Lesson 1. "Fungi and algae".

Objective of the lesson: To learn about fungi and algae as an object of study in botany. Learn to identify their systematic belonging. Learn how to make temporary micro preparations of these objects.

Questions of the initial level.

1. Which kingdom do fungi belong to? What are the features that characterise this kingdom?
2. The origin and classification of fungi.
3. Features of the body structure of fungi.
4. What types of reproduction of fungi do you know?
5. Types of nutrition of mushrooms. What is the difference between parasitic and saprophytic mushrooms?
6. Chaga mushroom and its medical significance.
7. Features of the body structure of algae.
8. Which group of organisms according to the type of nutrition do the algae belong to?
9. Features of algae reproduction.
10. The development cycle of green algae.
11. The development cycle of red algae.
12. The development cycle of brown algae.
13. What types of algae are used in medicine?
14. To which group of organisms do blue-green algae belong? How can they be distinguished from real algae?

Methodology for carrying out the work

Task 1. The structure of fungi of the class Zygomycetes, using Mucor as an example.

Prepare a temporary microslide of a white-headed mould, Mucor. With the tip of a dissecting needle from a Mucor culture, take part of the mycelium with young sporangia (white in colour), place it on a slide in a drop of water. Cover with a coverslip.

Examine the preparation under low magnification with a microscope. The mycelial hyphae, branched filaments containing sporangiophores with sporangia, can be seen in the microscope's field of view. The sporangiophores are thicker and more erect. Old sporangi usually burst and spores are discharged from them. At the ends of the sporangiophores, a bloat, a column, is visible at the burst sporangium, which in an undamaged sporangium is inside and covered by a mass of spores.

Turn the microscope revolver to high magnification and examine the mycelium. You can see that the mycelium has no septa and is one giant, highly branched cell.

Only strains of different mating types, usually indicated by "-" and "+" signs (the strains do not differ externally), participate in sexual reproduction. When two strains come closely together, hormones are produced which cause the hyphae tips to form special outgrowths which, upon coming into contact, turn into gametangia and separate into septa. The cell walls between the two contacting gametangia dissolve and the two multinucleated protoplasts unite. "-" and "+" nuclei fuse in pairs and a zygospore with several diploid nuclei is formed. It is then covered by a thick, rough black shell and remains in this dormant state for several months. Meiosis takes place

during germination. As a result, a zygosporangium is formed. The zygosporangium is opened, producing spores similar to those produced by asexual reproduction, and the life cycle begins anew.

Record in a workbook the systematic position of the fungus Mucor. Using figure 1, study and sketch the life cycle of the fungi of the class Zygomycetes, using Mucor mucedo as an example. Mark in the figure a) non-cellular mycelium, b) hyphae, c) sporangiospores, d) sporangia, e) spores.

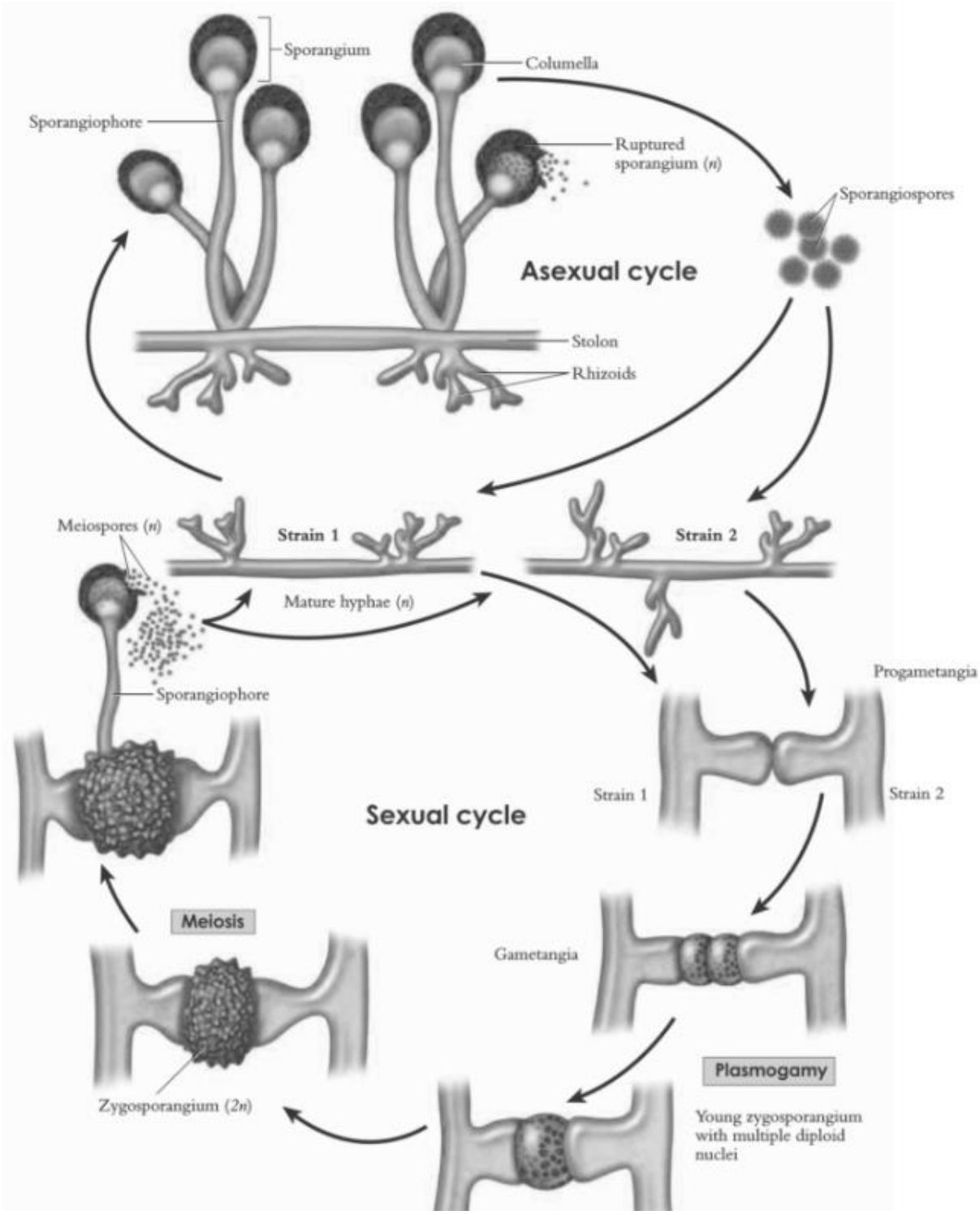


Fig 1. The life cycle of Mucor sp.

Task 2. Class Ascomycetes. Baker's yeast (Saccharomyces cerevisiae) its structure.

Prepare a temporary microscope of Saccharomyces cerevisiae. To do this, introduce a yeast culture with the tip of a dissecting needle into a drop of water on a slide. Cover the slide with a coverslip. Examine the preparation under low magnification under a microscope. After selecting the best area on the slide at low magnification, switch to high magnification. In the field of view of the microscope you can see oval-shaped cells, singular or connected to each other in small groups. These cells are yeast. In groups of cells, one large cell is visible, giving rise to other cells, which in turn give rise to new cells. The communication between the old cells is interrupted and they isolate themselves from each other, giving rise to new colonies. This reproduction is called budding.

Write down the systematic position of baker's yeast in a sketchbook. Draw and label the budding yeast in the diagram "Structure of baker's yeast" (Figure 2).

Yeast is a marsupial fungus, but the sacs are not visible in our preparation. The sacs form when there is a lack of nutrients and access to oxygen. The entire cell turns into a pouch in which 2-4 ascospores develop.

Draw the developmental cycle of yeast (Figure 3.). Mark all the stages of sexual and asexual reproduction of yeast in the drawing.

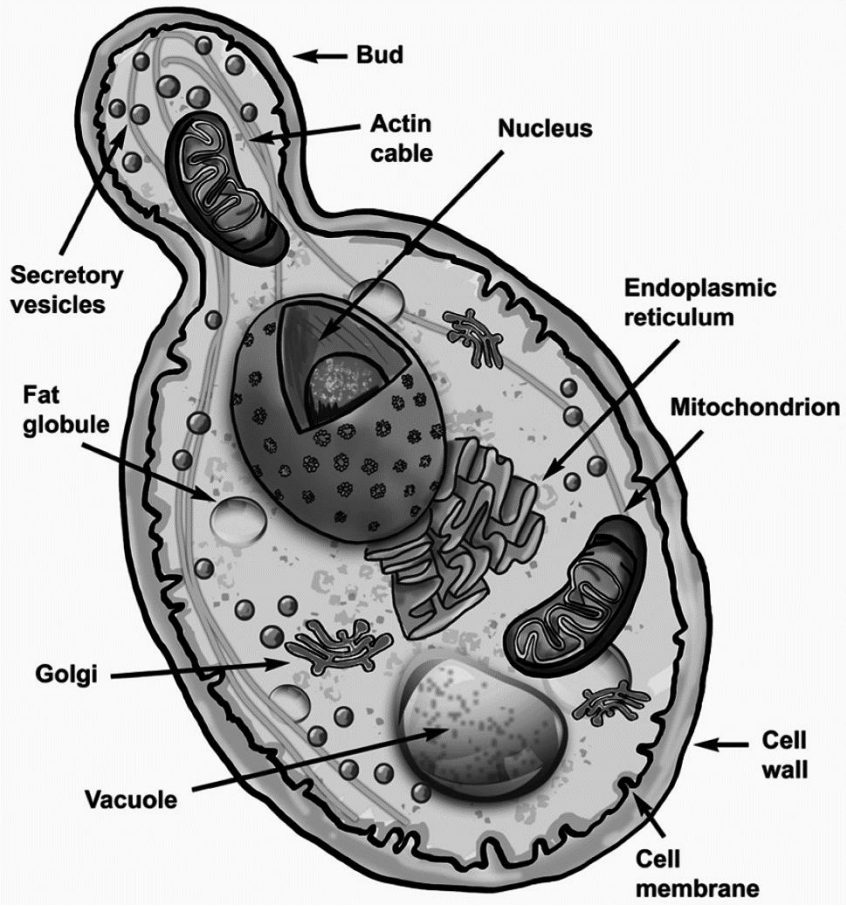


Figure 2. Baker's yeast.

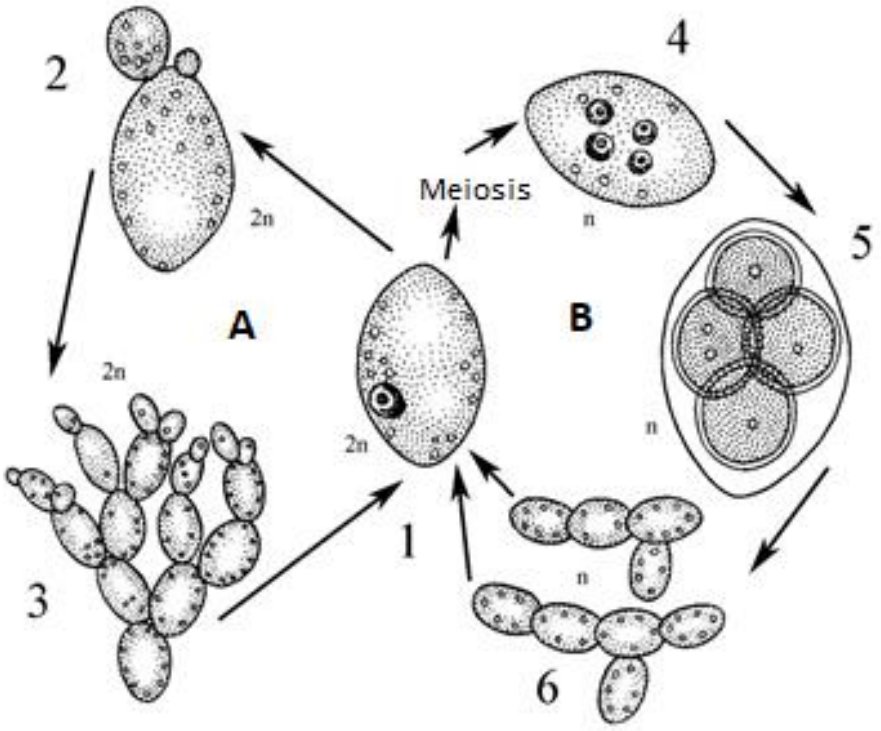


Figure 3. The life cycle of baker's yeast.

A - budding, B - sexual process; 1 - vegetative specimen, 2-3 - budding cells, 4-5 - formation of asci with ascospores, 6 - budding ascospores.

Task 3. Class Ascomycetes. The ergot (Claviceps purpurea) development cycle.

Examine the following in the herbarium: a) an ear of rye with ergot sclerotia looking like black-purple horns; b) a germinated sclerotium (wet preparation). The black-purple sclerotium shows cephalic stroma (dense hyphae plexus). Prepare a temporary preparation of "Longitudinal slice through stroma with perithecia". To do this, place the prepared longitudinal slice through the stroma head with the tip of a dissecting needle onto a drop of water on a slide. Cover the preparation with a coverslip. Examine the preparation under low magnification under a microscope. On the periphery of stroma heads fruiting bodies, perithecia, with ascospores formed in them, are visible.

Record the systematic position of the marsupial fungus ergot in a workbook. Using figure 4 and the textbook, draw a picture of the ergot cycle in the workbook. Mark in the picture all the main phases of the cycle.

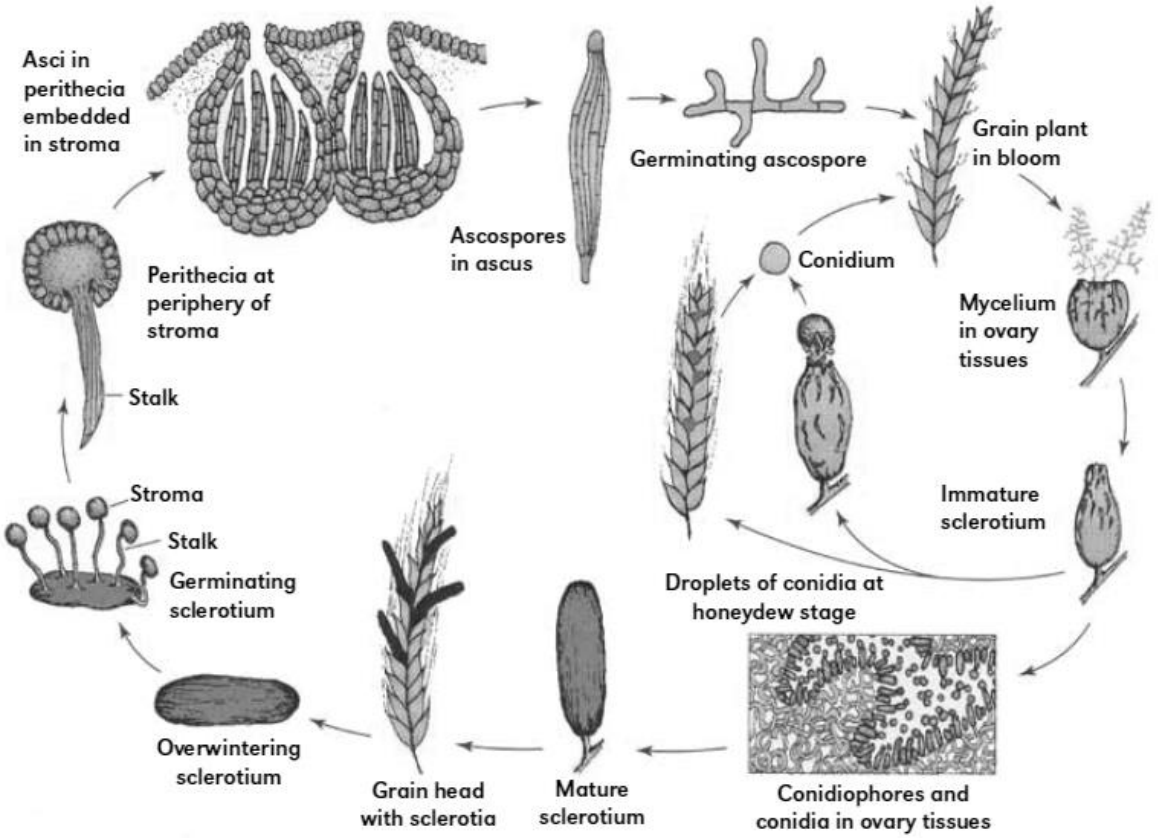


Figure 4. Lifecycle of ergot.

Task 4: Basidiomycetes: champignon, bracket fungis, "chaga".

Examine the tables and herbaria of the mushroom (Agaricus campestre).

Sketch its external appearance, write down its Latin name and systematic position. Using Figures 5 and 6 and the textbook, study and sketch the development cycle of basidiomycetes using the example of Field Mushroom.

Examine the tables and herbariums of the present mushroom. Sketch its appearance, write down its Latin name and systematic position.

Look at the tables and herbaria of the basidial mushroom "chaga", which is used in medicine. The body of chaga mushroom is shapeless, the body of trutovik mushroom is shaped like a hoof. Chaga is a sterile form of the trutovy mushroom (it does not form basidiospores and does not have a tubular hymenophore). Sketch its appearance in the workbook, write down its systematic position, Latin name and distinguishing features from the common trutovik mushroom.

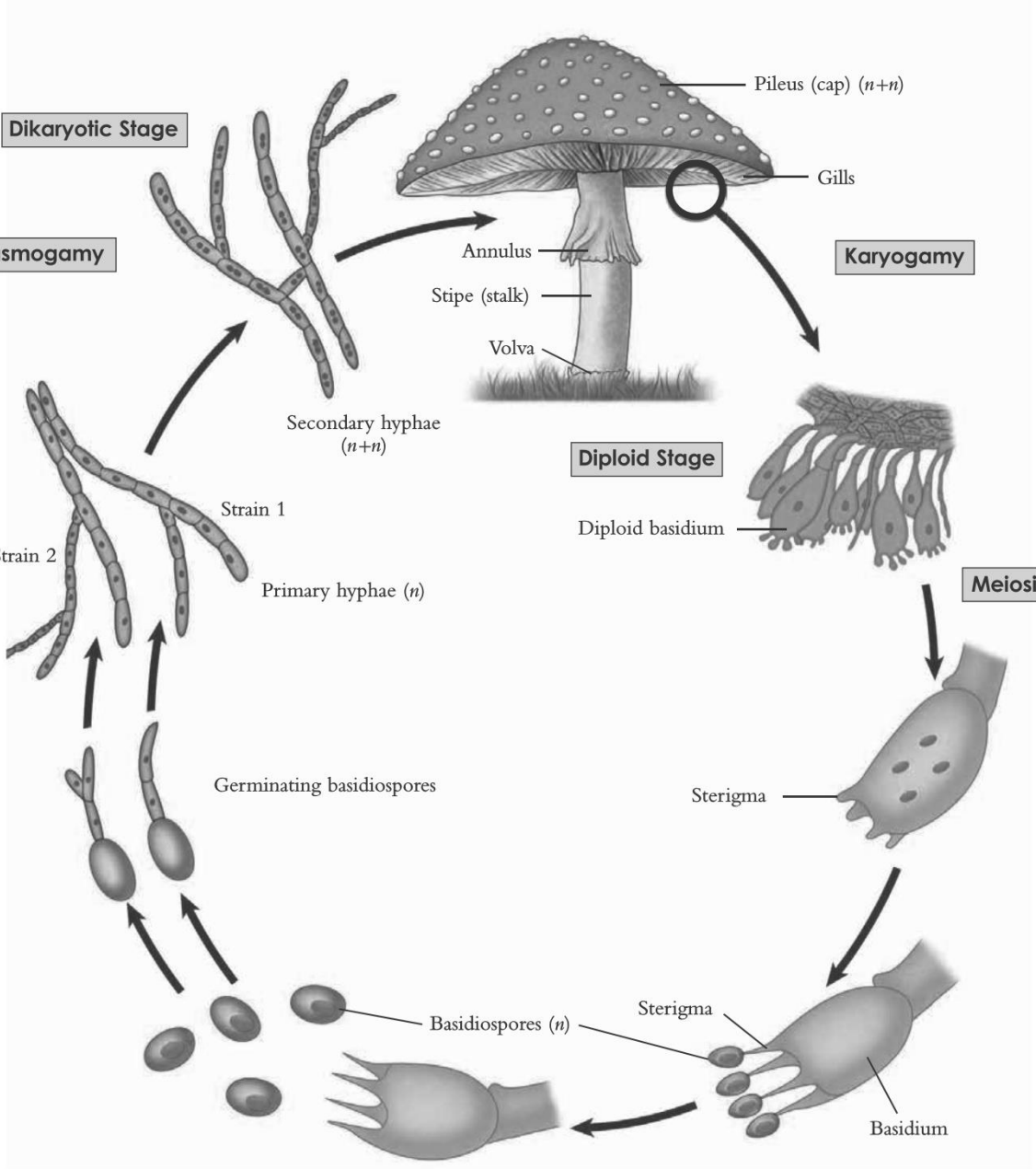


Figure 5. The life cycle of the champignon.

Task 5. The structure of Penicillum, a fungus of the class Deiteromycetes. (Deiteromycetes).

Prepare a temporary preparation of penicillium. Use the tip of a dissecting needle to take a mycelium of the fungus from a greenish pad of substrate and place it on a slide in a drop of water. Cover with a coverslip.

Examine the preparation under a high magnification microscope. The mycelium has a cellular structure. Along the edge of the mycelium you can see hyphae branching out at the ends - conidiophores. Conidiophores are multicellular, ending at the tip with tassel-shaped ramifications. From the terminal branchlets the conidia chains are separated. The youngest conidia are located at the base of the chain, the most mature ones at its end. The separated conidia are dispersed by air currents.

The sexual process of most species of the genus Penicillus is unknown, therefore they are traditionally considered in the class of Deuteromycetes. Those species in which sexual

reproduction has been studied are also sometimes considered in the class Ascomycetes, since they form fruiting bodies of cleistothecia with asci as a result of the sexual process.

Using Figure 6, sketch the developmental cycle and label the mycelial cells, conidiophores, conidia and conidiospores in the figure.

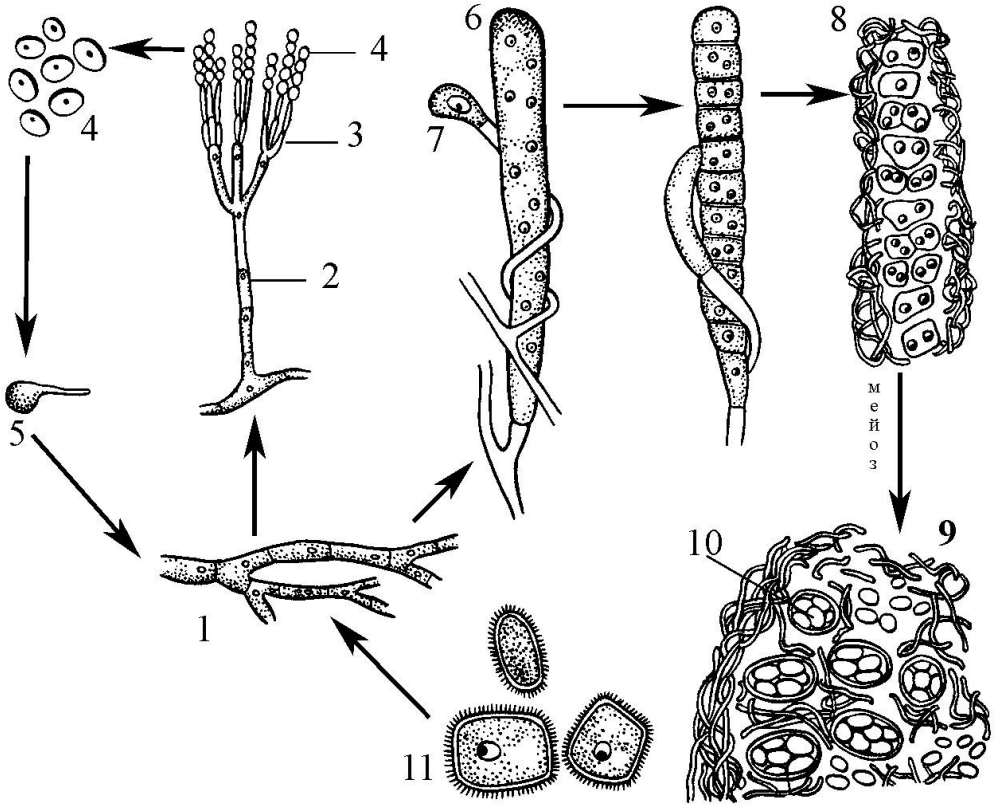


Figure 6. Life cycle of Penicillium.

1 - mycelium, 2 - conidiophores, 3 - chain of conidia, 4 - conidia, 5 - conidia germination, 6 - ascogonium, 7 - anteridium, 8 - cleistothecium formation, 9 - part of cleistothecium, 10 - ascus with ascospores, 11 - ascospores.

Task 6. Structure of diatomic algae, using Pinnularia (Pinnularia) as an example .

Pinnularia and other diatoms accumulate in large numbers in the silt at the bottom of water bodies. To prepare a micropreparation, a drop of silt is taken from the bottom of an algae jar. It is examined first at low and then at high magnification in the microscope. Diatomic algae can be seen in the drop among the dead particles of silt. The largest of these are pinnularia.

The cell wall of a pinnularia consists mainly of silica, which forms a protective shell that has two distinct parts (theca). The upper one is the epitheca and the lower one is the hypotheca. Each consists of a flat flap and a narrow ring connected to the flap, the girdle. Examine the pinnule from the side of the leaf and the girdle. Note that it is a unicellular alga. On the leaf side, the cell is oblong with rounded ends and a wider middle part. A suture runs along the leaf, and three nodes, called nodules, can be seen near the ends and in the middle part. Due to the movement of the cytoplasm in contact with water through the suture, the pinnularia can move, which is visible under the microscope. Strokes formed due to irregular deposition of silica are visible on the leaflet. A live pinnule has a cytoplasm, nucleus, vacuole, and two chloroplasts, lamellar in shape and brown in colour. On the cingulum side, the outer leaflet (epitheca) can be seen covering the inner leaflet (hypotheca), similar to the way the lid covers the capsule (Figure 7).

Sketch the pinnularia from the girdle and from the leaflet. Identify the epitheca, hypothecae, suture, nodules, nucleus, cytoplasm, vacuole, chloroplasts. Record its life cycle. Note that its main phase is sporophyte.

Research work. Look at the other diatoms on the same slide. Determine which group they belong to (centric or pennate, unicellular or colonial). Navicula may be the most common. It is smaller than the pinnularia and more rounded. Sketch the nauvicula from a micropreparation and mark all its cell organoids visible under the microscope.

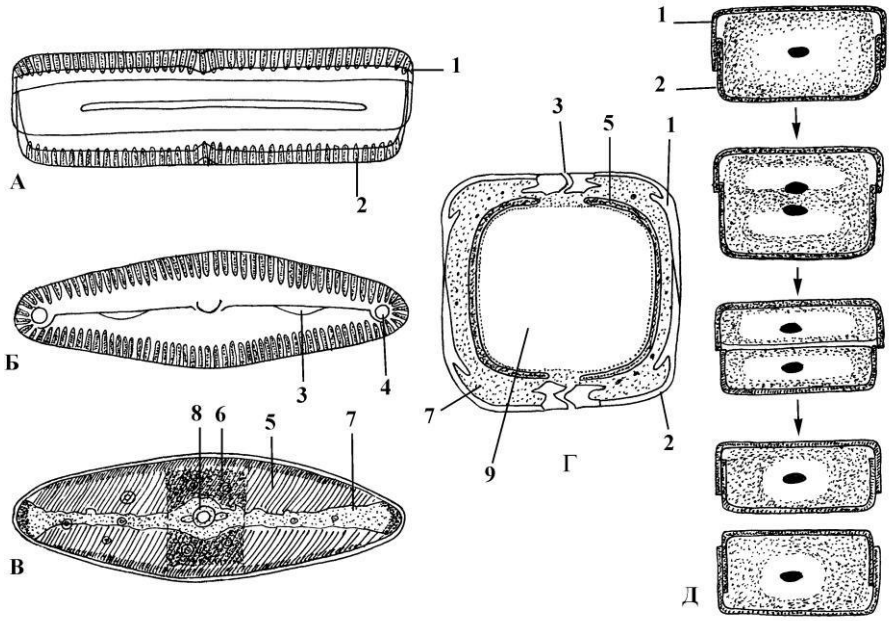


Figure 7. The diatom alga pinnularia.

A - leaflet view, B - girdle view, C - dissected cell, D - cross-section through cell, E - vegetative reproduction (division) 1 - epitheca, 2 - hypotheca, 3 - suture, 4 - nodule, 5 - chloroplast, 6 - pyrenoids, 7 - cytoplasm, 8 - nucleus, 9 - vacuole.

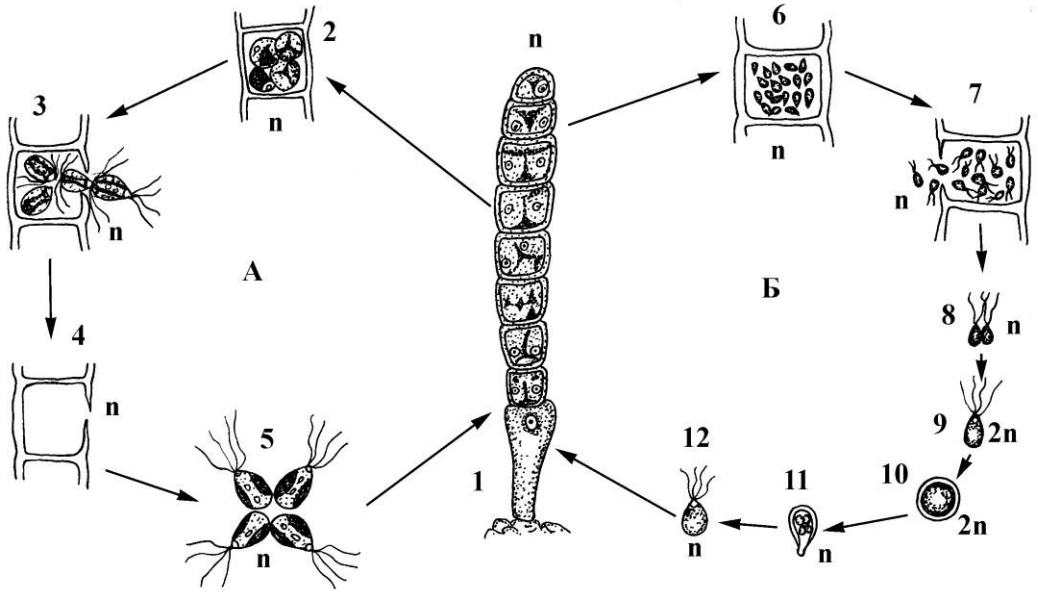
Task 7. Structure of the Green Algae of the class Isocontophyceae, using Cladophora as an example.

Prepare a temporary micropreparation of Cladophora by taking a piece of the thallus of Cladophora and placing it in a drop of water on a slide, cover with a coverslip. Examine first at low and then at high magnification under the microscope.

Cladophora belongs to the order Ulotrichales. The preparation shows that the thallus of Cladophora consists of large, cylindrical cells with a thick wall. The chloroplast is a pierced plate containing numerous pyrenoids. The cells are multinucleated and the strands of the thallum are branched.

Sketch the life cycle of cladophora, using Figure 8, mark the main phases of the cycle and the visible organoids of the cell.

Research work. Look at other green algae on the same microscope. Most of them are unicellular. These can most often be Chlamydomonas, Chlorella, and Stedesmus. Of the colonial ones, volvox can be found. In addition, euglena may also be found. Sketch these organisms from the microscope in a scrapbook and note their distinguishing features.



8. The life cycle of cladophora.

A - asexual reproduction, B - sexual reproduction. 1 - part of thallus (gametophyte), 2 - formation of zoospores, 3 - exit of zoospores, 4 - empty cell after exit of zoospores, 5 - zoospores, 6 - formation of gametes, 7 - exit of gametes from cell, 8 - gamete fusion (isogamy), 9 - zygote, 10 - incysted zygote, 11 - germination of zygote (meiosis), 12 - zoospore.

Task 8. The structure of members of the Green Algae, class Conjugataphyceae, using Spirogyra as an example and their sexual process.

Spirogyra belongs to the order Zygnematales.

Examine under low magnification the prepared microscope slide "Conjugation of Spirogyra". The filament of a spirogyra consists of cylindrical, elongated cells with cellulose sheaths. The cytoplasm is concentrated near the walls. In the centre of the cells is a nucleus. Green spiral whorls are clearly visible in the cell - these are the chromatophores. Extensions of the spiral ribbon are visible in the chromatophores, making the edges of this ribbon uneven. In this extension is placed a pyrenoid, a protein body surrounded by starch grains.

Locate the area where the sexual process is taking place. Under low magnification, you can clearly see filaments arranged parallel to each other, in which opposing cells are connected by bridges with tubules inside. Through tubules the contents of a cell of one filament (male) pass into a cell of the next one, which on the face of it does not differ from it in any way. As a result of fusion of two protoplasts a zygote is formed. After the dormant stage, it meiotically divides to form haploid cells, one of which gives rise to a new plant. This sexual process is called conjugation.

Record the systematic position of the green alga Spirogyra in a workbook. Draw the conjugation of the spirogyra and its life cycle, using figure 9, and indicate in the figure: the two filaments of the spirogyra, the shell, the nucleus, the chromatophore, the pyrenoid, the vacuole, the tubule, the zygospore. Note that the main phase of the life cycle is the gametophyte.

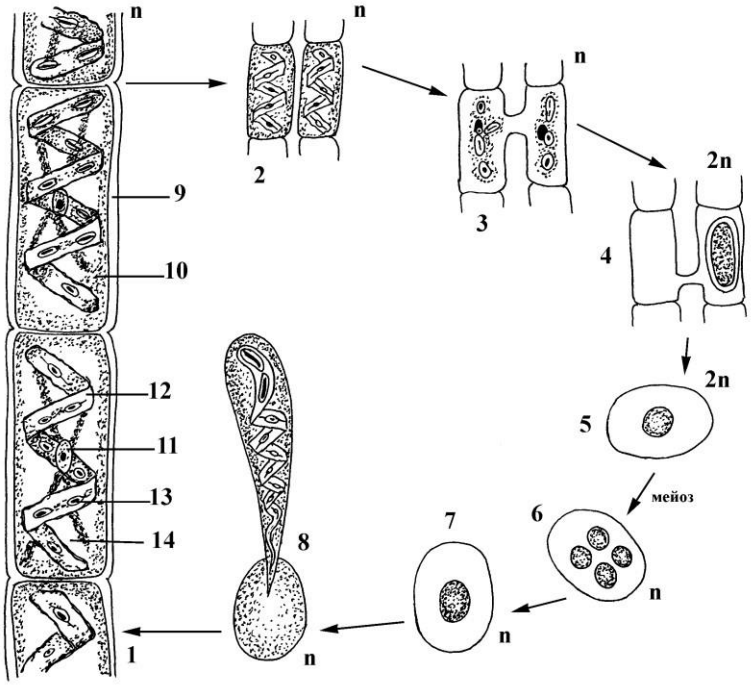


Figure 9. Life cycle of spirogyra.

1 - part of the thallus, 2 - 4 - conjugation sequence, 4 - 5 - zygote, 6 - haploid nuclei formed by meiosis, 7 - haploid cell formed by the abortion of three haploid nuclei, 8 - formation of a new thallus, 9 - cell wall, 10 - cytoplasm, 11 - nucleus, 12 - chromatophore, 13 - pyrenoids, 14 - vacuoles.