Diverse dissolved organic sulfur compounds play an active role in ocean biogeochemistry

**Organosulfur mediators**

Ksionzek et al. show that the DOS concentration decreases in depth relative to that of DOC. DOS concentration has been exaggerated in the water column to make the effect visible. These DOS compounds play key roles in ocean ecosystems.

**DOS cycling**

Phytoplankton take up $\text{SO}_4^{2–}$ and release DOS. Heterotrophic bacteria fulfill sulfur requirements by taking up DOS and/or $\text{SO}_4^{2–}$. Some also release $\text{SO}_4^{2–}$.

**Positive chemotaxis**

Zooplankton and heterotrophic bacteria exhibit chemotaxis, moving toward DMSP exuded by a phytoplankton.

**Quorum sensing**

Heterotrophic bacteria sense DMSP released by a phytoplankton (such as a coccolithophore) and release the signaling molecule $N$-acyl homoserine lactone (AHL).

**Exchange of goods**

DHPS released by diatoms is taken up by bacteria. The latter in turn release vitamin B12, which is taken up by the diatom.
particular, dimethylsulfide (DMS) and its precursor dimethylsulfoniopropionate (DMSP). These compounds are rapidly cycled by the upper-ocean microbial food web and have low concentrations in the water column (in the nanomole range per liter, compared with micromole per liter for bulk DOS as found by Ksionzek et al.). DMSP is produced by many eukaryotic phytoplankton species and some cyanobacteria (10, 11). Phytoplankton commit up to 10% of net photosynthesis to DMSP production (12, 13). Heterotrophs and co-occurring microbes (14) may play an important role in several facets of ecosystem dynamics (see the figure).

In the ocean, where the vast majority of organisms are microscopic and the relative distances between them can be large, finding food can be difficult. To overcome this challenge, organisms use chemical signals to locate resources, a process known as chemotaxis. Bacteria also use chemical queues to regulate community behavior (quorum sensing); for example, they may increase the production of antibiotics once a population has reached a certain size. DMSP causes strong chemotactic behavior in heterotrophic bacteria and zooplankton (4) and induces the production of quorum-sensing molecules (5). Similarly, another organosulfur compound, dihydroxypropane-1-sulfonate (DHPS), is a key participant in an “exchange of goods” (vitamin B12 for organic carbon) between phototrophs and co-occurring heterotrophs (6).

We are only just beginning to understand the ecological relevance of a handful of the 81 labile (rapidly cycled) DOS compounds identified by Ksionzek et al. in the surface ocean. Some of these organic sulfur compounds may play a critical role in ecosystem dynamics. A necessary next step is to better characterize these DOS compounds (such as their sulfur oxidation state), their turnover rate, and local or regional variations in the composition of DOS. Further work is needed to understand the extent to which microbial dynamics are limited by the availability of reduced sulfur compounds and to elucidate the connection between the small, rapidly cycled, labile DOS pool and the large, non-labile DOS pool.

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### References
Putting the spotlight on organic sulfur
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