

## The production of dissolved organic matter by phytoplankton and its importance to bacteria: Patterns across marine and freshwater systems

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### *Abstract*

We analyzed published rates of extracellular release (ER) of organic carbon to determine the primary constraints on this process and its importance to bacteria. From 16 studies we extracted observations of ER, particulate primary production (PP), and phytoplankton biomass. In a regression model based on 225 observations, PP explained 69% of the variance in ER. From this model we estimate the average percent extracellular release (PER) to be 1.3% of total fixation. The slope of this relationship does not support the hypothesis that the PER declines with increasing productivity. Differences exist between marine and freshwater systems. In lakes, ER increases nonlinearly with productivity, resulting in very low PER in very eutrophic systems. In coastal marine and estuarine systems, ER increases linearly with productivity and the PER does not vary systematically. ER is not primarily related to phytoplankton biomass as predicted by passive diffusion models. Instead, ER appears to be constrained by the total availability of photosynthates. By comparing our model to an existing model of bacterial production and assuming a 50% growth efficiency, we estimate that ER amounts to less than half the C required for bacterial growth in most pelagic systems.