

## THE PLANKTON ARTWORK STORY

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Many people are interested in learning more about the Under the Microscope body of work. Below is more information on the project.

### INTRODUCTION

**“View From Under the Microscope”** is a nationally traveling art and science exhibit created by South Carolina artist Alicia Leeke.

In a unique presentation, audiences discover the importance of phytoplankton have in relation to all living things and the need to provide sustainable oceans for future generations in a unique presentation.

The collection artistically showcases several species of phytoplankton specifically found the following fresh and saltwater bodies in South Carolina including:

- ◆ Quinine Hill Lake in Columbia, S.C.
- ◆ Moore Botanical Gardens (University of South Carolina in Columbia, SC,
- ◆ Swan Lake in Sumter, SC,
- ◆ Wateree River (W.T “Billy” Tolar Boat Ramp),
- ◆ Congaree National Swamp (Eastover, SC)
- ◆ Beaufort, SC (Beaufort River)
- ◆ Darrell Creek, a tidal waterway slightly north of Charleston, S.C.

Many of the same organisms are found globally in lakes, estuaries and oceans worldwide.

The exhibition consists of an artistic body of 2-D, digitally created paintings based on photographs of phytoplankton Leeke collected and identified from the two water bodies. Dr. Tammi L. Richardson, from the University of South Carolina’s Marine Science Program, was Leeke’s partner in the project.

Dr. Richardson’s research focuses on the role of phytoplankton in the global carbon cycle. Phytoplankton, like land plants, are photosynthetic organisms: they remove carbon from well-lit surface water and use it for growth and reproduction. In the ocean, the removal of carbon dioxide enhances the air-to-sea flux of this greenhouse gas and over long periods of time, phytoplankton play an important role in moderating Earth’s climate.

*“Phytoplankton are some of Earth's most critical organisms and so it is vital study and understand them. They generate about half the atmosphere's oxygen, as much per year as all land plants. Phytoplankton also form the base of virtually every ocean food web. In short, they make most other ocean life possible.”*

*(<https://www.whoi.edu/know-your-ocean/ocean-topics/ocean-life/phytoplankton/>)*

*Woods Hole Oceanographic Institution,  
–WHOI, 2021 website.*

Phytoplankton productivity also fuels life in the ocean. As the base of marine food webs, phytoplankton are consumed by zooplankton, the smallest animals of the ocean, and this energy is transferred up through the food web to the top predator – often a human. Somewhat counter-intuitively, some of the largest animals in the ocean (blue whales, finback whales and whale sharks) filter-feed directly on plankton. They exert little energy by just swimming with their mouth open, feeding constantly on this very abundant food source.

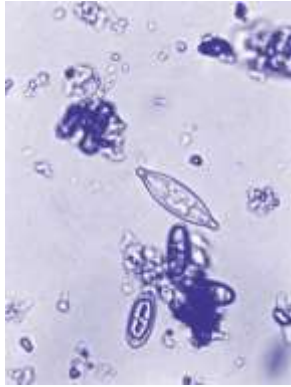
*“At the bottom of the ocean’s food chain, phytoplankton account for roughly half of the net photosynthesis on Earth. Their photosynthesis consumes carbon dioxide and plays a key role in transferring carbon from the atmosphere to the ocean.”*

*–Phys.org, September 2014*

Each of the 18 vibrant digital works of art is framed under plexiglass and features a significant microorganism in a colorful abstract fashion. Each painting is based on several different species of phytoplankton Leeke photographed with Richardson’s Nikon Eclipse TS100 inverted microscope used with a Nikon Infinity 1 digital camera. These images, printed on Kodak Professional Endura Premier Paper, were used as the foundation for creativity.

Leeke hopes the exhibition will encourage more partnerships between scientists and artists as well as increase community awareness about the importance of arts-based learning as an educational tool in non-artistic disciplines.

As you can see from the two images below, the artist has provided a scientific “before” image of the microorganism captured from the microscope and an artistic “after” image of the final painting. This leads the viewer from the Leeke’s scientific-to-artistic working process.



*Navicula*



*Navicula painting*

*Digital Mixed Media on silver halide  
photographic print  
2015*

*Saltwater specimen sampled from  
Darryl Creek, Mount Pleasant, SC  
June 2014*

Learn more by reading this article:

[The Bottom of the Arctic's Food Web Is of Top Importance](https://kids.frontiersin.org/articles/10.3389/frym.2020.00122)

<https://kids.frontiersin.org/articles/10.3389/frym.2020.00122>

*“My goal is to create awareness about the importance of climate change, clean water and ocean conservation. This body of work artistically showcases these beautiful creatures and allows audiences without access to technology to view them from an interesting, new perspective. I also hope to show the scientific community how art can complement their research visually. After all, ‘a picture is worth 1000 words.’ ”*

*– Alicia Leeke*

Phytoplankton are not the only microorganisms found in water bodies. Zooplankton, get their name from the Greek word *zoon*, meaning "animal" and *planktos* meaning "wanderer" or "drifter."

The majority of zooplankton are microscopic, but some (such as jellyfish) are larger and visible with the naked eye. Zooplankton range in size from protozoans to large metazoans. They can either spend their entire life cycle as a microscopic plankton or graduate to larger swimming animals. Although zooplankton are primarily transported by water currents, many have locomotion, which can be used to hunt prey or avoid predators. Zooplankton feed on bacterioplankton, phytoplankton and other zooplankton. As with phytoplankton, they play an important role in aquatic food webs.



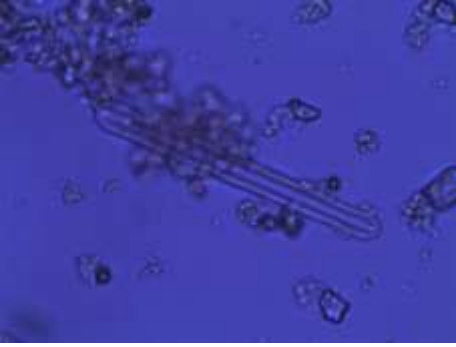
**Vorticella (Zooplankton)**

*Freshwater specimen sampled from  
Quinine Hill Lake, Columbia, SC  
August 2014*

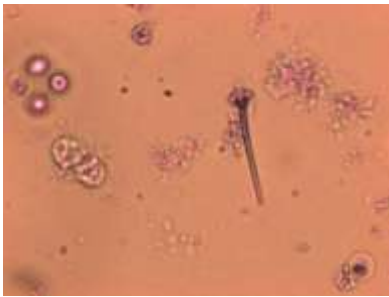
**ARTIST PROCESS**

Below you will see the "blue print" images (images shot with the camera and microscope prior to any painting) used as inspiration for making the final works of art.

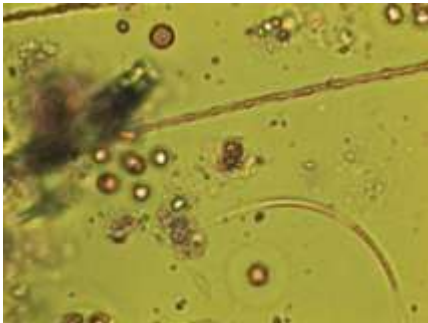
Each painting from the show was based on phytoplankton Leeke photographed with Richardson's Nikon Eclipse TS100 inverted microscope used with a Nikon Infinity 1 digital camera. These images, later printed on Kodak Professional Endura Premier Paper, were used as the foundation for creativity. These are the original images Leeke captured under the microscope. You can see the progression of an artist's mind from scientific reference material translated into an abstract body of work. These images are a selection of original images captured by the artist.



*Achnanthydium duthiei*



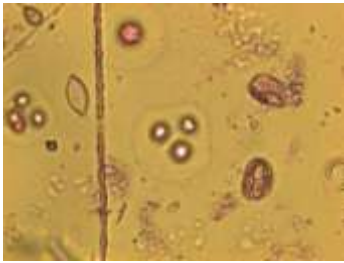
*Actinella*



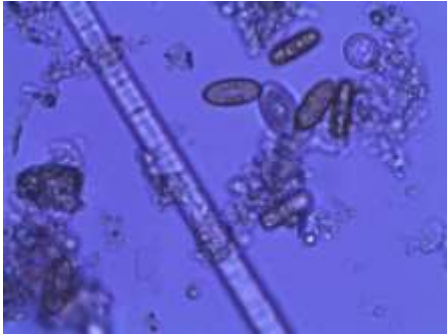
*Ankistrodesmus*



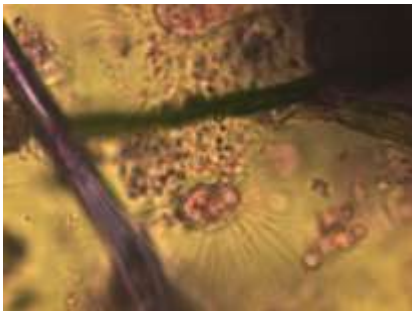
*Ceratium furca*



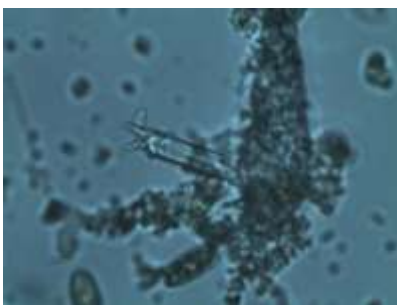
*Craticula*



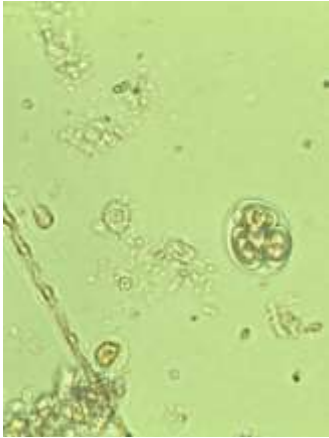
*Lyngba*



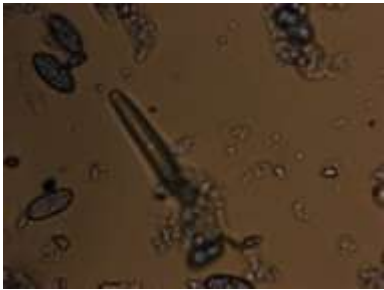
*Mallomonas*



*Oedogonium*



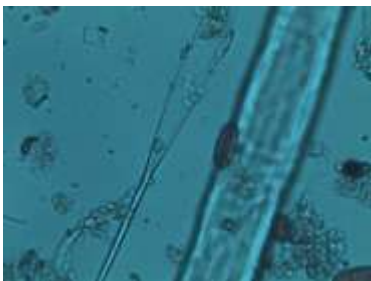
*Oocystis*



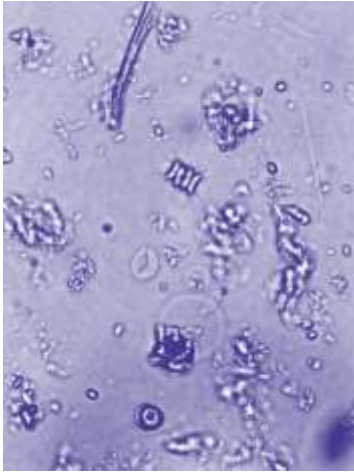
*Pinnularia*



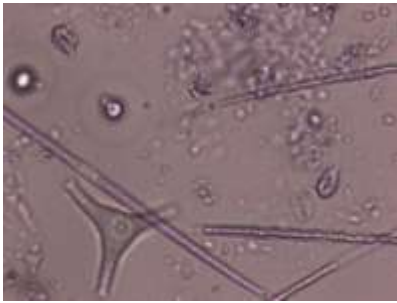
*Pleurosigma*



*Rhizosolenia*



*Scenedesmus*

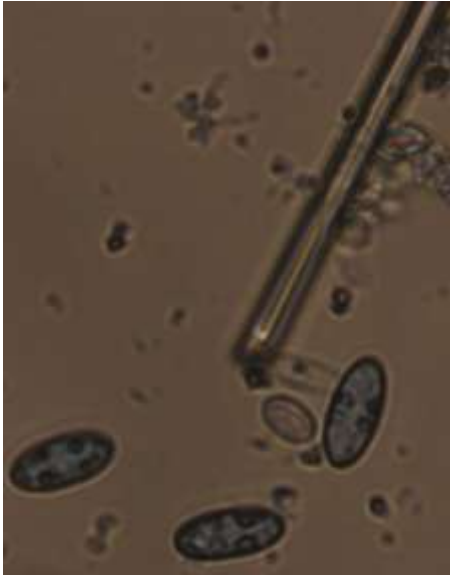


*Staurastrum*



*Staurastrum*





*Synedra*



*Urosolenia*



*Oscillatoria*

# “Under the Microscope”

## Scientific Definitions

**Art** – something that is created with imagination and skill and that is beautiful or that expresses important ideas or feelings.

**Abstract Art** – imagery which departs from representational accuracy, to a variable range of possible degrees. Abstract artists select and then exaggerate or simplify the forms suggested by the world around them.

**Antioxidant** – a substance that is added to food and other products to prevent harmful chemical reactions when oxygen combines with other substances.

**Aquatic** – of or relating to, animal and plant organisms that live in or near water.

**Bacterioplankton** – a bacterial type of plankton found in both seawater and freshwater that are free-drifting organisms.

**Butylated hydroxytoluene (BHT)** – is an organic compound that is useful for its antioxidant properties. European and U.S. regulations allow small amounts to be used as a food additive. In addition to this use, BHT is widely used to prevent oxidation in fluids (e.g. fuel, oil) and other materials where free radicals must be controlled.

**Carbon Dioxide** – a gas that is produced when people and animals breathe out or when certain fuels are burned and that is used by plants or animals for energy.

**Chlorophyll** – the green substance in plants that makes it possible for them to make food from carbon dioxide and water

**\* Clean Water – Water free of impurifications and other chemicals and thus, suitable for use by humans for drinking and bathing. It is also notable that plants and animals should also be able to live healthily in rivers, lakes and streams.**

**Water-borne pollutants fall into two categories:** “Point Source” pollutants are those that originate from a defined source, such as sewage discharge, ballast water from ships; anything that enters via a pipe as in storm water drainage. “Non- Point Source pollutants are more diffuse in nature. These include runoff from agricultural areas, groundwater or sheet flow runoff from golf courses and residential areas. Non-point sources are often high in nutrients like nitrogen (from fertilizers) and pesticides and other contaminants.

The Clean Water Act was established by the U.S. Government in 1972 to address the issue of water pollution in an effort to restore and maintain our nation’s water resources.

\* **Climate Change** – a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

**Columbia, South Carolina** – the capitol of and largest city in the state of South Carolina located in the United States of America.

**Cyanobacteria** – a group of photosynthetic bacteria that are common in freshwater, brackish or marine ecosystems. Formerly known as “blue-green algae.”

**Darrell Creek** – a saltwater tidal creek located in Mount Pleasant, South Carolina in the United States of America.

**Flux** – a series of changes: continuous change.

**Genus** – in biology, a group of genetically-related organisms that may include multiple species.

**Global Carbon Cycle** – the combined processes, including photosynthesis, decomposition, and respiration, by which **carbon** cycles between its major reservoirs—the atmosphere, oceans and living organisms.

**Greenhouse Gas** – a **gas that** contributes to the warming of the Earth by absorbing infrared radiation (heat), Examples include: carbon dioxide, methane and chlorofluorocarbons (CFCs).

**Locomotion** – the act or power of moving from place to place.

\* **Marine Food Web** – feeding relationships are often shown as simple food chains – in reality, these relationships are much more complex, and the term ‘food web’ more accurately shows the links between producers, consumers and decomposers. A food web diagram illustrates ‘what eats what’ in a particular habitat. Pictures represent the organisms that make up the food web, and their feeding relationships are typically shown with arrows. The arrows represent the transfer of energy and always point from the organism being eaten to the one that is doing the eating.

**Microorganism** – in biology, an extremely small living thing that can only be seen with a microscope.

**Microscope** – a device used for producing a much larger view of very small objects so that they can be seen clearly.

**Nitrogen Fixation** – the chemical processes by which atmospheric nitrogen is assimilated into organic compounds, especially by certain microorganisms as part of the nitrogen cycle.

**Mount Pleasant, South Carolina** – a large suburban town in Charleston County, South Carolina in the United States of America.

**\* Ocean Acidification** – for more than 200 years, or since the industrial revolution, the concentration of carbon dioxide (CO<sub>2</sub>) in the atmosphere has increased due to the burning of fossil fuels and land use change. The ocean absorbs about 30 percent of the CO<sub>2</sub> that is released in the atmosphere, and as levels of atmospheric CO<sub>2</sub> increase, so do the levels in the ocean. When CO<sub>2</sub> is absorbed by seawater, a series of chemical reactions occur resulting in the increased concentration of hydrogen ions. This increase causes the seawater to become more acidic and causes carbonate ions to be relatively less abundant. Carbonate ions are an important building block of structures such as sea shells and coral skeletons. Decreases in carbonate ions can make building and maintaining shells and other calcium carbonate structures difficult for calcifying organisms such as oysters, clams, sea urchins, shallow water corals, deep sea corals, and calcareous plankton. These changes in ocean chemistry can affect the behavior of non-calcifying organisms as well. Certain fish's ability to detect predators is decreased in more acidic waters. When these organisms are at risk, the entire food web may also be at risk. Ocean acidification is affecting the entire world's oceans, including coastal estuaries and waterways. Many economies are dependent on fish and shellfish and people worldwide rely on food from the ocean as their primary source of protein.

**Predators** – an animal that lives by killing and eating other animals or an animal that preys on other animals.

**Phylum** – in biology, a large group of related animals or plants.

**Phytoplankton** – phytoplankton are the drifting “plants” (but are really photosynthetic protists) of the ocean. They contain chlorophyll (and therefore absorb light energy). Through photosynthesis they convert carbon dioxide gas into sugars and release oxygen as a by-product. Phytoplankton are the base of aquatic food webs and provide approximately 90% of the oxygen in the Earth's atmosphere.

**Photosynthesis** – the use of light energy (as in the sun) to convert carbon dioxide to organic carbon molecules (carbohydrates/sugars).

**Quinine Hill Lake** – a suburban lake about 1 mile from the Columbia, South Carolina Capitol in the United States of America.

**Species** – in biology, a group of animals or plants that are similar and can produce young animals or plants: a group of related animals or plants that is smaller than a genus.

**Specimen** – something (such as an animal or plant) collected as an example of a particular kind of thing.

**Sustainable** – involving methods that do not completely use up or destroy natural resources.

**Water sampling** – the process of taking a portion of water for analysis or other testing, for example, drinking water to check that it complies with relevant water quality standards, or river water to check for pollutants, or bathing water to check that it is safe for bathing, or intrusive water in a building to identify its source.

**Zooplankton** – in biology, plankton consisting of small animals and the immature stages of larger animals.

*\* The definitions with asterisks above (\*) are considered to be more significant content presented in this exhibition and help in your understanding the importance of phytoplankton and the role they play in keeping our water bodies clean from the effects of pollutants that can eventually lead to the extinction of animals in our food supply chain.*