

FROM A SINGLE CELL TO A CHANGING PLANET

Discover our Science. Meet the People. Explore the Possibilities.

Open House | Goes and Pieribone Laboratories

Lamont-Doherty Earth Observatory, Columbia University

What can a microscopic organism tell us about the health of our oceans? Can bacteria help us understand how human brains respond to stress? Can microbes generate electricity? And can artificial intelligence and satellites help us protect the oceans?

Come meet the scientists, students, and engineers in our laboratories and discover how we bring together oceanography, microbiology, satellite remote sensing, artificial intelligence, robotics, and engineering to understand our changing planet—and develop innovative solutions to environmental challenges.

Our scientific journey begins with a single cell. We explore the remarkable lives of marine microorganisms, including the unusual partnership between *Noctiluca* and its tiny photosynthetic companion, *Protoeuglena*. We investigate why harmful algal blooms occur, how they affect fisheries and coastal communities, and how we might predict and mitigate them. In the Pieribone laboratory, we also explore how bacteria produce stress-response proteins, revealing the molecular mechanisms that help microorganisms survive challenging environmental conditions.

From this microscopic world, our research extends across the Pacific, Atlantic, Indian, Antarctic, and Arctic Oceans. Through international expeditions and collaborations with agencies such as NASA, NOAA, ISRO and JAXA, including OceanX, we investigate how ocean warming, melting sea ice, declining oxygen, and changing currents are reshaping marine ecosystems and the global carbon cycle. Closer to home, we are exploring how Arctic freshwater and changing ocean circulation are influencing lobster habitats and lobster population migration along the New England coast.

From microscopes to satellites orbiting Earth, we are transforming how we observe marine life. Using NASA's PACE satellite, autonomous ocean platforms, shipboard observations and coupled circulation-biogeochemical model outputs, we map microscopic marine organisms, measure ocean productivity, and track carbon cycling. In collaboration with Columbia's Data Science Institute, we are developing an AI-powered system to identify and classify marine microorganisms from millions of images collected at sea and from hyperspectral ocean color data from space. Our AQUA-SMART platform aims to turn satellite and field observations into practical tools for water-quality monitoring, harmful algal bloom forecasting, and management.

Our research also reaches beyond traditional oceanography. Working with Columbia's School of Engineering and Applied Sciences, and the Data Science Institute, we are developing optical chips to probe the hidden internal environments of living cells, exploring microbial fuel cells that harness bacteria to generate electricity, and designing innovative systems to capture microplastics before they enter our waterways. We are also investigating environmentally responsible ways to recycle discarded plastics into useful construction materials, including asphalt, concrete, and insulation foam.

What connects these diverse pursuits is a shared curiosity about how nature works, and a commitment to turning scientific discovery into technologies that benefit people and the planet.

Come visit our laboratories, meet our researchers and students, see our instruments and innovations, and discover how the smallest forms of life can help us understand and protect our changing world.