



# **WB - PSC**

**Pre & Mains**

**WEST BENGAL PUBLIC SERVICE COMMISSION**

**Paper 4 – Volume 1**

Science



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# Diversity "in the living" World

300 Lac (30 million)  
living organisms exist on earth

17-18 Lac (1.7 - 1.8 million)  
Described / known living organisms

1.2 million  
animals

0.8 million  
plants

Occurance of different types and different no. of living organism existing on earth is called Biodiversity

Max. Biodiversity - In tropical rainforest

In India = N-E states

Andaman and Nicobar islands

Second max. biodiversity - Coral reefs - Rocks of  $\text{CaCO}_3$   
in ocean

Taxonomy :-

Study of principles and procedures of classification or systematic arrangement of organisms.

'Taxonomy' term was proposed by A.P. de Candolle.

Book - Theories elementaire de La Botanique.

(Theory of elementary Botany)

Taxon

(Pl. taxa). Any plant group/animal group present at a particular taxonomic category is known as a taxon.  
Each rank represents a taxon.

	Mango	Wheat	Housefly	Man
Kingdom	Plantae	Plantae	Animalia	Animalia
Division	Angiospermae	Angiospermae	Arthropoda	Chordata
Class	Dicotyledonae	Monocotyledonae	Insecta	Mammalia
Order	Sapindales	Poales	Diptera	Primata
Family	Anacardiaceae	Poaceae	Muscidae	Hominidae
Genus	Mangifera	Triticum	Musca	Homo
Species	<u>Mangifera indica</u>	<u>Triticum aestivum</u>	<u>Musca domestica</u>	<u>Homo sapien</u>

Suffix for taxa :- (ICBN)

K	No suffix
D	<u>phyta</u>
C	<u>phyceae</u> , <u>ae</u> , <u>opsida</u>
O	<u>ales</u>
F	<u>aceae</u>
G	No suffix
S	No suffix

# Monera

- Bacteria - sole member of monera.

## General Characters:-

- Cell wall - Peptidoglycan / Murein

Amino acid + Polysaccharide

Peptidoglycan is a type of mucopeptide.

Sugars -

Amino Sugar

1. Glucose

\* 1. NAM - N, acetyl muramic acid

2. Galactose

\* 2. NAG - N, acetyl glucosé amine

3. Mannose

Other acids -

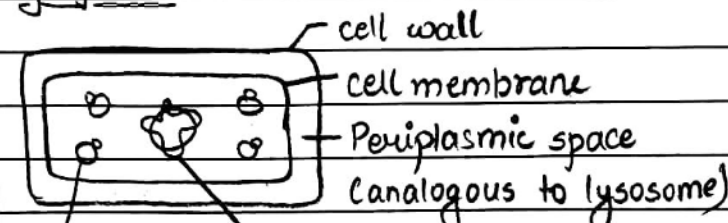
1. Diaminopimelic acid.

2. Muramic acid.

\* 3. Teichoic acid.

- Cell membrane - composed of  $\frac{1}{2}$  Lipoprotein  
(lipids + proteins)

- Cytoplasm -



70-S

Ribosome

DNA

ds, circular

Naked

G  $\equiv$  C rich

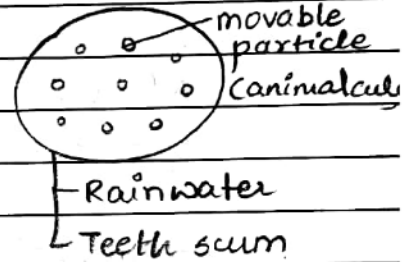
Histone absent

Non-histones (polyamines)

- Lacks membrane bound organelles.
- Nuclear membrane and nucleolus - absent.
- Incipient nucleus / Genophore / Nucleoid / Fibrillar nucleus.
- True chromosomes absent. false chromosome or prochromosome present.

### EUBACTERIA :-

- Most abundant microorganism.
- Found everywhere.
- Firstly observed by Leewenhoek.
- F.J. Cohn and Ehrenberg coined the term 'Bacteria'.
- Bergey - Proposed bacterial classification  
 Group: Prokaryota  
 Book: Manual of determinative bacteriology.  
 Bible of bacterial classification.



### Shapes of bacteria -

1. Coccus / Cocci -

Spherical, smallest, most resistance.

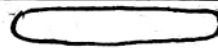


Eg - Micrococcus

2. Bacillus / Bacilli -

Rod shaped.

Eg - E. coli



3. Spirillum / Spirilli -

Spiral shaped

Eg - Spirillum volutans



4. Vibrio

Comma shaped.

Eg - Vibrio cholerae



## BLUE GREEN ALGAE:-

According to two kingdom = BGA placed in plantae  
(myxophyceae/cyanophyceae/  
cyanophyta)

According to 5 kingdom = Monera

Because of prokaryote character

According to ICNB = BGA → cyanobacteria.

- Photosynthetic Prokaryotes.
- First organisms to evolve  $O_2$  on earth.
- Oxygenic photosynthesis.

H-donor =  $H_2O$ ,  $O_2 \uparrow$

- Membraneous extension = Chromatophore

(= photosynthetic structure)

Associated with photosynthetic pigments

- Pigments:

Chlorophyll a - Green. (similar to green plant)

Carotenoids - Yellow.

Phycobillins - [ C-phycoyanin - Blue.  
C-phycoerythrin - Red.

BGA are not always blue green in colour.

Trichodesmium = Red coloured BGA

(Responsible for red colour of Red Sea.)

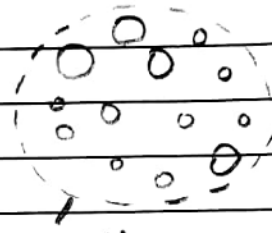
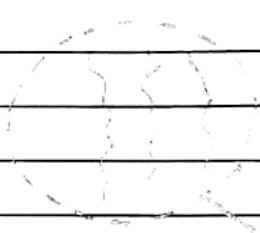
### Forms of BGA

#### 1. Unicellular BGA - Spirulina

- Edible BGA
- Highly rich in protein
- Artificially grown in water tanks
- Fodder for cattles.



## 2. Colonial BGA



multicellular sheath

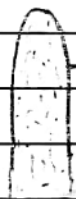
Filamentous Colony

Eg: Anabena

Non-Filamentous Colony

Eg: Microcystis

## 3. Filamentous BGA



Filament of BGA



Trichome

Eg:- Oscillatoria

◦ It can survive in hot water springs ( $\approx 80^{\circ}\text{C}$ )

◦ Protein  $\approx$  Protein

↳ Homopolar Bond (can tolerate high temperature)

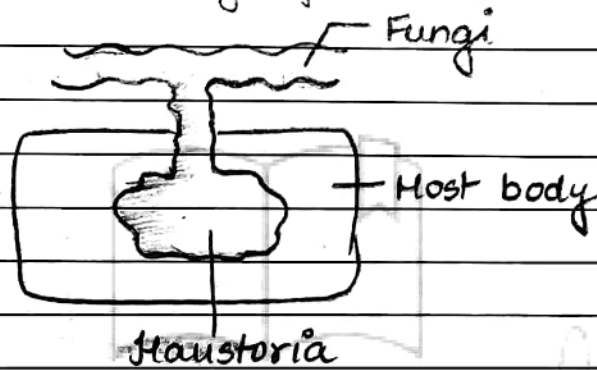
Eg:- Nostoc

Division	Pyrophyta	Chrysophyta	Euglenophyta	Myxomycota
2. Habitat	Marine	Marine/Fresh	FW, SW, BW, damp soil	dead organic matter
3. Cell wall	Cellulose	Cellulose + Silica	Absent	V.P → absent, RP → spore
4. Cell membrane	Lipoprotein	Lipoprotein	Lipoprotein	Lipoprotein
5. Nutrition	Holophytic	Holophytic	Mixotrophic	Phagotrophic → saprophytic
6. Pigments	chlorophyll a chlorophyll b & c xanthophyll - dino, di- -dinoranthin	chlorophyll a chlorophyll b & c xanthophyll - fucoxanthin	chlorophyll a chlorophyll b xanthophyll - zeaxanthin	No pigments
7. Motility	Motile, 2 equal & functional flagella Transverse & longitudinal special movement - whirling whips	Non-motile floats due to low molecular weight of fats	Motile, unequal shorter longer ↓ non-functional functional	Non-motile
8. Stored food	Starch	leucosin + fat	Paramylum + fat (unusable)	Glycogen
9. Nucleus	Haploid	diatoms - diploid dinoflagellates - haploids	Haploid	Diploid
10. Asexual repro.	Binary fission	Binary fission	longitudinal B.F	Fragmentation/spore formation
11. Sexual repro.	Haplontic zygotic meiosis	Diplontic gametic meiosis	Absent	Absent

# Fungi

- Multicellular Eukaryotes.
- Diversity in morphology and habitat.
- Heterotrophic mode of nutrition. (= absorptive)

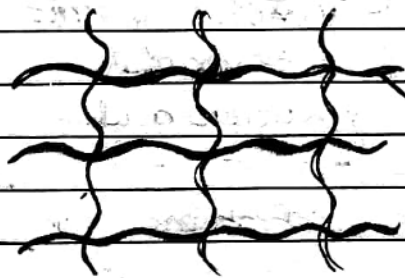
dead organic matter - saprophyte  
living - parasite.



(Knob like structure helps in absorption)

Body of fungi

Mycelium - Network of fungal filaments.



Hypa (sl.)

Hyphae (Pl.)

- Cell wall = chitin + polysaccharide

↳ Fungal cellulose

Exception - oomycetes. cell wall of glucos cellulose

	Phycomycetes	Ascomycetes	Basidiomycetes	Deuteromyces
Habitat	DOM, living	DOM, living	DOM, Living, Epixylic	DOM, living
Mycelium	Multinucleated aseptate.	Uninucleated septate, branched	uni/binucl. septate, branched	uni/multi nud septate,
Asexual Repro.	Sporangiospore Conidiospore	Conidiospore	absent	Conidio <sup>bran</sup> -spores
Sexual Repro.	Zoomeiospores Meiospores	Ascospore	Basidiospore	absent
Fruiting body.	absent	Ascocarp	Basidiocarp	absent
Dikaryo phase	absent	present	present	absent
Special points	Cell wall of oomycetes is cellulosic	Yeast is unicellular, non-mycelial	Dolipore septum, clamp connection, dikaryotisation	Dustbin of mycota, Formed class
Example	Oomycetes:- 1. <u>Phytophthora infestans</u> 2. <u>Albugo candida</u> 3. <u>Pythium</u>	1. <u>Aspergillus</u> 2. <u>Penicillium</u> 3. <u>Erysiphae</u> 4. <u>Periza</u> 5. <u>Morchella</u> 6. <u>Claviceps</u> 7. <u>Neurospora</u>	1. <u>Polyporus</u> 2. <u>Clavaria</u> 3. <u>Agaricus bisporum</u> 4. <u>Amanita muscaria</u> 5. <u>Ustilago</u>	1. <u>Colletrichum falactur</u> 2. <u>Alternaria solani</u> 3. <u>Trichoderma</u> 4. <u>Helmintho-sporium oryzae</u>

# Gymnosperm

- Seed bearing plant.

Gymno + angio = spermatophytes

- mature ovule is seed (ovule with embryo)
- Ovary absent.
- Fruit absent.
- Naked ovules.

- Plant body differentiated into

Root	Stem	Leaf
(Tap root)	unbranched - cycas branched - pinus	simple / compound

- In cycas, specialised roots called coralloid roots are symbiotically associated with Nostoc and Anabaena perform  $N_2$  fixation.
- In pinus, mycorrhizal association.
- Mainly found in colder areas in India on slopes of Himalyas.
- Water deficient conditions - xerophytes  
Adaptation to reduce water loss -
  1. Needle shaped leaves.
  2. Presence of thick cuticle.
  3. Presence of sunken stomata.
- Mostly small or tall trees .i.e, arborescent (woody nature)  
Shrub - Ephedra  
woody climbers - (Lianas) - Gnetum
- Presence of vascular tissues  
Xylem - vessels absent  
phloem - companion cells absent  
Albuminous cells analogous to companion cells.

Exception :- True vessels present

1. Gnetum

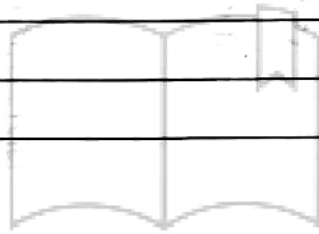
2. Ephedra

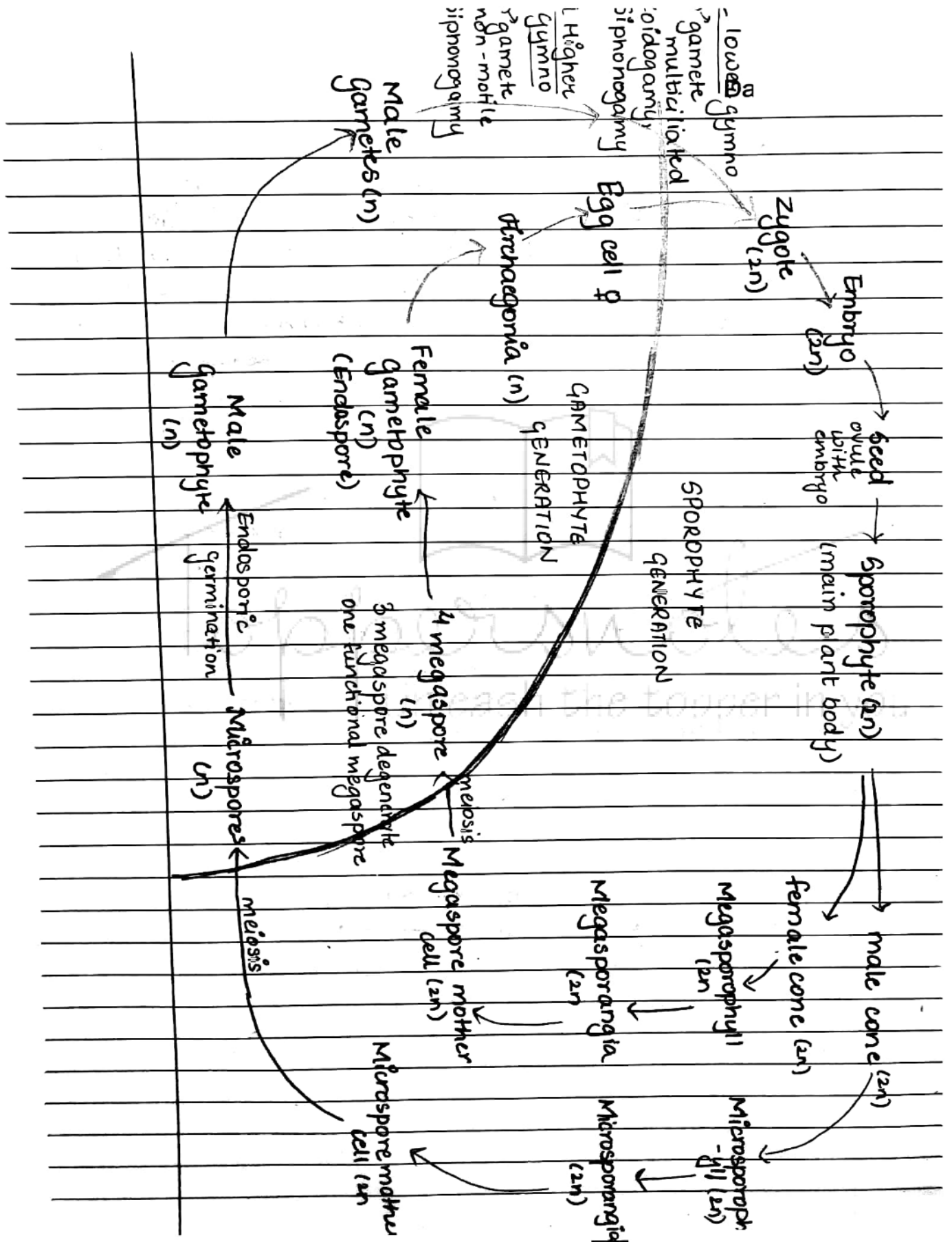
3. Welwitschia

} belongs to order Gnetales

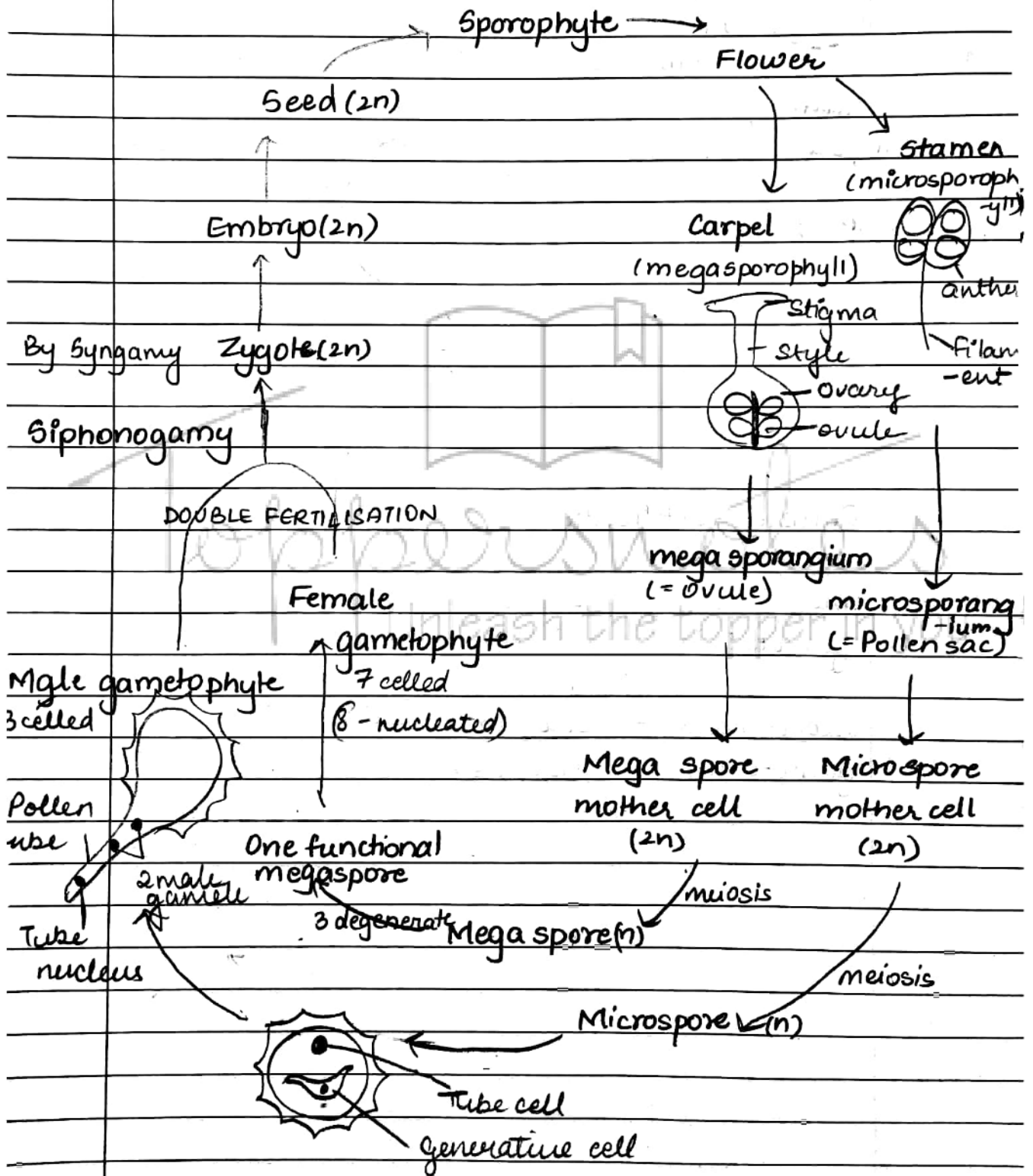
(most advanced order)

- Gymnosperms exhibit secondary growth.
- All gymnosperms are heterosporous.
- Pinus - Monoecious
- Cycas - Dioecious





# Angiosperm





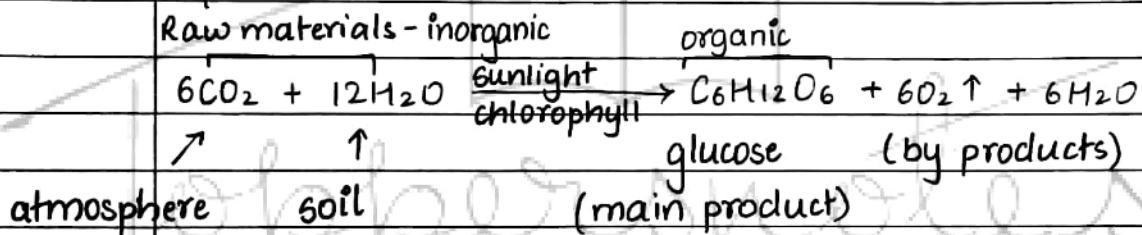
# Plant Physiology

## Photosynthesis

Photo → Light  
 Synthesis → to make

Sun → photons → plant → food → All other organism  
 (Energy)            (chlorophyll)

Equation:-



Light energy → chemical energy

Physicochemical process

Photobiochemical process

Endergonic process

Anabolic process

Glucose polymerise to form starch.

Redox process

Reduction

Oxidation

• Addition of  $\text{H}/\text{e}^-$

• Removal of  $\text{H}/\text{e}^-$

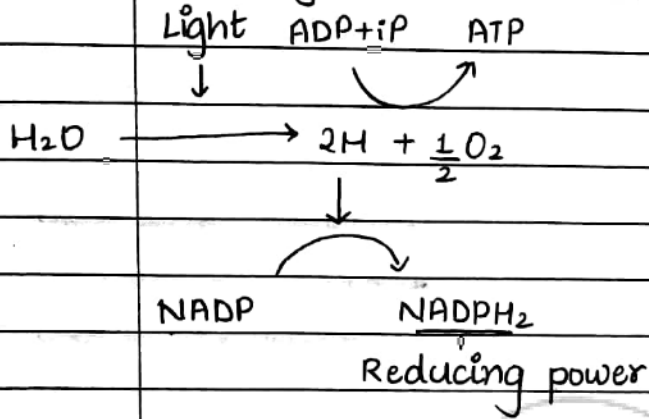
## Photosynthesis

**Light reaction :-**

Direct role of light

Dark reaction /

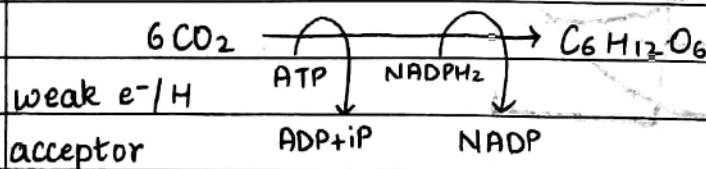
Biosynthetic phase



- Light reaction involves absorption of light by chlorophyll a and breakdown of water (photolysis)
- Main product of light reaction = NADPH<sub>2</sub> (reducing power) + (ADP + iP) ⇒ ATP
- $$\text{ATP} + \text{NADPH}_2 = \text{Assimilatory power}$$
- Phosphorylation = Addition of phosphate
- $$\text{ADP} + \text{iP} \xrightarrow{\text{photophosphorylation}} \text{ATP}$$

Addition of phosphate in the presence of light is called photophosphorylation.
- In light reaction, oxidation of water (removal of H) takes place.

**Dark reaction :-**



- Product of light reaction is required for dark reaction.
- Dark reaction is indirectly dependent on light.