Marine microbes are very small and have been around for a long time.

Most microbes are so small they can’t be seen by the unaided eye, so scientists use microscopes to see them. The same microscope comes from the Greek words “micro” (small) and “scope” (see). Microbes are so tiny that millions of them can fit on the head of a pin.

Microbes were the first life forms on Earth. Some of the oldest fossilized remains of microbes were found in the Pilbara region of Western Australia, and are estimated to be around 3.5 billion years old.

In the Inset photo, the tiny circle in the finger measures 1 mm on each side and represents an area of just 1 square mm. The main photo shows the entire number of microbes in 1 microscope of specimen. The big oval and green dots (representing about 5000) are bacteria, and the very small yellowish dots (about 15,000) are viruses.

Microbes are everywhere: they are extremely abundant and diverse.

Microbes are found in every ocean environment imaginable. They thrive in the deep ocean, for example, some microbes live in minerals deposited around hydrothermal vents. Certain microbes live inside the tissues of animals, such as whales and clams, while others live in the use of Ammonia.

Microbes are the most abundant and diverse biological entities in the ocean. They represent approximately 90% of the ocean’s biomass. This means that two-thirds of the weight of all the shells, whales, fish, plants, and all other visible marine life, their total weight would be considerably less than the total weight of all marine microbes. Yet imagine there are more microbes in the ocean than stars in the known universe.

Thousands of different species of microbes have been identified, and the total keeps growing as new species are continually being discovered.

Many microbes help break down organic material, recycling essential nutrients that can be reused by other marine microbes and which are ultimately incorporated back into the marine food web. This is known as the microbial loop.

Microbes are largely responsible for nitrogen fixation, or converting atmospheric nitrogen into a form that is useful to living organisms. Although nitrogen makes up almost 80% of the Earth’s atmosphere, it is in a form that most plants can use. Without microbes to “fix” nitrogen, there would be no nitrogen available for plants to grow.

Many microbes live in symbiotic relationships with other organisms. In most cases, both organisms benefit from living together. For example, nitrogen-fixing unicellular microbes that live within and provide nutrients to many corals. Without these microbes, communities would presumably be able to grow without them, but their growth rate would be reduced by 90%. Most of the marine microbes are marine mammals could survive.

Coral reefs provide important habitats for the organisms. In turn, coral reefs provide important habitats for the organisms. Marine life grows and study microbes. This means that a wealth of biodiversity is accessible to us.

Marine microbes are beneficial.

Marine microbes are a largely untapped resource that could yield benefits in medicine and technology.

Marine microbes are used to clean up certain environmental pollutants through a process called phytoremediation. For example, the green alga Pelagibacter uses sulfur compounds to degrade hydrocarbon pollutants, which results in the formation of hydrogen sulfide gas. This gas is then released into the atmosphere.

There are new discoveries every day in the field of microbial oceanography.

Marine microbiology is the study of the abundance and distribution of microorganisms in the marine environment. It is an exciting field that is rapidly expanding, and new discoveries are being made all the time.

**Microbes are everywhere:** they are extremely abundant and diverse. They are found in every ocean environment imaginable, and they are responsible for nitrogen fixation, or converting atmospheric nitrogen into a form that is usable by plants.

**Microbes significantly impact our global climate.**

Microbes help to maintain our global climate by regulating carbon dioxide (CO₂) levels in the atmosphere. By burning fossil fuels, humans put billions of tons of CO₂ in the atmosphere each year. Marine microbes remove a significant portion of the CO₂ that we put in the atmosphere each year, which is critical in curbing human-induced climate change.

Microbes contribute to cloud formation over the ocean. Microbes contribute to the formation of clouds over the ocean’s surface.

Viruses are extremely small; they are even smaller than a cell. In fact, viruses are not even alive.

A dozen of the genus Bacteriovorax showing long hair-like bristles called setae. (Micro*scope)
How did you get interested in microbial oceanography?

What is your coolest experience you have had on the job or during your studies?

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What is your favorite work related activity?

I participated in the Antarctica Biological Training Course at McMurdo Base when I was a graduate student. While I was in Antarctica, I had the opportunity to join my advisor on a research excursion to the South Pole to help him study bacterial respiration. I was at the South Pole for six hours, and the thought that I was standing on the bottom of the Earth was an amazing feeling that I will never forget. Also, following the path taken by the early explorers, and it was the most spectacular and most untouched landscapes I have ever seen.

If you had to give advice to someone who wanted to become a microbial oceanographer, what would it be?

My advice would be to parallel one’s research with the advancements in bioinformatics. The field is growing fast and expanding in a more molecular direction; having the tools of a field oceanographer with the genomic analyses will be instrumental for the future of microbial oceanographers.

What is your favorite microbe?

I am particularly interested in cyanobacteria because they are ancient, they were responsible for populating the planet, and they were also the precursor to the chloroplast.

Describe your research.

I am working to identify the major compounds that make up described diagenetic marker in the sediments and trying to determine which marine microbes produce and consume these compounds.

Why is your research important?

Information regarding nutrient cycling in the ocean is vital to our understanding of the Earth’s climate.

How did you get interested in microbial oceanography?

I loved the ocean growing up and have always been amazed by how little we know about something that covers almost 75% of the planet’s surface. There is so much room for discovery in microbial oceanography.

What is the coolest experience you have had on the job or during your studies?

The coolest experience I had has to do on the job as a researcher in the Pacific, where I was a passenger in the ALVIN submersible and traveled almost two miles down to the bottom of the ocean. The experience was unlike any I had ever done before.

What is your favorite work related activity?

My favorite work activity is conducting research at sea on research vessels. My work has already taken me to amazing places around the globe that I most likely would never have visited otherwise including Hawai’i, Australia, New Caledonia, and Fiji.

What any of the challenges you face in your research?

Marine microbes dominate the ocean and sustain planetary habitability. Louis Pasteur noted many years ago, “The very great is achieved by the very small” and he was absolutely correct.

The Center for Microbial Oceanography: Research and Education (C-MORE) was established to explore the largely unknown and fascinating world of sea microbes, to build partnerships between scientists and educators, to prepare the next generation of microbial oceanographers, and to facilitate outreach to the public at large. We have an excellent team in place and we are absolutely correct.

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