الجامعة المستنصرية

كليـــــــة العلـــــوم

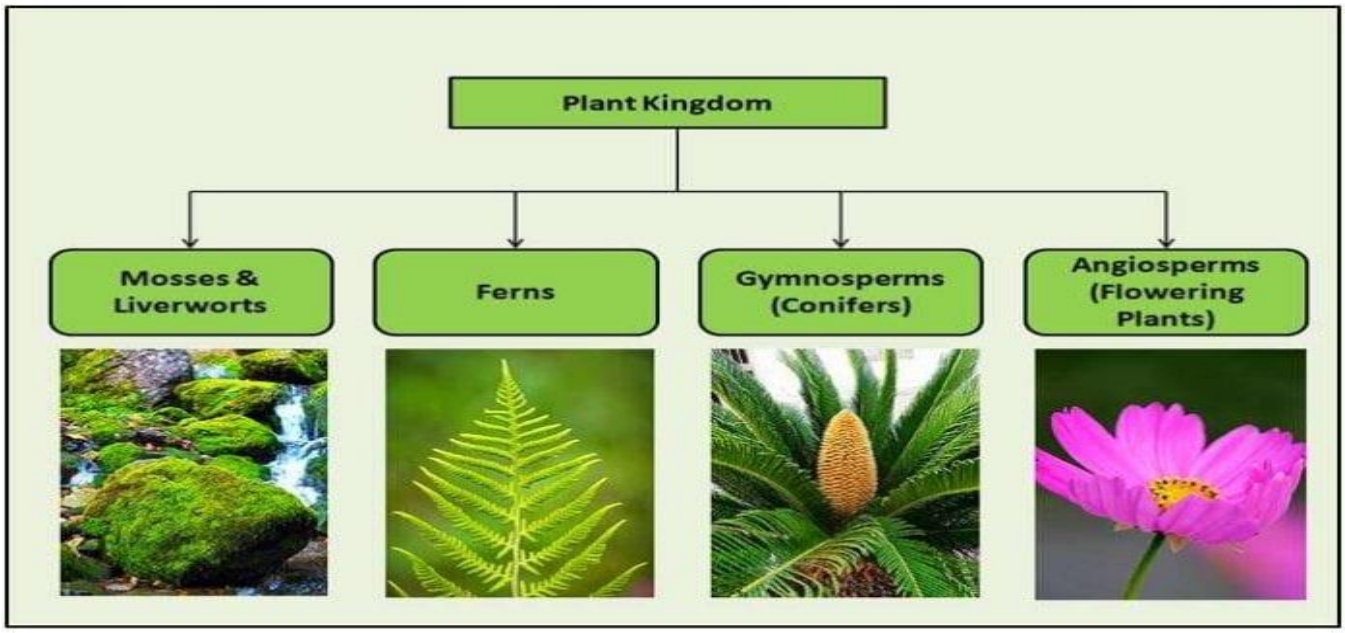
قسم علـــوم الحيـــــاة

مجاميع نباتية

Plant groups…Lab(1)Introduction in Plant groups

Introduction

Plants are multicellular Eukaryotes, that consider primary producers in the food chain. All the members of the plant kingdom can make their own food by utilizing sunlight, carbon dioxide, and water. They have photosynthetic pigments such as **chlorophyll a, b**, and carotenoid pigments. This process is known as **photosynthesis.** Only plants can make their food. **All other living organisms are dependent on plants to derive food and energy.**



Kingdom Plantae was first separated from heterotrophic fungi and unicellular prokaryotic cyanobacteria by **Whittaker in 1969** while proposing a five-kingdom classification system. According to this classification, all the known living organisms on the earth were divided into five categories:

1. **Kingdom Monera**
2. **Kingdom Protista**
3. **Kingdom Fungi**
4. **Kingdom Animalia**
5. **Kingdom Plantae**

Classification of Kingdom Plantae

There are **270,000** species of plants identified and classified to date. A.W. Eichler (1883) gave a system of classification of the plant kingdom. It is the phylogenetic system of classification. He divided plants **according to the presence of specialized tissues that transfer water and nutrients in plants**. Into two sub-kingdoms, **Cryptogams** and **Phanerogams**.

1- Non-Vascular Plant (Cryptogams): These plants **lack composed vascular tissue**, which is one of their characteristics. **The root, stem, and leaves, as well as from wood and bark, and reproduces by spores.**

a. Thallophyta

b. Bryophyta (**Mosses**)

2- Vascular Plant (Phanerogams): These plants **have actual vascular tissue made of Xylem and phloem** as one of their distinguishing characteristics. They also have **leaves, roots, and stems that reproduce by seeds and spores.**

The vascular plants are divided into two groups :

a) Seedless

They are plants that reproduce by spores, which are carried on leaves. It is divided into:

Lichens & Pteridophyta (**ferns)**

b) Seedling

They are plants that reproduce by seed .It is divided into:

1. Gymnosperms
2. Angiosperms: divided into Dicotyledonous and monocotyledonous plants

Plant groups…Lab.2: Thallophyta (algae)

Definition: **Algae (singular alga)** are the main microorganisms involved in photosynthesis process and may be defined as simple plants (lacking roots, stems, and leaves) that have chlorophyll type (A) as their primary photosynthetic pigment and lack a sterile covering around the reproductive cells. Algae range in size from microscopic organisms (**micro-algae**) to macroscopic forms which are visible to the naked eye and appear plant-like(**Macro-algae**). Algae most commonly occur in water. However, they have been also found in almost every other environment on earth.

Algae can be distinguishing from plant by the following:

1-they **do not** have root, leaf and stems, but plant **do** have.

2- they **do not** form true embryo, but plant **do** have

3- they **do not** have a vascular system. but plant **do** have

Algal classification: Algae are being distributed in two kingdoms:

1-monera: prokaryotic algae (cyanophyta) are placed in the monera

2-protista: eukaryotic algae (all other algal divisions) are placed in the Protista

Kingdom: Monera

Division: cyanophyta

General characteristics of cyanophyta (blue-green algae):

1- The simplest algae occurring essentially as solitary cells or be aggregated into plate –like or globular colonies. or occurring as filamentous form. Surrounded by thin mucilage layer

2- Contain chlorophyll type A.

3- Contain accessory pigment phycocyanean (this pigment give unique blue-green color for this algal division)

4- Chloroplast is absent

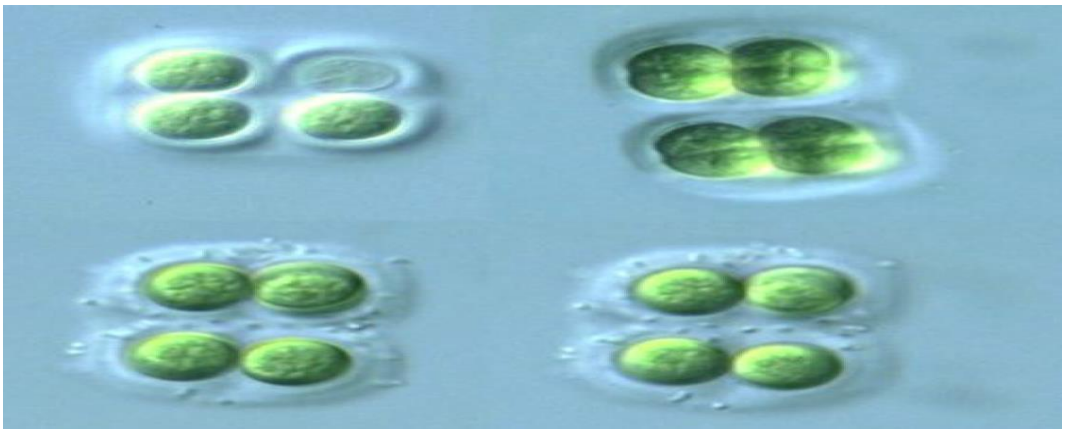
5- Store their food as unique starch compound named as **cyanophycean** starch

6- Cyanophyta **lacking** flagellated stage

7- Sexual reproduction is **absent**.

Genus: ***Gleocapsa***

Clustered cells enclosed in concentric layers of mucilage

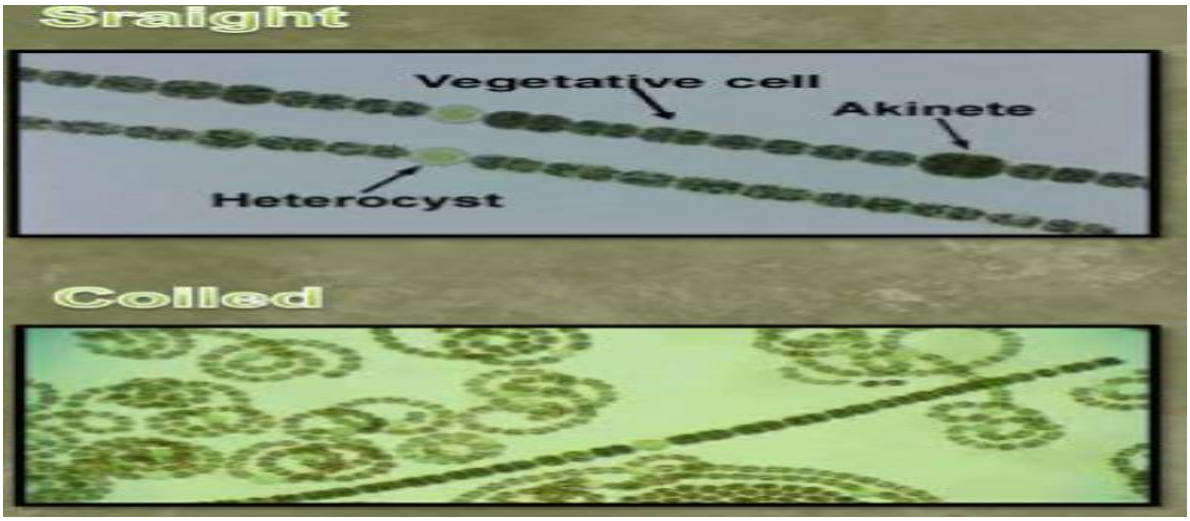


Genus: ***Nostoc*** …….. ***Anabaena***

1-filamentous algae (bead like filaments) covered with mucilaginous

2-possesing specialized vegetative cell with homogenous transparent named

(Heterocyst) responsible for nitrogen fixation.



Kingdom: Protista

Division: chlorophyte

General characteristics of chlorophyte (green algae):

1- Contain chlorophyll type A and B.

2- Chloroplast is present and vary in shape, size and number.

3- Chlorophyta store their food as true starch similar to that in seed plant.

4- Flagellated stages are present

5- Sexual reproduction is present. In addition to asexual and vegetative reproduction.

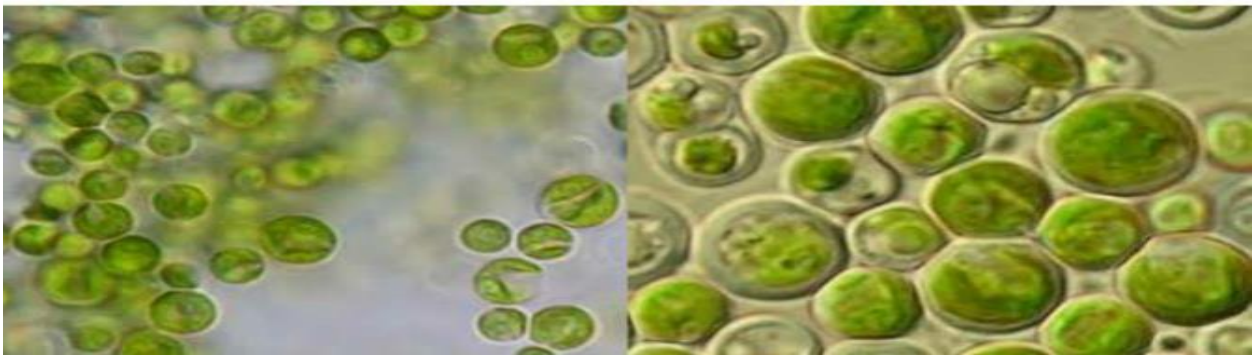
Genus: ***Chlorlla***

1-unicellular alga (spherical shape cells) or present in irregular colonies.

2-cup shape chloroplast

3- Reproduce by simple division

4- Lacks flagella



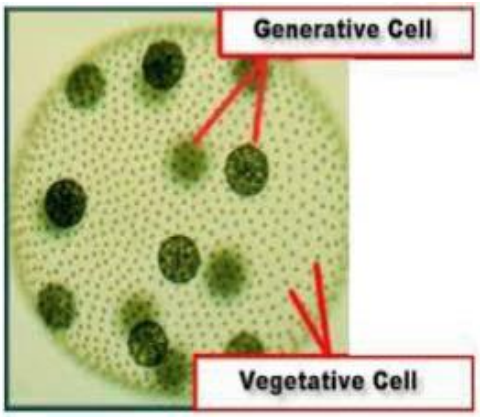
Genus: ***Volvox***

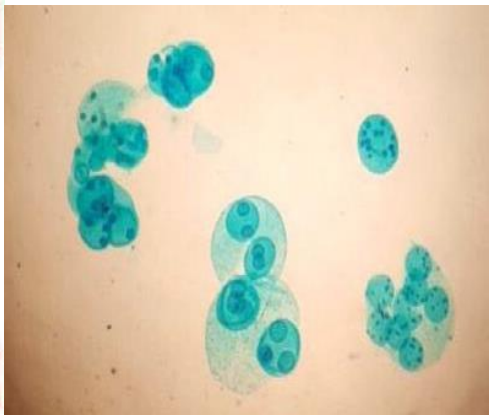
1-spherical colonies with hollow center (hollow ball).

4-there are specialized cells within Volvox colony:

A-somatic (vegetative) cells: (most of colony cells specialized for nutrition ,movement)

B-generative cells: responsible of reproduction





Plant groups…Lab(3): Non-Vascular Plant (Cryptogams)

Kingdom: Protista

Division: phaeophyta

1-Class: isogenerate

Order :Ectocarpales

Genus: ***Ectocarpus***

2-Class: heterogenerate

Order : Laminariales

Genus: ***Laminaria***

3-Class: cyclosporae

Order: Fucales

Genus: ***Fucus***

General characteristics of phaeophyta (Brown algae):

1- Brown algae exist in a wide range of sizes and forms, they are the major seaweeds live in marine environments (Unlike the chlorophyta and cyanophyta which are mainly freshwater). Their forms as **tissue like** or **parenchematous**.

2- Contain chlorophyll type **A** and **C**.

3- Most brown algae contain the pigment **fucoxanthin** (xanthophylls pigments) which is responsible for the distinctive greenish-brown color that gives them their name

4- Store their food as compounds named **Mannitol** and **laminarin**

5- Motile reproductive cells biflagellate .

6- During their life cycles, brown algae alternate between two multicellular forms (**alternation of generation**): the **gametophyte** and the **sporophyte**. The gametophyte develops sexually active reproductive cells, which, when they merge, create the sporophyte. In turn, spores produced by the sporophyte give rise to the gametophyte.

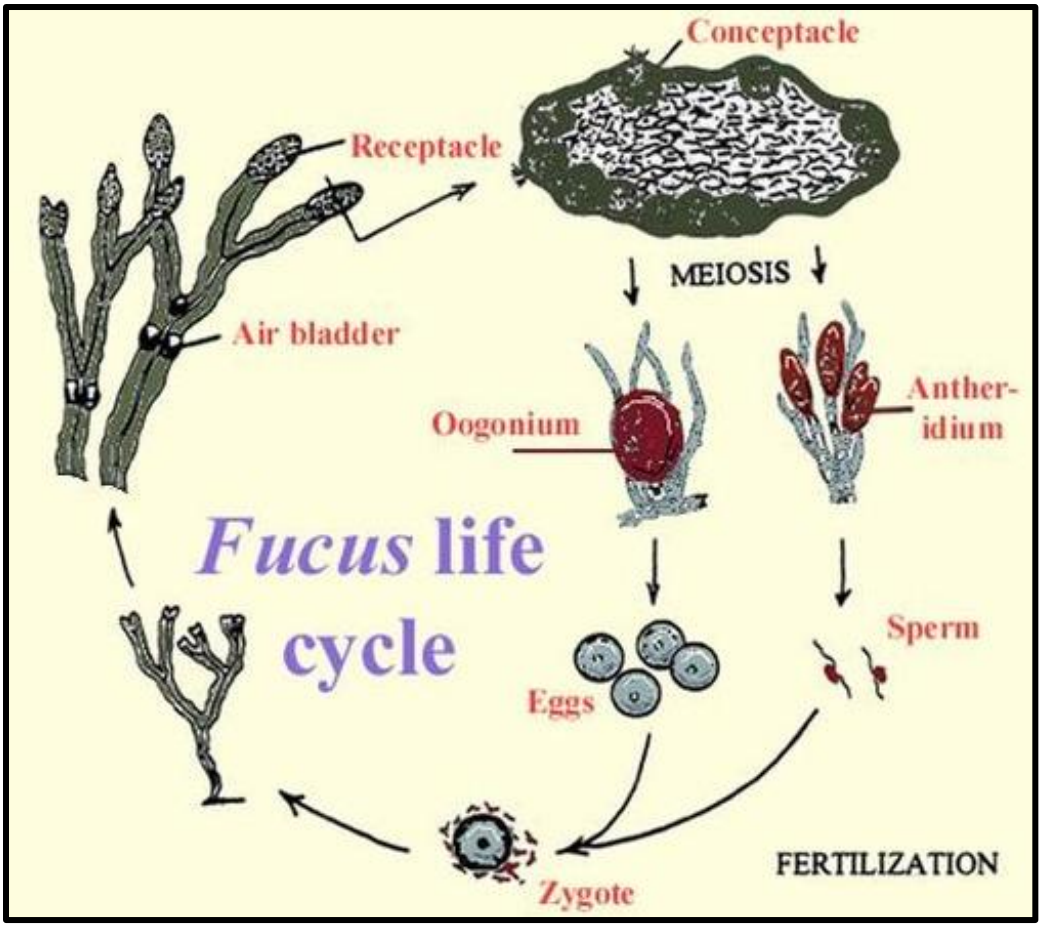


Figure (1): Life cycle of brown algae

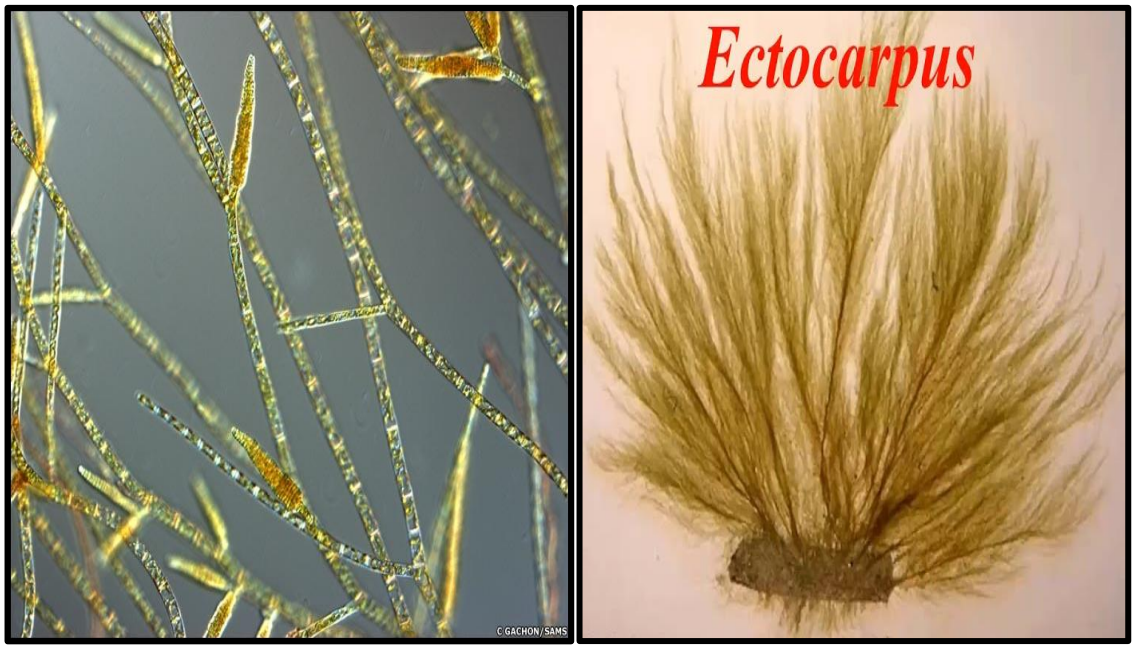
- In **isogenerate,** the two alternating generations **similar** in vegetative structure and size
- In **heterogenerate**, the two alternating generations **different** in vegetative structure and size(sporophyte is macroscopic while gametophyte is microscopic)
- In **cyclosporae**, gametophyte **reduced** into only male and female gametes (antheridia and oogonia) within sporophyte itself.

Essential terms

- **Oogonium** are female gamete mother cells, They produce eggs by oogenesis
- **Antheridium** is the saclike male reproductive organ .The antheridium produces and stores numerous sperm cells.
- **Conceptacle** flask-shaped cavity containing the reproductive organs.
- **Sporangia** is the capsule structure, in which the reproductive spores are produced and stored.

Genus: ***Ectocarpus***

Branched filamentous thalli with bushy structure.



Figure(2): ***Ectocarpus***

Genus: ***Laminaria***

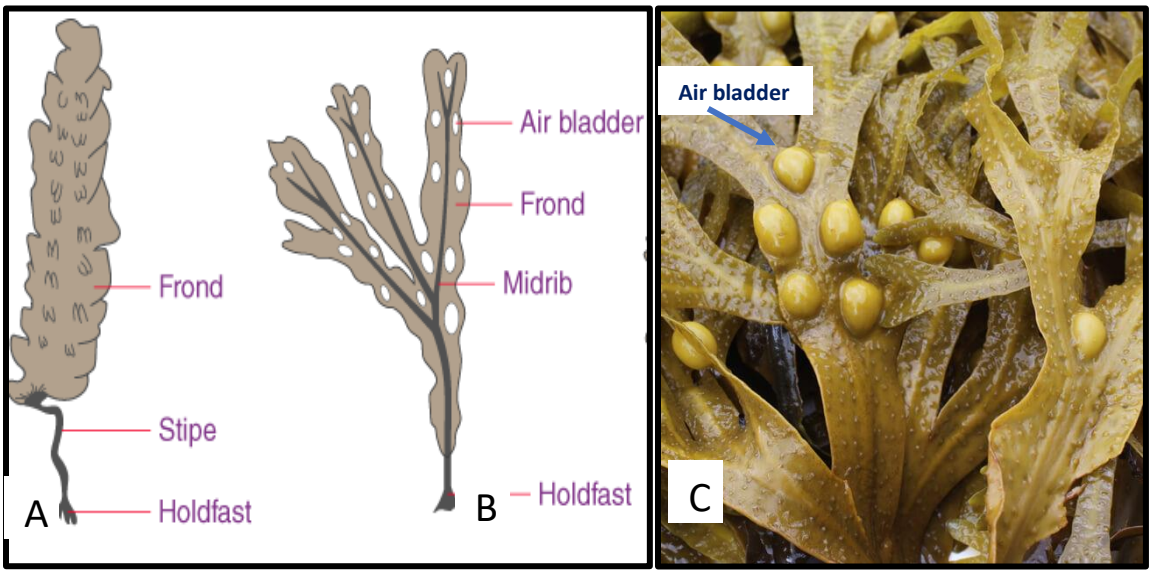
a- The common name of these algae is the **kelps**.
b- It has three distinct multicellular organs: a **holdfast**, that attaches the organism

to a substrate, a **broad flat blade** that carries out the bulk of photosynthesis, and a **stipe (stalk)** that connects the blade to the holdfast .

Genus: ***Fucus***

a- The common name is **rock weed**.

b- The thallus of these algae is **leathery dichotomously branched**, supported by a short narrow stalk that is attached to a disk-shaped holdfasts. The blade is mucilage- covered resist desiccation and temperature changes. And contains **air bladders** (to keep the thallus floating in vertical position when submerged.



Figure(3):A: *Laminaria* ,B: *Fucus*,C: *Fucus* air bladder

Practical section

See under microscope:

- **C.S in *Laminaria* blade shows sporangia.**
- **Whole view of *Ectocarpus*.**
- **Sections in *Ectocarpus* show Oogonium ,antheridium and conceptacle.**

Plant groups…Lab(4): Non-Vascular Plant (Cryptogams)

Kingdom: Protista

Division: Rhodophyta

1-Class: Bangiophyceae

Order : Bangiales

Genus: *Porphyra*

2-Class: Floridiophyceae

Order:ceremeales

Genus: ***Polysiphonia***

General characteristics of Rhodophyta (red algae):

1- unicellular to multicellular (**parenchematous)** mostly in marine water and also in fresh water.

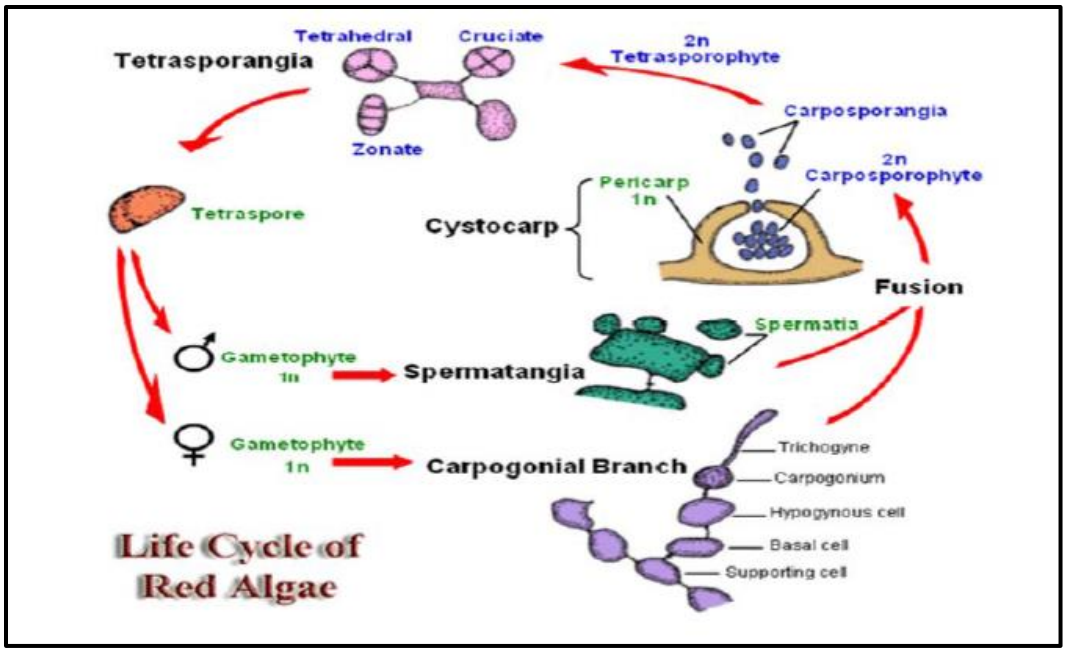
2- Contain chlorophyll type **A** and **D**

3- Most brown algae contain the pigment **phycoerythrin** which is responsible for the distinctive red color that gives them their name

4- Store their food as compounds named **floridean starch**

5- Characteristical for red algae is that **no motile stage occurs**, during the entire life cycle. The spores and gametes are transported by the water in a passive manner.

6- They show **alternation of generations**. In addition to gametophyte generation, many have two sporophyte generations, the **carposporophyte**-producing carpospores, which germinate into **a tetrasporophyte**, which generates spore tetrads, which dissociate and germinate into gametophytes,



Figure(1) life cycle of Rhodophyta

Genus: *Porphyra*

Irregularly lobed and split from central holdfast, and multiple blades grouped together to appear like a rosette.

Figure(2): *Porphyra*

Genus: ***Polysiphonia***

Highly branched filamentous thalli with bushy structure.

Figure(3): *Polysiphonia*

Practical section

See under microscope:

- ***Polysiphonia* sporophyte shows tetrapores**

Lab(5): Non-Vascular Plant(Cryptogams)

Bryophytes

Super kingdom: Eukaryota

Kingdom: Plantae

Division: Bryophyta

1- Class : Hepaticopsida (liver wort)

Order : Marchantiales

Genus : *Riccia*

Genus : *Marchantia*

2- Class : Bryopsida (Mosses)

Order : Bryales

Genus : *Funaria*

3- Class : Anthocerotopsida (Horn worts)

Order : Anthocerotales

Genus : Anthoceros

Bryophytes have the following general characteristics:

1. Plants thrive in moist, shady environments
2. The thallus-like body of the plant can be prostrate or upright
3. Rhizoids, which can be unicellular or multicellular, rhizoids perform the .function of roots, essentially anchoring the plants into the surface.
4. They have a root-like, stem-like, and leaf-like structure, but no genuine vegetative structure.

Figure(1): Bryophytes

Essential terms:

- Antheridia is the male sex organ, and is a haploid structure whose function is to produce male gametes called antherozoids or sperms.
- Archegonia is the female sex organ, which produces female gametes mainly in cryptogams.
- Gemma cup is cup-like structures containing gemmae. The gemmae are small discs of haploid tissue and they directly give rise to new gametophytes. A gemma (plural gemmae) is a single cell or a mass of cells, or a modified bud of tissue, that detaches from the parent and develops into a new individual

.

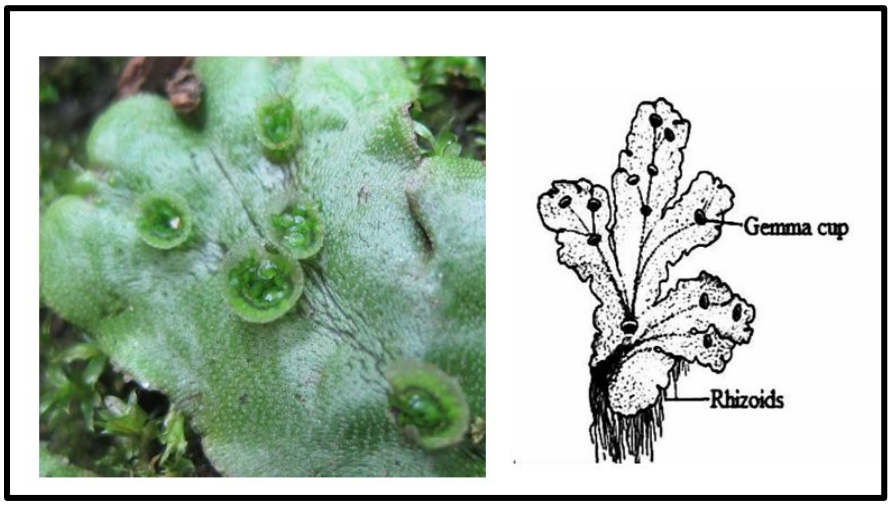
Genus: *Riccia*

The genus Riccia (liverworts) are small thalloid plants that are not differentiated into roots, stems and leaves.

Figure(2): *Riccia*

Genus: *Marchantia*

A thalloid liverwort is strap-like and often forms large colonies on the surface on which it grows. A liverwort is nonvascular green plant.



Figure(3): *Marchantia*

Table: Differences between *Riccia* and *Marchantia*

Riccia	*Marchantia*
Structure	
Riccia is a rosette-like dichotomously branched plant with a prostrate thallus.	Marchantia is dorsiventral, dichotomously branched with a prominent midrib. They have rhizoids and scales at the base to attach to the substratum.
Sexual system	
They have monoicy, that is, male and female reproductive organs that grow on the same plant.	They have dioicy, that is, male and female reproductive organs that grow on different plants.
Characteristic feature	
The characteristic feature of the *Riccia* plant is a rosette-like thallus.	The characteristic feature of the Marchantia plant is the presence of gemmae cups and barrel-shaped pores.
Sporophyte	
The sporophyte consists only of the capsule, foot and seta are missing.	The sporophyte is differentiated into foot, seta and a capsule.

Practical section

See under microscope:

V.s in *Marchantia*

- Antheridia
- Archegonia
- Gemma cup

Plant groups… Lab(6): Vascular Plant (Phanerogams)

Pteridophyta (ferns)

Kingdom: Plantae

Division: Pteridophyta

1- Class : Equisetopsida

Order : Equisetales

Genus : *Equisetum*

2- Class : Lycopodiopsida

Order : Lycopodiales

Genus : *Lycopodium*

General characteristics for Pteridophyta :-

1- Commonly termed as (ferns) includes many species, most of which are herbs.

2- Tropical ferns are characterized by their upright stems and many leaves, so they are called tree ferns.

3- Fern consists of leaves and a rhizome stem extends horizontally on or under soil, carrying downward transverse shoots.

4- Leaves are in **two types**: large, complex, with gaps in the vascular cylinder, and small, without gaps in the vascular cylinder.

5- The sporophytes consist of cohesive cell groups.

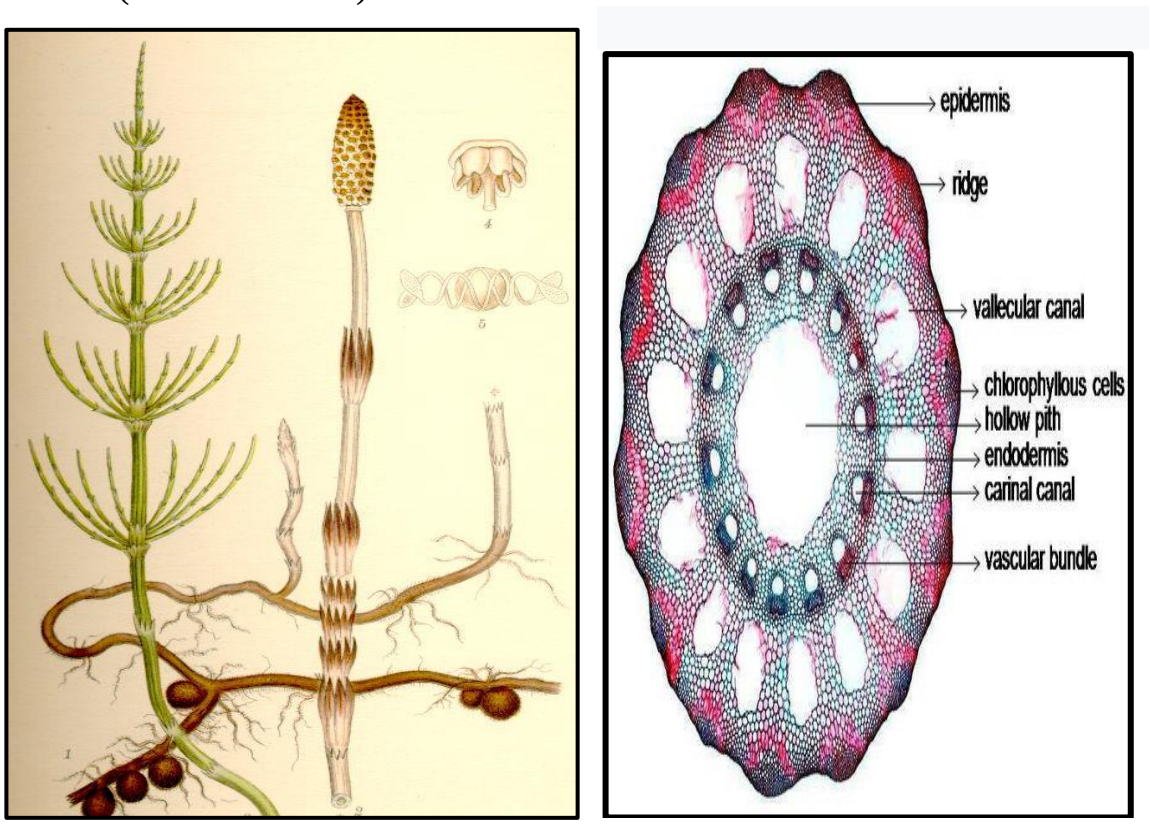
Genus : ***Equisetum***

A plant that lives in different environments.

• The sporophyte is divided into roots, stems, and leaves

• In Cross section of the stem you can see that:

The epidermis consists of a **single row of cells**, Then the crust and Then the vascular bundles, which are characterized by the presence of a (**Carinal canal**)



Figure(1): *Equisetum* whole view and C.S in stem

Characteristics of species that live in the aquatic environment:

1- The presence of the vascular canal.

2- The presence of the carinal canal.

3- The presence of a hollow pulp.

4- Wood grows sparsely.

Characteristics of the species that live in the desert environment:

1- The presence of thick cuticles.

2- The presence of sunken stomata.

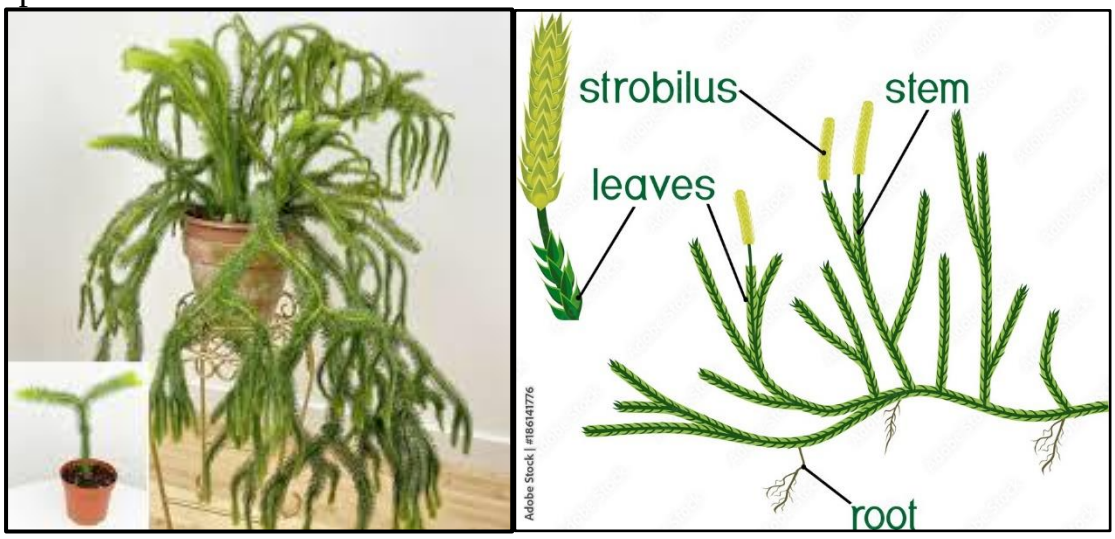
3- The presence of sclerenchyma under the skin.

Lycopodium (Club moss)

• It includes ancient fern individuals.

• Its individuals are distinguished into stems, leaves, and roots, and they have vascular bundles of the **primitive type**.

• It is noted that there are **no gaps in the cylinder**, and the spore leaves often gather at the **top of the stem** to form **cones (strobilus**) and various spores.



Figure(2): ***Lycopodium***

Plant groups….Lab (7): Advanced Vascular plants (Gymnosperms)

Kingdom: Plantae

1-Division: Ginkgophyta

Genus: *Ginkgo*

2-Division: Cycadophyta

Genus: *Cycads*

3-Division: Gnetophyta

Genus: *Ephedra*

4-Division: Coniferophyta

Genus: *Pinus*

Characteristics of Gymnosperms

1. They do **not** produce flowers.
2. Seeds are not formed inside a fruit. They are **naked**.
3. They develop **needle-like leaves**.
4. They are perennial or woody, forming trees or bushes.
5. They form **cones** with reproductive structures. (**cone**, also called **strobilus**, in botany, mass of scales or bracts, usually ovate in shape, containing the reproductive organs of certain nonflowering plants. The cone, a distinguishing feature of pines and other conifers)
6. These plants have vascular tissues which help in the transportation of nutrients and water. (**Xylem does not have vessels and the phloem has no companion cells and sieve tubes.)**

Genus: ***Ginkgo***

Commonly called the ginkgo tree. It is also known as the maidenhair tree because of the resemblance of its bilobed leaves to those of the maidenhair fern. ***It is*** may be the oldest living seed plant, and it is regarded by some as one of the wonders of the world.

Figure(1): ***Ginkgo* tree**

Genus**: *Cycads***

Cycads are gymnosperms distinguished by crowns of large pinnately compound leaves and by cones, which are typically borne at the end of the trunk in the center of whorled branches.

Figure(2): ***Cycad* tree and cones**

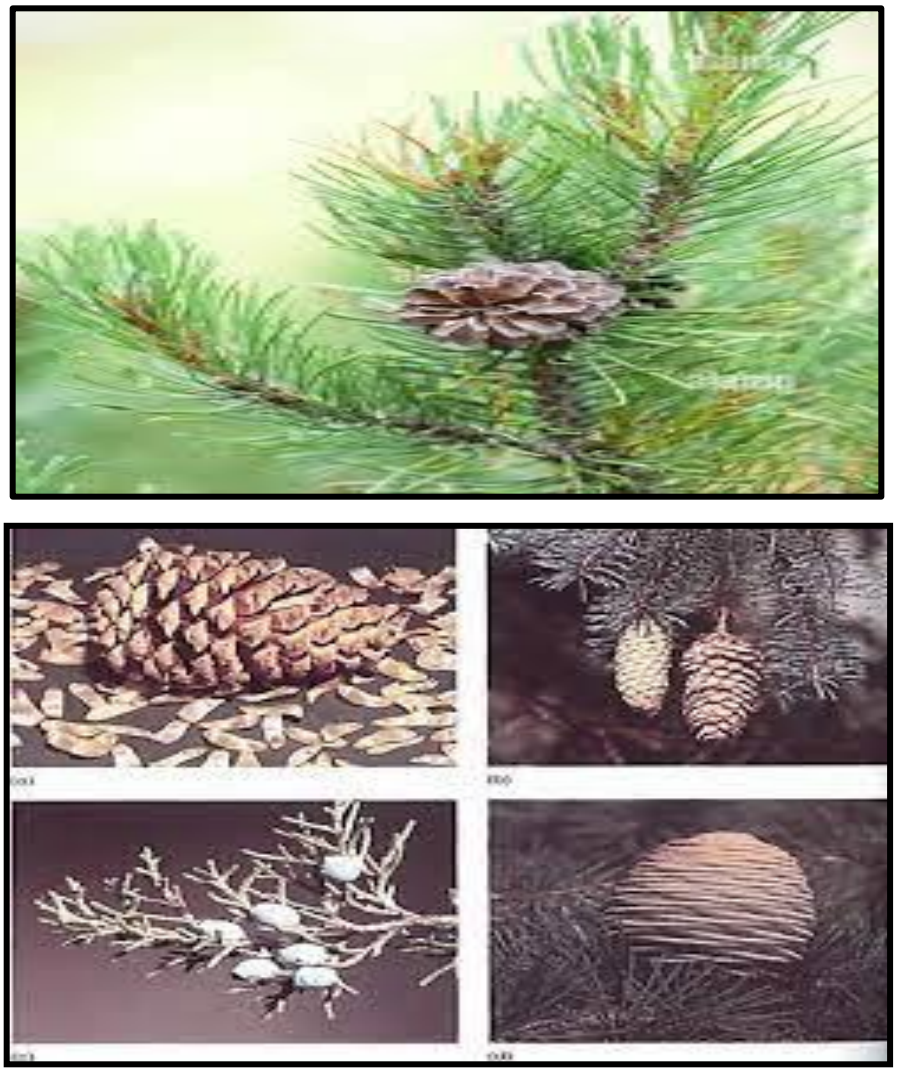
Genus: *Ephedra*

Members of the genus *Ephedra* are low, straggling, or climbing desert shrubs. The leaves, reduced to scales**.**

Figure(3): ***Ephedra* tree**

Genus: *Pinus*

Conifer, needle-shaped evergreen leaves and seeds attached to the scales of a woody bracted cone. Conifers are most abundant in cool temperate and boreal regions, where they are important timber trees and ornamentals, but they are most diverse in warmer areas, including tropical mountains.



Figure(4): *Pinus* tree and cones

Plant groups…Lab (8): Advanced Vascular plants (Angiosperms)

Angiosperm is a synonym for **flowering plant**. It means "seed within a vessel" or "enclosed seed." The defining angiosperm feature is the enclosure of the ovules within surrounding tissue called an ovary. The ovary is part of a flower, a structure that occurs only in angiosperms. The ovary, and sometimes associated tissues, eventually forms a fruit, another unique angiosperm structure.

The major characteristics of Angiosperm

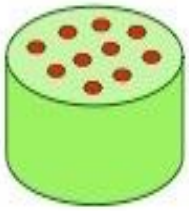
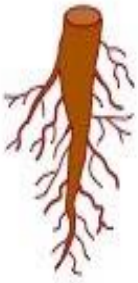
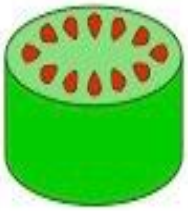
1- The largest and most diverse group within the kingdom Plantae.
2- About 300,000 species of flowering plants represent approximately 80 percent of all the known green plants now living.
3- Occurring in wide range of habitats.
4- They range in size from the smallest *Wolffia* to tall trees of *Eucalyptus* (over 100 meters).
5- They provide us with food, fodder, fuel, medicines and several other commercially important products.
6- Angiosperms posses true root, true stem and true leaves.
7- They are divided into two classes: the dicotyledons (dicot) and the monocotyledons (monocot).

There are 6 characteristics used to compare between dicot and the monocot

1- Monocots have one cotyledon (corn, lily, etc) while Dicots have two cotyledons (bean, oak, etc). Cotyledon is defined as a seed leaf of a flowering plant; it provides nutrients for the developing plant embryo before photosynthesis begins.
2- Type of stem in monocot is Herbaceous while in dicot is herbaceous or woody.
3- Type of root system in monocot usually Fibrous while in dicot is Tap root.

4- Leaf venation parallel in monocot while dicot have net-veined leaves.
5- Flower parts in monocot are groups of three while in dicot are groups of four or five.
6- Arrangement of vascular tissue in monocot is scattered while in dicot is bundle or ring.

- Monocots consist of such economically and ecologically important plants as agaves, bananas, grasses, onions, palms, rushes, and yuccas.
- dicots include such economically and ecologically important plants as blueberries,buckwheat, cacti, carrots, coffee, grape vines, legumes, melons,potatoes, roses, sandalwood, strawberries, sunflowers, tea, ,tomatoes, and walnuts.

	Seed	Root	Vascular	Leaf	Flower
Monocot					
	One cotyledon	Fibrous roots	Scattered	Parallel veins	Multiples of 3
Dicot					
	Two cotyledon	Tap roots	Ringed	Net-like veins	4 or 5

Figure(1): Comparison of Monocotyledons and Dicotyledons

Practical section

1-See under microscope:

- C.s in stem show vascular bundle in both Monocotyledons (***Zea mays***) and Dicotyledons (***Helianthus* sp**)

2-Diffrentiate between **Monocotyledons and Dicotyledons** in terms to structure of root, leaves and seeds