

The Royal Society of Edinburgh

For immediate release 9/10/06:

New Research Projects offer Public Benefits

Top Researchers are to develop their ideas here in Scotland, thanks to grants totalling over £1.3 million awarded by The Royal Society of Edinburgh (RSE). Innovative research, offering public benefit in areas such as healthcare, the ageing population, language, energy and the environment is to be supported through the RSE, in partnership with key funders in the public and private sectors. Forty new awards are detailed below.

RSE President, Sir Michael Atiyah said:

Our Research Awards recognise, celebrate and promote excellence by supporting some of the most outstanding young scientists and innovators working in Scotland today. The benefits of their research are far-reaching and many promise wide-ranging public benefits. The Research Awardees for 2006 have attained a standard of excellence which does them much credit. I wish them every success.

The organisations and Trusts which fund the RSE to administer these awards are: BBSRC; BP; Caledonian Research Foundation; Lloyds TSB Foundation for Scotland; PPARC; Scottish Executive; Scottish Enterprise. The latest funding is part of the RSE's successful Research Awards scheme which supports exceptionally talented academics and potential entrepreneurs. 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 each Awardee's project summary indicates where the research will be undertaken.

Cormack Vacation Research Scholarship

Mrs Sharon Baillie

The Building Blocks of Life: Unlocking the First Stages of Planet Formation and Nitrogen Chemistry Pre-Stellar Objects

Department of Physics, University of Strathclyde

A key area of interest in astronomical research is how planets form and how life evolves, seeded by simple chemical 'building blocks' from the interstellar medium. Nitrogen, essential for life, is present in DNA, proteins etc. It is difficult to detect N-containing chemicals in space, although it is present in pre-stellar cores and the icy mantles condensed on dust grains in star/planet forming regions. One aspect of this project was to familiarise myself with the experimental technology used to study ices in pseudo-interstellar laboratory conditions, and then use my chemical experience to study the interplay between H₂O and NH₃ in ice mixtures, searching for evidence to support or refute the formation of NH₄⁺, and its tentative assignment from SPITZERSRS observations. In the second part of my project I worked in programming and assembling an experiment designed to study the first stages of planet formation, observing aggregation of icy dust in microgravity conditions.

Mr Calum Brown

The Fate of the Baryons

Institute for Astronomy, Royal Observatory Edinburgh, University of Edinburgh

The baryons (protons and neutrons) were formed in the very early, hot Universe and only formed hydrogen and helium atoms considerably later during the cooler Recombination Era. Measurements of high redshift Quasi-Stellar Objects (QSOs) show that the baryons were ionised again long after Recombination. It is believed that this reionisation was caused by ionising photons from early structures such as galaxies and QSOs. This project builds on existing work of the supervisor and models the ionising effect of a single source such as a galaxy or QSO. This model will be integrated into existing numerical simulations with the eventual intention of modelling the predicted radio signature of

Reionisation as well as optical effects. These results will then be available for comparison with those obtained from radio telescopes like Lofar, currently under construction.

Mr Duncan Forgan

Investigating the Effects of Orbital Migration on Protoplanetary Growth

Institute for Astronomy, Royal Observatory Edinburgh, University of Edinburgh

The focus of this project was to discover what effects Type I orbital migration would have on protoplanets growing in the early Solar System. The planetary system was modelled using a FORTRAN Hermite N-Body Integrator, and contained: a star of one solar mass, and a protoplanet submerged in an elliptical debris disk of planetesimals (whose orbits had eccentricities and inclinations that were Rayleigh-distributed). Initially, to ensure the simulations were reliable, the data garnered from simulations without orbital migration were compared with known results and semi-analytic models. With this done, drag forces equivalent to the disk-protoplanet tidal interactions that cause Type I migration were then exerted on the protoplanet. The experiments confirmed that migration can either enhance or stunt growth ("Shepherd" or "Predator" behaviour) depending on the initial protoplanet mass. Although the project's aims were very specific, the programs used could be applied to a variety of projects in planetary astrophysics.

Miss Jennifer Noble

An Alcohol Problem! Understanding the first step in the formation of CH₃OH in star forming regions from H₂O:CO reactions.

Department of Physics, University of Strathclyde

One area currently of interest to astrochemists is the reactions occurring between atoms and molecules present on "dust" in the interstellar medium. Understanding these interactions could help explain how larger organic molecules are produced in the star and planet formation process. Methanol is an abundant species in pre-stellar clouds. It is present in the gaseous phase, but no reaction mechanism has been established to explain the generation of gas-phase CH₃OH. It is believed to form in the solid state, by successive hydrogenation of CO, and then later desorb. On the surface of SiO₂ grains, solid CO and H₂O molecules interact when energy is provided by cosmic rays. One possible reaction path produces HCO, an intermediate in the production of larger molecules such as methanol. By analysing the data from lab-based experiments simulating conditions on dust grains I have studied this first crucial reaction step, looking at the formation of CO₂.

Colin Simpson

Gravitational Microlensing

School of Physics & Astronomy, University of St Andrews

Galactic microlensing is increasingly being seen as a viable way of detecting extra-solar planets. The OGLEIII survey is one of a number of dedicated observation campaigns and is detecting hundreds of galactic microlensing events each year. I implement a number of different methods for the analysis of the OGLE III-provided datasets on some of the first events of the 2006 season. This analysis involves quantifying the parameter values and their associated errors for a point source point lens (single lens only) model of each event. I then discuss the methods which I found most effective in quickly and accurately quantifying parameter values, allowing other observation teams to more efficiently fit models to events. I also discuss the behaviour of the point source point lens model parameters for the chosen events, so as to try and determine any noticeable patterns or correlations of the event parameters of the observed events.

Cormack Undergraduate Prize 2005

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 stars at distances less than the orbit of Mercury, yet resemble gas giants such as Jupiter or Neptune. Hence they have come to be called "hot Jupiters". The position and size of these planets allow them to reflect around 0.01% of the light emitted by their central stars back into space. This project involved searching for the reflected starlight from a planet orbiting the star tau Bootis b, using data from the ESPaDOnS spectropolarimeter. Such a detection would have been the first direct observation of an extra-solar planet in visible light. The analysis was unfortunately unsuccessful in finding a significant signal. However, a useful by-product was

the first set of radial velocity measurements taken by ESPaDOnS. These measurements demonstrate that calibrating measured velocities using spectral lines created by the Earth's atmosphere can give high precision results.

Cormack Postgraduate Prize 2005

Dr Brian Hamilton

Electron Acceleration at Reconnecting X-Points in Solar Flares

Department of Physics and Astronomy University of Glasgow

We simulated the acceleration of electrons in solar flares using a full orbit test-particle code that included relativistic effects and Coulomb collisions in the dynamically evolving electric and magnetic fields obtained from magnetohydrodynamic solutions of a perturbed magnetic X-point. We demonstrated that electrons in this model exit the acceleration site at distinct footpoints with the relative numbers and energy distribution at each footpoint sensitive to the longitudinal magnetic field component and collision time. Our results show asymmetries in particle propagation, which are commonly seen in hard X-ray observation during flares, can result from simple coronal structures and we suggest this as another possible source for these asymmetries.

Lessells Travel Scholarship

Mr Guy German

Drop impact studies of complex fluids and visualisation of polymer dynamics

School of Engineering and Electronics, University of Edinburgh The research aims to investigate the dynamic process of drops impacting on a surface for different complex fluids. This process is common in industry, for example spraycoating or crop-spraying, and is of interest to academics because it is a complex freeboundary problem. Generally, a drop will impact on a surface and expand to form a thin flat disk. Upon retraction, the drop can rebound, splash or stick to the surface; this depends on parameters including the drop diameter, impact velocity and fluid properties. Two fluid types will be experimentally investigated: Viscoplastic fluids that can behave both like a solid and a liquid depending on the applied shear stress, making them difficult to model theoretically, and dilute polymer solutions that are similar to water except they have significantly higher elongational viscosities, which can prevent drop rebound. Polymer stretching is thought to cause this phenomenon. This stretching process will be microscopically observed.

Mr Alastair Scott Kilgour

How the structure of orthopaedic polyethylene changes as a result of wear in total joint replacements; an electron microscopy study

School of Engineering and Electronics, University of Edinburgh

10% of artificial hip replacements will become loose and require removal within 10 years of implantation. This is a consequence of wear-induced bone resorption. Reducing wear and hence failure is the aspiration driving research into orthopaedic materials. Hip replacements usually consist of a special hard-wearing plastic acetabular cup (the socket), articulating against a metallic or ceramic femoral head (the ball). The plastic component, manufactured from polyethylene generates tens of thousands of microscopic particles per step, causing bone loss. Research to be conducted with Prof. Lisa Pruitt (University of California, Berkeley), will utilise ultrahigh magnification scanning electron, and transmission electron microscopy to study worn polyethylene samples. Through identifying ultra-structural modification of polyethylene, these powerful techniques will serve to compliment and validate techniques implemented at The University of Edinburgh, with Dr. Alistair Elfick. This project aims to determine a theory of wear for orthopaedic polyethylene in order to better understand wear and thereby prolong the joints' life.

CRF European Travel Fellowship - Visits to Scotland

Dr Guido Alfani Università commerciale "L.Bocconi", Italy

Households and Plague

Visiting Department of History, University of Glasgow

During my three-month residence at the University of Glasgow I investigated in collaboration with Professor Samuel K. Cohn key characteristics of Medieval and Early Modern plague. In particular, we studied the patterns of plague deaths within households and families to discover new facts about plague transmission and its incubation period. We focused on Italian data from the mid-fifteenth to the

seventeenth century because its quantitative richness enabled us to use research methods rarely, if ever, used before. Our first results are proving that previous research has failed to notice some peculiar characteristics of the plague, such as the extremely short time spans between inhousehold deaths. These results suggest that it is highly improbable that Medieval and Early Modern plague was *Yersinia pestis*, and that other hypothesis recently proposed, such as that the plagues must have had an unusually long incubation period was false.

Dr Javier Calle Martin

Department of English Philology, University of Malaga

Digitisation and Electronic Edition of the Middle English Manuscripts in the Hunterian Collection

Visiting Department of English Language, University of Glasgow

The present research stems from a major project developed at Málaga University that, in collaboration with the University of Glasgow, pursues the digital edition of the mediaeval and early modern prose manuscripts which, hitherto unedited, are housed in the Hunterian Library at Glasgow University. The bulk of this material comprises legal and scientific prose texts covering the time span 1350-1600. Our main objective consists in the preparation of on-line editions wherein the manuscript high-resolution images accompany their corresponding diplomatic transcriptions, codicological and palaeographical apparatuses included. On the other hand, the project also tackles the compilation of a lemmatized text-corpus wherefrom the user may search for the occurrences of particular items, both word and lemma-based, context included.

Dr Alexander Pavlenko

Taganrog Institute of Management and Economics, Russia

Scots and Eastern Slavonic Languages: Some Common Features of Language Development

Visiting School of English, University of Aberdeen

Dr Alexander Pavlenko, of the University of Tagenrog, Russia, is a specialist in the field of language and sociolinguistics. He has a particular interest in Scots, and his published articles include a study of the distinctive *be*-perfectives in the Shetland dialect and a social and historical comparison of the relationship of Scots to English with that of Ukrainian to Russian. He has taken part in the triennial series of international conferences on the languages of Scotland and Ulster, and is currently on a study and research visit to Aberdeen University.

CRF European Travel Fellowship - Visit to Scotland

Dr Barbara Schaff Department für Anglistik und Amerikanistik, Universität München

Books Across Borders: John Murray's Handbooks to Italy and Germany Centre for the History of the Book

Visiting University of Edinburgh/NLS

This project examines the way in which Continental Europe was presented to British tourists in the nineteenth century. Following the Napoleonic Wars, Continental Europe was open as never before to British tourists. Infrastructures and networks developed that were to have enormous diplomatic, commercial and cultural consequences. An important factor in this process was the development of guide books for English-speaking travellers in this period, the most influential of which was the series of 'Handbooks for Travellers' initiated by John Murray III (1808-1892) in 1836. I propose to take as case studies the several nineteenth-century editions of Murray's Handbooks to Germany and Italy, tracing their development from production, through their marketing and circulation, to their reception. Among the larger issues to be examined are: the strategies of representing otherness and difference, the effect of guide books on local economies, the development of the mass tourist itinerary, the aesthetics of geographical space, and the function of guide books as sites for cultural negotiations and exchanges.

Maria Fletcher School of Law, University of Glasgow

European Criminal Law and Justice

Visiting Robert Schuman Centre of Advanced European Studies, European University Institute, Florence, Italy

The project involves a period of research at the European University Institute in Florence. This Institution is home to an excellent law library and some leading academics and researchers in the field of European Studies. My research project relates to European Union legal developments in the contentious field of

criminal law. Scotland's distinctive system of criminal justice means that it is crucial that Scotland's voice is heard and that the impact of EU policy-making is monitored. Together with two academics working in other Scottish Universities, Professors Chris Gane and Bill Gilmore, I am writing a book on European Criminal Law and Justice. Additionally, I have written a paper on the role of the European Court of Justice in the development of European Criminal Law, which I recently presented at the UACES conference in Limerick, Ireland.

Professor Brian Girvin Department of Politics, University of Glasgow

Three Roads to Europe: A Comparative Study of Denmark, Ireland and the Netherlands

Visiting Department of History, University of Aarhus, Denmark

The project will compare the European experience of Denmark, Ireland and the Netherlands since the end of World War Two. It will focus primarily on the internal (national) factors that contributed to the choices taken by each of the three states when confronted by European integration. It will be suggested that the European option was never inevitable, but that alternatives were always available (and sometimes chosen). Particular attention will be paid to the policy assumptions of each state. This will involve a close analysis of foreign policy formulation, economic development and the nature of the political system and public opinion. The object here will be to distinguish between what each of the states share and where they can be differentiated in the relationship with Europe. One question to be tested in the research is whether membership of the EU has led to convergence or whether national interest remains the key aspect of policymaking. It is hoped to extend this research beyond the cases identified here at a later stage.

CRF European Travel Fellowship - Visits to Europe

Dr Frank Lorenz Müller

Department of Modern History, University of St Andrews

Crown-Prince Frederick and the Political Culture of Imperial Germany (1858- 1888)

Visiting School of History, Free University of Berlin & University of St Andrews

The tragic life of the German emperor Frederick III (1831-1888) offers a fascinating perspective on the political culture of nineteenth-century Germany and Europe by capturing crucial elements such as generational change, the influence of dynastic aristocratic networks, the role of political parties, constitutional theory and the formative power accorded to the monarch. Friedrich succeeded to the throne at the age of 57, after 30 years as heir-apparent, only to die after a mere 90 days. Some of the great what-if speculations about the course of German history pivot on the person of this perpetual Crown Prince and his alleged liberalism and Anglophilia. The inherent problems of such speculative interpretations notwithstanding, a study of Friedrich's life and function will contribute to our understanding of the dissatisfaction felt by many with Germany's political and social status quo as well as highlighting contemporaries' belief in the openness of Germany's future.

Dr Jane Stuart-Smith Department of English Language, University of Glasgow

Investigating the influence of television on language change

Visiting Fachbereich Literatur- und Sprachwissenschaften, University of Hannover, Germany

This project is the first investigation into the potential influence of watching television on variation and change in language. Linguists have accepted for some time that certain features, like vocabulary, may be affected, but assume that core systems, such as pronunciation, change in response to interpersonal interaction. However, preliminary results from a large-scale statistical study of adolescents in Glasgow have revealed positive correlations with specific features of pronunciation, such as using 'f' for 'th' in e.g. think, and watching and engaging with programmes set in London, and especially EastEnders. German research has focused on linguistic interaction and television for several years, but this work is not widely accessible outside Germany. The CRF Fellowship will allow me to work with colleagues who specialize in media and language at Hannover University, and from this collaboration to develop a better theoretical understanding of the role of television in language change.

BP Trust Research Fellowship

Dr Cristina Persano

Magnitude and tempo of landscape changes: reading the music

Department of Geographical and Earth Sciences, University of Glasgow

This project aims to answer an apparently very simple question: 'how does the climate affect the landscape?' It is well known that when a climate change occurs, the landscape is perturbed, but the ways and timing through which these perturbations occur have yet to be understood. This is a difficult task because, as the processes act at different temporal scales, the methods used to constrain such processes need to be sensitive to different time scales. This project focuses on the western European Alps and aims at constraining the changes occurred in the landscape over the last 5 million years when the climate was overall wetter and more erosive than it is now. I plan to use a combination of methods, namely cosmogenic isotopes and low temperature thermochronometers that are capable of constraining rates of erosion over time scales varying from centuries to millions of years.

Caledonian Research Foundation Personal Research Fellowships in the Biomedical Sciences

Dr Francois-Michel Boisvert

Characterization of the nucleolar proteome during the cell cycle

School of Life Sciences, University of Dundee

In cells found in plants and animals, DNA compacted into chromosomes is kept within a compartment called the cell nucleus. The nucleolus is a subcompartment of the nucleus that plays a role mostly in generation and assembly of ribosomes, but is also involved in many cellular processes. When cells undergo division, they go through a series of steps which constitute the cell cycle. The proposed research is designed to study the protein content of the nucleolus during different stages of the cell cycle, to identify protein complexes that have a cell-cycle-specific association with the nucleolus and understand the cellular processes involved. A comprehensive analysis of the protein content of the nucleolus under different conditions should not only contribute to a better understanding of fundamental biological processes, but also provide insights into cancer biology, tumorigenesis and viral infections that may eventually lead to the development of novel therapies.

Dr Anne E King

The NF kappa B pathway and inflammatory and innate immune mechanisms in human endometrium

Section of Obstetrics & Gynaecology, Division of Reproductive & Developmental Sciences, University of Edinburgh

Implantation occurs in early pregnancy when the embryo embeds in the uterine lining (endometrium). Endometrial inflammation and defence against infection are important for successful implantation. Around one in six British couples seek treatment for infertility. Implantation defects are one cause of infertility and may occur due to abnormal endometrial function. My study will examine how endometrium works so we can better understand implantation problems. I am interested in a molecule called NF kappa B, which controls inflammation and defence molecules. I will study the way that NF kappa B and defence molecules work in endometrium collected from control women (no implantation problems) and will look for differences in the way they function in endometrium from women with implantation problems. This study will help us understand how molecular pathways are involved in implantation and may lead to new ways of modulating these pathways to better treat women with implantation defects.

Lloyds TSB Foundation for Scotland Research Studentship

Miss Katie L Blackett

Bacteria in the pathogenesis of Barrett's Oesophagus and Adenocarcinoma of the Oesophagus in older people

Microbiology and Gut Biology, Division of Pathology and Neuroscience, University of Dundee

Barrett's Oesophagus (BO) is a complication of gastro-oesophageal reflux disease (GORD), and is the only known precursor for cancer of the oesophagus. Oesophageal cancer has increased from the twentieth to the seventh commonest cause of cancer death in the United Kingdom. BO affects up to two per cent of the UK population, of which 10% will go on to develop oesophageal cancer. Prolonged exposure to an acidic environment through reflux can result in inflammation of the mucosa. Mucosal cells change morphology to withstand the environment, and this change is characteristic of BO. These new metaplastic columnar cells lead to increased risk of developing a carcinoma, because the cells may proliferate uncontrollably. Pilot studies have shown an unusual form of campylobacter present in Barrett's patients, which are not found in healthy people. Studies with these bacteria aim to find a link to cancer promotion, and treatments to prevent cancer developing.

Lloyds TSB Foundation for Scotland Personal Research Fellowship

Dr Irina Erchova

'Learning to Forget': Aberrant Plasticity in the Aged Hippocampus

Center for Neuroscience research and Institute for Adaptive and Neural Computation, School of Informatics, University of Edinburgh

My project will examine if some of the age-related deficits in memory might be explained by the very same brain processes that control learning and memory throughout life. Many types of memory rely upon the link between cortex and hippocampus, and are affected when the structures or link is damaged. During normal ageing there is little cell loss in either structure, but there are functional and structural changes in the major linking pathway which are related to subsequent memory loss. These changes are what might be expected if an activity-dependent plastic reorganisation had taken place. This is likely to be a consequence of slow age-related alterations in neuronal physiology and might be open to medical intervention. The project goal is to test this hypothesis by using electrophysiological and modelling techniques and suggest a set of cellular targets that might trigger the process.

Lloyds TSB Foundation for Scotland Support Research Fellowship

Professor John Speakman FRSE

Experimental induction of uncoupling as a mechanism for reducing free-radical production: an experimental test in the mouse.

School of Biological Sciences, University of Aberdeen

In 1908, Rubner observed that long-lived species have lower metabolic rates, leading to the idea that living fast inevitably means dying young. However, Rubner's observations were an artefact of failing to account for differences in body weight between species and when this is accounted for, high metabolism seems to have a positive effect on lifespan (living fast but dying old). A reason for this effect relates to the way mitochondria operate. Mitochondria consume oxygen, but also produce harmful reactive oxygen species (ROS), widely presumed to have a causal role in ageing. Mitochondria sometimes work in an 'uncoupled' state. In theory uncoupled mitochondria utilise lots of oxygen (high metabolism), but generate few ROS (low ageing). Potentially therefore increasing uncoupling should reduce ROS, which may be an effective method for retarding ageing. I propose to examine the effects of inducers of mitochondrial uncoupling to see if they retard the ROS production.

Scottish Executive Personal Research Fellowships

Dr Jan-Willem Bos

New Multiferroic Materials

School of Chemistry and Centre for Science at Extreme Conditions, University of Edinburgh

Electronic and magnetic materials are of vital importance in modern technological applications, such as computers and mobile phones. The proposed research focuses on "multiferroic" materials that are simultaneously ferromagnetic and ferroelectric. Both properties are technologically important and a combination of these in a single material is expected to lead to new applications exploiting the coupling between the two properties but is also of much fundamental interest. The primary aim of this research project is to discover new "multiferroic" materials and study the relationship between chemical composition, crystal structure and physical properties, leading to high-impact publications in scientific journals and possibly patents.

Dr Nancy Sabatier

The role of hypothalamic peptides in the regulation of appetite

Centre for Integrative Physiology, University of Edinburgh

Obesity is increasing dramatically world-wide, along with risks of associated diseases. Understanding the mechanisms of appetite is thus a major priority. Appetite is regulated by signals that inform the brain about the metabolic status of the individual; these signals are integrated by peptidergic neurones in the hypothalamus and the brainstem. Information is then relayed further into the brain in areas such as the ventromedial nucleus of the hypothalamus (VMH), which is a "satiety centre". In the hypothalamus, neurones of the arcuate nucleus produce alpha-melanocyte-stimulating hormone (alpha-MSH), which is a potent inhibitor of food intake; and neurones in the supraoptic nucleus (SON) produce oxytocin, another inhibitor of food intake. My hypothesis is that appetite-inhibiting actions of alpha-MSH involve release of oxytocin, which then diffuses to modulate satiety-mediating neurons in the VMH. My project will help

understand the hypothalamic circuitry that regulates appetite and help to define specific targets for therapeutic intervention.

Dr Huabing Yin

Click-Chemistries for 2D and 3D Programmable Surfaces: Applications in Biomedical Engineering

Department of Electrical and Electronic Engineering, University of Glasgow

By working together, biologists, chemists and engineers have developed new products that improve our quality of life. Some examples of this "bioengineering" include biosensors, replacement heart valves and artificial limbs. The opportunities in combining biology with chemistry and engineering now seem endless. Most recently a new technology has emerged where biological samples from the body (e.g. blood or cells) are placed in channels (the width of a hair) containing micro-engineered sensors, forming a miniaturized "laboratory on a chip". The aim of my research is to combine these Lab-on-a-Chip methods with a powerful new form of chemistry known as "Click" chemistry. This technique is like molecular "Lego", allowing the "block by block" assembly of different molecules onto the surface of the microchannels, producing a biologically compatible environment. The technology will be exploited for the life science and pharmaceutical applications for disease diagnosis or for discovering new medicine.

Scottish Executive Support Research Fellowships

Dr Kevin Hammond *Guaranteed Resource Bounds for Real-Time Embedded Systems*

School of Computer Science, University of St Andrews

My research aims to develop mathematically-based, certifiable bounds on resource usage for embedded computer systems. Common consumer examples include mobile phones, broadband routers, ABS and other automotive systems and digital set-top boxes, but embedded systems are also widely used commercially, including for the safety-critical flight-control systems used in modern fly-by-wire aircraft. A key problem with embedded systems is to accurately determine runtime usage of scarce resources, such as time or power. My approach is to construct strong, mathematical models of embedded software that expose the various types of resource usage. These models may then be incorporated in a software tool to give guaranteed limits on resource usage. This gives not only commercial advantages in terms of increased longevity, but also safety advantages in terms of increased reliability. My work is done in the context of a new programming notation named after the 18th Century Scottish philosopher, David Hume.

Dr Stuart Macgregor

Towards Ever-More Realistic Modelling of the Chemical Reactivity of Transition Metal Systems

School of Engineering and Physical Sciences (Chemistry), Heriot-Watt University Metals are central to many biological and industrial processes. A metal's reactivity, however, reflects not only its own properties, but also those of its environment. Thus enzymes – nature's catalysts – evolved to encase metals in a reactive but controllable form. Man can mimic nature with carefully designed catalysts for efficient industrial processes. In both cases the interplay between the metal and its environment is vital, but this is often poorly understood. Greater insight into this relationship promises more efficient catalysts for cleaner chemical processes. Moreover, as disease is often linked to enzymatic malfunction, understanding enzyme environments is a first step to rational therapeutic design. Computational modelling is one way to address this issue and the current challenge is to include the complex metal environment. This research fellowship focuses on this problem and will apply advanced simulation techniques to model the reactivity of complex metal systems of both biological and industrial significance.

Dr Tom G. Mackay

Chiral Sculptured Thin Film as Biosensors

School of Mathematics, University of Edinburgh

Increasingly, artificially-produced materials are being created which offer exciting opportunities to theoreticians and technologists alike. A particularly novel type of material which has been developed recently is the chiral sculptured thin film (CSTF). A CSTF consists of a collection of parallel spiral columns mounted on a base. Using the latest thin film fabrication techniques, the shapes, sizes and spacings of the CSTF spiral columns can be precisely engineered. Consequently, CSTF-based optical biosensors may be envisaged with optical responses and biomolecular specificities that may be finely tuned. The objective of this research project is to develop a rigorous theoretical description of the optical properties of CSTFs, providing a key step towards their implementation as biosensors. Recently-established mathematical techniques will be further developed and applied in the exploration of this unique optical

environment. This is an inherently multidisciplinary project, involving applied mathematics, engineering science and structural biology.

Scottish Executive Teaching Fellowships

Jennie Hargreaves

Placement with BNG Chapelcross, Nuclear Licensed Site

A seven-week placement was completed at BNG Chapelcross, a nuclear power station currently undergoing decommissioning. Outside teaching I had little experience of the world of work and yet this a key priority for the Scottish Executive. The subject of nuclear power is so politicised I wanted to make my own judgements. Amongst other tasks I : · organised a business conference, · developed the education programme at Chapelcross · evaluated nuclear industry educational materials · produced career profiles and assembled school materials · exchanged educational information and materials with staff My experience showed me how institutionalised I had become and that I have many transferable skills. I now have a much better knowledge of industry and am sharing this knowledge with colleagues and pupils. I have also advanced the educational work at Chapelcross. I had such a positive experience that I believe placements should be compulsory for teachers who have gone straight from higher education into teaching.

Keeley Hathway

Placement with Glasgow Science Centre

I completed a Scottish Executive Teacher Fellowship between January and February 2006 (6 weeks). My research was to produce structured education trails for the mall at the Glasgow Science Centre. The intention would be for teachers or parents to use them to make a child's visit more structured and to increase the learning from the given exhibits. The trails covered various aspects of the 5-14 curriculum including forces and motion, magnetism; including electromagnets, light and sound and gravity and air resistance. Each trail contained photographs of the exhibits, an explanation of how it worked and related background information and follow-up activities, specifically written for a non science specialist. Two quiz photo trails, designed to be used independently by the child encouraged focus and learning rather than just 'button pressing'.

Rebecca Sutherland-Shiell

'Phenology in Schools' Placement with the Education Department, Royal Botanic Garden Edinburgh

Climate change is very much an issue in the forefront of media coverage and it is important for pupils in schools to find the relevance of these issues within their own environment. Studying phenology, the effects of climate change on seasonal events, allows pupils to observe plants and animals that are found in their area or to cultivate an area to provide them with these organisms. The fellowship provided an opportunity to develop materials for schools to investigate the changes in their environment. Basing the project at Royal Botanic Gardens Edinburgh allowed me to draw on the extensive expertise in horticulture and to design materials appropriate for schools to use. The materials are being piloted in Bo'ness Academy this academic year.

Scottish Enterprise Enterprise Fellowships Electronic Markets

Miss Frances Flood

ePlace

Department of Electronic and Electrical Engineering, University of Strathclyde As organisations increasingly face the challenges of a disparately located workforce and customer base, they require tools to allow co-workers to communicate and work together, and to allow demonstrations to be made to customers, without the expense in time and money of meeting in a single location. Software companies are increasingly recognising this need, and are seeking to provide collaboration capabilities within their applications. However, providing collaboration capabilities is a non-trivial task, and many companies do not have the resources to develop this feature. The product we are seeking to commercialise, ePlace, is a collaboration product primarily aimed at providing software companies with this feature for their applications. ePlace also exists as a standalone product to provide generic application sharing and video-conferencing. It is designed to operate over network and mobile connections, whether on desktop machines, laptops or PDAs, and allows multiple simultaneous sessions with multiple users.

Amar Seeam

Completely Reconfigurable Display Keyboard

Hunter Centre for Entrepreneurship, University of Strathclyde

The product is a technology that allows dynamic key entry interfaces to provide tactile feedback. Currently, the only available solution is touchscreen technology. There are a number of drawbacks with touchscreens, mainly the lack of feeling, when pressing a touchscreen button, and a lack of accuracy when entering alphanumeric information. This product will alleviate these problems and has many applications, from multi-lingual computer keyboards to Point Of Sale terminals and Kiosks.

Jochen Leidner Mobile Search in National Language

Language Technology Group (LTG), School of Informatics, University of Edinburgh

Linguit Ltd., a private Scottish company limited by shares founded in 2005 by several members of the Universities of Edinburgh and Cambridge, has developed patent-pending software for mobile Internet search. The company, whose directors have a track record in research, was a finalist in the Cambridge-MIT "50k" Business Creation Competition. Linguit's patent-pending software allows people on the move to use their mobile phones to easily search for information on the Internet in a question-and-answer form, in ordinary English ('Where is the nearest Thai restaurant?', 'When was Edinburgh castle built?'). This is achieved using leading-edge automatic natural understanding technology. In contrast to competitors' offerings, which use humans in call centres to retrieve information, Linguit's solution is fully-automatic, that is the computer answers via the mobile phone without any humans in the loop, leading to a dramatic decrease in cost and waiting time.

Scottish Enterprise Enterprise Fellowships Life Sciences

Dr Alexis Enright

Detection of sexually-transmitted infections using surface enhanced resonance Raman scattering (SERRS).

Department of Pure and Applied Chemistry, University of Strathclyde

Molecular diagnostics uses the DNA of the disease target to identify infection. SERRS is a new detection technique that has significant advantages over the current market leader (fluorescence) in this industry. The two major advantages are: superior sensitivity, allowing more accurate identification of infection; and enhanced selectivity, allowing more targets to be identified from a single tube (multiplexing). *Chlamydia trachomatis* and *Neisseria gonorrhoea* are sexually transmitted organisms which have both shown staggering rises in prevalence over the past decade. These diseases can be readily treated if diagnosed, but if left undiagnosed can lead to severe complications and rapid spread. As such, the government has introduced a national screening programme to combat the spread, resulting in the need for more rapid, sensitive and multiplex capable diagnosis. The project aims to develop a commercially viable diagnostic kit that meets these needs and uses standard laboratory equipment.

Dr Alison Reith

The ARM Test - An in vitro cell assay for evaluating novel anti-cancer therapeutics and carcinogens

Division of Cancer Sciences and Molecular Pathology, University of Glasgow

We have developed a new generation efficacy test system for anti-cancer compounds that offers an exciting new approach to minimise both the time and cost of the drug discovery process. Our aim is to add value to new molecular entities and new drug delivery systems using a novel *in vitro* screening system (The ARM Test™), which acts as an alternative to animal testing. Our unique system accurately mimics multistage tumour progression and provides an economical assay to select lead compounds, as well as identifying mechanisms of a drug's action on diverse tumours. The aim of this project is to commercialise this test system as a service based company (ARM Oncologies) operating out of the University of Glasgow.

Dr Romain Viguiet

Harvesting Natural Products from Plants

School of Chemistry, University of Edinburgh

The project is to extract and commercialise rare natural products from plants. With our expertises in Botany and in Chemistry, our group aim to exploit the natural resources of plants and help manage the natural biodiversity in land and at sea. Our products include rare herbal standards, natural products and

derivatives for R&D. The main focus of this first year is to start commercialising high quality natural products on a small scale and planning the scaling up and the diversification of our production. This spinout company will be based in the School of Chemistry at the University of Edinburgh.

BBSRC Enterprise Fellowships

Dr Suzanne Dilly

The 'Magic Tag™' Kit: A Tool for Simple, Rapid Immobilisation of Bioactive Molecules for Chemical Genomics Approaches to Drug Discovery

Department of Chemistry, University of Warwick

Most medicinal drugs are relatively small molecules that interact with proteins in the body. There are believed to be about 5000 target proteins for drugs, but less than 500 of these have been discovered. We are developing new technology to find these as yet unknown drug targets. Our Magic Tag technology is a valuable tool for the "chemical genomics" approach to the discovery of new receptor proteins. We start with one of many molecules known to have a biological effect on humans, attach it to a solid surface using chemistry so simple that a non-specialist can use it easily, then expose the modified surface to mixtures of thousands of proteins at a time, displayed on the surface of bacteriophage that can "report" the identity of the protein. The utilisation of our technology will aid the pharmaceutical industry in developing new classes of drugs.

Mr Gareth Richards

Novel Cancer Therapies

Clinical Sciences, University of Sheffield, Medical School

Signalling between the cells in our body controls how our tissues function in health and disease. The way that cells perceive signals is that they possess "receptors" for specific messenger molecules. Such signalling between cells is involved in disease conditions such as cancer, and when tumour cells are unable to perceive certain messenger molecules they cannot proliferate and the tumour shrinks or dies. We have identified a signalling molecule that is known to be present in a majority of tumours regardless of cell type and we have shown that blockade of the receptors for that molecule interrupt the signalling process. We have encouraging proof of concept results and our plan is to develop a new therapeutic agent for the treatment of cancer.

Makdougall Brisbane Prize

Professor Colin McInnes FRSE

Professor of Engineering Science Department of Mechanical Engineering, University of Strathclyde

Awarded biennially, to a person working in Scotland for particular distinction in the promotion of scientific research, this award is made to Professor McInnes, for his fundamental contribution to orbital mechanics and advanced space mission concepts (in particular, solar sail spacecraft). Professor McInnes is an outstanding researcher who has made important contributions to our understanding of the engineering systems needed for spaceflight. He is an effective public speaker and is strongly committed to promoting mechanical engineering science in the UK and internationally.

Henry Duncan Prize Lectureship

Professor James Hunter

UHI Centre for History, UHI Millennium Institute

This prize is awarded triennially to a scholar of any nationality for work of international repute in Scottish Studies. It is given to Professor Hunter in recognition of his involvement in the public life of the Highlands where, in addition to publishing 11 books on Highlands and Islands themes, he has been Director of the Scottish Crofters Union and Chairman of Highlands and Islands Enterprise. He is now the Director of the UHI Centre for History, UHI being the prospective University of the Highlands and Islands. His lecture will contend that the Highlands and Islands, already doing better both demographically and in other ways, than much of the rest of Scotland, can have a first-rate future.

BP Prize Lectureship in the Humanities

Professor Graeme Laurie

Professor of Medical Jurisprudence, School of Law, University of Edinburgh

This prize is awarded biennially to a person working in a Scottish Higher Education Institution and this year is given to Professor Laurie, who is an outstanding scholar in the areas of medical law and the law of intellectual property. His academic output is little short of prodigious, but this does not detract from the depth of his research and analysis. He also enjoys a strong international profile and has spent significant periods of time as a Visiting Scholar at universities in Boston, Montreal and Buenos Aires, as well as serving on panels and working groups and presenting papers at academic conferences around the world.

Notes for Editors

The Royal Society of Edinburgh

The Royal Society of Edinburgh (RSE) is an educational charity, registered in Scotland. Independent and non-party-political, we are working to provide Public benefit throughout Scotland and by means of a growing international Programme. The RSE has a peer-elected,

multidisciplinary Fellowship of 1400 men and women who are experts within their fields. We seek to provide public benefit in today's Scotland by:

- ◆ Organising lectures, debates and conferences on topical issues of lasting importance
- ◆ Conducting independent inquiries on matters of national and international importance
- ◆ Providing educational activities for primary and secondary school students throughout Scotland
- ◆ Distributing over £1.7 million to top researchers and entrepreneurs working in Scotland
- ◆ Showcasing the best of Scotland's research and development capabilities to the rest of the World
- ◆ Facilitating Scotland's international collaboration in research and enterprise
- ◆ Awarding prizes and medals
- ◆ Providing expert information on Scientific issues to MSPs & Researchers through the Scottish Parliament Science Information Service.

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