



SSC - CGL

←—————→
COMBINED GRADUATE LEVEL

STAFF SELECTION COMMISSION

VOLUME – III

General 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 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 | Monocotylodonae | Insecta | Mammalia |
| Order | Sapindales | Poales | Diptera | Primata |
| Family | Anacardiaceae | Poaceae | Muscidae | Homonidae |
| 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 -

1. Glucose
2. Galactose
3. Mannose

Amino Sugar

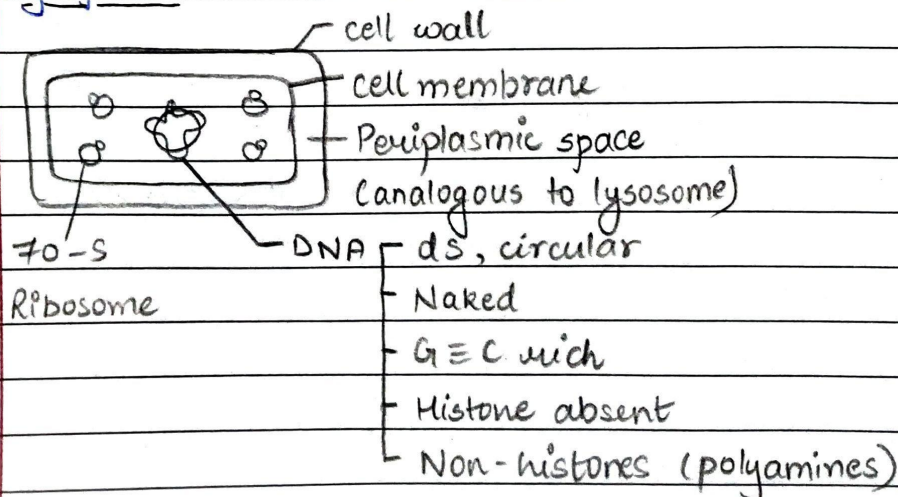
- * 1. NAM - N, acetyl muramic acid
- * 2. NAG - N, acetyl glucose amine

Other acids -

1. Diaminopimelic acid.
2. Muramic acid.
- * 3. Teichoic acid.

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

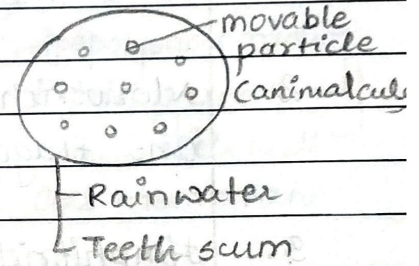
- Cytoplasm -



- 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. Eohn and Ehrenberg coined the term 'Bacteria'.
- Bergey - Proposed bacterial classification
 - Group: Protophyta
 - 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.

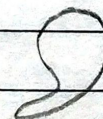
Eg - Spirillum volutans



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 plants)

Carotenoids - Yellow.

Phycobillins - [C-phycocyanin - Blue.

C-phycoerythrin - Red.

BGA are not always blue green in colour.

Trichodesmium = Red coloured BGA

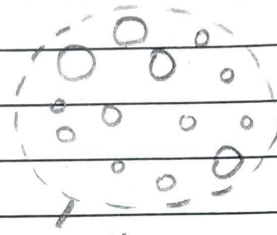
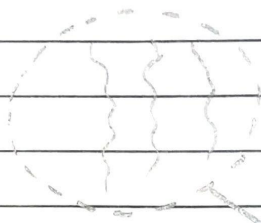
(Responsible for red colour of Red Sea.)

Forms of BGA

1. Unicellular BGA - Spirulina

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

2. Colonial BGA



mucilaginous 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

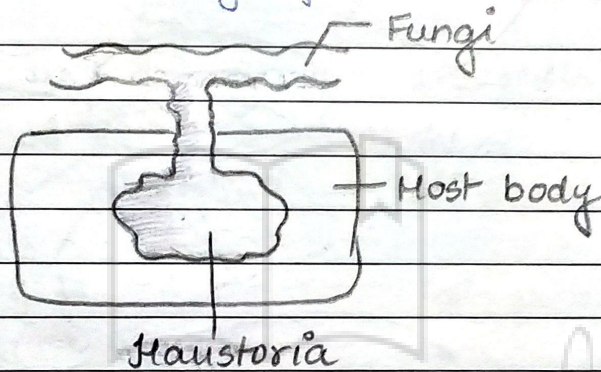
↳ Homopolar Bond (can tolerate high temperature)

Eg:- Nostoc

| Division | Pyrophyta | Chrysophyta | Euglenophyta | Myxomycota |
|--------------------|---|---|---|------------------------------------|
| 2. Habitat | Marine | Marine/Fresh | FW, BW, 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 → sapro-phytic |
| 6. Pigments | chlorophyll a chlorophyll b c xanthophyll - dino, di- -dinoxanthin | chlorophyll a chlorophyll b c xanthophyll - fucoxanthin | chlorophyll a chlorophyll b xanthophyll - zeaxanthin | No pigments |
| 7. Mobility | Motile, 2 equal & functional flagella Transverse & longitudinal special movement - whirling whirls | Non - motile floats due to low molecular weight of Fats | Motile, unequal shorter longer non - functional functional | Non - motile |
| 8. stored food | Starch | leucosin + fats | Paramylum + fats (Haploids) | Glycogen |
| 9. Nucleus | Haploid | diatoms - diploid dinoflagellates - diploid | 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

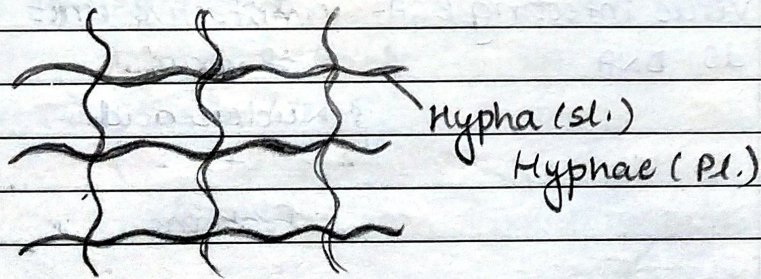
- Multicellular Eukaryotes.
- Diversity in morphology and habitat.
- Heterotrophic mode of nutrition. (= absorptive)
 - dead organic matter - saprophyte
 - living - parasite.



(Knob like structure helps in absorption)

Body of fungi

Mycelium - Network of fungal filaments.



- Cell wall = chitin + polysaccharide
 - ↳ Fungal cellulose

Exception - oomycetes. cell wall of ~~glucan~~ cellulose

| | Phycomycetes | Trichomycetes | Basidiomycetes | Deuteromycetes |
|----------------|--|---|--|---|
| Habitat | DOM, living | DOM, living | DOM, Living, Epixylic | DOM, living |
| Mycelium | Multinucleated aseptate. | Uninucleated septate, branched | uni/bi nucl. septate, branched | uni/multi nucl. septate, branched |
| Asexual Repro. | Sporangiospore Conidiospore | Conidiospore | absent | Conidio- ^{branch} -spores |
| Sexual Repro. | Zoospores Meiospores | Ascospore | Basidiospore | absent |
| Fruiting body. | absent | Ascocarp | Basidiocarp | absent |
| Dikaryo phase | absent | present | present | absent |
| Special points | Cell wall of oomycetes is cellulose | 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> 4. <u>Zygomycetes:</u> 1. <u>Rhizopus</u> 2. <u>Mucor</u> 3. <u>Pilobolus</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>Clavatia</u> 3. <u>Agaricus bisporum</u> 4. <u>Amanita muscaria</u> 5. <u>Ustilago</u> | 1. <u>Colletrichum falactum</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

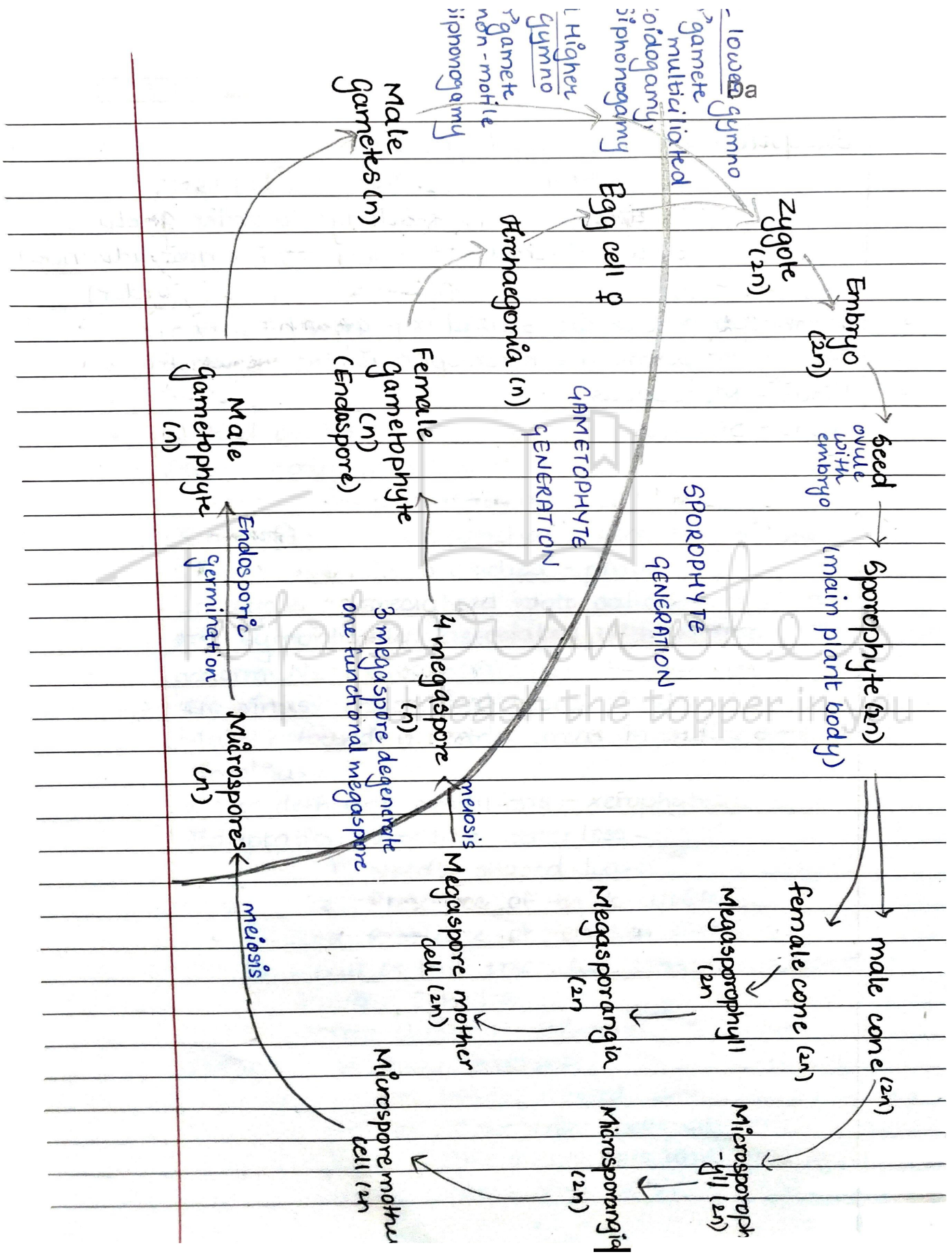
2. Ephedra

3. Welwitschia

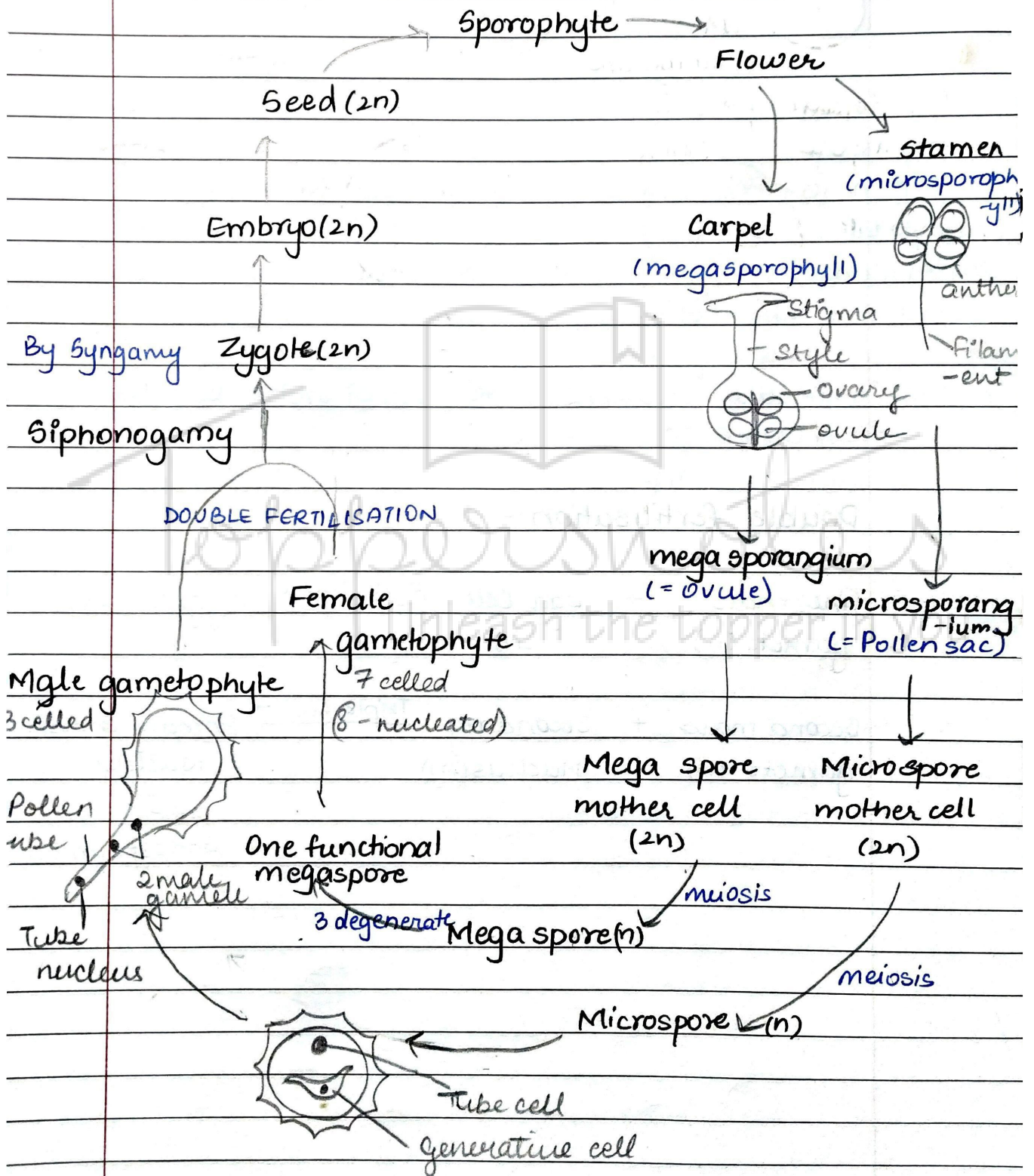
} belongs to order Gnetales

(most advanced order)

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



Angiosperm



Plant Physiology

Photosynthesis

Photo → Light

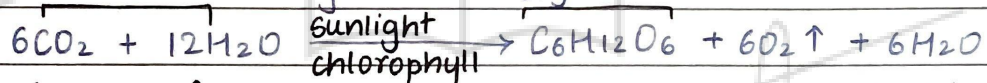
Synthesis → to make

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

Equation:-

Raw materials - inorganic

organic



↑ ↑ glucose (main product) (by products)
 atmosphere soil

Light energy → chemical energy

Physicochemical process

Photobiochemical process

Endergonic process

Anabolic process

Glucose polymerise to form starch.

Redox process

Reduction

Oxidation

◦ Addition of H/e⁻

◦ Removal of H/e⁻

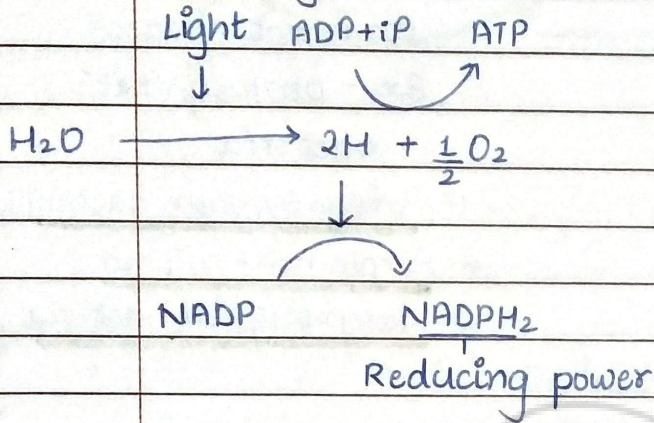
Photosynthesis

Light reaction :-

Direct role of light

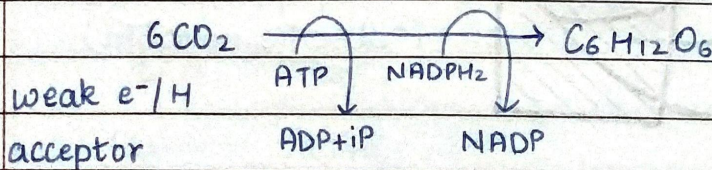
Dark reaction /

Biosynthetic phase



- Light reaction involves absorption of light by chlorophyll a and breakdown of water (photolysis)
- Main product of light reaction = NADPH_2 (reducing power) + $(\text{ADP} + \text{iP}) \Rightarrow \text{ATP}$
 $\text{ATP} + \text{NADPH}_2 = \text{Assimilatory power}$
- 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.