Oceanography Seminar

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"Towards 4 Dimensional (Eco) Systems Biology in the Sea"

Microbial communities regulate the cycling of energy and matter in the marine environment, yet the variability of their activities in space and time, and how they dynamically respond to both natural and anthropogenic environmental changes, is not well understood. Genome-enabled methodologies are now providing deeper perspective on the nature and the identity of microbial taxa, genes, and metabolic diversity in the marine environment. Yet one of the larger challenges remaining is defining the variability of these microbial taxa, genes and processes on different spatial and temporal scales in the environment. Questions that need to be better addressed include: How do activities of different microbial species vary of the course of minutes, hours, days and weeks ? Over what spatial scales are temporal dynamics coherently predictable? How does variation in any specific population correlate corresponding environmental variation, and the variability of other taxa? Novel *in situ* robotic sampling strategies that capture transcriptomic temporal profiles of wild planktonic microbial populations, have potential provide a four dimensional motion picture of microbial gene expression dynamics, that can begin to address such questions. New results using such approaches show that individual coexisting eukaryote, bacterial and archaeal populations display remarkably similar, time-variable patterns of synchronous gene expression over extended periods of time. Furthermore these patterns appear to be robust, and conserved in genetically related populations that span the Pacific Ocean. These results suggest that specific environmental cues may elicit cross-species coordination of gene expression among diverse microbial groups, that potentially enable multispecies coupling of metabolic activity. These data are leading to specific, testable hypotheses about how microbial interspecies matter and energy exchange may influence the cycling of matter and energy in the ocean.

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