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EARTH SCIENCE

SPECIAL SEMINAR

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Phytoplankton's 'crash diet'

what lipidomics can tell us about microbial growth and energy flux in the ocean

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Microorganisms drive globally important biogeochemical cycles, and they have shaped the elemental composition of Earth's surface environments and interior. Within the marine carbon cycle, they drive both primary production and turnover of organic carbon through mineralization processes. Microorganisms further have the metabolic and genetic capability to adapt to changing environmental conditions on very short time scales. For example, phytoplankton have developed strategies to maximize their growth by optimizing the allocation of photosynthetic resources in response to diel changes in sunlight. However, there is still incomplete knowledge about matter and energy transformations that are catalyzed by microbes on a daily basis. Based on a case study from high-temporal resolution sampling in the open oligotrophic ocean, I will present lipid biomarker evidence for how phytoplankton utilize a 'crash diet' strategy to support their cellular energy demands. During the day a significant fraction of daily primary production goes into energy- rich storage molecules (triacylglycerides; i.e. fats). Respiratory quinones suggest that phytoplankton then deplete these stores at night to meet the catabolic requirements of dark cellular processes. This work puts new constraints on matter and energy transformation on rapid time scales, and thus has major implications for our understanding of the highly coordinated processes that control daily biogeochemical fluxes in the oligotrophic ocean. The daily phytoplankton 'crash diet' drives an enormous carbon flux that may approach as much as 2 Pg C yr-1.

Complementary to other 'omics', the emerging field of lipidomics provides valuable information about microbial identities in natural samples as well as clues about how microbes respond, adapt and acclimate to their often rapidly changing environment. In this seminar, I will also discuss how analytical innovation can lead to exciting new discoveries through extending the analytical window for novel lipid molecules with distinct microbial sources and functions.