

Plankton

The Unnoticed Residents of All Water Habitats

Plankton are a diverse group of organisms that live in water. Many of these organisms are drifters and inhabit both oceans and freshwater. Since they are so widely available they provide a source of food to many aquatic organisms. Plankton can vary in size, from microscopic to the size of a jellyfish.

Four commonly found freshwater plankton include Planaria, Hydra, Daphnia, and Rotifers.



Planaria

Planaria are free-living flatworms. Like all flatworms, they belong to the Kingdom Animalia in the Phylum Platyhelminthes. Planaria are found in quiet ponds and bodies of water. They are considered scavengers in their ecosystems, eating other animals that have died and sank to the bottom of the pond.

Planaria's bodies are bilaterally symmetrical, meaning they are the same on both sides of their body when divided vertically. They have a triangle shaped head with two eyes, which can detect changes in light in their environment. They have an acoelomate body, meaning they have no internal cavities to hold their organs, thus having a very simple nervous system. Planaria have no circulatory system so it must obtain its oxygen through diffusion that takes place along its flat body. Because of this process, a

Planaria cannot survive outside of water. Flame cells are specialized excretory cells that line the lateral edge of a Planaria's body and remove waste materials.

Planaria can reproduce both sexually and asexually. Since all planaria are hermaphrodites, to reproduce sexually two Planaria pair up and fertilize one another's eggs. To reproduce asexually a Planaria undergoes a process called transverse fission, meaning a single Planaria will pull itself apart and the tail portion will grow a new head while the head portion will grow a new tail. The two new Planaria will then reproduce as normal.

Planaria have been very helpful to scientists in assisting research. A Planaria's body is full of stem cells that allow it to regenerate lost tissues anytime it needs. This could benefit scientific research in many areas, including cancer research and medical treatments.





Hydra

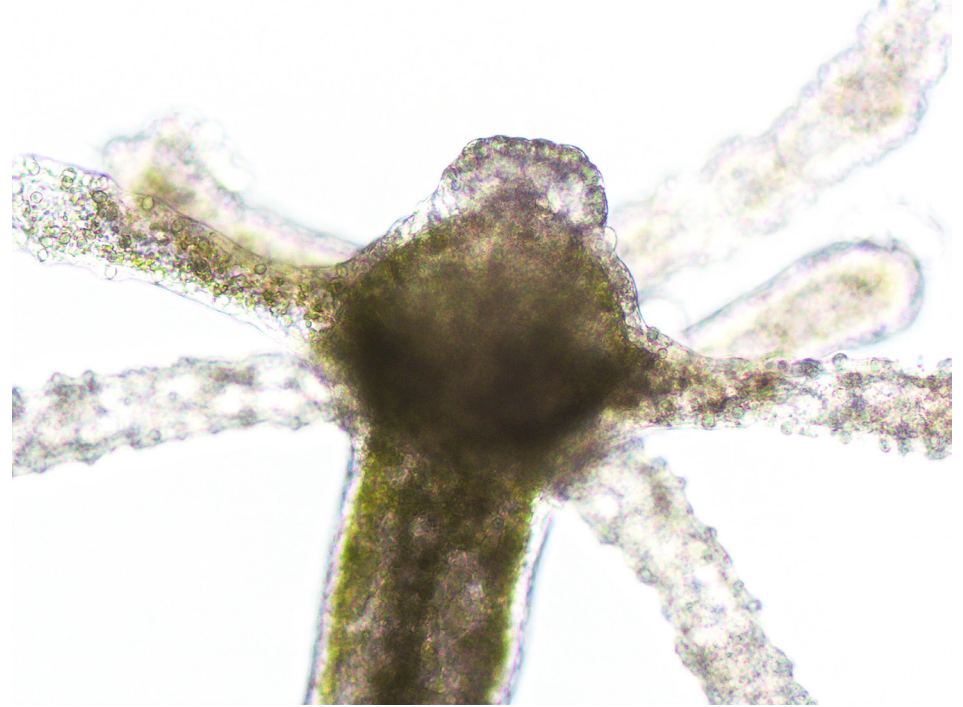
Hydra are freshwater relatives to corals, sea anemones, and jellyfish and belong to the Phylum Cnidaria. They are very common and widespread freshwater invertebrates, which is due to its harsh tolerance to a wide range of temperature fluctuations. They are usually found in slow moving water and attach themselves to vegetation, such as twigs, rocks, or leaves.

A Hydra has a very simple body that is radially symmetrical. It consists of a tubular body, stinging tentacles, a mouth at the base of the tentacles, and an opening in the gut, called the gastrovascular cavity. A species of Hydra called *Hydra viridissima* has a green color due to the presence of algae called zoochlorellae. The algae lives in the Hydra's cells, and in exchange for the color, the algae receives nitrogen from the Hydra's diet.

Hydra can, and will, eat any small invertebrates available,

up to the size of that particular Hydra. To do this a Hydra extends its tentacles which then sting and paralyze the prey, using neurotoxins, and pull it to its mouth. If there is no prey, Hydra will absorb organic molecules from the water to gain energy. If there is no food source available at all, a Hydra will cease reproduction and use their tissues for energy. A Hydra can do this indefinitely, shrinking to a very small size where it will then die.

The most common type of reproduction for a Hydra is asexually. To reproduce asexually it goes through a process called budding. A bud develops when cell division occurs repeatedly in one spot, eventually developing a growth. When the growth matures into a Hydra, it detaches itself from the parent. This new Hydra is a clone of its parent Hydra.



Daphnia

Daphnia are planktonic crustaceans that are a part of the Branchiopoda class. There are over 100 known species in the Daphnia genus. Daphnia can be found in almost all standing freshwater, such as lakes and ponds, but cannot survive in extreme habitats, such as a hot springs.

Daphnia gets its common name, Water Flea, from a jumping like motion that happens from the beating of its large antennae. If a Daphnia remains motionless in water, it will sink. To counteract sinking it will cling onto plants and other substrate found throughout the water.

A Daphnia ranges in size from about 1mm to 5mm. It has an uncalcified shell, called carapace, with a double wall. The gut of a Daphnia consists of three parts- esophagus, midgut, and hindgut. Food is expelled through the hindgut using peristalsis and only when there

is pressure caused by more food. Daphnia are filter feeders; they mostly eat suspended particles in the water. Food is gathered by filtering apparatuses, which consist of phylopods. Phylopods are their flattened, leaf-like legs, which produce a current to filter through. The color of a Daphnia depends on what food it eats. If it eats mostly algae the Daphnia will appear transparent with a tint of yellow or green, while if it feeds mostly on bacteria it will appear white or pink tinted.

Daphnia reproduce asexually. The female produces a clutch of parthenogenetic eggs, meaning unfertilized but they can still form embryos. The eggs begin development immediately and hatch in one day, but stay inside the brood chamber for further development. After three days the new Daphnia are released. Adult females can reproduce one clutch every three-four days until death.



Rotifers

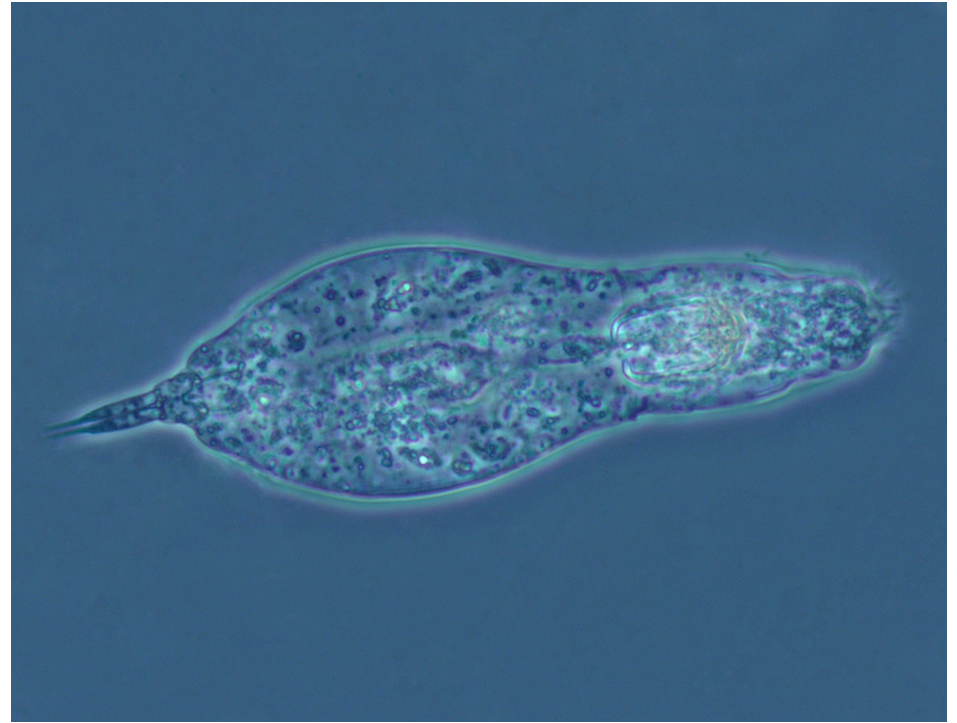
Rotifers are microscopic organisms classified within the Rotifera phylum. There are three classes within the phylum- Monogononta, which contains 1500 species, Bdelloidea, which contains 350 species, and Seisonidea, which is the most primitive of the three. Rotifers can be found in both standing and flowing freshwater environments, and sometimes even moist soil. Rotifers received their names due to some species appearing to have two lobes that look and rotate like wheels, although this is just cilia.

Rotifers are an interesting specimen because they are multicellular organisms but are unicellular sized. Rotifers are mostly soft-bodied and have four basic regions- the head, neck, trunk, and foot. The head carries a corona, or crown of cilia, which draws water into mouth to sift for food. The throat contains the jaws, which are the only hard part

of a Rotifer. The jaws, also called trophi, grind the food. The trunk of the body holds the stomach and reproductive organs. The foot is the bottom part of a Rotifer and ends in a toe, which contains a cement gland to attach itself to objects to sift for food.

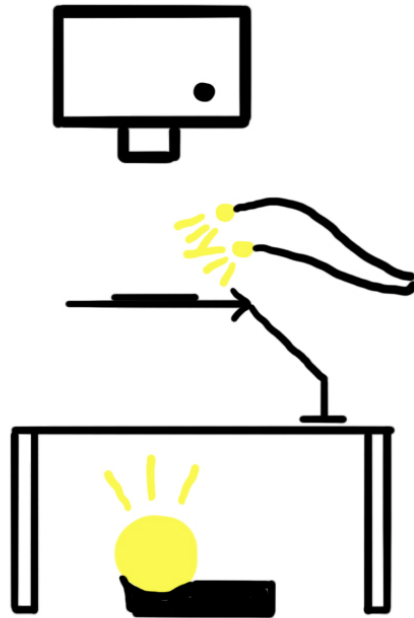
Rotifers are mostly omnivores, but some can be cannibals and carnivores. They may feed on dead or decomposing matter, and unicellular algae. They are usually prey to small carnivores such as shrimps or crabs.

The reproduction of a Rotifer is female based. Some species only have females and daughters develop from unfertilized eggs, called parthenogenesis. Other species have females and degenerate males, meaning that the males only live long enough to fertilize the females' eggs. The females in these species produce two eggs, which are released and hatched in the water.



About the Process

Photographs were taken using both a Zeiss microscope and a Nikon DSLR camera. The light microscope was used when imaging the Rotifers while the DSLR camera was used for the Planaria, Hydra, and Daphnia. When photographing Rotifers, the microscope was set to phase contrast in order for the specimen to be easily viewed. The Planaria, and Hydra were placed on a microscope slide and then transilluminated using a flash to get a white background. There was also two small lights placed above the subject for top lighting. The Daphnia was shot in a similar way to the previous two, but a small black piece of velvet was placed under the slide to get the black background, with just enough light around the velvet to still give bright edges. Please see drawing to the right for a visual representation of the setup.



About the Author:



Morgan Murray is currently a senior at Rochester Institute of Technology. She is pursuing a dual degree in Scientific Photography and Advertising Photography. She is fascinated by the underwater world and the organisms that live in it. Photography is the way she explores her world and captures the memories she will keep forever.

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