Microbial Oceanography: Patterns in Deep Oceans

Toshi Nagata

Ocean Research Institute, The University of Tokyo, Japan

The importance of water column microbes in planktonic food webs and biogeochemistry of the oceans has become increasingly apparent during the past three decades. The concept of "microbial loop" indicates that bacteria consume half or more of primary production and are in turn consumed by protists and viruses, exerting the major influence on primary productivity, nutrient cycling, food web organization and global carbon cycling. However, our current understanding is mostly based on research conducted in the sunlit layer, with much less information available in the deeper oceans. Only recently, studies have begun to reveal remarkable features in distribution patterns of microbes, their community structures, food web interactions and their metabolic activities in deep oceans. In the present talk, I review recent advances in microbial ecology of deep oceans. I also present our data on prokaryote abundance and production collected during two meridional transect cruises conducted in the central Pacific. The data set is among the first that describes cross hemispheric distribution patterns in microbial abundance and activities throughout the water column of the oceans. Our data support the hypothesis that distributions of bacterial production largely reflect sinking fluxes of particulate organic matter, but they also suggest that episodic inputs affect microbial activities in a complex fashion. Our data challenge the conventional view that activities of microbes in deep oceanic waters are extremely low and largely suppressed under cold and high pressure conditions; thus they play only a minor role in global biogeochemical cycles. We suggest that deep sea microbes interact with complex mixtures of particulate and dissolved organic matter and dynamically respond to changes in the ocean's biogeochemical state.