Plankton have divergent responses to iron shortage

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Marine phytoplankton have been prodded, poked, sampled and studied by generations of scientists, but the ocean-dwelling organisms still have the power to surprise. A team headed by UCI oceanographer Katherine Mackey has discovered striking differences in the way coastal and mid-ocean phytoplankton called Synechococci adapt to the abundance or lack of certain nutrients in their environments.

Employing cutting-edge mass spectrometry techniques, the researchers showed that coastal Synechococci from the New England shelf thrive in high- and low-iron waters by utilizing different sets of proteins for iron uptake and storage, effectively banking the mineral for later use. In contrast, a Synechococcus strain from the open Atlantic Ocean does not have this protein-based response. Key to the study is the knowledge that nitrogen concentrations are perennially low in mid-ocean environments and more abundant in coastal regions. Proteins require nitrogen to synthesize, so in the open ocean where the element is scarce, Synechococci must make tough decisions about which proteins to keep. They may opt to "give up" on competing for iron in order to conserve nitrogen.

"We tend to think of cyanobacteria as simple organisms, but they are in fact quite complex," said Mackey, an assistant professor of Earth system science affiliated with the UCI OCEANS Initiative for ocean research. "And since these organisms take up a significant amount of carbon from the atmosphere, they play an important role influencing climate. Knowing the mechanisms by which these creatures function in the

environment is enormously important to scientists and society as a whole." Mackey is lead author on the resulting research paper, an early electronic version of which appears in *Proceedings of the National Academy of Sciences*.

More information: "Divergent responses of Atlantic coastal and oceanic Synechococcus to iron limitation." *PNAS* 2015 112 (32) 9944-9949; published ahead of print July 27, 2015, DOI: 10.1073/pnas.1509448112

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