Dealing with photosynthetic neighbours: diurnal chemical modulation of crosstalk in biofilm communities.

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Communities of photosynthesising and nutrient-cycling microorganisms are fundamental to life on Earth. They rely on chemical crosstalk via a range of specific molecules to mediate their interactions, "communicate" and function efficiently. Microalgae-bacteria communities in aquatic systems share micro-habitats where abiotic conditions fluctuate substantially on a diurnal time scale, because the interplay of photosynthesis and respiration causes steep gradients of pH and oxygen. Such abiotic conditions have the potential to inactivate "communication chemicals" by altering the molecules and thereby disrupting the associated interactions, as shown in recent studies. So what if photosynthesis-related fluctuating pH and oxygen levels act as chemical timers? This project aims to understand if gradients in pH and oxygen can temporarily modulate the essential chemical interactions that drive microalgae and cyanobacteria-dominated communities. The objectives are to characterise pH and oxygen fluctuations in a representative diatom-bacteria biofilm system, establish when and which organisms use or produce key metabolites, and measure temporal dynamics in cell-cell signalling linked to chemical gradients before assessing the stability and resilience of community functioning under external environmental stressors including climate change. DIALMOD links chemical to biological dynamics at high temporal resolution from chemical molecular effects to complex community performance using biological, chemical analytical and computational methods. This novel cross-disciplinary approach offers the potential for insights into a mechanism likely of fundamental importance to ecological and community functioning. The outcomes are applicable to other photosynthesis-driven systems and have wider implication for a better understanding of the ocean's biological carbon pump and ecosystem-wide interaction networks.

Projektbeteiligte

Christina C. Roggatz
Universität Bremen
Fachbereich 2: Biologie/Chemie
Meeres-Chemie
Bremen