New PhD Opportunity

Sulphur metabolism in unicellular marine algae – from biochemical pathway to climate cooling

Applications are sought for this Norwich Research Park PhD studentship by:

Dr. Gill Malin School of Environmental Sciences, University of East Anglia, Norwich
Dr. Stanislav Kopriva John Innes Centre, Norwich.

Deadline 5pm Friday 15th December 2006

We are seeking applicants from the UK or EU who have a first or strong 2i class degree (or equivalent) and/or an MRes/MSc in a relevant subject. Prior experience in microbial physiology, biological oceanography, biochemistry and/or molecular biology would be ideal. Funding and application procedure is described on the following page. Any enquiries to g.malin@uea.ac.uk

PROJECT DESCRIPTION: Sulphur is a vital nutrient for all organisms because it is essential for a wide range of key metabolites. Primary producers play a critical role in food webs and the global biogeochemical sulphur cycle because they are able to assimilate inorganic sulphate. Sulphur-deficiency is a major issue for agriculture that drives a range of research activity on sulphur assimilation in higher plants. In contrast the oceans are a major global sulphur reservoir and it is thought that sulphur does not limit growth in marine primary producers. The role of marine algae in production of the climate-cooling gas dimethyl sulphide (DMS) has been a major focus, but little is known about the link between sulphate assimilation and the production of the algal DMS precursor dimethylsulphoniopropropionate (DMSP).

Recent progress in algal genomics, especially the genome sequencing of the diatoms *Thalassiosira pseudonana* and *Phaeodactylum tricornutum* and the haptophyte *Emiliania huxleyi*, and the availability of EST libraries from other marine microalgae, allows the use of molecular methods for analysis of ecophysiological processes in the phytoplankton for the first time. Our survey of genome sequences revealed novel variants of known enzymes of sulphate assimilation in some microalgae which opens up exciting questions about pathway evolution and provides a unique potential resource for programs on improvement of sulphur use efficiency of crop plants.

The aim is to address the genetic diversity of sulphate assimilation in marine microalgae using bioinformatics, biochemical and molecular methods. The novel enzyme variants we have identified in *T. pseudonana* and the dinoflagellate *Heterocapsa triquetra* will be expressed in *E. coli* and purified for further biochemical analysis. Subsequently, to assess the diversity and evolution of marine sulphur assimilation, a broader range of phytoplankton would be analysed for PAPR (3'-phosphoadenosine 5'-phosphosulphate reductase) and its plant analogue APS reductase (adenosine 5' phosphosulphate reductase) activities. A combination of metabolite and expression analysis of the model species *T. pseudonana* and *E. huxleyi* will be used to characterise the link between sulphate assimilation and DMSP production and determine the limiting metabolic steps. In addition, provide insight into the functional significance of this globally abundant compound, the rates of DMSP synthesis, sulphate uptake and reduction will be determined under various environmental conditions. Depending upon how the research proceeds, it may also be possible for the student to participate in ship-based fieldwork.

The student will work between Gill Malin's Marine Trace Gas Biology laboratory, which is part of the Laboratory for Global Marine and Atmospheric Chemistry in the School of Environmental Sciences, and Stanislav Kopriva's laboratory Department of Metabolic Biology at the John Innes Centre. **Links:** http://www.uea.ac.uk/%7Ee061/; http://lgmacweb.env.uea.ac.uk/lgmac; http://www.jic.ac.uk/staff//stanislav-kopriva/index.htm; http://www.jic.ac.uk/corporate/science-departments/met-bio.htm