



It's a beautiful, "warm-ish," sunny day, and you want to pull out your canoe or kayak and get out on the water. If you're in Dover, Silver Lake is a prime destination. The trees are just beginning to bloom and the water is like glass. But underneath the water, all sorts of tiny organisms call Silver Lake home, some of which are unhealthy. And while these might look scary under a microscope, the creatures pictured here are harmless. Take a fascinating underwater journey to the microscopic world of Silver Lake.

What's Unseen Beneath

PHOTOS BY DR. JERRY NELSON

STORY BY CLARK NELSON

LONG-TIME DELAWARE RESIDENT Dr. Jerry Nelson spent his working years as a chemist with DuPont. Five years ago, in his late 80s, he told his kids – seemingly out of the blue – “I’ve always been interested in microscopy.”

Shortly thereafter, what was once a bedroom became a full-blown microbiology lab complete with microscopes, an endless supply of slides and coverslips, specialized lighting, and all the intricate glasswork, stains, chemicals and tools necessary to peer like a scientific voyeur into the fascinating hidden world of extremely small organisms. Conversations with him quickly turned to excited exclamations about his latest observations, a newfound protist, or descriptions of the almost unbelievable antics of these organisms. Suddenly, a previously unrealized lifelong interest had turned into an intense passion.

Jerry uses an optical binocular microscope with a special lens to transmit

images to the computer monitor, and capture photos and videos. The objective lenses allow magnifications from 10x up to 60x. He slowly scans a single water drop at 10x magnification until he spots something interesting. He then zooms in to higher magnification on the scope, or projects it onto the computer monitor for more detailed study. Shunning the world of one-celled bacteria as too boring, Jerry prefers the entertaining antics of those more evolved protists as they eat, move, reproduce, romp about, and basically carry on their daily life activities.

With millions of species, identification can be a real challenge. He resorts to several books from the rich legacy of protist microscopy, to consultation with local experts and perusal of blogs and other websites from scientists and fellow enthusiasts around the world. The study of these organisms goes back centuries and continues with even more rigor today, in both amateur and scientific communities.

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Nauplius larva. This free swimming plankton is the larval stage of a fresh-water crustacean.

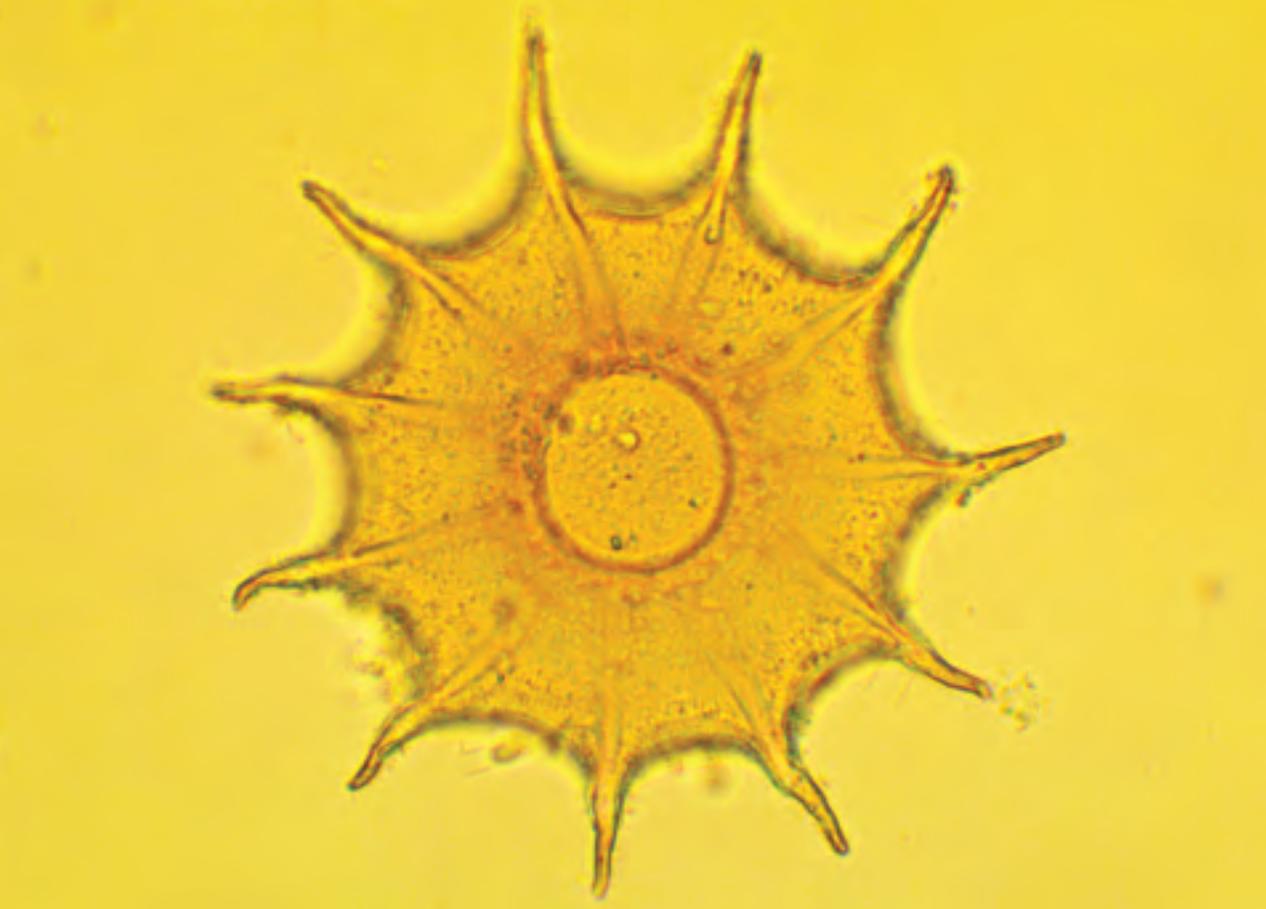
Philodina in a relaxed state. Freshwater members of the Philodina genus are multicellular, consisting of approximately 1000 cells. They are typically less than .5mm in length. Philodina, sometimes referred to as rotifers, appear to be able to survive for perhaps hundreds of years in dried or frozen states. They are critical to natural water purification processes, as they help break down organic materials, and serve as a food source for other important species.



These multi-celled organisms are from the genus Hydra. Hydras consist of a hollow cylinder, closed at one end, with tentacles and an opening on the other end. They range from .5mm in length when contracted, to several times that length when their bodies are extended. These organisms are carnivorous, stunning their prey with emitted toxins before pulling them in for digestion. Hydra are generally sedentary, but do move by looping and somersaulting end over end, moving as much as 100mm per day. Scientists are fascinated with the genus because the organisms don't seem to age or die of old age.



All specimens are single- or multi-celled freshwater organisms found in still water taken from Silver Lake in Dover, Delaware in 2013 and 2014.



Arcella is a single-celled protist living inside a shell structure which is typically only 300 microns in diameter. Finger-like pseudopods emerge from the hole in the center of the shell to help it move, and to capture food such as diatoms, unicellular green algae and a variety of other microscopic organisms.

Spirostomun are one-celled protists, the bodies of which are covered with tiny hair-like structures called cilia. The cilia, while not visible in this photo, are used to sweep bacteria into the body for food. When stimulated, this organism can contract its body to $\frac{1}{4}$ its size in under eight milliseconds – the fastest known contraction in any living cell.





Copepod. These tiny crustaceans are typically less than 1mm in size, but make up for it with their sheer volumes as part of the zooplankton communities. They feed on organic detritus and bacteria, and in turn, are a major food source for small fish. Copepods are critical to maintaining global ecology and the carbon cycle. In some countries, they are purposely introduced into water sources to help eliminate disease-bearing mosquitos.

Annelida. These microscopic views of segmented worms are streaming through an organic tubular structure that has bulged out on the side. These "worms" are significantly less than 1 mm in length, though certain species can grow several meters in length, and include more commonly known examples such as earthworms and leeches. Several thousand species of segmented worms inhabit environments as varied as land, oceans and fresh water bodies.



Nematodes. Similar to this specimen, nematodes are small slender worms, typically five to 100 microns thick, and 0.1 to 2.5 mm long. They inhabit virtually every environment on Earth. They are so numerous that they are often encountered in concentrations of one million individuals per square meter. Nematodes feed on bacteria, fungi and other organic materials, helping to maintain the ecological balance in our environments.

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These organisms hold many mysteries yet to be unlocked. Many are critical to maintaining healthy ecological balance worldwide, while others cause fatal illnesses to millions of people. Some are found inside the deepest mines over three kilometers beneath the surface, all the way to the top of the highest peaks and in the hottest and coldest places on earth. Some can survive in frozen or dehydrated states for hundreds of years, only to return to life once conditions change. Others are believed not to age at all, presenting the intriguing possibility of eternal life, or at least one of the keys to the oft-sought fountain of youth. One thing's for sure - these unseen critters are on us, all around us and everywhere on earth in great, but unseen profusion. **OD**

CLARK (KIP) NELSON RECENTLY RETURNED HOME TO NEWARK, DELAWARE AFTER 40+ YEARS AWAY, TO BE A COMPANION TO HIS FATHER JERRY, AND TO SHARE IN THE ENTHUSIASM OF ALL HIS PASSIONATE PURSUITS.

