



Division of Biological Sciences
Institute of Cell and Molecular Biology

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James Rennie Bequest Report

Morag Bilslan

Title of Conference

The Physiology, Regulation and Biochemistry of Electron Transfer in Microbial Catabolism

Date

April 8th-12th, 2001

Location

Isle of Terschelling, The Netherlands

The Physiology, Regulation and Biochemistry of Electron Transfer in Microbial Catabolism

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I am a second year PhD student and have worked full time on my research project under the supervision of Professor Graeme Reid and Professor Malcolm Walkinshaw. One of the major interests in our research group is to understand the catalytic mechanism of the enzyme, flavocytochrome c_3 (Fcc₃), the sole respiratory fumarate reductase of the Gram-negative marine bacterium *Shewanella frigidimarina* NCIMB400. During anaerobic growth, *S. frigidimarina* NCIMB400, a facultative aerobe utilises fumarate as an alternative terminal electron acceptor to oxygen. The terminal reduction of fumarate to succinate in the anaerobic respiratory chain is catalysed by Fcc₃. The crystal structure of Fcc₃ was recently solved in our lab and this has led to an understanding of electron transfer to fumarate bound in the active site.

I am involved in the study of respiratory flavocytochromes isolated from the freshwater Gram-negative bacterium, *Shewanella oneidensis* MR-1. *S. oneidensis* MR-1 is a facultative aerobe capable of coupling anaerobic growth to the reduction of a wide variety of efficient terminal electron acceptors. These include fumarate, insoluble manganese (IV) oxides, ferric iron [Fe (III)], Chromium (VI) and nitrate. Sequence gazing of the *S. oneidensis* MR-1 genome has identified four putative flavocytochromes that share high sequence identity to Fcc₃. Sequence analysis and molecular modelling studies have led to the conjecture that these putative flavocytochromes of *S. oneidensis* MR-1 are acrylate reductases.

The major objectives of my project are to determine the structure and function of one of these putative flavocytochromes. In order to identify the protein function, I am currently constructing a gene-knockout of my chosen flavocytochrome. I am also developing a suitable over-expression system that produces the target protein in large quantities for characterisation and structure determination. I am particularly interested in using X-ray crystallography to solve the protein structure and Molecular modelling of the structural template to identify the substrate. The structural approach to identifying protein function may couple the gene-knockout strategy. The ultimate goal of my project is to gain further insight into the complex anaerobic respiratory pathways of *S. oneidensis* MR-1 with implications in understanding the environmental interactions of this bacterium.

My PhD position has enabled me to develop skills in a wide variety of disciplines including Molecular Biology and Biochemistry. My main scientific interest is understanding the structure and function relationships of proteins. In January 2001, during the course of my study, I was informed of the above conference, 'The Physiology, Regulation and Biochemistry of Electron Transfer in Microbial Catabolism,' which was appealing as the title suggested it would be directly linked to my PhD project and research interests. The international meeting was scheduled over four days, commencing on the evening of Sunday 8th April, 2001 and ending with 'Biochemistry and Structure' talks on Wednesday 11th April 2001. As a second year PhD student making steady progress in my PhD, the above conference was a timely opportunity to present my work and meet others working in a similar field. After receiving confirmation that my meeting abstract was accepted, I applied for financial help from 'The James Rennie Bequest' to attend the above international meeting.

My successful application to the 'James Rennie Bequest' has enabled me to attend and participate in a very well organised and worthwhile conference. The opening lecture was given by Professor Rolf Thauer as honoured guest of the Swammerdam Institute for Life Sciences, University of Amsterdam. The conference continued with a series of talks presented by invited speakers who are experts in their field of scientific research. The talks were grouped according to four areas of research; physiology of anaerobic respiration, regulation of bacterial anaerobic respiratory pathways, biochemistry and bioenergetics of catabolism and properties of nitrogen fixation. The series of talks were based upon new findings and recent publications from the various research groups and were extremely informative. The delivery of all the talks was excellent and the speakers helped to clarify certain points from my personal reading. The talks and the following discussion were most conducive in relating my own project to other topics in the field of microbial catabolism. Listening to the broad scope of the talks gave me a better appreciation of how different disciplinary research areas associate to give a more complete understanding of a subject. The information I acquired from attending the talks will prove to be extremely advantageous for writing my thesis next year.

In addition to the programme of talks, two poster sessions were held during the meeting to allow both PhD students and invited speakers to present their work. The poster sessions were an ideal opportunity for me to present my own work to a wider audience out-with our research group in Edinburgh. My poster generated some interest and positive feedback, particularly from a scientist studying bacterial transport pathways involved in the transport of flavocytochromes. One of the putative flavocytochromes mentioned on my poster formed the basis of our discussion because it displays a novel signal peptide. I found the poster session invaluable as it gave me the unique opportunity to informally discuss my work with leading scientists and ask questions having read their publications. This was important for building my communication and public speaking skills. The poster presentation enabled me to establish future work contacts for exchange of information and ideas. Furthermore, I obtained some helpful advice for constructing the gene-knockout I am currently working on.

As a second year PhD student intending to continue a career in scientific research, the international conference was fundamental for making future work contacts. The conference hosted many opportunities for informal discussion both with experts in their field of research and other PhD students. I established contacts with scientists from the University of Stellenbosch, South Africa and we have kept in contact since my return to Scotland. Networking with scientists from different countries was particularly advantageous for me as I hope to obtain a research position abroad.

The travel prize I received from the James Rennie Bequest has allowed me the valuable opportunity of attending my first international meeting. To participate at the meeting and represent the Institute of Cell and Molecular Biology at Edinburgh University has proved an extremely rewarding experience. The poster presentation helped to enhance my communication and networking skills and the research contacts I have now formed may determine my future post-doctoral position.