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The Microbial Carbon Pump: A new Concept in Marine Biogeochemistry

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Traditionally, three mechanisms, called pumps, have been suggested to explain the vertical distribution of carbon in the water column: The solubility pump, the carbonate pump and biological carbon pump (BCP). Recently, the conceptual framework of the microbial carbon pump (MCP) has been developed by the SCOR (Scientific Committee on Oceanic Research) WG 134. The MCP is defined as the transfer of labile organic matter into recalcitrant organic matter by microbial activity (microbial loop and viral shunt) causing long-term storage of carbon. The major pathways of the MCP are: 1) Direct exudation of microbial cells during production and proliferation, 2) viral lysis of microbial cells releasing microbial cell wall and cell surface macromolecules and 3) organic aggregate (particle) degradation and transformation.The MCP is important for understanding the marine carbon cycle, since the carbon content in marine dissolved organic matter (DOM, DOC) is similar to the carbon content of CO_2 in the atmosphere. First estimates indiacte that the capacity of carbon sequestration into deep marine waters and sediments of the BCP and MCP is in the same order of magnitude (0.4 and 0.5-0.6 Gt C per yr). The fourth carbon pump is likely an important mechanism in the marine carbon cycle and potentially vulnerable to global change.