APPLIED AND ENVIRONMENTAL MICROBIOLOGY

Volume 77 November 2011 **No. 21**

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Cover photograph (Copyright © 2011, American Society for Microbiology. All Rights Reserved.): The term "microbial carbon pump" (MCP) refers to the microbial processes that transform labile dissolved organic carbon (LDOC) to recalcitrant dissolved organic carbon (RDOC)—i.e., compounds such as peptidoglycans, heteropolysaccharides, lipoproteins, and lipopolysaccharides, which are resistant to biological degradation and, thus, can persist for long periods of time in the ocean water column, thereby constituting carbon sequestration in the ocean. The MCP is a conceptual framework for the integration of environmental, trophic, physiological, molecular, and genomic processes relevant to the *in situ* microbial activities that regulate RDOC production and dynamics toward a better understanding of the ocean's carbon cycle and its interactions with climate change. (*See related article on page 7439.*)