Two Scientists Studying the Biological Ocean-Climate Nexus Receive Tyler Prize

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by RP Siegel on Wednesday, May 2nd, 2018

The Tyler Prize for Environmental Achievement, founded in 1973, is considered by many to be the Nobel Prize for the environment. This year's prize was jointly awarded to two scientists that have spent their careers studying ocean life and the role it plays in shaping our climate. This is the first time the prize has recognized researchers who have focused their efforts on the oceans.

The two, Dr. Paul Falkowski, Distinguished Professor at Rutgers and Director of the Rutgers Energy Institute, and Dr. James J. McCarthy, the Alexander Agassiz Professor of Biological Oceanography at Harvard, have both focused their attention on the ocean biological systems and their relationship to the environment. These systems are comprised largely of tiny photosynthetic microorganisms called phytoplankton that are key drivers of the carbon cycle. While Falkowski studied this "engine of the ocean," directly, McCarthy studied the nitrogen cycle, without which, the carbon cycle could not operate.

Falkowski founded the Environmental Biophysics and Molecular Ecology Laboratory, the only one of its kind, a cross-disciplinary program that bridges physical and biological sciences and focuses on measuring changes in the environment. Their goal is "to understand how biological systems function and evolve."

When asked what he'd learned that he wanted everyone else to know, he said that "microbes are the stewards of the planet." The "ocean's invisible forest," is what made the planet habitable in the first place, going back 450 million years. It's their ability to produce organic matter from sunlight, absorbing carbon dioxide and giving off oxygen in the process, that

makes it possible for us, and most other living things to exist here. If we fail to understand how these systems function, or inadvertently disrupt their operation, we could put ourselves and all life on the planet in jeopardy.

As to what he considered some of his most noteworthy contributions, he mentioned the algorithm that he wrote, with Chris Field, that enables visual satellite data to be used to determine the ocean's productivity on a continual spatial and temporal basis. He also contributed to the development of fluorometer technology to enable the measurement of photosynthesis.

McCarthy also made significant contributions in basic research about the role that photosynthesis plays in the oceans, and by extension, on the planet. He also became involved in organizing scientific views from across disciplines and nations, in an effort to cooperatively improve understanding of the major forces and issues facing our planet.

McCarthy, who told Triple Pundit that "Many of my mentors and heroes are among the past recipients, that I never expected to join," served as co-chair of the IPCC, Working Group II, which had responsibilities for assessing impacts of and vulnerabilities to global climate change for the Third IPCC Assessment (2001). He was also one of the lead authors on the recently completed Arctic Climate Impact Assessment.

McCarthy's key takeaway is that although kelps and seaweeds represent a tiny fraction of the planetary mass of photosynthetic organisms, they are responsible for fully 45% of all photosynthesis. McCarthy's work has greatly improved our understanding of the ocean's productivity, which is twice as great as originally thought. A full one-third of atmospheric CO2 is taken up by the oceans. This is converted by micro-organisms which form the basis of the ocean's great food web. "A small fraction gets buried in the sediment, the source of most of today's oil and gas which is found "in coastal margins or ancient inland seas." At the heart of it all is the "biological pump." The productivity of this pump is determined by two things: light, and the availability of nitrogen. McCarthy studied the ocean highly complex nitrogen cycle around the globe. Factors include deep water mixing, where much is recycled, as well as runoff from land, and even lihgtning strkes. He learned to read the history of a molecule through the use of isotopes. When he first started, people primarily thought of phytoplankton as fish food. He has come to understand its much larger role in the web of life.

On the policy side, starting in the mid-1980's, he led an effort among Earth Scientists to outline a set of studies to answer large (International Geosphere-Biosphere program) scale questions about the climate system up to the early 2000s. In the reports that came out in 1990's for the UN IPCC, they saw unusual changes. At that time they didn't know how unusual it was or how much was caused by human activity. By 2000, "we could now see unprecedented changes that could only be explain by release of greenhouse gases. We could see the effects on every continent whether it was organism range, loss of ice, sea level rise, or extreme weather events." He gave testimony at various levels of government from congress to cities. "Citizens have more impact at the city level." He analyzed what the impact of new standards could be, and trumpeted, the need to invest in alternative systems.

Our entire civilization, our economy and every aspect of modern society rests on a bedrock of science. Yet, we find ourselves in a strange time when much of our best science is ignored and even ridiculed, because some of its findings are threatening to the profitability of some of the world's most powerful corporations, who themselves owe virtually all of their success to the application of science. It is for this reason, that awards like this one, are more important than ever, to acknowledge the great work that scientists do every day, and how indebted we all should be to them.

Yet, as Dr. McCarthy says, "I think there is reason to be optimistic that we really have a very clear vision now of what the future could be, and its just a matter of getting the forces re-aligned and realize that the benefits of that for healthy working conditions for all people, for longevity, is an extremely important and reachable goal. And it's something that I don't think any of us who are convinced, as I am, of the science, will ever feel anything but impatience until we get this on the right track."

Images by Katie Voss. Courtesy of the Tyler Prize