NEW GRANTS

Professor Stephen George and co P.I.s from Birmingham, Exeter and Glasgow.
Three grants have been awarded by NERC post-genomic and proteomics programme
(i) Identifying and defining the bases of individual and population susceptibility and adaptation to environmental pollutants in fish: An integrated transcriptomic proteomic and metabolic approach. A programme grant of £1,442,000 (of which the Stirling component is £388,066 plus a PhD studentship from NERC)
(ii) Molecular and genomic ecotoxicology knowledge transfer for environmental chemical risk assessment. A networks project in conjunction with co P.Is - an additional £59,673.
(iii) International Workshop and inter laboratory working exchanges to establish an international a fish toxicogenomics consortium. A further £148,000

Professor Sandra Adams and Dr David Morris have been awarded two new three year grants for proliferative kidney disease (PKD) research. ***Examination of the life cycle of* Tetracapsuloides bryosalmonae** (Funded by the BBSRC) Dr David Morris has been appointed as post doctoral scientist to the project.
PKD is the most important parasitic disease affecting rainbow trout farming in the UK. Its incidence on farms appears to be increasing while its possible impacts on wild fish stocks are currently unknown. The complete life cycle of *Tetracapsuloides bryosalmonae*, the parasite that causes this disease is also unknown. To date only freshwater bryozoa and salmonids are known to harbour the parasite. To improve our understanding of the disease and the parasite we aim to identify the fish and invertebrate hosts required to complete the life cycle.
A Vaccine for PKD (£182,599 from DEFRA and Schering-Plough Aquaculture)
Dr Charles McGurk has been appointed as the post doctoral scientist to the project.
The aim of this project is to develop a sub-unit recombinant vaccine to offer protection for farmed rainbow trout against PKD. This project follows on from previous Stirling studies which have shown the importance of a number of antigens in protecting fish against PKD.

Prof. Sandra Adams and Dr Kim Thompson have also been awarded two new three year grants.
Do cell-mediated immune responses equivalent to Th1 responses exist in fish? (£121,565 from the BBSRC).
This project is in coordinated by Professor Chris Secombes and Dr Zou from the Scottish Fish Immunology Centre, Aberdeen University. Dr Kim Thompson has been appointed as the post doctoral scientist to the project.
Antibody and cell-mediated immune responses, effected by B and T lymphocytes respectively, are known to be important for disease resistance in mammals. Whilst antibody responses are well established in fish very little is known about cell-mediated immune responses. In this proposal we aim to produce recombinant proteins to key immunoregulatory molecules in the rainbow trout, test their activity and then raise antibody probes to them, to allow the numbers of cells secreting these molecules post-vaccination or post-exposure to pathogens to be determined. We will also characterise the cells secreting these molecules further, and attempt to isolate them for in-depth study.

Developing control strategies for Rainbow Trout Fry Syndrome (£183,780 from DEFRA and Schering-Plough Aquaculture).
Dr Alison Morgan has been appointed as the post doctoral scientist to the project.
Rainbow trout fry syndrome (RTFS), caused by *Flavobacterium psychrophilum*, continues to be one of the most significant diseases affecting the rainbow trout fry and fingerling industry in the UK. Antibiotic treatment of infected fish is currently the only method of control as no commercial vaccine is available to prevent the disease. We propose to use a natural field challenge to test a variety of vaccine formulations, while at the same time developing a standardised challenge model that will be required for batch efficacy testing of commercial vaccines. In addition, broodstock vaccination will be evaluated as a means of controlling RTFS.

Aquatic Diagnostics Ltd (ADL)
Aquatic Diagnostics Ltd, a spin-out company from the University of Stirling, joins 22 other partners in an new EU funded integrated project. Prof Sandra Adams and Dr Kim Thompson from the Vaccine Unit are Directors of ADL while Mrs Karen Snedden is the project scientist. The Integrated project is coordinated by Prof Niels Lorenzen, DFVF, Denmark and aims to establish a platform of knowledge and tools for improving the immunological status of the major aquacultured species in Europe (Atlantic salmon, rainbow trout, sea bream, sea bass, carp, mussel and oyster). Focus will be put on use of vaccines, immuno-stimulants, immuno-diagnostic surveillance as well as markers for selection of the most immuno-competent individuals. Assays for qualitative and quantitative monitoring of key elements of the innate and adaptive immune system at genetic and functional levels will be established and used for determination of response profiles which correlate with protective immunity. In combination with the know-how established during the project these tools will represent a strong platform for immunity-based reduction of losses caused by infectious diseases in future aquaculture.

Dr Andrew Shinn
Prevention and management of Ichthyophthirius multifiliis. £30,264 from DEFRA
A joint research program funded by the British Trout Association, DEFRA and Scottish Aquaculture Research Forum between the Institute of Aquaculture, Stirling and Pisces Engineering Ltd., has led to the development of a patented mechanical system which removes the threat of white spot - *Ichthyophthirius multifiliis* - one of the major threats and causes of mortality to worldwide aquaculture. The system has been successfully trialed in the field on a commercial scale with dramatic results. The primary device in the system is a special suction head connected to a pump. Rather than being brushed or cleaned in other ways, the bottom is vacuumed, removing the unwanted cysts. The design of the vacuum ensures that even very small fry are not drawn in or damaged by it, whilst retaining sufficient

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suction and mechanical action to remove the cysts and other debris. An additional benefit is that the vacuum is also very effective at removing uneaten feed and faeces, resulting in improved water quality and probable other environmental and pathogenic benefits to the fish. A secondary and equally necessary device used in the trial was to line the concrete raceways with a special low adhesion polymer sheeting which eliminated the problems of cyst adhesion and the potential for cysts to settle and develop in the cracks and pores of the rough surface. A raceway system was used in the field trials, and other trials in lined ponds and tanks are about to commence. For further information please visit www.pisces-aqua.co.uk or contact Dr Andy Shinn / Dr Nick Taylor / Sara Picon Camacho in Parasitology at the Institute of Aquaculture (aps1@stir.ac.uk , nght1@stir.ac.uk) or Bob Bawden (bob@pisces-aqua.co.uk) at Pisces Engineering Ltd., Stirling.

Dr Gordon Bell
Blood fatty acids and phospholipase A2: £129,835 from the Scottish Executive
Preliminary research by a team of Scottish scientists has indicated a possible link between fatty acid deficiency and childhood autism. Fatty acids are required for the optimal function of cells and organs such as the brain and eyes as well as for fighting off infection.
Results of a pilot study by researchers at the universities of Stirling and Edinburgh, in conjunction with the Royal Hospital for Sick Kids in Edinburgh and South Glasgow University Hospitals NHS Trust, suggest that the behaviour of fatty acids in the blood of children diagnosed with autism may differ from that of other children. The consortium has been awarded £125,335 by the Chief Scientist Office (CSO) to test this finding. The study will measure the blood fatty acid levels in 50 children with autism and compare them to samples from non-autistic children.

Professor Alan Teale
Transcriptomic Analysis of Host-Pathogen Relations. £550,154 from the BBSRC
Alan Teale, Randolph Richards, James Bron, and Bill Starkey have received a major award from the BBSRC to study the molecular basis of infectious pancreatic necrosis (IPN) in Atlantic salmon. The project will be performed in collaboration with FRS Marine Laboratory, Aberdeen, and the ARK Genomics facility at the Roslin Institute. The annual economic loss to the UK aquaculture industry resulting from IPN exceeds five million pounds. IPN virus may persist in surviving salmon and then spread to other susceptible fish, perpetuating IPN in both farmed and wild salmon populations. The study will identify genes that are associated with resistance to IPN virus and with virus persistence and provide insight into the mechanisms of tissue damage occurring in IPN. The results of the study will contribute to salmon breeding programmes and to the rational development of tools for controlling IPN such as vaccines and sensitive diagnostic reagents.

Dr Douglas Tocher
Transcriptional control of polyunsaturated fatty. £280,241 from the BBSRC
Dr Douglas Tocher, Professor Alan Teale and Dr Michael Leaver will study genes and molecular control mechanisms involved in omega-3 polyunsaturated fatty acid synthesis in salmon and cod. Success in obtaining this award was undoubtedly assisted by the considerable investment in molecular technologies that recent refurbishments in the Institute have brought. The modernised laboratory suites and extensive new equipment will greatly facilitate the researchers in their investigations and the successful accomplishment of their research aims.
Fish are the only major dietary source for humans of health-promoting long-chain omega-3 fatty acids. With the decline of marine fisheries, farmed fish constitute an increasing proportion of the fish in the human diet. The high level of omega-3 fatty acids in farmed fish has been assured hitherto by the addition of fish oils derived from feed grade marine fisheries to aquaculture feeds. However, this is not sustainable in the longer term, and will constrain continuing growth of aquaculture activities, particularly with marine fish. Vegetable oils provide safe and sustainable alternatives to fish oil for aquaculture feeds, but they do not contain long-chain omega-3 fatty acids. If successful, this approach could lead to the development of sustainable aquaculture feeds, which, at the same time, will enable fish farmers to continue to produce fish rich in health-promoting omega-3 fatty acids for the human diet.

Dr Trevor Telfer
Development of GIS-based tool to assist planning. £19,934 from Scottish Aquaculture Research Forum.

Sustainable options for people, catchment and Aquatic Resources in China (SPEAR). £82,222 from the EC.

What should I eat... does the future look brighter for farmed fish?

Does eating more fish make you healthier or are you actually loading the dice against enjoying a ripe old age? Popular media has been full of claims and counter claims over the last few years and the conflicting advice available to consumers concerning their dietary choices is now causing stress to anxious shoppers as they nervously wheel their trolley down the supermarket aisle (see The Observer, 14th August 2005).
Should they load up with tins of canned tuna or will the benefits of all those lovely PUFAs (polyunsaturated fatty acids) be outweighed by the bio-accumulated mercury -a legacy of our rush to modern lifestyles. Will wild Alaskan salmon or farmed Scottish be best for keeping our arteries clean or will the PCBs (Polychlorinated Biphenyls) make us and our descendants sick? While the relative risk of individual factors have been discussed and the debate warmed up with the Hites et al paper[1] in early 2004, the jury is still out.

Clearly what is required is joined-up research that brings together risk analysis from a range of perspectives and mechanisms for this information to be made available to various stakeholders, especially consumers, in a way that is informative and trusted.
A recent paper[2] attempts to do this based on some assessment of composite benefit-risk by using dose curves. The outcomes are a sobering read for those that like their fish suppers and very worrying for those for whom fish are staple items.

Several thoughts occur. Aquaculture systems that can control the levels of good and bad things entering the fish we eat will be in a good position to compete with wild fish and alternatives in the medium to long term as awareness of the need for a holistic risk assessment grows. Secondly, capacity to assess risks and conduct joined up research is currently rather weak and needs to be strengthened through interdisciplinary approaches that bring together practitioners and researchers in aquaculture/fisheries science and human health. Thirdly, if we have a need to understand these issues now in the developed world where fish consumption