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GENERAL BIOLOGY II

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

Answer

Eichler’s grouped the plant kingdom into four divisions with each division having classes under it as shown in the table below.

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| --- | --- |
| DIVISION | CLASS |
| Thallophyta | Phycotinae(Algae)  Mycotinae (Fungi) |
| Bryophyta | Hepaticae(Liverworts)  Musci(Mosses) |
| Pteridophyta | Psilotinate(Psilotum)  Lycopodinae(Lycopodium, Selaginella)  Equisetinae(Horsetails)  Filicinae(Ferns) |
| Spermatophyta | Gymnospermae(Gymnosperm)  Angiospermae(Angiosperm) |

2.How are algae of importance to man?

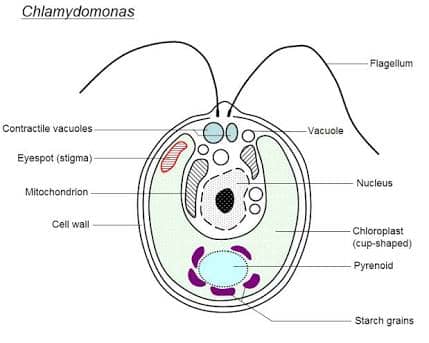
Answer

Algae have numerous uses to mankind. Some of which are:

* It serves as source of food for people, thickening agents in ice cream and shampoo, drugs to ward of diseases
* Algae are considered nutritious because of their high protein content and high concentrations of minerals, trace elements and vitamins.
* Algae help to prevent goitre due to their high iodine content.
* Seaweeds are source of three chemical extracts used extensively in the food, pharmaceutical, textile and costume industries.
* Brown algae produce alginic acid which is used to stabilize emulsions and suspensions; found in products such as syrup, ice cream and paint.
* Species of red algae yield agar and carrageen used for the preparation of various gels used in scientific research. Bacteria, fungi and cell cultures are commonly grown on agar gels.
* Agar is also used in food industry to stabilize pie fillings and preserve canned meat and fish. Carrageen is also used as a thickening and stabilizing agent in products like puddings, syrups, and shampoos.
* Diatoms have been used in forensic medicine, as their presence in the lung indicate if a person died due to drowning.

3. Describe a unicellular form of algae

Unicellular form of algae; chlamydomonas

Chlamydomonas represent the unicellular and motile forms of algae (green algae to be precise). They are found usually in stagnant water along with other forms of algae. Chlamydomonas uses flagella as structures for movement. The cell of a chlamydomonas is bounded by a cellulose cell wall; contains various organelles e.g. nucleus, mitochondria stigma(eyespot), cup-shaped chloroplast, pyrenoid etc. the nucleus carries the genetic programme of the cell. The eyespot is for photoreception, chloroplast for photosynthesis, mitochondria mediate the elaboration of energy molecules; used for respiration and generate energy needed for the activities of the cell. Pyrenoid also converts manufactured sugar into starch. A diagram showing the different parts of the cell is shown below:

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

Answer

Reproduction in chlamydomonas can either be asexual or sexual. These are:

* VEGETATIVE(ASEXUAL) REPRODUCTION: This type of reproduction occurs during favourable conditions. Vegetative reproduction in chlamydomonas results in production of daughter cells in which the amount(quantity) and quality of genetic material in the nucleus of the mother cell is maintained in the daughter cells. Thus, if the amount of genetic material in mother cell nucleus is **n**, the daughter cells also have **n** quantity of genetic material. The kind of cell division which maintains the quality and quantity of genetic material is called **mitotic division**. It is responsible for increase in number of cells in unicellular organisms and for increase in size in multicellular organism. In chlamydomonas, a cell about to divide loses its flagella. The cell will then undergo mitotic division leading to two nuclei, cell walls are elaborated which delimit cytoplasm around each nucleus i.e, two daughter cells(zoospores) are released. This lead to increase in the population of the cells.
* SEXUAL REPRODUCTION: This type of reproduction happens when certain environmental conditions are not favourable e.g. lack of nutrients or moisture. Sexual reproduction involves union of sex cells(gametes). The haploid daughter cells form gametes that have two different strains which are structurally similar and are positive and negative strains. Opposite mating strains fuse in a process called **isogamy** to form diploid zygote, which contains two set of chromosomes. After a period of dormancy, the zygote undergoes meiosis, a type of cell division that reduces the genetic content of a cell by half. This cell division (i.e. meiosis) produces four genetically unique haploid cells that eventually grow into mature cells. In chlamydomonas, aggregation of cells (clumping) in a colony occurs under favourable conditions. These cells pair by their posterior (flagellated) ends. This pairing is said to be isogamous because the pairing cells (gametes) are morphologically identical. The cytoplasm of the pairing cells fuse (plasmogamy) and the flagella are lost. The two nuclei fuse (karyogamy); this situation is essentially a fertilization process so that a zygote is formed. In other words, two cells each with n quantity of genetic (nuclear) material (i.e haploid nuclear material) undergo karyogamy (fusion of nuclei) to 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 for sometimes. After karyogamy sometimes, the zygote undergoes two successive cell divisions; the first division restores the haploid condition by halfing the nuclear material in the two resulting nuclei (reduction division) while in the second division; each haploid nucleus undergoes a normal mitotic division. These two divisions which end up with four cells and with n quantity 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 forms of algae.

The two colonial forms of algae are; (1) volvox (2) pandorina

|  |  |
| --- | --- |
| volvox | pandorina |
| Volvox contains thousands of cells in a colony. | Pandorina consists of a colony of 16 cells attached to one another. |
| Only the larger cells at the posterior ends (gonidia) form new colonies. | All cells in the parent colony form new colonies. |
| The cells are specifically arranged into a definite form and integrated to form a coenobium colony. | It does not form coenobium colony |
| The cells in volvox colony show greater levels of differentiation and specialization. Hence, evolutionarily more advanced than the pandorina colony. | The cells in pandorina colony show lesser levels of differentiation and specialization. Hence, less advanced than the volvox colony |

6. Describe a named complex form of alga.

An example of a complex form of alga is one of the genera of the so-called rock weeds (a genus of brown algae) known as **Fucus**. A genus of brown algae whose species are often found on rocks in 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 which is believed to aid the plant to float on the water. Various species of fucus exist; vary in size from a few centimetres to about 2metres in length. They also vary in terms of whether the sex cells are found in the same sexual chamber or in different sexual chambers on different sexual chambers on 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 undergoes many mitotic divisions to produce antheridium having 64 cells of which each cell develops into a biflagellate sperm that swims out of the conceptacle through the ostiole. In the female conceptacle, similar to the situation in the male conceptacle, leads to the production of an 8 celled 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 eggs are fertilized 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.

