

1. Classify plants according to Eichler's grouping of 1883

DIVISION	Classes
Thallophyta	Phycotinae (Algae)
Bryophyta	mycotinae (Fungi)
	Hepatiticae (Liverworts)
	Musci (mosses)
Pteridophyta	Psilotinae (Psilotum)
	Lycopodinae (Lycopodium)
	Equisetinae (Solaginella)
	Filicinae (horse tail)
	Filicinae (ferns)

2. How are algae important to man

Economic Importance

Algae ~~are~~ ^{serve} as food for people and livestock, thickening agents in ice cream, and shampoo, drugs to ward off diseases.

Certain species of algae are harvested for food and cosmetics in the Far East.

Algae have high iodine content therefore prevent goiter.

Algae are nutritious because of their high concentration of minerals, trace elements and vitamins.

(iv) Brown algae yield alginic acid which is used to stabilize emulsions and suspensions found in product such as Syrup, Ice cream and paint.

(vi) Different species of red algae provide agar and carrageen used for the preparation of various gels used in scientific research.

(vii) Agar is used in food industry to stabilize pie fillings and preserves. Curries, meat and fish.

(3) Describe a unicellular form of algae

Chlamydomonas is an ~~example~~ unicellular form of algae. It represents the unicellular and motile forms of green algae, it is found in stagnant water usually along with other forms.

The cell of Chlamydomonas is bounded by a cellulose cell wall which contains organelles example nucleus, mitochondria, stigma (eyespot), cup shaped chloroplast, pyrenoid, etc.

The nucleus carries genetic programme of the cell

The stigma for photoreception

Manufactured sugar is processed into starch on the pyrenoid

The mitochondria mediate the elaboration of energy molecules

4. How does this unicellular alga described in question 3 carry out its reproduction?

Reproduction in *Chlamydomonas* is either vegetative or sexual.

(i) Vegetative reproduction: This kind of reproduction results in the production of daughter cells in which the amount and quality of genetic material in the nucleus of the mother cell is maintained in the daughter cell. This kind of cell division which maintains quality & quantity of genetic material is mitotic division. In *Chlamydomonas*, a cell about to divide loses its flagella, the cell undergoes mitotic division leading to two nuclei, cell walls are elaborated which delimit the cytoplasm around each nucleus i.e. two daughter cells (zoospores) are released. Increase in the production of cells in a colony is achieved by repeated mitotic divisions.

(ii) Sexual reproduction

Sexual reproduction is due to certain environmental conditions e.g. lack of nutrients or moisture that trigger the haploid daughter cells to undergo the reproduction. The haploid daughter cells form gametes that have two different mating strains which are structurally ~~but~~ ^{however} a process called ~~isogamy~~ ^{isogamy} and are positive and negative strains. Opposite mating strains fuse in a process called "isogamy" to form

a diploid Zygote, which contains two sets of chromosomes.
e.g. After a period of dormancy, the zygote undergoes
meiosis (the cell division that reduces genetic content
of a cell by half). This cell division produces four
genetically unique haploid cells that eventually grow into
mature cells. Sexual reproduction involves the union of sex cells
(gametes). Aggregation of cells in a colony occurs under
unfavourable conditions. These cells pair by their posterior
and morphologically identical. The cytoplasm of the pairing cells
(Plasmogamy) fuses and the flagella are lost. The two nuclei fuse (Karyogamy)
the situation is essentially a fertilization process so that a zygote
is formed. Two cells each with n quality of genetic (nuclear) material
undergo Karyogamy (fusion of nuclei) produce a single cell with $2n$
(diploid) nuclear material. The zygote secretes thick cell wall called
a Zygospore and may remain dormant in that state. Sometimes
after Karyogamy sometimes the zygote undergoes two successive cell
divisions the first division restores the haploid condition by halving
the nuclear material in the two resulting nuclei (reduction division)
while in the second division each haploid nucleus undergoes a
normal mitotic division. The two divisions which end up
with four cells and with n quality nuclear material are
together known as meiosis. The four products of meiosis
are released as haploid zoospores.



5 Differentiate between the two types of colonial form of Algae.

(i) Pandorina (ii) Volvox

Pandorina: - It usually occurs in water bloom. The colony consists of 16 cells attached to one another. Each cell has many attributes/features in common with Chlamydomonas, e.g. nucleus, large chloroplast, Pyrenoid, flagella. It undergoes vegetative ~~and~~ sexual reproduction. Vegetative reproduction: This is achieved through 4 successive mitotic divisions of each of the 16 cells in the colony, thus producing daughter colonies. This colony within a colony is analogous to the mythology of the Pandora's box and that's where the alga's name is derived from - Pandorina. When the right comes, each daughter colony is released from the matrix of the mother colony to become independent.

Sexual reproduction: This is achieved by anisogamous pairing (pairing by the flagella ends). When conditions are favourable, the single cells in the colonies assume gametic functions and pair by their flagella ends. Plasmogamy (fusion of cytoplasm) and Karyogamy (fusion of nuclei) occur which is followed by meiosis. The colony may be unisexual (only 1 kind of gamete produced) in some species or bisexual (male & female gamete produced).

Volvox

The genus Volvox (also green colonial form) show more complex form than Pandorinae. These are more cells in the colony, number may

run in tunnels and connected with cytoplasmic strands that run through the cells. Not all cells form new colonies, but the larger cells of the periphery (gonidia) are the only ones that do to form new colonies. Other cells remain vegetative throughout the life of the colony. Sexual reproduction is oogamous i.e. the male gamete is motile while the female gamete (egg) is not. Sperm are formed by repeated divisions of cells in the colony to form motile sperm platelets containing many sperm. The platelets move to egg colonies where fertilization takes place. Colonies of Volvox may also be either unisexual/bisexual. Volvox is considered to be evolutionarily more advanced than Pandorina with the differences between them especially as the cells show greater levels of differentiation and specialisation.

6. Describe a named complex form of algae.

Fucus is a genus of brown algae whose species are often found on rocks in the intertidal zones of the sea shores. The plant body is flattened, dichotomously-branched thallus with a midrib, a vegetative apex, a reproductive apex at maturity) and a multicellular disk (hold fast) with which plant is attached to rock surface. The plant body also has air bladders ~~with~~ which ~~is~~ ^{is believed} ~~to be attached~~ to aid the plant to float on the water. Various species of fucus

assist; vary in size from a few centimeters to about 2 metres in length. They also vary in terms of whether the sex cells are found in the same sexual chamber or in different plant bodies. Sexual reproduction is oogamous, sex cells are produced in conceptacles which have openings (ostioles) on the surface of the thallus. In the male conceptacles, one of the diploid cells from outgrowth of the wall of the conceptacles undergoes meiosis, the meiotic product undergo many mitotic divisions to produce antheridium having 64 cells of which each cell develop into a biflagellate sperm that swim out of the conceptacle through the ostiole.

In the female conceptacle, similar to the situation in the male conceptacle, lead to the production of an 8 called Oogonium - each becomes an egg which is the female sex cell. Motile sperm cell from the antheridium move through the ostiole into the female conceptacle where the egg are fertilised and diploid zygote are produced.

Apart from the antheridia and Oogonia, sterile multicellular filaments (paraphyses) are also produced in the conceptacles which are dispersed among the antheridial and oogonial outgrowths and at the entrance into the conceptacles.

The diploid zygote germinates into a new diploid fucus plant making the diploid the dominant generation.