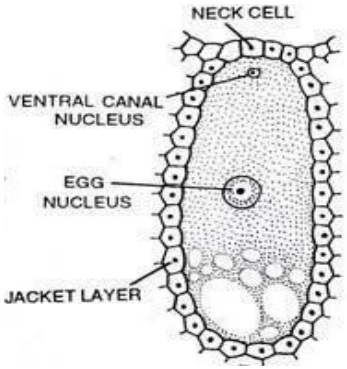
Moved to pollen chamber of ovule through air and transformed into **body cell, stalk cell and two sperms.**

Wind pollination



Male gamete of Cycas

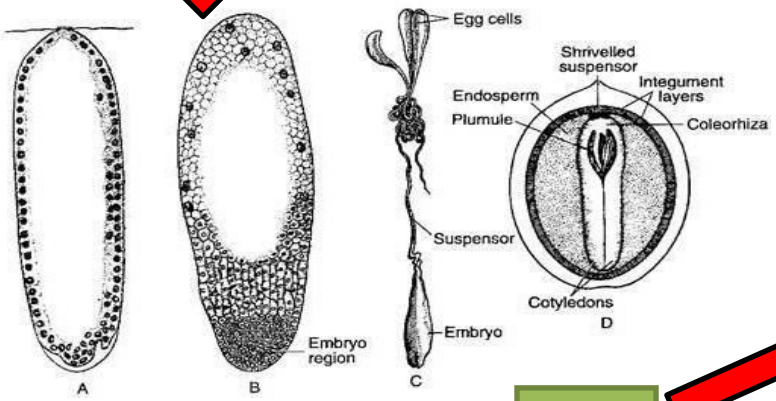
FERTILIZATION



ZYGOTE

Numerous divisions

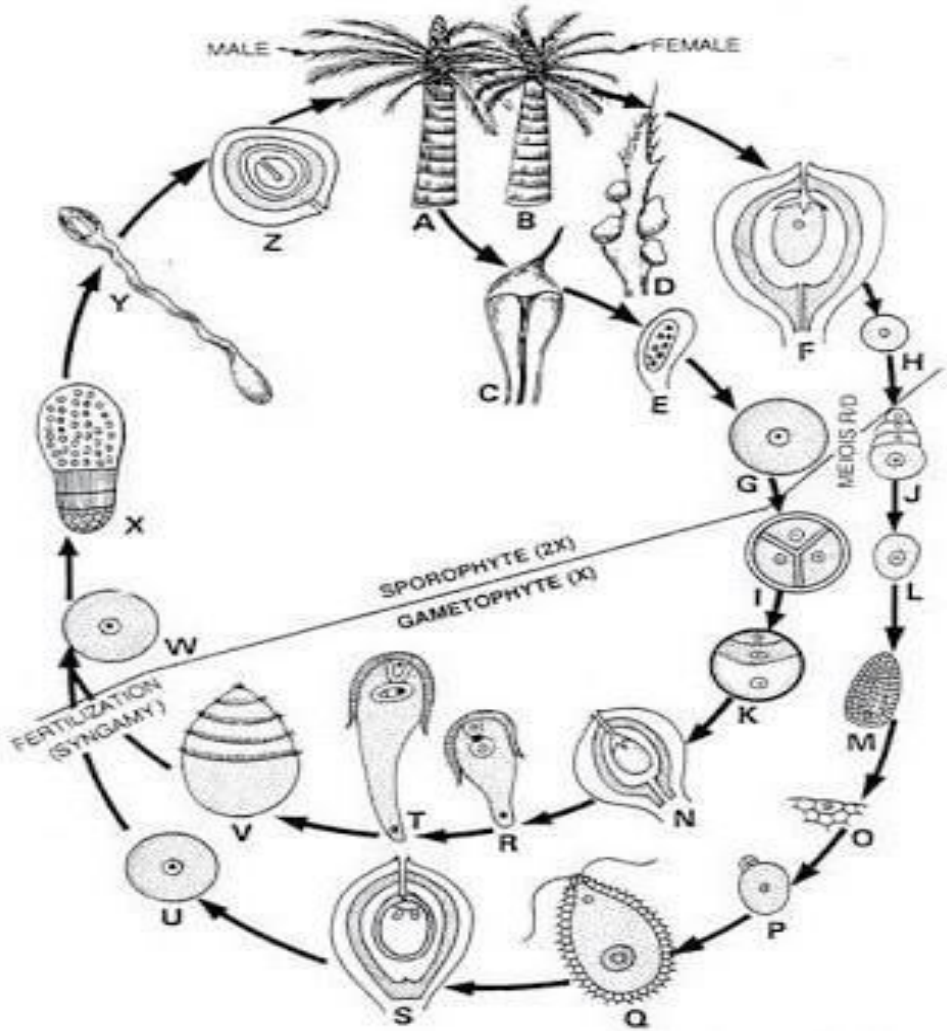
EMBRYO



SEED

NEW SPOROPHYTIC CYCAS PLANT

Alternation of generation in Cycas



Economic importance of Cycas

- **Cycas is used as a source of food in Japan, Australia, South East Asia, southern and eastern parts of India and some other countries. It is used in the preparation of starch and alcoholic drinks. The starch, extracted from its stem, is called 'sago'.**

- **The juice obtained from young leaves of Cycas circinalis is used in skin diseases, vomiting of blood and stomach disorders.**

- **The decoction of young red seeds of C. circinalis is used as a purgative and emetic.**

- **To relieve the headache, giddiness and sore throat, the seeds of Cycas revoluta are prepared in the form of a tincture and used.**

- **In Japan, seeds and stem of Cycas revoluta are used for preparing wine.**

- **Cycas revoluta and C. circinalis plants are grown for ornamental purposes in various parts of the world.**

- **The wood of Cycas revoluta is used for preparing small boxes and dishes.**

- **Cycas leaves, being very large, are used for preparing baskets, mats, etc.**

- **Cycas circinalis seeds are used in Democratic Kampuchea as a fish-poison.**

Thank-You

Photosynthesis

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Contents

Definition of photosynthesis

- Is the process by which autotrophic organism use light energy to make sugar and oxygen gas from carbon dioxide and water .during the process of photosynthesis ,the light energy is converted into chemical energy and is stored in the organic matter which is usually the carbohydrate and along with oxygen form the and products of photosynthesis.

Significance of photosynthesis

- It maintains equilibrium of oxygen in the atmosphere.
- It provides food either directly as vegetable ,or indirectly as meat or milk of animals which in turn are fed on plants.
- Besides providing energy in the form of food,photosynthesis has also provided vast reserves of energy to as man fuel such as coal ,oil peat and also wood and dung

Photosynthesis apparatus

- Photosynthesis occur in chloroplast,organelles in certain plants.
- All green plants parts have chloroplast and carry out photosynthesis .
- The leaves have the most chloroplasts.
- The green colour comes from chlorophyll n the chloroplasts.the pigment absorb light energy.

Site of photosynthesis

- Plant cell have a green chloroplast .
- A chloroplast contains (a)stroma ,a fluid, (b)grana ,stacks of thylakoids .
- The thylakoid contains chlorophyll.
- Photosynthesis pigments are three types – (1)chlorophyll(2) carotenoids (3)phycobilin.

Process of photosynthesis

- Photosynthesis consists of two process
- (1)Light reaction-occur in grana-during in the light reaction .there are routes for electron flow.(a)cyclic electron flow (b)non-cyclic electron flow.
- (2)The calvin cycle-occur in the stroma .forms sugar from carbondioxide ,using ATP for energy and NADH for reducing power.

factor affecting photosynthesis

- Light intensity –High intensity light cause the rate of photosynthesis to increase. The rate will increase until it reaches its saturation point. At the saturation point ,the rate of photosynthesis remains constant.
- Temperature- As the temperature increase, so does the rate of photosynthesis.
- Water-A shortage of water can slow or even stop photosynthesis.

conclusion

- Plants are only things on earth that turn sunlight into food. They do it through a process called photosynthesis.
- it is only known method of manufacture of organic food from inorganic raw materials.Production of oxygen which is the sole of man s livelihood is also by his photosynthesis.