Royal Society of Edinburgh – National Natural Science Foundation of China Joint Projects
Case Studies

The Royal Society of Edinburgh (RSE) – National Natural Science Foundation of China (NSFC) Joint Project scheme is designed to facilitate international collaboration between researchers based in Scotland and China. The Joint Project grant provides a maximum of £6,000 per year and the Joint Projects run for two years. The funding may be seen as seed money to enable further collaboration and funding in the future.

The collaborations are based on a single project, between a team or individuals based in Scotland and in China. The collaboration involves bilateral exchanges between Scotland and China.

Since the scheme commenced in 2006, 13 awards have been made in the areas of biological science, animal science and management science, engineering and public policy.

Below are excerpts from reports of Joint Projects supported by the RSE-NSFC Joint Project Scheme. Information is taken from mid-term reports (after one year) and final reports (after two years).

Dr Xiaozhong Zheng, Institute of Aquaculture, University of Stirling, Scotland
Professor Zhaokun Ding, Institute for Fisheries Sciences, Guangxi University, China

Study of the desaturases of omega-3 highly unsaturated fatty acid (HUFA) biosynthesis in the Cobia (Rachycentron canadum).

Intensification of fish farming activities in China must be achieved using sustainable feeds which will necessitate the use of plant meals and oils. However, feeding carnivorous marine species with high levels of plant products can reduce growth and cause other health problems in fish that are not well adapted to utilising these products. The project aims to address this problem in a tropical/temperate marine fish, the Cobia, currently being developed for aquaculture in several parts of the world including China.

Dr Tocher and Dr Zheng travelled to China from 12th to 25th April 2007. They worked closely with their Chinese partner, Professor Zhaokun Ding and his group, and trained them in the main laboratory techniques. One desaturase PCR fragment was obtained during the visit. Dr Tocher and Dr Zheng also gave oral presentations to staff and students in Nanning. They were then in regular contact with their co-workers in China and eventually putative desaturase and elongase cDNAs were cloned. Professors Ding and Xu visited Scotland from 2nd to 29th June 2008. During this stay, they functionally characterized the two genes and investigated their expression

in 11 tissues by quantitative PCR. One joint paper was prepared after their visit and recently it was accepted for publication in the international journal “Aquaculture”. Therefore, the joint project went very much to plan, and it has been very successfully completed.

Professor Chris Secombes FRSE, University of Aberdeen, Scotland
Professor Nie Pin, Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan, China

Fish antiviral defence

Viral diseases are of economic importance to the aquaculture industry and outbreaks can lead to severe losses. This programme will target key fish species of economic importance to China/UK and study genes important in conferring resistance to viruses. An analysis of the gene variation between individual fish will allow a better understanding of possible disease control at a population level, and whether such traits could be selected for within broodstock programmes.

Professor Colin Campbell, Macaulay Land Use Research Institute, Scotland
Dr Yao Huaiying, University of Zhejiang, China

Nitrifiers in acid soil ecosystems in China and Scotland

The soil microorganisms that carry out the oxidation of ammonium-N are important to cycle nutrients to crops such as tea plants but there are little known about their diversity and community composition. The project aims to compare and contrast the soil microbial communities in highly acid soils of China and Scotland to better understand how they contribute to nutrient cycling in these important soils. Soils under pine trees in both countries are being compared and techniques developed in Scotland applied to Chinese soils for the first time. The overall objective of this project is to understand and quantify the rate of nitrification (ammonia oxidation) and the role of nitrifying bacteria in tea orchard soils, so as to assist in improving nitrogen utilization and management to move to more sustainable practices.

Professor James Prosser FRSE, University of Aberdeen, Scotland
Professor Limei Zhang, Research Centre for Eco-Environmental Sciences, China

Biodiversity-ecosystem function relationships in terrestrial nitrifiers

Nitrification by soil microorganisms involves oxidation of ammonia to nitrate, via nitrite. It is central to the global cycling of nitrogen, controls the availability of nitrogen for plants and generates nitrous oxide, an important greenhouse gas. For many years, the first and rate-limiting step in nitrification, ammonia oxidation, was thought to be carried out by a restricted group of bacteria. This view has been revolutionised by discovery of ammonia oxidising, soil crenarchaea. These organisms have never been cultivated in the laboratory and were discovered using molecular techniques. The collaborating laboratories have been investigating, independently, the

respective roles of ammonia oxidising bacteria and archaea in contrasting soils to determine the factors influencing their relative activities, their contributions to terrestrial ammonia oxidation, and nitrous oxide production, and the links between diversity and ecosystem function. Collaborative research will integrate these projects and provide significant added value.

Dr Jun Zou, University of Aberdeen, Scotland
Dr Jun Chen, Institute of Hydrobiology, Chinese Academy of Sciences, China

Bioinformatic discovery of fish chemokines and expression modulation by pathogenic and environmental bacteria.

Chemokines are a large family of soluble peptides directing cell migration in vertebrates, consisting of two major subfamilies, CXC and CC type. Initial Bioinformatic analysis was performed to identify CXC chemokine in the salmonid nucleotide databases. This led to discovery of 11 CXC chemokines in salmonids. Subsequently, these chemokines were cloned from rainbow trout and sequenced. Preliminary phylogenetic analysis and homology structural modelling revealed most of them can be classified into the homologous groups in mammals with a couple of molecules being uniquely present in teleosts. Further experiments are being undertaken to investigate how inflammatory and antiviral cytokines modulate their expression in various cell types.

Dr Will Shu, Heriot-Watt University, Scotland
Professor Dongsheng Liu, China National Centre for Nanoscience and Technology, China

DNA Aptamer Biosensors for Rapid Disease Diagnosis

The first year of RSE-NNSFC funded joint project has resulted in good initial success. Both parties visited each other's institution and gave public seminars. Dr. Shu recruited one master graduate from Prof. Liu's group for PhD studies in his group and put the PhD student working on this joint project. The research was carried out as planned and achieved the initial results set for the first year, with several research papers under preparation and an invited review paper to be published. In addition, Dr. Shu's group also successfully developed disposable microcantilever biosensors, partly sponsored by this project. He has been invited to give talks in several national conferences as well as universities (e.g. Glasgow & Edinburgh). He is also being invited by Prof. Liu to extend wider collaborations in China on this technology.