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Title: Reduced Genomes of SAR11 and UCYN-A in the World Ocean: Specialized Roles in Biogeochemical Cycles.

Abstract: It has long been considered universal that marine heterotrophic bacteria use glucose as a carbon and energy source, and that all marine cyanobacteria fix carbon. However, a member of the abundant open ocean clade SAR11 has been found that cannot use glucose, and a periodically abundant nitrogen-fixing cyanobacterium (UCYN-A) has been found that shows no known capacity to fix carbon. The advantage to not fixing carbon in UCYN-A could be related to improved nitrogen fixation: the electrons for carbon fixation normally come from the use of light to split water and generate oxygen, which inhibits nitrogen fixation. However, the advantage of jettisoning glucose utilization is less clear. It appears that there is a phylogenetic separation between metabolizers of sugars and metabolizers of organic acids in the ocean that mirrors the compartmentalization of glycolysis and the TCA cycle in eukaryotic cells. These results have implications for studies of the carbon cycle in the world’s oceans and help to explain why some bacteria do not grow in standard culturing media.