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## Kinetically regulated utilization and detoxification of acrylate is a key mechanism for marine bacterial DMSP metabolism

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Dimethylsulfoniopropionate (DMSP) cleavage, yielding dimethyl sulfide (DMS) and acrylate, provides vital carbon sources to marine bacteria, is a key component of the global sulfur cycle and effects atmospheric chemistry and potentially climate. Acrylate and its metabolite acryloyl-CoA are toxic, if allowed to accumulate within cells. Thus, organisms cleaving DMSP require effective systems for both the utilization and detoxification of acrylate. Here, we examine the mechanism of acrylate utilization and detoxification in roseobacters, an abundant group of marine *alphaproteobacteria* that catabolise DMSP. We propose acrylate-CoA ligase (PrpE) and acryloyl-CoA reductase (AcuI) as the key enzymes involved and through structural and mutational analyses, provide explanations of their catalytic mechanisms. In most cases, the efficiency and substrate affinities of the enzymes involved in DMSP catabolism and acrylate detoxification increases in the order DmdAs=DMSP lyases>PrpEs>>AcuIs. We propose a kinetic regulation model for DMSP catabolism and acrylate detoxification in *roseobacters*. This study provides insight on acrylate metabolism and detoxification and a possible explanation for the high Km values that have been noted for some DMSP lyases. Since acrylate/acryloyl-CoA is probably produced by lactate, propionate, alanine and glucose metabolism, and AcuI and PrpE are conserved in many marine and terrestrial organisms across all domains of life, the models proposed here are likely relevant to many metabolic processes and environments just above DMSP catabolism.

### Biography

Yu-Zhong Zhang is a Professor of the State Key Laboratory of Microbial Technology, Shandong University, China. He obtained his PhD degree in Marine Biology from Institute of Oceanography, Chinese Academy of Sciences in 1995. He has been In-charge of several important projects in China, such as 863 key projects and NSFC key projects. He has published over 150 peer-reviewed scientific papers, some of which are published in well-known international journals, such as PNAS, the *ISME Journal*, *Molecular Microbiology* and *Journal of Biological Chemistry* etc. He is now an Editor of FEMS Microbiology Letters and an Editor in Board of *Applied and Environmental Microbiology*.

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