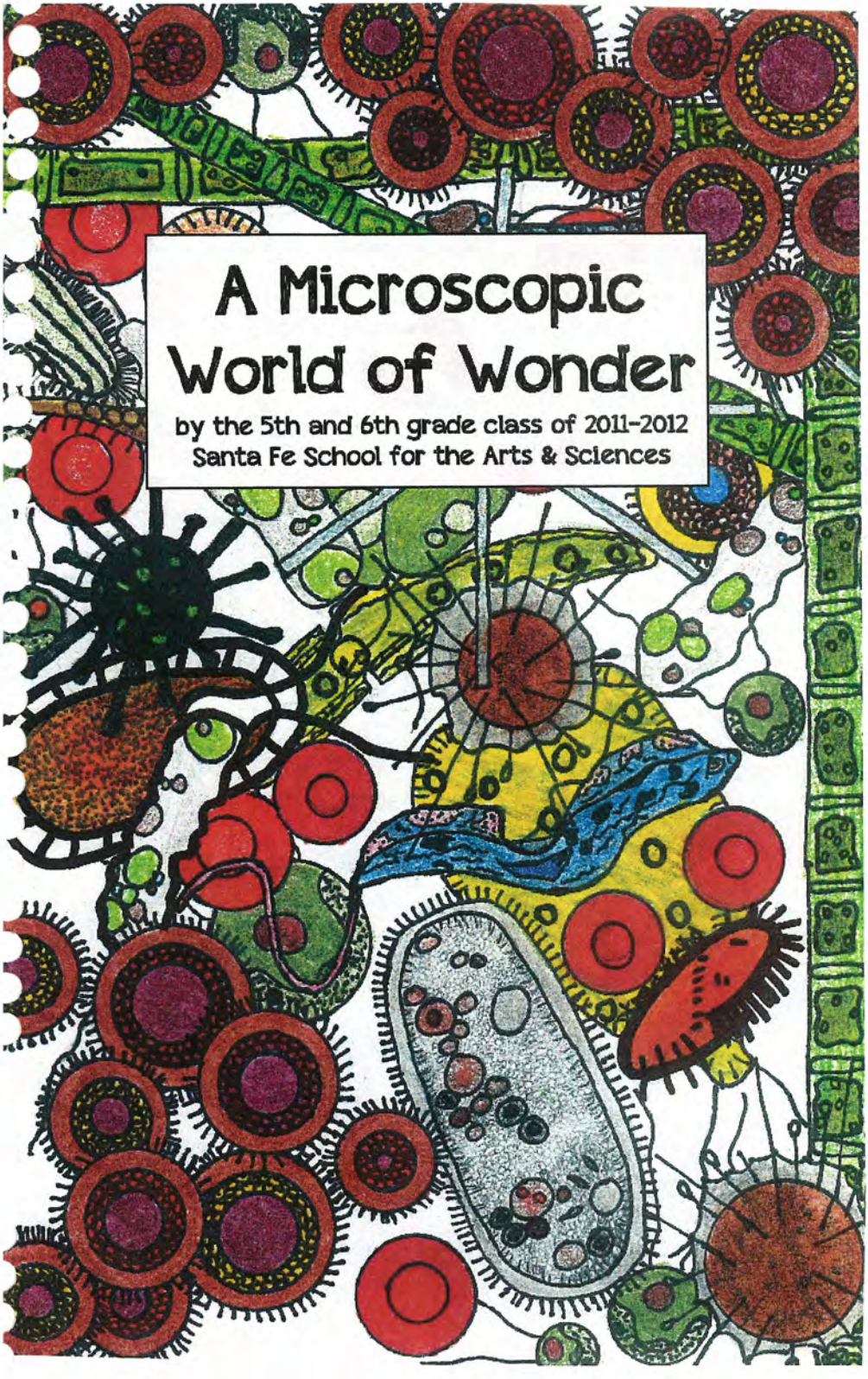
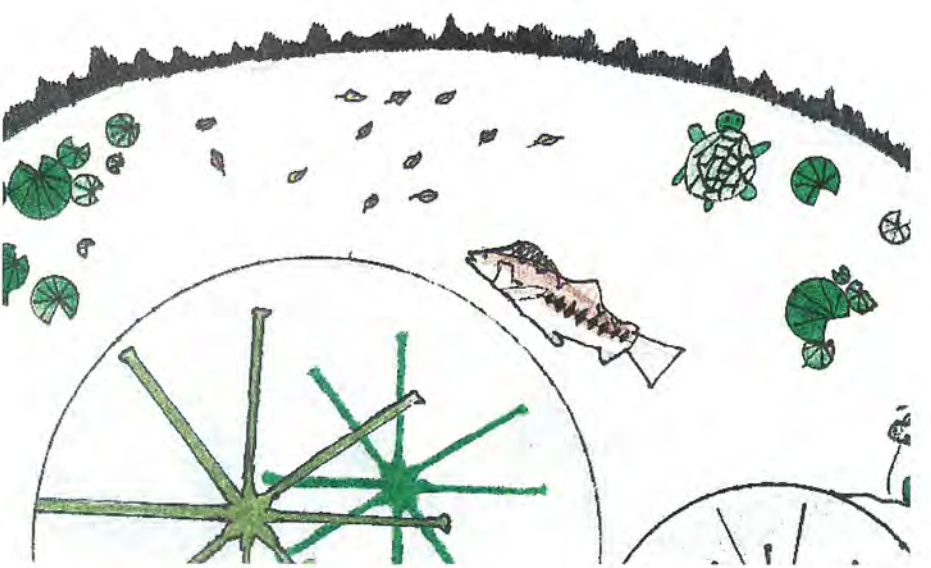

A Microscopic
World of Wonder
by the 5th and 6th grade class of 2011-2012
Santa Fe School for the Arts & Sciences

Santa Fe School for the Arts & Sciences is an independent Expeditionary Learning school for preschool through 8th grade. We are committed to academic excellence with a global perspective and a hands-on art & science enriched curriculum, in an environment of respect, inclusion and diversity.

We believe that students thrive when given opportunities to develop their personal talents, in a caring environment where each child has opportunities for self-expression and growth; and are challenged to meet rigorous academic and character standards.

We believe that learning needs to be challenging, engaging and connected to real life.

We believe in the power of compassion, citizenship and service to transform the lives of children and teens.



The 5th and 6th grade class at Santa Fe School for the Arts & Sciences conducted an expedition on the importance of microorganisms. The students collected samples to analyze from a spring fed pond ecosystem near our school and also conducted research using various resources, including books and the internet. To our amazement, we viewed and documented over 30 different species from algae, to protista, to tiny multi-celled animals.

Some of the pages in this book contain research on species that we found and others are microorganisms that students found to be interesting.

After conducting our research and learning about the basics of biology, we came up with a list of reasons why these microorganisms are so important.

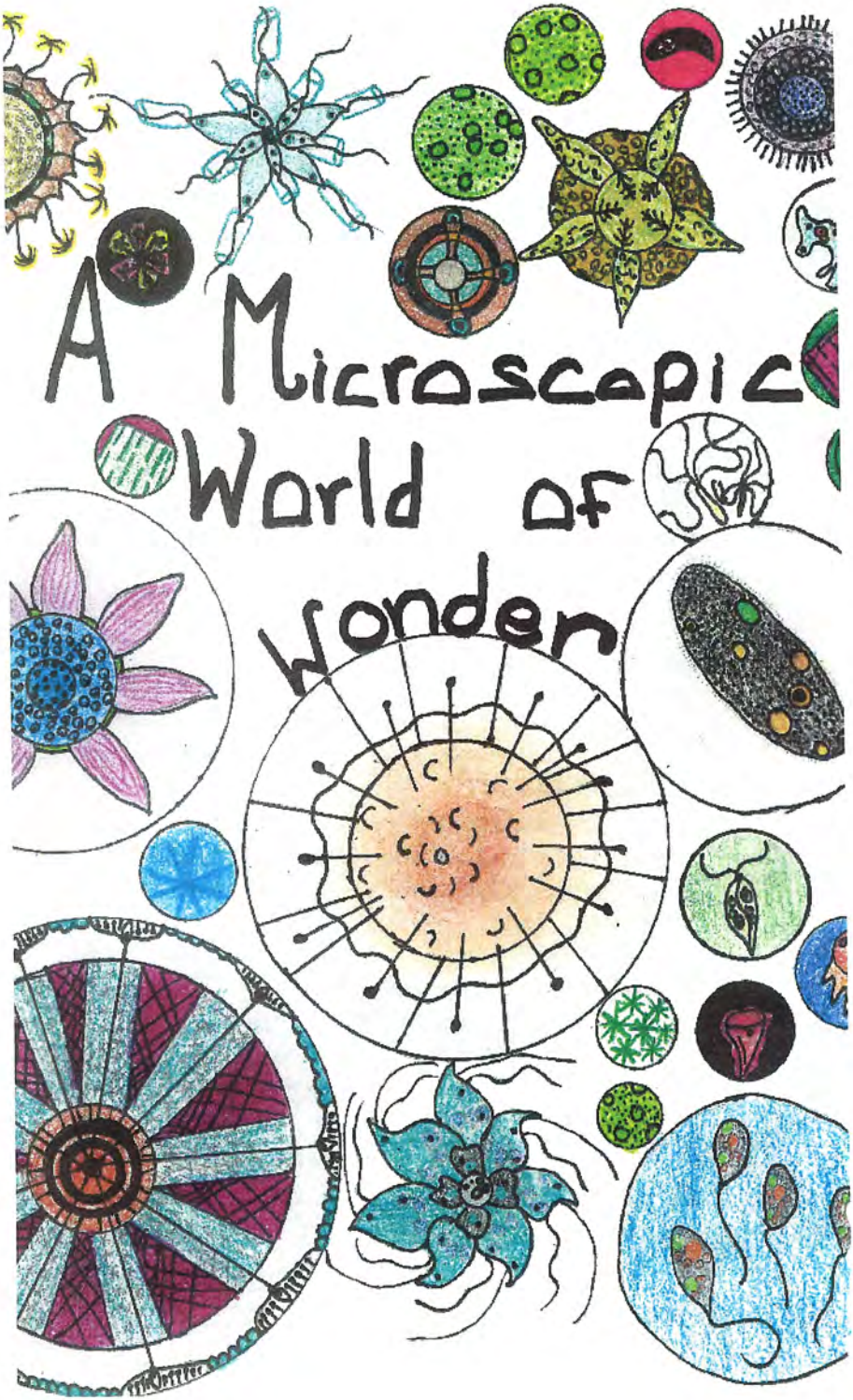
- Bacteria that photosynthesize oxygenated our atmosphere billions of years ago.
- Bacteria help us digest our food.
- Algae produce 50-70% of the earth's oxygen.
- Algae are used to produce many of the foods that we eat including Nori, jellies and ice-cream.
- Species from the kingdom of Protista are the backbone of most food chains and end up feeding everything from insects to whales.
- Many bacteria and fungi are the primary decomposers in our world and without them we would be living in a world where nothing ever returned to the soil.
- Bacteria produce rich soil for growing the world's crops. They release the Nitrogen in the earth that is necessary for plants to live.
- Some microscopic organisms are needed to research and create medicines.
- Bacteria and yeast are needed to create foods such as bread.
- Single celled organisms could be the very first living things which eventually evolved into all of the known species.

This guide contains organisms that fall into three main categories; Protists, Fungi and Bacteria.

Most of the organisms are measured in micrometers. One micrometer equals 1/1000 of a millimeter.

We hope you enjoy our book.

The Badger Class


A Microscopic
World of
Wonder

Protists

By Elliott

Protists are small microscopic creatures that live in moist places all around us. Protists can be split up into two simple groups, the algae and the protozoans.

Algae: Algae are autotrophic creatures, meaning they have chlorophyll and create their own food through photosynthesis. Algae can be multicellular but are mostly singled-celled. Algae are eukaryotic organisms. Eukaryotic means that the algae have a membrane bound nucleus. Algae can reproduce sexually and asexually.

Protozoa: Protozoa are organisms that are usually single-celled and are heterotrophic (heterotrophic means they have to eat things to live). They are eukaryotic which means they have a membrane bound nucleus. Protozoans can reproduce sexually and asexually.

Fungi

By Nathan

Fungi are unique organisms. That's why they have their own kingdom. Fungi are decomposers. They break up and dissolve organic materials on the earth. Without fungi and other decomposers, the world would be filled with trash and debris. Everything that ever died wouldn't decay.

Fungi reproduce using seed-like things called spores. When a fungus releases its spores they attach to anything they can. The spores then grow into a full grown fungus. The word fungi is derived from the Latin word 'fungi' meaning mushroom. Molds are fungi as well, but they are in the Hyphae phase. Molds are colonies of fungi that grow where there is moisture. Some molds and fungi are poisonous, like the Death Cap mushroom. Caution: Do not eat mushrooms if not identified.

Bacteria

By Landon

In our modern world, everyone thinks of bacteria as harmful, disgusting, horrible organisms that are nothing but trouble. It is true, some types are dangerous and harmful, but in fact, the human race would never have existed without bacteria! These microscopic organisms do so much for us: they break down waste materials; they give us air; they strengthen our immune systems; they are used to create medicines; they live in our stomachs to break down the food we eat; they help our plants grow. From some of these bacteria that we can't even see, life may have begun.

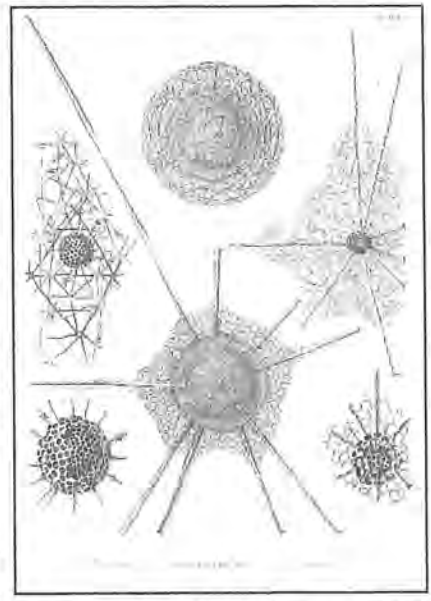
One of the main things they have given us is oxygen. In the early Archaean and Proterozoic Eras, several different species of bacteria transformed Earth's toxic atmosphere into an oxygenated one that could support life.

Bacteria also help plants grow by using nitrogen fixation, the process in which nitrogen chambers buried in the soil are broken, releasing the nitrogen for the plants to absorb. Without bacteria rich soil, most of our food crops would not be able to grow.

Sadly, not all types of bacteria are as amazing and giving. Many of them are hazardous menaces, such as the bacteria known by scientists as Necrotizing fasciitis, also known as the flesh eating bacteria. Necrotizing fasciitis is a relentless species of bacteria that make their way into wounds and releases flesh eating toxins upon your skin, a rare but horrible disease to catch.

Ernst Haeckel

Sofia



Ernst Heinrich Phillip August Haeckel was born on February 16, 1834, in Potsdam, which at the time, was part of Prussia. He coined many words that are commonly used in biology today, such as anthropogeny, ecology, phylum, phylogeny, and stem cell. Haeckel created the name for the Kingdom Protista, of which he discovered thousands of new species. His published artwork includes one hundred color illustrations of animals, protists, and sea creatures. His first published artwork was an atlas of radiolarians which was published in 1862. Haeckel was somewhat of a Renaissance man; he was known as a naturalist, an artist, and a poet.

After finishing his studies at Cathedral High School in 1852, Haeckel studied medicine in Berlin and Würzburg under the instruction of Albert von Kölliker, Franz Leydig, Rudolf Virchow, and with anatomist Johannes Peter Müller. After receiving a doctorate in medicine in 1857, Haeckel attained a license to practice medicine. At his father's wish, Haeckel became a doctor, but realized he couldn't stand the suffering of patients. Despite his father's aspirations for him, Haeckel studied under Karl Gegenbaur at the University of Jena for three years, and received a doctorate in zoology. In 1862, Haeckel began his career as Professor of Comparative Anatomy. He remained in this position for forty-seven years.

Haeckel's scientific career began just as Charles Darwin published On the Origin of Species in 1859. After reading On the Origin of Species, Haeckel immediately converted to Darwinism, and was the first known Darwinist in Germany.

Between 1859 and 1857, Haeckel named thousands of species of radiolarians while voyaging on his boat, the Challenger. On one

Challenger expedition, Haeckel discovered that the Marianas Trench was the deepest spot in the world. In 1866, Haeckel journeyed to the Canary Islands where he met Charles Darwin. He traveled as a researcher to Norway in 1869, Dalmatia in 1871, and Egypt, Turkey, and Greece in 1873.

In 1867, Haeckel married a woman named Agnes Huschke. They had three children: a son, Walter, who was born in 1868, and two daughters; Elisabeth, who was born in 1871, and Emma, who was born in 1873. Haeckel retired from teaching in 1909 and his wife died six years later in 1915. After his wife's death, Haeckel grew increasingly frail, and suffered from a broken femur. He died in Jena, Germany on August 9, 1919 at the age of eighty-five.

Ernst Haeckel is the namesake for two mountains, Mount Haeckel in the Eastern Sierra Nevadas with an elevation of 13, 418 feet, and Mount Haeckel in New Zealand with an elevation of 9,649 feet. Asteroid 12323 Haeckel was also christened after Ernst Haeckel.

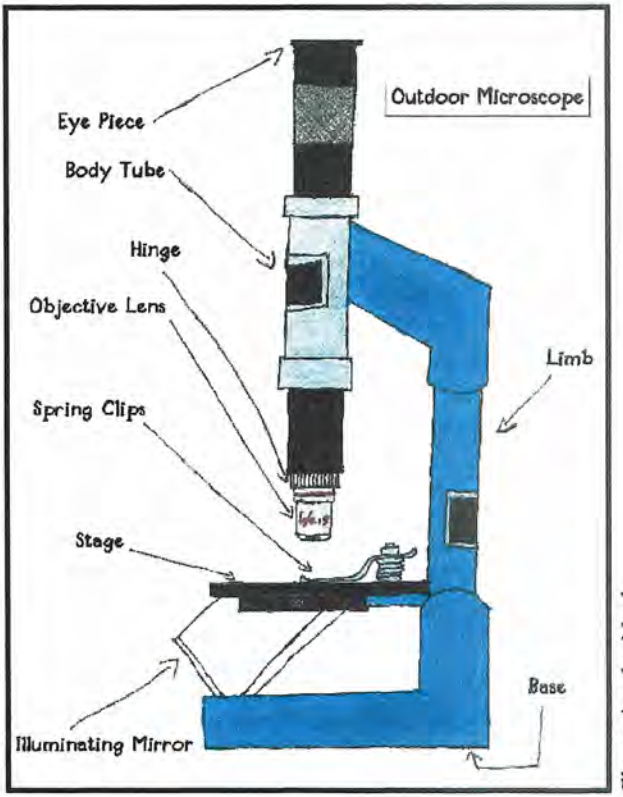


Illustration by Noah

White Fish Fungus
Saprolegnia ferax

Phylum: Heterokontophyta
Class: Oomycota

Description: Saprolegnia ferax is a white or grey fungus that grows on fish and tadpoles. It reproduces by releasing its seed-like spores. Saprolegnia ferax causes white fungus disease. It attacks already dying fish or tadpoles. The fungus disease begins to grow around the fins; it then spreads out towards the stomach area. Over a long period of time it kills the fish or tadpole. It then decomposes its victim. It does not attack humans.

Habitat and Distribution: Saprolegnia ferax is found in freshwater ponds, rivers, and lakes. The fungus grows on most types of fish; therefore the fungus is found wherever fish are found in the world.

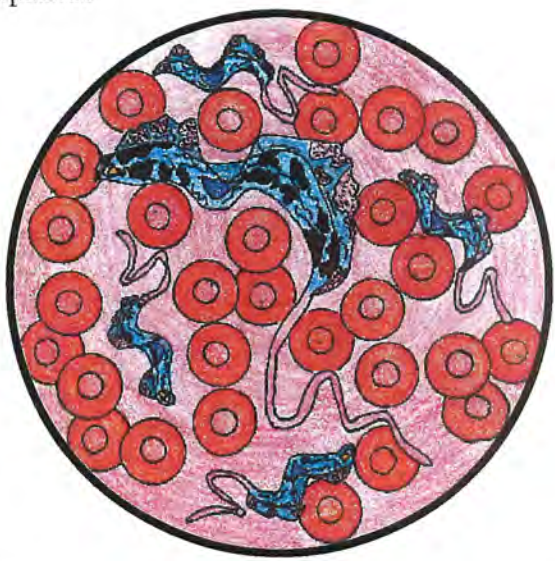
Facts:

- When the fish dies, the Saprolegnia ferax decomposes the fish which releases nutrients into the water.
- The fish is like armor for the Saprolegnia ferax, the fungus does not die even if the fish dies.
- Hyphae (the white stuff) can grow on newborn tadpoles and fish almost immediately.

-Nathan

Trypanasoma brucei

Phylum: Euglenozoa
Class: Kinetoplastea



Description: Trypanasoma brucei are protozoans that have a similar body shape to the eel. These microscopic parasites are the same size as human blood cells. T. brucei are the protozoans that cause the disease African trypanosomiasis (sleeping sickness). Trypanosoma brucei are multicellular parasites that have pink uniflagella to help them propel their body through the hosts' blood stream. The creature is different shades of blue with pink, black and purple patches all over its body. This species lives in the mid gut of the Tsetse fly and travels to the salivary glands of the fly. When a host is bitten by the fly, T. brucei can be transmitted to the host. The symptoms for sleeping sickness are: red spots on arms, swollen and tender lymph nodes, fever, drowsiness, sweating, and malaise. Weakness later on may cause a coma and possibly death. After two to five years, brain issues may start to occur. These creatures reproduce by binary fission, which means that they are Asexual. Trpanosomaisis eat antibodies which are fibers in human and insect blood cells.

Habitat and Distribution: T. brucei are only found in Africa in the sub Saharan. They live in the human blood stream or in the mid gut of the Tsetse fly.

Facts: There is a drug called Melarsopol that can cure sleeping sickness but this treatment is unbelievably painful causing a burning sensation throughout your body and the treatment can be fatal.

-Berke

Eutardigrade
Hypsibus eutardigrade

Phylum: Tardigrada
Class: Eutardigrada

Description: The Eutardigrade is a microscopic creature that lives in moss around freshwater. The Eutardigrade (Water Bear) looks similar to a bear. They have four legs on each side of their bodies making a total of eight legs with several claws that extend out. The Eutardigrade's size can range from 0.05 to 1.2 millimeters. The Water Bear trudges around on moss and lichen sort of like a bear. Water Bears eat liquid plant and animal cells, but they can also occasionally eat nematodes and rotifers. The Water Bear can put itself into a sort of coma called cryptobiosis when they're not in preferable circumstances. When they put themselves in the coma they don't need food or water and they can live forever if they stay in the coma. Later on when conditions are preferable again, the Water Bear can awaken itself.

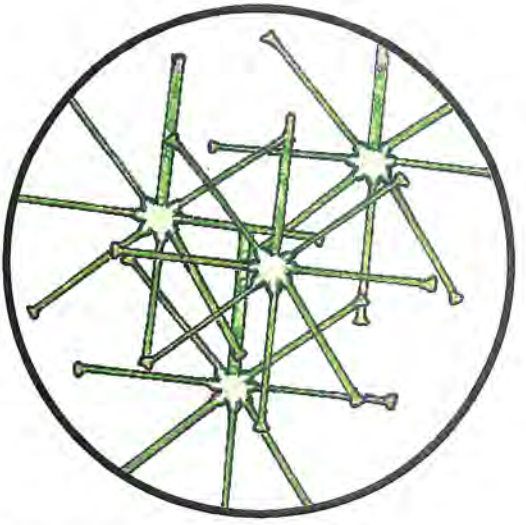
Habitat and Distribution: The Eutardigrade lives around freshwater on mosses, lichens, and liverworts. There are more female Water Bears than male, and after they mate the female lays eggs that have exoskeletons. After the eggs hatch, the Water Bears molt. They have to shed their exoskeletons numerous times before they are full adults.

Facts: The Tardigrade can withstand extreme temperatures such as being frozen and also boiled. Scientists have sent Water Bears into space and they have lasted fifteen days.

-Amaica

Asterionella
Asterionella formosa

Phylum: Heterokontphyta
Class: Bacillariophyceae



Description: Diatoms are microscopic single-celled algae. They exist in many different forms such as ribbons, fans, zigzags, and stars.
Diatoms are encased in a cell wall made of silica called a frustule. Silica is made of hydrated silicon dioxide. When the Diatoms die, the frustules fall to the bottom of the ocean. Over time, the frustules build up into a layer of soft sedimentary rock. This is called diatomaceous earth. Diatomaceous earth is mined and used for many different things such as a stabilizing component for dynamite, cat litter, thermal insulation, and pesticides. Asterionella is a species of Diatom. It is named for its starburst shape and is green to golden-brown in color. The word Asterionella is derived from a word in Latin meaning beautiful or handsome. Asterionella is a very large Diatom; it can grow to be as large as the period at the end of this sentence. Scientifically speaking,
Asterionella is 10 to 160 micrometers in diameter. It reproduces through binary fission, meaning it only needs itself to reproduce. Each generation of Asterionella gets smaller because of the way it reproduces. Eventually, it reproduces with another Asterionella, and then the binary fission cycle repeats. Asterionella is an autotroph, meaning it creates its own food through photosynthesis. Photosynthesis occurs in organelles called chloroplasts. The chloroplasts hold chlorophyll, which is an important component in the process of photosynthesis.
Asterionella collects molecules of carbon dioxide and water. The chlorophyll traps light energy from the sun. This light energy helps start a series of chemical reactions that split the water molecules into hydrogen and oxygen, releasing chemical energy. Asterionella collects the energy. It moves around using a flagella, which is a long tail-like appendage.
Asterionella is a tasty meal for different types of zooplankton as well as different types of worms, anemones, and assorted mollusks like clams and mussels.

Habitat and Distribution: Asterionella is a freshwater Diatom. It is very common, and can be found in ponds and lakes all over the world. It can especially be found in hard water with high levels of calcium and magnesium salts.

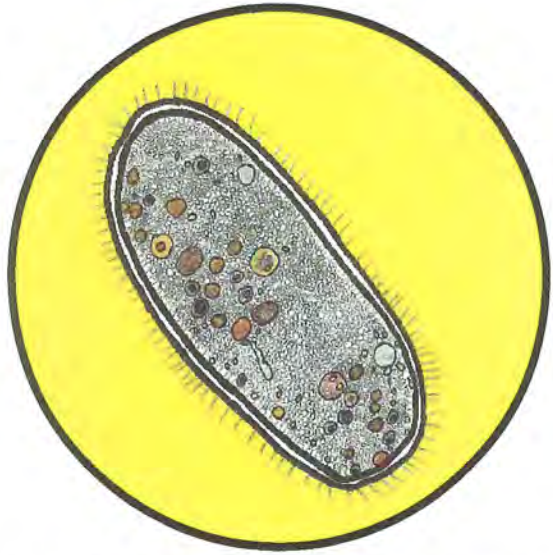
Facts:

- Diatomaceous earth can be used as a dietary supplement and to get rid of mites found on chickens.
- Asterionella is a centric Diatom, meaning that it is arranged symmetrically around a central point.

-Sofia

Paramecium

Phylum: Ciliophora
Class: Holotrichia



Description: Paramecium are single-celled animals. Their body is mainly made up of water. They're clear on the surface and coarse on the inside. Paramecium have brown, white, yellow, orange, black, and gray colors on its inside. Paramecia have one big nucleus and usually a smaller one as well. They have a solid layer on the outside that is a permanent shape, unlike an amoeba. The Paramecium is 200-260 micrometers long. Paramecium are covered in small hairs called cilia and they move through the water by waving these cilia. The Paramecium usually eats Green Algae, Bacteria, Euglena, and Amoeba. Food goes through a hollow in one of the sides of the Paramecium called the Oral Groove. The Oral Groove leads to a tube called the gullet. Food in the gullet will form a ball; it passes into the protoplasm as a food vacuole. The food is digested as the food vacuole passes through the organism; then the waste goes through a place called the Anal Pore. The predators of Paramecium are, Amoebas, Water Fleas, Easter Lamp Mussels, Golden Shiner, Euglena, Greater Bladderwort, Black Crappie, Rotifers, Copepods, Scuds, Predatory Nematode, Planarian(Flatworm), and Didinium. The Paramecium has capsules that release dart like structures to fight off Protists like Didinium.
Paramecium may reproduce by splitting in two, which is called Binary Fission. Paramecium also show the beginnings of sexual reproduction. Two individuals may come together and exchange their micronuclei. This process is called conjugation.

Habitat and Distribution: The Paramecium is usually found in fresh water ponds, lakes, rivers, and streams.

Facts: Before Paramecium divide, they exchange packs of DNA. Then they split and make two daughter cells. This process is called conjugation.

-Sabrina

Rotifer

Phylum: Rotifera
Class: Monogononta

Description: Rotifers are microscopic animals that have huge wheel-like organs. They are yellowish in color. They are animals and not protists because they have more than one cell. Some rotifers have a triangular shaped body with two small arms, but most are long and can retract. Rotifers are about 50 micrometers long. They move by using their tiny hair-like structures called cilia, or by somersaulting around. Each rotifer lives from a week to a month. Rotifers reproduce by laying eggs. During the warm seasons, there are only female rotifers. When the weather gets cooler the females lay special small eggs that hatch into males. The males swim to find a female and then they mate. Once all the eggs hatch they will be females. If a pond dries up, a rotifer can change into a cyst and survive for up to a year. The wind will blow the cysts around until they land in water. They eat by sucking in their prey with the cilia on their wheel organ. Shrimp and crabs eat them.

Habitat and Distribution: They can be found in different quiet waters, such as ponds, gutters, puddles and birdbaths. They also like weedy shallows so they can attach to plants and algae. They are found most everywhere in the world.

Facts: Did you know that rotifers can attach and live on the heads of shrim-like animals such as daphnia?

-Orion

Gastrotricha

Phylum: Gastrotricha
Class: Chaetonotida

Description: The Chaetonotus is a type of Gastrotrich. Gastrotrichs are microscopic, multicellular animals that have a shape similar to a bowling pin. Their bodies are covered in small hairs called cilia. The Chaetonotus moves in a gliding action with its cilia moving back and forth. They have a mouth and may have sticky tubes on the head or the trunk. The usual size of a Gastrotrich is 50 micrometers to 3.5 millimeters. They are usually light blue. They possess both male and female sex organs. The sperm are released through ducts on the underside of the animal roughly two-thirds of the way down the body. Once the sperm is produced they are picked up by another organ on the flagella which transfers their sperm to the partner. The eggs are released by a rupture of a body wall. They eat bacteria and algae such as Volvox. They can be eaten by other organisms such as; Amoebas, Nematodes, and other small amphibians or mammals.

Habitat and Distribution: All Gastrotrich live in water. They're mostly found in bogs, mossy pools, plant-choked ditches, birdbaths, and ponds. Some live on the sea floor while other species can be found in moist soils.

Facts:

- They look similar to ciliated protists.
- They can loop around, rather like a leech.
- Did you know that the Chaetonotus is the largest known freshwater Gastrotrich?

-Noah

Spirogyra

Phylum: Gamophyta
Class: Zygnematophyceae

Description: Spirogyra is a green algae that looks like long chains or ribbons at first glance. However, if you look at them closely under a microscope, you will see they are more like long trains of many cars that are all alike. Each of these "cars" is a single cell. Each cell is 10-100 micrometers long. Spirogyra move with the water currents and if they are lucky they will find a mate. Spirogyra reproduce both sexually and asexually . Spirogyra is a very vibrant green that makes it very easy to spot under a microscope. They are autotrophs which means they photosynthesize to get energy. Spirogyra is very important to us because they give us a lot of our oxygen and it would be much harder to breathe without them.

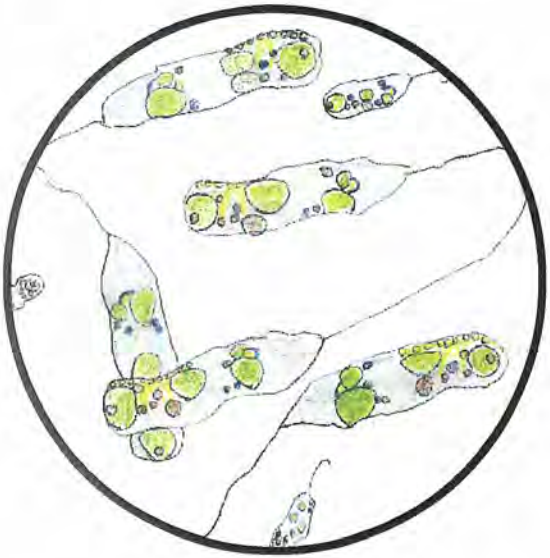
Habitat and Distribution: Spirogyra like to live in calm and quiet waters along shorelines.

Facts: Did you know that in times of stress Spirogyra reproduces genetic material across conjugating tubes? These tubes may form between two cells and they can exchange DNA. To the naked eye, Spirogyra looks like green human hair. Spirogyra, along with all other algae, give us 50-70 percent of our oxygen!

-Makai

Peranema
Peranema trichophorum

Phylum: Euglenozoa
Class: Euglenoidea



Description: The Peranema is a microscopic single-celled organism. It has two thick flagella (tails) that it uses to move. The first tail turns at its tip and creates a propeller to help them move. The second tail is very hard to see and it emerges from the hole at the bottom of the peranema. Their bodies are oval shaped with a narrow top and a shortened bottom. They are 20 to 70 um (micrometers) long. They capture their food live then ingest it with the help of a stiff feeding tool called a "rod-organ," and they also rip it apart. The rod-organ is dull and has been seen to move back and forth while feeding. Its main task is to create suction to draw prey to its mouth called a cytostome.

Habitat and Distribution: Peranema are found in quiet waters such as ponds, lakes and ditches. They are common at the bottom of rich pools in rotting natural material. You can find them in Western Australia.

Facts: In 1841, Dujardin created the genus of the peranema, however, he was not able to detect the second flagella.

-Julianna

Arcella

Phylum: Rhizopoda
Class: Lobosea

Description: Amoebas are small single celled animals. Arcella is a kind of amoeba that has a transparent light brown test (shell) that is shaped like a dome. They have pseudopods (fake feet) sticking out of the sides of the test. Arcella use their pseudopods to move. They will reach out with their pseudopods and pull the rest of the amoeba along. Arcella can be anywhere from 50 to 200 μm (micrometers) wide. Arcella can occasionally be seen with the naked eye, but usually they look like miniscule specks without a microscope. Arcella eat algae and other protists. They eat using a process called phagocytosis. Phagocytosis is the process of enveloping prey. Arcella grasps its prey with their pseudopods in order to trap and eat it. Arcella have predators too. They are often eaten by Mononchus, a kind of nematode, or round worm. To reproduce, Arcella and other amoebas divide in half through a process called fission. The arcella splits into two daughter cells that eventually grow and split again.

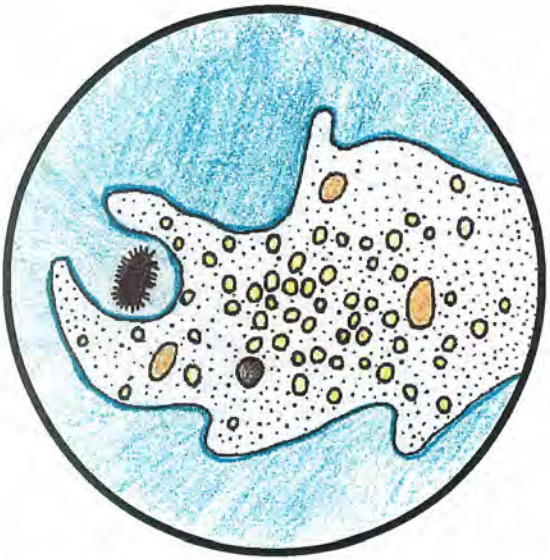
Habitat and Distribution: Arcella live almost everywhere in the world. Their habitat includes, ponds, marshes, mosses and even wet foliage.

Facts: The word, 'Amoeba' is derived from Greek, meaning 'to change'. There are about 11,500 known living species of amoeba.

-Indu

Amoeba

Phylum: Rhizopoda
Class: Tubuliena

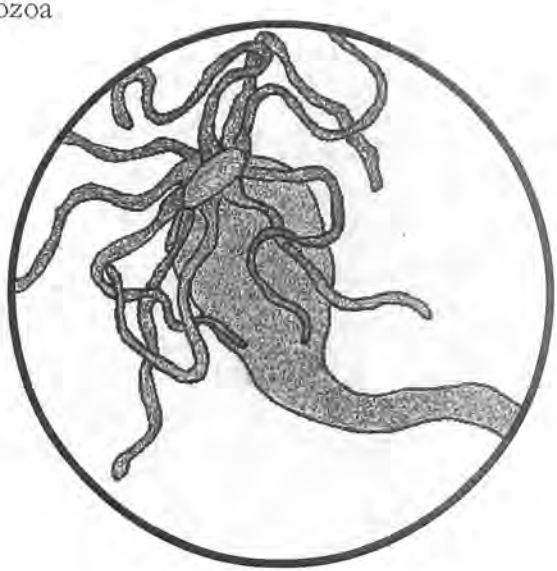


Description: There are many different types of amoeba, but the most common is small, see-through, and blob-like. Amoebas can get up to 800 μm wide; most amoebas can be seen without a microscope.
Amoebas move by reaching out with their pseudopods (fake feet) and pull the rest of the amoeba foreword. Amoebas reproduce using a process called fission. Fission is when the amoeba splits in half, creating two small cells called daughter cells. The daughter cells will eventually grow and split again. Amoebas eat using phagocytosis. Phagocytosis is the process of enveloping prey. They grasp their victims with their pseudopods in order to trap and envelope the prey.
Habitat and Distribution: Amoebas can be found almost everywhere in the world. They live in ponds, wet foliage, marshes, mosses, and some can even be found in dirt.
Facts: When an amoeba consumes its prey, the prey can stay alive for a while inside the amoeba. There is a kind of amoeba called Naegleria floleri that lives in fresh water. If the amoeba gets inside of a human it will make its way to the brain and cause fever, headache, loss of appetite, and nausea.

-Indu

Hydra

Phylum: Cnidaria
Class: Hydrozoa



Description: The hydra is a tiny vicious animal with powerful tentacles and one opening for a mouth. When a large hydra is extended it can stretch up to 10mm long, with a long sack-like body equipped with up to 12 tentacles bordering its mouth. The hydra moves by bending over and holding on with its mouth and tentacles, then it releases its foot. This creates a firm attachment and then it flips again. This process is called looping. The hydra can reproduce sexually or asexually. When food is plentiful, it can reproduce asexually by creating a small bud on its body wall. This bud will become a small adult and detach when ready. When food is rare, hydras will reproduce sexually, also creating the small buds. The hydra eats prey by wrapping its tentacles around it and pulling it into its mouth. The hydra has an amazing defense system. When a small trigger hair is pushed, the hydra can shoot out tiny-harpoon like nematocysts into its enemies or prey, and then use a small string to pull the victim into its mouth.

Habitat and Distribution: The hydra lives all around the world on submerged plants in unpolluted fresh water streams, ponds and lakes.

Facts: Some hydras use nematocysts which can paralyze prey. Some have long tentacles that can be used like ropes and other hydras have sticky tentacles that stick to prey. When hunting the hydra can move up to 10cm a day.

-Alec

Stephanodiscus

Phylum: Bacillariophyta
Class: Centrales

Description: Diatoms spend most of their lives using sunlight to turn carbon dioxide and water into nutrients, energy and oxygen. Stephanodiscus is a golden-brown diatom that lives in the open waters of the world. It is 60 to 70 micrometers in length and has small spherical cells with miniscule radiating spines that are equally spaced around its outer border. Stephanodiscus is in the kingdom Protista and is a type of algae. The Stephanodiscus diatom reproduces sexually, meaning it needs a male and a female to reproduce. Most photosynthesizing organisms use sunlight to create nutrients, and diatoms store it as fats and oils. Some of the predators of the Stephanodiscus are zooplankton and mollusks. Basically, anything that eats algae eats diatoms.

Habitat and Distribution: Stephanodiscus has been sighted on the coasts of Brazil and other parts of South America. They have also been found in Ohio, USA, Iran, The United Kingdom and Australia.

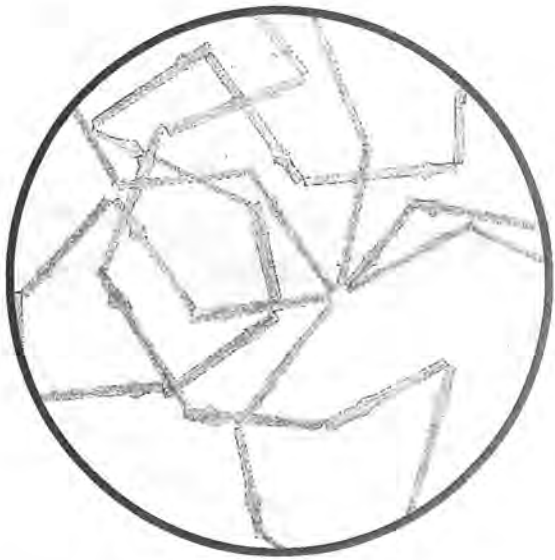
Facts:

- Diatom skeletons are made from a material called silica, often used in glass.
- Some Diatom skeletons are used in some toothpaste, insecticides, chalk, water filters and even as mite dust.
- Diatom shells create layers of ocean floor that are over 50 meters thick.
- On average, diatoms produce almost sixty percent of our oxygen.

-Serena

Tabellaria

Phylum: Bacillariophyta
Class: Pennales



Description: Tabellaria cells often attach in straight rows and then eventually form zigzag links. Tabellaria cells have a rectangular shape and range from green to golden-brown in color. Single Tabellaria cells are 50 micrometers in size and are part of the algae community. Most diatoms produce a special sticky gel that eventually cover their outer silica shells which allows them to attach to rocks, each other, and other algae. Tabellaria reproduce sexually. Like most other diatoms, Tabellaria create energy through photosynthesis. Most enemies of diatoms are also enemies of algae. Some things that eat them are zooplankton, mollusks, and anything else that eats algae.

Habitat and Distribution: You can find Tabellaria almost anywhere, as long as it's wet and has a ton of algae.

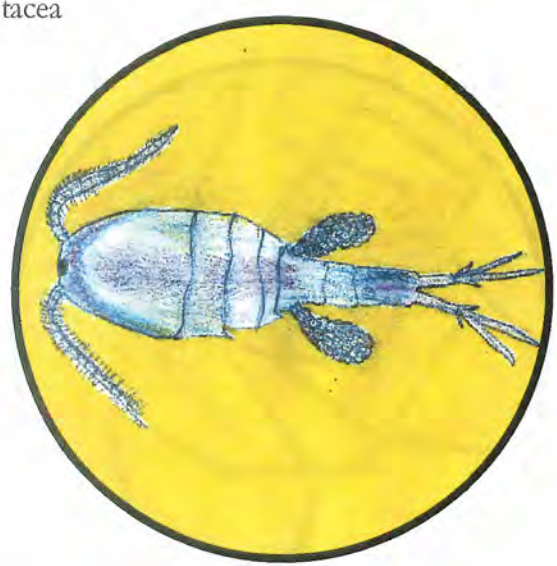
Facts:

- Tabellaria have a thin glass like skeleton that (once the diatom dies) pile up on the ocean floor by the billions.

-Serena

Cyclops

Phylum: Anthropoda
Class: Crustacea



Description: The Cyclops is a microscopic animal about 2-3 mm long with one black or red eye in the middle of its head. Cyclops is one of the most common genera of fresh water copepods. The Greek myth told of a person with one eye, which is how this microscopic animal got its name. Most of them are plain grayish brown, but some can be brightly colored. They flick their long feathery antennae to push themselves through the water. A Cyclops' body is divided into two parts, the thorax and the abdomen. A hard hat-like jointed shell covers the head and thorax. The Cyclops is eaten by fish and other aquatic animals and they make up a very important part of the food chain. Copepods make up the largest source of protein in the oceans. They are very close to zooplankton (a major food source for seabirds and other aquatic animals) and they feed on phytoplankton (small algae).

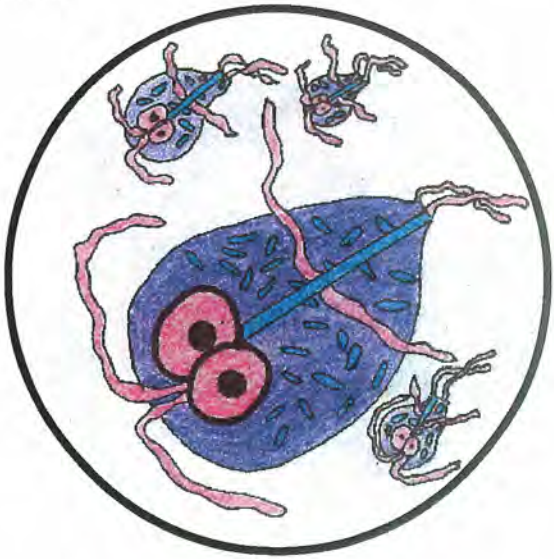
Habitat and Distribution: Soils, sands and quiet waters. In shoreline sands to a depth of 10cm.

Facts: The Cyclops has five pairs of legs and a divided tail-like appendage called a Furca. The female carries the eggs in little side pouches and they can multiply rapidly. The Cyclops is commonly seen near water fleas or Daphnia. The female Cyclops reproduce without fertilization for many generations until the habitat starts drying up. They then reproduce another generation, including both male and female, which produce fertilized eggs.

-Chloë

Giardia

Phylum: Metamonada
Species: G. lamblia



Description: Giardia lamblia are pear shaped creatures that are about eight to twelve micrometers long. They move around using their long whip-like tails called flagella. Giardia can reproduce using binary fission. Binary fission is when a cell replicates by splitting itself into two. If Giardia gets into your system it'll give you diarrhea, nausea, and gas. Giardia can duplicate itself while inside your body, making its symptoms worse.

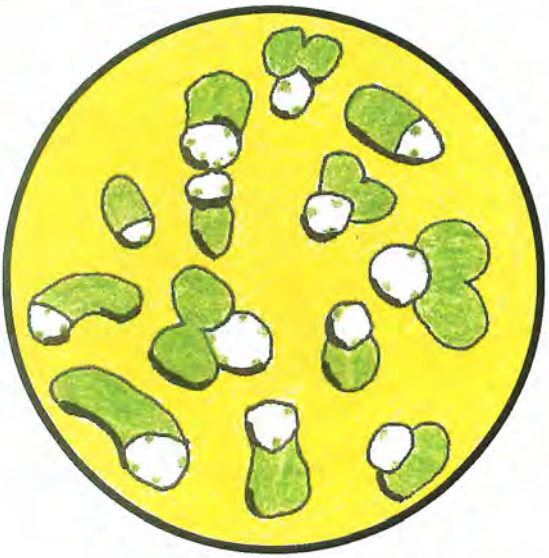
Habitat and Distribution: Giardia lamblia can be found in contaminated food or water and they live almost anywhere in the world. This dangerous parasite is also found in unhygienic places such as untreated sewage and untreated water and sometimes in our own poop. Even water we drink sometimes contains trace amounts of this miniscule parasite.

Facts: Giardia was first discovered by the inventor of the microscope, Antonie Van Leeuwenhoek, when he looked at a sample of his own feces and found it to be swimming with pear shaped critters. People can also pick up this parasite by drinking or eating food that has been contaminated with Giardia passed out in human and animal fecal matter. Remember, whenever you go hiking or camping and drink water from a lake or stream, be sure to boil, filter, or use iodine in your water, just in case.

-Camille

Red Algae
Cyanidioschyzon merolae

Phylum: Rhodophyta
Class: Cyanidophyceae



Description: Red Algae are microscopic plants that look like long oval beans. Inside the front there is the nucleus that contains the DNA of the cell. Right under the nucleus is the mitochondria, which is the cell powerhouse of the cell and under the mitochondria is the green plastid that contains chlorophyl. The plastid is the cell's storage area. Red Algae are about one micrometer wide and around two micrometers long. Red Algae reproduce by duplicating all of their organelles, and then the cell splits into two new cells. The way Red Algae gets energy is by creating its own food through a process called photosynthesis.
Habitat and Distribution: This Red Algae likes very acidic environments so it is generally found at the bottom of saltwater oceans.
Facts:

- This specific species of Red Algae is the leading cause of a red tide. A red tide is a major algae bloom that causes the water to glow red.
- A red tide can be harmful to sea life and if we eat any seafood that is infected we could get sick and die.
- This Red Algae is green when the cell is alone, but when it is in large groups it is red.

-Kareem

Brain Eating Amoeba
Naegleria flowleri

Phylum: Percolozoa
Class: Heterolobosea

Description: Naegleria flowleri are free-living ameboflagellates that can infect the nervous system of humans. The N. flowleri has two forms, in water it has a flagella for swimming and when in a hosts' brain, it takes on an amoeba-like form where it moves by stretching pseudopods out and dragging itself. N. flowoeri reproduces by binary fission where it splits into two identical cells. N.flowri is a light blue color. The form it takes while reproducing is called the Trophozite. These amoebas can change into a cyst form to help it survive poor conditions. In cyst form, they can survive temperatures under 10 degrees celsius. The ameboflagellates eat by stretching out its pseudopods around its food then it closes in and dissolves the prey. Naegleria flowleri can invade the nervous system of humans by entering through the nose and into the brain where it feeds.

Habitat and Distribution: N.flowleri can be found in warm fresh water lakes in the southern United States.

Facts:

- If you are infected, you have a 98% chance of dying.
- An infection by N. flowleri is extremely rare, but in worst cases, the amoeba feeds on the human brain and usually causes death.

-Isaac

Armored Water Bear
Heterotardigrada

Phylum: Tardigrada
Class: Heterotardigrada

Description: Heterotardigrada are small microscopic animals that resemble armored polar bears. These armored plates are split into five segments. The armor is very strong for their minute size. They also have eight legs with sharp claws. Heterotardigrada grow from .1 to 3 mm long. At their biggest, they can be seen without a microscope. They move by paddling around or walking on their legs. Heterotardigrada can reproduce in different ways. Female water bears can lay from 1-30 eggs that are then fertilized by the male. They can also lay eggs that will hatch without fertilization from a male. Heterotardigrada suck the fluids from plant and animal cells using a stylus, but sometimes they eat smaller organisms. Heterotardigrada are not eaten by many other organisms. They are in the Animalea kingdom because are multicellular.

Habitat and Distribution: Heterotardigrada live on mosses and lichens. They have been found on every continent, including Antarctica. Using a stage called cryptobiosis (cryptobiosis is when the Heterotardigrada shuts down all of its systems and goes into a state of suspended animation) Heterotardigrada can live in space.

Facts:

- When Heterotardigrada are in the state called cryptobiosis they can withstand temperatures from -314° to +308° Fahrenheit for months. In cryptobiosis they can also withstand six times the pressure in the deepest oceans on earth. But that's not all, it takes 1-2 days for a human to die in a desert, but a water bear has been found in a sample of dry moss where it lived for 120 years. They can also withstand 570,000 roentgens (roentgens are used to measure radiation). That is 100 times the radiation it would take to kill a human.
- Because Heterotardigrada can enter the state of cryptobiosis when their environment gets tough, scientists have been sending them into space to be studied. This is such a big movement that the European space agency started a program called Tardigrades In Space which they abrivated to TARDIS.

-Elliott

Didinium

Phylum: Ciliophora
Class: Litostomatea

Description: The Didinium is roughly 90 micrometers long, but can grow up to 200 micrometers. It is shaped like a cylinder and has a long snout-like mouth. It is a ciliate, meaning it moves using cilia. Cilia are small wires, kind of like miniscule hairs that pulsate to make the creature move. Unlike other protists in the Phylum Ciliophora, Didinium move using two bands of cilia around the bottom and top of the critter as opposed to a body completely covered in cilia. It can reproduce asexually or sexually. The Nuclei copies its genetic information then splits using a process called Binary Fission. The Didinium's diet consists of Paramecium. If there are not enough Paramecium it can and will eat other things. The Didinium hunts in packs, like microscopic wolves. One Didinium is a quarter size of Paramecium, which is why the packs are more effective. The Didinium pack will encircle a Paramecium and devour it with their snout mouths.

Habitat and Distribution: The Didinium lives in freshwater ponds, lakes, and in other still waters. The Didinium, because of its diet of Paramecium, is found wherever its prey is. It is usually found among dead vegetation and pond scum.

Facts:

- D. nasutum, a species of Didinium, can shoot poisonous spears called trichocysts at their prey.
- A pack of Didinium can eat up to two Paramecium in an hour and up to eight in a day.

-Nathan

Water Flea
Daphnia magna

Phylum: Arthropoda
Class: Branchiopoda

Description: Daphnia magna is a small organism that is similar to a flea. Daphnia magna can grow up to 3 mm. The reproduction for daphnia is called parthenogenic (that means the eggs develop without having to be fertilized). Daphnia appear to be see-through. Daphnia have a circular-like body and bony-like antenna that are actually arms. The arm-like antenna are used to move in a zigzag motion. While it moves it catches suspended bacteria and green protists that it eats. Fish, hydra, and insect larva are daphnia's enemies and eat them. Daphnia are very important to freshwater food chains. Daphnia is an animal and not a protist because it is not single cellular.

Habitat and Distribution: Daphnia can be found in quiet or open waters, away from vegetation, like ponds and lakes.

Facts: It doesn't seem fair to call harmless organisms fleas, but in 1669, a Dutch naturalist (who was good with a microscope) named Jan Swammerdam, called what he saw Pulex aquaticus arborescens, which in Latin means "the water flea with the branching arms." Ever since then the common name for Daphnia has been water flea. Did you know that Daphnia have compound eyes?

-Okema

Stentor
Stentor roeseli

Class: Heterotrichea
Phylum: Ciliophora

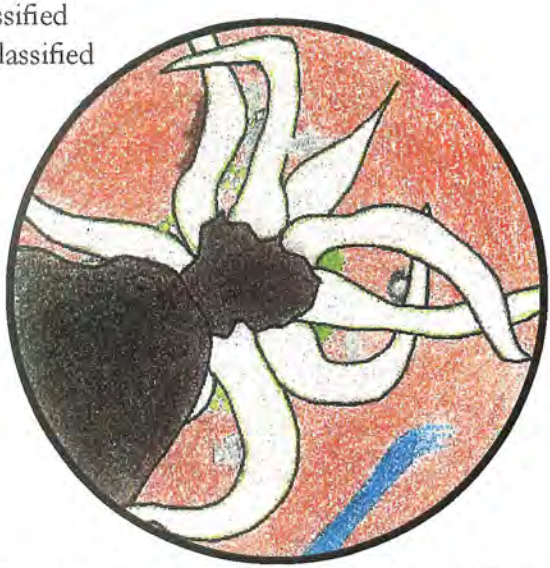
Description: The Stentor is one of the largest unicellular organisms and reaches a length of two millimeters. They have a trumpet like shape, giving them the nickname trumpet animalcules. The Stentor has cilia around the perimeter of its "bell", which sucks in food and helps with swimming. When food comes near the bell, the suction created by the movement of the cilia vacuums the food toward the mouth. The Stentor can be various colors like a bluish-green, peach, brown, or green differentiated by the different species. The Stentor reproduces asexually, using Binary Fission and cloning itself. The Stentor can also reproduce sexually, with two Stentors of different gender.

Habitat and Distribution: The Stentor can be found worldwide. They are usually found on leaves, algae, and other debris, and are normally found in freshwater.. The Stentor can contract into a sphere and can swim around either extended or in its spherical condition.
Facts: The Stentor dislikes light, and thus prefers to be in faintly lit areas.

-Amaica G.

Cyanophyta/Blue Green Algae

Phylum: Cyanobacteria
Class: unclassified
Species: unclassified



Description: Cyanobacteria are microscopic, unicellular bacteria that are photosynthetic and often grow in large colonies. These bacteria have developed the nickname "blue green algae" because, not only are they a blue green shade (in most environments), but they are aquatic and photosynthetic just like algae cells. When in colonies, they can appear in long chains or spiked balls. One of the greatest gifts Cyanobacteria gave all creatures on Earth was during the Archaean and Proterozoic Eras, when many types of Cyanobacteria developed Earth's oxygen atmosphere. Because we depend on our modern atmosphere for life, before the Cyanobacteria began forming, this planet was not suitable for life at all. Cyanobacteria are also extremely famous because they are said to be the oldest known fossils, more than three and a half billion years old!

Habitat and Distribution: During the beginning of the early Cambrian Era (just after Proterozoic), Cyanobacteria began making their way into eukaryotic cells (organisms that have a membrane bound nucleus and organelles). Once inside the cell, they then donated most of the food produced from photosynthesis to the eukaryote in return for a place to live (this process is called endosymbiosis). A part of eukaryotes today known as the mitochondrion is simply an organelle originating from the Cyanobacteria. Today, Cyanobacteria can be found in most terrestrial and aquatic habitats, such as oceans and freshwater, and have been found in bare rock and soil.

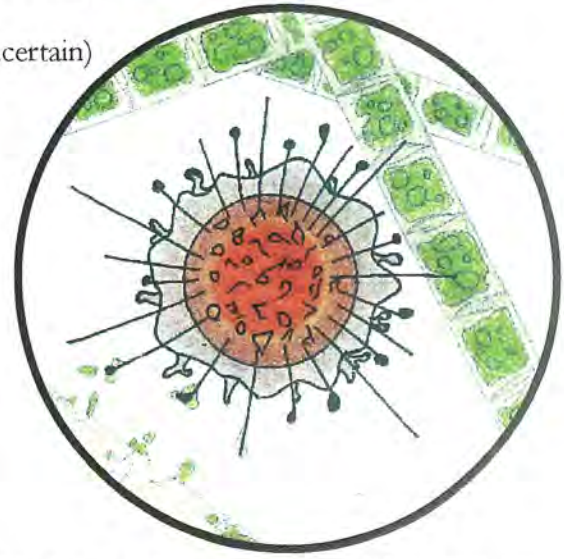
Facts:

- Cyanobacteria make 20-30% of our planet's production of photosynthetic energy.
- They also convert solar energy into a type of chemical energy at surprising rates.
- Cyanobacteria are nitrogen fixaters, which is one of the best fertilizing materials for rice and bean farmers.
- WARNING: If your skin comes in contact with the aquatic form of Cyanobacteria, it will mildly burn. Wash wherever it has been exposed with water and soap.

-Landon

Vampyrellidae/Vampyrellid
Vampyrella Lateritia

Phylum: Cercozoa (uncertain)
Class: Proteomyxidea



Description: The Vampyrellidae has a very distinctive appearance: It has a glowing center of orangey-brown, accented by vicious spikes lining its entire outside. Occasionally, under a certain light, you can spot it giving off more of a green-blue color. The Vampyrellidae measure from 30-50 micrometers across, and to move, takes on a more amoeboid form by stretching its body. Their method of reproduction is currently unknown, but they are thought to use binary fission (The process of the cell replicating its DNA, then itself, and then separating into two daughter cells). To eat, this heliozoan-like cell (meaning "sun creature" because of the limbs stretching out radially covering the cell) locates a string of algae cells and punctures one of their cell walls with its spike-like appendages. It then squeezes the trap doors it made and simply waits for the cell's cytoplasm (inner jelly-like filler) to flow out. Per cell, the intake of the cytoplasm usually occurs within a second. The Vampyrellidae inherits its name because of the resemblance between its method of feeding, and that of the infamous Vampire. Vampyrellidae have reasonable defenses. If it already had its pseudopodia ("fake foot/feet") extended into directed spikes, not only would the larger creature be highly intimidated, but if its cell wall was weak, the spikes would rupture and tear up the wall. If placed in a freshwater environment where there were high amounts of algae and it was a location where those cells were not wanted, the Vampyrellidae could theoretically regulate the amounts.

Habitat and Distribution: The Vampyrellidae is found mostly in freshwater ecosystems because of the plentiful sources of algae living in them. However, its only confirmed relatives: The Platyreta and the Arachnula, target fungi cells instead, making them dwell in terrestrial waters all over the world. The Vampyrellidae has only been discovered in the United States (specifically Lamont Pond in New York).

Facts:

- Alternate Order: "Aconchulinida"
- Contains granular cytoplasm
- Contains tubular cristae inside mitochondria (energy source for the cell)

-Landon

Planarians

Phylum: Platyhelminthes
Class: Turbellaria

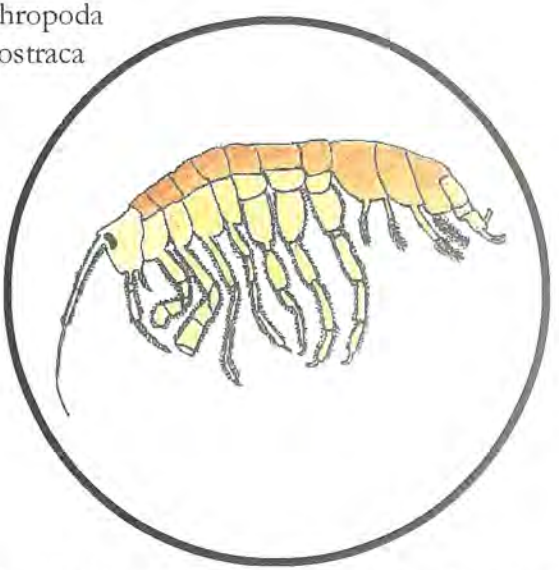
Description: Planarians are non-parasitic flat worms that are in the Animal kingdom because they are multicellular. They have a soft, wedge-shaped body that may be black, brown, grey and even white. Planarians have two eyespots known as ocelli that are sensitive to light. These eyespots are used as photoreceptors; planarians use these to move away from light sources. They also have two ear-like projections called auricles at the base of the head. These are sensitive to touch and some chemical compounds. The mouth on a planarian is located in the middle of their underside. This mouth is covered in lots of cilia, which are hair-like projections that move them along. They eat by extending a tube from their mouth and spitting acid onto their prey and then they suck up the parts that have dissolved. They eat crustaceans, larvae and small worms. Planarians have two nerve cords that connect to a simple brain. Lots of other small nerves join them making a ladder like formation.
Planarians grow up to 12.7 mm long. They can reproduce sexually and asexually. Planarians can produce both male and female gametes, but they need another planarian to fertilize their eggs. To reproduce asexually, planarians split their body in half and both sides develop into a full planarian. That means that they can regrow their head and nervous systems.
Habitat and Distribution: Planarians live in salt and freshwater lakes, ponds and rivers. Some terrestrial planarians live under logs, in wet soil and on leaves. They can be found all over the world as long as they have the right conditions to thrive.
Facts:

- Because planarians can regenerate their body pieces, you could cut a planarian into ten pieces and all of them would grow back into a new planarian.
- Planarian is the common name given to many non-parasitic flat worms from the Turbellaria class.

-Elliott

Amphipods
Amphipoda

Phylum: Arthropoda
Class: malacostraca



Description: Amphipods are in the family of crustacean and are related to things like crabs and lobsters. They look like little shrimp. Amphipods are animals because they have more than one cell. They can grow to 10 millimeters, but they have been known to get up to 11 inches long! They usually mate after they molt six times. They reproduce by having the eggs in a pouch. The female carries the eggs around until they get fertilized by a male. Then the little amphipods will hatch in 2 to 54 days depending on conditions. They move by using their legs to swim. They are eaten by fish, penguins, shore birds and other little crustaceans. Amphipods are a huge food source and are very helpful in the food chain. They eat detritus, which is dead plant and animal material floating around in the water or algae. The marine amphipods eat seaweed and algae. Amphipods are broken up into 13 segments, three of which include the head, thorax, and the abdomen. The front two legs are used for grabbing things to eat. The other 8 pairs of legs are used for swimming around.

Habitat and Distribution: They like to live in quiet shallow waters. They also like submerged vegetation. They live in most parts of the world. You can also find them in swimming pools, but they will clog up the filter. The marine amphipods can be found on seaweed. Recently a new type of amphipod was discovered. It was found in a cave in Carlsbad, N.M. The cool thing is that they were blind, and they had been down there for thousands of years. So they also live in caves or warm moist places.

Facts:

- Did you know that the amphipods have no larva stage which means they come out as mini adults?
- Did you know that they are more active during the night than the day?
- Did you know that after amphipods die they turn a reddish color?

-Orion

Euglena
Euglena gracilis

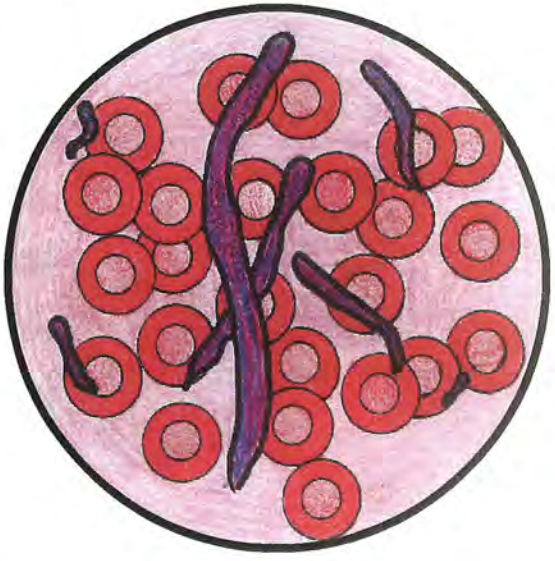
Phylum: Euglenoza
Class: Euglenoidea

Description: Euglena is a microscopic, single celled algae. They are cylindrical in shape and have a flagella that may be longer than their bodies. Euglena is one of the strange algae that actually has a tail to move itself through the water. They also have a red eye that can see light. Euglenas are 35 to 45 micrometers long. They are asexual which means that they can split into two. Euglena are green or red, and they make their own food through photosynthesis. Their predators are fish, frogs, amoeba, paramecia, craneflies, worms, and other microscopic protozoa.
Habitat and Distribution: Quiet and open waters, pools, puddles, bird-baths, aquaria, ditches, muds and sands. You can find them everywhere.
Facts: In the summertime the crust on the water can turn green to red from lots of euglena on the surface. When they are in a group their color is green. When the Euglena are in the dark for too long, their green spots will disappear and then they can't make their own food. When they are colorless and they can't create food, they die. But if you put them in the sunlight they can get their color back and come back to life.

-Julianna

Roundworms
Wuchereria bancrofti

Phylum: Nemotoda
Class: Secernentea

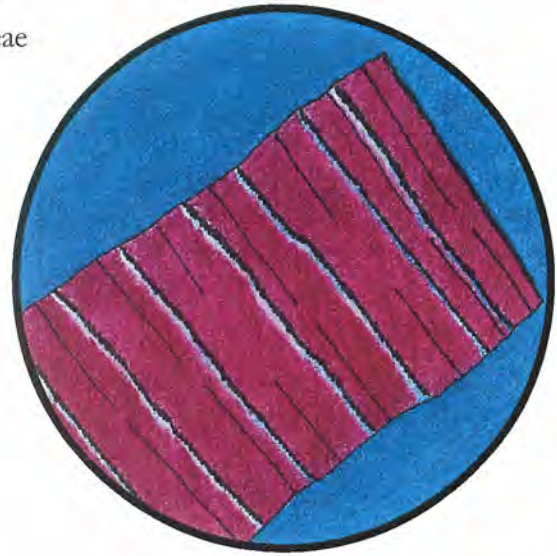


Description: Wuchereria bancrofti (also known as roundworm) are long, thread-like parasitic worms that are about eighty to one hundred micrometers long. Roundworms reproduce sexually. This means that they have to mate with another roundworm that is the opposite gender. Wuchereria bancrofti lay up to about 2,000 eggs a day.
These worms cause a disease known as elephantiasis. Elephantiasis is a disease known to block the bodies' lymph vessels, making the lower part of the body swell up with the skin thickening, just like an elephant's.
Habitat and Distribution: Although this tropical disease is spread by Wuchereria bancrofti, it can also be spread by mosquitos. The way this happens is the worm gets into the mosquito and lays her eggs. Then when the mosquito goes to feed, it inserts the larvae into a person's bloodstream and into the lymphatic vessels. The baby worms stay in the person's body until they're full grown. As full grown adults, these worms get so big, they block the bodies' lymph vessels, causing fluid to build up in the tissues, making the body swell. Roundworms can also live in the soil. If in the soil, they can be transmitted into the body by getting in through the mouth or nose.
Facts: Elephantiasis affects almost 100 million people each year in South America, Central Africa, and Asia. Wuchereria bancrofti isn't the only parasite that causes elephantiasis! Brugia malayi and Brugia timori can also cause this disease. Remember, always wear bug spray when in a place infested with mosquitos and always remember to wash your hands after playing in the dirt, just in case W. bancrofti is hanging around.

-Camille

Fragellaria pectinalis

Phylum: Ochrophyta
Class: Bacillariophyceae



Description: Diatoms are microscopic single-celled algae. Fragellaria is a rectangular shaped diatom. It is also a pennate diatom. Pennate diatoms are bilaterally symmetric and are usually boat or needle shaped. Fragellaria is green to golden-brown in color and can grow to be 140 μm (micrometers) in length. It is encased in a shell made of silica called a frustule. Fragellaria doesn't swim around, but attaches itself to plants and other objects in the water. It reproduces through binary fission, meaning that it splits in half and creates a new Fragellaria. Each generation of Fragellaria gets smaller, meaning that it eventually has to reproduce with another diatom, and then it repeats the binary fission cycle. Fragellaria is an Autotroph, meaning it feeds itself by photosynthesizing. Photosynthesis occurs in organelles called chloroplasts. The chloroplasts hold chlorophyll, which is an important component in the process of photosynthesis. Fragellaria collects molecules of carbon dioxide and water. The chlorophyll traps light energy from the sun. This light energy helps start a series of chemical reactions that split the water molecules into hydrogen and oxygen, releasing chemical energy. Fragellaria stores the energy in the form of fats and oils. It uses these fats to give itself energy. Fragellaria is eaten by zooplankton, different types of worms, and even mollusks.

Habitat and Distribution: Fragellaria can be found on film on rocks or other stationary items in moving waters, or in shallow waters amongst aquatic plants in still waters. Fragellaria likes to reside in waters from -1.948 to 29.468 degrees Celsius in temperature. It can be in water up to three hundred meters in depth, but it needs to be able to close enough to the sun that it can photosynthesize.

Facts:

- When diatoms die, their shells fall to the bottom of the body of water they're residing in, and over time they form a layer of sedimentary rock called diatomaceous earth.
- Diatomaceous earth can be used as an abrasive in toothpaste, and even a stabilizing component in TNT.

-Sofia

Dileptus anser

Phylum: Ciliophora
Class: Litostomatea

Description: Dileptus anser are unicellular protozoans that look like stretched out pears. These creatures are about 24 micrometers wide and 60 micrometers long. Dileptus are wider in the front part and narrower in the back. Dileptus ansers are clear at the front and rear of body with an earthy brown color covering its center. They have a broad and tapered proboscis that moves in the same way as an elephant's trunk. During the feeding process, most of their proboscis falls off, but before their next meal their proboscis grows back. They use their proboscis to strike at their prey. At the tip of their proboscis they have thorn-like hairs that help them grip on to things. The mouth is surrounded by a toxin that stings and paralyzes its prey. To propel its body through water they have cilia, little hairs that help them move. They feed on other unicellular organisms and are very aggressive predatory creatures. Dileptus anser can reproduce both sexually and asexually.

Habitat and Distribution: Dileptus anser like to live in freshwater streams, lakes and ponds. These unicellular protozoans are found everywhere in the world, except for Antarctica.

Facts: Dileptus anser were first discovered by Otto Friedrich Muller in 1773.

-Berke

Volvox

Phylum: Chlorophyta

Description: Volvox is a sphere made out of individual algae forming one colony. Volvox swims around like a big ball with dots in the middle. Volvox is usually one mm long. For many years scientists thought that Volvox rolled in the water like a beach ball, but now they know that each single cell in the colony has a flagella on the outside of the globe. When Volvox reaches a certain size, some of the single cells in the rear lose their flagella and the Volvox starts to divide into daughter cells. Volvox is a bright yellow green and is usually easy to spot under a microscope. Volvox are autotrophs which means they photosynthesize just like plants. Volvox are very important to us because they are an algae and algae gives us 60 % of our oxygen.

-Makai

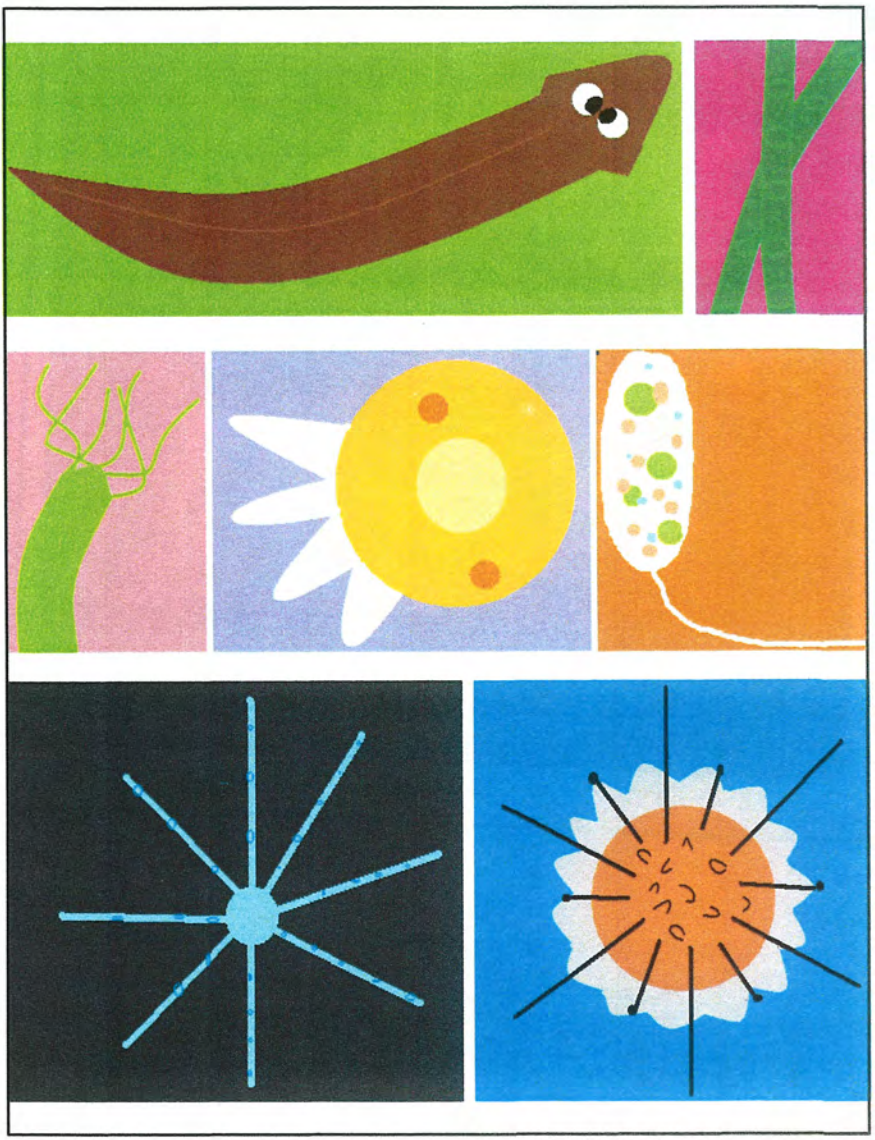


Illustration by Indu

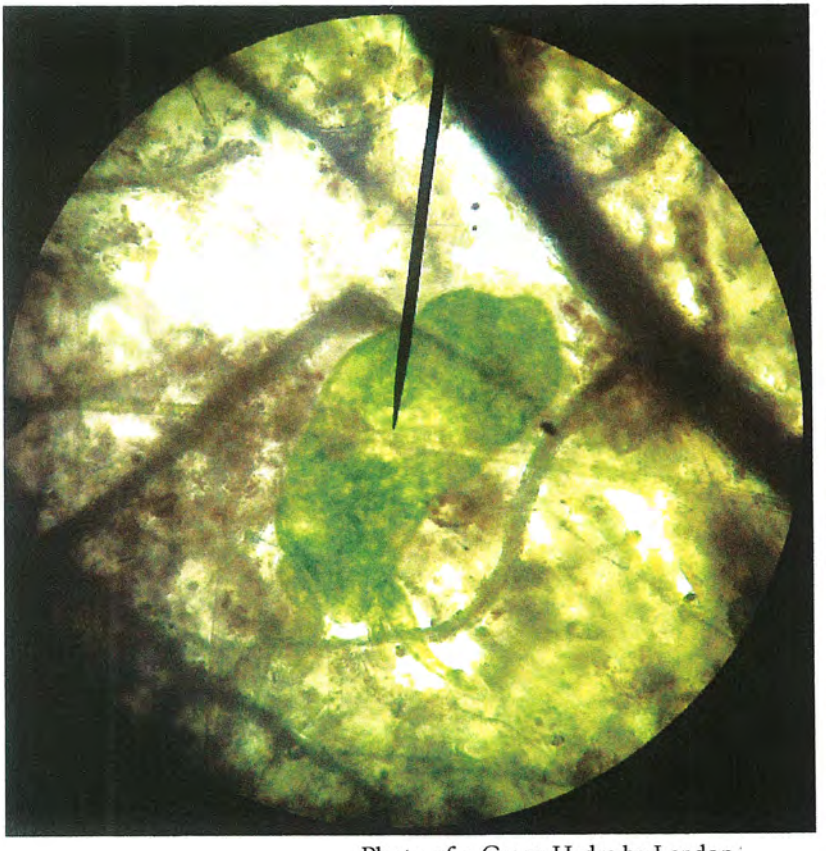


Photo of a Green Hydra by Landon

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