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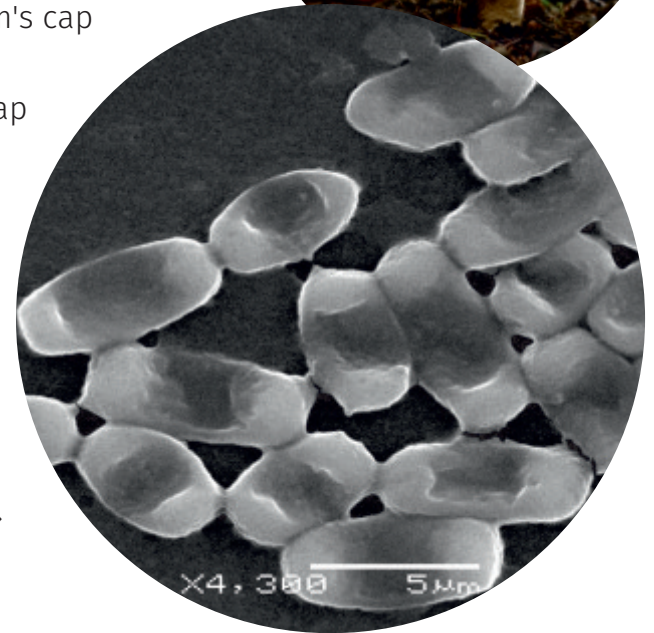
Fascinating fungi

Fungi belong to a separate kingdom of nature; they are neither plants nor animals. Over 200,000 kinds of fungi grow on our planet. They can be found on land, in water, in soil, and even on other organisms. Mushrooms are fruiting bodies of some fungi.

What we know about mushrooms

The mushrooms you pick in a forest are called blewits. They consist of a cap and a stalk, with mycelium underground – thin colorless threads of the mushroom. Spores are located on the bottom of a mushroom's cap and are used for reproduction. Spores are small as specks of dust, and can only be seen through a microscope. To get them, place a cap on a piece of paper and tap it to release the spores. You can also leave the cap on the paper for a night to let spores fall out on their own. Carefully pour the spores onto a glass slide, dip some water, place a cover slip on top. Now you can magnify the spores. Spores of every mushroom have their own unique structure; they vary in shape, size, and color. Spores can even help you identify what kind of a mushroom it is.

A puffball mushroom releases billions of spores →



Mushroom spores magnified 4000x →

Millions and billions of spores
form under a mushroom's cap every week!

1 0 0 0 0 0 0 0 0 0 0 0

← *Aspergillus*, or black fungus, – mold fungi that look like a dandelion flower under a microscope



Curious fact

Some mushrooms are grown on unusual “farms” – anthills. Leaf-cutting ants drag leaves into their homes, chew them with their jaws and put them in a pile. Later, a mushroom forms in these leaves, and it serves as food for the ants. The leaves are too tough, so the mushroom-growing ants can't eat them.

Coral mushroom

All over stumps and trunks of fallen trees in pine forests, grow magical mushrooms, with caps so twiggy that they look more like ocean corals. If you ever come across it, you will marvel at this rare mushroom. But to keep it in nature, don't pick it up. This mushroom has many names – a coral hedgehog, the ice mushroom, the king mushroom, the white jelly mushroom, or the silver ear.



Mushroom noodles

Lion's Mane has an even weirder appearance. It's called mushroom noodles, or grandpa's beard. This rare mushroom grows on tree trunks, like a beard of a magical woodsman. The noodles mushroom tastes like shrimp or lobster, which you can see for yourself in some restaurants.

Veiled lady

The mushroom that looks like a woman's figure in a netted outfit is called veiled lady. This rare greenwood mushroom is commonly known as “netted stinkhorn.” The mushroom emits an odor that you will hardly enjoy. Flies, on the other hand, love its smell. They circle around it, helping it spread its spores.



Parasitic mushrooms

Many mushrooms have adapted to living on other organisms and feeding on them. You may already be familiar with the tinder polypore, which looks like a horse hoof hanging on a tree. This mushroom's mycelium spreads deep within the tree trunk, destroying it, making it rot. In ancient times, this mushroom was used to create drawing charcoal. The polypore was also used to make fire: The mushroom would be dried, and two stones would be used to cast a spark. The mushroom would catch fire from a single spark, like tinder. That's why it was named tinder conk.



Mushrooms to avoid

When eaten, some mushrooms can cause serious poisoning. Never pick up mushrooms you're not familiar with. When you walk home, they can crumble and mix with other mushrooms. Just a few grams of a death cap contain enough poison to endanger your health. Also avoid bitter bolete and amanita. Remember, even edible mushrooms, if stale, may contain poison. Don't pick them up!



Mind the mushrooms you collect, some have a poisonous effect!

↑ A death cap is easy to identify by its gray-green cap, and thin, dry, and membranous skin on the bottom part of its stem that botanists call "scariosus," and a scariosus ring at its top



Curious fact

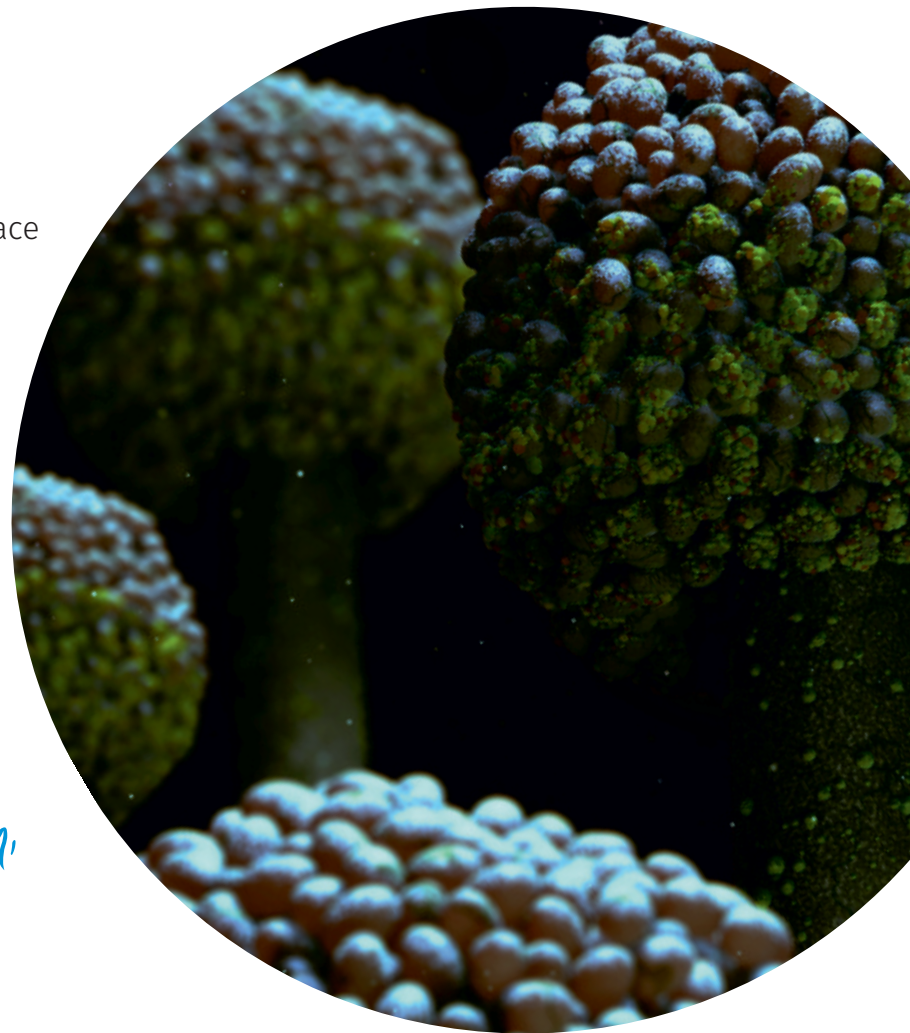
In the tropical forests of Brazil and Japan, there are rare and mysterious *Mycena* mushrooms, which glow in the dark. Some of them are so bright that you can easily read a book under their light.

Mold

You are certainly familiar with a stale sandwich, or bread. It becomes very unappetizing, and its surface becomes covered in green or gray fluff. This is mold of a microscopic size, which consists of thin branching mycelium. Capsules of spores form at the ends of these threads. When spores are ripe, the capsules open and the spores get carried around in the air. Getting in a nutrient medium, like milk, bread, jam or fruit, the spores begin to grow, forming new mold.

Mucor spore capsules under a microscope →

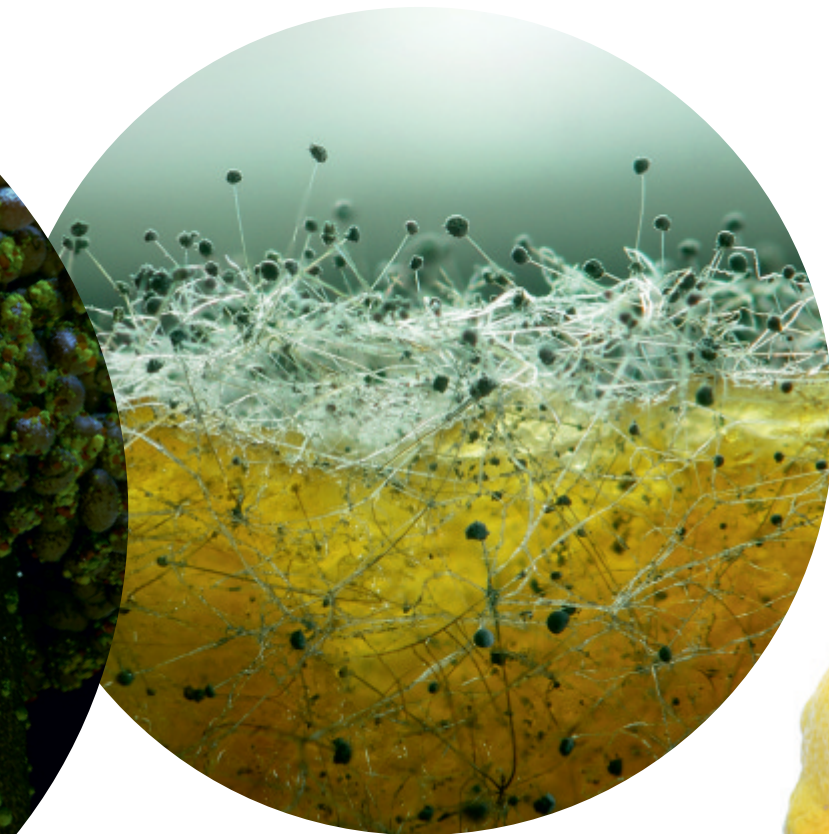
When your bread is looking furry,
Throw it out – in a hurry!



Experiment



To grow mold, you need to put a piece of bread in a warm and humid place. Place it in a container, like a glass jar, and cover it with a piece of wet paper or cloth. A few days later you will see white and green fluff on the bread. This is a moldy fungus called Mucor. Now, you need to carefully remove a sample of the mold. It is best to use tweezers or a needle. Spread the mold threads on a glass slide. Drip some water on to them and place a cover slip over.



You can see under small magnification (60 times) what fungi threads, mycelium, look like. Under 300x magnification, you will see the spore capsules. To see the capsules burst, conduct this experiment: Place the threads on a glass slide, and drip some water on one end. When the water reaches the spore capsules, they will begin to burst right before your eyes!

This is what mold on a lemon looks like under a microscope ↓



*I'm a very active form –
growing where it's wet and warm!*



Curious fact

Some molds are used in making cheese. These molds are called "blue molds." They give the cheese a unique and pleasant taste, and are harmless to people. To see a blue mold under a microscope, scrub it off store-bought cheese with a knife. The best known varieties of this cheese are Roquefort and Gorgonzola.

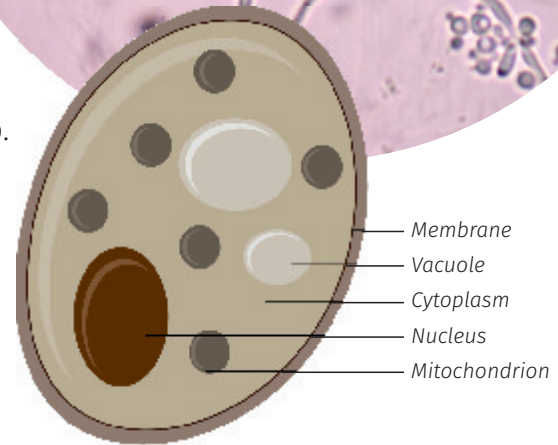
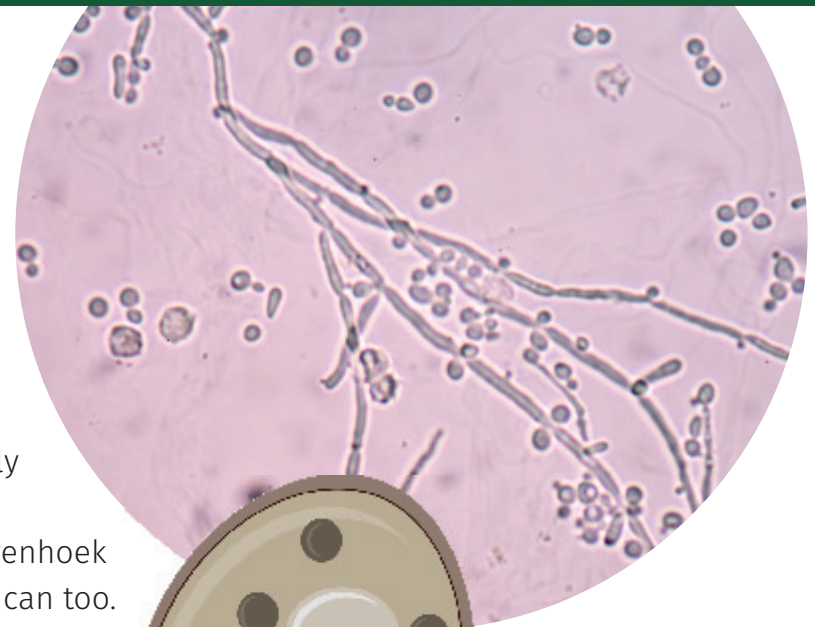
Yeast

Yeast is another interesting type of fungus. These fungi live on berries of some plants, like grapes, in soil, and in the nectar of some flowers. You could say yeasts were the first thing humans domesticated. Egyptians learned how to bake bread using yeast as early as three thousand years ago. Of course, nobody knew how these little helpers looked. Only Antonie van Leeuwenhoek managed to see them through his microscope. Now you can too.

*Examine the grapes before the feast,
And you will see a layer of yeast!*



On the surface of grapes you will find a white layer, which comes right off when you rub it with your finger. It is yeast that feeds on the sugar on the surface of berries. The same white layer can be found on dark-blue plums.



↑ Structure of a yeast cell

Curious fact

Yeast helps the dough in bread rise. Bread dough consists of flour, water, and yeast. When the ingredients are stirred together, yeast interacts with starch molecules, producing gases that form air bubbles. But don't forget to keep an eye on the dough, or it will crawl out of the pot before you know it and you'll have to catch it!



Experiment

Mix a teaspoon of baking yeast in 1/3 of a cup of room-temperature water. Using a dropper, place a drop of this solution on a glass slide. Cover it with a cover slip and watch. Under magnification you will see that yeast is made up of single-celled fungi. You will also see cells linked in long chains. These fungi reproduce by gemmation: A bud forms on the cell, which grows and then separates from the original.

Yeast grows very quickly. To test this, add some sugar to water and yeast. Mix it up and wait two hours. Get that glass slide ready again. See how there are a lot more cells now? Sugar feeds the yeast. Feeding on the sugar, yeast produces gas, which makes dough thick. You can test this by pouring the solution of water, yeast, and sugar into a bottle, and putting a balloon on the top. The produced gas will inflate the balloon.

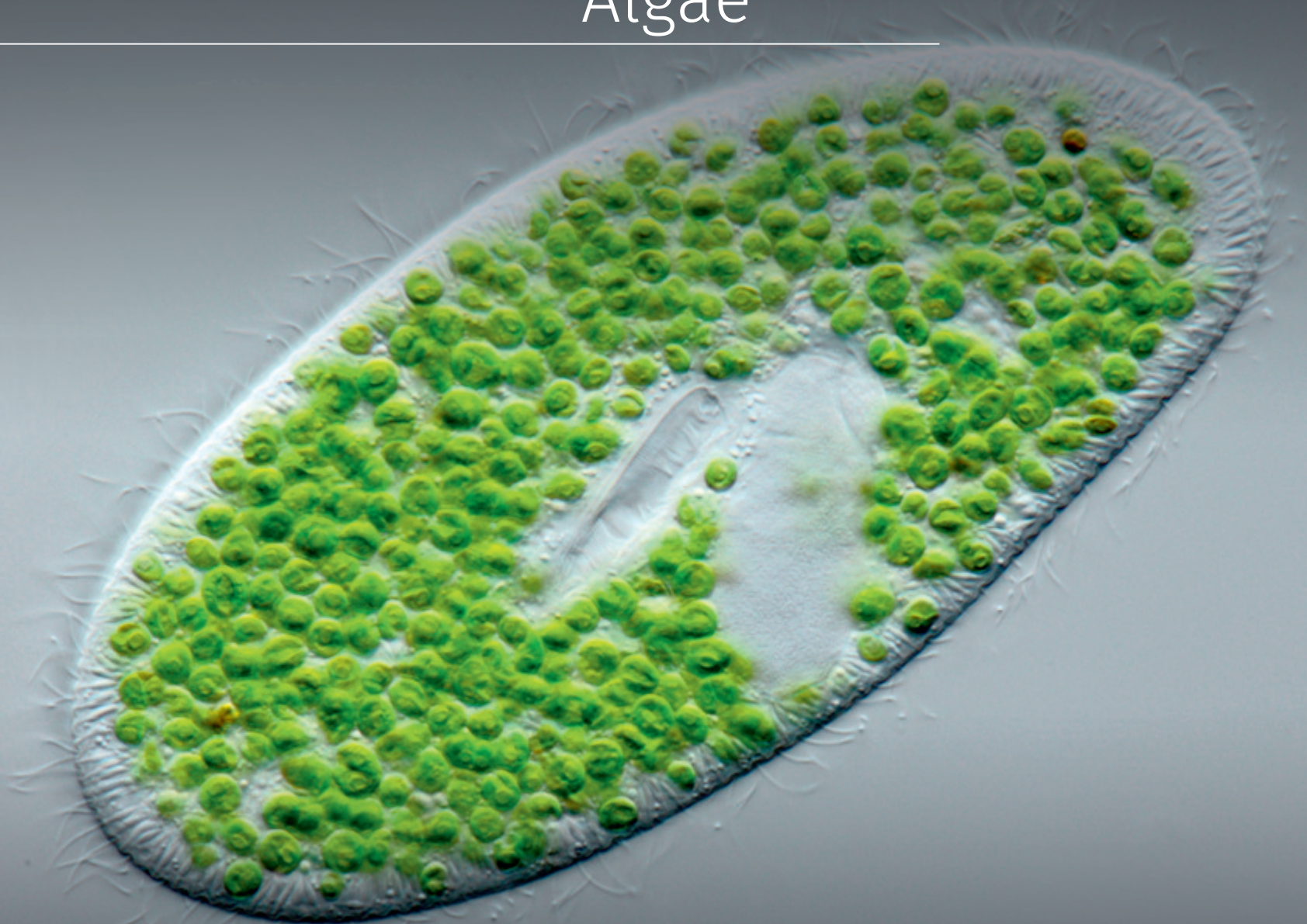


*If you want your bread to grow,
Add some yeast into the dough!*

Nutritional yeast is healthful, which is why it is used in making food supplements, medicine, and vitamins. Those are taken by people with allergies, and problems with the skin and bowel. To balance protein in their diet, vegetarians often take yeast-based supplements, as yeast contains protein in spades. Besides, yeast is chock-full of vitamin B and fiber.



Algae



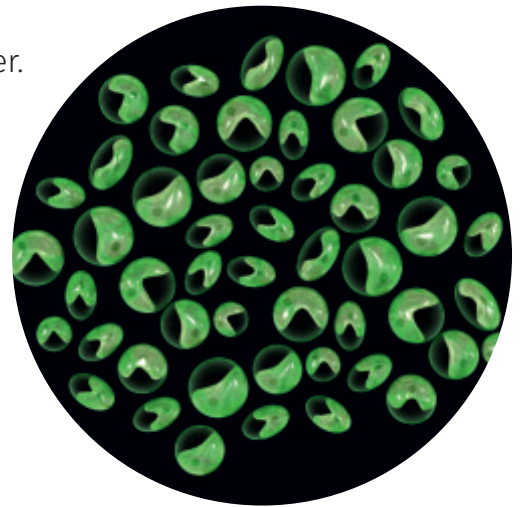
You can find algae at home: on an aquarium wall, in flower water, or in the soil of a house plant. Take a closer look and you'll see that algae live on tree trunks, on walls of buildings, on fences, and even on drainpipes. Some algae consist of a single cell, while others are multicellular, and can grow to immense sizes. These large and complex algae are known as seaweed, which can form whole underwater forests in seas and oceans.

Mystery of the emerald water

Scoop up some water from a “blooming” puddle or pond. Look at a drop of this water through a microscope. You will see algae of all shapes: spheres, threads, etc. A genus of unicellular algae – chlamydomonas – gives water the green color. It is easy to identify, as it looks like a constantly moving green ball. Its cell has two flagella to move around in the water, and it uses a red eyespot to “see.” When it's hot, there is so much of this alga in the water that it gives puddles and ponds an emerald color.

Chlorella is also a unicellular alga that can be found in ordinary puddle water. It quickly multiplies, and contains so many nutrients that people grow it as animal food; and use it as fertilizer, a food supplement, and a vitamin source. It is also useful in filtering wastewater and producing oxygen on spaceships!

Inside chlorella cells you will see green chromatophore, which takes part in photosynthesis →



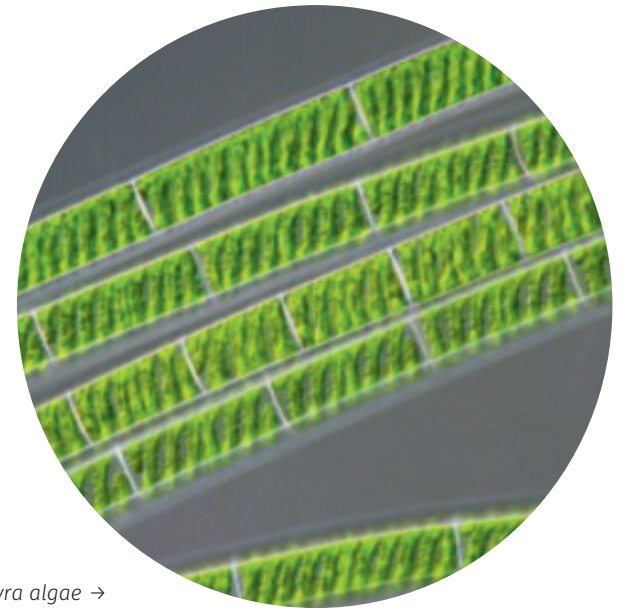
Pleurococcus – the green “compass”



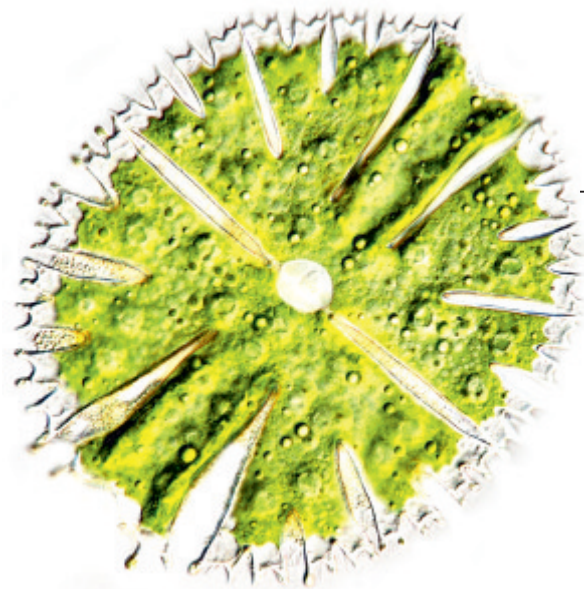
Some algae have learned to live not only in water, but also on land. They get moisture from rain, fog, and dew to stay alive. Look at the green layer on the bottom portions of tree trunks. That is a unicellular green algae, pleurococcus. Scrape some of it off the tree bark using a needle. Place the substance in a drop of water on a glass slide and put the cover slip over it. Use a soft tissue to spread the drop out a little. Now you will be able to see single cells, as well as groups of them. That's pleurococcus. It may serve you as a compass, since it only grows on the northern side of tree trunks.

What is pond scum made of?

If you find yourself near a pond, river, or lake, collect some of the slimy pond scum from the surface of the water. Using the tip of a needle, spread its threads on a glass slide, drip some water on it, and put a cover slip over it. Through the microscope you will see a lot of thread-like algae. One of them, spirogyra, you will identify by the thin green ribbon inside its cells. This spiral ribbon is chromatophore, and is involved in photosynthesis.



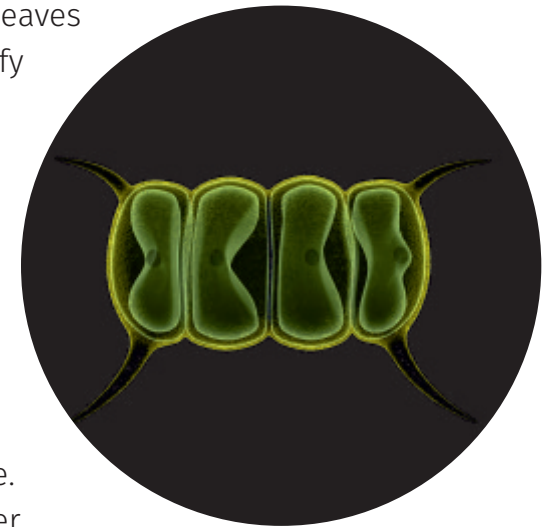
Multicellular spirogyra algae →



↑ Inwrought micrasterias cell

Beauty in the swamps

Living on the surface of peat bog waters, there is a remarkably beautiful microscopic alga. Squeeze some water out of moss or a swamp plant into a glass jar. There are algae on their leaves invisible to the naked eye. You will identify the elegant micrasterias green alga by its beautiful cells, which consist of two halves with small cuts. Some crayfish use this alga as food.



Scenedesmus is a genus of green algae shaped like a bar of 4 cells, with horn-like outgrowth on its sides →

Scenedesmus is a microscopic alga that people cultivate – grow on purpose. It is rich in nutrients, and is used as animal food supplements, field fertilizer, and in production of medical supplies. This alga can also be used to filter out bacteria and poison from wastewater.

Seaweed on your dinner table

People have long been using marine algae, or seaweed, as food. Seaweed is so rich with nutrients that it's not only eaten, but used in making medicine for all sorts of illnesses. The best known edible seaweed is laminaria, commonly known as kelp. It grows in the sea in dense underwater forests. Kelp will give your body the iodine it needs.



↑ *Laminaria*, commonly known as kelp

Sushi seaweed



Seaweed is also used to make sushi, a key part of Japanese cuisine. Rice is wrapped in dry thin leaves of the porphyra seaweed, known as nori. Nori contains iodine, phosphorus, iron, calcium, and vitamins A, C, and D.

Curious fact

Many candies, marshmallows, and jellies are made from agar-agar. The substance with this odd name is extracted from certain red and brown algae. If you add it to hot water and let it cool down, after a while it will turn into a thick jelly. Some medicine capsules are made of agar-agar. Agar-agar is often used to make “gummy worm” candy.



*When you encounter a gummy worm,
It's agar-agar that makes it squirm!*

Root, stalk, leaf

You can see fantastic patterns and shapes through the lens of a microscope that were made by nature itself. Take a closer look, and you will understand why leaves are so green, how roots soak up water, what pollen is, why roses smell, and why nettle bites.

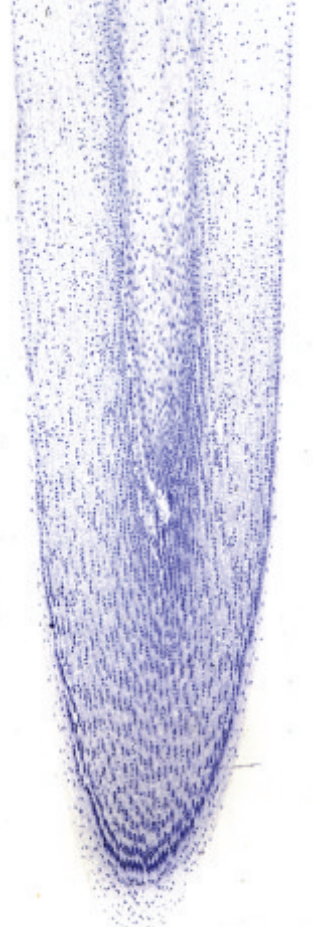
Root

Even though plant roots come in all shapes, they all have similar structure. One of the root's main functions is soaking up water and mineral salts. A microscope will help you find out how this process goes.

Experiment

It is best to look at young roots of wheat or pea sprouts.

- 1 Place some wheat seeds into a shallow bowl, then pour some water so it covers the seeds halfway, cover the bowl with a piece of wet cheesecloth, and put the bowl away into a dark cupboard for a few days. During this time, the seeds will wake up and begin to sprout.
- 2 Prepare a very thin section of the very tip of a root. Put it into a drop of water on a glass slide and cover it. Looking through your microscope, notice how the cells on the tip of the root appear loose. They form what is called the root cap. This cap protects the sensitive tip of a root from damage. Besides, the root cap cells exfoliate and lay the way for the root to more easily make its way through the soil.
- 3 Above the root cap are the zones of cell growth and multiplication, which allow the root to grow in length. Above these zones are sensitive root hairs.
- 4 Use a sharp blade to separate a thin layer with root hairs on it. Put the sample on a glass slide and a cover slip over it. Roots soak up so much water, because there can be a thousand of these hairs on one square millimeter of a root. Under a microscope you will see that a hair consists of a single elongated cell.



↑ Longitudinal section of a wheat sprout

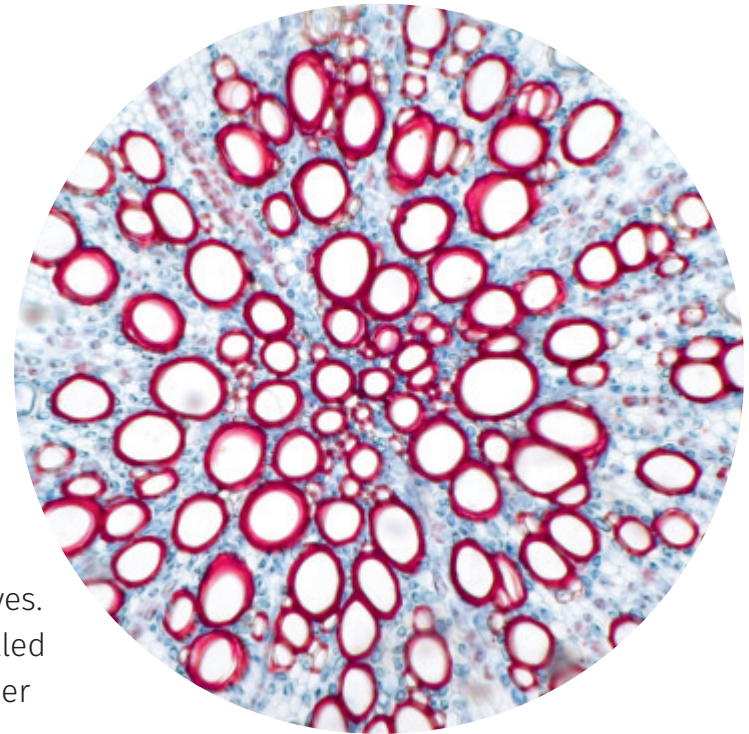
↓ Root hair



Inside of stalks

To study a plant stalk, learn to make thin and transparent sections of them. If you cut the stalk lengthwise, it's called a longitudinal section, and if you position the blade across, you'll get a cross-section. To begin, choose plants with soft stalks, like begonias, spiderworts, or tulips.

You'll see groups of cells, and many empty circles on a cross-section – those are long hollow tubes that allow water and mineral salts to travel through the stalk to the leaves. The tissue consisting of these tubes and transport cells is called xylem. Trees have dense bark on the outside, and dense timber on the inside.

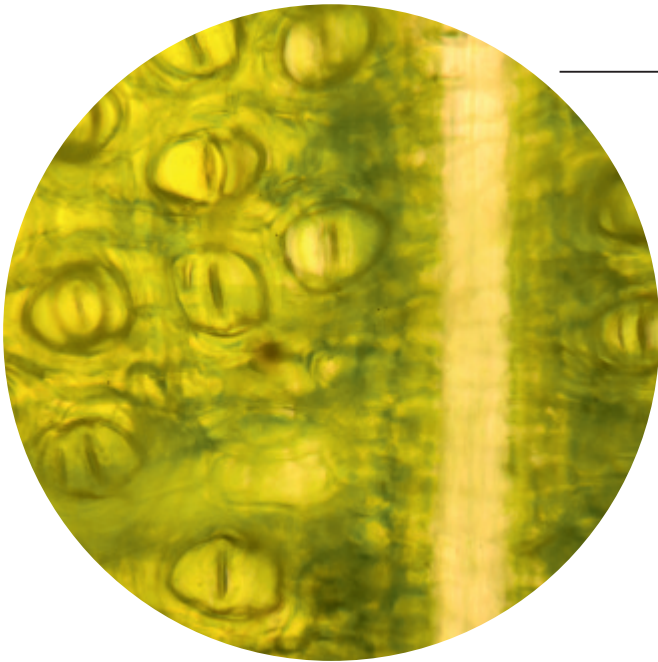


↑ Cross-section of a parsley stalk

Such green leaf

Look at the leaves of different plants, like celery, parsley, geranium, or begonia, through a microscope. Notice how the lower surface of leaves is filled with stomata, which serve for breathing. Stoma consists of two cells that close and open, forming a gap. Gas exchange and moisture evaporation occur through this gap.

← Stoma on the lower surface of a leaf



It's fun to examine
all the parts of a plant;
The microscope sees things
that our eyes can't!

