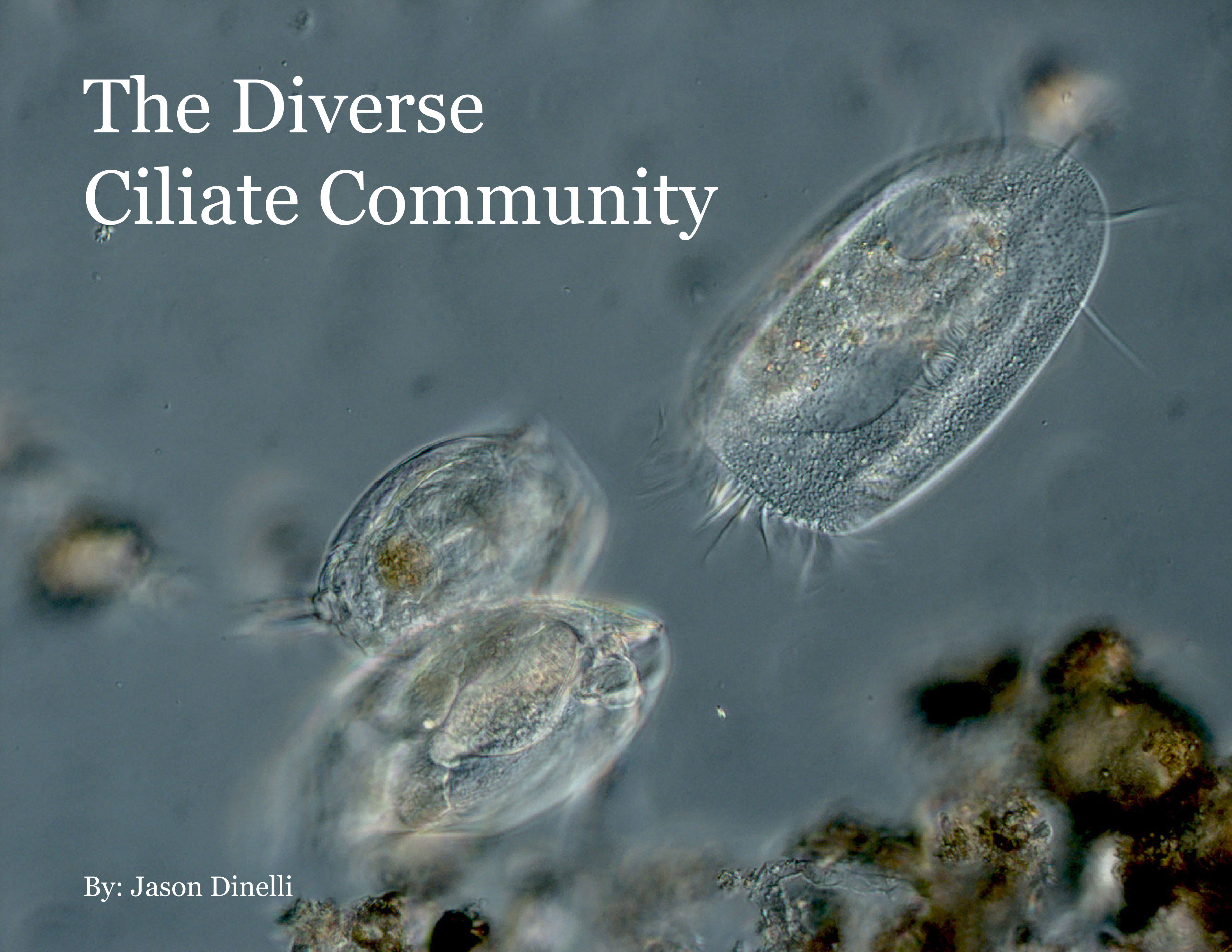
The Diverse Ciliate Community



By: Jason Dinelli

Overview

There are millions of different microorganisms that can be found and identified in fresh water, but they mainly fall under two different kingdoms; the Bacteria Kingdom and the Protista Kingdom.

Bacteria are formed from only one cell, and are referred to as unicellular organisms, or prokaryotes. While bacteria do have genetic material, it is suspended freely in cytoplasm and can easily move around inside the bacteria. There are two Kingdoms of bacteria: Eubacteria and Archaebacteria. Archaebacteria typically live in very harsh conditions that range from being very hot, to very cold, and from being very acidic and very basic. Eubacteria live in less harsh conditions than that of Archaebacteria. Bacteria are found in everything around us and can be helpful to some organisms, and also very dangerous to other organisms.

Protists are either uni or multicellular organisms of the Protista kingdom that live in wet, or moist conditions. Protists, unlike bacteria, are eukariotic. This means that the organism has a membrane-bound nucleus and other membrane-bound structures in their cytoplasm. Protists are both autotropic (synthesize energy on its own) and heterotropic (obtaining energy from organic compounds created by autotrops) depending on its specified species. Protists come in many different forms including Ciliates, Sarcodians, Zooflagellates and Sporozoans. The article focuses on different classifications of Ciliates and the main structures that compare and contrast each classification.

Ciliates

Ciliates in the phylum Ciliophora are protozoans that are covered in short hairlike projections that are called cilia. Protozoa have cilia to move through water, feed, attach onto things, and feel. A distinguishing factor of Ciliates is the presence of two nuclei; the **macronucleus** and the **micronucleus**. The macronucleus contains short pieces of DNA and it also pinches off during cell division. During cell division, the cell will completely separate into two identical organisms, thus explaining the term “pinching off”. The micronucleus contains two copies of each chromosome. There may be several micronuclei throughout the organism. During cell division, the nucleus will divide through mitosis.

Ciliates have **contractile vacuoles** and sometimes **digestive vacuoles**. The contractile vacuole is used to push water out of the cell. If the contractile function of a cell is ruined, the cell will swell until it bursts. The digestive vacuole is the part of the cell that digests food and utilizes nutrients. The digestive vacuole is connected to the mouth, or the **cytosome**. The cytosome is sometimes set back in a grove in the cell called the **oral grove**. Cilia that are placed around the oral grove generate water currents that help move food into the cell’s mouth. These organelles are an essential part of the cell’s structure and make sure the cell’s stay healthy and alive.

Location/Collection

The specimens documented were retrieved from the Genesee River next to Rochester Institute of Technology. The source of the Genesee River starts in Potter County, Pennsylvania, and flows 160 miles north, where it ends in Lake Ontario. The river flows through different waterfalls and gorges in Letchworth State Park, and through the City of Rochester. There are three waterfalls the river flows over while in the City of Rochester: Highfalls, Middle Falls and Lower Falls. There are many different species of micro-life living in the Genesee River, which can easily be documented if samples are collected properly.

When collecting samples of water from the river, it is important to bring a part of the habitat back with the sample, including an aquarium with river-water and plant life. Having the plant life will make it much easier to acquire live and active specimens by allowing the organisms to feed off of and attatch to the plant life in their habitat. Mosses, grasses and soil samples are a good place to start to see living and moving specimens.

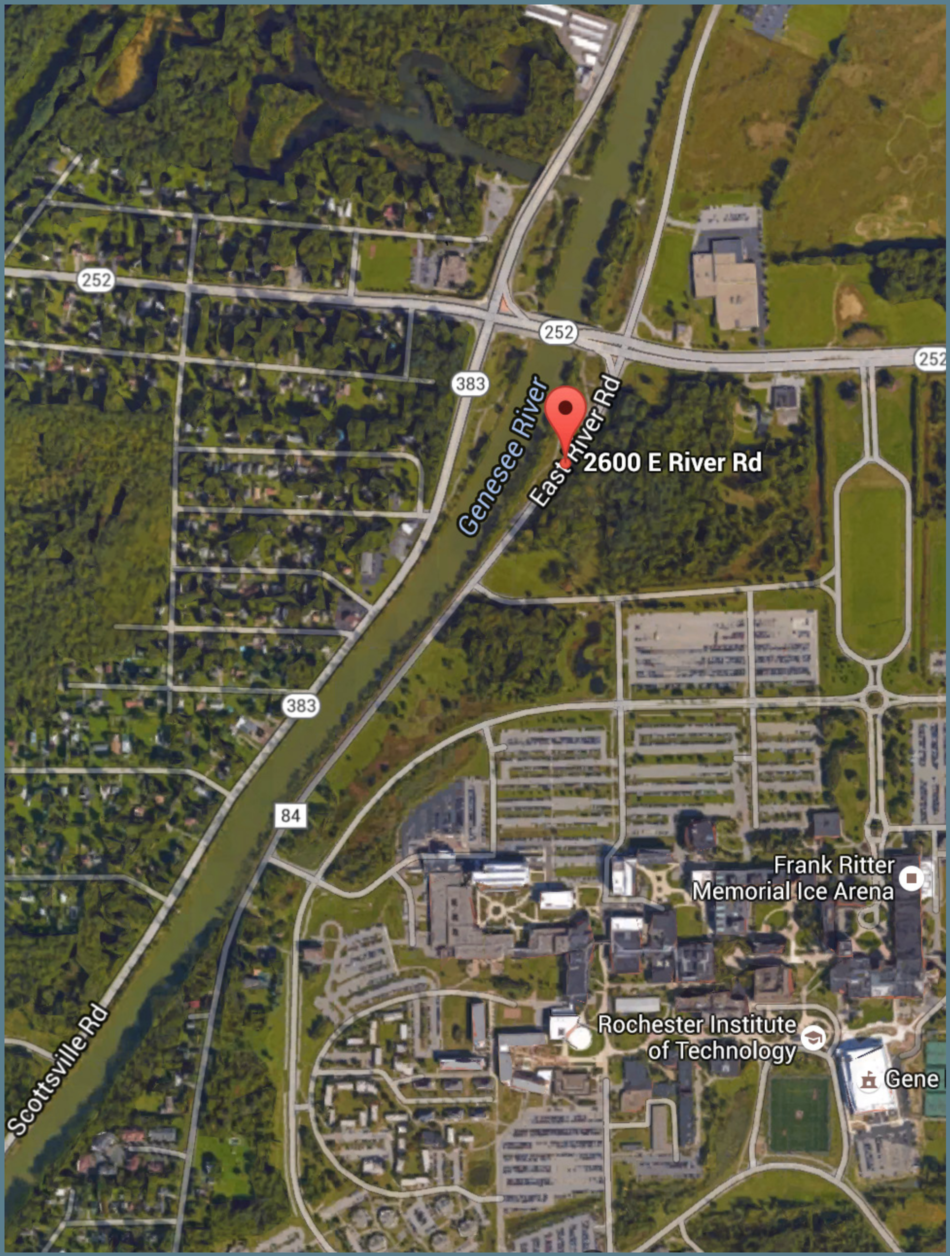
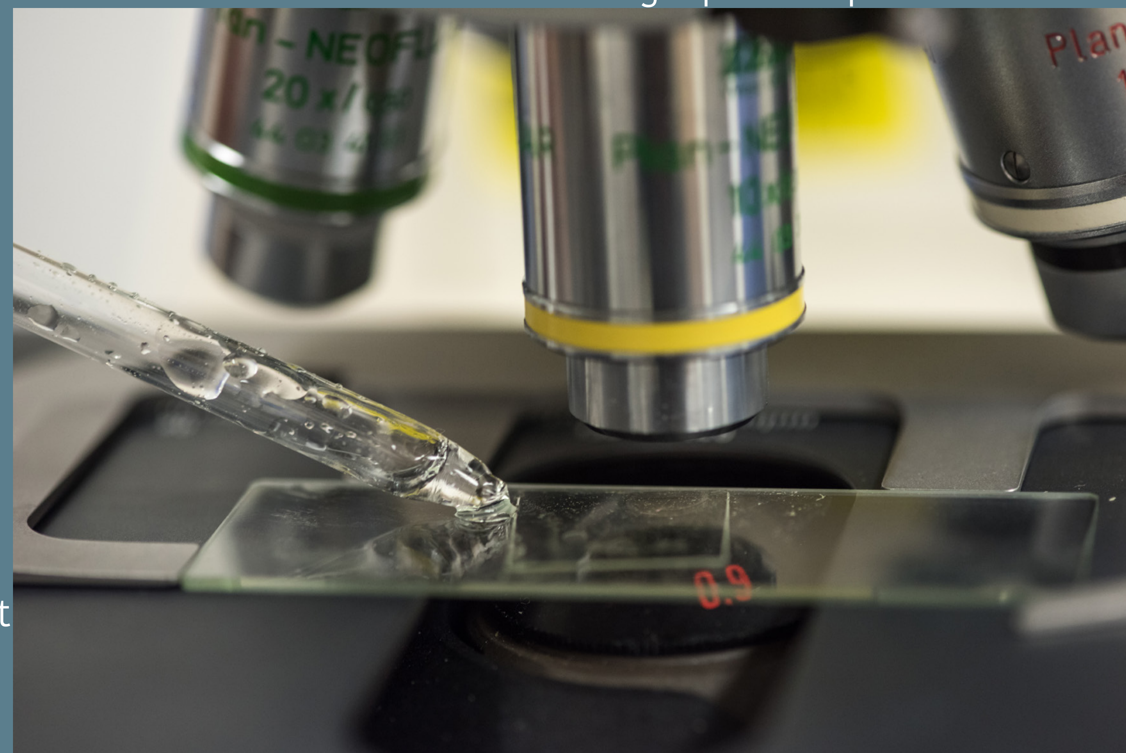


Image credit/courtesy from Google Maps

Handling/Preparation

After retrieving the sample, it needs to be prepared a certain way to make viewing easier. When extracting a water drop, make sure to take the sample from around/inside of the moss or plant life in the aquarium. Taking the sample from the plant life usually guarantees more organisms that come along in the water drop. Cells typically stay around plant life and algae because that is their source of food. Adding a piece of plant to the slide will make it easier to find more life. Some micro life likes to attach to a plant leaf and filter feed in the water. The more simulation of the cell's natural habitat, the easier it will be to view the subjects.



When it comes to photographing, it is tricky to get the subject to stay in place. One way to make the subjects stop moving is to add glycerin to the water sample on the slide. Glycerin will slowdown or kill the cells, and retain their structure to a degree. Using other mediums to kill the subject, like any alcohols, will make the cells shrivel up and will not be up to standards for photographing. The easiest way to add glycerin to the sample is to add it directly to the edge of the cover slip on the slide. The glycerin will flow underneath the cover slip and will diffuse through the water, creating a glycerin solution.

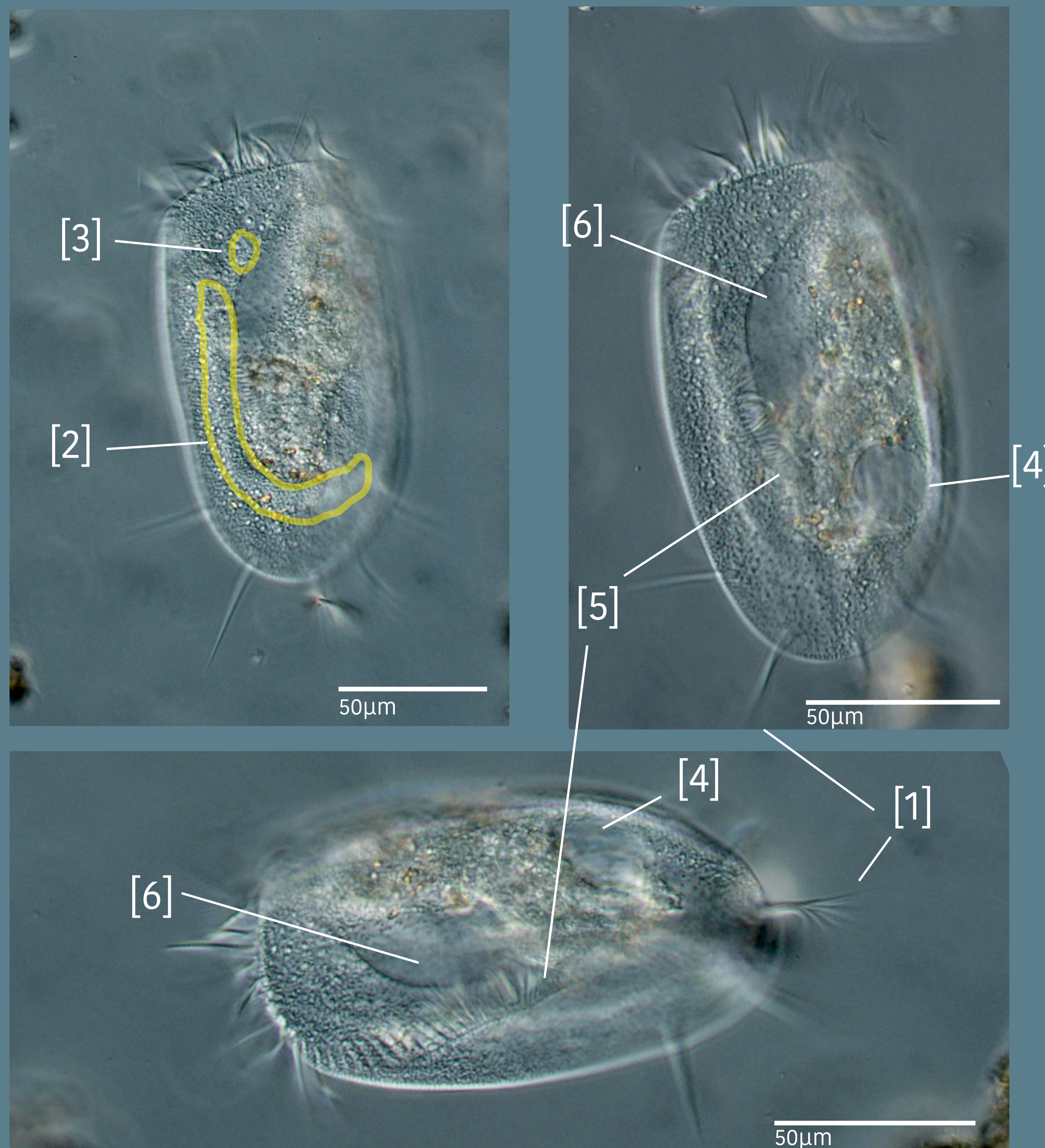
Using too much glycerin can end up shrinking the cells and destroying its structures. Too much glycerin can also push the subject to the edge of the slide, creating an unphotogenic mess. A good way to visualize using too much glycerin is to envision an overflowing river gushing through a town. The river will take any debris in its path and create a cluttered mess in the path of the water. There will be nothing left to view on the slide because everything will be moved to one corner. To avoid this, make sure to use a small dropper with minimal glycerin, and be aware of where debris is in the slide. Doing this will prevent debris from flowing into the subject and into the photograph.

Euplotes Eurystomus

Class: Spirotrichea
Subclass: Hypotrichida

Important/Unique structures:

[1] **Cirri:** used for walking/swimming
[2] **Macronuleus region**
[3] **Micronucleus region**
[4] **Contractile Vacuole**
[5] **Cytosomal Region**
[6] **Oral Grove**



Additional information:

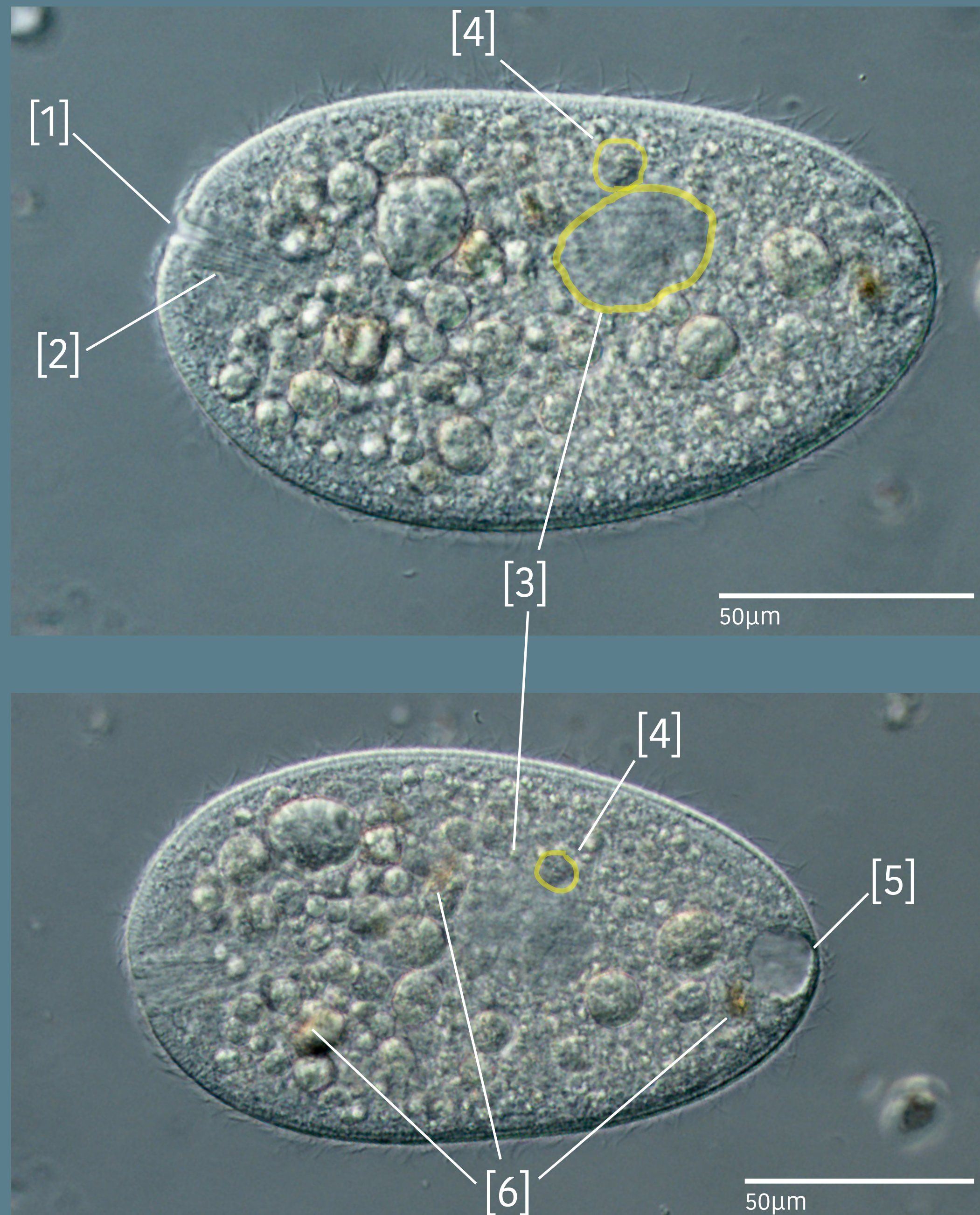
- Similar to cilia functions, the cirri are used for walking and swimming.
- Euplotes Eurystomus is a carnivorous ciliate and an a commonly used food source in research studies is the Tetrahymena organism.

Holophrya discolor

Class: Prostomatea
Subclass: Prostomatida

Important/Unique structures:

[1] Mouth
[2] Cytopharyngeal Basket
[3] Macronucleus
[4] Micronucleus
[5] Contractile Vacuole
[6] Fat Droplets (yellow)



Additional information:

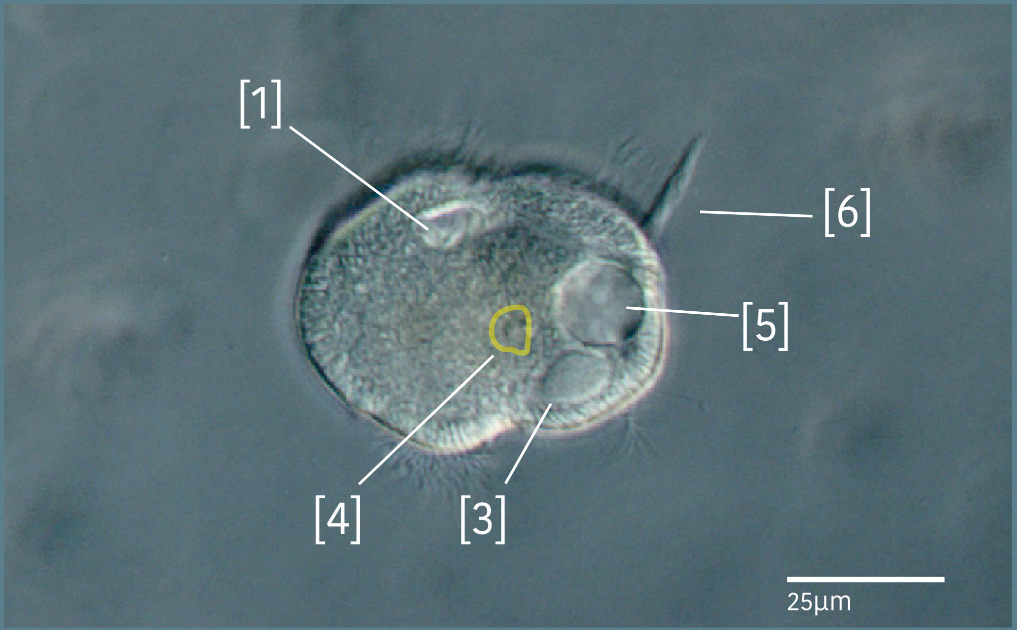
- The cytopharyngeal basket is veinated in structure and lined with cilia to help move food through the organism.
- Holophrya discolor may have more than one micronucleus, and it also may have no micronucleus at all.
- This organism is an algae eating ciliate.

Urocentrum turbo

Class: Oligohymenophorea
Subclass: Hymenostomatida

Important/Unique structures:

[1] Mouth
[2] Medial Belt
[3] Macronucleus
[4] Micronucleus
[5] Contractile Vacuole
[6] Tail Cirrus



Additional information:

- The medial belt is used for increased propulsion through water and it explains why the organism is usually spinning when observing it.

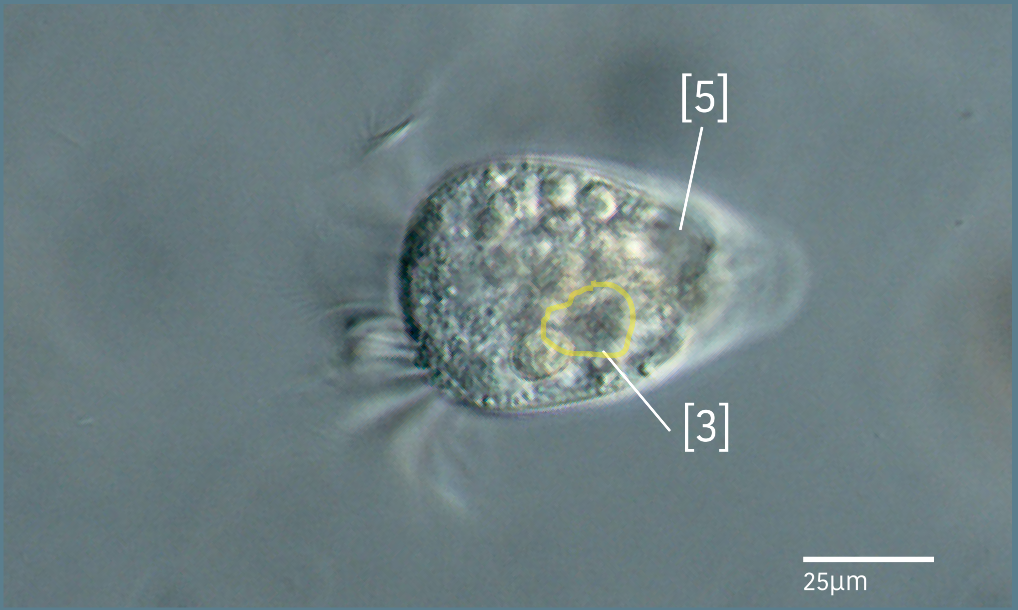
- The tail cirrus is used for swimming and directing the organism.

Strombidium caudatum

Class: Spirotrichea
Subclass: Oligotrichia

Important/Unique structures:

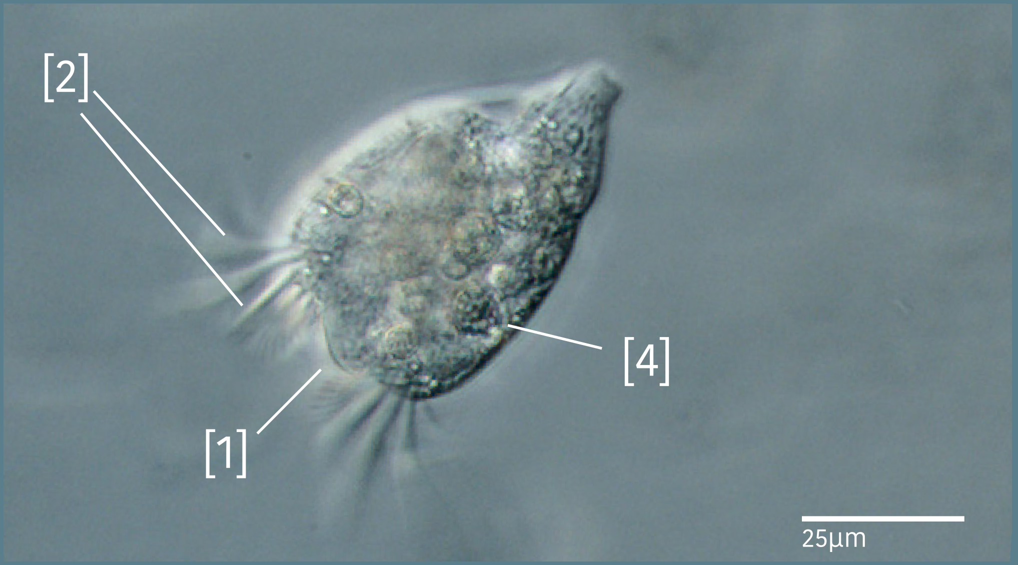
[1] Peristome
[2] Cirri
[3] Macronucleus
[4] Food Vacuole
[5] Contractile Vacuole



Additional information:

- The peristome is the protruding oral region of Strombidium caudatum. The mouth is at the posterior end of the peristome

- There is an entire ring of cirri around the front of Strombidium caudatum. It creates currents to move food into the mouth of the cell



References

http://www.digilibraries.com/html_ebooks/109901/18320/www.digilibraries.com@18320@18320-h@18320-h-1.htm

http://plankt.oxfordjournals.org/content/33/7/998.full

https://en.wikipedia.org/wiki/Ciliate

http://www.funsci.com/fun3_en/guide/guide1/micro1_en.htm

http://www.uic.edu/classes/bios/bios104/mike/bacteria01.htm

http://pinkava.asu.edu/starcentral/microscope/portal.php?pagetitle=assetfactsheet&imageid=26938

http://jcs.biologists.org/content/joces/3/4/493.full.pdf

http://jcs.biologists.org/content/joces/15/2/379.full.pdf

http://pinkava.asu.edu/starcentral/microscope/portal.php?pagetitle=assetfactsheet&imageid=26898

http://c2.griffithps.schoolwires.net/cms/lib07/in01000714/centricity/domain/49/chap12.pdf

http://www.cityofrochester.gov/geneseeriver/

http://eol.org/info/456

http://www.ucmp.berkeley.edu/protista/ciliata/ciliatamm.html

http://pinkava.asu.edu/starcentral/microscope/PDF/buildPDF.php?imageid=27343

http://www.plingfactory.de/Science/Atlas/KennkartenProtista/01e-protista/e-Ciliata/e-Ciliata1.htm

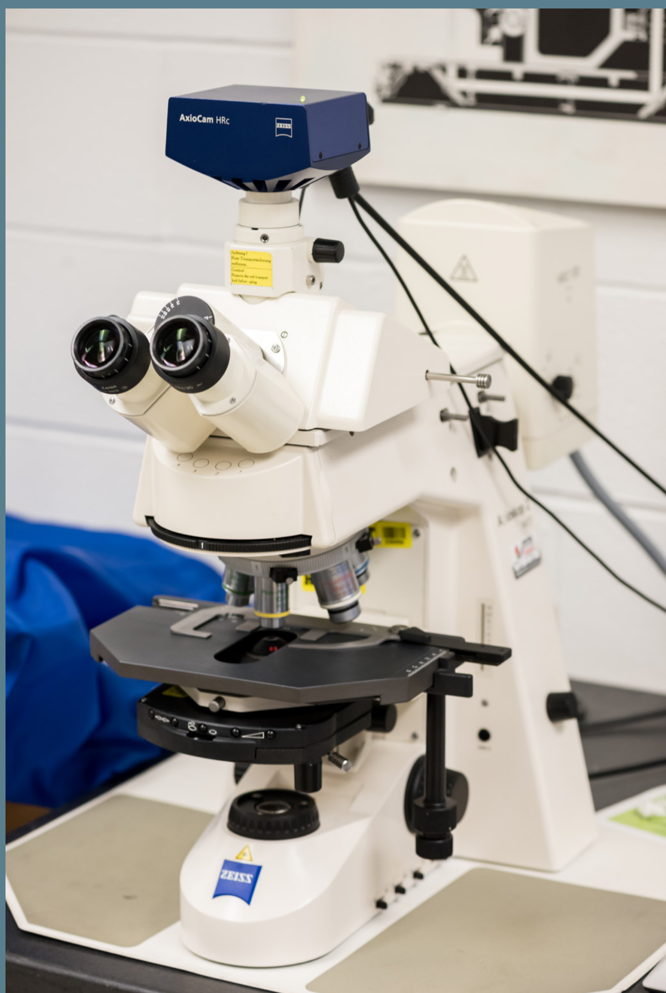
http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/wimsmall/cilidr.html

http://teachers.henrico.k12.va.us/godwin/strauss_s/sscwebpage/tutorials/protista%20tutorial.pdf

http://jcs.biologists.org/content/joces/1/4/439.full.pdf

Additional Information

All images were taken on the Zeiss Axioskop 2 MOT with the AxioCam HRc camera using differential interference contrast (DIC).



About The Author

Jason Dinelli, as of December 2015, is a third year Biomedical Photography student at Rochester Institute of Technology expecting to graduate in May 2017. His concentration is in high magnification imagery and is striving to get a job in the microscopy field. Jason always had a passion for photography and biology and is now combining both of them through the Photographic and Imaging Technologies major at RIT.

Contact Information:
jdinelli125@gmail.com