

Attracting, Retaining & Recognising Scotland's Research Talent

Aiming to continue Scotland's legacy of life-changing invention and innovation, world-class research projects here in Scotland are to receive grants totaling £1.7 million from The Royal Society of Edinburgh (RSE). Innovative research, offering public benefit in areas such as healthcare, crime-detection, communications, energy and the environment is to be supported through the RSE, in partnership with key funders in the public and private sectors. Enabling top ideas to be developed here in Scotland, over 35 new awards will be announced at the RSE's Research Awards Ceremony to be held for the first time in The Scottish Parliament today, September 2.

On this occasion, the RSE, in partnership with Scotland's Futures Forum will discuss how best to attract, retain and recognise Scotland's Research Talent. Hosted by The Presiding Officer of The Scottish Parliament The Rt Hon George Reid MSP, leading scientists, economists, politicians and other key decision-makers will hear from speakers Dr Gary Crawley of the Science Foundation of Ireland; Mr Hugh Ilyine, Stem Cell Sciences Ltd & Prof Peter Grant FREng, FRSE, FIEE, FIEEE, University of Edinburgh & Member of The Scottish Science Advisory Committee (SSAC). A full report of the discussion and conclusions, both from the speeches and break-out sessions will be published after the event.

RSE President, Lord Sutherland of Houndwood said:

These awards enable some of the brightest researchers and potential entrepreneurs from home and abroad to develop their ideas here in Scotland. Today we have many world-class centres of excellence and brilliant individuals and networks, but as competition grows from countries such as India and China who are building scientific and technological expertise, it is essential that we continue to attract and retain the best minds.

The RSE is working with key partners to showcase the best of Scotland's research and development capabilities to the rest of the World. We are also seeking to enhance Scotland's capacity for international collaboration through a growing programme of exchange schemes with sister academies overseas. Collaboration must be central to enhancing our Science Base and ensuring Scotland's future prosperity. I'm therefore delighted that we are working in partnership with Scotland's Futures Forum for this event and are gathering to discuss how best to attract and retain Scotland's research talent. I am grateful to the Presiding Officer, The Rt Hon George Reid, MSP, and to Scotland's Futures Forum and its Staff for hosting us today. I wish Scotland's Futures Forum every success and offer my sincere congratulations to the outstanding awardees whose success we celebrate on September 2.

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Notes for Editors

1. The Royal Society of Edinburgh (RSE)

The Royal Society of Edinburgh (RSE) is Scotland's National Academy of Science & Letters. An independent body with charitable status, its multidisciplinary fellowship of 1400 men and women of international standing represents a knowledge resource for the people of Scotland. Committed to its Royal Charter of 1783 for the "advancement of learning and useful knowledge" the Society recognises the important role it can play in today's Scotland. Working as part of the UK and within a global context, the RSE seeks to provide public benefit by:

- organising conferences and lectures for the specialist and for the general public on topics of national and international importance
- providing independent, expert advice to key decision-makers in Scotland
- awarding over £1.7 million annually to Scotland's top young academics to promote research and knowledge transfer in Scotland
- enabling leading Scottish-based researchers to collaborate with the best of their international counterparts
- inspiring school children in classrooms from the Borders to the Northern Isles and promoting their interest in science, society and culture
- producing academic journals of international standing

2. Scotland's Futures Forum

Following a four-month scoping study, the Scottish Parliament has agreed to establish a Futures Forum. In a spirit of open learning and creativity the forum will:

- Expand the Parliament's ability to learn from others and develop its capacity for futures thinking
- Bring MSPs into contact with new perspectives on longer-term issues
- Link the Parliament into existing networks, and relationships, with other organisations, companies and universities undertaking futures work, at home and internationally
- Enhance the Parliament's profile both at home and abroad

You can get involved by:

- Signing up for a quarterly Futures Forum Newsletter giving details of the Forum's work and forthcoming events
- Contributing your ideas on Scotland's future and issues you think MSPs & others in public life should be considering
- Commenting on the Futures Forum, its work or direction

Please email: Robert.rae@scottish.parliament.uk

Or visit : www.scottish.parliament.uk/nmCentre/futures/

The RSE's Research Awards support some of the most outstanding young scientists and innovators working in Scotland today. The benefits of their research are far-reaching. It is only through valuable partnerships with key bodies such as BP, the BBSRC, the Caledonian Research Foundation, the Lloyds TSB Foundation for Scotland, Scottish Enterprise, the Scottish Executive and the Wellcome Trust that the RSE is able to provide these awards. To each of these partners, we offer our sincere thanks.

These highly competitive awards enable people with good ideas, across a spectrum of disciplines to research and develop their work for the good of Scotland and beyond.

A full summary of the new projects follows. The institution listed immediately prior to the Awardee's project summary indicates where the research will be undertaken.

CORMACK VACATION RESEARCH SCHOLARSHIP 2005

Mr Edward Bloomer

The Search for Burst Gravitational Waves from Pulsar Glitches

Department of Physics and Astronomy, University of Glasgow

A pulsar glitch, believed to be caused by a dramatic change in a pulsar's structure, alters the star's normally-regular emission of radiation, and, in theory, causes the pulsar to 'ring' like a bell, producing gravitational waves. Using data collected by the LIGO and GEO600 gravitational wave detectors at the time of a giant flare from the soft-gamma-ray repeater SGR 1806-20, the project's aim was to find evidence of this ringing, and use it to establish more accurate boundaries for the strain on these detectors caused by such events.

Miss Amy Cowan

Ultrafast Rotators as a Signpost for Kinematic Associations in the Solar Neighbourhood

School of Physics and Astronomy, University of St Andrews

Young stars in close proximity to the sun provide favourable conditions for the study of the formation of stars and planets. Following the recent discoveries of numerous young kinematic associations in the solar neighbourhood, it was found that many moving groups contained late type stars which are fast rotators, with a $v \sin i$ of 20 km s⁻¹ or more.

During the research project, Miss Cowan looked at the use of ultrafast rotators, stars such as EK Dra and Speedy Mic, as signposts for youthful kinematic associations. For each ultrafast rotator under consideration a list of likely companions was compiled, and a colour-magnitude diagram constructed, in order to obtain an age estimate for each cluster.

Mr Charles Gentry

Alfven wave propagation near coronal magnetic null points

Division of Applied Mathematics, University of St. Andrews

One of the most elusive problems in solar physics is the so-called coronal heating problem, i.e. by what mechanism is the solar corona heated to around 1,000,000 K? One proposed solution is phase mixing of magnetohydrodynamic (MHD) waves. This occurs mostly in the neighbourhood of magnetic null points because waves cannot travel through these regions and so must dissipate their energy. This contributes the heating of the corona. The exact nature of MHD wave propagation in these regions will be investigated in this project.

Ms Katharine G. Johnston

A search for starlight reflected from tau Bootis b

School of Physics and Astronomy, University of St Andrews

A significant fraction of the 150 or so extra-solar planets found to date, orbit their parent stars at distances

Miss Christina Helen Walker

The Structure of Brown Dwarf Circumstellar Disks

School of Physics and Astronomy, University of St Andrews

For this study, a self-consistent Monte Carlo radiation transfer code was used to model the structure of circumstellar disks heated by a central Brown Dwarf. Our results suggest that under conditions of vertical hydrostatic equilibrium, these Brown Dwarf disks will be highly flared in comparison to classical T-Tauri disks. Miss Walker shows that this high degree of flaring could result in a large fraction of obscured sources due to extinction of direct starlight by the disk over a wide range of sightlines and she suggests that this could have possible implications for the optical and near-IR detectability of such systems.

LESSELLS TRAVEL SCHOLARSHIP

Mr Sachi Arafat

Creating Novel Paradigms for Information Retrieval to Rid It of Its Ad Hoc Nature

School of Information & Management Sciences, University of California at Berkeley

This work is based on the formal modeling of information retrieval (IR), more commonly understood as the process of searching on a computer. Formalisms from quantum mechanics (QM) are used to describe and analyze the way in which a search engine reacts to user queries. The project will investigate the feasibility of these formalisms in describing how the user reacts to search engine results. One of the main applications of being able to formalise the search process in this way, is that of simulating search-scenarios, which can significantly reduce search engine evaluation costs. An important benefit of being able to describe IR using QM formalisms is that a rich set of formal reasoning tools from physics becomes available for use in the theoretical analysis of search processes. The intended project is expected to strengthen the justification for using QM on IR, and for broader interdisciplinary research concerning these areas.

Mr Allan John Jardine

Combined research of cooperative diversity protocols with ETH, Zürich

Institut für Kommunikationstechnik, Swiss Federal Institute of Technology

One of the biggest problems faced by designers of mobile telecommunications systems is the multi-path nature of the communications channel. However, the very multi-path that creates difficulties also offers us spatial diversity, which can be used to combat fast-fading. MIMO systems have recently attracted a lot of attention; however, it is only possible to fit two antenna elements on to a device the size of current mobile phones, while preserving the benefits offered by spatial diversity. Cooperative diversity is a method that allows mobile terminals to share information together, to benefit from spatial diversity. Mobile terminals can act as virtual antenna elements (relays) for other mobile terminals in a cooperative network. The focus of Mr Jardine's work in this area is to characterise the capacity benefits of using this method in a network, and how it can be improved to meet the capacity requirements of the telecommunications market.

Mr Ravindran Manoharan

Novel nonlinear dynamics method for NDT of ground anchorages

Research and Development Institution: MP Interconsulting

This research project entails the development of a novel nonlinear dynamics method for non-destructive testing (NDT) of ground anchorages based on multi-mode, multi-frequency, nonlinear modulation technique. Ground anchorages are safety-critical elements which are employed in practically all civil and structural infrastructure engineering projects from bridges, buildings and dams to mines and tunnels. Due to the weaknesses of both the current practice of lift-off testing (only 5-10% of ground anchorages are actually monitored in reality [BS8081: 1989]) and existing NDT methods, this research aims to overcome this problem by developing a quick, economical and effective method which is robust yet highly sensitive. The novel method proposed encompasses the development of novel equipment based on power ultrasonics, including transducer design, tracking and feedback circuit, as well as employing novel methods of data acquisition and signal processing. Ideally, once the technique has been validated experimentally, it would be applicable to all types of structures and materials, including in-homogenous specimens as well as composites and polymers.

Mr Rafael Martin

Gas production under aged-waste and field confirmation of radius of influence of gas wells

School of the Built Environment, Napier University

Conventional geomechanical analysis of landfill settlement (time dependent) masks the fundamental nature of decomposition effects. The presence of a solid organic fraction in waste soils and the many factors controlling its decomposition cannot be explained by conventional inert soil analysis. It is the intention of this research student to achieve a better understanding of the process of biodegradation which currently is the least understood due to lack of data and test limitations. To this end, a visit to Swire-Sita Ltd and Hong Kong Baptist University is proposed to carry out a programmed research work on the WENT landfill site and other closed landfills with the intention of analysing landfill gas production under aged-waste heterogeneity (and in time) and field confirmation of the radius of influence of gas wells.

Dr Dimitri Mignard

Organo-metallic Polymer Electrocatalysts for the Chemical Synthesis of Alcohols and Hydrocarbons from CO₂

Instituto di Chimica dei Composti OrganoMetallici (ICCOM), University of Florence

Dr Mignard's project is concerned with producing chemicals and fuels from the reaction of carbon dioxide (CO₂) with water using electricity. A catalyst is needed for this, that is to say an electrode material that facilitates the reaction. Dr Mignard will test revolutionary catalysts invented by the ICCOM team in Florence, which have shown unrivalled efficiency for generating power from fuels (they are catalysts for 'fuel cells'). CO₂ is considered a waste from power stations, but it could be recycled in this manner. The project could lead to an efficient technology for manufacturing chemicals, using 'clean' feedstocks such as CO₂ rather than other chemicals derived from gas, oil or coal. It could also make it possible to store and transport renewable energy produced in remote areas from wave, tidal or wind power, with dual-purpose shipping tankers able to carry the CO₂ to the plant before returning with the fuel product.

Ms Alexandra Price

Application of Neural Control Techniques to Wave Energy Conversion

Laboratoire de Mécanique des Fluides, Ecole Centrale de Nantes

The first wave energy converters are currently being built commercially in Scotland following an order for €8million by a Portuguese company. Much remains to be done though to ensure that wave energy becomes an economically viable alternative in Scotland. The development of successful control strategies is important to minimise loads and increase power take off. Given the data-driven nature of this problem, intelligent strategies which learn from data appear promising. ECN in France is a world-renowned centre for hydrodynamics, specialises in control, and has experimental facilities available. This project will apply an intelligent control technique, e.g. neural networks, to the control of the SEAREV device being developed at ECN. The device will be modelled using time domain techniques, which will be learnt during the secondment to ECN.

BP PERSONAL RESEARCH FELLOWSHIP

Dr Sarah Louise Hinchley

Determination of structures of unusual, unstable and reactive species

School of Chemistry, University of Edinburgh

Chemistry never ceases to amaze, and we are always reading about new technologies and products – materials, medicines, chemicals with special properties. To make their work efficient, chemists need to be able to predict the properties of target molecules, and to understand the routes to these molecules, and the rates at which reactions will take place. Techniques for determining molecular structures are therefore of primary importance. Nowadays computers can predict structures of many molecules accurately, and they may also model gas-phase reactions. However, the programs use standard information from experimental gaseous structures, so new, accurate information from gas-phase experiments is always required. There is a mass of gaseous structural information for stable molecules, but information about short-lived or unstable

species is much harder to obtain. Data are scarce, although they are essential for modelling reaction pathways and thus predicting rates of reactions. This project will develop ways to provide this information.

CRF/RSE PERSONAL RESEARCH FELLOWSHIPS IN THE BIOMEDICAL SCIENCES 2005-2008

Dr Tobias Bast

Hippocampal substrates relevant to episodic memory: differentiation and integration of functions along the septo-temporal axis of the hippocampus

Division of Neuroscience, University of Edinburgh

Our memory of specific events in our lives - for what happened, where and when – enables us to carry out everyday tasks, such as remembering where we parked the car this morning, or left the keys last night. This type of memory, known as episodic memory, gets worse as we age and is among the first mental capacities to be affected by Alzheimer's disease. During tenure of his Fellowship, Dr Bast will investigate the underlying processes in the hippocampus, the part of the brain that plays a central role in the acquisition and use of episodic memory. In particular, he will be studying how different parts of the hippocampus work together to combine, process, and store information from diverse brain regions and to convey the stored information to executive brain structures. His results may point the way to understanding how such devastating loss of normal function can be avoided.

Dr Carole Torsney

5-HT_{2c} receptor regulation of AMPA receptor function as a basis for increased excitability of spinal cord dorsal horn neurones during neuropathic pain

Moving from Columbia University, New York to Centre for Neuroscience, University of Edinburgh

Neuropathic pain is one of the most debilitating types of chronic pain and is often resistant to pharmacological intervention. It results when the nerves that transmit sensory information from peripheral parts of the body to the spinal cord become damaged, for example as a result of infection, diabetes or surgery. As well as altering the function of the peripheral nerves themselves, this kind of injury dramatically changes the spinal cord regions which are critical for processing sensory information before it is relayed to the brain and 'perceived'. As a result, sensory information is 'misprocessed' and patients experience spontaneous pain, pain in response to non-painful stimuli and exaggerated pain. During tenure of her Fellowship, Dr Torsney will be hoping to identify targets for future drug development by identifying key molecular interactions in the spinal cord which result in this information 'misprocessing'.

SCOTTISH EXECUTIVE PERSONAL RESEARCH FELLOWSHIP

Dr Rosalind Allen

Rare events in non-equilibrium systems

School of Physics, University of Edinburgh

Rare events are processes that happen rapidly, yet infrequently, such as earthquakes, system failures or the aggregation of misfolded proteins. They are difficult to study experimentally, or using computer simulations, because of the long waiting times between events. This project will use a newly-developed simulation technique, known as Forward Flux Sampling. Dr Allen will first simulate the crystallization of particles under shear. This process is very important in a wide range of industrial processes, but is thus far not well understood. Dr Allen will also study the flipping of bistable genetic switches. These are networks of interactions between DNA and proteins, which enable biological cells to respond to external signals and coordinate their internal functions. The project aims to shed light on the general design principles of such networks, which are of relevance in medicine, agriculture and biotechnology.

Dr Alan Kemp

Advanced Disk Lasers: A New Horizon in Solid-State and Semiconductor Laser Design

Institute of Photonics, University of Strathclyde

The laser can become a scientific and industrial penknife. From studying the shortest events, to precision machining for the fastest aircraft, it already excels. Yet the potential is greater still: high performance lasers are too often locked in the lab by their bulk, inefficiency and fragility. Lasers based on a thin disk of

crystalline material produce high output powers with extraordinary efficiency, yet are bulky and limited in output colour. Semiconductors laser media can be engineered to produce almost any colour, yet struggle to produce high powers in a good beam. This project aims to exploit the strengths and address the weakness of both classes of laser; utilising the disk geometry to enable a range of novel systems. The penknife is adaptable; the penknife is robust; the penknife is compact. The advanced disk laser concept can be the optical penknife of the future.

Dr Keith Mathieson

A Retinal Prosthesis for the Blind

Department of Physics and Astronomy, University of Glasgow

Many forms of blindness have no known cure. One solution is to use advances in microelectronics to develop a retinal prosthesis. Dr Mathieson is attempting to manufacture a small device to be implanted onto the retina. This device would contain an imaging detector (like that found in mobile phones) with hundreds of pixels. Each of these pixels would be connected to a very small electrode, which generates electrical pulses. When light falls on the imaging detector, the stimulus pulses activate retinal cells located immediately under the electrodes. If light forms an image on the detector then the result will be electrical stimulation of the retina in the shape of this image. The nervous impulses generated could lead the brain to recognize this letter. The main beneficiaries will be sufferers of photoreceptor diseases, such as retinitis pigmentosa (15,000 sufferers in the UK) and age-related macular degeneration (0.8 million sufferers in the UK).

SCOTTISH EXECUTIVE SUPPORT RESEARCH FELLOWSHIP

Dr Dominic Campopiano

Defensins – structure and function of man's natural antibiotics

School of Chemistry, University of Edinburgh

Humans have evolved a range of sophisticated defence mechanisms to protect themselves from constant bombardment by potentially life-threatening infectious organisms. However, due to the widespread use of antibiotics such as penicillin, pathogenic bacteria have also evolved equally ingenious ways of protecting themselves against currently-prescribed drugs. This has led to the rise of the “superbugs” such as MRSA (methicillin-resistant *Staphylococcus aureus*) which are causing increased hospital-acquired infection and mortality. Dr Campopiano will use this fellowship to better understand the molecular details of the battle being fought between our immune system and pathogens. He will focus on a group of antimicrobial proteins called “defensins” which are produced by our immune cells in response to infection. Defensins can not only kill bacteria upon contact but their presence in the bloodstream alerts the host that they are under attack. The results of Dr Campopiano’s work will help in the design of new antibiotics.

Dr Alison N. Hulme

Chemical Biology Approaches to Tagging and Imaging in Biological Systems

School of Chemistry, University of Edinburgh

Tracking the path of biomolecules within a cell, or organism, is a crucial part of understanding the role that they play in transmitting signals within the cell, and in regulating many important processes which allow the cell to function normally. Hence, the selective labelling of biomolecules with a tag (e.g. a visual label such as a fluorescent tag) is an important tool for the study of their function and cellular fate. Chemical Biology approaches to biomolecular tagging can offer significant advantages over traditional biological imaging techniques as they open up a broader diversity and greater flexibility to tag introduction. New ways of tagging specific classes of biomolecules including glycosaminoglycans, and steroidal hormones will be investigated; these will ultimately allow a unique insight into biological processes in areas as diverse as the healing of wounds and the decline in the human body’s immune defence system with age.

Dr Graham Kirby

Self-Managed Reliable Location-Independent Distributed Storage

School of Computer Science, University of St. Andrews

The project will apply principles of autonomic (self-managing) and distributed computing to the problem of reliable data storage. This issue is becoming increasingly important to individuals and organisations as the

quantity and intrinsic value of digital information continues to rise. Many owners of computers have little appreciation of data backup and its importance until it is too late. The goal of the project is to develop a software layer providing automatic and transparent backup for computer users, who should be completely unaware that the software is in operation. Once the software was installed, all the user's data on that machine would be made resilient. Should the user lose files accidentally or through virus attack, or their hard drive crash, or they reinstall the operating system, or move to a new computer, their data would be restored without any intervention other than the reinstallation of the backup software.

ROYAL SOCIETY OF EDINBURGH/SCOTTISH ENTERPRISE ENTERPRISE FELLOWSHIP

ELECTRONICS

Mr Mir Faheem

Digital Wireless Electromagnetic Interference (EMI) Measurement System

Department of Electronic & Electrical Engineering, University of Strathclyde

The Digital Wireless Electromagnetic Interference (EMI) Data Acquisition and measurement system is one of the first digital wireless systems for the acquisition of fast transient EMI signals in harsh electromagnetic environments. A prototype of the new system has been developed and tested in the field. The system has applications in the power industry, the EMC Testing industry and the electronic equipment manufacturing industry. The system can be used for fault analysis of circuit breakers in power substations. It can also be used for proactive monitoring of EMI radiations. Since the remote acquisition unit is a lightweight portable system, it has a very attractive application for one-off EMI measurements. The acquisition unit of the system has potential and far-reaching applications in embedded systems and industrial control applications in the automated control industry, as it is probably the first acquisition unit to provide an open interface to an embedded CPU.

Dr Ayse Goker

AmbieSense: an infrastructure to provide personalised, context-sensitive information to mobile users

School of Computing, Robert Gordon University

AmbieSense Ltd. is a company specialising in high-quality 'context-aware' information services and technologies, particularly in ambient and mobile settings. AmbieSense works closely with users, studying them and observing their needs in these mobile settings, to make sure that the developed solutions work naturally for people, and fit with their daily life. AmbieSense also works closely with large information providers, developing solutions and applications that help them manage large amounts of information, indexing it, and making it easy for users to browse and search. These specialities are brought together in the AmbieSense core business: the development and deployment of carefully-designed context-aware solutions, particularly for mobile platforms such as mobile phones and PDAs, which can give people the information they need, as and when they need it.

Dr Sonia Schulenburg

Evolving Artificial Traders for Successful Market Trading

Centre for Enterprise Management, University of Dundee

The enterprise fellowship, through access to an incredible network of mentors and business professionals, is supporting business planning, assessment of further market potential and access to strategic funding to launch Level E Limited, a new venture whose aim is to deliver the financial community with smart decision-support and decision-making systems to increase speed, performance and consistency in trading a variety of markets. Key differentiators from other smart technologies that have been identified include a novel agent-based platform offering 'continual learning', a higher level of explanatory power and more granularity in recommendations, making it more suitable for compliance. Generation of trading signals is fast, works with single stocks or portfolios, and is highly customisable to various trading styles, data streams and financial instruments.

Dr Andrew Sherlock

PartBrowser

School of Engineering and Electronics, University of Edinburgh

There are estimated to be 20 billion 3D models of engineering components world-wide. Currently, there is no simple way of finding a part if its part number is not known or there is no obvious keyword description. At the University of Edinburgh, techniques have been developed to catalogue, search and browse for models based on their shape. PartBrowser uses these techniques to produce 3D model search-engines for in-house databases and the web, making it easier for engineers to re-use components from previous products. This reduces costs by saving design time, allowing manufacturing data and tooling to be re-used, and improving inventory management by reducing the number of part variants. This technology is now ready for the next stage of commercialisation.

ENERGY

Mr Tong Teh

Electrochemical Sensor Technology

School of Engineering and Physical Sciences, Heriot-Watt University

Fouling of surfaces in components such as valves, pumps hydraulic arms in the oil and gas industry leads to unscheduled shutdown of oil-recovery process and increase maintenance budgets. The formation of inorganic scales such as CaCO₃ and BaSO₄ mineral scales has long been one of the critical flow assurance issues in the oil and gas industry. The reduced flow rates and blockages (reduces the diameter of pipe) as consequences of the build up of scale on the inside of the pipes can lead to deterioration in process efficiencies and unscheduled shutdown. Being able to monitor the extent of mineral scale deposition on component surfaces and the scaling tendency of brine in a system, in real-time, would offer a unique opportunity to tailor the scale management programmes to effectively reduce unplanned reductions in oil recovery. Therefore this will ultimately lead to significant cost savings.

LIFE SCIENCES

Dr Richard McHugh Cannon

Improved Method of Male Fertility Testing

Department of Aerospace Engineering, University of Glasgow

On average around 1 in 7 couples in the EU and US are sub-fertile, with studies indicating that these fertility levels will continue to decline over the next two decades. Statistically, both partners are equally at risk of causing any sub-fertility and a male fertility assessment is essential before a course of treatment can be pursued, for instance IVF. In the majority of Andrology clinics the microscopic measurements required to complete a male fertility test are conducted manually, using several preparations, and taking several days to complete. This project has developed a totally automated Computer Aided Sperm Analyser (CASA) that seeks to standardise a portion of the clinical diagnostic procedure. The time taken for a typical analysis has been reduced to the order of a few minutes with results indicating an improved repeatability and reliability of semen assessment over existing systems.

Dr John B. March

Bacterial viruses for antiserum production services and vaccine delivery

Department of Bacteriology, Moredun Research Institute

Although vaccination has significantly reduced the worldwide burden of disease, for many diseases, no suitable vaccines currently exist for diseases such as cancer, HIV and malaria. Often the vaccines cannot be produced economically, while others work in principle but not in practice. In this research, bacterial viruses (phage) have been modified to carry 'vaccine' genes (e.g. from hepatitis B) for use as 'genetic' human/animal vaccines, presenting them to the immune system in such a way as to allow them to function effectively. Phage vaccines offer many other advantages compared to current technologies - the 'genetic vaccine' is protected inside the protein shell of the virus making it longer lasting and easier to store, and large scale production is cheap, easy and extremely rapid. Most interestingly, results to date suggest that phage vaccines can be delivered via the oral route - suggesting the possibility of vaccines in a pill.

This technology is now being used to develop both infectious disease and cancer vaccines as well as immune products for therapeutic & research use.

Dr Margot McBride

A Computerised Method of Positioning and Simulating Patient Positioning for Diagnostic Radiography
School of Health & Social Care, Glasgow Caledonian University

The Royal Society of Edinburgh Enterprise Fellowship will enable the development and potential commercialisation of a computerised patient positioning system for diagnostic radiography. The prototype device is designed as a navigational system, which 'maps' the area under radiographic investigation and therefore reduces operator-positioning errors. Computer graphics inform the operator of the correct position in which to place the patient and x-ray beam. Accuracy of position ensures that the radiation dose is kept to a minimum level and that the area under investigation is included in the resultant image. Reducing the time spent repeating radiographs is beneficial in 'speeding up' the diagnostic process, particularly in the field of accident and emergency radiology and reducing the waiting times for patients with life-threatening conditions such as heart disease and cancer. Additional software will be developed not only to extend the range of clinical procedures but also as a simulator for training purposes.

Dr Congo Tak Shing Ching

Development of a portable/wearable monitoring system for non-invasive monitoring of blood glucose levels for diabetic patients

Bioengineering Unit, University of Strathclyde

Epidemiological studies have shown that the prevalence of diabetes is steadily increasing and is a widespread problem in modern society. Rigorous control of blood glucose levels through a combination of frequent glucose measurements and insulin injections can reduce the occurrence of long term complications in type 1 diabetes. However, the current methods, e.g. finger-stick methodologies, of repetitive blood glucose measurement are expensive, painful, cumbersome, aesthetically unpleasant and inconvenient. This provides considerable impetus for the development of non-invasive methods for monitoring blood glucose. In addition there are a number of other blood parameters where patients could benefit from non-invasive monitors and the adaptation of this technology for glucose in this commercialisation will open the way for this.

MICROELECTRONICS

Mr Kenny Hough

Commercialisation of Image Techniques Applied to CCTV Footage

Department of Electronic and Electrical Engineering, University of Strathclyde

Four out of five cases in the criminal courts that depend on CCTV footage as evidence are dismissed due to the footage not being of sufficient quality to formally identify a suspect. Computational Techniques have been developed which can remove noise from and increase the sharpness of a wide variety of video imagery, such as CCTV footage. These techniques have been applied in hardware creating a prototype system which will enhance video sequences in real time. Significant interest has been shown by industry leaders in the CCTV market. It is intended that a company would be formed to sell products to the CCTV industry based on the image processing techniques.

OPTOELECTRONICS

Dr Gordon McAllister

Commercial Pose Estimation and Tracking Software

Division of Applied Computing, University of Dundee

At the heart of this project lies a software platform for rapidly developing applications which uses Dr McAllister's automatic human pose estimation and tracking technology. This technology allows human motion in images and video sequences to be tracked and measured automatically without the need for intrusive marker-based or mechanical measurement systems. The software platform provides a flexible base from which different applications can be rapidly prototyped and developed. There are many potential application areas that can benefit from such technology, either augmenting and adding value to existing

applications or creating novel applications that are not possible without the ability to automatically analyse human pose non-intrusively and accurately. The possible markets for this technology include sports video analysis, video content indexing, video game interfaces, medical applications and surveillance.

ROYAL SOCIETY OF EDINBURGH/BBSRC ENTERPRISE FELLOWSHIP

Mr Riccardo Matjaz Bennett-Lovsey

Development of a company for logic-based drug discovery

Faculty of Life Sciences, Imperial College, London

Equinox Pharma Limited is a new spin-out biotechnology company from Imperial College, London. It will provide state-of-the-art software packages for use in protein structure prediction and modeling, together with a novel logic-based system for pharmaceutical drug discovery. Many of these software products were developed from academic research supported by the Biotechnology and Biological Sciences Research Council (BBSRC). Complementing the software, Equinox has access to expertise specializing protein bioinformatics, chemoinformatics, and protein structure determination. Together these technologies combine to form a powerful *in silico* drug discovery pipeline, which will not only offer a robust and cost-effective method for drug development, but also potential insights into the nature of drug effectiveness. The aims of this Fellowship are to advance the development of the business and make Equinox a natural commercial exploiter of new research in bioinformatics.

Dr Mark Eccleston

Responsive Biopolymers for innovative diagnostic and therapeutic delivery

Department of Chemical Engineering, University of Cambridge

The project continues the development of a responsive biopolymer platform designed to react to disease-specific microenvironments in a predictable and reproducible manner. Thus, the peptidic-like biocompatible polymers confer clinical benefit through specific delivery to and selective activation of therapeutics and diagnostic imaging agents at the disease site. The responsive drug delivery systems and diagnostic imaging agents have applications in oncology, cardiovascular disease, diabetes, inflammation, infection and gene therapy. Since the enabling responsive polymer chemistry is common to both product areas, substantial synergistic efficiencies can be achieved in the parallel development of these products. Drug delivery applications will be developed collaboratively with biopharmaceutical companies that provide the therapeutic component offering patent extension for reformulated drugs and/or potential rescue of failed drug candidates through improved solubility, targeting and reduced side effects. Imaging agents will be developed in-house, partnering at a late stage of development and retaining maximum value.

Mr Ian Shadforth

GAPP: Transforming proteomic data into commercial knowledge

Department of Analytical Science and Informatics, Cranfield University

The Genome Annotating Proteome Pipeline (GAPP) is a system to improve the identification of proteins from human, and other, samples and to allow searching of the results on a high throughput scale. The pipeline facilitates large-scale, high-confidence protein identification work, which is currently very labour-intensive, by performing this in a completely automated fashion. By identifying increased numbers of proteins from various pooled studies, novel disease biomarkers and drug targets may be revealed. This information can then lead to the development of novel or improved healthcare and pharmaceutical products. A public version of the pipeline, funded by the BBSRC, will be released in September 2005, but there is a commercial need for a version that can be used in-house. The Fellowship has been awarded to develop a business to meet this need. It is envisaged that this will take the form of a combined consultancy and pipeline integration service.

Dr Martin Wickham

The IFR Model of Human Digestion

The Model Gut Exploitation Platform, Institute of Food Research

The Institute of Food Research Model Gut is a "state of the art" *in-vitro* system that simulates human digestion for the first time from a true physiological perspective. The Model provides an accurate and meaningful method for predicting the fate of foods and pharmaceuticals during digestion. It is the first model

developed to combine new and emerging scientific knowledge of the physical, mechanical, and biochemical environments experienced within the stomach and small intestines, and therefore provides a true simulation of the human gut. It is also the first model available that can handle real foods and pharmaceutical preparations and allows access at any stage of 'digestion', permitting sample collection and analysis at any time point. These unique design aspects of the technology fulfil a long required market need for a simulation that can be used to provide in-depth understanding of the digestion of structurally complex food or drug preparations during new product development.

RESEARCH PRIZE-WINNERS 2005

MAKDOUGALL BRISBANE PRIZE

Dr James Wright

School of Mathematics, University of Edinburgh

Awarded biennially, with preference to a person aged under forty working in Scotland, for particular distinction in the promotion of scientific research. It is awarded to Dr Wright for his outstanding contribution to the mathematical analysis of generalised and singular Radon transforms.

W S BRUCE MEDAL

Dr Michael Bentley

Department of Geography, University of Durham

For his outstanding work on Antarctic glaciers and ice sheets in relation to global climate change.

NEILL MEDAL

Professor Mike Hansell

Division of Environmental and Evolutionary Biology, Institute of Biomedical and Life Sciences, University of Glasgow.

For his two publications "Birds Nests and Construction Behaviour", Cambridge University Press and "Animal Architecture" Oxford University Press.

BRUCE PRELLER PRIZE LECTURESHIP

Professor Jason Reese

Department of Mechanical Engineering, University of Strathclyde

In recognition of his contribution to Engineering Science

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