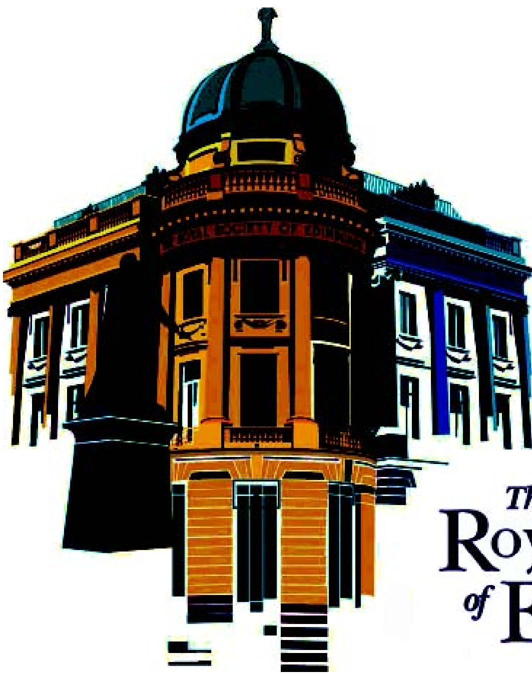
The Royal Society of Edinburgh

Review 2006 (Session 2004-2005)



The Royal Society of Edinburgh

THE ROYAL SOCIETY OF EDINBURGH

REVIEW OF THE SESSION 2004-2005

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THE ROYAL SOCIETY OF EDINBURGH

REVIEW OF THE SESSION 2004-2005

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CONTENTS

PROCEEDINGS OF THE ORDINARY MEETINGS

8 November 2004

Chairman
Professor John Mavor FREng FRSE.

Formal Admission to Fellowship
Professor Eleanor B Campbell, Professor Wolfgang Mecklenbrauker, Professor Cornelis J Weijer.

Lecture
Osteoporosis: African Genesis - European Nemesis. Professor David Purdie, Consultant, Edinburgh Osteoporosis Centre. (page 103)

6 December 2004

Chairman
Lord Sutherland of Houndwood KT, FBA, PRSE.

Lecture
The Challenge of the Ageing Skeleton. Professor David Hamblen, Professor Hamish Simpson and Professor Joseph McGeough. (page 105)

7 March 2005

Gannochy Meeting

Dr Ian Underwood, FRSE, Director of Strategic Marketing, MicroEmissive Displays Ltd. (page 57)

4 April 2005

Chairman
Professor John Coggins VPRSE.

Lecture
The Robot in your Head. Professor Noel Sharkey FIEE, Professor of Computer Science, EPSRC Senior Media Fellow, University of Sheffield. (page 118)

13 June 2005

Chairman
Professor John Coggins VPRSE.

Lecture
How Safe Are Vaccinations?
Professor Harry Burns, Director of Public Health, Greater Glasgow NHS Board. (page 121)

19 September 2005

Chairman
Lord Sutherland of Houndwood KT, FBA, PRSE.

Formal Admission to Fellowship
Professor Paul William Jowitt, Professor Karen Heather Vousden.

Lecture (Presidential Address)
The Lisbon Earthquake: 250 Years On and Counting. Lord Sutherland of Houndwood. (page 101)

3 October 2005

Chairman
Lord Sutherland of Houndwood KT, FBA, PRSE.

Formal Admission to Fellowship
The Very Reverend G I MacMillan.

Lecture
Who You Are or Where You Are? Social and Spatial Patterning of Health Professor Sally J Macintyre OBE FRSE, Director, MRC Social and Public Health Sciences Unit, University of Glasgow. (page 126)

PROCEEDINGS OF THE STATUTORY GENERAL MEETING

Minute of the Statutory General Meeting held on 10 October 2005, ending the 222nd Session

The Annual Statutory Meeting took place in the Society's Wolfson Theatre on Monday 10 October 2005 at 5.30pm. Lord Sutherland of Houndwood, KT, FBA, FRSE, President, took the Chair.

Minutes

The Minutes of the Annual Statutory Meeting held on Monday 25 October 2004 were taken as read, approved by those Fellows present and signed by the President as a correct record.

Election of Officers and Council for the 223rd Session.

Lord Sutherland reported that 566 ballot forms were returned and examined by Sir David Carter and Mr Ivor Guild, who were appointed as Scrutineers at the Ordinary Meeting on 13 June 2005. Their report showed all those proposed for election as having been elected by an overwhelming majority. Lord Sutherland congratulated the following elected members:

Council

President
Sir Michael Atiyah OM

Vice-Presidents
Professor Janet McDonald
Professor John Coggins
Professor John Mavor

General Secretary
Professor Gavin McCrone CB

Treasurer
Mr Edward Cunningham CBE

Fellowship Secretary
Professor Andrew Walker

Ordinary Members
Professor Ron Asher
Mr Ewan Brown CBE
Professor Tariq Durrani
Professor Rona M MacKie CBE
Ms Shonaig Macpherson CBE

Executive Board

General Secretary
Professor Gavin McCrone CB

Treasurer
Mr Edward Cunningham CBE

Curator
Professor John Howie CBE

International Convener
Professor Rona M MacKie CBE

Programme Convener
Professor David Ingram OBE

Research Awards Convener
Professor Peter Holmes CB

Young People's Convener
Professor Miles Padgett

Annual Review for Fiscal Year 2004/05

Lord Sutherland commented that, in addition to producing the formal Trustees' Report and Accounts for 2004-2005 in accordance with Charity Regulations, an illustrated Annual Review of highlights of the year (with a summary financial review) was again produced, and this had been widely circulated to all Fellows, as well as to many others interested in the Society.

Office Bearers' Reports for Session 2004/05

Lord Sutherland invited Professor Andrew Miller, General Secretary, Mr Edward Cunningham, Treasurer, and Professor Colin Bird, Fellowship Secretary to report:

General Secretary's Report

Professor Miller highlighted three particular areas during his four year term of office which he saw as strengthening the future of the Society. These were: the introduction of Corporate and Business Plans defining the Society's strategy and providing a solid base on which to deliver and monitor progress of activities; a more stable financial base, which supports better forward planning of activities; and new and improved governance and staffing structures. Professor Miller then provided the following report of the Society's activities during the Session:

The Session is one of two annual reporting cycles. The other cycle covers the fiscal year from April to March. We are, by charity legislation, required to produce an Annual Trustees' Report and Accounts for the fiscal year – which we have done and which has been approved by Council in its capacity as the Society's Trustees. As with previous years, all Fellows have received an illustrated Annual Review which covers the fiscal year, summarises the main activities described in the Trustees Report, and includes an approved summary of Accounts. I hope Fellows and others interested in the Society find this version provides a more interesting and accessible document than the formal Trustees' Report, although this is freely available to any who wish to see it.

I am delighted that at my last Annual Statutory Meeting as General Secretary, I am able to report a very productive and successful year; a year in which the Society delivered a wide range of public benefit activities in keeping with its charitable objects and mission – "the advancement of learning and useful knowledge".

Our Corporate Plan sets six strategic objectives through which we aim to achieve that mission. I shall highlight some of the key activities delivered during the Session under each of these strategic objectives, but before doing so, I should report briefly on governance issues approved at last years ASM, and which are pivotal to the Society being able to deliver these activities.

This Session was the first year during which we operated with a reduced Council – from 25 to 12 Trustees; a new Executive Board, chaired by myself and comprising the Treasurer, Committee Conveners and Senior Staff Managers; and a new Audit & Risk Committee, which replaced the Treasurer's Committee and jointly serves both the Society and the RSE Scotland Foundation.

These new arrangements were implemented seamlessly, and enabled the Society to operate in a more streamlined, progressive way, consistent with the demands and expectations brought by significant changes in charity legislation. The smooth change-over was due the persuasive leadership shown by the President; the willingness of the Fellowship to move with the times; and meticulous administrative input by the Chief Executive and his staff. The new arrangements have served us well in their first year of operation and should continue to do so for years ahead.

Providing authoritative advice, independent advice and making recommendations to policy decision takers

In May, we launched an Inquiry into Scotland's future energy supply. Chaired by Professor Maxwell Irvine, the Inquiry began its work immediately and considerable evidence has already been gathered from across the UK and overseas. The Inquiry's work will continue during the coming Session, with a report of its findings expected to be published in June 2006.

With the input of the multi-disciplinary Fellowship, the Society produced 21 authoritative responses to a wide range of public, mainly Governmental, consultations. Amongst the responses were:

- Genetics and Reproductive Decision-Making
- Cross-Border Student Flows and Higher Education Tuition Fee Levels
- Simplification of the 7th EU Research Framework Programme
- Sustainable Business Growth
- The draft Animal Health and Welfare (Scotland) Bill
- Long-tem Radioactive Waste Management
- Review of Scottish Climate Change Programme

I am most grateful for the expert input of so many Fellows, including many with busy "day jobs". It is the quality of this input which enables the Society to submit these much respected responses.

We also initiated a new series of Position Papers, the first entitled *Climate Change and the Management of Scotland's Natural Heritage.* The aim of these is to bring together, in one document, views expressed in previous consultations to help inform policy makers.

Of course, it is understood that not every view expressed in our consultation responses or Position Papers, reflects those of every Fellow. We are a broad church and that diversity is a strength, but it also makes unanimity unlikely. Hence, in approving the submission of evidence and advice produced in this way, the role of the General Secretary is to ensure that it reflects a broad consensus within those who contribute their views.

During the Session, the pilot Scottish Parliament Science Information Scheme, operated in partnership with the Royal Society of Chemistry and the Scottish Parliament Information Centre, was reviewed and endorsed as a worthwhile initiative which should continue.

Lastly, we continued to provide the Scottish Science Advisory Committee with the necessary support to enable it to undertake its work of producing independent reports and advice to the Scottish Executive.

Supporting and enhancing Scottish research-based excellence

The Society awarded grants totalling £1.7m to support the brightest researchers from Scotland, elsewhere in the UK, and overseas, to develop their ideas here in Scotland. These awards supported some of the most outstanding scientists and innovators working in Scotland in subjects of wider benefit to Scotland and its people, for example, in areas of healthcare, the environment, the ageing population, and advancing social and economic well-being.

Some 23 new Personal Research Fellowships, Support Fellowships, Research Studentships and Scholarships were presented at the Annual Research Awards Reception on 2 September. This year, the Reception was held in the Main Chamber of the Scottish Parliament; a fitting place for such important and prestigious awards. The presentations were part of a wider event, organised in partnership with the Parliament's *"Scotland's Futures Forum"*, which included discussion involving some 140 participants on the topic of attracting, retaining and recognising Scotland's research talent. These awards would not have been possible without the financial support of organisations such as – BP, the Caledonian Research Foundation, Lloyds TSB Foundation for Scotland, the Scottish Executive and, last but not least, specific purpose legacies bequeathed to the Society. To each of these the Society offers its sincere thanks.

In May, a Steering Group was established, under the Chairmanship of Sir John Enderby, CBE, FRS, to oversee an independent review of the Society's Scottish Executive funded Research Fellowships Scheme. The review shows that both the Personal and Support Fellowships have addressed their stated aims and provide value for money. It was, however, expected that some changes would be necessary to ensure the schemes continue to attract and retain the highest quality researchers in Scotland, and the Review Group accepted the view of the Scottish Science Advisory Committee that RSE Fellowship programmes should be adapted to be more akin to those offered on a UK-wide basis by the Royal Society of London and Research Councils. This will require three changes:

- The scheme must cover full economic costs;
- The duration of Fellowships should be extended from three to a minimum of four years; and
- The Fellowships should lead to a contract of employment at Scottish HEIs

The funding implications of these changes, as well as increasing the number of Fellowships available to reflect demand, is clearly significant and will depend on the outcome of negotiations with the Scottish Executive.

Supporting the commercialisation of research and innovation

We administered 3 separate Enterprise Fellowship schemes, funded by Scottish Enterprise, BBSRC and PPARC. The aims of these are to increase the commercialisation of the Scottish academic research base; raise understanding of commercialisation throughout Scottish universities and research institutes; and to create sustainable companies with high value jobs. During the Session we also awarded a further 15 Enterprise Fellowships (11 Scottish Enterprise: 4 BBSRC) to those awarded in previous years.

The Session saw the continuation of the highly prestigious Gannochy Trust Innovation Award of the Royal Society of Edinburgh. This award is Scotland's highest accolade for individual achievement in innovation and was created to encourage and reward Scotland's young innovators. The third recipient of the award, receiving a cheque for £50,000 on 7 October, was John Harrison for his new material technology work, from which he developed Micro Emulsion Technology with future benefits in relation to industrial cleaning applicants.

In January we launched the RSE Entrepreneurs' Club which provides the opportunity for all the RSE's past and current Enterprise Fellows to come together at networking events. The most recent gathering of the "Club" included a key-note presentation by Dr Ian Underwood FRSE, of MicroEmissive Displays Ltd, who received the Gannochy Award in 2004.

Communicating knowledge and understanding

The Society was active in four areas under this objective – publishing journals, a Public Events Programme, a Young People's Programme and communicating generally.

We continued our long tradition of publishing two journals, *Transactions: Earth Sciences* and *Proceedings A: Mathematics,* which were published on behalf of the Society by the RSE Scotland Foundation. Six issues of the *Proceedings A* journal were published during the Session. The publishing schedule of *Transactions* greatly improved and six issues were published. This coming session *Transactions* will undergo some changes with a slight change in title (to broaden the remit to 'Earth and Environmental Sciences'); a revitalised cover design; and a dedicated marketing drive to launch the new-look, broader remit journal.

The public events programme delivered some 30+ Lectures, Discussion Forums, Conferences, Workshops and 3 Award Ceremonies. Amongst these were:

- Presidential Address – *The Lisbon Earthquake: 250 Years on and Counting*
- Caledonian Research Foundation Conference – *Reproductive Health*
- *The Coming Century – Ten Trends to Back,* by Frances Cairncross
- Conference on *Europe's Hidden Coral Worlds*
- The Caledonian Research Foundation Prize Lecture – *Once There was a Golden Age, How We Judge Television: Then and Now* by Joan Bakewell CBE
- Gunning Victoria Jubilee Prize Lecture – *Energy – A Challenge for Materials Chemistry* by Professor Peter Bruce, University of St Andrews
- BP Prize Lecture – *Russia's Fallen Heroes: Men's Experiences of Post-Soviet Change* by Dr Rebecca Kay, University of Glasgow
- Discussion Forums on *HIV and AIDS in Scotland, Neurosurgery for Mental Disorder, The Ethics of War* and *Artificial Intelligence*

As before, we also participated in the Edinburgh Lecture series and hosted Professor Roland Jung, Chief Scientist, the Scottish Executive and Dr James Robson, National Team Medical Co-ordinator, the Scottish Rugby Union who spoke on *The Health and Psyche of the Scottish Nation.*

It was with much regret, that Council accepted Professor Ian Stevenson's resignation, due to ill-health, as Programme Convener during the Session. The Society was extremely sad to lose Ian's skilful and considerable input to the Events programme; his contribution was pivotal to its successful delivery. Our thanks go to Ian, and to Professor David Ingram, who kindly agreed to cover Ian's duties until the end of the Session, and to stand for election as Programme Convener.

The Young People's programme continued to prosper and to cover the length and breadth of Scotland. Amongst activities were:

- 10 *Talk Science* Schools' lectures. Venues ranged from Thurso to Dornoch and Dumfries and many point in between. Students heard about subjects such as *Black Holes and Big Bangs, DNA Profiling* and *What Does your Granny have in Common with a Spaceman*.
- Startup Science Masterclasses in Dundee, St Andrews, Aberdeen, Glasgow and Heriot-Watt Universities.
- Maths Masterclasses in Aberdeen, Dundee, South Queensferry and Glasgow
- Roadshows in Arbroath and Dingwall, comprising a selection of talks and workshops for primary and secondary school students, as well as a talk for the wider community. At the Arbroath Road-show, Professor Sue Black spoke to local schools students and also to the general public.
- A Discussion Forum at St Andrew's on *Climate Change,* where senior school students heard from the experts and then made up their own minds on how Scotland should act in relation to this.
- Two Science, Engineering and Technology Summer Schools at Heriot Watt University, to introduce Highers level students to university life.
- A Christmas Lecture, *Why Clone? Cloning in Biology and Medicine,* by Professor Ian Wilmut at Pitlochry Festival Theatre, who spoke to local schools pupils in the afternoon and the general public in the evening.

There were a number of general activities covering both communicating with the Fellowship and with a wider public audience.

In January, a monthly e-Bulletin to Fellows was piloted, with printed copies going to Fellows who could not, or did not wish to, receive it electronically. The feedback was positive, including feedback from overseas Fellows. The Bulletin is now a permanent fixture on the communications calendar.

Three editions of the Society's newsletter – "*ReSourcE*" were published during the Session. This continued to serve as an excellent vehicle for keeping the Fellowship and the wider world informed of the Society's work and achievements.

Full reports were published, on our web-site and in print, of many events in the Public Events, Young People's and International Programmes. These were widely distributed. The target for the forthcoming session is to work towards publishing full reports for all events within these programmes, and indeed for all other activities where the knowledge and understanding merits wider communication.

Lastly in this area, there were improvements to how Fellows and others can connect to the Society's activities. Through a restructured web-site the majority of Research Award and International Exchange Fellowship applications were made on line and there was increasing use of online ordering of Lecture tickets. Alongside this, our activities received good media coverage.

Promoting the international awareness of Scottish research and innovation

The International work of the Society grew from strength to strength during the Session. Amongst the Programme's achievements were:

- The programmes of international exchanges were well subscribed with a total of 60 exchanges taking place – 13 on the bilateral programmes run with China, Poland and Taiwan, and 47 on the open programme with visits to/from various countries including Argentina, Australia, Belgium, Brazil, Bulgaria, Denmark, France, Germany, Hungary, Italy, Jordan, Laos PDR, Latvia, The Netherlands, New Zealand, Nigeria, Russia, Slovakia, South Africa, Spain, Turkey, Ukraine, and USA.
- two Issues of *Science Scotland* (Issue 3, Physics, and 4 Understanding the Genome), which promotes the excellence of Scottish research, were published and distributed mainly to an overseas audience.
- The establishment and gathering together of the "*RSE China Forum*", chaired by Professor Stephen Blackmore and the *"RSE European Policy Forum"*, chaired by Sir David Edward.
- A visit to the Society in May by the European Commissioner for Science and Research, Dr Janez

Potocnik, who discussed Framework 7 Programme issues and in particular the funding issues related to this.

- Visits to and/or from the National Natural Science Foundation of China, the Cuban Academy of Sciences, the Norwegian Academy of Science and Letters; the Academy of Sciences of the Czech Republic, and the Hungarian Academy of Sciences. Memoranda of Understanding were signed with the Cuban, Czech and Hungarian academies.

The credit for these many achievements goes to Professor Rona Mackie, International Convener, and the support given by Michael White, who was seconded to the Society from the British Council to manage the International Programme. He returned to the Council in August after 3 years with the Society, and with him its thanks for the considerable contribution he made to the delivery and further development of the programme.

Sustaining and utilising the expertise of our multi-disciplinary Fellowship, and recognising outstanding achievement and excellence

The President's Triennial Dinner was held in June at the Signet Library. Lord Oxburgh, KBE, FRS, Chairman Shell UK, was the principal guest and speaker. It was a most enjoyable and successful event, at which the President also had the pleasure of presenting Sir Laurence Hunter, the Society's past Treasurer, with a Bicentenary Medal in recognition of his distinguished service to the Society.

Other medals, prizes and prize lectureships awarded during the year at the Awards Reception at the Scottish Parliament on 2 September were:

- Makdougall Brisbane Prize to Dr James Wright, School of Mathematics, University of Edinburgh
- W S Bruce Medal to Dr Michael Bentley, Department of Geography, University of Durham
- Neill Medal to Professor Mike Hansell, Division of Environmental and Evolutionary Biology, Institute of Biomedical Life Sciences, University of Glasgow
- Bruce Preller Prize Lectureship to Professor Jason Reese, Department of Mechanical Engineering, University of Strathclyde

Fellows are involved in all areas of activity – as speakers or organisers of events; as contributors to the independent expert advice we provide; and as conduits for our many partnerships and relationships. The individual and collective part that Fellows play in the success of the Society's activities is invaluable and Council is extremely grateful for their support.

Conclusion and Thanks

My report does not account for all activities during the Session, but is evidence of a wide range of achievements on many different fronts. As I have said, these achievements would not be possible without the contribution of Fellows. Nor would they be possible without the input and commitment of a dedicated team of staff. My sincere thanks to each and every one of them for the part they have played and also for the help and support they have given to me, during my period of office. My particular thanks goes to those with whom I have worked most closely, namely William Duncan, Kate Ellis, Graeme Herbert and Marc Rands.

I am of course one of several people who will be stepping down from office at the end of this ASM. I would therefore like to conclude my report by mentioning the “others” who step down from office today:

Conveners - Professor David Saxon, Research Awards Convener, Professor Cheryl Tickle, Young People’s Convener, Dr Ian Sword, Enterprise Fellowships Convener and Dr Brenda Moon, Curator, all stand down today. The Society is extremely grateful to all of them for the valuable contributions they made to their areas of activity, and its sincere gratitude goes to them.

Fellowship Secretary – Professor Bird will shortly present his final report as Fellowship Secretary. The Society is sincerely grateful to Colin for all that he has done to ensure: the smooth running of the Fellowship election process; that the Society continued to elect individuals deserving of Fellowship; and that there was a greater involvement of the Fellowship in the election processes.

I should also apologise to Colin. As some of you may have noticed, the Fellowship Secretary has been omitted from the Council members listed in the Annual Review brochure for the 2004/05 fiscal year. Colin was, and his successor will continue to be, on the Society’s Council. The omission is purely accidental.

Vice-President – Professor McCrone steps down today as Vice-President and on behalf of the Society my thanks to him for serving the role so ably. Of course, election permitting, he also today steps into my shoes as General Secretary. I wish him every success in this new role.

President - during his term Lord Sutherland has ensured that the Society has maintained the steady, moving forward and modernising course set by his predecessors; and within that ensured it remained on a sound financial footing. Most notably he skilfully piloted the fundamental governance changes I mentioned earlier – and in doing so avoided division within the Fellowship. As a communicator of the Society's business and interests, he excelled. On behalf of the whole Fellowship I would like to take this opportunity to express our sincere gratitude for all he has done and wish him every success in the future.

Finally, I would also like to take this opportunity to welcome our incoming President, Sir Michael Atiyah, who I know will more than ably continue Lord Sutherland's good work.

Lord Sutherland thanked Professor Miller for his report and conveyed the Society's deep gratitude to him for the care and sensitivity he had applied during a successful tenure as General Secretary – an important position around which all of the Society's business and activities revolves.

Treasurer's Report

Mr Cunningham presented the following report:

"As this is my first annual meeting as Treasurer, I want to take the opportunity to look a bit further into the future than is normally the case on these occasions and to consider certain issues, which will influence the Society's development. But first of all, let me report on the results for 2004/05 before going on to tell you about the outlook for the current financial year. When I have done that, I will take up these issues.

Results for 2004/05

You will have already received the Annual Review for 2004/05. In addition, the full set of accounts is available for you to pick up. The latter provides considerable detail and, if after you have had a chance to study it, you have any specific points you would like to raise, do please get in touch with me or Kate Ellis, the Director of Finance.

In overall terms, the Society's net income was £82K compared with £60K in the previous year; an increase of just short of 40%. This improvement is a consequence of the groundwork laid by my predecessor, Sir Laurence Hunter, and I do want to emphasise the extent of the contribution he made from the time when the Society's finances were in a somewhat precarious state.

After allowing for gains realised on our investments, the net income going into our reserves is about the same as last year; that is £102K, compared with £94K in 2003/04.

Turning to the balance sheet, you will see that our reserves have increased overall by around £230K, made up of the £102K I have just mentioned and the unrealised gains on our investments.

Outlook for 2005/06

So far as the current year is concerned, our original forecast was that we would only achieve breakeven. The key factors we had to take into account then were that the mix of the returns we would be earning to cover our overheads would be less satisfactory than previously and that some programmes might extend into next year. Although I am pleased to say that we will do better, the change between last year and the original forecast for this year does highlight the longer term issues to which I referred to earlier.

Three Specific Issues

There are three specific ones, which I want to explore, namely: revenue growth, strengthening the financial base and fund raising

Revenue Growth

The key to the growth in our activities in recent years has been the commissioning of the Society by other organisations to manage programmes for them. In doing this, our management has achieved a distinctive reputation for delivering. At the same time, the quality of what the Society can offer through the expertise and efforts of the Fellowship is unique and is by now well recognised as being a significant contribution to the wider community in Scotland.

However, securing these commissions is dependent upon many factors which are outwith our control. Also, the timing and amounts can be quite variable. In addition, our principal source of revenue, around two-thirds, is from the public sector. This is a strength, but could also make us vulnerable to any significant changes in the resources available to government.

It is against that background that the Management Team are now examining, on a continuing basis, how the Society's revenues can be both grown and diversified. This will not be an easy task nor can it be accomplished in the short term. However, at the next annual meeting, I will let you know the progress we are making.

Strengthening Our Financial Base

On the second issue, the Society needs a stronger financial base if it is to accommodate the financial fluctuations which arises from the nature of our activities; and, all the more so as we seek to expand them. Also, and this is important, it will only be from a strong financial base, that we will have the confidence to take some risks with programmes which we have originated. Such opportunities to do this will enable the Society to be really innovative.

The challenge is, how can we get into this position? In part, it will be a function of revenue growth; and in part, it will be improving the returns we obtain on the work we do for others. The latter is an issue, which I will be addressing at the beginning of next year.

I should add that another aspect of strengthening the financial base is cost control. I am satisfied that this is being exercised and that there is limited scope for mobilising additional resources.

Fund Raising

Then on the third issue, in 2001, Fellows responded most generously to the fund raising appeal. The proceeds have enabled us to contribute towards and add flexibility to a number of programmes.

However, if we are to expand our activities, we will need considerably more in the way of funds over the use of which the Society will have some discretion. I accept that we will need to look to sources other than the Fellowship. Work on identifying other sources is presently being undertaken by Sir Michael Bond and me.

Although we are not ready at this stage to go into any real detail, what I would say is that it is becoming apparent that we will need to construct initiatives, which will attract support from specific sources rather than adopt a general approach.

At the same time, we will be instituting a continuing legacy programme backed up with advisory support for those who would like to call on it.

Conclusion

In conclusion, the Society has a wide range of opportunities to contribute to the Scottish community and we have the management and intellectual capabilities to make a significant, and I would like to say unique, contribution. However, we do need to build up an adequate financial base. This outcome is shared objective towards which I, together with Kate Ellis and her Finance team, will contribute as much as we can over the coming year."

Fellowship Secretary's Report

Professor Bird presented the following report:

"This year saw the first implementation of a Postal Ballot to elect Fellows. Almost half of the Fellowship returned Ballot papers and the result was announced by the Scrutineers, Lord Ross and Professor John Laver, at the first Ordinary meeting in March. The Society elected 55 Ordinary Fellows, 7 Corresponding and 4 Honorary Fellows. The average age this year of the new cohort of Ordinary Fellows was 52 (53 in 2003; 49 in 2004). Fourteen female Fellows were elected representing 25% of the intake (up from 16% last year). Two of the female Fellows represent Engineering, the first time women have represented this discipline in the Fellowship.

The changes to the structure of the Sector Groups meant a reduction in the number of sectional committees with some discipline areas being clustered together to reflect the previous allocations of interdisciplinary candidates. In the main this worked well and as with all aspects of the selection process, it will be reviewed every year and changes to improve decision-making approved by Council.

Currently the Fellowship is composed of 68 Honorary Fellows, 30 Corresponding Fellows and 1298 Ordinary Fellows. The discipline balance of the Ordinary Fellowship remains almost the same as last year with 37.5% from the Physical, Engineering and Informatic Sciences, 36.5% from the Life Sciences, 18.5% from the Arts and Humanities and 7.5% representing Economics, Business and Industry. This represents a slight increase in the Life Sciences from last year. Currently females make up 7.7% of the Ordinary Fellowship, an increase of around 3% from 1999, with the majority representing the Life Sciences.

On 2 May there was a very successful New Fellows' Induction Day held at the Society, which was attended by 44 of the new Fellows elected in 2005. This new initiative will continue in the next Session, and will hopefully become a permanent fixture.

Also looking ahead to the next Session, 169 Ordinary, 6 Honorary and 7 Corresponding Fellowship nominations are being considered for the next Fellowship election. Council has decided the following places should be available: 55 Ordinary places – which breaks down into 17 for Life Sciences, 15 for Physical, Engineering and Informatic Sciences, 13 for Arts, Humanities and Social Sciences, and 7 for Economics, Business and Administration; 4 Honorary places; 10 Corresponding; and 3 floating.

As this is my last act as Fellowship Secretary, I would to conclude by thanking all those members of Sectoral Groups and Sectional Committees for their input and support during my term of office. I would also particularly like to thank Lesley Campbell, Fellowship Officer, whose support and input was invaluable to me."

Lord Sutherland invited comments / questions on the reports.

Sir Neil MacCormick asked when the natural / social science balance of the Fellowship was last reviewed. Professor Bird said 1999 and since then significantly more "new Fellows" were being admitted from the Arts, Humanities and Social Sciences sector and that the number was continuing to increase.

Lord Sutherland observed that whilst the increase in the number of females in the Fellowship had increased, there was still some way to go before a better gender balance was achieved, and Fellows should be encouraged to nominate more female candidates of appropriate standing.

Lady Balfour said she was not supportive of positive discrimination, but it would be helpful to see a better gender balance of Society office bearers. She also observed that while the Society is multi-disciplinary, its main strengths lay in natural science and this should be the main focus of it. Finally, she asked if there had been any consideration to placing a ceiling on the total number of Fellows in the Society at any one time. Professor Bird said no ceiling had been set, but a review of this would soon be needed as part of the consideration of places made available for new Fellows.

Professor David Sloan asked how this year's first year nominees were distributed. Professor Bird answered; 33 for Life Sciences, 30 for Physical, Engineering and Informatic Sciences, 17 for Arts, Humanities and Social Sciences, and 8 for Economics, Business and Administration.

Dr John Francis asked if the Society was doing enough to address the public debate on the future of science. Professor Miller agreed it could do more and that this should be factored into its forward planning for future activities.

Dr James Irvine observed the importance of the Society ensuring that its future activities maintained the Society's independence and the discussion and debate is conducted in a balanced way.

Sir Neil MacCormick proposed approval of the reports, Professor Rona Mackie seconded this. There was no dissent. Lord Sutherland declared the reports approved.

AOB

Professor David Finney expressed great concern over the failure of the Society in the last few years to produce timely obituaries of deceased Fellows, and asked that steps be taken to address this. Lord Sutherland said that whilst it was unlikely that the Society would be able to provide obituaries in every case, it should be doing better, and proposed that the issue be considered at the next Council meeting (5 December 2005) and the subject should be an agenda item for the 2006 ASM, when progress made should be reported. Dr Brenda Moon agreed the Society should be doing better in this area, but observed that whatever process was introduced to achieve an improved performance, the ability of the Society to deliver is dependant on the willingness of Fellows to write the obituaries.

Presentation of Royal Medals

Lord Sutherland presented medals to Sir David Edward in recognition of his outstanding contribution to the law both in the European Union and in Scotland, to the legal profession in Scotland, and for his contribution to public life; and to Professor William Hill in recognition of his outstanding contribution to Life Sciences and particularly to the theory of quantitative genetics and its applications to animal breeding. Vice-Presidents Professor Gavin McCrone and Professor John Coggins read the respective citations.

Handover of Presidency

Lord Sutherland thanked the Society's staff for the quality input provided during his Presidency, which was pivotal to the Society's success. He also thanked all those who had served as Office Bearers during his tenure, for their support and contributions. He concluded by formally handing over the Presidential insignia to Sir Michael Atiyah, who, he observed, was only the second person to be President of both the Royal Society of Edinburgh and the Royal Society of London; the first being Lord Kelvin in the 19th century. Sir Michael thanked Lord Sutherland for all his work in continuing to lead the Society in keeping with its tradition, but also looking forward to the future. He then declared the ASM closed.

TRUSTEES' REPORT TO 31 MARCH 2005

The Council of the Society present their report for the financial year ended 31 March 2005.

Structure, Governance and management

The Royal Society of Edinburgh (RSE) is Scotland's national academy and premier learned society, founded by Royal Charter in 1783 for "the advancement of learning and useful knowledge", and is registered as a Scottish Charity.

Following the changes to the Society's laws approved by the Fellowship in September 2004, the Council, chaired by the President, now comprises 12 Trustees, including the 3 Vice-Presidents, the General Secretary, the Treasurer, the Fellowship Secretary and five ordinary members. Subject to annual re-election, all members serve for three years, other than the General Secretary and Treasurer, whose terms of office are normally four years. All are volunteers and unpaid. The Council is responsible for the Society's strategic direction and policies and normally meets four times annually.

The Executive Board has delegated to it from the Council responsibility for managing the operational delivery of the Society's activities. It is chaired by the General Secretary, and has as its members, the Treasurer, the Curator, Convenors of operational committees, staff management and the Chair of the RSE Scotland Foundation. The Board meets quarterly and reports to the Council. Council members and other office bearers are elected annually by the Fellowship, from a list recommended by the Council, after taking into account suggestions by Fellows.

Reporting to the Council through the Executive Board is a wide range of operational committees, including, the International Committee, the Research Awards Committee and the Meetings Committee. These Committees largely, but not exclusively, comprise Fellows of the Society and are concerned with the operational delivery of the Society's varied activities. All Fellows are actively encouraged to participate. A connected charitable trust, the RSE Scotland Foundation plays a leading role in the continued development of the Society's public outreach activities and which manages the premises in George Street.

The Scottish Science Advisory Committee, whose members are appointed by the Council of the RSE, provides independent strategic advice on scientific issues to the Scottish Executive. Its funding is administered by the RSE.

Statement of Council's responsibilities

Under the Laws of the Society, the Council has the responsibility to control all matters concerning the affairs of the Society and set the overall policy and strategy. The Treasurer, a member of the Council, has a duty under the Laws of the Society to present to the Fellows at the Statutory Meeting the Accounts for the preceding financial year to 31 March. Under Charities legislation, the Council is required to prepare accounts for each financial year which give a true and fair view of the state of affairs of the Society at 31 March and of its financial activities during the year then ended. In preparing these accounts, the Council should

- select suitable accounting policies and apply them consistently
- make judgements and estimates that are reasonable and prudent
- ensure that the recommendations of the Statement of Recommended Practice (Accounting by Charities) have been followed
- prepare the accounts on a going concern basis unless it is inappropriate to assume the Society will continue its activities.

The Council is responsibile for keeping proper accounting records that disclose with reasonable accuracy at any time the financial position of the Society and which enable it to comply with the Law Reform (Miscellaneous Provisions) (Scotland) Act 1990 and the Charities Accounts (Scotland) Regulations 1992. It has general responsibility for taking such steps as are reasonably open to it to safeguard the assets of the Society and to prevent and detect fraud and other irregularities.

Risk management

As part of the recent governance changes, an Audit and Risk committee, reporting directly to Council, and chaired by a non-office bearer has been established. Its remit includes keeping under review the effectiveness of internal control and risk management systems in the Society. The Council believes that the existing systems and the structure of decision-taking and reporting through the staff management group, Executive Board and Council continues to provide assurance that risks are assessed and carefully managed.

Objectives and Activities

The Society's mission is 'the Advancement of Learning and Useful Knowledge'. To fulfil this, it promotes learning and puts the multidisciplinary expertise of its Fellows to work for the good of

Scotland and its people. It has two roles:

- To serve as Scotland's national academy of science and letters
- To support research and innovation in Scotland

The Society has set three strategic objectives over the period of its corporate plan from 2004-2007:

- To continue to deliver a range of "core" activities, including those covered by existing arrangements with funders and partners;
- Within these activities, to prioritise selected action areas and, where necessary, seek the resources needed for development; and
- To encourage wider Fellowship and public participation and better integration in the delivery of Society programmes.

The Society achieves these aims through six main strands of activity:

i) Providing authoritative, independent advice and making recommendations to policy decision takers;

ii) Supporting and enhancing excellence in the Scottish research base;

iii) Supporting the commercialisation of research and innovation;

iv) Communicating knowledge and understanding

v) Promoting the international awareness of Scottish research and innovation;

vi) Sustaining and utilising the expertise of its multidisciplinary Fellowship, and recognising outstanding achievement and excellence.

In each activity there are measurable output targets for each year.

Achievement and performance

Overall performance during the year was good. Only one of the 128 output targets set by the Council was not implemented, the majority of targets having been achieved and in some cases surpassed. A few (18) targets did not, for varying reasons, largely resource constraints, progress as far as had been expected in the year under review.

Policy, Evidence and Advice

Having concluded an Inquiry into the Scottish Fishing Industry in March 2004, the RSE set about preparing for a major Inquiry into Scotland's Energy Supply, prior to launching it in May 2005. The Society also initiated a new series of Position Papers, with the first entitled *Climate Change and the Management of Scotland's Natural Heritage*, which aimed to reshape the views expressed in previous consultation papers in more general terms so that they might be able to inform more general policy issues on that topic for a wider range of policy makers. During the year, the Society submitted evidence and advice to Government and Public agencies on 26 topics which included:

- *Science and Innovation - Working Towards a 10-year Investment Framework*. HM Treasury, Department of Trade and Industry & Department of Environment, Food and Rural Affairs.
- *Code of Practice for the Use of Human Stem Cell Lines*. Medical Research Council
- *Human Reproductive Technologies and the Law*. House of Commons Science and Technology Committee
- *Developing a UK Sustainable Development Strategy Together.* Scottish Executive Environment Group
- *Developing a Strategic Framework for Scotland's Marine Environment*. Scottish Executive Environment Group
- *Long-term Radioactive Waste Management*. Committee on Radioactive Waste Management
- *Review of the Scottish Climate Change Programme*. Scottish Executive Environment Group

During the year under review, the pilot Scottish Parliament Science Information Scheme completed its trial period and following a review, was endorsed by the RSE Council as a worthwhile initiative that should continue to be supported.

Supporting Research Excellence

Some of the brightest researchers from home and around the world were able to develop their ideas here in Scotland, thanks to grants totalling over £1.5 million awarded by the Society. Innovative research, offering public benefit in areas such as healthcare, the ageing population, communications, energy and the environment were supported in partnership with key funders in the public and private sectors.

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

The following were awarded during 2004-2005:

1 BP Personal Research Fellowship, 3 Scottish Executive Personal Research Fellowships, 3 Scottish Executive Support Fellowships, 2 Lloyds TSB Personal Research Fellowships, 2 Lloyds TSB Research Studentships, 2 CRF Personal Research Fellowships, 1 Wellcome Research Workshop.Cormack Prizes: 2 Undergraduate Prizes, 1 Postgraduate Prize and 6 Vacation Research Scholarships. 6 Lessells Travel Scholarships. 3 Scottish Executive Science Fellowships for Teachers.

Supporting Commercialisation and Innovation

The RSE runs three Enterprise Fellowship Schemes, funded by Scottish Enterprise, PPARC and BBSRC. The BBSRC scheme ran for the first time in early 2005, with the first Enterprise Fellows taking up post in 2005-06. The general aim of these schemes is to increase the commercialisation of the academic research base, raise understanding of commercialisation throughout Scottish universities and research institutes, and to create sustainable companies with high-value jobs.

During the year, 12 Scottish Enterprise Enterprise Fellowships and 2 PPARC Enterprise Fellowships were awarded.

The Gannochy Trust Innovation Award of the Royal Society of Edinburgh is Scotland's highest accolade for individual achievement in innovation and was created in 2003 to encourage and reward Scotland's young innovators for work which benefits Scotland's wellbeing. The award is presented annually to a young innovator whose work has the potential to promote social and economic wellbeing. Established in partnership between The Gannochy Trust and the RSE, the purpose of the award is to encourage younger people to pursue careers in fields of research which promote Scotland's inventiveness internationally, and to recognise outstanding individual achievement which contributes to the common good of Scotland. The prestigious award also seeks to promote Scotland's research and development capability in new technologies and areas of social importance. In 2004 the award was presented to Dr Ian Underwood, FRSE in recognition of the contribution he has made to the development of highly innovative optoelectrical and display devices here in Scotland.

Communicating Knowledge and Understanding

A restructured RSE website went live in April 2004. The majority of Research Award and Exchange Fellowship applications are now made through the web. Lecture tickets can also be ordered online and increasing use is made of this facility.

Three volumes of *ReSourcE*, the RSE newsletter, were published and distributed to the Fellowship and around 2000 others, including business leaders, journalists, research institutes, schools, MPs, MSPs and interested individuals. Fellows also receive a monthly e-bulletin, which enables them to keep up to date with and, if appropriate, further disseminate information on the RSE and its work in a timely and succinct format.

The RSE continues its long tradition of publishing with its two journals, *Transactions: Earth Sciences* and *Proceedings A: Mathematics,* which are published on behalf of the Society by the RSE Scotland Foundation. Six issues of *Proceedings* A and six issues of *Transactions* were published during this session. The journals are also exchanged with over 200 exchange partners world-wide. Both journals are highly regarded by academics as publication vehicles, and they maintain a respectably high impact factor in comparison to similar journals in their fields. *Transactions* will undergo some changes for the 2006 volume, with a slight change in title (to broaden the remit to include 'Environmental Sciences') and a revitalised cover design.

The RSE Events team delivered 20 Lectures, 4 Discussion Forums, 6 Conferences, 1 Workshop, and 3 Award Ceremonies. These included: The Bruce Preller Prize Lecture, *The Threat of Terrorism – The Place of Science* by Sir Keith O'Nions; *The Coming Century – Ten Trends to Back*, by Frances Cairncross; *Fire and Structures – Implications of the World Trade Center Disaster*; and the CRF Prize Lecture, entitled *PremRNA Splicing: the Tie that Binds* by Professor Joan Steitz, Yale University. Published reports of events are available in hard copy from the RSE, or on the website.

As in previous years, the RSE participated in the Edinburgh Lecture series and hosted Professor Roland Jung, Chief Scientist, the Scottish Executive and Dr James Robson, National Team Medical Co-ordinator, the Scottish Rugby Union who spoke on *The Health and Psyche of the Scottish Nation* on 21 January 2005.

Three meetings – a joint lecture with the Scottish Crop Research Institute, the CRF Prize Lecture, and a joint conference with the Royal Swedish Academy of Sciences – were held outwith Edinburgh.

The four Discussion Forums, on *Fingerprint Identification, Secular Europe and Religious Turbulence, HIV and AIDS in Scotland* and *Neurosurgery for Mental Disorder* met with an encouraging response, audiences being over target in most cases.

The Young People's programme covered the length and breadth of Scotland:

- 15 *Talk Science* Schools' lectures, with venues ranging from Wick to Selkirk. Students heard about subjects such as *Black Holes and Big Bangs, DNA Profiling* and *Throwing Light on the Human Genome*.
- Startup Science Masterclasses at Dundee, St Andrews, Aberdeen, Glasgow and Heriot-Watt Universities.
- Maths Masterclasses in Aberdeen, Dundee, South Queensferry and Glasgow.
- Roadshows in Arbroath and Dingwall. The roadshows comprised a selection of science workshops for primary and secondary school students, as well as a talk for the wider community.
- A Discussion Forum in Dumfries on Scotland's Future Energy Supply.
- A Science, Engineering and Technology Summer School to introduce students to university life. (In partnership with Heriot-Watt University)
- A Christmas Lecture, *Why Clone? Cloning in Biology and Medicine* by Professor Ian Wilmut at Pitlochry Festival Theatre for local school students and also a talk for the general public.

In addition, the Education Team successfully encouraged school students to attend a variety of RSE public lectures.

Promoting the International Awareness of Scottish Research and Innovation

The success of the RSE's international programme continued during the year. The international exchanges were well subscribed, with a total of 45 exchanges taking place - 8 on the bilateral programmes run with China, Poland and Taiwan and 37 on the open programme with visits to/from various countries including Armenia, Argentina, Australia, Belgium, Brazil, Denmark, France, Germany, Hungary, Italy, Jordan, Lao PDR, Latvia, The Netherlands, New Zealand, Nigeria, Russia, Slovakia, South Africa, Spain, Turkey, Ukraine, and the USA.

Three Issues of *Science Scotland* (Issues 2 and 3, Physics, and 4 Understanding the Genome) were published. *Science Scotland* aims to promote the excellence of Scottish research to an overseas audience.

The RSE was involved in several high-profile international events, including:

- a *Crossroads for Ideas* Biosciences Workshop, (one of a series of workshops to celebrate the Accession of eight new Member States to the European Union). June 2004.
- RSE-KNAW (Royal Netherlands Academy of Arts and Sciences) Brain Science Event, September/ October 2004, part of the Scotland – Netherlands Season.
- A National Science Council of Taiwan workshop for international partner organisations, August 2004.
- The RSE-Royal Swedish Academy Mathematical Biology conference, Glasgow, November 2004.

RSE Chief Executive, Dr William Duncan, attended the annual ERRIN (European Regions Research and Innovation Network) in Brussels and also an ALLEA Workshop on *The Future of the Research Information Chain* in Budapest.

The Society set up the RSE China Forum, (chaired by Professor Stephen Blackmore) which met in January 2005 and the EU Policy Forum (chaired by Sir David Edward) was created in Autumn 2004.

The Society received visits from the National Natural Science Foundation of China, the Polish Academy of Sciences, and the Norwegian Academy of Science and Letters.

RSE International Convener, Professor Rona MacKie and Dr William Duncan visited the Czech Academy of Sciences in December 2004 to lay the foundations of a bi-lateral agreement.

Utilising the expertise of the Fellowship

The multidisciplinary membership of the RSE makes it unique amongst learned Societies in the UK, its peer-elected fellowship of men and women encompassing excellence in the Sciences, Arts, Humanities, the Professions, Industry and Commerce. The Society currently has 1302 Ordinary Fellows, 30 Corresponding Fellows and 69 Honorary Fellows. In March 2005 the Society announced the election of 55 Ordinary, 7 Corresponding and 4 Honorary Fellows. This election of new Fellows was carried out by Postal Ballot for the first time and around half of the Fellowship returned ballot papers.

RSE Fellows are involved with the Young People's programme as speakers and workshop/masterclass organisers. In the International area, they are often key speakers at international meetings and take lead roles in relationships with sister academies, etc.

Evidence and Advice submissions are compiled from views polled from the Fellowship. Fellows are heavily involved in Conference organising committees and at an earlier stage are instrumental in suggesting meetings for future sessions. Fellows also serve on the Editorial Boards of the *Transactions* and *Proceedings A* journals, and the Executive Editors in particular play a vital role in maintaining the high standard of papers published. The part that these Fellows play, individually and collectively, in the success of the Society's activities cannot be underestimated. The Council is extremely grateful for their support and actively encourages Fellows to make suggestions of more ways in which they could participate.

Financial review and policies

Investment powers and policy

The Council has power under the Laws to control and manage the investments of the Society. The management of the investments is carried out by Speirs & Jeffrey & Co on a discretionary basis. The objectives set by the Council of the RSE are first to ensure a sufficient level of income to meet the target set annually by Council and thereafter to invest for capital growth potential. The Council has delegated the detailed monitoring of performance to an Investment Committee, which includes at least one non-office bearer, and which makes comparisons against a composite benchmark reflecting the mix of assets held and the WM Median index.

The income targets for the year have been exceeded and the total return values have outperformed the average charity index and the UK market. Representatives of the Investment Committee meet twice annually with the investment managers to review investment performance and discuss their compliance with the constraints set by the Committee. In the year under review no compliance issues arose which required to be reported to the Committee.

Operating policies - grant making

The RSE makes grants to individuals in higher education institutions in support of research activities in the categories of postdoctoral Research Fellowships, support Research Fellowships, post graduate Studentships, undergraduate Vacation Scholarships and Enterprise Fellowships. Each of these categories is specifically funded from various sources including the RSE's restricted funds. The basis of eligibility and selection varies according to the detailed scheme regulations, which are published on the RSE's Web site (www.royalsoced.org.uk).

Grants are also made in support of research activities of Fellows of the RSE, including support for travel connected with research or scholarship, small scale specialist meetings, to assist research visitors to Scotland, to undertake collaborative research work with a Fellow, to assist a visiting lecturer to come to Scotland, to assist research collaboration between two institutions in Scotland or between universities and industry and to assist in the publication of books written by Fellows. These grants are funded by the RSE's designated Grants Fund. The Grants Committee is responsible for making awards in accordance with the detailed rules set out by the Council of the Society for the disbursement of the Grants Fund.

Details of committee membership are to be found in the Society's annual directory and on its website.

Reserves policy and funds

The Society holds a number of restricted funds resulting from bequests for particular purposes, details of which are set out in note 2c) to the financial statements. There are also designated funds, where the Council has set aside sums from its unrestricted funds, the purposes of which are set out in note 2b) to the financial statements. The General Fund represents the balance of unrestricted funds which are not invested in fixed assets or designated for a specific purpose.

The Council has examined the requirement to hold unrestricted funds, and concluded that, whilst the present level of reserves gives adequate working capital for core costs, it would be desirable to have a General Fund in the range of three to six months expenditure on central costs. They have also reviewed the purposes and amounts of each of the designated funds and are satisfied that it is appropriate to continue to allocate the unrestricted funds for the purposes described in note 2b) to the financial statements. In particular, the Society should continue to maintain a Development. Appeal Fund to give flexibility to respond to new initiatives on a timely basis without the need for specific fundraising.

Result for the year

The overall result at the net incoming resources, or revenue, level was a surplus of £82,000, with the General Fund result contributing £1,000 of this sum. The realised surplus for the year after including realised gains on investments rose to £2,000 in the General Fund and £102,000 overall. This reflects both the plan for a period of consolidation and the continuing recovery of the investment portfolio, following its realignment in 2003-04.

Incoming resources

Total incoming resources of £3.06m have increased by 6%, or £0.16m, over last year. The increase has arisen mainly from support for our charitable activities and also investment income from cash deposits. 'Donations and grants' has remained stable, increases in Scottish Executive funding for international and other activities offsetting the decline in value of secondments, as Graeme Herbert's secondment from the Scottish Executive ended, and the higher level of subscription income from Fellows countering a gradual fall in Appeal receipts. In the restricted funds an amount of £41,000 was received as a capital distribution from the 'Baron Fleck of Saltcoats Will Trust'. Income from this fund is to be used to promote interest in science and its applications. The increase in 'Charitable activities' of 10%, or £0.16m, includes increases in funding for Research and Enterprise Fellowship schemes from the Scottish Executive and Scottish Enterprise, building on the new appointments last year. Income for other activities has remained broadly steady, reflecting the maintenance of activity levels. Investment income was boosted by interest received on cash, which is mainly held in the designated funds, and interest of £32,000 received on the loan to the RSE Scotland Foundation.

Resources expended

Total resources expended have increased in line with income by 5%, or £0.14m, from last year. This mainly reflects the increase in support for research and Enterprise awards discussed above. Expenditure categorised as 'Cost of Generating funds' has remained at a low level as formal fundraising has not been a major focus in the year. This heading does not include the costs of ongoing negotiation with, claims from and reconciliations for funders of continuing activities. These costs are regarded as support costs for the activities concerned. Grants payable of £1.91m have increased by 8%, or £0.15m. This includes the disbursement of the increased funding for research and enterprise awards and, pleasingly, the first administrative expenditure in relation to new Enterprise Fellowships to be funded by BBSRC. Expenditure on Activities has remained steady with increased expenditure on international activities offset by lower expenditure on evidence following last year's important Fishing Industry Inquiry. The international programme is now well established with many new links being developed; the continued partnership with the British Council through the part-time secondment of Michael White has been very important in achieving this.

Management and Administration costs have increased by about £21,000, or 9%, overall, but about half of the increase relates to non-recurring expenditure on overhauling the lift. The management component of this category has increased by £5,000, or 6%, reflecting increased staff time on management activities following the staff restructure. By careful control of the non-staff elements of central costs, resulting in a decrease of £10,000 from the previous year, to offset the rise in salary cost as a result of increased staffing, the overall increase in central costs has been contained to 4.6%. As is explained in the policy on reserves, the Council undertook a review of the level and purpose of all the Designated Funds. The transfers shown in the Statement of Financial Activities represent the release from the Capital Asset Reserve of a total of £101,000 to match the write down of buildings and the capital repayment of the loan to the Foundation, of which £47,000 is passed to General Fund, net of a transfer of £8,000 to the Staff Development Fund.

Balance Sheet

Net assets continue to rise, being up 3.2% overall to a total of £7.27m; the major reason being the 10% increase from £1.98m to £2.18m in the investment portfolio. Net current assets have increased by 26% to £695,000.

Of the total cash balance, £682,000 is allocated to Designated Funds, the major part of which is the cumulative receipts from the Appeal; a further £127,000 relates to restricted income.

Fundraising

In the current year work is ongoing to identifying possible sources of support and to develop a strategy for new business development. In the longer term, success in both of these elements is essential in enabling the Society to achieve its strategic intentions in the Corporate Plan.

Future prospects

The continued improvement in 2004-2005 in the Society's results, although modest, is nonetheless encouraging. For 2005-2006, we do not expect the outturn to be much more than breakeven. This is primarily attributable to shifts in the timing of certain initiatives which we are managing. It is our intention to increase the pace of growth in revenue and to strengthen our overall financial position. With this in mind, the Executive Board and the staff are developing a programme to achieve such results and its impact is expected to become apparent from 2006-2007 onward.

AUDITORS' REPORT AND ACCOUNTS

We have audited the financial statements on pages 35-52.

These accounts have been prepared under the historical cost convention as modified to include the revaluation of investments and in accordance with the Statement of Recommended Practice: Accounting by Charities and applicable accounting standards. This report is made solely to the Society's Trustees, as a body, in accordance with regulation 7 of The Charities Accounts (Scotland) Regulations 1992. Our audit work has been undertaken so that we might state to the Society's Trustees those matters we are required to state to them in an auditor's report and for no other purpose. To the fullest extent permitted by law, we do not accept or assume responsibility to anyone other than the Society and the Society's Trustees as a body, for our audit work, for this report, or for the opinions we have formed. Respective responsibilities of Council and auditors The Council is responsible for preparing the Trustees' Report and, as described above, the financial statements in accordance with the Laws of the Society, relevant United Kingdom legislation and accounting standards. Our responsibilities, as independent auditors, are established in the United Kingdom by statute, the Auditing Practices Board and by our profession's ethical guidance. We report to you our opinion as to whether the financial statements give a true and fair view and are properly prepared in accordance with the Laws of the Society, the Law Reform (Miscellaneous Provisions) (Scotland) Act 1990 and the Charities Accounts (Scotland) Regulations 1992. We also report to you if, in our opinion, the Trustees' Report is not consistent with the financial statements, if the Society has not kept proper accounting records, if we have not received all the information and explanations we require for our audit, or if information specified by The Law Reform (Miscellaneous Provisions) (Scotland) Act 1990 and The Charities Accounts (Scotland) Regulations 1992 is not disclosed.

We are not required to consider whether any statement in the Trustees' Annual Report concerning the major risks to which the charity is exposed covers all existing risks and controls, or to form an opinion on the effectiveness of the charity's risk management and control procedures. We read other information contained in the Trustees' Annual Report and consider whether it is consistent with the audited financial statements. We consider the implications for our report if we become aware of any apparent misstatements or material inconsistencies with the financial statements. Our responsibilities do not extend to any other information.

Basis of Audit Opinion

We conducted our audit in accordance with Auditing Standards issued by the Auditing Practices Board.

An audit includes examination, on a test basis, of evidence relevant to the amounts and disclosures in the financial statements. It also includes an assessment of the significant estimates and judgments made by the Trustees in the preparation of the financial statements, and of whether the accounting policies are appropriate to the Society's circumstances, consistently applied and adequately disclosed.

We planned and performed our audit so as to obtain all the information and explanations which we considered necessary in order to provide us with sufficient evidence to give reasonable assurance that the financial statements are free from material misstatement, whether caused by fraud or other irregularity or error. In forming our opinion we also evaluated the overall adequacy of the presentation of information in the financial statements.

Opinion

In our opinion the financial statements give a true and fair view of the state of the Society's affairs as at 31 March 2005 and of its incoming resources and application of resources including its income and expenditure for the year then ended and have been properly prepared in accordance with the Laws of the Society, The Law Reform (Miscellaneous Provisions) (Scotland) Act 1990 and the Charities Accounts (Scotland) Regulations 1992.

Henderson Loggie
Chartered Accountants
Registered Auditor
Edinburgh
September 2005

STATEMENT OF FINANCIAL ACTIVITIES

(INCORPORATING THE INCOME AND EXPENDITURE ACCOUNT)

YEAR ENDED 31 MARCH 2005

	Note No £	General Fund Funds £	Designated Funds £	Restricted Funds £	**2005 Total £**	2004 Total £
Incoming resources						
Donations, grants and similar incoming resources	4	731,126	37,475	299,896	**1,068,497**	1,078,495
Activities in furtherance of objectives	5	89,098	-	1,735,684	**1,824,782**	1,663,675
Investment income	6	53,678	57,802	56,524	**168,004**	154,532
Total incoming resources		873,902	95,277	2,092,104	**3,061,283**	2,896,702
Resources Expended						
Cost of generating funds	7	7,191	-	-	**7,191**	9,119
Charitable expenditure:						
Activities in furtherance of objectives	8, 9	646,527	27,187	2,054,073	**2,727,787**	2,605,273
Buildings, management and administration	10	219,048	25,218	-	**244,266**	223,221
Total resources expended		872,766	52,405	2,054,073	**2,979,244**	2,837,613
Net incoming resources before Transfers		1,136	42,872	38,031	**82,039**	59,089
Gains/(losses) on investment assets						
Realised gains		1,173	7,200	13,117	**21,490**	37,895
Realised losses		(87)	(536)	(977)	**(1,600)**	(2,702)
		1,086	6,664	12,140	**19,890**	35,193
Realised Surplus/(deficit) for the year		2,222	49,536	50,171	**101,929**	94,282
Transfers between funds	18	94,055	(94,055)	-	-	-
Unrealised gains/(losses) on investment assets		7,117	43,697	79,603	**130,417**	221,590
Net Movement in Funds		103,394	(822)	129,774	**232,346**	315,872
Balance brought forward at 1 April 2004		69,103	5,764,491	1,214,054	**7,047,648**	6,731,776
Balance carried forward at 31 March 2005		172,497	5,763,669	1,343,828	**7,279,994**	7,047,648

BALANCE SHEET
AS AT 31 MARCH 2005

	Note No	2005 £	2005 £	2004 £	2004 £
Fixed Assets					
Tangible fixed assets	13		**2,420,445**		2,475,829
Fixed Asset Investment					
Investments at market value	14a		**2,179,527**		1,989,023
Historical Cost : £1921,750 (2004- £1,862,113)					
Loan to RSE Scotland Foundation	14b		**1,984,752**		2,031,560
			6,584,724		6,496,412
Current Assets					
Debtors	15	**62,285**		86,588	
Cash at bank and in hand		**377,985**		74,259	
Money Market and other term deposits:					
Designated funds		**681,659**		591,045	
Restricted funds		**118,341**		208,955	
General fund		**8,500**		-	
		1,248,770		960,847	
Current Liabilities					
Creditors: Amounts falling due within one year	16	**(553,500)**		(409,611)	
Net Current Assets			**695,270**		551,236
Net Assets			**7,279,994**		7,047,648
Funds					
General Fund	17		**172,497**		69,103
Designated Funds	18		**5,763,669**		5,764,491
Restricted Funds	19		**1,343,828**		1,214,054
	20		**7,279,994**		7,047,648

Approved by the Council on 5 September 2005

Edward Cunningham
Edward Cunningham, CBE
Treasurer

CASH FLOW STATEMENT
AS AT 31 MARCH 2005

	2005		2004
	£	**£**	£
Cash flow statement			
Net cash inflow/ (outflow) from operating activities		**75,111**	(2,730)
Returns on investments and servicing of finance:			
Interest received	**75,399**		58,230
Dividends received	**91,552**		96,388
		166,951	154,618
Capital expenditure and financial investment:			
Purchase of tangible fixed assets	-		(451)
Proceeds from sale of investments	**244,101**		262,552
Purchases of investments	**(244,101)**		(262,552)
Capital receipt re Fleck bequest	**881**		
Loan to RSE Scotland Foundation	**46,808**		46,808
		47,689	46,357
Net cash flow before financing		**289,751**	198,245
Financing			
Appeal receipts		**22,475**	56,558
Increase in cash in the year		**312,226**	254,803

Reconciliation of net cash flow to movement in net funds		
(note 25)		
Increase in cash in the year	**312,226**	254,803
Net funds at beginning of year	**874,259**	619,456
Net funds at end of year	**1,186,485**	874,259

Reconciliation of net movement in funds to net cash outflow from operating activities		
Net incoming resources before Transfers	**82,039**	59,089
Appeal receipts	**(22,475)**	(56,558)
Dividends receivable	**(92,603)**	(92,636)
Interest receivable	**(75,399)**	(58,228)
Depreciation	**55,384**	55,890
Capital distribution from Fleck bequest (shares and cash)	**(41,079)**	-
(Increase)/decrease in debtors	**25,351**	(17,340)
(Increase)/ decrease in RSE Scotland Foundation current account	**(6,682)**	78,455
Increase in creditors	**150,575**	28,598
Net cash inflow/(outflow) from operating activities	**75,111**	(2,730)

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

1 Accounting basis

The accounts have been drawn up to comply with the provisions of the Law Reform (Miscellaneous Provisions) (Scotland) Act 1990, the Charity Accounts (Scotland) Regulations 1992 and follow the recommendations of the revised Statement of Recommended Practice for charities (SORP) approved by the Accounting Standards Board in October 2000 and applicable accounting standards. The accounts have been prepared under the historical cost accounting rules as modified to include the revaluation of investments. The accounts comprise three primary financial statements:, the Statement of Financial Activities, which incorporates the Income and Expenditure Account, the Balance Sheet and the Cash Flow Statement.

2 Funds

The Society's funds are classified in accordance with the definitions in the SORP into Restricted funds, where there are restrictions placed by a donor as to the use of income or capital, Designated funds, where the Council of the Society has set aside sums from its unrestricted funds for a particular purpose, and the General (unrestricted) Fund. The classifications made are as follows:

a) General Fund - a discretionary Fund available to Council to meet the ordinary activities of the Society.

b) Designated Funds

Staff restructuring fund - In July 2000 Council resolved to create a Staff restructuring fund, to be used at its discretion to provide flexibility in staffing arrangements and in developing future operations.

Development Appeal Fund - to provide development finance to implement the Society's Corporate plan.

Capital Asset Reserve Fund - representing the book cost of the rooms at 22-24 George Street, and 26 George Street and an allocation in respect of funding of the refurbishment of 26 George Street.

Building Maintenance Fund – a reserve to support the future maintenance of the fabric of the Rooms.

Dr James Heggie Fund - income from this fund supports the Society's activities with young people.

Grants Fund - a fund created by contributions and legacies from Fellows and used to provide grants to support research activitie of Fellows.

Programme Fund - a fund created in 2004 by transfer from the Development Appeal fund and surplus funds in the Grants fund to act as a source of funding for meetings activities.

C H Kemball Fund – income from this fund is used to provide hospitality for distinguished visitors from other learned societies and academies.

c) Restricted Funds

Robert Cormack Bequest - to promote astronomical knowledge and research in Scotland.

Lessells Trust - to fund scholarships abroad for engineers.

Auber Bequest - to fund research in Scotland and England by naturalised British Citizens over 60 years of age.

Prizes Fund - to fund various prizes.

Dryerre Fund - to fund postgraduate research in medical or veterinary physiology.

Piazzi Smyth Legacy Fund - to fund high altitude astronomical research.

CASS Fund - to fund academic/industrial liaison.

Retailing Seminar Fund - to fund a programme of seminars on retailing.

Fleck Bequest Fund - to promote interest, knowledge and appreciation of science and its applications throughout Scotland.

3. Accounting Policies

Incoming resources

a) Donations, grants and similar incoming resources

Subscriptions are accounted for on the basis of the subscription year to October 2005 and include income tax recoverable on subscriptions paid under Gift Aid.

Revenue grants are credited to income in the period in which the Society becomes entitled to the resources.

Donations of a recurring nature from other charitable foundations and one-off gifts and legacies included in other income are taken to revenue in the period to which they relate.

b) Incoming resources for charitable activities

Incoming resources for activities are accounted for on an accruals basis.

Publication income receivable in foreign currencies is converted into sterling at rates of exchange ruling at the date of receipt.

c) Investment income

Interest and dividends are accounted for in the year in which they are receivable.

Resources expended

d) Expenditure and support costs

All resources expended are included on an accruals basis and where directly attributable allocated to the relevant functional category. Central costs, which include support costs, are allocated to categories of resource expended in proportion to staff salaries.

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

e) Tangible Fixed Assets, Depreciation and Repairs

The Society's principal assets are its buildings in George Street, Edinburgh, which are stated at historical cost. Under FRS 15 the Society depreciates the buildings assuming a 50-year life. It is the policy of the Council to maintain the buildings to a high standard and provision is made for upkeep of the buildings as required through a designation from General Fund. Any permanent diminutions in value are reflected in the Statement of Financial Activities. Costs of repairs and maintenance are charged against revenue.

Minor equipment is written off to Income & Expenditure Account in the year of purchase. Computer and audio-visual equipment is depreciated on a straight-line basis over four years.

f) Investments

Investments are stated at their market value at the balance sheet date. Gains and losses on disposal and revaluation of investments are charged or credited in the Statement of Financial Activities and allocated to funds in accordance with their proportionate share of the investment portfolio.

g) Pensions

The Society participates in defined benefit pension schemes which are externally funded. The cost of providing pensions is allocated over employees' working lives with the Society and the Foundation and is included in staff costs.

			2005	2004
			£	£
4a	**Donations, grants and similar incoming resources**			
	Fellows' subscriptions	4b	**161,397**	145,741
	Scottish Executive Grant- international activities		**119,975**	125,000
	Scottish Executive Grant other activities		**411,002**	369,087
	Scottish Executive Grant re Scottish Science Advisory Committee	24a	**149,372**	156,224
	Gannochy Trust		**100,000**	104,111
	Other grants and donations	4c	**66,651**	58,774
	Gifts in kind- (value of secondment of staff)		**37,625**	63,000
	Appeal receipts		**22,475**	56,558
			1,068,497	1,078,495
4b	**Subscriptions**			
	Contributions from Fellows			
	Admission Fees		**15,400**	13,340
	Annual Subscriptions		**126,508**	114,638
	Income tax recoverable under gift aid		**19,489**	17,763
			161,397	145,741
4c	**Other grants and donations**			
	Fleck additional receipt		**238**	1,722
	Lessells Trust additional receipt		**9,445**	9,948
	Legacy		**15,000**	-
	Capital receipt from Baron Fleck of Saltcoats Will Trust		**41,079**	-
	Donations for Fishing Inquiry		-	45,321
	Sales of sundry publications		**609**	183
	Other income		**280**	1,600
			66,651	58,774

The Society also receives donations made specifically in support of meetings which are included in meetings income (see note 24c)

			2005	2004
5a	**Activities in furtherance of charitable objects- incoming resources**		£	£
	Promotion of research	5b	**1,703,380**	1,560,490
	Meetings		**76,362**	84,884
	Educational activities		**10,290**	6,268
	Academic / Industry links		-	3,000
	International activities		**34,750**	9,033
			1,824,782	1,663,675

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

			2005	2004
5b	**Promotion of research - receipts**		**£**	£
	Scottish Executive grant - Research Fellowships		**600,770**	538,690
	- Teaching Fellowships		**31,772**	25,124
	British Petroleum Research Fellowships Trust		**120,060**	143,909
	Caledonian Research Foundation		**21,186**	30,979
	Enterprise Fellowships (Scottish Enterprise)		**615,953**	591,216
	Enterprise Fellowships (PPARC)		**59,920**	28,332
	Lloyds TSB Foundation for Scotland		**253,719**	202,240
			1,703,380	1,560,490
6	**Investment income**			
	Dividends (Net)		**92,605**	92,636
	Income tax recoverable on dividend income		-	3,666
	Interest arising on deposits (Gross)		**42,424**	27,905
	Interest receivable from RSE Scotland Foundation (note 23)		**32,975**	30,325
			168,004	154,532
7	**Cost of generating funds**			
	Fundraising costs		-	2,174
	Proportion of central costs (note 11)		**7,191**	6,945
			7,191	9,119
8a	**Grants payable**			
	Promotion of Research	8b	**1,781,367**	1,625,549
	Prizes and Grants		**130,699**	137,225
			1,912,066	1,762,774
8b	**Promotion of Research**			
	Direct Costs : Restricted Funds		**£**	£
	SEELLD Research Fellowships - Support		**105,867**	99,698
	SEELLD Research Fellowships - Personal		**414,197**	377,203
	SEELLD Teaching Fellowships		**25,644**	19,145
			545,708	496,046
	BP Research Fellowships		**111,335**	133,039
	CRF European Fellowships		**16,804**	27,362
	Enterprise Fellowships (Scottish Enterprise)		**532,688**	510,445
	Enterprise Fellowships (PPARC)		**53,307**	23,291
	Enterprise Fellowships (BBSRC)		**289**	-
	Lloyds TSB Foundation for Scotland Fellowships		**229,919**	181,615
	Robert Cormack Bequest		**4,240**	3,957
	John Moyes Lessells Scholarship		**23,474**	22,810
	Auber Bequest Awards		**1,000**	4,000
	Henry Dryerre Scholarship		**15,875**	11,040
			1,534,639	1,413,605
	Direct Costs: Designated Funds			
	D S McLagan Travel Grant		**28**	900
			1,534,667	1,414,505
	Direct Costs: General Funds			
	Library		**25**	363
			1,534,692	1,414,868
	Proportion of central costs (note 11)		**246,675**	210,681
			1,781,367	1,625,549

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

9a Charitable activities

		2005	2004
		£	£
Publications	9b	**36,293**	20,583
Meetings		**203,763**	240,470
Educational activities		**77,220**	64,988
Academic / Industry links		**7,191**	9,754
Fellowships Office		**52,240**	48,908
International activities		**212,020**	186,304
Evidence Advice and Comment		**77,622**	115,268
Scottish Science Advisory Committee		**149,372**	156,224
		815,721	842,499

9b Publications

Editorial and management costs of journals	**23,938**	17,132
Deficit (Surplus) on journals published by RSE Scotland Foundation	**1,558**	(7,137)
	25,496	9,995
Proportion of central costs (note 11)	**10,797**	10,588
	36,293	20,583

The RSE Scotland Foundation became publisher of the Society's journals and Year Book in 1997. The Society retains copyright and incurs editorial costs in respect of these publications. The Society has made (2004 received) a donation from the RSE Scotland Foundation equivalent to the Foundation's net deficit (2004 surplus) on publications.

10 Buildings, Management and administration

	£	£
Buildings and Maintenance	**13,424**	13,518
22-24 George Street- depreciation	**22,061**	22,061
26 George Street- depreciation	**32,949**	32,949
22-24 George Street -expenditure from designated funds	**14,132**	4,101
	82,566	72,629
Management and secretariat	**90,167**	85,074
Publicity	**71,533**	65,518
	244,266	223,221

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

11 Central Costs	**2005**	2004
	£	£
Total Payroll:	**763,268**	685,796
Less funded by Scottish Science Advisory Committee	**(84,786)**	(62,704
Less funded by RSE Scotland Foundation	**(66,666)**	(81,816)
Salaries (note 12)	**611,816**	541,276
Value of secondments	**37,625**	63,000
Staff training, agency and recruitment costs	**21,056**	17,815
Total staff costs	**670,497**	622,091
Other Costs:		
Establishment expenses (22-24 George St)	**35,209**	31,822
Establishment expenses (26 George St)	**75,318**	93,743
Computer and equipment costs	**7,188**	3,888
Communication, stationery and printing costs	**44,772**	43,159
Travel and subsistence, hospitality	**18,003**	19,318
Miscellaneous	**3,301**	2,778
Audit fee	**5,522**	5,795
Other Professional fees	**9,720**	8,346
Depreciation of equipment	**375**	880
	199,408	209,729
Total Central Costs	**869,905**	831,820

In addition to direct costs incurred, central costs have been apportioned to expenditure on functional activities, as follows:

	General Fund	Designated Funds	Restricted Funds	**2005 Total**	2004 Total
	£	£	£	**£**	£
Cost of generating funds					
Fundraising	7,191	-	-	**7,191**	6,945
Support costs - charitable activities					
Publications	10,797	-	-	**10,797**	10,588
Meetings	130,241	-	9,250	**139,491**	161,865
Educational Activities	60,839	5,667	-	**66,506**	54,321
Academic/Industry links	7,191	-	-	**7,191**	6,945
Fellowships Office	52,240	-	-	**52,240**	48,906
International links	86,337	-	-	**86,337**	83,774
Evidence, advice & comment	76,331	-	-	**76,331**	74,508
Promotion of Research	11,676	-	234,999	**246,675**	210,681
Prizes and Grants	3,612	6,505	21,218	**31,335**	24,635
Management and administration					
Buildings and Maintenance	13,424	-	-	**13,424**	13,518
Management and Secretariat	79,081	3,128	-	**82,209**	85,074
Publicity	50,178	-	-	**50,178**	50,060
	589,138	15,300	265,467	**869,905**	831,820

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

12 Employees	Total 2005	Funded by SSAC	Funded by Foundation	**2005 Funded by Society**	2004 Funded by Society 2004
	£	£	£	**£**	£
Wages and salaries	626,495	(56,179)	(69,551)	**500,765**	446,359
Social Security Costs	47,033	(5,013)	(4,742)	**37,278**	33,596
Other pension costs	89,740	(5,474)	(10,493)	**73,773**	61,321
(note 21)	763,268	(66,666)	(84,786)	**611,816**	541,276

The average number of employees of the Society including those employed under joint contracts with the RSE Scotland Foundation during the year was 26 (2004 - 25). Of these two were employed in respect of the Scottish Science Advisory Committee. One member of staff earned over £50,000 per year in respect of duties with the Society.

	22,24 George Street	26 George Street	Equipment	Computer	**Total**
	£	£	£	£	**£**
13 Tangible Fixed Assets					
Cost					
At 1 April 2004 and 31 March 2005	1,103,038	1,647,468	68,799	40,036	**2,859,341**
Depreciation					
At 1 April 2004	110,305	164,745	68,426	40,036	**383,512**
Charge for the year	22,061	32,950	373	-	**55,384**
At 31 March 2005	132,366	197,695	68,799	40,036	**438,896**
Net Book Value					
At 31 March 2005	**970,672**	**1,449,773**	-	-	**2,420,445**
At 31 March 2004	992,733	1,482,723	373	-	**2,475,829**

	Market Value at 1 April 2004	Investments made at cost	Proceeds on sale of investments	Gain/(loss) on sale	Revaluation	**Market value at 31 March 2005**
	£	£	£	£	£	£
14a Fixed Asset Investments						
Managed Funds	426,223	-	(25,366)	(506)	53,443	**453,794**
Fixed interest	593,866	13,152	-	-	(4,281)	**602,737**
UK equities	949,685	249,650	(218,734)	20,396	81,255	**1,082,252**
Cash deposits	19,249	(222,605)	244,100	-	-	**40,744**
	1,989,023	40,197	-	19,890	130,417	**2,179,527**

The gain on sale of investments measured against their historical cost was £48,956 (2004 surplus £45,140). Investments comprising more than 5% of the portfolio were as follows: Treasury 5¾% stock 2009-£111,643, Treasury 5% stock 2012-£132,860, Treasury 5½% loan 2008/12-£133,365, Treasury 5% stock 2014-£133,497, Murray International Trust-£122,820, Scottish Mortgage - £ 113,220, Dunedin Income Growth Trust £114,000.

14b Loan to RSE Scotland Foundation	**2005**	2004
	£	£
Due within one year	**46,808**	46,808
Due after one year	**1,937,944**	1,984,752
	1,984,752	2,031,560

The Loan initially bears interest at 4% per annum, capped at the amount of rent received by the Foundation, and is repayable over the period to 30 June 2047, the expiry of the lease to the Foundation of 26 George Street. On 23 June 2003 Council agreed to waive part of the interest payment due for the years ended 31 March 2004 and 2005 and interest paid was restricted to rental received from the third floor letting. The capital repayment for the year of £46,808 was paid at the end of the financial year as normal.

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

15 Debtors	**£**	£
General debtors	**27,709**	59,752
Stock of ties	**2,282**	2,442
Prepayments and accrued income	**7,577**	6,630
Income Tax Recoverable	**24,717**	17,764
	62,285	86,588
16 Creditors: Amounts falling due within one year		
General creditor	**175,194**	102,949
RSE Scotland Foundation current account	**8,648**	15,330
Accruals and deferred income	**364,989**	259,475
University of Glasgow (note 19)	**1,049**	17,737
Symposia income deferred	**3,620**	14,120
	553,500	409,611
17 General Fund		
At 1 April 2004	**69,103**	1,142
Net movements in funds for the year from Statement of Financial Activities	**103,394**	67,961
At 31 March 2005	**172,497**	69,103

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

18 Designated Funds

	Capital Asset Reserve £	Building Maintenance Fund £	Staff Restructuring Fund £	Development Appeal Fund £	Programme Fund £	C H Kemball Fund £	Grants Fund £	Dr James Heggie Fund £	**Total £**
At 1 April 2004	4,507,016	211,776	42,417	303,166	72,737	16,780	450,000	160,599	**5,764,491**
Investment income	-	9,442	1,891	13,940	3,320	781	20,951	7,477	**57,802**
Other income	-	-	-	22,475	15,000	-	-	-	**37,475**
Less									
Direct expenditure	-	(14,132)	(7,958)	-	-	-	(12,313)	(2,702)	**(37,105)**
RSE admin and staff costs	-	-	-	(3,128)	-	-	(6,505)	(5,667)	**(15,300)**
Surplus (deficit) for the year	-	(4,690)	(6,067)	33,287	18,320	781	2,133	(892)	**42,872**
Transfers between funds									
Re building depreciation	(55,010)	-	-	-	-	-	-	-	**(55,010)**
Re loan repayment	(46,808)	-	-	-	-	-	-	-	**(46,808)**
from General fund	-	-	7,763	-	-	-	-	-	**7,763**
	(101,818)	-	7,763	-	-	-	-	-	**(94,055)**
Net gains on investment assets									
Realised	-	-	-	-	390	168	4,500	1,606	**6,664**
Unrealised	-	-	-	-	2,561	1,100	29,506	10,530	**43,697**
At 31 March 2005	4,405,198	207,086	44,113	336,453	94,008	18,829	486,139	171,843	**5,763,669**

As described in note 2, the Development Appeal Fund comprises the receipts from the Appeal launched in 2001 to raise funds to finance developments in implementing the Society's Corporate Plan. The Programme Fund is a new fund created by the Council to provide support for meetings activities.

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

	Robert Cormack Bequest	Lessells Trust	Auber Bequest	Prizes Fund	Dryerre Fund	Other Funds	Restricted income	**Total**
	£	£	£	£	£	£	£	**£**
19 Restricted Funds								
At 1 April 2004	94,166	333,609	295,369	64,598	397,525	28,787	-	**1,214,054**
Donations & grants	-	9,445	-	-	-	41,079	249,372	**299,896**
Income from activities	-	-	-	-	-	-	1,735,684	**1,735,684**
Investment income	4,384	15,532	13,752	3,008	18,508	1,340	-	**56,524**
Less								
Direct Expenditure	(4,240)	(23,474)	(1,000)	(1,541)	(15,875)	-	(1,742,476)	**(1,788,606)**
RSE Admin and staff	(1,775)	(6,289)	(5,568)	(1,218)	(7,494)	(543)	(242,580)	**(265,467)**
Surplus/(deficit) for year	(1,631)	(4,786)	7,184	249	(4,861)	41,876	-	**38,031**
Net gain on investment assets								
Realised	942	3,336	2,953	646	3,975	288	-	**12,140**
Unrealised	6,174	21,874	19,367	4,236	26,065	1,887	-	**79,603**
At 31 March 2005	99,651	354,033	324,873	69,729	422,704	72,838	-	**1,343,828**

"Prizes Fund" comprises The Keith Fund, The Neill Fund, The Makdougall-Brisbane Fund, The Gunning-Victoria Fund, The James Scott Prize Fund, The Bruce-Preller Lecture Fund, The W.S. Bruce Memorial Fund, The Dr D.A. Berry Fund, The Henry Duncan Prize Lecture Fund and The BP Prize Lecture in the Humanities Fund. "Others" comprise the Piazzi-Smyth Legacy Fund, the Retailing Seminar Fund, the Fleck Bequest Fund and the CASS Fund. The Retailing Seminars Fund arises from the donation of the surplus from an earlier series of meetings that publicised research in the retailing sector. The fund is to be used to support meetings in this area.
Under the terms of the Lessells Trust the University of Glasgow is entitled to 10% of additional amounts received by the Society from the Trust. The balance included in Creditors at 31 March 2005 represents the total sum apportioned but not yet paid over to the University (note 16).

	General Fund	Designated Funds	Restricted Funds	**2005 Total**	2004 Total
20 Analysis of Assets between Funds	£	£	£	**£**	£
Fund balances at 31 March 2005 are represented by:					
Tangible fixed assets	-	2,420,445	-	**2,420,445**	2,475,829
Investments	158,886	676,813	1,343,828	**2,179,527**	1,989,023
Loan to RSE Scotland Foundation	-	1,984,752	-	**1,984,752**	2,031,560
Current assets	56,072	-	6,213	**62,285**	86,588
RSE Scotland Foundation current account	(8,648)	-	-	**(8,648)**	(15,330)
Deposits	8,500	681,659	118,341	**808,500**	800,000
Cash at bank	55,477	-	322,508	**377,985**	74,259
Current liabilities	(97,790)	-	(447,062)	**(544,852)**	(394,281)
	172,497	5,763,669	1,343,828	**7,279,994**	7,047,648

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

21 Pension Costs

a) USS

The Society participates in the Universities Superannuation Scheme, a defined benefit pension scheme which is externally funded and contracted out of the State Second Pension (S2P). The assets of the Scheme are held in a separate trustee-administered fund. The fund is valued every three years by a professionally qualified independent actuary using the projected unit method, the rates of contribution payable being determined by the trustee on the advice of the actuaries. In the intervening years the actuaries review the progress of the scheme. It is not possible to identify each institution's share of the underlying assets and liabilities of the scheme and hence contributions to the scheme are accounted for as if it were a defined contribution scheme. The cost recognised within the deficit for the year is equal to the contributions payable to the scheme for the year.

The latest actuarial valuation of the scheme was at 31 March 2002. The most significant assumptions, those relating to the rate of return on investments and the rates of increase in salary and pensions, are as follows:

	Past Service Liabilities	Future Service Liabilities
Investment return	5%	6%
Salary Increase	3.7%	3.7%
Pension Increase	2.7%	2.7%

At the valuation date the market value of the scheme’s assets was £19,938 million and the value of past service liabilities was £19,776 million leaving a surplus of assets of £162 million. The value of the assets represented 101% of the benefits that had accrued to members, after allowing for expected future increases in earnings. The contribution rate payable by the Society was 14.0% of pensionable salaries. The actuary has confirmed it is appropriate to take the pension charge to be equal to the actual contribution paid in the year.

b) Lothian Pension Fund

The Society also participates in the Lothian Pension Fund, a defined benefit pension scheme established under local government pension fund regulations. This scheme has determined that it is possible at a cost to ascertain the share of assets and liabilities relating to individual admitted bodies. The assets of the Scheme are held in a separate trustee-administered fund. The fund is valued every three years by a professionally qualified independent actuary using the projected unit method, the rates of contribution payable being determined by the trustee on the advice of the actuaries. In the intervening years the actuaries review the progress of the scheme.

The latest actuarial valuation of the scheme was at 31 March 2002. The major assumptions used by the actuary were that, over the long term, the return on the scheme’s assets would be 6.2% per annum, salary increases would average 4.1% per annum and present and future pensions would increase at a rate of 2.6% per annum.

At the valuation date the market value of the scheme’s assets was £1,792 million and the value of past service liabilities was £1,866 million. The value of the assets represented 96% of the benefits that had accrued to members, after allowing for expected future increases in earnings. The contribution rate payable by the Society in the year was 300% of employees' contributions of 6% of pensionable salaries, amounting to 18.0%. The actuary has confirmed that it is appropriate to take the pension charge to be equal to the actual contribution paid during the year.

Whilst the Society continues to account for pension costs in accordance with Statement of Standard Accounting Practice 24 'Accounting for Pension costs', under FRS 17 'Retirement benefits' the following transitional disclosures are required:

The valuation at 31 March 2002 has been updated by the actuary on an FRS 17 basis at 31 March 2005; the major assumptions used in this valuation were:

	2005	2004
Rate of increase in salaries	**4.4%**	4.4%
Rate of increase of pensions in payment	**2.9%**	2.9%
Discount rate	**5.4%**	5.5%
Inflation assumption	**2.9%**	2.9%

The assumptions used by the actuary are the best estimates chosen from a range of possible actuarial assumptions which, due to the timescale covered, may not necessarily be borne out in practice.

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

21 Pension Costs b) continued

Scheme assets

The fair value of the scheme assets, which are not intended to be realised in the short term and may be subject to significant change before they are realised, and the present value of the scheme's liabilities, which are derived from cash flow projections over long periods and thus inherently uncertain, were:

	Expected return	**Value at 31 March 2005 £'000**	Expected return	Value at 31 March 2004 £'000
Equities	**7.7%**	**1,643,981**	7.7%	1,553,820
Bonds	**4.8%**	**138,205**	5.1%	116,210
Other- Property	**5.7%**	**197,312**	6.5%	149,098
Cash	**4.8%**	**83,456**	4.0%	18,096
Whole scheme assets	**7.2%**	**2,062,954**	7.2%	1,837,224

	£'000	£'000
Of which RSE share	**485**	345
Present value of scheme liabilities	**(561)**	(429)
Surplus/(deficit) in the scheme- Net pension (liability)/ asset	**(76)**	(84)

The amount of this pension deficit would have a consequential effect on reserves. The movement in the net pension asset/ liability during the year comprised:

		£'000
Deficit at 1 April 2004		**(84)**
Current service cost		**(68)**
Employer contributions		**74**
Net return on assets-		
Expected return on employer assets	29	
Interest on pension scheme liabilities	(26)	
		3
Actuarial gains		
Actual return less expected return on pension assets	13	
Experience losses on Scheme liabilities	-	
Changes in assumptions underlying present value of scheme liabilities	(14)	
		(1)
Deficit at 31 March 2005		**(76)**

If FRS 17 had been fully adopted the movements would have been recognised in arriving at net incoming resources other than the actuarial loss which would have been included in unrealised losses.

c) Pension Charge

The total pension charge for the year was £89,740 (2004 - £66,274)

22 Transactions with Council members

No member of Council received any payments other than reimbursement of expenditure on travel and subsistence costs actually and necessarily incurred in carrying out their duties as Councillors and Officers. The aggregate of such reimbursement to the Council members amounted to £3,930 (2004 - £3,418).

23 RSE Scotland Foundation

RSE Scotland Foundation is a charitable trust, Scottish charity number SCO24636. It was created in March 1996 with the object of advancing the education of the public in Scotland in science and engineering and in so doing to conserve the scientific and cultural heritage of Scotland. The President, General Secretary, Treasurer, Curator and a Vice-President of the Society are ex officiis Trustees of the Foundation, which draws on the resources of the Society in carrying out its objects. The Foundation also has five nominated Trustees. The Foundation became publisher of the Society's journals under a Publications Rights Licence effective from 1 January 1997.

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

23 RSE Scotland Foundation (continued)

On 1 July 1997 the Society granted to the Foundation a 50-year lease over 26 George Street carrying an obligation to refurbish the building within a three year period. The Council of the Society agreed to make funding of up to £2.3 million available to the Foundation in support of the refurbishment. The agreed terms of the loan are as described in note 14 b. A waiver of interest was agreed for the years ending 2002, 2003 and a partial waiver in 2004 and 2005 to assist the Foundation in extinguishing its deficit of net assets.

At 31 March 2005 the financial position of the RSE Scotland Foundation was as follows:

	2005	2004
	£	£
Net Liabilities		
Fixed assets	**1,961,467**	2,013,615
Current assets	**147,961**	91,853
Current liabilities		
Loan from Royal Society of Edinburgh	**(46,808)**	(46,808)
Other	**(105,525)**	(144,537)
Creditors over one year:-Loan from Royal Society of Edinburgh	**(1,937,944)**	(1,984,752)
Represented by		
General Fund	**19,151**	(70,629)

The Statement of Financial Activities for the year ended 31 March 2005 was as follows:

	2005	2004
Incoming resources	**£**	£
Donations, grants and similar incoming resources	**1,557**	-
Charitable activities		
Publications	**126,250**	93,480
Licence fees	**93,725**	91,400
Conference Facilities letting (net)	**92,323**	63,760
Activities for generating funds		
Rental and service charges receivable	**202,169**	196,800
Investment income - bank interest	**603**	216
	516,627	445,656
Cost of generating funds		
Building management	**(60,162)**	(52,153)
Net incoming resources available for charitable application	**456,465**	393,503
Charitable expenditure		
Conference facilities hire	**59,199**	53,571
Publications	**127,807**	93,480
Building costs recovered	**93,725**	91,400
Management and secretariat	**41,487**	29,747
Depreciation on leasehold improvements	**44,467**	44,467
Total Charitable expenditure	**366,685**	312,665
Total resources expended	**426,847**	364,818
Net incoming resources and movement in funds for the year	**89,780**	80,838
Balance brought forward	**(70,629)**	(151,467)
Balance carried forward	**19,151**	(70,629)

The Council of the Society has confirmed to the Trustees of the Foundation that they will continue to support the Foundation and will not call for the repayment of the current account balance in the foreseeable future.

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

24 Supplementary Information ; grants, donations, receipts

a) Scottish Executive Grants

Income	**2005** £	2004 £
Enterprise and Lifelong Learning Department		
Promotion of Research including French/ Scottish PhD studentships	**668,542**	563,813
Scottish Science Advisory Committee	**160,000**	150,000
Activities grant	**411,000**	369,087
International activities	**119,976**	125,000
Other Departments support		
Scotland in the Netherlands- Brain Science event	**18,000**	-
Science Scotland publication	**15,000**	-
	1,392,518	1,207,900

Allocated to Functional Activities	Direct Costs £	Staff and other costs £	**2005 Total** £	2004 Total £
Scottish Science Advisory Committee	150,000	-	**150,000**	150,000
Meetings	-	119,826	**119,826**	126,062
Educational activities	-	60,839	**60,839**	27,677
Publications office	25,495	10,797	**36,292**	19,998
Evidence advice and comment	-	76,331	**76,331**	69,946
Promotion of research	545,708	76,834	**622,542**	563,813
Joint Scottish/ French PhD studentships	36,000	10,000	**46,000**	-
International activities	125,835	27,139	**152,974**	125,607
Management and secretariat	-	79,081	**79,081**	79,457
Buildings				
- Establishment expenses	-	35,209	**35,209**	31,822
- Maintenance	-	13,424	**13,424**	13,518
	883,038	509,480	**1,392,518**	1,207,900

The Scottish Executive provides grant-in-aid under the powers of S.23 National Heritage (Scotland) Act 1985 to meet the costs of SEELLD Research Fellows, and costs of activities including the cost of maintaining the Society's premises and a share of the Society's staff and other costs. In addition to the cash grants set out above, the Society benefited for part of the year from a staff secondment from the Scottish Executive, which has been included in the accounts at its value to the Society of £11,375.

Expenditure in relation to the Scottish Science Advisory Committee comprised:

	2005 Total £	2004 Total £
Chairman's fee, salaries and other staff costs	**91,469**	95,504
Establishment	**14,589**	15,079
Office costs	**4,120**	4,302
Travel and subsistence	**6,784**	4,767
Committee and working groups	**7,452**	6,734
PR and publicity	**15,786**	10,918
Printing	**4,446**	14,351
Professional services	**4,726**	4,569
	149,372	156,224
Less balance brought forward	**(1,695)**	(7,919)
Balance carried forward	**12,323**	1,695
	160,000	150,000

This includes amounts paid to the Society for use of office space and services.

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

24 Supplementary Information; grants, donations, receipts (continued)

b) Donations

	BP Research Fellowship Trust	Caledonian Research Foundation	Scottish Enterprise	Lloyds TSB Foundation for Scotland	Wellcome Trust
	£	£	£	£	£
Income					
Promotion of research -receipts	120,060	21,186	615,953	301,750	6,041
Transferred to deferred income	-	-	-	(287,773)	-
Deferral brought forward	-	-	-	239,742	-
Meetings Income	-	26,263	-	-	-
	120,060	47,449	615,953	253,719	6,041
Costs					
Promotion of research	111,335	16,804	532,688	229,919	5,291
Conference & lectures	-	17,763	-	-	-
RSE administration and staff costs	8,725	12,882	83,265	23,800	750
	120,060	47,449	615,953	253,719	6,041

The BP Research Fellowship Trust supports postdoctoral fellowships in Scottish HEIs. The Trustees of the Trust are the President, General Secretary and Treasurer of the Royal Society of Edinburgh.
The Caledonian Research Foundation supports postdoctoral fellowships in biomedical sciences and European visiting fellowships, a prize lecture and an international conference.
The Wellcome Trust sponsors a series of research workshops.
The Lloyds TSB Foundation for Scotland supports postdoctoral Fellowships, postgraduate studentships and lectures and conferences to fund and disseminate research aimed at improving the quality of life for an ageing population.

c) Donations in Support of Meetings

The Society gratefully acknowledges all those who make donations in support of meetings. The companies, trusts and other donors that made donations of £1,000 or more in the year ended 31 March 2005 are as follows:

Edinburgh Technopole
FM Global Research
Scottish Association for Marine Science
Scottish National Heritage
Scottish Rural Property & Business Association
Shell UK Ltd
Sir Walter Gibley
Statoil ASA

25 Analysis of Net Funds

	At 31 March 2005	Cash Flows	At 1 April 2004
	£	£	£
Cash at bank	**377,985**	303,726	74,259
Deposits - Restricted funds	**118,341**	(90,614)	208,955
- Designated funds	**681,659**	90,614	591,045
- General Fund	**8,500**	8,500	-
	1,186,485	312,226	874,259

NOTES TO THE FINANCIAL STATEMENTS
YEAR ENDED 31 MARCH 2005

26 Main Activities	2004/05 Number	2003/04 Number
Meetings		
Lectures	**20**	22
Symposia/Conferences/Seminars	**6**	10
Debates/ discussion fora	**4**	1
Workshops	**3**	3
International activities		
Exchange visits- bilateral (weeks)	**8**	18
Exchange visits- open (weeks)	**37**	19
Seminars and discussion forum	4	3
Voyages of discovery- visits by overseas industrialists	-	2
Science Scotland international magazine (issues)	**2**	2
Visitors to/ from overseas institutions	**7**	9
Young People's events		
Science Masterclasses	**36**	32
Maths Masterclasses	**16**	12
Schools Lectures	**16**	13
Christmas Lectures	**2**	2
Discussion Forum	**1**	1
RSE Roadshow	**2**	1
Physics masterclasses	-	4
Science summer camp	**1**	1
Publications (issues)		
Proceedings A	**6**	6
Transactions	6	3
Directory & Review	**2**	2
ReSourcE (/RSE News)	**3**	3
RSE Fellows		
Number of Fellows	**1410**	1385
Candidates for Fellowship	**192**	216
Research Fellowships and Scholarships		
Postdoctoral Research Fellows in post	**21**	15
Support Research Fellows	**6**	5
European Visiting Research Fellows	**7**	7
Enterprise Fellows in post	**26**	23
Applications for Research Fellowships	**103**	119
Studentships appointed	14	14
Prizes and Grants		
Royal medals	**2**	3
Prizes awarded	**4**	2
Grants awarded	**23**	23
Gannochy Trust award	**1**	1
Policy evidence and advice		
Major inquiries	-	1
Position papers	**1**	-
Submissions to Government and public agencies	**26**	24
Central Administration		
External events held at RSE 22-26 George Street	**163**	130

Royal Society of Edinburgh Schedule of Investments- movements at valuation. Year Ended 31 March 2005

Investment Current Holdings	Closing No.	Opening Market Value £	Purchase Cost £	Sales Proceeds £	Gain/(Loss) on Sale £	Revaluation for Year £	Closing Market Value £
Gilts							
7.5% Treasury 2006	7,716	-	8,170			79	8,249
7.25% Treasury 2007	4,632	-	4,983			54	5,037
Treasury 5.75% 2009	105,000	112,657				-1,014	111,643
Treasury 5% 2012	130,000	132,899				- 39	132,860
Treasury 5.5% 2008/12	130,000	134,574				-1,209	133,365
Treasury 5% 2014	130,000	133,185				312	133,497
Other Fixed Interest							
R B of Scotland 7.387% 2010/49	70,000	80,551				-2,465	78,086
Investment & Unit Trusts							
Aberforth Geared Cap & Int Trust	45,000	72,450		25,365	-510	4,275	50,850
Aberforth Smaller Co Trust plc	10,000	45,800				7,100	52,900
Duneden Income Growth Inv Trust	57,000	97,185				16,815	114,000
Murray International Trust	27,600	107,088				15,732	122,820
Scottish Mortgage & Trust	34,000	103,700				9,520	113,220
UK Balanced Property Trust	-	50,738		53,410	2,672	-	-
Financials							
Barclays	11,824	45,529	11,715			6,724	63,968
HSBC Holdings Ord US$ 0.50	7,500	40,450	20,885			1,440	62,775
Land Securities Group		49,050		51,791	2,741		-
Legal & General Group Ord 2.5p	68,000	64,430				12,580	77,010
Lloyds TSB Group	14,000	20,262	46,209			449	66,920
Provident Financial	8,500	-	50,312			9,868	60,180
Prudential	4,984	21,480	850	913	913	2,889	25,219
Royal Bank of Scotland Ord 25p	3,700	38,963	21,359			1,986	62,308

Royal Society of Edinburgh Schedule of Investments- movements at valuation. Year Ended 31 March 2005

Investment Current Holdings	Closing No.	Opening Market Value £	Purchase Cost £	Sales Proceeds £	Gain/(Loss) on Sale £	Revaluation for Year £	Closing Market Value £
Consumer							
Diageo	8,000	37,577	20,615			1,488	59,680
Unilever Ord 1.4p	7,142	38,495				-1,142	37,353
Pharmaceuticals							
Astrazenica	1,772	44,153	470			-7,659	36,964
Glaxo Smith Kline Ord 25p	3,282	33,108	2,071			4,632	39,811
Services							
Associated British Ports Holdings £0.25	8,100	25,920	12,042			959	38,921
BAA	8,176	1,200	496			6,011	47,707
Firstgroup	3,850	20,655		14,007	3,680	2,888	13,215
GUS	3,350	25,092				5,427	30,519
Rank Group	14,200	47,570				-8,697	38,873
Reed Elsevier	-	32,261		34,104	1,843	-	-
Sainsbury (J) Ord 25p	13,037	38,852		5,215	-1,090	5,228	37,775
Telecommunications							
BT Group	-	-	437	465	28	-	-
Vodaphone Group	-	-	1,734	1,810	76	-	-
Utilities							
National Grid Transco	8,485	36,120	397			5,081	41,598
Scottish & Southern Energy	-	35,750	1,053	46,263	9,460	-	-
Scottish Power	20,000	35,029	44,297			2,474	81,800

Royal Society of Edinburgh Schedule of Investments- movements at valuation. Year Ended 31 March 2005

Investment Current Holdings	Closing No.	Opening Market Value £	Purchase Cost £	Sales Proceeds £	Gain/(Loss) on Sale £	Revaluation for Year £	Closing Market Value £
Industrials							
BOC Group	3,000	27,015				3,555	30,570
Rotork Ord 5p	7,500	28,875				6,075	34,950
Resources							
BP Ord US$0.25	8,868	38,760	2,006			7,875	48,641
Shell Transport & Trading Org 25p	9,578	32,351	2,021			11,124	45,496
Lord Fleck of Saltcoats Bequest							
BAE Systems	-	-	383	383	-	-	-
BG Group	-	-	795	795	-	-	-
BHP Billiton	-	-	870	870	-	-	-
British Land Co	-	-	1,395	1,395	-	-	-
Compass Group	-	-	291	291	-	-	-
Imperial Tobacco	-	-	554	554	-	-	-
Next	-	-	1,956	1,956	-	-	-
Northern Rock plc	-	-	519	519	-	-	-
Reed Elsevier	-	-	1,059	1,059	-	-	-
Rentokil Initial	-	-	289	289	-	-	-
Rio Tinto	-	-	595	595	-	-	-
tesco	-	-	1,303	1,377	74	-	-
Wolseley	-	-	672	672	-	-	-
TOTALS	**997,796**	**£1,969,774**	**£262,803**	**£244,098**	**£19,886**	**£130,414**	**£2,138,780**

Gannochy Trust Innovation Award Prize Lecture

Dr Ian Underwood FRSE
Director of Strategic Marketing, MicroEmissive Displays Ltd

7 March 2005

Over twenty years of research and innovation, which have led to the creation in Scotland of a world record-breaking technology, were recognised in October 2004 when Dr Underwood was named winner of the *Gannochy Trust Innovation Award of the Royal Society of Edinburgh.* The coveted title went to Dr Underwood in recognition of the contribution he has made throughout his career to the development of ground-breaking optical and display devices here in Scotland.

Ian Underwood's work has centred around two distinct technologies – Liquid Crystal on Silicon (LCoS) from the mid 1980s until the late 1990s and, since then, Light Emitting Polymer on Silicon (LEPoS). LEPoS actually emits light and does not require sunlight or a lamp to illuminate it. In 1999, Dr Underwood co-founded MicroEmissive Displays (MED) Ltd. with former RSE Enterprise Fellow, Dr Jeff Wright. MED designs and produces ultra-miniature television-quality screens based on light emitting polymers (LEP) for use in consumer electronic products such as digital still cameras, digital video cameras and personal viewers for mobile devices.

MED's screens typically use at least 70 per cent less power than commonly used LCD microdisplay modules, and it is anticipated that this development will lead to smaller, lighter cameras with longer battery life. MED's technology can also produce a highly magnified viewable virtual image in space, as is the case in electronic viewfinders of the type found in camcorders or digital cameras and in wearable or headset displays. There is also potential for this advanced technology to be a market enabler for hands-free and wearable headset displays that will allow users hands-free access to information, infotainment and entertainment on the move, probably in conjunction with a mobile phone or other wireless devices. Personal wearable displays are likely to have application in fields including medical, professional, security and industrial environments.

Gunning Victoria Jubilee Prize Lecture

Professor Peter G Bruce FRSE
Professor of Chemistry, University of St Andrews

9 May 2005

ENERGY : A CHALLENGE FOR MATERIALS CHEMISTRY

The Gunning Victoria Jubilee Prize Lectureship was founded in 1887 by Dr R H Gunning, who spent his much of his life in Brazil and was particularly noted in the words of our General Secretary, "for his generosity". This particular award is made quadrennially in recognition of original work by scientists resident in or connected with Scotland.

Professor Peter Bruce is Professor of Solid State Chemistry at the University of St Andrews. He was born and educated in Aberdeen, completing his PhD at Aberdeen University before moving to Oxford where he spent four years in the Inorganic Chemistry Laboratory. His first permanent academic post was at Heriot-Watt University, here in Edinburgh. In 1991 he moved to the University of St Andrews, where he established the St Andrews Centre for Advanced Materials and was for six years, head of the Chemistry Department. Peter Bruce was elected to a Fellowship of the Royal Society of Edinburgh in 1995, at the age of 38. He has held research fellowships from the Royal Society, the Royal Society of Edinburgh and the Leverhulme Trust. He is a recipient of: several Royal Society of Chemistry awards, including the Materials Chemistry Award, the Bielby Medal, the Interdisciplinary Award and the John Jay Lectureship and Medal. He also received a Royal Society Wolfson Merit Award in 2001, one of the first in Chemistry. He has published more than 200 papers in leading journals, including *Nature* and *Science*, and he holds several patents on materials for energy storage and conversion.

Peter Bruce, is awarded this Prize in recognition of his expertise in two major fields of solid state chemistry. He has pioneered methods for elucidating the structures of molecular compounds using power x-ray diffraction, greatly extending the technique so that the structures of large and complex molecular solids may now be determined. He has also made major advances in the field of energy-related materials, designing new solid-state batteries for use in computers, mobile telephones, etc. He has developed new materials for electrodes (some based on lithium manganate are now being commercialised) and he has made special contributions both to the understanding of how the polyelectrolytes used in these batteries work, and to the design and production of new more effective electrolytes. This has included discovering an entirely new class of crystalline solid electrolyte.

What I want to do today, is to tackle one of the greatest problems facing humanity in the 21st Century, and that is global warming. Indeed Sir David King, the Chief Scientist Advisor to the UK Government, has described this as the greatest challenge ahead of us, and he got into some hot water for doing so, but I have to say that I agree with him. If you look at this dispassionately, it really is the greatest threat to humanity in this century.

Chemistry and materials chemistry hold the key to developing new devices that can generate and store electrical energy in a safer, cleaner more sustainable fashion and I plan to expand on this over the next 40 minutes or so.

Hopefully, this is a reasonably non-scientific slide, to start off with. This is, as you can see, a map of the world, and we see these regions shaded in red. These regions will be flooded by 2080, if we don't mitigate CO_2 emissions. If we don't slow production of CO_2 in its current and its projected levels, then this would be the result. The blanket of CO_2 which arises of course from burning fossil fuels, largely to produce energy, creates the greenhouse effect, warms the planet. The ice caps melt, and the water levels rise. Right through the Indian subcontinent, through Malaysia and Indonesia, the flooding will take place as a result. Many people will lose their homes; many people, of course, will lose their lives. This is very much the area that the recent tsunami disaster was in, and I have to say that was almost really just a foretaste of what the effect of global warming would be in these regions. It is a major problem facing humanity. We live in a global village, so although the problems appear to be here, they of course affect us all throughout the world.

Now there are two approaches to tackle this. You can either, try and roll back technology, going back to an earlier era of low energy consumption, which I think is unrealistic and unlikely to be acceptable to the majority of people in the western world, or you can try and develop new technologies. New technologies that will generate and store electrical energy in a cheaper, cleaner more sustainable fashion than has been the case with using fossil fuels. So that is the target that we have to address.

This is the other side of the fossil fuel energy coin. Here you see a plot of the production of fossil fuels versus time, starting from the 1930s and projected up to 2050. As you can see production of fossil fuel has risen throughout this period of time. You can see a peak here at around year 2010, and then fossil fuel production will fall. I think, there are certain doubts that we can all have about the exact position of this peak. It will probably shift to the right, this is what generally happens. Interestingly enough, speaking as someone who grew up in Aberdeen in the early 70s, and witnessed the development of oil exploration off-shore there, the projections at the time were that there would be no oil in the North Sea by the turn of the century. Now, clearly, that is not the case, there is still oil there. This peak will often move to the right, and you will always find a little more oil, but eventually there will be a downturn.

This is a valuable and finite resource, we should be using this to make new materials and chemicals and pharmaceuticals, not burning it simply to produce energy. So, again, we have to develop new ways of generating and storing electrical energy.

Here are some ways of generating electrical energy in a cleaner and more sustainable fashion. We have wave power and wind power, these resources of clean energy are in abundance in Scotland. And indeed Scotland, which of course has been a major player in the conventional fossil fuels area, has the potential to become a major player in clean energy too. In clean energy economy, and clean energy science and technology, if we make the right decisions then we can do well in this context. It is very important because our economy has a significant proportion of fossil fuels at its heart.

I put this rather amusing picture illustrating the use of wind power, a windmill rather than a wind turbine, for two reasons. First, to remind us that this is a well proven technology, it has been around for many centuries and it works. But it is also interesting that the technologies of several hundred years ago become things of beauty. Wind turbines of today are regarded as a scourge that no one wants in their backyard.

Solar power is another source of clean energy, although perhaps not here in Scotland, but certainly in other parts of the world. We also have other technologies, like fuel cells and nuclear power. Nuclear is perhaps the most contentious of these technologies, but I think it is true to say that if we are going to plug the energy gap over the next 20-40 years, we will probably have to build new nuclear reactors. Even if we develop cleaner forms of energy, and we should, it is unlikely that we would be able to cover the gap between supply and demand, with these alone. I am not enthusiastic about expanding the nuclear power sector, but I think it is probably a reality. It is a reality that Government has not been able to declare as yet, but this is going to be reviewed in the House.

These are generating technologies, and the problem with all of them, particularly wind, wave and solar, is that they don't generate energy according to consumer demand. The sun doesn't shine at night, and we want energy to light homes, etc, and the wind doesn't necessarily blow when we need the power. So the reality of these clean energy technologies for generation, is that they place a far greater demand on the need for energy storage. A far bigger demand would be to store electrical energy, and this has been proven true in the past.

In the last two or three years of euphoria over renewable sources of energy, the generating technologies have been focused on, but people are now beginning to appreciate a holistic solution, what is important is getting energy from a clean source to the consumer. It is no good generating a lot of wind energy, just because the wind happens to be blowing, if the consumer demand isn't there at the same time. So you have to buffer these two things with storage. Storage is a key issue if we are going to deliver clean energy.

Let me take a couple of slides to look at the role that storage plays in the future of clean energy. We can divide things into transport and static applications of clean energy. Let us look at the transport applications first. Around 30% of CO_2 emissions from fossil fuels arises from transportation, and if you look at the phenomenal growth of the car ownership in China, there are one million more cars this year than last year. This is going to grow at a significant rate, thus it is a worsening problem which is becoming more and more significant. We have to tackle emissions from transport if we are going to make a significant impact on CO_2 emissions. I would propose and contend that the dominant technology that will impact on this over the next twenty to forty years will be the hybrid electric vehicle. For the next twenty years, it will be a petrol/battery hybrid, and after that, probably, a fuel cell/ battery hybrid. Hybrid cars are already on the road, you can buy them here in Scotland and throughout the world. This is a Toyota Prius here. You don't plug this car in, it is not a true electric vehicle, the battery inside here is charged by the petrol engine, and it reduces emissions by around 85 - 87% compared to conventional technologies. This is already a proven technology that works and is likely to become a dominant force.

These devices have two power sources, a petrol engine or fuel cell and a battery. The difficulty is that that adds more weight to the car, and it also takes up more space within the vehicle, so you want the battery to be as small and lightweight as possible, and this means that we have to develop advanced batteries.

The other area is the static application, the one that I have already touched on when discussing the use of wave power, for example. These generators tend to be smaller than the large fossil fuel power stations. They tend to be more diverse in the nature of their generating technology, wind, wave, solar, a plethora of different ways of generating electricity, and are more distributed geographically.

These generators are intermittent in supply and this means that storage is required. It is also true that nuclear power stations are not particularly well suited to switching on and off, again storage can be important for them too. In the future, beyond 2025, photovoltaics may become more efficient. The problem with photovoltaics is the conversion efficiency from sunlight to electrical energy is rather low. If that can be improved over the next couple of decades, then photovoltaics, solar energy power, may be a greater contribution to other parts of the world, but again storage will be important.

As a measure of the grid application, we are all used to being connected to the commercial grid, but that is probably not going to be the way for the future, particularly in remote communities, so it is important for Scotland. You may well see even sizeable communities having their own local generating capacity, wind power for example. Again, storage is critical because there is no other way of supplying the energy when the wind isn't there.

Now, there are various ways in which you can store energy, but one of the most attractive is a rechargeable battery. It is a quintessential example of an electrical energy storage device. You first pump electricity into the device and then you extract it when you want to. One of the most promising technologies in that regard is a rechargeable lithium battery. This device is important because it can store up to three times the amount of energy in the same size and weight of a conventional rechargeable battery, such as a lead acid, nickel cadmium or nickel metal hydride battery.

So you have a significant advance in energy storage. This is in an area of energy storage technology which would normally measure improvements in terms of a few percent. This is not like the situation with semi-conductors where you can have 10-fold advance in 18 months. Nevertheless, it is a very substantial leap forward for the performance of technology. Indeed, I think it is true to say that rechargeable lithium batteries are probably the most successful electrochemical technology in the last several hundred years.

These are green batteries, they don't have any heavy metals like lead or nickel cadmium. They are high voltage devices, you can replace three conventional rechargeable batteries, like lead acid batteries, the sort of thing you have in your car, with one lithium battery.

This is a schematic representation of what is inside a rechargeable lithium battery. Virtually everyone who has a mobile telephone or a laptop computer will have one of these batteries inside. Like any battery, it consists of two electrodes, a negative electrode down here, and a positive electrode over here, and we have an electrolyte separating these two electrodes. The negative electrode in a lithium battery in a mobile telephone or laptop computer, contains graphite. Here you see the hexagonal arrangement of the carbons, the sheet structure, the layered structure of graphite. The material of the positive electrode is lithium cobalt oxide. This is also a layered compound that consists of slabs of cobalt oxide, here shown with blue and red, with these layers of lithium ions which can see here between these cobalt oxide layers.

When you charge up the battery, lithium ions move from between these layers of this compound, and cross the electrolyte and become inserted or intercalated between the graphite layers, here. On discharge, the reverse process will occur. So if you are talking on your mobile phone, or typing on your laptop computer, think of all the tiny lithium ions are making their way out of the graphite across this electrolyte and inserting back into these two small slabs of cobalt oxide.

This is what is happening within new technology. It is a beautiful example of materials chemistry, of solid state chemistry in action. The properties of this material are critical for the performance of the device. In fact, this material was developed in the UK, not by me but at some of the early stages I was also involved in this area, and it has made millions of pounds for the UK economy in licensing this technology. There is manufacturing plant of AEA Technology up in Thurso producing lithium batteries based on this technology.

It is a major technology worldwide – 109, that is one (American) billion, cells were sold in 2001 alone. Typically the production doubles each year, so we are talking about massive volumes of production of this technology. The technology is really dominating portable consumer electronics now, these are some of the examples. Mobile telephones I have mentioned before, laptop computers, i-pods, PDA's, cam-corders, all of them almost exclusively powered by rechargeable lithium batteries, because of the benefit that these are small, lightweight batteries that can store a lot of energy.

That is the present, that is where we already are with this technology. What about the future, what about energy storage in the context that I have discussed, not related to consumer electronic products? Before I go into that, let me just take a little step aside, for one slide, and talk a bit about the potential applications of lithium batteries in medicine, which is appropriate in view of our Chairman's interests. Over the next twenty to thirty years, there will be a considerable increase in the use of implantable medical devices, electro-mechanical devices implanted into the human body. All those devices need power, often significant power, and that will come from rechargeable lithium batteries. One example, here is a picture of an artificial heart. The heart is just a pump, and one of the major killers of the elderly in the Western world is heart failure. If we can replace that organic pump by this mechanical pump, you need a power source to drive it. You couldn't just put an ordinary battery inside the body as you can with a pacemaker, because you need a lot more energy than could be delivered by any battery that you could implant. This means that you will have to replace it every few years and it will only last a week or two on a single charge. It has to be rechargeable, and with lithium batteries it means that it could be lighter and smaller. Potentially it could be located subcutaneously and recharged through the skin.

I have been also involved in a different programme involving liver pumps. This picture over here is the picture of a liver of someone who has suffered from cirrhosis. I have to say that cirrhosis is not a disease which most of us will get through the more pleasurable pastimes of our youth of too much alcohol abuse. Most people in the world suffer from cirrhosis as a sort of consequence of hepatitis, maybe 800,000 people each year. If you have cirrhosis of the liver, the only real option is a transplant, and as with everything else, there are insufficient donors. But in collaboration with our colleagues at Hammersmith Hospital in London, we discovered that if you forced blood through the liver in this condition, you could recover some liver function. To do that you have to locate a pump in the portal vein of the liver, which is somewhere around about here. The pump is to be no more than 7mm in diameter and

20mm long, has to rotate at 20,000 revs per minute, and pump 1.5 litres of blood at about 40mm mercury pressure. It is a considerable challenge for the engineers, I can tell you, but it also requires a battery to power it. So that is where we come in.

Another application is a limb actuator. I thought I would show you this little video. Some of you might remember this. This is an extract from a television series in the 1970s called the "Bionic Man". He was involved in some horrific accident and he was reborn, if you like, with all these various electro-mechanical implants, ocular implants, etc. This of course is fiction, certainly it was in the 70s, but this sort of thing will become more of a reality in the future. All of these things will require devices such as lithium batteries.

Let's go back to the energy issue. Why can't we just take those nice lithium batteries that people are making around the world for mobile telephones, and make them bigger for cars, and use them for static energy storage? Well it is not just an issue of scale. You can't use the same materials, the same electrodes and electrolyte materials, and just scale everything up. There are fundamental challenges which have to be addressed in developing this technology for these applications. You need batteries which you can charge and discharge, much faster. For the mobile telephone or laptop, you can charge and discharge them relatively slowly from taking relatively small current. For this sort of application, if you are thinking about a car, you have to charge that battery rapidly and have to discharge it again rapidly when you are accelerating, so that is a step change or a magnitude change in performance. These batteries will have to last a lot longer, which means that instead of 4/500 discharge cycles you might need 10,000 cycles. They also have to be cheaper and safer. Petrol is a remarkably cost-effective way of moving us around, it is a very cost-effective technology. That is why it is very challenging and difficult to replace it in a cost-effective manner. The cost is a serious issue. The technology, which is fine for mobile telephones and laptops, has got to come down in price by orders of magnitude if we are going to make it competitive, and it has to be safer, there are safety issues and I shall show you some of those.

How do we address this? Well the key to this lies in chemistry, and especially materials chemistry. We need new and innovative developments in materials chemistry, new materials with new properties, new combinations of properties, that haven't been available to us before, in order to address these sorts of challenges. We need to innovate in terms of the negative electrode, the positive electrode and the electrolyte. What I want to do now, for the rest of the talk, is to show you some of the things that we have been trying to do in St Andrews in Scotland in order to address these problems for the future of energy storage.

So let us start with the positive electrode that is a lithium cobalt oxide compound. Here is one of the problems with this compound, which will become a serious deficiency in larger batteries. In 2004, the price of cobalt was $12 per pound, in 2005 that is already up to $20, and projected to go up to $50-60 next year. That is a very hefty price hike, it is a major factor in the cost of this technology, and it must be brought down.

This material is not toxic in comparison with lead or cadmium, but is more toxic than we would like it to be. There are also safety issues because in this compound the charge of cobalt atoms is 3+. If you take lithium out of this compound, cobalt has to convert to cobalt 4+, in order to maintain charge balance. Cobalt 4+ , as my chemistry colleagues in the audience know, is a strongly oxidising ion. It is a very reactive ion and it is sitting bathed in an organic electrolyte and that, I have to tell you, is a recipe for problems.

Lithium battery technology which is used in consumer products is relatively very safe, but there have been accidents, particularly in the early years of development. Safety issues, like fires, arose because of the reactive nature of this material when you charge the battery. This problem is multiplied by an order of magnitude when you try to make devices for clean energy storage. Also, you can move and insert only half a lithium per cobalt, and the more lithium you can move and insert, the more charge you will store, the more energy you will store, the better the battery will be. The limit of half a lithium is something we have to address.

These are just some of the deficiencies. I haven't listed all of them for the materials used in the current generation of rechargeable lithium batteries.

This is the one of the materials we developed in order to address the problem, lithium manganese oxide. Now the sharp eye will notice that on paper transformation from lithium cobalt oxide to lithium manganese oxide simply involves rubbing out cobalt from the structure, and putting manganese in its place, it is very easy. We wished it was as simple as that. What seems to be a very simple paper exercise is not quite as simple in terms of experimental chemistry. You cannot make this material using the same methods that are used for many years to prepare lithium cobalt oxide. We were fortunate to be the first to discover how to make this material using a different route. Lithium manganese oxide is a crystalline material, as can be seen from the arrangement of the atoms shown here. We have layers of oxygen, layer of manganese, another layer of oxygen. And there we have layers of lithium, these red circles correspond to positively charged lithium atoms sitting there in sheets. So it is similar in structure to the lithium cobalt oxide, but crucially replacing cobalt, which is where the problem lies, with manganese, and manganese helps us a great deal.

Manganese is around 1% the cost of cobalt, so it reduces the costs. It is safer because, when you remove lithium from lithium manganese oxide, you form manganese dioxide. Manganese dioxide has been around from all over the environment for many, many years. You can dredge it out of the ocean bed, silt, the white cliffs of Dover, believe it or not. It is quite a benign material which is much safer than cobalt oxide. Toxicity is also lower, and you can remove and insert more lithium, which means better energy storage.

So here is some data, I shall just take you through this briefly. What we have done here, is we have made a battery with lithium cobalt oxide, a conventional battery that you can buy when you go to the local electronics shop, and we have measured the amount of lithium that you can remove and insert in lithium cobalt oxide, and that is what plotted here. Each of the points on the graph corresponds to a charge/discharge cycle of the battery, from zero to fifty. From here what we see is we can remove and insert a little less than half of the lithium per cobalt in this material.

This other curve is for lithium manganese oxide. Here we can remove and insert 0.75 lithium per each manganese. This means that more charge and more energy can be stored. That is a significant improvement. And you can see that the line is very flat which means that there is no drop-off in performance during cycling. After fifty cycles you can store the same amount of energy as after one cycle. That is a very important feature. The material is cheaper, safer, less toxic than the cobalt-based material. We have now licensed it to a couple of companies who are investigating of how to scale up the production. In the laboratory we make maybe one or two grams of material while every commercial lithium cell contains nearly 20 grams. You can do your mathematics, 10^9 x 20 grams, it is a lot of grams of this material, so you have to make this stuff in large quantities.

Let us move to the other electrode, the negative electrode. The negative electrode is something we are all familiar with since it is graphite. Here is the crystal structure of graphite, a hexagonal arrangement of atoms in graphite forming sheets, as you can see. This other picture is a very high magnification view of a grain of graphite extracted from a lithium ion cell after cycling. You can see the layers there, but you also see that they are not nice and flat and parallel to each other. They are all crinkled and curved. What has happened here is exfoliation. The liquid electrolyte penetrates between those carbon layers, prising the graphitic sheets apart and causing their fragmentation. That is a serious issue which reduces the life time of a battery.

The other problem is that the potential difference at which lithium is inserted into graphite is very similar to the voltage at which you can plate lithium metal on the surface. You are familiar with electroplating of, say, silver which has been around for a long time. In this case though, this is not silver but lithium which is being plated on the surface, and lithium is very reactive. Again, we have an important safety issue here.

How are we going to address this problem? We have to move away from graphite but what are we going to use? It turns out that perhaps nanomaterials will hold the key to this problem. At the moment there is a lot of talk about nanomaterials in many areas. It is true to say that they have a unique role to play in energy devices. Nanomaterials are materials which have at least one dimension on the scale of 1,000-millionth of a metre. Simply by making materials very small, you can have a profound influence on their properties. Perhaps the most famous nanomaterial of all is Buckminsterfullereine, the C_{60} molecule, shaped like a football with sixty carbon atoms. Harold Kroto with his colleagues won the Nobel Prize for discovering that material.

Perhaps a more useful material would be carbon nanotubes? In nanotubes, graphitic sheets are folded forming hollow cylinders while preserving the hexagonal arrangement of carbon atoms. There is a lot of interest in carbon nanotubes. Unfortunately, carbon nanotubes are not sufficient for what we need because of the same problems as with graphite. We have to move further away from graphitic structures and work on the nano scale but with more complex inorganic materials, like titanium dioxide.

You are all familiar with titanium dioxide. You appreciate it because if you are using a white paint around the house, it is titanium dioxide which makes it white. It is a well known and well understood material which is already in the environment and has been for a long time. On this slide you see a rather different form of titanium dioxide, a nanomaterial form. What you see on the left here, is a very high magnification image from a transmission electron microscope. It shows you nanotubes of titanium dioxide. We are looking at tubes which have been slit down along their axes. The parallel lines represent the walls, which are built from titanium dioxide, and there are hollow centres. The diameter of each tube is 100-millionth of a metre. On the left you see titanium dioxide wires which are solid objects. They have similar diameters. These are new forms of titanium dioxide which were not available to us before. It turns out that these materials have very attractive properties as electrodes for lithium batteries, because you can insert a lot of lithium into these materials and take it out again. Here is another schematic representation of a lithium battery but with the graphite replaced by titanium dioxide nanotubes. As you charge the battery, lithium ions will move across the electrolyte, and insert into those tiny little tubes the, and they will move in the opposite direction when you discharge the battery.

This is perhaps one of the most technical slides, but let me take you through it briefly. What we have done here is we have made an electro-chemical cell, a battery if you like, and we are charging that battery, with lithium ions going into those titanium dioxide nanowires. The potential of this electrode is shown on the vertical axis. You can see a nice smooth curve here that shows us we can insert and take out 0.9 lithiums per titanium. Remember that in the cobalt oxide we couldn't even get half of lithium? Here we are able to remove and insert 0.9 lithiums per titanium, so there is a lot more lithium storage in this material.

This curve simply shows that you can take lithium out and put it back in many times and very efficiently. This material is also cheap and safe. One of the things about nanomaterials is that many of them are being produced in milligram quantities, maybe gram quantities. A lot of nanomaterials are being made by rather exotic or difficult methods, which are difficult to scale up in order to produce larger quantities. Here is a method, which I don't have time to go into, which would make this material cheaply and in relatively large quantities.

Let us turn to the last part of the lithium battery, the electrolyte. As I mentioned already, the electrolyte is made from an organic material, an organic liquid. The problem with organic liquids is that they tend to be flammable and volatile, so they can escape from the battery. You need a mechanical separator, some sort of coarse membrane, to keep the two electrodes apart in order to avoid short circuiting. The separator can be then impregnated by the liquid electrolyte. It would be very nice if you could replace that liquid by a solid, particularly a solid polymer. A polymer would be ideal because it has the right mechanical properties. It is solid, so you can keep the electrodes apart, and it is soft and flexible so that it can give good contact with the electrodes.

The Holy Grail of lithium ion batteries is to replace the liquid electrolyte with a solid polymer membrane. There are various advantages of a solid polymer. No liquids to leak out, no problem with flammability, no need for a mechanical separator. The polymer does everything; it separates as well as conducts the ions. You can also have a solid state construction which is attractive, and again for reasons I don't have time to go into, you get a higher energy density, more energy in the same size and weight of the cell. This is a picture of a polymer electrolyte. It looks like a piece of a plastic, but this material can conduct like a liquid electrolyte.

How on earth is that possible? You can understand how ions can move around in a liquid. You take common table salt, add it to water and the ions in the salt break up. The sodium ions and chlorine ions can float around in a solution, it is not difficult to understand how ion motion might be relatively easy. How does this solid polymer conduct? Here is my representation of ion transport in a solid polymer. Polymer is made up of long chain molecules, with atoms strung together in great long chains; imagine 'snakes' of polymer chains. You can see these snakes are pretty disordered; you can't really spot any regular arrangement here. That is true in amorphous polymers, which have no regular structure.

An important characteristic for amorphous polymers is the glass transition temperature. Glass transition temperature is the point at which the chains start moving around, sliding over each other, pretty much like the snakes in the picture. As this happens sites will open up randomly in this polymer matrix, in which ions will be randomly distributed. Once the chains create new pockets, new holes, new sites for the ions to move into, the ions will start moving through the polymer. Thus the ion transfer is facilitated by the motion of polymer chains, by local dynamics of polymer chains.

For the last 30 years everyone has believed, as the text books will tell you, that this is the only way that ions transport through polymers. Polymer has to be amorphous, it has to be above its glass transition temperature, it has to be in this state, like the snakes.

By making amorphous polymers, as we have over the last 30 years, we have gained improvements in the conductivity of these electrolytes, because good conductivity is an important criterion for applications.

Here you can see conductivity plots as a function of temperature. These are for several amorphous polymer electrolytes, it doesn't matter what they are, but the important thing is that after 30 years of hard effort of many groups we have crawled our way up to the level of this curve here. But we have reached a ceiling, and that ceiling is set, unfortunately, too low for many applications. It has proved very difficult to break through this barrier, and we need to be up in this white space here for many applications.

In science, when this sort of thing happens, you have to start looking for new avenues and directions. It was our view that there was no fundamental reason why crystalline polymers, where the chains are in a regular order arrangement, should not conduct. For the last 30 years these crystalline materials were believed to be insulators, look in any of the text books and that is what they tell you. We didn't actually believe that, so our view was somewhat heretical, to say the least, at the time. We wanted to go back and look at crystalline polymers although they were written off all those years ago.

What of course happens in science is you have some innovation, you have a logical development of that innovation, and eventually you come to a point at which the innovation and logical development just don't work anymore, you reach a brick wall when using established thinking. At that point you have to look in different directions. As I said, the different direction we looked in was to consider crystalline polymer electrolytes.

We looked at several crystalline polymer electrolytes where the chains are arranged in a regular order, and one of those turned out to be this material here. This is a simple polymer which is made in many tonnes every year. It is called poly(ethylene oxide). The chains consist of carbon; carbon; oxygen, repeated again carbon; carbon, oxygen. In this polymer we have trapped this salt, $LiPF_6$.

By putting the polymer and the salt together in a 6:1 ratio you get this crystalline material. The picture is of the crystal structure of this compound. The green and the red lines represent polymer chains, those are the six oxygens. Each of those chains folds back and forth to form a half cylinder and then two half cylinders interlock to form a tunnel. In the middle of that tunnel you see these blue spheres, which are lithium ions.

Once we solved this crystal structure, we immediately thought this compound could transport ions. I will show you a little video which demonstrates the transport lines down these polymer tunnels. The graphics are not great but, I think, you can see what is happening here. The yellow spheres are lithium ions, and the red ones are oxygens. You can see this lithium ion making its way down the tunnel. There are also breathing motions of the polymer, it is dynamical even in a crystalline state. Crystalline polymers do indeed conduct!

Here is a plot of conductivity versus temperature. The red circles represent conductivity of the material that I have just shown you. You can see that it conducts, contrary to the established wisdom. But it doesn't conduct terribly well, so it is important scientifically but not a competitive material technologically. Here are the data for one of the best amorphous polymer electrolytes as well, the best after some thirty years of effort in the field. This top curve here is for one of our recent crystalline polymer electrolytes. By modifying these materials, we can substantially raise the conductivity in the crystalline state, and this is after just a few years of working with crystalline materials. This demonstrates that new directions are often a promising way to go.

So I hope I have shown you in this talk that global warming is an important issue; that storage will be a very vital part of addressing this critical issue facing humanity over the next 50 years; and that by developing new solid state materials with new properties and combinations of properties, we can begin to address the key issues that will contribute to clean energy generation and storage.

Finally, I must acknowledge the people who are really doing the hard work, people in my research group who have been involved in some of this work over the last few years. I am indebted to them for their efforts and that gives me the opportunity to come along here and take up your valuable time, telling you about what is an exciting time over the last 5-10 years. Thank you very much for your attention.

Discussion Session

What size of storage are you looking towards?

Well, for the hybrid electric vehicles you are talking about something which would be perhaps in the volume of several of the lead acid batteries that we are used to having in our cars at the moment. For the application, which I suspect is behind your question, in static energy storage we are talking about much larger installations. The benefit of lithium batteries for that is, because the energy density is higher, you can have a storage medium which is a third the size of a battery that you would require if it is based on conventional technology. To give you some sense of that, a lithium battery 10 metres x 10 metres x 10 metres stores over 400 mega watt hours of energy. It is going to have at least a factor of 3 or 4 smaller footprint than in the case of a lead acid or nickel-cadmium system. So it has less environmental impact for that reason.

As a retired research scientist, I would like to personally say: what an absolutely fascinating lecture. I would like to ask you about the part that nanotechnology could play in chemistry, and also the part that it could play in future energy, which is one of my interests, in spite of my age.

Thank you very much for your first comment in particular. There are many trends in science, that that come and go. If you go back in history, you will find lots of examples there. Nano science and nanotechnology are not one of those. They are here to stay. After all they are not new; Faraday made colloidal gold quite a few years ago. The impact of nanoscale on the properties of materials and biological systems is so great that they are, undoubtedly, here to stay. I couldn't possibly address the whole range of applications of nanomaterials, only one small part of it.

In the energy area, they will be important for lithium batteries and fuel cells. They will be important in a whole lot of other applications in the energy sector of the future. There is also, of course, a concern, and rightly so, about the safety issues of nanotechnology. People are concerned about these very small particles. These issues should be examined and considered alongside the technology, and that is being done. Of course we are already using nanotechnology in sunscreens. If it is a sunny day you will be using titanium dioxide in a nanoform. So, in fact, you are used to having nano particles in our consumer products.

Because of my past history, I happen to be a member of the pro-Nuclear Group. Would you *like to comment on how the nanotechnology is trying to affect the design and evolution of nuclear power plants?*

The short answer to that is 'no', because I wouldn't profess to have enough knowledge to make an intelligent comment on that, so I would pass on that particular one, if you forgive me. The only thing I would say, as I have already mentioned in my lecture, is that I think that we are going to revisit nuclear fission, hopefully one day fusion. For citizens living in the south of England, it is really not sensible to be too concerned about safety issues building a nuclear reactor in the south of England, when just across the Channel, the French have 77% electricity generation from nuclear energy. The greatest danger of nuclear power is, undoubtedly, in the former Soviet Bloc. If we are really concerned about the dangers of nuclear power we ought to be giving money to those countries, for them to clean up their old nuclear reactors for a safer generation of power.

If you will allow me just one final question, I did read a while ago that we were moving towards a hydrogen economy. I don't know whether this is true or not, possibly it's across from America or from the Kyoto; and this is the way in which, they say, some of the money was going, to the hydrogen economy, which involved both transport and, I understand, reactors. Have you any contacts in America?

Yes, there is no doubt that the hydrogen economy will play an important part, I think, in the energy scenario of the future. As I mentioned in the lecture, you will see a greater diversity in generating technology. But, and it's a big 'but', there are two critical problems that have to be addressed before hydrogen economy can become a reality. One is how you produce the hydrogen, and the other is how you store it? There is a lot of hype about hydrogen economy, and if you want the cynical view, the hype is there for those who know it is hype, and those who know it is not a technology that is just about to deliver instantly. They would like to propose it because they know it is yet to happen.

Do you know about methanol?

Yes, there are obvious attractions in trying to use methanol directly in fuel cells, which is probably what you are thinking about. If you can solve the catalytic problems on the electrodes to make that happen, that won't be a problem. Of course the problem with methanol is that you are going to generate pollutants of methanol, which of course hydrogen would not. So hydrogen is an important player, it rightly should be having research and development in that area, I think my colleagues in the area of fuel cells, I would say have actually suffered over 20 – 30 years from this area when the tap was turned off and no-one put any money into it, and then suddenly it is the solution to everything, and the tap was turned on again. That is not the way forward for developing science or technology.

Who is, or should, be providing the finance to make your work financially viable?

Well, unpicking out your question a little bit, I suppose the real problem is that, unlike in Japan, in Europe and in the States we are very poor at bridging the technology gap, taking new ideas and turning them into commercial success. The reason is that it takes maybe ten years from laboratory to the market place. The reality of the way that our economy works, is that industry will be unlikely to invest funds that are necessary to bridge that gap.

The Japanese take a different view. I visit there often, and their research programmes run for ten years, my research programmes run for about two or three years at best. Their development programmes will run for a similar length of time, and that radically changes the scene, because I think the single biggest factor in why the Japanese are so successful at commercialising their technology. They are not afraid to make the investment, to develop things, they know that not all of them will work, but some of them will, and those that will, will pay for those that don't.

I don't think it is going to happen from industrial funding. I think that in reality it will have to come from the tax payer. I know that here in Scotland the Intermediary Technology Institutes are trying hard to bridge that gap. I certainly applaud these initiatives and hope that they will work, and we will see in the course of the next five to ten years whether they do. That is putting public money into promising technologies that will hopefully deliver in the future.

I have to ask the same question in another way, the chicken and egg scene. As you say your work is mission-oriented, and driven on in a way which is really very remarkable, but that doesn't really count in the higher echelon of science, and I believe that Mr Brown, for example, is determined to put a lot of money into pure science, because that's somehow is how it should be done. I think your work has shown that is not a very good idea.

Well, a degree of controversial sentiment down there. I think that one has to have both of these things working in parallel. I have always endeavoured to carry out fundamental research alongside research that is more mission-orientated as you say. I haven't talked about it here today, because for a general audience the sort of energy theme is one that is attractive and interesting. We have developed new methods for determining the crystal structures of molecular solids in ways which were not possible before, which you could say is really very much pure science. For me, applications are equal to pure science. The reason we got into doing that work on the structures of these compounds was driven by an interest in understanding polymer electrolytes in greater fundamental depth. We went off and spent two years developing this technique to solve crystal structures, and as a result of the crystal structures we then identified those which might conduct, and then we came back to look at a more technologically focused aspect of conductivity. For me these things have always moved side by side, and I have never had a difficulty with that. I would say that the widened view for our funding agency would be to recognise the worth of both fundamental science and applied science.

You mentioned what the aims of the batteries use are. I was wondering, would you put batteries on the sustainability scale?

Well again, some countries, Iberian countries and Japan, recycle rechargeable batteries. You can certainly recover materials from within batteries, and in fact it is often economically advantageous to do so. People have actually made the point: is their enough lithium in the world to have lithium batteries? Of course the reality is you don't throw the thing down the drain, you recycle these things, so that addresses both the problem of the finite nature of the resource and the recycling.

I am not really for the use of more energy than is absolutely unavoidable, and I go along with Sarah Parkin, who said some years ago now, that we all have to do far, far more with far, far less.

To address your first point, which I know is a critical issue, you are absolutely right to say that, to put it differently, you should do as much as we can do with what we have got. In other words, we should be efficient. Yes of course we should be efficient. Now, there is a lot that we can do to address some of these global warming issues by making every unit of fossil fuels to go as far as possible, and we should clearly do that. So I think you are right in what you say, an efficiency should be the first thing that we should look at, and that is of course happening, I think globally, or at least in Europe and Japan, less so perhaps in America. But, that can only take you so far, you then have to go to new technology. However, that is a fair point.

Where do you see the applications may be first coming, in a practical way?

You mean the technology that I have discussed here today? I think that the most likely first application of these technologies will be in vehicles, in private vehicles. There is an intense effort for rechargeable lithium batteries for vehicles, and I believe that will happen. We will see lithium batteries in heavy vehicles in perhaps a five year timescale.

Are you thinking of private vehicles, rather than say public transport, aeroplanes and all the rest of it?

Not entirely. Another area that is of interest is trains. It is probably uneconomical for us to extend our electrification system in the UK, it is too expensive. One way to address it would be with electrical power trains, or even hybrid trains, similar to the cars that I mentioned.

Vote of Thanks by Professor Alan Welch: Well I was very pleased to be asked to propose this vote of thanks, for a couple of reasons. First of all, it always a nice thing to say some complementary things about Peter Bruce and his work. Also just about a year ago, Peter was visiting Heriot-Watt, and was in fact in my office, when he took a phone call telling him that he was awarded the Gunning Victoria Jubilee Prize, so there is a certain symmetry about that.

How do you describe a global problem, and describe it incredibly well? We also have a problem that is well known now, in academic chemistry in particular in Britain, with the closure of a number of departments, and really departments of quite high standing. Our response to that has to be to demonstrate that we can do research which is several things, attractive and inspirational to young people, while at the same time be of benefit to society and of relevance to industry, and all of this assuming that it has to be of the highest academic and intellectual standing. Peter Bruce's work is all of these things. So ladies and gentlemen, we have enjoyed this afternoon, a beautifully presented lecture, on a really very important topic by an international expert in the field. Would you please join with me in thanking Peter Bruce in the usual way.

BP Prize Lecture

Dr Rebecca Kay
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University of Glasgow

5 September 2005

RUSSIA'S FALLEN HEROES: MEN'S EXPERIENCES OF POST-SOVIET CHANGE

In 1990, BP provided an endowment to create a Prize Lectureship in the Humanities. The first Prize lectureship was awarded in 1991. It is awarded biennially to a person under 40 working in a Scottish Higher Education Institution. It is awarded sequentially in the following subject areas: Language, Literature and the Arts, Archaeological and Historical Studies, Social Studies, Philosophy, Theology and Law.

Dr Rebecca Kay has been fascinated by Russia, its people and their lives since she first visited Moscow on a school exchange programme in 1989. Since that time she has been travelling to Russia on a regular basis and her love for and interest in its culture and society has continued to grow. Since the early 1990s, her research has primarily focused on gendered identities and the ways in which women and men experience and respond to changes taking place in the country, away from the capital cities of Moscow and St Petersburg. Rebecca has lived and worked in several provincial towns and areas, most recently in Kaluga region, in European Russia to the south-west of Moscow and in the Altai region of Western Siberia. Her PhD research on the activities and aims of grassroots women's organisations was published by Palgrave as *Russia's Women and their Organisations 1991-96* and won the American Association of Slavic Women's Studies, Barbara Heldt Prize for Best Book in Slavic Women's Studies 2000. She is also co-author with Sue Bridger and Kathryn Pinnick of *No More Heroines? Russia, women and the market,* which won the same prize in 1996. Rebecca's most recent research has been a Leverhulme Trust-funded study of Russian men's experiences of and responses to post-Soviet change. Rebecca and her co-researcher Dr Sue Bridger are currently working on completion of a monograph arising from this project, to be published in 2005.

Attitudes towards and media images of Russia have undergone a series of profound shifts in the last two decades. The euphoria with which Gorbachev's programme of profound economic, social and political change was initially met, waned as the Soviet Union began to disintegrate. This was followed by a new surge of enthusiasm for the new post-socialist Russia in the early nineties, however this too was not to last. As Russia has faced up to the very substantial problems left in the wake of a struggling planned economy, the western media have consistently focused on the wretched and the squalid, the hopeless and the incompetent. In popular discourse there is a prevailing sense that Russia is a disturbing, if not frightening, place to be, a country which is somehow incapable of pulling itself out of the hole it is in.

Within this shifting picture, an overwhelmingly negative portrayal of Russian men has become almost commonplace. It is as if the degeneration of a nation can best be typified by the image of the self-pitying drunk, defeated by circumstance, spiralling into an early grave. Headlines in British newspapers, for example, have declared that Russian men are, 'dying of drink and despair' (Traynor 2000). Yet reporting such as this in the western media does no more than reflect popular opinion within Russia itself. A sense that there is something intrinsically hopeless about the state of men in Russia has been a recurrent theme in the Russian media over the past decade. Russian journalists and reporters have also commented that men always seem to find solutions to their problems, 'at the bottom of a bottle' (Kuznetsov 2002) and that if Russian women see marriage to foreign men as an attractive option, it is because of 'the catastrophic situation with men inside our country' (Kondrat'eva 1999: 22).

Behind many such statements lies the premise that men have been unable to adapt quickly enough or effectively enough to the social, economic and political changes occurring in Russia. This, it is argued, has led to a crisis of male identity and an increasingly apathetic and irresponsible response from many men. These suggestions are in fact not dissimilar to debates about a 'crisis of masculinity' which have become popular in many western societies, including our own over the past 20 years. Whilst a quick glance at Russian health statistics confirms that there are very significant problems with male health and lifestyle choices, the purpose of the research on which this lecture is based has been to explore a little more deeply what has been happening to men in Russia since the break-up of the Soviet Union.

Certainly, the basis for deep concerns about Russian men and their abilities to cope well with Russia's social, economic and political upheavals is far more than simply anecdotal. In Russia, as in the UK, health issues figure high on any list of male problems and the evidence of crisis here seems particularly compelling. Changes in male and female life expectancy over the reform period offer some of the most indisputable evidence that men have been less able than women to cope with post-Soviet change and the pressures and challenges it has brought. Whilst male life expectancy has fallen by some five years from 63.8 in the mid 1980s, to 59 in 2000, female life expectancy in the same period has fallen by just under two years from 74 to 72.2 (Notzon *et al*. 2003: 47).

Research has also shown that increased mortality rates are due primarily to deaths in the young and middle-aged population (25–64 years) (Notzon *et al*. 2003: 10). Cardio-vascular diseases are the biggest killers, especially of middle-aged men, whilst deaths from injury, accident and poisoning take second place, claiming some 3–400,000 lives each year (Gerasimenko 2001). Over 100,000 deaths annually are the result of suicide or murder (Gerasimenko 2001) with men over seven times more likely to commit suicide and six times more likely to be murdered than women (Notzon *et al*. 2003: 50-51).

Alcohol abuse clearly plays a significant role in premature deaths, both as a direct cause and as an indirect or contributory factor. A three-year study conducted by the International Family Research Institute in Moscow in 1997 – 2000 found that in two-thirds of male mortalities in the 20 – 55 age group, the man was drunk at the time of death (Traynor 2000). Men's heavy drinking also exacerbates other negative social phenomena including accidents and absenteeism at work (Kalinin 2002a), increased rates of foetal alcohol syndrome (Martynova 2001), marital breakdown and family instability (Vannoy *et al*. 1999: 12, 31, 123) as well as the incidence of violent crime. Some 30-40 per cent of all serious violent crime in Russia now takes place within the family: each year approximately 14,000 Russian women die at the hands of their partners, a figure which those working in the field of domestic violence have compared with the 17,000 fatalities which occurred during the ten years of the war in Afghanistan (Kostenko 2003b: 19; Osukhova 2003).

The problems concerning Russian men, therefore, are clearly not to be taken lightly. However, simply blaming men for the difficulties they face or even for the often negative behaviours they may adopt in response, is both insufficient as an explanation for the complex social and cultural processes at work and unhelpful in seeking a constructive solution to some of these deeply troubling issues.

Studying men's experiences of and responses to post-Soviet change

The research which I refer to here was carried out in 2002-3 in two provincial areas of Russia: the city of Barnaul, capital of the Altai Region in western Siberia and a small town in Kaluga Region, south-west of Moscow. The city of Barnaul itself is remarkably European in feel with a tree-lined central boulevard which is dotted in summer with pavement cafes and where the most notable buildings were designed by architects from St Petersburg. It has a population of over 600,000 and a rich industrial history within a region whose economy has been overwhelmingly based on agriculture. Despite considerable post-Soviet decline which has particularly affected the remaining large machine-building plants and a wide range of smaller factories, in recent years a growing array of retail and service sector businesses has sprung up.

By contrast, research in Kaluga Region was based in what is still a largely underdeveloped town and two outlying villages in a district with a population of some 11,000. There has never been any significant industrial development in or around the town and it continues to function as an administrative centre for an agricultural district which is currently in a state of decline and as the home of a scientific research institute which is struggling to emerge from near collapse following the withdrawal of state financing. The town itself, situated in an area of considerable natural beauty, has a very rural atmosphere: minutes from the potholed streets around the central square, livestock roam freely between the houses in summer.

In both of these areas I interviewed men from a range of backgrounds, age groups and family situations. I looked at what they told me about their lives, families and work in the context of wider attitudes to men and their roles in Russian society. I built up a picture of these by reading articles in the Russian press, by looking at the ways in which those in positions of authority or responsible for providing social services to the Russian population talk about men, and by listening to the things which both women and men in the areas where I was working said were 'true' about men, their attitudes, abilities and problems. Some of the aims of this research were: to see what models or stereotypes of male attitudes and behaviours are part of contemporary Russian culture; to look at the extent to which men actually fitted into these stereotypes and what room for manoeuvre they might have in choosing not to; and to think about where the triggers for some of the troubling developments which I have just mentioned might lie.

There is not time in this lecture to look in detail at all the issues covered by this research, nor to discuss all its findings. I have chosen therefore, to look at two areas of men's lives which came across as being particularly important to the men whom I interviewed: work and fatherhood. These areas are also particularly interesting in the light of what I have just been saying because in relation to both of them the men involved in this study expressed views and behaved in ways which did not necessarily conform to widely-held negative stereotypes and generalised expectations of male behaviour.

'What kind of a man doesn't provide for his family?': making ends meet in the new labour market

There is no doubt that the changes which have occurred in Russia since the late 1980s have had an enormous impact on the Russian labour market. Ever since economic restructuring and reform began in earnest under the Gorbachev regime, Russian workers have had continually to adapt to rapidly changing circumstances in both practical and ideological terms (Filtzer 1994). At the most tangible level, the Russian economy has witnessed the collapse of substantial sections of heavy industry and agricultural production where vast numbers of men were previously employed. Delays in the payment of wages, payments of wages in kind, temporary stoppages and arbitrary dismissals, whilst certainly not as widespread as a decade ago, continue to trouble certain regions and sectors and have damaged the confidence of considerable sections of the workforce in terms of their economic and employment security (Ashwin & Clarke 2003: 152-174). Simultaneously, wages in many areas of the economy have failed to rise at anything like the same rate as inflation. This has been exacerbated by the removal of universal subsidies, the introduction of a private market and of charges for a variety of services including health, education and public transport. As a result poverty has become widespread and has remained a deeply problematic issue throughout the post-Soviet era (Silverman & Yanowitch 2000: 50).

'In Russia the husband was always the breadwinner': attitudes to gender and expectations of male employment

A very public promotion of more strictly divided roles and responsibilities for men and women has also been an explicit part of the agenda for social, economic and political change in contemporary Russia. Since the collapse of the Soviet system the idea that Soviet attempts to 'enforce' gender equality were at best 'mistaken' and at worst 'cruel' and 'perverted' has become extremely popular. In this context it is frequently asserted that whilst the primary focus of women's lives and activities should be the private sphere of home and family, men should be concerned above all with activities in the public sphere and particularly with waged employment. A wide range of studies have been conducted showing the negative repercussions for women of such shifting attitudes to gender (Buckley 1997; Bridger *et al* 1996; Posadskaya 1994). Yet, relatively little research has been conducted on their implications for men and there has been a generalised assumption that men stand primarily to gain from a return to more rigid gender roles and divisions. Yet, as we shall see, uncompromising views on gender difference have particular, and not necessarily positive, repercussions for men in terms of their position as fathers and expectations regarding the extent and nature of their involvement with children. They have also had a specific impact on male and female employment. From the late 1980s onwards, calls for women to return to primarily domestic and family-oriented roles, combined with the persistent erosion of what was once accepted as the Soviet social wage have placed an increased emphasis on the importance of men's role as providers. Indeed, this has been interpreted more or less explicitly in media and public debate, as well as in everyday discussions of gender, as men's key role, the counterpart to women's role as mothers, and the marker of a good husband and father (Almazov & Iushkevichko 1993; Kiblitskaya 2000: 69; Zdravomyslova 2003: 85).

Russian women interviewed during the 1990s frequently argued that to provide materially for the family was a man's primary function. Even women who had made a career for themselves, as doctors, lawyers or test pilots for example, still insisted that: 'Of course, it is a man's place to support the family and earn money for it', 'A woman should be provided for so that she can choose to stay at home and look after the children if she wants to' and that, '[In Russia] the husband was always the breadwinner.' Yet in both media discussions and during interviews with Russian women, such assertions have frequently been followed by the complaint that men are either unwilling or unable to live up to this responsibility, leaving the burden to women instead. Commenting on Russia's falling birth rate, for example, one media commentator laid the blame firmly on men and their failure to provide for their families:

The problem is not that women like to slave away from morning until night instead of giving birth to children. The problem is that it is hard for a woman to survive without a career. Men are weak; there is not much point in relying on them. They don't know how to earn money themselves and anyway they can't wait to run off with someone else. So our women have to be able to survive on their own. (Kuznetsova 2002)

The overwhelming majority of men involved in the study I carried out in 2002-3 in fact also actively supported the idea that men have a non-negotiable duty to provide materially for their families. Many men stated this simply as a matter of fact, for example by quoting sayings such as: 'A father is not a father if he doesn't feed his son until his pension.' Some men who had never married explained that this was not due to a lack of desire for a wife and children, but because they had not been in a position to provide properly for a family. A man in his mid forties, who had experienced prolonged periods of low and delayed wages and considerable employment insecurity, clearly regretted that he had never married or had children, but explained. 'It was kind of like to begin with I didn't want to, but then later I didn't have the means to.' Thus, at least for some men, the right to start a family has been seen as dependent on the ability to provide for one. Meanwhile, the process of marketisation has placed men in a double-bind where such provider roles are concerned. As the buying-power and stability of their wages has fallen, living expenses have risen and expectations of what proper material provision for a family comprises have also increased (Kiblitskaya 2000: 63; Meshcherkina 2003: 97). This trend is encouraged both by the removal of the ideological and practical constraints on consumerism which were inherent in the Soviet system, and by the revival of attitudes to gender which emphasise a division of labour within the family where men provide and women fulfil domestic roles.

'A man should be a true professional': work as a source of male identity and pride

In addition to the importance of earning money and being able to provide for a family, however, both women interviewed in the 1990s and men interviewed in 2002-3 viewed work as having an intrinsic value for men, and being a source of male identity, self-esteem and personal fulfilment. In Russia, as in many other modern, industrialised societies, work and professional status are frequently assumed to be at the centre of male identities and sense of self-worth (Meshcherkina 2003: 92). This view is reinforced by a reading of the post-Soviet press in which positive images of men focus overwhelmingly on men's work-based activities and initiatives. This stands in stark contrast to reporting on women where family issues, domestic achievements and skills are frequently discussed with considerable emphasis, even where they have no direct relevance to the particular focus of a given article (Kay 2000: 43-45).

During interviews, many men talked with great pride about their work and stressed the importance of doing a job properly, being a 'real professional' and working at a job which a man would feel was 'for him'. Men of all ages described their work as an extension of personal interests and hobbies and vice versa. For example, a man who had devoted his entire working life to scientific research spoke with great enthusiasm about his work and described his path to this career as directly linked to his character, identity and broader interests:

"Science was my goal in life, and it's amazing but I still have it now – I like it when there's something I don't know! I loved books, the library was my favourite pastime, and that's stayed the same too. … I went to work in a research institute. I soon started to work seriously, started to publish and I started to win competitions for young scientists. I was working on low temperatures in liquids which is all fairly difficult, it's like another planet."

For men who did not feel that they had a particular 'calling' to one specific profession, taking pride in a job well done and in the range of their interests, skills and abilities was also important. A man who had done various skilled and semi-skilled, manual and technical jobs explained his attitude to work as follows:

"I like my job when I am doing it well and in principle that applies to any job. That's my attitude. Basically, I have tried my hand at various kinds of work and when it works well, then it's good and I like it. For example, I also tinker around with my car, well and that's like, it's not that I don't like the car, of course I like it, but when you have fixed it yourself then you like it twice as much!"

Thus, whilst for some men, especially those who had invested considerable time and energy in prolonged training or higher education, work-based identities might be linked to a specific profession, for others what was important was to work diligently and efficiently and to know that they were good at their job.

'If a man loses the work he loves, it's a great loss': Men and the threat of unemployment

Women interviewed during the mid 1990s saw this close identification with their work and the central role jobs played in men's lives as a source of potential vulnerability in the context of widespread socio-economic change. The threat of unemployment and reduced earning power could be deeply damaging for men, they argued:

"Men give a lot of time to work. It uses up a lot of their energy, both physical and emotional ... This is why men die younger. If a man loses the work he loves, it's a great loss. They immediately lose their sense of purpose in life."

Other women asserted that, since men's only valid role in the family was that of provider, if they lost the ability to fulfil this they became nothing but a burden. Men's awareness of this, they argued, made the loss of employment potentially fatal:

"Now, well not everyone is able to fulfil this role [of breadwinner] and so in some ways it's easier without a husband. … I know of a lot of examples of husbands who can't earn enough to live on, even though they are well educated and have a professional job. … Lots of people lose themselves in these situations. There are so many male suicides. Men are more hurt by these situations than women."

During interviews conducted in 2002-3, men also described unemployment, financial insecurity and an inability to provide properly for their families as phenomena which had been extremely difficult for many men to deal with. Men who had themselves managed to stay afloat, despite the difficulties of the post-Soviet economic environment, frequently expressed sympathy and a degree of understanding for others who had been less able to cope. As a rural sports teacher and former army colonel put it:

"What's a man to do if there is no reliability that you get paid or how much? So maybe they give you 100 roubles, what can you buy with that? You can't buy your child a uniform or even a football. So instead a man will go and buy a bottle and he won't even go to the shop because he'll be economising, so he'll get homebrew instead, and by the time he comes home he'll be in a complete state."

Men making such comments were not necessarily condoning or excusing these tendencies. Indeed they often went on to point out that this set a bad example to the younger generation and was behaviour unworthy of a 'real man'. On the other hand they recognised that for many men the ability to provide, at least as much as the job itself, was closely linked to issues of self-respect. The sense of uselessness and loss of identity which accompanied a failure to fulfil this role adequately, they felt, offered a ready explanation for the descent into depression and patterns of destructive behaviour so widely visible. Nonetheless, they pointed out, widespread though such a response might be, by no means all men behaved in this way; many men, they insisted, continued to do all that they could to ensure their ongoing employment and to provide for their families to the best of their abilities.

'I work as hard as I can and I try to find more': Men's strategies for dealing with the new world of work

For the overwhelming majority of respondents in this study rigidity and resistance to change were simply not an option. Their overriding sense of responsibility to provide for their families, combined with their view of work as a crucial part of their own identities and roles as men, made the development of strategies for dealing with the new world of work an issue of paramount importance. Moreover, the strategies and experiences they described made it clear that flexibility and adaptability had become very much the order of the day. Far from having the luxury to insist on working only in one narrowly specialised area, many men said that the contemporary labour market demanded a range of skills and a preparedness to undertake a wide variety of jobs both within one and between several places of employment.

Younger men, whose only experience of work had been in the post-Soviet era, appeared to accept a demand for flexibility as simply part of the reality of a competitive labour market. They stressed that it was vital to be able to respond immediately to new demands and circumstances and saw no point in expecting a more stable or unchanging working experience. As one man in his early 20s explained:

"It's all so unpredictable here that sometimes you may have to change your profession very quickly. If one thing doesn't work out you have to be able to switch very quickly to doing something else. Otherwise you will just fall down a complete hole."

Despite widespread age discrimination in the post-Soviet labour market and a generalised assumption that those who grew up and began their working lives under the Soviet system will be particularly resistant to change, many of the older men in this study had proved beyond doubt their ability to be adaptable. They were clearly both willing and able to convert skills and experience gained during the Soviet era into a basis for finding or developing new forms of employment in the post-Soviet context. Former agricultural specialists took on labouring jobs at factories and warehouses. Men who had worked as works' drivers and factory mechanics became taxi drivers and private car mechanics. Others used their artistic skills and hobbies to set up craft and design based businesses. Far from viewing their working lives as over when the enterprises they had worked for collapsed or refusing to seek alternative employment even when their current place of work ceased to pay them properly, these men sought out or created new forms of gainful employment as a matter of course.

The difficulties of finding work in the post-Soviet labour market, particularly work that pays well enough to support a family, has forced men to think flexibly about employment not only in terms of what sort of work they can and will do, but also in terms of where and when they are willing to do it. In discussing their current working arrangements many respondents referred to wage levels and the importance of earning enough to live on as a decisive factor in their choice of employment and one which often overrode considerations of personal preference, professional training, or previous work experience. As one man put it: "it's not a question of whether you like it or not, you just go where they pay the most money".

Many of the men who took part in this study had taken on multiple jobs, shifted from skilled-manual or white-collar work, to unskilled and physically demanding manual labour, or accepted work long distances away from their homes in order to secure higher wages. A man in his late thirties, providing for a large family, explained that he had been forced, out of financial considerations, to seek employment in a city, 100 kilometres from his home, despite the added pressures of a long commute on public transport and frequent separation from his family:

"There simply isn't any alternative. Hard or not, it's just, well I worked here for a year, but we had borrowed money to buy a flat and we had to pay the money back, but here, you just can't earn enough, it's practically impossible. … So that's what it's like, and you have to do what you have to do."

For other men, making enough money to ensure that they and their families could live comfortably meant working extremely long hours and combining formal paid employment with informal work through subsistence farming, trading or ad hoc employment in the private sector of home and car maintenance, as hired manual labour, or as impromptu taxi drivers. Clearly none of these strategies are without their problems. Working away from home may put considerable strain on family relationships as a district registrar of births, deaths and marriages in Kaluga region, whom I interviewed during this study, was at pains to point out. A shift into self-employment and/or a combination of low paid formal employment and additional earnings in the informal economy limit men's rights to sick pay, pensions and other social benefits. Many of the men in this study expressed concerns about their position in the future regarding a pension and described the prospect of any form of prolonged ill-health as potentially disastrous. Taking on multiple jobs, often involving shift work and manual labour takes a toll on men's physical health. Where those who already have a record of ill-health see no alternative to continuing strenuous formal or informal work the results may be fatal. Many of the men involved in my research complained of high levels of stress, sleeplessness, fatigue and poor diet caused by a lack of time for sufficient rest or proper meal breaks and constant worry about the need to earn enough money for their families' survival. Many men stressed that their health was the only thing they had left to rely on and in the words of one very hardworking respondent: "Heaven forbid if anything were to happen to your health. That would be the end."

Men in this study had developed a variety of strategies in order to continue working and to provide for their families. Some strategies were certainly more successful than others, not only in terms of the level of income they were able to secure, but also in terms of their sustainability, both physically and emotionally. In some cases, strategies which men had developed with the aim of ensuring a family's well-being and material comfort, had in fact introduced new vulnerabilities in terms of damage to their health or their physical removal from the family for prolonged periods of time. Whatever approach they choose to pursue, men's experiences of work in the post-Soviet era were taking place in the context of an unstable labour market where there could no longer be any guarantee of long term job security in formal employment with a clear set of benefit and pension rights. Yet they insisted that it was crucial for men to continue to work, whether formally or informally, both in order to provide for their families and because they viewed work as a defining source of male identity and dignity: 'What kind of man doesn't work to provide for his family?' was a frequent comment in both interviews and more informal conversations. This view was also closely reflected in media discussions and women's comments on men's roles and responsibilities. The difficulties of the post-Soviet economy may be acknowledged and the potential risks for men of such a singular focus plus an unrelenting pressure to provide recognised. Yet, even where these issues are raised as potentially contributing to various forms of male 'crisis', discussions are only very rarely taken one stage further to a questioning of the stark gender divisions which underpin much of this state of affairs.

'I couldn't live without my kids': fatherhood as a contested identity

It is, of course, over the question of providing materially for a family that the interface between men's public and private roles is at its most visible. This may also, at least in part, help to explain the value ascribed to this activity. There is no doubt that it remains the most widely acknowledged and socially approved contribution men make to the family and, in particular, to the well-being of their children. For, whilst understandings of what a mother is, or should be, are highly developed and, indeed, saturate Russian popular culture, the notion of what a father is, or should be, is far more hazy, sometimes, effectively, to the point of non-existence. The way in which parenting and upbringing are portrayed in Russia frequently conveys the sense that every child has a mother but may or may not have a father. What this boils down to in practice is the view that in each child's life there should be a man who provides, who should perform a duty, but may not necessarily form or maintain a relationship. As one Russian sociologist has expressed this: 'The exclusion of fatherhood from social discourse in Russia is an absolutely obvious fact' (Gurko 1999: 221).

This emphasis on motherhood as a vital part of any woman's life and dismissal of the idea that fatherhood might be of similar importance to men is not new to the post-Soviet era. In late Soviet society, a renewed cult of motherhood was the subject of massive official propaganda. In support of the state's attempts to encourage women to bear more children, newspapers, magazines and popular literature, all of which were still under control of the state censor at that time, were put to work to persuade women of their unique 'calling'. An extract from a perestroika-era school textbook illustrates the tone of much of this writing:

'Every woman is a mother or a future mother. She knows feelings which even the most devoted father cannot experience. … Motherhood makes women beautiful and wise. … For every woman who is a mother, all people, including her husband, become to some extent her own children.' (Sukhomlinskii 1987: 74-5)

Women whom I interviewed in the mid-1990s continued to employ a good deal of the language and imagery used in these Soviet era campaigns, much of which has been repeated and reinforced by post-Soviet discussions of the 'natural differences' between men and women. For these women the idea that good parenting was something which came naturally to mothers but might never be understood by fathers seemed to be simply a case of common sense. In interview, they made it clear that they did not really believe men had it in them to be adequate, never mind good, parents, especially with small children. They frequently made categorical statements that men lacked the patience to deal with children and were simply incapable of looking after babies. As one woman explained it: "You can educate a man as much as you like, he still won't be able to bring up a child the way a woman can."

These gender specific attitudes did not only relate to parenting skills however, they were concerned with emotions too. Women were convinced that men were quite simply incapable of caring as much as a mother would about their children. As one woman put it: "A mother's heart aches more for her child."

Yet, in the course of my study of Russian men, in virtually every interview and through much of the observation which accompanied them, men made clear the very strong emotional bonds they had with their children and the importance of these relationships in their lives. The significance of these ties frequently emerged through body language: the way in which a man's face would light up as he talked about his children or grandchildren or proudly showed off their photographs or the profound tenderness with which he might describe his experience of fatherhood - "Who can say I haven't achieved anything when I have grandchildren like these?" It was particularly noticeable, in a society in which it is often assumed that men are incapable of dealing with small children, how often men described their feelings, for example, about a birth, about taking a newborn home from hospital, about having a toddler in the house, in unmistakeably emotional terms. As one father of an 18 month-old baby girl described it: "it's something inexplicable. You just can't explain it. It's like a little wonder that's running around the place".

In describing their own experiences of being fathers, men often explained the roles they played in relation to their children and discussed what they felt a good father should be. Not surprisingly perhaps, providing for children in material terms topped the list, however, transmitting skills, instilling discipline and offering guidance were also seen as important paternal roles. Moreover, in all areas the underlying issue of the deep emotional ties between a man and his children remained paramount.

'You have to have a lot of money for children.': providing as a father's role

The men in this study overwhelmingly portrayed their children as a source of joy, but, at the same time, as a massive responsibility, one which continued well into their adult lives. In the face of post-Soviet economic change, the scale of this responsibility had increased dramatically and was clearly a source of substantial anxiety. Ensuring their children's health, enabling them to fulfil their intellectual potential and setting them on their feet in their own homes with their own young families had become a huge potential financial drain as formerly free provision had disappeared. As one man with two children summed it up: "You have to pay for everything now. You have to have a lot of money for children." Having children, for these men, clearly implied a commitment to provide for them long-term but, in the current climate, men had no way of knowing what their long-term circumstances might be.

One of the results of these new economic pressures on men who took their family responsibilities seriously was, therefore, to place them in a Catch 22 situation. Because they cared about their children, they believed that they should be providing all they could for them; because it had now become more difficult to provide the amounts necessary, men were likely to find themselves seeing far less of the children they cared for. As one father of two put it:

"Well, of course today it's possible that fathers are excluding themselves from the family. Because with us, what is it that's expected of a man – wages! You are supposed to support your family. So some men hardly ever see their families, because they don't have any time. ... People work as much as they can, even in several jobs simultaneously if they can."

'My Dad showed me how to do everything.': transmitting skills to children.

When men were talking about passing on skills to their children, they often began by speaking in a predictably stereotypical way about engaging in DIY or basic mechanics with boys. Some men who had daughters began by saying that perhaps it would have been easier for them if they had had a son: "Maybe to talk with him or he could help me for example if I was doing DIY at home and hammer nails with me or hold things for me." Men who talked in this way often reminisced about how they had been taught skills such as this by their own fathers. Yet several men who talked about this had in fact moved far away from such traditional gender stereotypes in practice. An older man, for example, described with huge enthusiasm the summer visit of his grand-daughter, the highlights of which were when he took her to visit his workshop and "she spent lots of time there banging around with a hammer and made herself toys and things".

For some men, however, this question of transmission of skills was less about practical tasks and more bound up with imparting knowledge or a way of thinking analytically which would stand their children in good stead in the future. In this, some clearly felt a gender bias which might be expressed quite overtly. A father of one adult son and a teenage daughter explained that in his view, "A son and a daughter are different things of course. You can love a daughter but a son has got to become independent. Learn to do things yourself and then everything will be fine." The expectation in statements such as these was clearly that a son, like his father, would be expected to provide, not to be provided for. A father's role, therefore, was seen in this light as being about preparing children, but perhaps especially boys, to meet the demands of life in the public sphere. A father of two children, one male, one female, both in their late teens, said of his son:

"I tell him … everyone has to know their trade. … In the future you'll see you'll have kids of your own and then there'll be an inheritance and so on. And so the thread will continue and you have to work in that direction. ... It's clear, I tell him, no-one will come and hand it to you on a plate, no-one else will … lead you by the hand to anywhere useful. It's all up to you now, I say. You have to try for yourself."

'Society can't influence children the way their parents can': exercising discipline and offering guidance

In these exhortations to older children to find their own way in life there was unmistakeably an element of anxiety about their future. In part, as suggested above, this related to insecurities about providing them with the necessary opportunities. But it also, inevitably, related to the influence of broader cultural changes on their lives. At its most obvious, there were concerns about drugs and alcohol and, interestingly, a great deal of concern about smoking, perhaps reflecting the extent to which Russia has been bombarded with cigarette advertising since the demise of the USSR. Men were also clearly concerned about peer group pressure, the influence of 'the street' on their children, but believed that they themselves could and should be the most important influence in their children's lives.

Yet what came across very clearly in many of these interviews was an enormous disapproval of any form of physical chastisement of children. Whilst this runs counter to much of what appears in the press about male attitudes, men who raised this issue were adamant about the need for children to learn discipline, to know where the boundaries lay, but that this should be based on reason and personal authority, not on violence and fear. A man who was raising three teenage children alone said, "In my family I was brought up without physical punishment and I brought up my family the same way, so that there would never be any fear that their father would use any kind of force."

With small children also men often underlined the need for firmness, suggesting that they saw their role as an antidote to fussing or mollycoddling, especially by female relatives. Most of all, this was described as being about a need not to see their child becoming spoiled. Not all men, however, were able to maintain this position, even if they thought it desirable. Some responses made it clear that discipline is very much an individual matter and is not automatically gender-defined. For some men, the degree of besottedness they were describing with the small child in their life might make discipline problematic, even if they thought it was what a man should be doing. One man with a very young daughter laughed sheepishly as he explained his situation: "My wife, she's much more strict than me, I'm the one who's a softie and I might forgive something or feel sorry for her, but my wife makes her do things with military discipline and will put her in her place."

'The kids know I'm all for them': love for children - fatherhood and beyond

As these examples suggest, for the men in this study who discussed being a father, it was clearly not only a very active role but also one in which a great deal of emotion was invested. Several described how much they valued the communication they shared with their children, the openness between them that they experienced. Men described listening to their children's opinions, never treating them with condescension, being 'like an older friend, like a comrade maybe'. In talking about this, some men chose to make clear the depth of the bond they felt, often in a way which was the antithesis of the stereotypically distant, disinterested or, at best, sternly disciplining father. In the words of one father of two teenage sons, "They're my children, it's my blood, if they're doing something I can't not pay attention to them." Meanwhile, a single-father spoke of the importance of having a close and trusting relationship with his two young daughters:

"I really want to instil in them the understanding that any problem, that they should always share it with me and there will never be anything like: 'I don't have time,' or anything like that. I say: 'I will always listen.' I don't know. I just love them."

Interestingly, men who felt this sense of emotional engagement with their children, did not necessarily restrict its expression within the confines of the nuclear family. Some engaged in activities with broader groups of children or had adopted children.

For others, a broader involvement with children might be part of their job but could then involve them in intensive activities which they themselves had chosen and developed:

"I really love children. Every year – I'll do it this year as well – I get a group of children together and we go off into the forest for two or three weeks. We live in tents, pick mushrooms and cook them, we don't take lots of food with us but we collect things. Or we'll go to a farm and help an old lady with her potatoes and she'll give us some, things like that. The kids know that I'm all for them and they repay me with the same kind of loyalty."

Men were clearly able to talk about a sense of parental responsibility and concern, about love and affection for children which went far beyond any notion of obligation. In the opinion of the men in this study, all of this formed part of the question of what made a good father and, indeed, a good man. For them, it was about offering guidance, providing protection, preparing children to cope with the world outside and to be ready to make their own positive contribution. Yet, other elements of this study showed that men's attitudes and wishes might count for little when measured against the overwhelming weight of widespread assumptions that only women are designed by nature for parenthood. In a country where divorce rates have been rising steadily for over 30 years, the reflection of such opinion in court practices and social service provision can cause tremendous pain to both men and their children when they are separated by force (Kay 2004).

Conclusions: Some new perspectives on men in contemporary Russia

The research which I have, in part, described here seeks to contribute to extending awareness of the ways in which Russian men have been affected by post-Soviet change. One of the central aims of this research has been to reveal some of the less widely acknowledged aspects of men's experiences and their responses to processes of socio-economic and cultural transformation in contemporary Russia. The study's findings challenge some of the negative assumptions about Russian men which are such a widespread feature of both western and Russian media. In particular, they contradict the overwhelming sense that there is nothing to be hoped for from Russian men, that they have, en masse, simply given up, on themselves, on their responsibilities and on the wider society of which they are a part.

The men interviewed in the course of this study were in no sense part of a successful or privileged elite, indeed the majority were in some way or other struggling to deal with the circumstances in which they found themselves. Nonetheless, none of them could have been described as apathetic, irresponsible or in any way despairing. All of them, without exception, consistently emphasised a need to be self-reliant and responsible, above all for the sake of their families, and they sought to explain how they themselves were striving to live up to this ideal. In giving voice to these men, I have hoped to draw attention to the details of men's lives, attitudes and relationships and in doing so to reveal a more intricate picture which is frequently lost because it is assumed that widely accepted stereotypes tell the whole story.

Many of the problems and difficulties which were raised by the Russian men in this study are not, in fact, unique to post-Soviet Russia. In the UK, and perhaps particularly in Scotland, there has been growing concern in recent years about male health and mortality. In particular, the consequences for men's health of a culture of extremely long working hours, stress, problematic lifestyle choices and a reluctance to prioritise preventive health care have attracted attention (Mitchel *et al* 2000; Hartley-Brewer 2000).

Meanwhile, in the private sphere, men in western societies, who have in recent years become far more actively engaged in parenting, have become increasingly unwilling and vocal in their refusal to accept widespread assumptions about the primacy of the mother's role, particularly when marriages break down (Pyke & Verkaik 2004).

It seems unlikely that men in any society will be able to overcome the kinds of problems and restrictions highlighted here unless there is a far more general attempt to redress gender inequalities and to challenge stereotypical divisions of roles, responsibilities and spheres of activity. The problems women have faced in attempting to challenge such stereotypes and the debates and political activism which emerged from second-wave feminism have shown that it is not possible to resolve single issues of discrimination without addressing wider gender inequalities which lie at their root. Yet, on-going popular resistance to feminism continues to be based, at least in part, on a common perception of it as a movement seeking to secure rights for women and with very little to offer men apart from a demand that they relinquish their privileges and power. One aspect of this rejection of the feminist agenda stems from an assumption that feminism positions men exclusively as 'winners' who invariably stand to gain from the perpetuation of an unequal status quo. Such assumptions overlook the fact that many activists and advocates of gender equality have called for an end to confrontational approaches and a recognition that gender equality will be more readily achieved when men and women are seen as allies not enemies in this process (Wolf 1994; Alibhai-Brown 2005). A recognition that the question of achieving gender equality is crucial to and in fact likely to be advantageous for both men and women may therefore have a contribution to make in moving forward debates on and developing effective challenges to gender discrimination not only in Russia but in other countries and societies, including, perhaps, our own.

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Presidential Address

Lord Sutherland of Houndwood KT FBA PRSE

19 September 2005

THE LISBON EARTHQUAKE: 250 YEARS ON AND COUNTING

On 1 November 1755, All Saints Day. Lisbon and its inhabitants experienced a massively destructive earthquake. Most of the city was reduced to rubble by the triple shocks and consequent huge tidal waves and fires. Estimates of the death-toll range from 30,000 to 100,000.

Shocks and destruction were also experienced in Spain, France and North Africa, and remnants of the tidal wave reached England and spread further to Jamaica within hours.

The events in Lisbon were described in graphic detail, and speedy reactions varied from letters of comment from Malta, to articles in the London Press and even to the publication of three articles on the physical causes of earthquakes by Immanuel Kant in his local newspaper in Koenigsburg.

Scientists began further research and speculation on the geophysics of the event, and the politician Pombal grappled with great skill with the processes of the re-planning and reconstruction of the city.

However the most lasting and dramatic consequences of the destruction, which are still with us, focus on the attempt to assimilate the ghastliness of these events into our thought patterns and discourse. What if anything can be said of such horror, suffering and evil?

Voltaire was in no doubt that it set at nought the claims of the poet Pope, and behind him the philosopher Leibniz, that this was the best of all possible worlds, and that if we could only see it God's manifest goodness was present even in such pain and suffering. His first public response was in his *Poem on the Lisbon Disaster or an Examination of the Axiom 'All is well'*.

Rousseau responded, but the lasting literary legacy is undoubtedly Voltaire's *Candide*, with its cast of characters who live through and beyond the Lisbon Earthquake.

And so a debate was set running which changed the face of European thought, and which accelerated the direction of the Enlightenment towards secularised, and even anti-theistic, patterns of thought.

Its significance is as much, however, in the implicit attack upon absolutism in all its forms – whether the absolute judgements which are the stock in trade of the demagogue, whether political or religious, or the absolute certainty with which claims to wisdom are enunciated from the same sources. The Lisbon Earthquake was a pointer to western thought that human insight, knowledge and wisdom are circumscribed, limited, and far from comprehensive. The mistakes which arise from ignoring this fact are seen all too clearly in our own contemporary world, where we are still coming to terms with the lessons that it taught.

LECTURES

Professor David Purdie,
Consultant, Edinburgh Osteoporosis Centre

8 November 2004

Osteoporosis: African Genesis - European Nemesis

Professor Purdie's aim for his lecture was to discuss one of the most difficult problems faced by Western Societies, that of the increasing fragility of our bones as we age, and continue to age. Life expectancy for women in the UK is now 82 years, and it is upon middle-aged and elderly European females that the principal burden of osteoporosis continues to descend.

Professor Purdie went on to point out that the condition now costs the NHS some £1.7 billion per annum and that figure does not account for the loss of economic activity among both the patients and their younger relatives required to care for them. Osteoporosis onsets usually after the menopause when the central bone-protection hormone, estradiol, ceases production in the ovaries. By age 75 fully 50% of UK females are osteoporotic and at risk of fracture after minimal trauma. The means to detect osteoporosis, DXA bone scanners, and the means to treat it are available, but have only been deployed in certain areas, leading to postcode preference instead of the required blanket coverage.

The realisation, Professor Purdie explained, that all Europeans are of African descent has prompted a major research drive to determine why the black skeleton is so much more resilient and stronger than the white. African and African-American women have much lower rates of osteoporosis and fracture than their white cousins and the reasons for this, when uncovered, may well provide a major lead in the hunt for effective means of prevention and treatment.

Professor Purdie outlined the anthropological thesis; the ancestral wave of *H. sapiens* left Africa some 100,000–120,000 years ago, dark skinned heavy boned and relatively short lived. In the higher latitudes of Europe, selection pressures led to the divergent phenotypes seen today when Europeans are compared to the surviving ethnic group nearest to the ancestral population – the San Bushmen of the Namib. Euro-Africans exhibit lighter skin colour to conserve Vitamin D production, straight hair to conserve warmth and lighter bone structure, for, at present, no detectable biological advantage. It may be that the light skeleton conferred no disadvantage, provided individuals died young. But the combination of a gracile skeleton and high longevity may have contributed to the present problem faced by Western societies with aged populations.

Thus the disease, Professor Purdie concluded, which robs women, and some men, of their height, stature, good health and sometimes their lives, may have its ultimate origin in our childhood as a species and in the fact that we no longer hunt, scavenge and gather – the activities for which our design specifications have uniquely fitted us.

Professor Purdie drew his lecture to a close by stating that osteoporosis is a silent stalker of women. It arrives undetected and unrecognised by patient and doctor alike, until it manifests in height loss or in fracture after a simple fall. Its detection requires the positioning of bone densitometers (bone scanners) in hospitals within the reach of all UK general practitioners, for only then will the tide of fractures and their associated misery among our elderly, begin to abate.

Professor David Hamblen,
Emeritus Professor of Orthopaedic Surgery, University of Edinburgh
Professor Hamish Simpson,
Professor of Orthopaedic Surgery, University of Edinburgh,
Professor Joe McGeough FRSE
Regius Professor of Engineering, University of Edinburgh

6 December 2004

The Challenge of the Ageing Skeleton

The lecture was presented by two orthopaedic surgeons and an engineer, respectively Professor David Hamlin CBE Emeritus Professor of Orthopaedic Surgery, University of Glasgow, Professor Hamish Simpson, Professor of Orthopaedic Surgery and Trauma, University of Edinburgh, and Professor Joe McGeough, then Regius Professor of Engineering, University of Edinburgh. The former two first presented the clinical background to the ageing skeleton that they encounter orthopaedic surgery. With increasing need for manufacture of prostheses the engineer can complement the work of surgeons.

An outline of the anatomy and structure of the failing arthritic joint provided the basis to understanding the history of its surgical treatment. The evolution of joint replacement was traced through its beginnings in the interposition arthroplasty and hemiarthroplasty to the present day success of total joint arthroplasty based on the engineering principles developed by John Charnley. This required the introduction of new inert biomaterials for the bearing surfaces, both metals and polymers, with low friction and wear rates. It also necessitated new methods for fixing these artificial materials to bone using either methylmethacrylate cement or textured surfaces to allow macro or micro-interlock. The successful results with conventional hip and knee replacements now exceed 90% after 10 years. Despite this work continues to improve on these with improved materials for the articulation, such as ceramic-on-ceramic, and the re-introduction of metal-on-metal surface replacements to minimise bone removal.

Bone porosity increases with age for both males and females, with a significant rise occurring in women over the age of about 70. Bone fracture mainly arises road traffic accidents (about 58%), with simple falls accounting for 19% were for women above the age of 70 there is a dramatic rise in the likelihood of wrist fractures, compared to men. 6,500 hip fractures per year occur in Scotland, 80% occurring in women over 70 years of age; about 10% of hip replacements require revision surgery within ten years. Loosening of bone contacting implant is a major problem. New coating technology is needed for hip prostheses, which can promote adhesion between living tissue cells of the human bone and the implant. Computer-aided design and manufacture can be used to produce design the prostheses needed. The average age for total knee arthoplasty (TKA) is 68 years: 5 to 10 per cent require revision surgery within 10 years. Long term biological stability is achieved from initial mechanical stability, by press-fit or cementing of the knee replacement.

The final part of the lecture dealt with sheltered housing and nursing homes and the introduction of Smart technology. Research into non-obtrusive Intelligent flooring was described. It gives position, and direction of movement and can detect heartbeats.

In summary, engineers working with orthopaedic surgeons can provide cross-disciplinary solutions to questions posed by the latter. These solutions can be based on existing technology.

Professor Ian Wilmut, OBE, FRS, FRSE
Principal Investigator, BBSRC, Roslin Institute

9 December 2004
at Pitlochry Festival Theatre

Why Clone? Cloning in Biology and Medicine
Public Lecture following the RSE Schools' Christmas Lecture

Speaker's Abstract

There is much confusion when people see the words 'clone' and 'cloning'. Cloning (also known as nuclear transfer) involves the transfer of the genetic information from a cell to an unfertilised egg, from which the genetic information has been removed. The cloning technique involves several complex steps and is carried out by specialists in the laboratory. In 1996, 'Dolly the Sheep' was created, the first animal cloned from a cell taken from an adult mammal. Offspring have been produced in several species, sheep, cow, mouse, pig, goat, cat, rat, rabbit and horse. However, despite considerable effort by experienced laboratories, no offspring have been reported from the rhesus monkey or dog. There are many limitations to this technology, but also many potential applications, for example, copying our most productive farm animals, producing organs for transplantation or treating conditions such as spinal cord injury.

Professor Roland Jung
Chief Scientist, Scottish Executive
Dr James Robson
National Team Medical Co-ordinator, Scottish Rugby Union

21 January 2005

The Health and Psyche of the Scottish Nation
(In association with the Edinburgh Lectures Partnership)

Obesity has become the most important nutritional problem of the new millenium, affecting not only developed but also less developed nations. There has been a rising tide in obesity in adults from 1980 to 2002 as the number of obese women has trebled, and in men the figure has quadrupled. A recent Scottish Health Survey showed that 62% of men and 54% of women are now medically obese. One of the major problems is the lack of the awareness. Parents who are obese often fail to recognise the problem in their offspring and as a result childhood obesity has reached an alarming level. Obesity in children aged 2 to 4 years has doubled and in 6 to 15 year olds trebled over the past two decades. It is a disturbing fact that already 50% of 12 year olds are overweight or obese. There is a risk that if this pattern of obesity is continued into adulthood it could reverse the increase in longevity achieved in the last three decades by improvements in health.

Obesity is the major reason for the rise in diabetes mellitus, itself associated with subsequent cardiovascular disease. Heart disease has become the second highest cause of death in Scotland, killing 12000 people each year. Obesity is also involved in the development of cancer, metabolic complaints (such as gout and gallstones), sleep apnoea and osteoarthritis, as well as various other conditions all with major health, societal and economic consequences. It was reported in 2002 that the cost of managing obesity and related diseases cost the NHS Scotland an estimated 172 million a year.

Prevention is not easily implemented, with the energy expenditure of the average person much reduced since the 1970s because of the changing nature of work, lost activities, increased sedentary activity, etc, and changes in eating habits, (i.e. larger portions, ready meals, take outs etc.).

Treatment is difficult with limited approaches dependent on diet motivation. Drug therapy is still in its infancy and bariatric surgery is effective, but limited in availability.

Professor Ian Wilmut, OBE, FRS, FRSE
Principal Investigator, BBSRC, Roslin Institute

25 February 2005

To Clone or Not to Clone?

The Peter Wilson Lecture
(Joint ECRR/IoB/RSE Lecture)

Professor Wilmut began by acknowledging the following funding agencies, the Research Councils now known as the BBSRC and DEPRA, and MAF (previously the Scottish Office). Funds were also received from the European Union, the Californian Biotechnology Company and the Jone Corporation.

Cloning has the potential to be used in a great variety of different ways; Professor Wilmut's lecture looked at ways in which nuclear-transfer might be used in agriculture, concentrating primarily on genetic modification. Why might you wish to make genetic changes in livestock? Some concepts (current and evisaged) are: producing proteins in animals, not just for nutrition but also for medical use; organ transplantation; to impart resistance to some diseases, such as foot and mouth; and for pure research.

It is important to note the different approaches that have been used for making genetic change over the last 25 years. From artificial insemination where we are familiar with the fact that efficiency is low, and there are some abnoramilities (which are not normally seen); to the more recent approaches, such as the use of lentiviral vectors, using viruses to carry DNA which have shown startling efficiency in introducing precisely what you want, in exactly the place you want to insert it. In the research involving lentiviruses, experiments have been done with sheep and pigs, with no adverse effect on the animals themselves.

Professor Wilmut concluded that as experience shows you cannot really predict the outcome of research or the practical applications, Dolly had not been considered until the year before she was born. In an agricultural context, artificial insemination in livestock which is hailed because of its contribution to animal breeding, was in fact initially developed to stop the spread of venereal disease.

Ms Alice Walker
British Geological Survey

8 March 2005
at Dingwall Academy

Earthquakes at Home and Abroad

RSE Roadshow Public Lecture

The Indian Ocean Boxing Day tsunami in 2004, highlighted the increasing vulnerability of people across the World, to the impact of natural disasters. In this case, more than 50 countries suffered the deaths of their nationals, some 280,000 in total. Additionally, economic losses from natural disasters, which are measured in £billions, have been rising exponentially for 5 decades, which is a situation that cannot be sustained.

Earthquakes occur everywhere in the world, although most are along the edges of the great plates that make up the Earth's outer skin and which move at about the speed our fingernails grow. Each year the globe is shaken by about 800 'moderate' earthquakes, (magnitude 5-5.9 on the Richter scale), 120 'strong' ones (magnitude 6-6.9) and around 20 'major' earthquakes of magnitude 7 or greater. One point up on the scale means 32 times more destructive energy, so two points is about 1000 times more. There are many more smaller ones but most go unnoticed except by the seismologists who study them (see UK earthquakes, below).

Larger earthquakes can cause landslides, tsunamis and even cause the ground to turn to liquid for a while with buildings sinking and toppling. They can rupture gas or water mains, causing raging fires, and block access for emergency services. The great fire in San Francisco following the 1906 earthquake lasted three days, was more damaging than the shaking itself, and resulted in 80% of the damage.

The Italian earthquake on 31 October 2002, illustrated the importance of protecting public buildings through sound engineering practices. It killed 26 schoolchildren and teachers when the school collapsed despite registering only 5.6 on the Richter Scale; about 270 quakes of this size or greater happen each year, worldwide. TV images showed the extent of the school's destruction and the minimal damage elsewhere, clearly revealing poor construction and a tragedy which should never have happened. The Kobe (Japan) earthquake in 1995, yielded an example of poor planning, when the only bridge to the hospital from the main population centre failed.

The Indian Ocean tsunami was caused by a magnitude 9 earthquake which happens on some plate margins about once every 10 years but not always with a tsunami and the scale of destruction experienced in 2004. To cause a tsunami, the earthquake has to be under the sea and shallow enough so that the fault causing it breaks the seabed and displaces the overlying column of water. This generates the tsunami which is a long wave, less than 1 metre in height and only noticeable when it arrives in shallow water where the height rises to many metres with a kilometer or two of wave behind it that keeps coming in. There may be 2 or 3 more waves behind the first.

Travelling at the speed of a jet plane over the ocean (about 800km/hour) the tsunami struck the nearest shoreline of Banda Aceh, in Indonesia, within 15-20 minutes, Thailand in 1 hour, Sri Lanka in 2 hours, and the east coast of Africa in 7-8 hours. There was, therefore, an opportunity to provide a warning but, sadly, there was no system in place to deliver it in time, except for Kenya where only 1 person was killed. In neighbouring Somalia, 176 lost their lives.

Around the Pacific Ocean, tsunami warning is routine, with a coordination centre in Hawaii where potential tsunami-genic earthquakes are located within minutes (seismic waves travel 50 times faster than tsunami waves), and where the surrounding countries have systems to warn people of the danger, often many hours before the wave arrives. Fortunately, global organizations like UNESCO, have responded to the Indian Ocean disaster by instigating a warning system for that region (already being constructed) and consideration of similar ones for the Mediterranean and Caribbean seas.

It is clear that for all disasters, there is a cycle of relief and recovery followed by a period of normality, then a repeat of the disaster. The only way to break this cycle is to invest in preparation, immediately after the relief, so that the next time the earthquake, flood or storm happens, buildings, infrastructure and warnings protect people instead of failing. As well as making humanitarian sense, this strategy is also economically sound. Studies have shown that £1 spent on preparation saves £7 in relief needed.

The UK is not immune from earthquakes. There are around 200 each year but people only notice about 20 of these. The largest, in 1931, had a magnitude of 6.1. Fortunately, it was centred on Dogger Bank, 100km out in the North Sea, and caused only minor damage on the east coast of England, where many chimneys fell down. Onshore, the largest earthquake in the last 140 years occurred in North Wales on 19 July 1984 with a magnitude of 5.4. It was felt over most of England, throughout Wales, and even into Scotland and Ireland. It caused minor damage as far as Liverpool, 120km from its epicentre. Over the past 15 years, the most damaging earthquake was centred on Dudley, in the West Midlands, on 23 September 2002. It woke up people from Dublin to the east coast of England, and from Yorkshire to the south coast and Devon. At the epicentre, there was much alarm and some damage to chimneys and roofs, with plaster cracking on interior walls, indicating a maximum intensity of six on the European Macroseismic Scale (which describes the degree of shaking in an earthquake). BGS received some 8,000 responses to questionnaires which we distributed nationwide through the media and internet.

The British Geological Survey, in Edinburgh, operates a network of 146 seismometer stations to monitor earthquakes around the world and at home. Data is transferred via telephone lines or the internet to determine, within two hours, the location, magnitude and nature of an event (earthquake, explosion, sonic boom, or mining-induced seismicity) within two hours. The results are widely disseminated, with Government, industry, academia, the media and the public often intensely interested.

Around Dingwall and Inverness, there have been very few earthquakes detected by the BGS seismic stations over several decades. None of these have been felt by people. But a magnitude 2.7 earthquake shook Aviemore on 28th August in 1995, and when we go back over 100 years, we find strong shaking in Dingwall and earthquake damage in Inverness. In 1901, an earthquake of magnitude 5.1 caused damage around the city. Fifty smaller aftershocks were felt during the year but none since then. The Inverness Journal reported that bells rang for nearly a minute and that the spire attached to the jail was “completely rent and twisted several inches round”.

So, in Britain, where we want to understand the risk from earthquakes, we must go back in time, before sensitive instruments were invented, to capture reports of our shaky historical past.

For more information visit www.earthquakes.bgs.ac.uk.

Dr Robert Hawley CBE FREng FRSE
Deputy Chairman of the Foundation for Science and Technology

11 March 2005

Engineering and the Creative Arts : A New Frontier?

(Joint Lecture with the Royal Academy of Engineering)
Part of National Science Week.

Extracted from full published report, available on the RSE Website, or in hard copy from the Publications Office.

Introduction

Since the late 1970s, the influence of technological advances on Man's lifestyle and well-being has increased beyond all predictions and yet this is not appreciated by the majority of people inhabiting our planet. In some cases out of ignorance and, in many cases, because they have yet to benefit from technological advances.

I marvelled at the engineering and technology involved in staging and delivering, to a global audience, the two concerts from the grounds of Buckingham Palace to celebrate the Queen's Golden Jubilee.

In the recent past I have explored two bridges, the bridge between Science and Engineering and the bridge between Engineering and the City. However, there is yet another bridge to be examined and strengthened, that between Engineering and the Creative Arts and through the arts into the creative industries.

This bridge has a long and honourable history, but it is in need of an upgrade and redesign for the twenty-first century. It is a topic that creates a lot of interest and is worth exploring even in a very scant and amateurish way in the hope this will at least start a broader debate elsewhere.

The Engineering profession itself, with a critical role to play in a changing 'knowledge-based' economy, faces problems of recruitment, change and future direction.

This paper suggests some ideas on the way ahead but, to set the scene, I have chosen a few examples of the many remarkable ways in which, throughout history, engineers and artists have worked together in many fields such as painting, sculpture, theatre and film.

It always helps when discussing a bridge to define the two sides between which the bridge stretches.

Engineering has been defined in various ways, quite often using a lot of words, but the simplest definition is that it is the process that converts basic science, via technology, into wealth creating products.

The term creative arts covers many areas such as painting, graphic design, advertising, music, dance, designer fashion, the performing arts, film and video, communications, television, radio and architecture.

The Oxford English Dictionary defines creative as "having the power or ability to create things: showing imagination and originality as well as routine skill" and arts as "subjects (e.g. languages, literature, history, etc) in which sympathetic understanding plays a great part, as opposed to the sciences where exact measurement and calculations are used".

Those in the creative industries depend on engineers, not only for their infrastructures and equipment (heat, light, electricity, water, roads, building and communication systems) but, in partnership with each other, for the development of new techniques, such as digital graphic displays.

For their part engineers turn creative ideas into reality by creative design. Engineers need imagination both to be able to think laterally but also to put themselves on the other side of a discussion.

So engineers have a great deal to learn from those in the arts, perhaps the biggest lesson of which is in the ability to communicate with the rest of humanity, although there are those in the arts who have their own communication problems.

The so-called creative industries are emerging as the critical battleground for the new economy and wealth-creating society of the future. Successful economies depend increasingly on the creation and the communication of, and the understanding and use of, ideas and images. Because of rapidly increasing technological advances engineering has a key role to play as never before. So there is much to be gained from strengthening the bridge between the two disciplines.

So what are the creative industries? These have been defined as "those which depend on the creation of original intellectual property by individuals and teams for their added value; which have creativity at their heart and which have the potential for wealth and job creation". This could also be another possible definition for engineering.

The component parts of the creative sector, as officially defined, are: visual art, design, fashion, advertising and graphics, film and broadcasting, the music business across the spectrum, digital software, theatre, dance and live performance, museums and galleries, the heritage business and publishing. The Department of Culture Media and Sports' Creative Industries Task Force estimates that the creative industries employ more than 1.3 million people, contributing £8.7 billion to the balance of trade, 7.9% of GDP and growing at the rate of 9% between 1997 and 2000. There was an inward investment of £22m in 2001/ 2002 into the UK Creative Industry sector.

As Lord Puttnam has so fully and clearly stated"These industries are the key to the future; not just for those who work in the sector, or those who merely enjoy its products, but to our collective future; that is to say our collective future as an economically and culturally sustainable nation in the globalised economy of the 21st Century."

He continues, "However broadly or narrowly we may choose to define the creative industries they are essential to our future as a modern, competitive trading nation. We would also probably agree that their importance can be measured every bit as much in terms of the contribution to the balance of payments as in their ability to provide pleasure and enjoyment for millions of people all around the globe; and that the future development of these industries is intimately bound up with the development of electronic technologies – most particularly, the Internet.

Talent and skills are, and always have been, the key to the future of the creative industries.

Much more needs to be done if our creative industries are to remain competitive in the digital era. Much, much more must be done if we are to have any chance of creating an international industry, operating on a sufficiently attractive cost-base, to be seriously capable of competing on the world stage. Our only competitive advantage lies in the innovative quality and cost-effectiveness of our workforce.

That means talent and skills right across the board, not just designers, writers and software engineers, but also that new generation of creative entrepreneurs and managers with a serious interest in marketing and finance".

Conclusion

I have only touched on some of the many areas of the arts in a most superficial way and, no doubt, left out many that should have been included. But my purpose was to highlight the growing need and interests in more broadly educating engineers in the arts and humanities and to point out the benefits to both disciplines of so doing.

Undoubtedly there are already many areas where such collaboration is taking place, but much more needs to be done; not only at undergraduate level, but also at the many interfaces of engineering and the arts in order to produce the creative engineers and industries so vital to the future economy of the UK. In addition, those who study the arts and humanities need a basic understanding of science, as future developments will depend on partnerships between engineers and the users of the new technology.

It is a major step forward that the Arts and Humanities Research Board has been redesignated as the Arts and Humanities Research Council and will shortly take its place alongside the other Research councils under the Office of Science and Technology. This will include further cross-fertilisation between science, engineering, the arts and the humanities at the research level.

In addition, one future opportunity should be provided by UK eUniversities, a company created by the UK Government to enable UK universities to deliver their high quality courses on line across the world. UK eUniversities will not offer its own degrees but will provide them from established UK universities. While the initial focus will inevitably be on subjects such as business and management, science, technology, health and environmental studies, over time a wide range of courses, spanning a whole range of subjects, could be made available. Perhaps the most exciting prospect is that the same platform used to gain technical expertise and subsequent continuing professional development could also open up the world of the arts.

To quote John Maeda "More than ever we need people who can lead humanity towards technology that improves society rather than technologies that simply improve our technology itself".

Finally let me quote from my Bridge Lecture :

"But in addition to the existing Bridges between engineering and the City and between engineering and science there is one fascinating Bridge to be more strongly built and used in the future, that between Engineering and the Creative Arts.

Whilst the thought processes of the individuals involved can be different, the Creative Arts depend on engineering for the production of their output whilst Engineering, particularly in the design field, still has much to learn from those involved in the Arts. Building this Bridge will strengthen the foundations of the other two Bridges".

My purpose has been to highlight the need for more open, two-way, interactions between engineers and the arts and humanities and to celebrate some of the rich legacy of achievement on which we can build.

We have, however, a very serious conjunction of challenges; on the one hand, a growing awareness of the critical economic relevance of open bridges between arts/humanities and engineering and the sciences; and on the other, a clear need for a more robust industry/university/Government programme to address both the attraction and creative content of educational provision for new entrants to the profession.

The situation urgently requires action to secure the future. By definition, there are a very large number of professional engineers already in mid-career and also, in the new socio-economic climate, working independently. I am alert to the significance of their creative needs.

For this reason, I have taken an increasing role in the Creative Value Network organisation set up by Ralph Windle. We are close to launching a sustained, inter-active programme of events, working projects, research and communication links; aimed precisely at stimulating the freer exchange of creative ideas and experience across disciplinary boundaries. This programme is known as The Janus Programme, one part of which is to stimulate more arts/engineering interaction. It is named after the Roman God of the open door and I hope by means of this paper I have succeeded in opening the door wider.

Professor Noel Sharkey FIEE FBCS
Professor of Computer Science, EPSRC
Senior Media Fellow, University of Sheffield

4 April 2005

The Robot in your Head

Speaker's Abstract

A lively walk through the history of robots and their relationship to animals. The audience heard about the automata of the ancients (280 BC-) and how they gradually developed into the robots of the 20th century. Following clips of Noel's favourite robots in the movies, he examined the stark reality of the development of real robots today illustrated by his public projects and museum exhibitions. Since the 17th century, the idea has become increasingly strong that we humans and other animals are mere machines or automata. But do you believe it? Are you a robot?

Professor Ricardo Uauy
Professor of Public Health Nutrition,
London School of Hygiene and Tropical Medicine

20 May 2005
at Rowett Research Institute, Aberdeen

New Concept of Food Quality: Beyond Safety and Sensory Properties
Scottish Agriculture & Biological Research Institute Joint Lecture

Professor Ricardo Uauy is one of the most eminent and distinguished scientists in international nutrition today. He is a highly respected advisor to the UN, WHO and FAO and his expertise is wide-ranging and includes basic nutritional science, applied biomedical research, and population-based intervention programmes.

In his lecture, Professor Uauy described how current trends in lifestyles towards energy-dense, high-fat diets and low levels of activity, are risk behaviours that travel across countries and are transferable from one population to another like infectious agents, affecting disease patterns globally. He went on to say that great changes have swept the entire world since the second half of the twentieth century, producing major modifications in diets, first in industrial regions and more recently in developing countries. Traditional, largely plant-based diets have been swiftly replaced by high-fat, energy-dense diets, accelerated by low prices of high fat and high sugar foods, explained in part by agricultural subsidies. Although these changes in diet may have contributed to improved child health and growth in some countries, we now find that nutrition-related chronic diseases such as heart disease, diabetes and cancer are the main killers in developing countries undergoing rapid changes such as China, India, Brazil and Mexico.

Professor Uauy currently holds the Chair of Public Health Nutrition at the London School of Hygiene and Tropical Medicine, University of London, a post which he took up following eight years as Director of the Institute of Nutrition and Food Technology (INTA), Chile. In September 2005 he becomes President of the International Union of Nutrition Sciences. Professor Uauy is a highly respected advisor to the UN, WHO and FAO. "Quality food should not only look, smell and taste good and be free from harmful chemical and microbial contaminants, it should be wholesome in terms of current and long-term health and well being," said Professor Uauy. "Promotion of this idea of food quality is an essential component of preventive health policy, but to successfully promote healthy diets and active lives we need to go beyond individual education. This is almost a lost battle, with the spend on marketing of unhealthy foods being around $500-1000 per each $ spent on promoting the healthy choice. Governments need to practice what they preach, particularly in their institutional feeding programmes in places such as schools. In essence, we need to make the healthy choice, the easy choice."

Professor Harry Burns
Director of Public Health
Glasgow NHS Board

13 June 2005

How Safe are Vaccinations?

Immunisation - the process of inducing immunity in an individual by administering a vaccine, toxoid or antibody-containing preparation.

Professor Burns emphasised that as a Director of Public Health, he had a responsibility for making sure that interventions which would improve the health of the population were available, while also ensuring that the public was protected from interventions which might harm them. There is a balance between effectiveness and risk, as the question is not, "are vaccinations completely safe?" - any kind of intervention has a risk attached, even if that intervention is as basic as drinking a cup of tea - but "do the benefits outweigh any risks or downsides that may be apparent in terms of vaccination?"

Vaccination has a long and chequered history, from Indian Buddhists in the 7th century who tried to protect themselves against the effects of snake venom by drinking it, to the process of variolation; injecting dried smallpox pus into the skin, introduced into England in the early part of the 18th Century. By the late part of the 18th Century it became clear that there was some relationship between smallpox and cowpox, when Benjamin Gesty contracted smallpox from his cows and this led to Jenner's attempt to protect humans from smallpox by scarification with the cowpox virus. One hundred years went past and Pasteur showed that you could grow viruses and bacteria in an attenuated form so that they were less pathogenic and could be caused to produce an infection in humans that would protect them through the more pathogenic virus. Dissent has always gone hand in hand with these developments – Vaccination Acts were passed in 1840, 1853 and 1867 and the anti-vaccination league was founded in 1853. Publications such as the Anti-Vaccinator and the National Anti Compulsory Vaccination Reporter were cirulated and there are reports of demonstrations with 150,000 people attending them against the notion of compulsory vaccination. The Vaccination Act of 1898 abolished penalties for people who objected to compulsory vaccination and that 1898 Vaccination Act was the first time the phrase "conscientious objector" came into the English language.

There are two types of vaccine; live, attenuated vaccines which provide a response close to that of naturally acquired protection and the inactivated vaccine, where often the cell wall of an organism is broken down and some kind of antigenic fraction extracted. This is then used to stimulate an immunological memory in the body. It can't cause an infection because there is not a live organism there, and it is also less immunogenic because there is not a live organism there. Sometimes you need several doses per immunity and often boosters in subsequent years.

Can you still get a disease if you have been vaccinated against it? Generally the vaccinated population is less likely to be affected by a condition. Some immune systems are not pure enough to respond with T-cell responses and in the elderly or the chronically ill, there may be a weakened immune system, which cannot respond appropriately. Therefore vaccination in these circumstances may be ineffective. Sometimes storage is inadequate or the vaccine has expired. Breast-fed new-born babies are taking in immunoglobulins and antibodies in the mother's milk, and in those circumstances, those antibodies may kill the vaccine before it has the chance to stimulate some kind of memory in the baby.

Can vaccines harm you? It all depends on what you mean by harm. There is no question that vaccinations have some side effects. Many of these vaccines involve the injection of life attenuated organisms with an aim of creating a clinical syndrome that stimulates the body's response to those organisms. So, it would be unusual not to have a proportion of patients who are vaccinated who don't get a temperature and it is not correct to try and give the impression that there are no consequences of vaccination.

Professor Burns discussed the MMR controversy and other vaccination related studies from Finland, Sweden and Japan and concluded that he saw no significant trends for vaccines being harmful, and could see significant trends that convinced him that it is very important to vaccinate the population. Failing to vaccinate to the required level does result in oubreaks, and consequently individuals are harmed. By choosing not to vaccinate you are making a decision which affects the wider community.

"I think the answer to the original question is that side effects are rare, and generally slight, although not always and it would be wrong of us to deny that tragedies can occur. We don't know the future, but in the vast majority of cases, side effects are slight. The vaccines are effective in protecting against the diseases that they are designed to mimic, and the system that allows vaccines to come into common use is one in which great care is taken to respond to public concerns. The use of mercury, for example, in vaccines is now almost completely phased out. I think there is no doubt that vaccines have contributed significantly to advances in life expectancy and quality of life in this country, and I am very pleased to be part of a public health system that has helped to generate these improvements in life circumstances particularly for our children."

Professor John Mitchell OBE FRS
Chief Scientist,
The Met Office

11 July 2005

Climate Change: Apocalyptic, Much Ado about Nothing or Cause for Concern

Professor Mitchell looked at six broad areas relating to climate change:

i) what is happening to the climate?

ii) recent observations

iii) the physics of the climate

iv) how do we know climate change is due to human activity or do we indeed know that?

v) what would happen in the future and when?

vi) the speculative changes covered often by the media.

What is happening to our climate? There is a general trend of warming, but with some variations. There was warming early in the twentieth century, followed by a period of little change with cooling particularly in the Northern Hemisphere, and then a much more pronounced warming over the last three decades. What is causing the longer term trend, is it natural variability or is it something else?

Recent observations have included independent sets of temperature measurements of surface, air and sea. Collectively they all show the same trend and pattern of the gradual rise in global warming. Other evidence is taken from what is happening to glaciers - most of the world's glaciers are receding.

Why is this happening? One hypothesis is that it is due to an increase in greenhouse gases, which warm the atmosphere. There has been an increase in carbon dioxide, as well as other greenhouse gases such as methane and CFCs.

How do we know climate change is due to human activity? Firstly, the natural factors affecting the climate must be taken into account. But, when we add those effects of human activity which increase the greenhouse gases (i.e. factors including aerosols etc.) we find that they corrolate with this very rapid warming over the last three decades.

What will happen in the future and when? Over the next hundred years the weather will become more extreme. Sea levels will rise, temperatures will rise, some areas will become drier (particularly the Mediterranean) and rainfall will eventually become more extreme.

Extreme weather conditions that were once sporadic will become more frequent.

Professor Mitchell concluded that there isn't any uncertainty about there being substantial future climate change, but there is a lot of uncertainty as to the extent of it. Even if we do reduce emissions there are still going to be substantial climate changes. One can certainly rule out some of the doomsday scenarios, but it's not much ado about nothing, it is a cause for concern.

A video of Professor Mitchell's lecture and his Powerpoint presentation can be found on the RSE website.

Professor Sally J Macintyre OBE, FRSE
Director, MRC Social and Public Health Sciences Unit,
University of Glasgow

3 October 2005

Who You Are or Where You Are? Social and Spatial Patterning of Health

Interest in the impact of the social and physical environment on health dated from the classical Greek and Roman periods, as seen in Greek and Roman medical thought and embodied in Roman public health architecture. The attention paid to the environment as an influence on health had also been particularly important in nineteenth century public health thinking in industrial societies. The response to poor living conditions was not to target individuals but the environment, resulting in a sanitary movement which involved things like water-works in Loch Katrine producing fresh water; sewerage etc.

Attention to the environment had waned with the epidemiological transition from infectious to chronic diseases, and much recent public health thinking focused on personal lifestyles and responsibil-ities. What came to be seen after the Second World War was the chronic disease of affluence rather than poverty. There were consid-erable improvements in living standards and also control of environments, and an increased interest in lifestyles and behaviour. A White Paper from all the UK Health Departments in 1976, *Prevention and Health, Every-body's Business*, tried to put the spotlight back onto individuals and their lifestyles.

Professor McIntyre described findings from her own work on health-promoting and health-damaging features of local environments in the west of Scotland, with particular attention to the poor living conditions in Glasgow in the 19th Century. She suggested that we need more focused research on specific pathways, such as how the environment influences physical activity and diet, or the social factors which influence mental health. She concluded by sug-gesting that "who you are" and "where you are" both matter for health, and both need to be taken into account in public policy-making.

CONFERENCES, WORKSHOPS, SYMPOSIA, SEMINARS AND DISCUSSION FORUMS

Conference

Current Research in Mathematical Biology

Joint Conference with the Royal Swedish Academy of Sciences
at the Kelvin Gallery and Hunterian Museum,
Gilmorehill Campus, University of Glasgow

25 November 2004

The concept of the Royal Society of Edinburgh and the Royal Swedish Academy of Science co-hosting this conference was born during a coffee break conversation with a Swedish colleague in the course of a meeting on stem cells in Scotland House, Brussels. We both work in the field of cancer research, and discussed the need for a greater quantitative contribution to our own work and to the exciting developments in stem cell research we were hearing about in Brussels.

On returning to Scotland, it was encouraging to find from mathematical colleagues that they were equally enthusiastic to establish and extend such a dialogue, and contact with the Royal Swedish Academy of Science confirmed that Nordic colleagues shared this view.

The conference itself exceeded expectations. Fields covered included modelling of the degree of risk to life from aortic aneurysms, the quantitative relationship between plankton stores and fish stock in the Atlantic, evolutionary theories, mathematical calculations to accurately target tumour cell load in cancer chemotherapy, cell movement and resultant soft tissue modelling, and branch theory in population ecoloty. The formal presentations were accompanied by lively and informed discussants both from invited panellists and the audience.

Informal comment from delegates who ranged from enthusiastic undergraduates to more mature but no less enthusiastic Nobel Prize winners indicated that the chosen topic was an exciting growth area, and one which merits revisiting over the next few years.

Professor Rona MacKie, CBE, FRSE. International Convener, The Royal Society of Edinburgh.

Over the past 25 years Mathematical Biology has become an increasingly important research area. It is a wide ranging subject which has seen success in many practical and applicable problems, from helping to determine government policy on conservation and infectious disease control issues investigating the mechanisms by which tumours grow or wounds heal. This one-day conference aimed to bring together experts in several different areas of mathematical biology to present talks and to hold open discussions on what has been achieved to date and what we would like to achieve in the future.

Professor Brian Sleeman opened the conference by discussing contributors to mathematical biology in the last century, including AL Hodgkin and AF Huxley (physiology), John Maynard Smith (Genetics and Ecology), Alan Turing (morphogenesis) and Jim Murray, whose work ranges widely over the field of mathematical biology. Professor Sleeman also touched on some current problems in mathematical biology including immunology, climate change, plankton dynamics, understanding things at the gene level, cell biology and bioinformatics.

Professor Nick Hill discussed mathematical modelling of vascular disease. Current and future problems include (i) global circulation models (ii) flow in collapsible tubes (iii) fluid structure interactions; and (iv) structure and material properties of the arterial wall, looking specifically at the example of the abdominal aortic aneurysms.

The session *Mathematical Ecology: From Plankton to Fish: Ecological models on the Ocean Scale* was chaired by Professor Torbjorn Fagerstrom and the speaker was Dr Douglas Speirs. The chairman remarked that historically mathematical ecology can be split into three branches (i) Ecosystem Ecology which looks at how energy flows and is transformed into ecosystems, (ii) Population Dynamics which looks at how populations vary over time and space, and (iii) Evolution, the short term processes of adaptation to competitors and the environment.

Professor Nick Barton and Professor Siv Andersson were the speakers for the session *Applications of Mathematics in Bioinformatics and Genetics.* Professor Barton discussed how there have been many contributions to this field from statisticians and computing scientists. The area is not just technological; it is about how to understand large bodies of data. Professor Andersson started by discussing genome projects. He then went on to present several possible evolutionary theories: the tree of life (the neutral theory of evolution); and the Web of Life, in which each gene has a unique history.

In the session *Efficacious Mathematical Modelling: Chaos, Complexity and Calculus Can Cure Cancer,* Professor Mark Chaplain introduced biological hierarchy: Ecosystem–population–family–whole organism–tissue/organ–cell–organelle–nucleus–chromosome–gene–RNA–protein sequence–

protein 3D structure–molecular function.

Soft Tissue Mechanics to Cell Motion: Mathematical Modelling of Cell Motion was introduced by Professor Jonathan Sherratt by saying that cell motion is important in wound healing. There are two ways of modelling this: (i) looking at the individual cell and how it moves and (ii) looking at the collective behaviour of the whole cell population. The speaker for this session was Professor Brian Sleeman who went onto explain the movement of cells in more detail.

The session *Branching Processes in Biology* was introduced by Professor Eric Renshaw advocating research interplay between biologists and mathematicians. The speaker was Professor Peter Jagers who discussed population modelling and calculating the probability of extinction.

The final part of the day was an open panel discussion chaired by Professor Sean McKee, questioning what were the main challenges mathematical biology and where is mathematical biology now?

Professor Jagers of the Royal Swedish Academy of Science expressed his satisfaction at the quality of all the scientific contributions and suggested that the dialogue established in Scotland could perhaps be continued in Sweden at a future meeting on a similar topic.

Discussion Forum

HIV and AIDS in Scotland: Beyond the 1980s

8 December 2004

Dr Gordon Scott
Department of Genito-Urinary Medicine, Royal Infirmary, Edinburgh

Mr Neil Gerrard MP
Chair, All Parliamentary Group on AIDS

A Discussion Forum at the Royal Society of Edinburgh lead by Mr Neil Gerrard MP, Chair of the All Party Group on AIDS and Dr Gordon Scott of the Genito Urinary Medicine Department at the Western General Hospital in Edinburgh. Chaired by The Right Reverend Richard Holloway FRSE.

Neil Gerrard began the discussion by presenting the large audience with an international overview of the AIDS pandemic. By the end of 2003 an estimated 53,000 people were living with HIV in the UK. New diagnoses have been rising steadily since 1998. There were over 6,600 new diagnoses in 2003, more than double the 1998 total. In the earlier years of the epidemic men who have sex with other men were consistently the largest group diagnosed, but in each year since 1999 they have been outnumbered by infections acquired through heterosexual sex. The majority of the new heterosexual infections are believed to have been acquired in sub-Saharan Africa, but the trends are bad for virtually every group of people at risk of infection.

All the data indicate how short-sighted it would be to regard HIV as a problem which we in the UK do not have to worry about, that this is an issue for the developing world but not for us.

Africa is currently the centre of attention in relation to HIV. But new epidemics are springing up. In Central and Eastern Europe and the Commonwealth of Independent States (mostly the former USSR) UNAIDS estimate as many as 280,000 people contracted the virus in 2003, bringing the total infected to as many as 1.8 million. This region includes several countries which are either EU members, or will be soon.

The Russian Federation, Latvia, Ukraine and Estonia are experiencing some of the fastest growing HIV epidemics in the world. Injecting drug use is the main driver, but with an HIV prevalence rate approaching 1% of the population Russia, and other East European states, are at the point where this could tip over into a generalised epidemic.

It is not only Eastern Europe where there are dangers. Approaching 5 million people are infected in India. China has a growing problem. Some of the worst estimates for new infections in these countries over the next ten years, if nothing is done, are horrendous.

In some of the worst affected countries the response so far to the epidemic has been at best patchy, and in some countries politicians have been unwilling to acknowledge how serious the problems are. The consequence is that policies to prevent HIV infections are poorly developed.

So how will this affect us and how should we respond? The rise in heterosexual infections originating in countries outside the UK has lead to calls for mandatory testing of those coming to settle or work in the UK, with the implication that a positive test would lead to the denial of entry. Calls for testing ignore the potential public health impacts and the effects on the individuals concerned. We know that the stigma attached to HIV infection is one of the major drivers of the worldwide epidemic. People who are fearful of being identified as having HIV are much less likely to test. They then are much more likely to pass on the infection, a clear public health risk.

There is another dimension to this question. We know from countries which have large numbers of people infected now that HIV has devastating effects not just on health, but on the economy, on all public services, and on security. Can we sit back and ignore the possibility of these effects developing in the countries now starting to be seriously affected, or should we be doing all we can to help them address their problems?

Dr Gordon Scott followed Neil Gerrard with a snapshot of HIV epidemiology in Scotland. The first case of HIV-related illness in Scotland was seen in 1983. Initially it was anticipated that our epidemiology would be similar to that seen in the USA and England, with gay men being affected predominantly. However, when testing for HIV became available in early 1985 as a research tool, the virologist in Edinburgh tested some samples from intravenous drug users (IDUs) attending health care facilities, and found to his surprise and horror that approximately 50% were positive. Thus the Edinburgh IDU outbreak was uncovered.

In 1986, there were 257 new cases of HIV infection in Lothian, of whom 206 were IDUs. As most IDUs are heterosexual, this led to significant numbers of cases being transmitted to sexual partners. Some pregnant women infected with HIV had the additional tragedy of passing on the infection at childbirth.

Harm reduction interventions including needle exchange and prescription of oral opiate substitutes such as methadone led to a dramatic fall in needle-sharing HIV transmission, and by the end of the 1980s sexually transmitted cases of HIV predominated.

Throughout the 1990s, the number of new cases of HIV diagnosed in Scotland each year was remarkably consistent at 150-180. However, in 2002 and 2003 there were 250 and 257 cases respectively, and there have been 274 new cases in the first nine months of 2004. We now have a similar pattern to the rest of the UK, with the two major groups affected being gay men and those infected in Sub-Saharan Africa. Heterosexual acquisition in Scotland continues at low level, but currently there are almost no new cases acquired through drug use

Advances in the management of HIV such as antiretroviral therapy (ART) have now made this an eminently treatable condition, with life expectancy now measured in decades. ART use in pregnancy can also significantly reduce the risk of mother-to-child transmission (MTCT). Although these advances are available to those living in the developed world, most HIV-infected people worldwide have no access to ART.

Our challenge now is to develop efficient services for the growing number of people living with HIV in Scotland, whilst offering all assistance to colleagues working in resource-poor settings.

An extremely useful discussion, informed by the high level of knowledge represented by the mainly professional audience, followed the presentations from Neil Gerrard and Gordon Scott. Among the topics discussed were Methadone maintenance programmes, the fundamental importance of getting prevention messages over, the nature and effectiveness of the new drug therapies that had had such a dramatic effect in the UK, the possible importance of research into micro-biocides and the complex role that culture played in impeding effective preventive messages to populations.

In his vote of thanks, the Chair noted how it would be easy to be depressed by the statistics of the pandemic, with 30 million infected world-wide, the biggest health catastrophe in history: but we had also been given enough data to support a more optimistic view. We know that this is a health crisis that can be dealt with by a combination of highly effective drug therapies and changes in culture and life-style in the prevention sphere: what is needed is appropriate political leadership and a new ethic of resource allocation.

Discussion Forum

… but Cuckoos don't nest, do they? Neurosurgery for Mental Disorder in the 21st Century

17 January 2005

Professor Keith Matthews

Head of Psychiatry & Behavioural Science, University of Dundee.

Speaker's Abstract

Originally introduced as a treatment for schizophrenia in the era before the discovery of effective drug treatments for mental illness (the 1930s), the frontal or prefrontal lobotomy came to be widely used as a treatment for a broad range of poorly specified mental and behavioural disturbances. These crude and destructive freehand procedures were overused, with an absence of critical appraisal of their efficacy and adverse effects. Without question, many individuals were damaged and disabled as a result of over-zealous and unjustifiable clinical practise. Although the most unsavoury aspects of the history of what ultimately became known as '*psychosurgery*' are familiar to many, the potential value of such treatment approaches in the 21st century is much less widely recognised.

In 1976, the World Health Organisation defined psychosurgery as, *"the selective surgical removal or destruction of nerve pathways for the purposes of influencing behaviour".* Implicit within this definition, was the assumption that the primary purpose of surgery was to modify behaviour by its effects on psychological processes within healthy brain tissue. This no longer reflects appropriately our understanding of the neuroscience of mental disorder, nor the therapeutic aims of what has more appropriately become known as Neurosurgery for Mental Disorder (NMD).

NMD has been defined instead as, *"a surgical procedure for the destruction of brain tissue, for the purposes of alleviating specific mental disorders, carried out by a stereotactic or other method capable of making an accurate placement of the lesion"*. This definition emphasises important conceptual shifts:

1. in the manner in which psychological processes are now considered to be located within, and a product of, specific brain circuitry, and;
2. in the explicit focus on the alleviation of the symptoms of specific mental disorders.

Just as the symptom burden of neurological disorders such as Parkinson's disease can now be

effectively and reliably modified by the targeted interference in function of specific brain circuitry through neurosurgical methods, there are selected forms of chronic and otherwise untreatable mental illness that can benefit from stereotactic neurosurgery. Such procedures have been available in Dundee since 1992 for a highly selected group of patients with chronic, severe and otherwise intractable illnesses. We believe that the ethical and effective application of such NMD techniques is possible, provided that treatments are offered within a multidisciplinary setting and subject to appropriate clinical governance arrangements. Indeed, it is only within such a clinical framework that the 'third-wave' of neurosurgical treatments for mental disorder, for example electrical deep brain or Vagus nerve stimulation, may be explored.

In my presentation, I shall review the history and present status of neurosurgical interventions for mental disorder, I shall consider some of the key ethical issues and I shall describe the activities of the Dundee Advanced Interventions / NMD service.

Conference

Europe's Hidden Coral Worlds

Organised Jointly with the Scottish Association for Marine Science

23 February 2005

Extracted from the published report (ISBN 0 902 198 54 8) which is available on the RSE website

The term 'coral reef' is normally associated with shallow-water tropical seas, but recent developments in the technology used to survey the deeper waters of the continental shelf and slope have revealed dramatic and diverse coral ecosystems. These are formed by relatively few coral species, often referred to generically as deep-water or cold-water corals. These ecosystems represent an exciting habitat in the depths of the oceans but their true extent is only now being fully realised. This one-day conference, which attracted some of the leading international figures in this field, focused on key areas of geology and biology, as well as conservation and management.

Cold-water corals are found along the European continental margin where they can develop reef structures, colonise seabed mounds and are intimately associated with large carbonate mounds. The two main species are the framework-forming *Lophelia pertusa* and the frequently associated species *Madrepora oculata*. A large number of carbonate mounds have been discovered in the Porcupine Seabight, to the west of Ireland. Cold-water corals are also found to colonise smaller seabed mounds. Examples are found in the Rockall Trough, to the north-west of the UK, and include the Darwin Mounds, described as 'sand volcanoes' capped with coral colonies. The majority of reefs described so far in the north-east Atlantic are found along the Norwegian continental shelf.

All speakers began by demonstrating that knowledge of cold-water corals in the north-east Atlantic stretched back 150 years, with some of the earliest work published by the Royal Society of Edinburgh. **Dr Jean Pierre Henriet** discussed the formation of carbonate mounds. He asked if cold-water corals play a role in this process and suggested that mound formation occurs at the interface between external and internal processes. **Professor Christian Dullo** spoke of the importance of oceanographic conditions on the distribution of cold-water corals. **Professor Andre Freiwald** provided an overview of the key cold-water coral species around the world and highlighted important aspects of these communities. **Dr Jan Helge Fosså** gave an overview of research in Norwegian waters and the impact of the fishing industry. He went on to show how some areas have been protected and what he believes needs to be done to safeguard cold-water corals. **Dr Mark Tasker** gave a national conservation agency's perspective on how to protect cold-water corals. He detailed the problems that are faced and suggested some solutions to overcome them.

Dr Martin Hovland spoke of his experiences in the oil industry in terms of surveying areas of cold-water corals in Norway. He presented evidence that the occurrence of corals may be related to methane seepage from the sea floor.

Dr Murray Roberts of the Scottish Association for Marine Science, summarised the day's proceedings. He mentioned the need for our biological knowledge of cold-water coral reefs to develop to a similar level to our geological understanding. He emphasised the exciting potential of the project to drill the Challenger Mound to understand the genesis of carbonate mounds and how close interdisciplinary collaborations were essential to gain full benefits from any deep-water research efforts. Another important point that Dr Roberts noted was the use of palaeo-records to understand past variability and predict the results of future environmental change. He also felt that statistical modelling techniques using the growing database of cold-water coral occurrence and associated habitat requirements should be developed to allow predictive mapping of deep-water coral areas to be developed. There was also a clear need to increase the involvement of all marine stakeholders from the fishing and oil industries to the general public.

To conclude, Dr Roberts highlighted the need to understand and integrate larger-scale processes to appreciate fully the ecological significance of cold-water coral reefs. However, the lack of unified methodologies remains a barrier, which can only be overcome by an international and interdisciplinary approach. He suggested there is also a need to unify methodology and definitions. He also suggested we learn from the shallow-water coral community as well as striving to continue the efforts in basic ocean exploration and mapping. All of these elements are vital to design appropriate conservation measures. A final point that he felt came across from the conference was that the expertise, technology and areas of the ocean described were almost exclusively from the developed world. There is now a clear and urgent need to transfer this knowledge and expertise to the developing world.

Discussion Forum

The Ethics of War

1 June 2005

Professor Richard Sorabji CBE FBA
Emeritus Professor of Philosophy, Kings College, London
Professor John Kelsay
Richard L. Rubenstein Professor of Religion
Florida State University

Regime Change. Professor Richard Sorabji CBE FBA

Who have been against regime change, other than the regimes threatened with change?

Early thinkers

Aristotle in the 4th century BC explained how to avoid regime change in Book 5 of his *Politics*, because civil war had been such a curse for the Greek city-states. Freedom from civil war may be more important, he thought, than whether the regime under which one is living is one of the better types.

In the thirteenth century AD, Thomas Aquinas did not mention regime change as one of the possible motives for a just war. But he thought the assassins of Julius Caesar justified, because Caesar got power illegitimately through violence.[1] Further, tyrannicide is not seditious, unless it creates suffering out of proportion to any benefit; it is the tyrant who creates sedition, by failing to serve the common good.[2]

A little later, Marsilius of Padua who lived in the thirteenth to fourteenth centuries, made the power of kings and Popes depend upon the people, so that the Pope had no power to depose a king.[3] This initially suited Ludwig of Bavaria who had himself crowned by the Roman people without the Pope's sanction and then deposed the Pope. But when the Roman people deposed Ludwig in turn, hoist by their own petard, he and Marsilius were forced to flee.

The most impressive of the early discussions was that of the Spaniard Vitoria, who in 1539 wrote against regime change by his fellow-Spaniards among the American Indians, except under two rather particular circumstances.[4] Even if injustice can only be rectified by invasion, it does not follow that regime change is justified. Further, he declared in the same year that the American Indians had the right to rule themselves, unless they could be shown to be like orphans who needed someone to rule them, but that would have to be for their own good.[5] Vitoria was also the first to rule out religion as a possible justification for war. His successors, such as Grotius, were more opportunistic about regime change.

English kings and a philosopher

James I, King of England from 1603-1625, was confronted by the Gunpowder Plot in 1604, and made all Catholics in the realm swear an Oath of Allegiance, according to which they would not kill him, if the Pope declared him deposed. King Henry IV of France was assassinated in 1609. So the Spanish Jesuit Suarez chose a sensitive time in 1613 to publish against James his *Defence of the Catholic Faith Against the Errors of the English Sect*. The book was burnt in London and Paris. Following Thomas Aquinas, it allowed the killing of a ruler who came to power illegitimately. But as regards a legitimate ruler like James, it allowed killing only after a legitimate sentence had been declared on the grounds that the ruler was not serving the common good, which in natural law was the basis of the ruler's power. And among further safeguards there was also Thomas Aquinas' insistence on proportion – not doing more harm than good [6]. Charles I of England was executed later in 1649 only after a formal sentence had been passed.

20th Century

Vitoria's idea about orphans was revived in the form of trusteeships in the 20th century. But Noah Feldman has argued that the Hague Conventions envisaged returning an invaded country after a period of trusteeship to its original owner, whereas the League of Nations envisaged returning things after a period of trusteeship only to the developed nation, not to the original ruler. The latter idea was resuscitated in connexion with the invasion of Iraq in 2003, after a period of disuse, when first a longer period of US military rule was discussed and then a shorter period decided on of military rule by a 'Provisional Authority' consisting of the USA and Britain.

In 2002, The British Attorney General, however, warned the British Prime Minister that regime change was not legal in international law as an end in itself, but could only be justified if shown to be the sole means to some other legitimate aim.

Two thought-provoking rationales for regime change: (1) Philip Bobbitt

In *The Shield of Achilles* (Knopf 2002) Philip Bobbitt gives a highly original account of European War going back to the ancient Greek historian Thucydides, and adorned with the most wonderful poetry. I write with admiration in spite of expressing disagreement. Bobbitt argues that the sovereign nation state came to an end in 1990, with the end of the Soviet regime, and its demise was made apparent in the former Yugoslavia by the failure of the United Nations, the society of nation states, to prevent massacre in Srebenica and by the subsequent invasion of Kosovo, part of what had once been regarded as a sovereign country; an invasion vetoed in the United Nations, but led by the USA.

The nation state, on this view, has been replaced by the market state. The market state cannot offer security, which in the modern world is no longer available, but it can offer opportunity to conquerors and conquered. It needs legitimacy, but this is provided by its bringing democracy. The bringing of democracy implies regime change.

To mention three disagreements, I believe that legitimacy requires attention not only to opportunity, but also to justice. Secondly, for a market state to have legitimacy, it will need to be seen as just even by those it may be invading. And this requires it to have a reservoir of people with an intimate understanding of the history, outlook and religion of those who may be invaded and of people with the ability to communicate at every level, which presupposes a tradition of intensive language training on a large scale. Thirdly, I myself believe that we will live in a more peaceful world, if instead of having such market states, we respect sovereignty unless certain things are wrong. The Western tradition has for long concentrated on one example of this; satisfaction for injustices when that cannot be obtained except by invasion, with or without regime change. But more recently, there has been concern with preventing imminent and massive human catastrophy and still more recently with the legitimacy of secession, like the recent secessions of smaller countries from the Soviet Union. There are a number of different forums in which the 'unlesses' may be hammered out and agreed on. But I do not believe this approach should be superseded. The advantages of the market state may seem less attractive in the West, if we imagine, let us say, China, soon becoming the most powerful market state.

Rationales (2) Noah Feldman

Noah Feldman is, for a start, a wonderful scholar of attitudes in medieval Islam and Judaism to war and conquest, having written about those two contemporaries Averroes and Maimonides, who belonged respectively to the conquering and the conquered communities of 12th century Spain. But he has also been Senior Adviser to the US Government on the Iraqi Constitution. This expertise lies behind his book, *What We Owe Iraq* (Princeton 2004) in which he makes a suggestion whose thoughtfulness I admire, even though I disagree with it.

It is too much to ask, on this view, that the main motive for an invasion should be the benefit of those invaded, because everyone is motivated by their own interests. The benefit of the others should be required as a constraint on pursuing one's own interests, rather than as the primary motivation. Democracy does constitute a benefit, and the bringing of this benefit presupposes regime change.

My first doubt about this proposal is that if the introduction of democracy is always a benefit, then it is too easy to believe that the constraint is being met, so that it will not act as a sufficient constraint. I am also not sure that governments always try to act principally in their own interests, or that the invasion of Kosovo a little earlier was principally motivated by the invaders' interests. The huge cost and difficulty of the subsequent nation-building was surely foreseen. At most, there may have been a balance of costs between action and inaction, but the salient point was the certain and imminent human disaster if action was not taken. Nor was regime change a primary purpose. Admittedly, the invasion was illegal, because it had been vetoed by Russia at the United Nations, and illegality is a very serious consideration, given the kind of world in which I believe it is best to live. But given the imminent and certain human disaster, I do not myself believe that the Kosovo invasion was immoral as well as illegal.

Notes

1 In *Sent*. 2, dist.44, q2, a2.

2 *Summa Theologiae* 2.2, 42.2, ad 3.

3 In *Defender of the Peace*.

4 *On the Law of War* Q 3, a 9 and in 1537 *On the Dietary Laws* 1.5.

5 *On the Indians* Q 3, a 8.

6 I have benefited from Harro Höpfl, *Jesuit Political Thought*, Cambridge 2004, Ch 13 and from a draft chapter on Suarez, which Terry Irwin was kind enough to show me from his forthcoming history of ethics.

Regime Change in Islamic Tradition. Professor John Kelsay.

Professor Sorabji's précis of remarks begins with these lines: "Regime change was such an attractive idea. Was anyone ever opposed, except the victims?"

I should like to organize my comments around these lines. From the standpoint of Islamic tradition, regime change was, and indeed remains, an attractive idea. It is so because the problem of tyranny. At the same time, particular cases of regime change are complicated. Thus, Muslim scholars suggested that responsible regime change requires answers to several questions: Who has the right to authorize regime change?; When is regime change advisable?; and most importantly, how is regime change to be accomplished?

The attraction of regime change

In considering those things that make regime change attractive, it is important to focus on the moral attractions of the idea. One should not deny that regime change possesses other sorts of attractions. It is or can be a way of amassing wealth, increasing land holdings, winning fame and glory, or pursuing power. However one will not understand regime change in Islamic tradition, apart from the moral attractions of the notion. For that matter, I think a grasp of the moral attractions of regime change is necessary when thinking about the power of the idea in our own time.

Muslim scholars saw regime change as a means of dealing with tyranny. Two passages from the Qur'an provide insight into this. Qur'an 79:15ff. begins with the question: "Have you heard the story of Moses?" The passage proceeds as a recitation of the tale:

"His Lord called out to him in the sacred valley of Tuwa: 'Go to Pharoah, for he has exceeded all bounds, and ask him, `do you want to purify yourself? Do you want me to guide you to your Lord, so that you may hold him in awe?'"

Moses follows this invitation with the performance of miraculous deeds. Nevertheless, Pharoah refuses the offer of guidance:

He turned away and hastily gathered his people, proclaiming, 'I am your greatest Lord,' so God condemned him to punishment in the life to come as well as in this life. The passage concludes that "there is truly a lesson in this for anyone who stands in awe of God."

Unfortunately, tyrants do not stand in awe of God, or indeed of any other power. Pharoah illustrates this, in that he 'exceeds all bounds,' a phrase indicating that he violates the limits of moral propriety. With tyrants through the ages, Pharoah regards the people and land for which he has oversight as 'his own.' He does not rule for the common good; rather, Pharoah rules for personal gain. He tells his people "I am your greatest Lord," meaning that there is no other to which they may appeal. The vocabulary is a Muslim vocabulary, but the image is familiar to all. Islamic tradition regarded government as a necessity, and good government as a blessing. Indeed, Muslim scholars generally argue that even bad government is usually better than the alternative. But some governments are tyrannical, and one should strive to change them.

In Qur'an 79:15ff., Moses tries to deal with tyranny through preaching. Islamic tradition typically prefers that regime change occurs by this means, *viz.*, that the ruler who 'exceeds all bounds' recognizes the error of his ways, and repents. In Pharoah's case, as in many others, this will not work. Thus one must turn to a second passage, in which fighting is commanded. Qur'an 4:75 occurs in the context of the long struggle between the early Muslims and the Quraysh, the most powerful tribe in Arabia during the sixth and seventh centuries C.E. From the Muslim point of view, the leaders of this tribe were tyrants, as demonstrated by their attempts to suppress Islam. The chronology of the struggle is given in the works of Muslims historians. Their accounts correlate with a reading of the Qur'anic verses dealing with fighting. From these accounts, we learn that Muhammad, like Moses, first confronted tyranny with preaching. When that failed, he turned to military means. At 4:75, the struggle is reaching its crescendo, and thus we read:

"Why should you not fight in God's cause and for those oppressed: men, women, and children who cry out, 'Lord, rescue us from this town whose people are oppressors! By your grace, give us a protector and helper!'?

In this text, tyranny is identified with oppression. Most commentators suggest those 'who cry out' are Muslims prevented from practicing Islam by the leaders of the Quraysh. They may also be people desirous of hearing the message of Islam. In either case, the attraction of regime change is clear. It is a way of dealing with tyranny, and thus of restoring God-given rights of justice and dignity to those who suffer.

The complexities of regime change

This moral attraction of regime change is a constant in Islamic tradition. As people say, however, the 'devil is in the details.' When Muslim scholars addressed the particulars of regime change, they expressed a number of concerns.

For example, who has the right to authorize regime change? From the time of Muhammad's death in 632 C.E. to the middle of the eighteenth century, the answer of the majority (Sunni scholars) went as follows: the right of regime change belongs to the Caliph or sovereign head of the Islamic State, in consultation with recognized religious authorities. By contrast, the right of regime change does not belong to private citizens. Muslim scholars understood that the idea of regime change carries anarchic tendencies. The idea is attractive, and may in some cases be considered a moral imperative. Yet human beings make mistakes, and it is therefore best to limit the right of implementation to those assigned to rule.

The minority (Shi'i scholars) pressed the question: What if the ruler is unjust? In the Shi'i view, only the divinely appointed Imam or leader has the requisite knowledge and character to authorize regime change. As history shows, the various Shi'i groups found it difficult to agree on the identity of the leader. Further, for the largest group, the twelfth Imam was taken into hiding by the will of God in 873/74, where he will remain until God orders his appearance. At that time, the rightly-guided leader will command a war that will drive out tyranny for a thousand years. In the interim, Shi'i scholars through the centuries delimited the right of rulers to 'imposed' wars. In recent times, the Ayatollah Khomeini put forward the controversial idea that religious scholars might lead the people in a campaign to depose a rule whose record reveals him as a rebel against Islam. Khomeini argued that the record of Shah Reza Pahlavi fitted this description, and thus justified regime change. Similarly, the war between Iraq and Iran in the 1980s was interpreted as one in which Saddam Hussein rebelled against Islam by attacking an Islamic State. Khomeini and other Iranian leaders hoped to depose Saddam, and thus to create space for the Iraqi people to form a new government. That this did not occur was a disappointment, which Khomeini described as "worse than drinking poison."

Despite their differences, both Sunni and Shi'i scholars avoided assigning the right of regime change to private citizens. Contemporary Islamists (most Sunnis) argue differently: If there is no ruler able or willing to secure Islamic interests, the right of regime change falls to the people, or to a vanguard who will lead them. This argument, put forward by Usama bin Ladin and like-minded persons, gives many

Muslims pause. The idea of regime change is morally attractive. But if anarchy or something worse results from the effort…what then?

In addition to asking 'who may authorize regime change?,' Muslim scholars worried about when regime change is advisable, and how it will be accomplished. With respect to when, the majority argued that a non-Muslim regime should be invited to acknowledge Islam. Should the target government decline, that is proof of its tyranny. Here it is important to note that the majority did not consider wars aimed at changing non-Muslim to Muslim regimes as 'conquests.' These were wars of "opening," based on the notion that Islam is the natural religion of humanity and that non-Muslim regimes are preventing people from enjoying God-given rights to hear and respond to the call to faith.

From the Shi'i point of view, the practice just described holds only when the divinely appointed leader is present. In his absence, as noted, it is possible for the religious scholars to authorize regime change if a ruler resists Islam by force. In the contemporary Islamist discourse, the idea is that governments unable or unwilling to implement God's law are illegitimate, and should be removed. Some Islamists make distinctions between the 'near enemy' and the 'far enemy,' which might map onto a distinction between regime change in one's own country and in someone else's. Yet diverse instances of tyanny can be connected, and thus al-Qa'ida's program is built on the notion that fighting against unjust regimes should be carried out on multiple fronts: 'in any country where it is possible, by anyone who has the means.'

As to how regime change should be accomplished, we have the most longstanding set of limits placed on regime change in Islamic tradition. For Muslims through the ages, fighting in the path of God requires observance of distinctions between civilian and military targets. This holds for both Sunni and Shi'i scholars. The type of fighting called for by Usama bin Ladin and others, in which there is a settled policy of indiscrimate warfare, is most unusual. Further, classical Sunni and Shi'i literature worries about the use of certain weapons, on the grounds that their use may cause unacceptable levels of damage. In such cases, a scholar like al-Mawardi says quite clearly that Muslim forces must discontinue fighting; they must strike the best treaty possible, and come back to implement regime change when circumstances suggests a higher probability of success. The point is twofold: one may not employ immoral means in the service of a moral end; and one must take care, even in the struggle for justice, that one's actions do not result in more harm than good.

Concluding remarks

The current struggle in Iraq provides the occasion for this discussion. Iraq presents special features for Muslim scholars, since the deposition of Saddam comes from the 'outside.' Many expressions of Muslim opinion focus on this. Thus the Qatari scholar Yusuf al-Qaradhawi argues that the presence of US, UK, and other forces presents a cause of war, and every Muslim should support the Iraqi resistance. Al-Qaradhawi is joined in this opinion by the Shaykh al-Azhar and other Sunni authorities. In terms of Islamic tradition, the worry here is over who has the right to authorize regime change. It is important to note, as well, the vigorous and ongoing debate among Sunni scholars regarding the tactics of those involved in resistance to US and UK forces, which again reflects traditional concerns regarding the how or means of fighting.

The opinion of Shi'i scholars is different. The Lebanese Muhammad Husayn Fadlallah declares that Islam allows for non-Muslim forces to come to the aid of oppressed Muslims, and that the Iraqi Shi'a should welcome US and UK help in deposing the tyrant Saddam. The Ayatollah Sistani's view is similar. However the Shi'i 'welcome' comes with a proviso: American and British forces must not reinstate colonial rule. This proviso is one of the roots of the opposition of Muqtada al-Sadr, who from the beginning has been more suspicious about US and UK motives than other Shi'i leaders.

I conclude that Islam makes the attractions of regime change very clear. It does so by focusing attention on the problem of tyrannical rule. At the same time, Muslim scholars dealing with particular cases addressed questions regarding who has the right to attempt regime change, as well as when and how regime change should occur. With respect to how, Islamic tradition is particularly clear: one must never employ immoral means in the service of regime change, and one must further ask whether regime change may in some cases bring about more harm than good. To put it another way, one can always wonder whether, in a given case, a change that may in some sense be right, will also prove wise. These strike me as good questions for all of us to ask, whether or not we are Muslims.

Royal College of Surgeons of Edinburgh Quincentenary Congress
Co-sponsored by the Royal Society of Edinburgh

Surgery; Lessons from the Aviation Industry. Transferring aviation psychology research on safety to surgery.

30 June 2005
at EICC

Chairs: Professor Rhona Flin (University of Aberdeen)
Mr Simon Paterson-Brown (RCSE)

Speakers: Dr Judith Orasanu (Aviation psychologist, NASA Ames) *Pilots' Judgements and Management of Risks*

Mr Michael Woldring (Aviation psychologist, Eurocontrol, Paris) *Organisational and Operator Errors in the Uberling Air Disaster*

Dr Sandy Mitchell (747 pilot and consultant anaesthetist; IFALPA) *Human Error in Aviation*

Aviation workplaces, such as flight decks and air traffic control centres are very different environments from hospital operating theatres, yet from a psychological perspective, the behaviours required to maintain safety and maximise performance are strikingly similar. One of the symposia at the Quincentennial Congress of the Royal College of Surgeons of Edinburgh (organised on behalf of the Royal Society of Edinburgh) illustrated aspects of aviation research and practice that had potential applications for reducing errors in surgery. Thirty years ago, the aviation industry realised that many accidents were not primarily due to technical failures or poor flying skills; instead both human error and organisational factors were the prime causes of aircraft losses. Consequently, resources were directed at gaining good diagnostic data on when and why errors occurred and what could be done to trap them or minimise their effects. Three eminent aviation specialists took part: Dr Judith Orasanu, an aviation psychologist from NASA Ames in California, Michael Woldring, a human factors specialist from Eurocontrol (air traffic safety) in Paris and Captain Sandy Mitchell, a 747 pilot and consultant anaesthetist.

Orasanu outlined data gathering techniques used in aviation psychology, such as cockpit voice recordings, simulator experiments, surveys/ interviews and accident analysis. She showed that pilots' decision errors were a major causal factor in modern aviation accidents, although these were often accompanied by secondary errors when the other pilot failed to monitor and / or challenge the action. One particular decision failure was a 'plan- continuation' error, when pilots were reluctant to deviate from their plan, even though the situational risk had increased. This became more likely when they were to close to completing the flight. She had also examined pilots' perceptions of different types of risk – showing that co-pilots were particularly concerned with professional (career) risk, as well as other threats; possibly explaining their reluctance to challenge captains' errors.

Woldring presented a detailed analysis of the Uberlingen accident when a cargo jet and a passenger jet (carrying Russian children) collided in mid-air. He revealed not only the complexity of decisions facing the pilots (who had contradictory advice from the controller and the electronic traffic warning system on the aircraft) but also how the degraded working conditions of the controller on duty created a fatal set of error enforcing conditions. This had raised many organisational questions in relation to air traffic safety management that were now being addressed.

Mitchell showed how this kind of research and accident analysis data were fed into a range of practical techniques used by the airlines to monitor and manage safety. Nowadays this includes routine safety audits based on flight deck observations and the regular tracking of flight technical performance. With very few accidents to analyse, he emphasised the importance of collecting incident and near miss data through mandatory, as well as confidential, reporting systems - the latter allowing much deeper data capture than the anonymous systems.

Research at Aberdeen University is now applying aviation psychology methods to study surgeons' non-technical skills

(see www.abdn.ac.uk/iprc/NOTSS).

Discussion Forum

Artificial Intelligence: In your Life Today

05 August 2005

Professor Aaron Sloman
Professor of Artificial Intelligence and Cognitive Science,
The University of Birmingham

Professor Wolfgang Wahlster
Director and CEO of the German Research Centre for Artificial Intelligence
DFKI, Saarbruecken, Germany and
Professor of Computer Science at Saarland University, Germany

Abstract

Science fiction books and recent movies focus on intelligent robots, but Artificial Intelligence covers a much broader scope: we study human and artificial minds, aiming to produce intelligent computing systems which have a direct, beneficial impact on the lives of countless people. How do we build systems which can undertake intelligent activities? Where are these systems, and how can they change lives for the better?

Wellcome Trust Research Workshop

The Use of Brain Imaging Technology

University of Stirling, Department of Phsycology August 2005

Organised by Dr David I Donaldson

The topic of the Workshop was the use of brain imaging technology (Event Related Potentials) and its utility for understanding how the mind works (Memory, Language, Attention). The workshop was a huge success – it was very well attended, and appeared to strike a positive note with all concerned.

Speakers were invited from across the UK, and participants came from a diverse set of institutions including all of the major Scottish Universities, along with a number of English and Welsh Universities. Each Principal Investigator brought along several post-doctoral researchers or postgraduate research students, some of whom also gave presentations. In addition, a key-note speaker, Professor M D Rugg, was invited from the University of California, Irvine.

The workshop was focused around a series of very impressive talks and interactive discussion sessions. Senior speakers presented a range of presentations, covering issues such as how best to analyse ERP data and what sorts of assumptions can be made from it, and the meeting also provided an opportunity for the more junior speakers to showcase recent work and to elicit discussion on how best to proceed.

The addition of the key-note speaker was extremely sucessful, providing a very high quality example of ERP research methods – students in particular were very impressed by the added International flavour.

The meeting was also organised to facilitate networking and interaction between laboratories. Ample time was given for formal discussion sessions, along with informal tea and coffee breaks for individuals to meet. Students visiting from relatively isolated laboratories were particularly pleased to be able to compare notes with other students, and several good connections between laboratories were formed.

Finally, it is worth noting that the meeting had such a large impact (highly visible and clearly a great success) in the department of Psychology that there are now plans to host similar meetings (covering a range of topics) over the coming year.

Discussion

Attracting, Retaining and Recognising Scotland's Research Talent

In Association with Scotland's Futures Forum

The Scottish Parliament
2 September 2005

Foreword by The Rt Hon George Reid MSP, Presiding Officer of the Scottish Parliament & Professor John Coggins, FRSE, RSE Vice-President

"Our nation is world-renowned for its pioneering legacy of invention and innovation. Research and technological advances in areas such as medicine, agriculture and communications have transformed the lives of millions. Scotland's expertise in R&D and the enterprising spirit of many researchers and entrepreneurs have made a major contribution to our economy. With increasing international competition, it is essential that we continue to produce and attract top people. We have particular opportunities in the medical sciences, the physical sciences, in engineering, and we need to link all of these together. Collaboration must be key to Scotland's future prosperity and so we were delighted that The Royal Society of Edinburgh and Scotland's Futures Forum were able to work in partnership on this event which took place in The Scottish Parliament on September 2."

The consensus among Scotland's research talent is that the country has much to be proud of and much to celebrate in terms of research excellence and innovation. Within the UK, it attracts a disproportionately high level of research council funding, has a disproportionately high number of world-leading research departments, and is among the world leaders in terms of research publications per capita. Yet it fails to broadcast its achievements adequately, a potentially damaging omission in an increasingly competitive global market.

Scotland can also promote an attractive quality of life, including affordable housing, spectacular countryside and a thriving cultural scene. But universities themselves need to make more effort to improve conditions for young researchers, who may otherwise seek posts in other countries or move out of higher education completely. The transition from temporary to permanent status is critical, and it is important that Scotland provides young researchers with secure career pathways so that they and their families have confidence that they can stay in higher education.

A recent innovation which is already proving a draw for both young and established researchers is research pooling. Scotland's small size means that individual university departments struggle to achieve the necessary critical mass to produce outstanding research. The pioneering pooling strategy aims to overcome this by bringing together departments across a range of universities. Physics and chemistry are in the vanguard of these alliances, which will allow researchers to work beyond the boundaries of a single institution.

These research pools may well develop into centres of excellence, attracting international funding. The healthiest way for centres of excellence to grow is through the enthusiasm of academics themselves, rather than being externally planned. It is important not to be too prescriptive about subject areas, since these drop in and out of fashion. It is valuable to nurture a number of subject areas, such as life sciences and medicine, but it is of crucial importance to maintain a broad, solid educational base as a springboard for specialist research. Scottish higher education should maintain enough flexibility to respond to promising research whenever and wherever it emerges. And Scotland has the possibility of promoting itself as a centre of excellence on the international stage.

Ireland has been increasingly proactive in determining priority areas it wishes to support by creating research posts. Scotland does not have the same room for manoeuvre: many of its research priorities are determined at a UK level. But this can be of benefit in forging UK-wide research partnerships, and Scotland already punches above its weight in UK terms.

But links between higher education and industry are not as good as they should be, despite a growing willingness in universities to encourage researchers to create spin-out companies. Industrial research and development lags behind the UK average, and applied research has suffered from a lack of recognition compared to pure research, despite its importance to the economy.

Summary Event Rapporteur: Olga Wojtas, Scottish Editor, *Times Higher Education Supplement.*

A full report of the Discussion is available on the RSE website, or can be obtained from Stuart Brown at the Society.

PUBLICATIONS

Proceedings A: Mathematics

Transactions: Earth Sciences

ReSourcE **:** Issues11 and 12.

Royal Society of Edinburgh Directory 2005 (Session 2004-2005)

Royal Society of Edinburgh Review of Session 2005 (Session 2003- 2004)

Other Publications

RSE *Annual Review* 2004-2005.

Conference and Enquiry Reports

THE SCOTTISH SCIENCE ADVISORY COMMITTEE

The Scottish Science Advisory Committee (SSAC) was established in May 2002 to provide independent advice to the Scottish Executive Ministers on strategic scientific issues. The Committee, chaired by Professor Wilson Sibbett, Wardlaw Professor of Physics at the University of St Andrews, is an independent voice for science in Scotland.

The Committee is uniquely placed to take a broad overview of the diverse scientific landscape in Scotland and it would wish to place this within an international perspective. It takes a medium to long-term, horizon-scanning and strategic view in formulating its advice on science strategy, science policies and science priorities – with an overall aim of improving the social, environmental and economic prosperity of Scotland.

The Committee membership represents a breadth of expertise and experience, and it is intended that the SSAC will be well placed to provide expert advice across a number of relevant policy areas.

Over the past year, the SSAC produced two key reports:

Investing in Scientific Talent

The impact and quality of the science undertaken in the science base and industry is determined primarily by the calibre of the scientists working there. It is essential that Scotland has effective mechanisms to retain and attract the best scientists and engineers. New initiatives will be required to provide the basis for better career progression, and rewards, to ensure that there are flexible opportunities for the best researchers already working in Scotland.

The recommendations contained within this report are designed to attract, retain and develop the very best, internationally competitive scientists and technologists who will be magnets for the growth of clusters of international scientific excellence. These will be powerful attractors for inward investment by research-intensive industry and be a world-leading resource for innovation by established Scottish industry.

The recommendations, in priority order, are:

1. Create a number of high level specialist support packages for selected professorial level appointments, to attract world-leading and inspirational scientists to Scotland;
2. Maintain and, where possible, increase, funding for research programmes to allow Scotland's scientists to reach their full potential;
3. A prestigious and flexible fellowship scheme for outstanding young scientists who have the potential to be the scientific leaders of the future;

4. Maintain the number of Research Council-funded PhD studentships, using 1999-2000 as the baseline, and make a commitment to clearing a proportion of student debt for successful and timely completion of a PhD programme;
5. A new fellowship scheme to promote exchanges between industry and academia; and
6. Increased longer-term contracts for scientific support staff.

The Scottish Executive is currently looking at how it can best take these recommendations forward in conjunction with the Scottish Funding Councils, the SSAC, the RSE, Universities Scotland and Scottish Enterprise.

Knowledge Transfer: Science to Scottish Businesses

This position paper was intended to contribute to the creation of a clearer vision for an overall shared agenda for knowledge transfer from the science base in Scotland. The SSAC believes that there is a need to create a process of discussion between key stakeholders, in which the role of the science base in knowledge transfer can be more fully examined in relation to the range and effectiveness of initiatives that are underway in Scotland and elsewhere. This will be crucial to the implementation in Scotland of the recommendations from the Lambert Review.

The highlighted issues (listed below) in the report are directed at those individuals and organisations, "the enablers", who will assist in feeding the pipeline of new technology-based companies, and those who can expand the capabilities of established Scottish industrial organisations.

§ The SSAC believes that the Scottish Executive, in conjunction with Universities Scotland and SHEFC, must consider with due urgency the processes and mechanisms that ought to be put in place for the Lambert Review to be taken forward in Scotland.

§ Given the recognised distinctive objectives within their existing frameworks, it is imperative that the Scottish Executive, Scottish Enterprise and SHEFC work together to better identify the overall aspirations and implementation timescales for Scotland in relation to KT.

§ The Scottish Executive, working through Scottish Enterprise, is urged to prioritise and enhance *proof-of-concept* and seed level technology funding, and the continued funding of schemes such as the RSE/SEN Enterprise Fellowships.

- § To be most effective, knowledge transfer funding to HEIs, Research Institutes and other bodies must come with full-cost recovery to the host institutions.
- § The SSAC welcomes the new SIE initiative, www.university-technology.com, that promotes a selection of technologies for licensing or for collaboration with industry. The SSAC view is that the provision of a "one-stop shop" for all of Scotland's research capacity should be regarded as a key objective.
- § The SSAC supports the ITI initiative. To maximise its success and ensure that it becomes a significant engine for invigorating the Scottish economy, the SSAC believes that the Scottish Executive, working through Scottish Enterprise, must create an environment that supports the new initiatives and the fledgling companies generated from ITI Scotland.
- § The SSAC supports the development of metrics and recognises that they should be based around economic and societal impacts, rather than just on numbers of patents, spin-outs etc, as currently measured.
- § For the overall benefit of Scotland, third stream, or equivalent, KT funding should be extended to all Scottish research organisations and parts of the public sponsored science base, including Further Education Colleges. This will require a proportionate increase in allocated resource.
- § Spin-out and start-up companies originating in the science base are crucial to the development of a knowledge economy in Scotland. The legislation in the Finance Act 2003 must therefore be changed urgently to avoid inhibiting the formation of new spin-out and start-up companies. Scottish Enterprise and the Scottish Executive are urged to make appropriate representations to the Treasury to ensure that this legislation is amended.

Further information about the SSAC and copies of the Reports can be found at www.scottishscience.org.uk

Scottish Science Advisory Committee - Members

Professor Wilson Sibbett CBE, FRS, FRSE (Chair)

Professor Steven Beaumont OBE, CEng, MIEE, FRSE

Professor Geoffrey Boulton OBE, FGS, FRS, FRSE

Professor Muffy Calder FIEE, FRSE

Professor Sir Kenneth Calman KCB, FRCS, FRCP, FMedSci FRSE

Professor John Coggins FRSE

Professor Julie Fitzpatrick MRCVS

Professor Peter Grant FREng, FRSE, FIEE, FIEEE

Dr Stuart Monro CGeol., FGS, ILTM, FRSSA

Professor Peter Morgan FRSE

Professor Richard Morris FMedSci, FRS, FRSE

Dr John Nicholls

Professor Stuart Reid MRCVS, FRSE

Professor Jonathan Seckl FRCPE, FMedSci, FRSE

Dr Barbara Spruce MRCP

Professor Joyce Tait CBE

Professor Chris van der Kuyl FRSE

Eur Ing Graham Wren

Scottish Science Advisory Committee - Staff

Dr Avril Davidson, Head of Secretariat

Ms Tracy Rickard, PA/Administrator

SSAC Staff are employed by the RSE.

EVIDENCE, ADVICE AND COMMENT

The Society submitted evidence, advice and comment on the following reports during the Session:

November 2004

Future of the National Institute for Medical Research. House of Commons S&T Committee

Future Directions in Farm Animal Genetics & Genomics. BBSRC

December 2004

UK Honours Degree Classification System. Quality Assurance Agency for Higher Education

January 2005

Long-term radioactive waste management. Committee on Radioactive Waste Management

Extending the Authority to Credit Rate. Scottish Credit and Qualifications Framework

February 2005

Review of the Scottish Climate Change Programme. Scottish Executive Environment Group

April 2005

Sustainable Business Growth. Scottish Parliament Enterprise and Culture Committee

June 2005

Cross Border Student Flows: Higher Education Tuition Fees. Scottish Executive Enterprise and Lifelong Learning Department

How the UK should manage radioactive waste. Committee on Radioactive Waste Management

July 2005

The Draft Animal Health and Welfare (Scotland) Bill. Scottish Executive Environment and Rural Affairs Department

Role of BBSRC in Biodiversity Research. BBSRC

Systems Biology. The Academy of Medical Sciences

A Universal Ethical Code for Scientists. Council for Science and Technology

August 2005

Simplification of the FP7. EU Commission

7th RTD Framework Programme. EU Parliament Committee on Industry, Research and Energy

September 2005

Impact of ICT on Health and Healthcare. Royal Society

Science for Sustainable Marine Bioresources. NERC

Position Papers

During this session, the RSE undertook to produce a series of position papers to help inform debate on a wide range of issues by providing a clear summary for the non-specialist of the RSE's position on a variety of topics.

RSE Position Paper 1: *Climate Change and the Management of Scotland's Natural Heritage.* February 2005

Scottish Parliament Science Information Scheme

Following a pilot period, the RSE committed to continue its participation in the "Scottish Parliament Science Information Service" in collaboration with the Royal Society of Chemistry (RSC), the Scottish Parliament Information Centre (SPICe) and participating affiliated organisations. The goal of this service is to ensure that all Members of the Scottish Parliament have access to reliable, rapid and impartial information on science, engineering and technology-related issues in order to help inform Parliamentary debates on scientific issues; raise the profile of science in the Parliament and help ensure MSPs are informed by appropriately knowledgeable experts.

INQUIRIES

During the 2004-2005 Session the RSE initiated an inquiry into Scotland's Energy Supply Chaired by Professor Maxwell Irvine, Professor of Physics, University of Manchester and former Principal & Vice-Chancellor of the Universities of Aberdeen and Birmingham.

The inquiry, which is expected to complete in the summer of 2006, aims to review the options for Scotland's energy supply, taking into account the economic issues of capital investment and distribution infrastructure, together with the impact of energy availability on commerce and industry; environmental concerns about global climate change and the impact on ecological and other natural resources, including waste management and landscape; and social consequences of energy generation and distribution on employment opportunities, health, affordability and risk implications.

During this Session, the Committee travelled and heard evidence from areas around Scotland, including Forres, Stornoway, Aberdeen, Orkney, Shetland, Glasgow as well as travelling to hear witnesses in Finland. The Inquiry also received over 150 written submissions and heard oral evidence from over 60 witnesses.

EVENTS FOR YOUNG PEOPLE

Talk Science School Visits

10 November 2004 *Soap Bubbles and Membranes* by Dr Ciaran Ewins at Pitlochry High School, Perth and Kinross.

24 November 2004 *Death, Drugs and Dynamite!* by Professor Allan Jamieson at Beeslack High School, Penicuik, Midlothian.

2 December 2004 *DNA Profiling: Its Use in Famous Cases* by Dr Adrian Linacre at Elgin Academy, Moray.

15 December 2004 *What Does your Granny have in common with a Spaceman?* by Dr Val Mann at James Watt College, Greenock Campus and Kilwinning Campus for local school students.

15 December 2004 *Bubbles, Gases and Cells* by Dr Ciaran Ewins at James Watt College, Greenock Campus and Kilwinning Campus for local school students.

24 January 2005 *Black Holes and Big Bangs* by Dr Alan Heavens at Lochgilphead High School, Argyll and Bute.

16 February 2005 *Chemistry is Magic* by Dr Christine Davidson at Langholm Academy, Dumfries and Galloway.

7 March 2005 *Black Holes and White Rabbits* by Professor John Brown FRSE at Dornoch Academy, Highlands.

15 March 2005 *One Small Step, Many Giant Myths* by Dr Martin Hendry, talks for schools as part of the Caithness Science Festival at Wick and Thurso High Schools. As part of *National Science Week.*

Christmas Lectures

9 December 2004 *Why Clone? Cloning in Biology and Medicine* by Professor Ian Wilmut OBE FRS FRSE at Pitlochry Festival Theatre, Perth and Kinross. There was a talk for local school students as well as a talk for the public. Professor Wilmut's thought-provoking talk discussed the ethical and moral concerns over potential applications of cloning technology.

RSE Roadshows

Workshops and talks for primary and secondary students, as well as the public.

8 & 9 March 2005. Dingwall Academy and cluster group primaries, Highlands. Alice Walker of the British Geological Survey talked to S1 and S2 students about earthquakes. Meanwhile, a team from Glasgow University revealed the role Computer Science plays in our every day lives in a workshop for S4 and S5 students entitled *Computer Science Inside…the mobile phone*. Following their popularity at the Arbroath Roadshow in October 2004, a team of postgraduate students from Edinburgh University once more gave P6 and P7 students the opportunity to answer the

question *Do I eat DNA?* In a workshop where children extracted DNA from strawberries and kiwi fruit.

On Tuesday 8 March Alice Walker gave a public talk, *Earthquakes: at home and abroad*, in which she discussed the cause and impact of earthquakes in the UK and further afield, including the Boxing Day Indian Ocean tsunami.

Discussion Forum

21 June 2005. *Climate Change: the greatest threat facing Scotland and the World?* At St Andrews University.

After presentations from climate change experts, S5/S6 students from Fife and Dundee debated the ethical, political and economic considerations of climate change. 90% of students present said they would be willing to make changes to their own lifestyle in order to reduce emissions and reduce the risks for others. However, students felt that it may be a greater challenge to convince the general public to make such changes.

The students' conclusions have been compiled in to a report, which has been published and distributed to decision-making bodies including the Scottish parliament, so that the opinions of the young people who took part can be heard.

Copies of the report can be downloaded from the RSE Website

e-Discussion Forum

In tandem with the 2005 Discussion Forum, this pilot project expanded the format to enable students from throughout Scotland to access the resources associated with the event. A CD-Rom, including video material of all the presentations, resources for teachers and a student debate pack was sent to all schools in Scotland. Schools have been invited to feedback the results of their debate to the RSE and results received will be compiled in a report.

This resource is also available on the RSE Website.

Summer School

Workshops and talks on science, technology and maths subjects, but also on transferable skills and advice for those not sure about continuing into higher education. Run in partnership with Heriot-Watt University, supported by Edinburgh City, East Lothian, West Lothian and Midlothian Councils.

25 – 29 July 2005. For S5/S6 students East Lothian and West Lothian

1 - 5 August 2005. For S5/S6 students from Midlothian and the City of Edinburgh

Maths Masterclasses

Saturday morning games and puzzles for P6/7 students to encourage an interest in mathematics. Run in partnership with Aberdeen City Council, the University of Dundee and Heriot-Watt University.

Aberdeen City Council
23 April 2005
7 May 2005
21 May 2005
4 June 2005

University of Dundee
7 May 2005
14 May 2005
21 May 2005

Kelvinside Academy, Glasgow
15 January 2005
22 January 2005
29 January 2005
5 February 2005

Queensferry Primary School, Edinburgh
6 November 2004
13 November 2004
20 November 2004
27 November 2004

Startup Science Masterclasses

Saturday morning workshops for S1/S2 students, emphasising the role of science, engineering and technology in society. Run in partnership with organisations throughout Scotland.

University of Aberdeen
26 February 2005
5 March 2005
12 March 2005
19 March 2005

University of Dundee
6 November 2004
13 November 2004
2 December 2004
11 December 2004
and
7 May 2005
14 May 2005
21 May 2005
4 June 2005

University of Glasgow
20 November 2004
27 November 2004
4 December 2004
11 December 2004
and
30 April 2005
7 May 2005
14 May 2005
21 May 2005

Heriot-Watt University
6 November 2004
13 November 2004
20 November 2004
and
23 April 2005
30 April 2005
7 May 2005

St Andrews University
13 November 2004
20 November 2004
27 November 2004
4 December 2004
and
23 April 2005
20 April 2005
7 May 2005
14 May 2005

Annual Inspiration Awards - 2005

Contributors to RSE Young People's activities are inspirational role models for young scientists in schools from the Borders to the Highlands. Inspiration Awards for Session 2004-2005 were presented to Dr Christine Davidson, University of Strathclyde; Dr Ciaran Ewins, University of Paisley; and Professor Alan Heavens, University of Edinburgh, who have made exceptional voluntary contributions to the Young People's activities.

RESEARCH AND ENTERPRISE AWARDS

The following awards were made in Session 2004/05:

RESEARCH FELLOWSHIPS

BP Personal

Dr Sarah Hinchley. *Determination of structures of unusual, unstable and reactive species.* School of Chemistry, University of Edinburgh.

CRF European Visiting

Outbound

Dr Natalie Adamson. School of Art History, University of St Andrews. Visiting Paris.

Dr Peter van Dommelen. Department of Archaeology, University of Glasgow. Visiting Italy and Ibiza.

Dr Andrew M Godfrey. School of Law. University of Glasgow. Visiting Germany.

Dr Jens Timmermann. Department of Moral Philosophy, University of St Andrews. Visiting Germany.

Inbound

Dr Joan C Maixe Altes. Department of Applied Economics, University of La Coruna. Visiting University of Glasgow.

Dr Martin Ivanov. Bulgarian Academy of Sciences. Visiting University of Edinburgh.

Dr Ilenia Ruggiu. University of Cagliari. Visiting University of Glasgow.

CRF Personal

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.

Dr Carole Torsney. *5-HT2c 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.

Scottish Executive Personal

Dr Rosalind Allen. *Rare events in non-equilibrium systems.* School of Physics, University of Edinburgh.

Dr Alan Kemp. *Advanced Disk Lasers: A New Horizon in Solid-State and Semiconductor Laser Design.* Institute of Photonics, University of Strathclyde.

Dr Keith Mathieson. *A Retinal Prosthesis for the Blind.* Department of Physics and Astronomy, University of Glasgow.

Scottish Executive Support

Dr Dominic Campopiano. *Defensins – structure and function of man's natural antibiotics.* School of Chemistry, University of Edinburgh.

Dr Alison N. Hulme. *Chemical Biology Approaches to Tagging and Imaging in Biological Systems.* School of Chemistry, University of Edinburgh.

Dr Graham Kirby. *Self-Managed Reliable Location-Independent Distributed Storage.* School of Computer Science, University of St. Andrews.

ENTERPRISE FELLOWSHIPS

BBSRC

Mr Riccardo Matjaz Bennett-Lovsey. *Development of a company for logic-based drug discovery.* Faculty of Life Sciences, Imperial College, London.

Dr Mark Eccleston. *Responsive Biopolymers for innovative diagnostic and therapeutic delivery.* Department of Chemical Engineering, University of Cambridge.

Mr Ian Shadforth. *GAPP: Transforming proteomic data into commercial knowledge.* Department of Analytical Science and Informatics, Cranfield University.

Dr Martin Wickham. *The IFR Model of Human Digestion.* The Model Gut Exploitation Platform, Institute of Food Research.

Scottish Enterprise

Electronics

Dr Ayse Goker. *AmbieSense: an infrastructure to provide personalised, context-sensitive information to mobile users.* School of Computing, Robert Gordon University.

Mr Faheem Mir. *Digital Wireless Electromagnetic Interference (EMI) Measurement System.* Department of Electronic & Electrical Engineering, University of Strathclyde.

Dr Sonia Schulenburg. *Evolving Artificial Traders for Successful Market Trading.* Centre for Enterprise Management, University of Dundee.

Dr Andrew Sherlock. *PartBrowser.* School of Engineering and Electronics, University of Edinburgh.

Energy

Mr Tong Teh. *Electrochemical Sensor Technology.* School of Engineering and Physical Sciences, Heriot-Watt University.

Life Sciences

Dr Richard McHugh Cannon. *Improved Method of Male Fertility Testing.* Department of Aerospace Engineering, University of Glasgow.

Dr John B. March. *Bacterial viruses for antiserum production services and vaccine delivery.* Department of Bacteriology, Moredun Research Institute.

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

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.

Optoelectronics

Dr Gordon McAllister. *Commercial Pose Estimation and Tracking Software.* Division of Applied Computing, University of Dundee.

RESEARCH SCHOLARSHIPS AND PRIZES

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.

Miss Amy Cowan. *Ultrafast Rotators as a Signpost for Kinematic Associations in the Solar Neighbourhood*. School of Physics and Astronomy, University of St Andrews.

Mr Charles Gentry. *Alfven wave propagation near coronal magnetic null points.* Division of Applied Mathematics, University of St. Andrews.

Ms Katharine G. Johnston. *A search for starlight reflected from tau Bootis b.* School of Physics and Astronomy, University of St Andrews.

Miss Rachel Natalie McInnes. *Magnetic Pumping in Oscillating Solar Flare Loops.* Department of Physics and Astronomy, University of Glasgow.

Cormack Undergraduate Prize 2004

Mr Thomas Barber. *The Age of Galaxies.* Institute of Astronomy, Royal Observatory, University of Edinburgh.

Cormack Postgraduate Prize 2004

Dr Rejean Dupuis. *Setting upper limits on the strength of periodic gravitational waves from PSR J1939+2134 using the first science data from the GEO 600 and LIGO detectors.* Department of Physics and Astronomy, University of Glasgow.

Miss Christina Helen Walker. *The Structure of Brown Dwarf Circumstellar Disks.* School of Physics and Astronomy, University of St Andrews.

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. University of Glasgow.

Mr Allan Jardine. *Combined research of cooperative diversity protocols with ETH, Zürich.* Institut für Kommunikationstechnik, Swiss Federal Institute of Technology. University of Edinburgh.

Mr Ravindran Manoharan. *Novel nonlinear dynamics method for NDT of ground anchorages.* Research and Development Institution: MP Interconsulting. University of Aberdeen.

Mr Rafael Martin. *Gas production under aged-waste and field confirmation of radios of influence of gas wells.* School of the Built Environment, Napier University.

Dr Dimitri Mignard. *Organometallic Polymer Electrocatalysts for the Chemical Synthesis of Alcohols and Hydrocarbons from CO_2.* Instituto di Chimica dei Composti OrganoMetallici (ICCOM), University of Florence. University of Edinburgh.

Ms Alexandra Price. *Application of Neural Control Techniques to Wave Energy Conversion.* Laboratoire de Mecanique des Fluides, Nantes. University of Edinburgh.

Research Fellows in Post During the Session

RESEARCH FELLOWSHIPS

BP Personal

Dr Sarah Hinchley

Dr Benjamin Hourahine

Dr Patrik Ohberg

Dr Darrel A Swif

CRF European Visiting

Dr Natalie Adamson

Dr Joan C Maixe Altes

Dr Martin Ivanov

Dr Jens Timmermann

Dr Peter van Dommelen

Lloyds TSB Foundation for Scotland Personal

Dr Ashley L Craig

Dr Anna Dickinson

Dr Margaret Lai

Dr Val Mann

Scottish Executive Personal

Dr Richard Blythe

Dr Kirsten Dickson

Dr Timothy Drysdale

Dr Sonja Franke-Arnold

Dr Nikolaj Gadegaard

Dr Alun Hubbard

Dr Nigel M Kelly

Dr Alan J Kemp

Dr Linda A Kirstein

Dr Gail McConnell

Dr Paul McKenna

Dr Abbie Mclaughlin

Dr Annette MacLeod

Dr David F Manlove

Dr Keith Mathieson

Scottish Executive Support

Professor Mark Ainsworth

Dr Jacques D Fleuriot

Dr Ian Philip Gent

Professor Desmond J Higham

Dr Xavier Lambin

Dr Colin R Pulham

ENTERPRISE FELLOWSHIPS

BBSRC

Mr Riccardo Matjaz Bennett-Lovsey

Dr Mark Eccleston

Mr Ian Shadforth

Dr Martin Wickham

PPARC

Dr Christopher Doran

Mr Ian Latham

Scottish Enterprise

Electronics

Dr Ayse Goker

Mr Faheem Mir

Dr Andrew Sherlock

Dr Sonia Schulenburg

Energy

Mr Matthias Durr

Dr Alan Feighery

Ms Susanne Olsen

Mr Tong Teh

Food and Drink

Dr Kyu Namkung

Life Sciences

Mr Paul Ajuh

Dr Richard McHugh Cannon

Dr Margot McBride

Dr John B. March

Optoelectronics

Dr Rayne Longhurst

Dr Gordon McAllister

Dr Martin O'Dwyer

Dr Andrew Willshire

RESEARCH STUDENTSHIPS AND SCHOLARSHIPS

Robert Cormack Bequest Scholarships

Mr Edward Bloomer

Ms Amy J Cowan

Mr Charles Gentry

Ms Katharine G Johnston

Ms Rachel N McInnes

John Moyes Lessells Scholarships

Mr Sachi Arafat

Mr Robert A F Currie

Mr Blair Fyffe

Mr L Darren Graham

Mr Allan J Jardine

Mr Ravindran Manoharan

Dr Dimitri Mignard

Ms Natalie Plank

Ms Jana Urban

Lloyds TSB Foundation for Scotland Research Students

Mr Stephen Butler

Paula Cox

Mr Charles Duffy

Ms Claire Fitzsimmons

Mr Alan Gow

Ms Carly S Rivers

Ms Beth Wilson

MEDALS, PRIZES AND PRIZE LECTURESHIPS

Bicentenary Medals

8th Award. 2004

Sir Laurence Hunter, CBE, FRSE, Other 2004 awardees were reported in the 2005 review.

Bruce Preller Prize Lectureship

36th Award. 2004

Professor Jason Reese. Department of Mechanical Engineering, University of Strathclyde. In recognition of his contribution to Engineering Science.

W S Bruce Medal

28th Award. 2004

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.

CRF Prize Lecture

16th Award. 2005

Professor Ronald McKay, NINDS (National Institute of Neurological Disorders and Stroke), Porter Neuroscience Research Center, National Institute of Health, Bethesda, USA.

Gannochy Trust Innovation Award

3rd Award. 2005

Mr John Harrison. Surfactant Technologies Ltd.

Neill Medal

63rd Award. 2004

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.

Royal Medals

6th Award. 2005

Humanities and Social Sciences: Professor Sir David Edward KCMG QC FRSE, for his outstanding contribution to the law both in the European Union and in Scotland, to the legal profession in Scotland, and for his contribution to public life.

Life Sciences: Professor William Hill OBE FRS FRSE, in recognition of his outstanding contribution to Life Sciences and particularly to the theory of quantitative genetics and its applications to animal breeding.

CRF Prize Lectures. Further to the detection of a numbering error in the 1999 Yearbook, we have produced a complete list of CRF Awards to date, as follows:

CRF PRIZE LECTURESHIP

17th Award 2005-06 - Baroness O'Neill of Bengarve (lecture May 07)

16th Award 2004-05 - Professor Ronald McKay (lecture May 06)

15th Award 2003-04 - Joan Bakewell (lecture October 05)

14th Award 2002-03 - Professor Joan Steitz (lecture May 04)

13th Award 2001-02 - Professor Richard Holmes (lecture May 2003)

12th Award 2000-01 - Dr Lewis Cantley (lecture April 2002)

11th Award 1999-00 - Sir John Keegan (lecture never given due to illness)

10th Award 1998-99 - Dr Iain W Mattaj (lecture April 2000)

9th Award 1997-98 - Sir Roy Strong (lecture April 1999)

8th Award 1996-97 - Professor Maynard Olson (lecture October 1998)

7th Award 1995-96 - Douglas Cardinal (lecture May 1997)

6th Award 1994-95 - Professor Stanley Prusiner (lecture May 1996)

5th Award 1993-94 - Professor George Steiner (lecture June 1995)

4th Award 1992-93 - Professor D Metcalf (lecture June 1994)

3rd Award 1991-92 - Professor H Galjaard (lecture April 1993)

2nd Award 1990-91- Professor W Gilbert (lecture May 1992)

1st Award 1989-90 - Professor H E Varmus (lecture April 1991)

GRANTS COMMITTEE

The Grants Committee considered 22 applications and a sum of £11,762 was awarded to 19 applicants. Approximately 61% of this sum was awarded as travel assistance.

Travel Assistance

Professor K Brown, for travel to China. £460

Professor M C R Davies, for travel to Japan. £950

Professor J Dickson, for travel to Austria. £500

Professor W Firth, for travel to Uruguay and Argentina. £750

Professor T Goodman, for travel to Spain. £350

Professor C A Greated, for travel to India and Belarus. £850

Professor S Kuksin, for travel to Spain. £450

Dr R Milne, for travel to Nepal. £662

Professor A Ranicki, for travel to Canada. £790

Professor A B Smith, for travel to Switzerland. £500

Professor J Speakman, for travel to China. £900

Support for Meetings

Professor B Main, for *The Globalization of Labour Markets and the Consequences for Economic Policy*. £600

Professor J Neil, for the *15th International Conference on the Runx gene family*. £600

Professor K J Oparka, for *Plasmodesmata 2006.* £750

Professor E M Scott, for *Isotope (radiogenic, cosmogenic and stable) and noble gas analysis in Quaternary research*. £600

Professor J Skorupski, for *The Unity of Reason*. £600

Visiting Lecturer

Professor R Elliott, to allow Dr Michael Rossman, Hanley Distinguished Professor of Biological Sciences, Purdue University, USA, to visit the University of Glasgow. £350

Professor S H Ralston, to enable Professor Stephen Krane, Harvard Medical School, to give a lecture at Edinburgh Royal Infirmary. £350

Research Visitor to Scotland

Professor C J van Rijsbergen, to enable Professor W Bruce Croft, Department of Computer Science, University of Massachusetts, to visit the University of Glasgow. £750

INTERNATIONAL PROGRAMME

International Exchanges

During the 2004-05 Session, the following awards were made:

Bilateral Programme

Outgoing to China:

Professor Christopher Jefferies, University of Abertay.

Professor Peter Robertson, Robert Gordon University.

Dr Gail McConnell, Strathclyde University.

Outgoing to Poland:

Dr Ivan Crozier, University of Edinburgh.

Dr David McKee, University of Strathclyde.

Incoming from Poland:

Professor Alan Barnard of the University of Edinburgh hosted a visit by Professor Marian Kempny.

Dr Bernard Cohen of the University of Glasgow hosted a visit by Dr Maria Bitner.

Professor Patricia Connolly FRSE of the University of Strathclyde hosted a visit by Dr Dorota Pijanowska.

Dr David Kilpatrick of the Scottish National Blood Transfusion Service hosted a visit by Dr Anna Swierzko.

Dr David Kilpatrick of the Scottish National Blood Transfusion Service hosted a visit by Dr Maciej Cedzynski.

Outgoing to Taiwan:

Mr James Ritchie, Heriot Watt University.

Dr Jessica Chen-Burger, University of Edinburgh.

Dr Geoff Elliott, University of Dundee.

Dr David S Robertson, University of Edinburgh.

Professor Kenneth Turner, University of Stirling.

Open Programme

Argentina – Outgoing from Scotland:

Dr Maria de la Paz Vaqueiro-Rodriguez, Heriot Watt University.

Australia – Incoming to Scotland:

Professor Raj Bhopal CBE of the University of Edinburgh hosted a visit by Dr Michael Morrissey.

Professor Anthony Edward Fallick FRSE of the Scottish Universities Environment Research Centre hosted a visit by Dr Russell Drysdale.

Australia – Outgoing from Scotland:

Dr Dilys Freeman, University of Glasgow.

Dr Lorna Dawson, Macaulay Institute.

Belgium – Outgoing from Scotland:

Dr John Jones, Scottish Crop Research Institute.

Brazil - Incoming to Scotland:

Dr Wamberto Vasconcelos of the University of Aberdeen hosted a visit by Dr Flavio Correa da Silva.

Bulgaria - Incoming to Scotland:

Professor Nikolai Zhelev of the University of Abertay hosted a visit by Professor Vili Stoyanova.

Chile - Incoming to Scotland:

Professor Peter Anthony Davies FRSE of the University of Dundee hosted a visit by Professor Yarko Nino.

China (Open) - Incoming to Scotland:

Professor Iain M Young of the University of Abertay hosted a visit by Professor Li Ren.

Croatia – Incoming to Scotland:

Professor Alan Prior of Heriot Watt University hosted a visit by Dr Sonja Butula.

Denmark – Outgoing from Scotland:

Dr Gordon Cramb, University of St Andrews.

France – Outgoing from Scotland:

Dr Cristina Persano, University of Glasgow.

Germany - Incoming to Scotland:

Dr Carol Trager-Cowan of the University of Strathclyde hosted a visit by Dr Aimo Winkelmann.

Hungary – Incoming to Scotland:

Dr David F Manlove of the University of Glasgow hosted a visit by Dr Tamas Fleiner.

Dr Alison Lees of the Scottish Crop Research Institute hosted a visit by Dr Jozsef Bakonyi.

Italy - Incoming to Scotland:

Dr Roland Billen of the University of Glasgow hosted a visit by Professor Eliseo Clementini.

Italy - Outgoing from Scotland:

Dr Volfango Bertola, University of Edinburgh.

Dr Daniel Cuthbertson, University of Dundee.

Dr Barbara Webb, University of Edinburgh.

Japan - Outgoing from Scotland:

Professor Grant Jordan, University of Aberdeen.

Jordan - Outgoing from Scotland:

Dr Zoe Shipton, University of Glasgow.

Dr Christopher Brett, University of Glasgow.

Laos - Incoming to Scotland:

Dr Mark Newman of the Royal Botanic Garden of Edinburgh hosted a visit by Dr B. Svengsuksa.

Latvia – Incoming to Scotland:

Professor Carole Gray of Robert Gordon University hosted a visit by Aija Druvaskalne-Urdze.

Latvia - Outgoing from Scotland:

Professor Carole Gray, Robert Gordon University.

Lebanon – Outgoing from Scotland:

Dr Christopher Brett, University of Glasgow.

Netherlands - Outgoing from Scotland:

Dr Tobias Bast, University of Edinburgh.

Dr Stephen Martin, University of Edinburgh.

New Zealand - Incoming to Scotland:

Professor David Eckersall of the University of Glasgow hosted a visit by Dr Adrian Molenaar.

Dr John McDougall of Napier University hosted a visit by Dr Mark Milke.

New Zealand - Outgoing from Scotland:

Dr Lorna Dawson, Macaulay Institute.

Nigeria – Incoming to Scotland:

Professor David O'Hagan FRSE of the University of St Andrews hosted a visit by Dr C. Isanbor.

Russian Federation - Outgoing from Scotland:

Dr Tara Marshall, University of Aberdeen.

Slovak Republic - Outgoing from Scotland:

Dr Uhrin Dusan, University of Edinburgh.

South Africa - Outgoing from Scotland:

Dr Maria Stuttaford, University of St Andrews.

Spain – Incoming to Scotland:

Dr Javier Perez-Barberia of the Macaulay Institute hosted a visit by Dr Ramon Soriguer.

Spain – Outgoing from Scotland:

Dr Javier Perez-Barberia, Macaulay Institute.

Thailand – Incoming to Scotland:

Professor Paul Michael Bishop FRSE of the University of Glasgow hosted a visit by Niran Chaimanee.

Turkey – Incoming to Scotland:

Professor Mark Jerome Steedman FRSE of the University of Edinburgh hosted a visit by Dr Cem Bozsahin.

Ukraine - Incoming to Scotland:

Dr Ashok Adya of the University of Abertay hosted a visit by Dr Oleg Kalugin.

United States – Incoming to Scotland:

Dr Iain Richardson of Robert Gordon University hosted a visit by Professor Maja Bystrom.

Dr Randall Stevenson of the University of Edinburgh hosted a visit by Professor Brian McHale.

Professor Pat Monaghan of the University of Glasgow hosted a visit by Professor Robert Ricklefs.

Dr Min Zhao of the University of Aberdeen hosted a visit by Dr Christine Pullar.

United States – Outgoing from Scotland:

Dr Iain Richardson, Robert Gordon University.

Dr Colin Campbell, University of Edinburgh.

Dr Murray Roberts, Scottish Association for Marine Science.

Events

25 November 2004: Marie Curie Information and Proposal Writing Day. The day focused on the new Human Resources and Mobility Work Programme, providing an outline of the key changes as well as lessons learned from the first round of deadlines. The event was divided into two separate sessions (morning and afternoon). Each session provided a brief outline of the Marie Curie Actions, the benefits of the fellowships, guidance on preparing proposals and feedback from the first calls. Organised by The Royal Society of Edinburgh, in partnership with the UKRO, the UK National Contact Point for Marie Curie Actions.

26 November 2004: Current Research in Mathematical Biology. See page 127.

April 2005: A joint British Council - RSE Science Communication seminar was held as part of the Edinburgh Science Festival.

31 May 2005: the European Commissioner for Science and Research, Commissioner Janez Potocnik visited the RSE. Presentations were given by Professor Wilson Sibbett, Professor Peter Downes and Dr Ian Underwood to the Commission and a specially invited audience about the current status of research and development in Scotland. Commissioner Potocnik outlined his goals for his five-year tenure as European Commissioner for Science and Research, and especially highlighting his approach to the EU budget for research and development. In addition, the Commissioner had an opportunity to meet members of the business community. As a consequence of this discussion, the President and President-elect wrote to the Prime Minister to express their serious concern about the cut to the research budget proposed by the Council of Ministers. The Prime Minister replied in encouraging terms,

noting "I couldn't agree more on the importance of Research and Development for building the knowledge economy which Europe needs if it is to compete with the USA, China and India". Mr Blair went on to pledge "As EU Presidency, we will work hard over the next five and a half months to move towards agreement on a budget for the next Framework Programme".

5 October 2005: Dinner held at the RSE for delegation from the European Parliament's Industry, Research and Energy Committee, during which there was an interesting discussion centring mainly on the future direction of Europe, particularly in relation to research and its economic potential.

Visits

December 2004: Dr Kasturirangan of the National Institute of Advanced Studies, Bangalore, India, visited the RSE as part of a visit to the UK to give the Jagdish Chandra Bose Memorial lecture at the Royal Society of London.

December 2004: Lord Sutherland met with the President of the Chinese Academy of Sciences for dinner at the House of Lords.

December 2004: Professor Rona MacKie and Dr William Duncan visited the Academy of Sciences of the Czech Republic, including two of their research institutes.

May 2005: the RSE hosted a delegation from Korea and discussed amongst other things the Enterprise Fellowships and the commercialisation of research in general, within the Scottish context.

June 2005: representatives from the National Natural Science Foundation of China visited the RSE as part of a trip to the UK.

June 2005: Professor Barbara Crawford FRSE visited Norway to progress the RSE's relationship with the Norwegian Academy of Arts and Sciences and to explore the potential of future joint activities.

July 2005: A Cuban delegation visited the RSE to meet with Michael White and to listen to the "Climate Change: Apocalyptic, Much Ado about Nothing, or Cause for Concern", a public lecture delivered by Professor John Mitchell OBE FRS, Chief Scientist, Met Office.

Relations with Sister Academies

25 February 2005: the RSE hosted a visit by the staff of the Norwegian Academy of Arts and Sciences.

30 May 2005: a bilateral agreement was signed by the RSE and the Academy of Sciences of the Czech Republic (ASCR). The ASCR representatives (Professor Jan Palous, Head of the International Council for International Affairs at

the academy and Mr Andrzej Magala, International Department Officer responsible for the UK) were given a tour of the Royal Observatory Edinburgh as part of their visit and attended the meeting with Commissioner Potocnik (see above).

16 September 2005: an informal agreement was signed by the RSE and the Norwegian Academy of Science and Letters, agreeing to communicate and liaise regularly and where possible to work jointly.

21 September 2005: a bilateral agreement was signed by the RSE and the Hungarian Academy of Sciences, during a brief visit to Budapest by Dr Ferenc Antoni FRSE and Frances Fowler (RSE International Relations Manager).

22-25 September 2005: Professor Andrew Miller FRSE and Michael White (former RSE International Activities Manager) visited the Cuban Academy and a number of Cuban institutions. During the visit, an informal agreement was signed between the RSE and the Cuban Academy.

FELLOWS' SOCIAL EVENTS

Fellows' Reception

There was no Fellows Reception during the Session.

Triennial Dinner

The Triennial Dinner to mark the end of the Presidency of Lord Sutherland of Houndwood KT FBA FRSE was held on Friday 24 June 2005. The dinner took place in the grand surroundings of Edinburgh University's Playfair Library Hall. Nearly 200 Fellows and their guests attended the dinner. During the evening Sir Laurence Hunter CBE FRSE was awarded the Bicentenary Medal. The reply to Lord Sutherland's Toast and a toast to the society was delivered by the Society's guest Lord Oxburgh KBE FRS FREng.

New Fellows' Induction Day 2005

An Induction Day for New Fellows was held for the first time on 2 May 2005. Fellows met Council and Executive Board Members for lunch where they were welcomed to the Society by RSE President, Lord Sutherland. Chairman of Trustees of the RSE Scotland Foundation, Professor Andy Walker provided New Fellows with an overview of the Society's activities. Prior to the ceremony of admission to Fellowship, there was an opportunity to meet the Society's Staff and to find out the many ways in which New Fellows might make a valuable contribution to the life of the Society.

Fellows' Coffee Meetings

Weekly Coffee Meetings were held throughout the winter and spring months. Speakers at the monthly lecture meetings were :

2 November 2004. *Thwarting and Origin of Speech.* Professor Eric A Salzen

7 December 2004. *How we Think.* Sir Michael Atiyah

11 January 2005. *The Ups and Downs of Natural Populations.* Professor Jonathan A Sherratt

1 February 2005. *Why Educate?* Professor Sally A Brown

1 March 2005. *Geological Hazards.* Mr John H Hull

The Royal Society Dining Club

This Club was established on 3rd January 1820, with the view of promoting the objectives of the Royal Society of Edinburgh. In Session 2004/2005 meetings were held as follows :

831st dinner - 6 December 2004
Praeses: Professor John Laver
Croupier: Professor A D I Rolfe

832nd dinner - 4 April 2005
Praeses: Dr Brenda Moon
Croupier: Professor Carol Duffus

833rd dinner - 6 June 2005
Praeses: Professor Andrew Miller
Croupier: Dr Lesley Glasser

834th dinner - 3 October 2005
Praeses: Professor David Saxon
Croupier: Professor J M M Cunningham

Fellows' Golf Challenge

The 2005 Golf Challenge was held on 22 August 2005 over the Balcomie Links course at Crail Golf Club, Fife. The Stewart Cup was won by Professor Wilson Sibbett, for the second time.

GRANTS, SPONSORSHIP AND DONATIONS

The society is grateful to the following organisations for their continuing support during the Session:

BBSRC

BP Research Fellowship Trust

British Council

Caledonian Research Foundation

Lord Fleck Will Trust

Lessells Trust

Lloyds TSB Foundation for Scotland

GM Morrison Charitable Trust

Gannochy Trust

PPARC

Scottish Enterprise

Scottish Executive

and also to the following for their support for specific events and activities:

Aberdeenshire Council

The Binks Trust

Buccleuch Estate

Charities Aid Foundation

The Darwin Trust of Edinburgh

Edinburgh Centre for Rural Research

Sir Walter Gibbey

Halifax Bank of Scotland

Health Foundation

Heriot-Watt University

Highlands & Islands Development

Imperial College London

Institure of Biology

Institute of Physics

James Weir Foundation

The Rowett Research Institute

Royal Meteorological Society

Scottish & Southern Energy

Scottish Enterprise Grampian

Scottish Association for Marine Science

Shell UK

Statoil

Total E & P UK plc

The Wellcome Trust

CHANGES IN FELLOWSHIP DURING THE SESSION

DEATHS REPORTED TO THE SOCIETY

Fellows

Gerald Oliver Aspinall
Ivor (Ralph Campbell) Batchelor
Richard Alan Beatty
Lindsay Sutherland Bryson
John Barklie Clements
William Murray Cormie
David Daiches
Morrell Henry Draper
Peter Stephen Farago
William Ewart John Farvis
Charles Arthur Fewson
John Robert Stanley Fincham
William Hugh Clifford Frend
Alexander Norman Jeffares
George Scott Johnstone
Eric Duncan Grant Langmuir
Angus McIntosh
John Drake Matthews
Robert William Milne
Bertram Desmond Misselbrook
Autar Singh Paintal
Francis David Penny
Lord Polwarth
Hubert Lloyd David Pugh
William Devigne Russell-Hunter
Richard Malcolm Sillitto
David John Tedford
Edward (Maitland) Wright

Honorary Fellows

Jack St Clair Kilby
Saunders MacLane
Joseph Rotblat

ELECTIONS

Honorary Fellows

David Frederick Attenborough
Michael Victor Berry
John McCarthy
Michael E Porter

Corresponding Fellows

Orley C Ashenfelter
Malcolm Harold Chisholm
Bruno S Frey
Cameron McAllan Gordon
Knut Helle
Elizabeth Loftus
Ralph M Steinman

Fellows

Robin Campbell Allshire
Robert David Anderson
Alan Langskill Archibald
Christopher Jon Berry
Wendy Anne Bickmore
Susan Margaret Black
George Cooper Borthwick
Daphne Jane Bower
Alistair James Petersen Brown
Steve Bruce
Doreen Ann Cantrell
Michael Elmhirst Cates
Stephen Kenneth Chapman
Patricia Connolly
Edward James Cowan
Anthony Terence Doyle
Allan Mackay Findlay
Mary Gibby
Evelyn Glennie
Lesley Anne Glover
Alison Jane Patricia Goligher
Andrew William Goudie
Istvan Janos Gyongy
John Williams Hancock
John T S Irvine
Eve Cordelia Johnstone
Paul William Jowitt
Michael James Keating
Peter David Keightley
Andrew Ramsay Knox
David Alan Leigh
Kenneth Iain Muir McKinnon
William Henry Irwin McLean
Gilleasbuig Iain MacMillan
John Duncan MacMillan
Iain Duncan MacPhail
Susan Lindsay Manning
Andrew Alexander Meharg
Duncan Michael
Alan Millar
Gordon Douglas Murray
James Henderson Naismith
Anthony Aubrey Nash
Anne Neville
Jeremy Alastair Peat
James Ivor Prosser
Stuart Hamilton Ralston
Robert Paul Reid
John Michael Rotter
John Stewart Savill
Ethel Marian Scott
Mona Siddiqui
Garry Lindsay Taylor
Philip Lee Wadler
John Bainbridge Webster

STAFF CHANGES DURING THE SESSION

Arrivals

Ms Frances Fowler, International Relations Manager

Mr William Hardie, Energy Enquiry Administrative Assistant (temporary post)

Mr Robert Hunter, Evening Caretaker

Departures

Ms Sarah Gilmore, Events Co-ordinator

Mr Gary Johnstone, Accounts Assistant

Mr Michael White, International Activities Manager

Other Staff in post throughout the Session

Ms Christel Baudere, Personnel Assistant

Mr Stuart Brown, PR and Communications Manager

Mrs Roísín Calvert-Elliott, Events Manager

Ms Jennifer Cameron, IT Support Manager and Communications Officer

Dr Lesley Campbell, Fellowship, Policy, and Education Manager

Dr William Duncan, Chief Executive

Ms Zoë Eccles, Receptionist/ Telephonist

Miss Kate Ellis, Director of Finance

Ms Emma Faragher, Education Assistant

Mrs Anne Fraser, Research Awards Manager

Ms Jean Finlayson, International Relations Officer

Ms Kirsteen Francis, Conference Centre Co-ordinator

Mrs Vicki Hammond (formerly Vicki Ingpen), Journals and Archive Officer

Mr Graeme Herbert, Director of Corporate Services

Mr Robert Lachlan, Accounts Officer

Mrs Jenny Liddell, Research Awards Co-ordinator

Mr George Pendleton, Facilities Assistant

Mr Frank Pullen, Central Services Manager

Dr Marc Rands, Policy Officer

Dr Harinee Selvadurai, Education Officer

Mr Brian Scott, Technical Support Assistant

Mrs Sheila Stuart, Administration Assistant

Mrs Margaret Tait, Receptionist/ Telephonist

Ms Susan Walker, Events Officer

Mrs Doreen Waterland, PA to Chief Executive and Officers

Mr Duncan Welsh, Events Officer

OBITUARY NOTICES

Sir Kenneth (John Wilson) Alexander
14 March 1922 - 27 March 2001

Kenneth Alexander was a man of his time: academic, social scientist, political activist, businessman, administrator and statesman. In the turbulent years from 1950 to 2000, he was in the thick of it. Throughout, he was big enough to meet the challenges, to ride out the storms and to rise above the gratuitous jealousies, pettiness and crossfire that attend all men of action, especially academic men of action.

Sir Kenneth was an academic and educator prepared to apply his knowledge to the outside world. He was also a socialist and, when it was not popular to be so, an advocate of the Scottish dimension. He stood for change, for evolution and carried into the Highlands and Islands of Scotland his convictions that the future held not fear but promise. He finally took this experience and warmth of character into the then new University of Stirling. In his long life, he saw the comings and goings of many new Jerusalems, culminating in Scotland's devolution to a near independent nation. A Keynesian economist, he was never a toady to theory and never afraid to stand his ground in defence of what he believed to be true. He had all the qualifications for membership of this Society.

Educated at George Heriots, and Dundee University, he researched at Leeds and lectured at Sheffield and Aberdeen before becoming Professor of Economics at the then new University of Strathclyde. He was the first dean of the first business school in Scotland.

Not bad for one life but there was much more in store. Unlike many academics of his day, he sought to put his talents and his experience to useful purpose. As a reformer he knew that to get anything done it was essential to step into the political arena. There his keen brain, clear head and good heart drew him into the cockpit of Scotland's post-war agonies. He became a board-member of the Clydeside shipbuilding companies, Fairfields and Upper Clyde shipbuilders. Later still, he became Chairman of Govan Shipbuilders. Here indeed was a bed of nails and an intellectual challenge second to none. How was job security to remain wedded to market forces? Given the deeply held prejudices of everyone involved in this titanic struggle there was no solution to this or to any other of Britain's industrial problems. Somewhere along the line the analytical brains of the political theorists had broken loose from the social experience of the work force. For all his trying, Kenneth Alexander's beliefs in the promise of new technologies and unionmanage-ment cooperation were to be frustrated by the familiar conserv-ative forces of the left and right.

However, because of his senti-ments, he was the obvious choice for another workforce to lead the Campaign for the Defence of the Steel Industry in Scotland. That also came to nothing, those opposing him having already made up their minds that Raven-scraig should close. Was it necessary for Scottish manufactur-ing industry to haemorrhage to death? Kenneth Alexander thought not and in that persist-ently positive frame of mind, he was appointed to succeed Sir Robert Grieve as Chairman of HIDB, the Highlands and Islands Development Board, there to leave his mark on another episode of Scotland's 20th Century. The Highlands and Islands had always been on the fringe of a nation, itself on the fringe of its big southern neighbour which in turn is on the fringe of Europe. Distance had not yet been conquered by the information technology and communications revolution but Kenneth Alexander brought a new face, fresh opti-mism and humanity to bear on another aspect of the regenera-tion of Scotland. He was an advocate of its music and other arts. This was to be a turning point and out of the seeds sown there would emerge a stemming of the then population outflow, together with the enhancement of further education and, in the end, the creation of the embryonic University of the Highlands & Islands.

He was the obvious choice to pilot HIDB. He knew the Highlands and he was well schooled in develop-mental economics. Again there would be opposition to top-down efforts to revitalise ancient customs and ancient attitudes and there was a new prime minister on the warpath.

After four years of economic planning, Sir Kenneth, as he now was, left the Highlands to take up yet another challenge which would involve all his political skills. In 1982 he was appointed Principal & Vice-Chancellor of the still new University of Stirling. It was not a good time to be entering university administration. The infamous letter from the University Funding Council, which sealed the fate of the older, benign University Grants Commit-tee, imposed massive financial cuts which were arbitrary and selective. A young university still finding its feet was vulnerable. There were whispers of closure of more than one Scottish university.

This clumsy act destroyed a collegiality which had held the university community together over the centuries. It required someone of Sir Kenneth's confidence and experience to steer Stirling into safer waters, which he surely did. And then there was an even more far-reaching discussion to which he was a party. In the mid-1980s the Scottish Office had established a new body, the Scottish Tertiary Education Advisory Council (STEAC). Chaired by Sir Donald McCallum, it sought the view of the Scottish universities as to whether they should look south to London for succour and inspiration or north to Edinburgh. Option 6 of the study which advocated closer ties with home was supported by only three of the eight universities, namely Stirling, Strathclyde and Glasgow. The option was therefore defeated but the arguments for a more Scottish university system were noted and minuted. They would resurface 20 years later when devolution swept up the whole of Scottish education into a North-of-the-Border empire. Still some universities look south for salvation, but Kenneth Alexander did not.

When he stepped down from Stirling it was to climb one more rung of the academic ladder to become Chancellor of Aberdeen University, another prickly patch but well within his ability to manage. A far cry from the Glasgow shipyards. In his life, Kenneth Alexander served many bodies and gave much advice. In between times, and to enshrine his academic credentials, he wrote several books and articles about industrial change and political economy. He received many distinctions and was elected a Fellow of the Royal Society of Edinburgh in 1978. Throughout, he was knowingly supported by his consort Angela who was always at his side but seldom in the footlights. She and their five children gave Kenneth Alexander the greatest pleasure. He led a consummate life which was a personal denial of the allegation, often levelled at academics, that they are irrelevant, if not useless, to the outside world. Kenneth Alexander had no inhibitions. His fellow academics could ‘tut tut’ but he was always ready to stand his ground. Polymaths are now out of fashion; perhaps they always were. On his own terms, Kenneth Alexander was such a person.

Sir Graham Hills

Sir Kenneth Alexander was a wise and practical man for all the people. He once said: “walking the streets of the towns and villages of your native land keeps your feet and your thoughts firmly on the ground of reality”... So it was in his life as Student, Lecturer, Director, University Chancellor, and, not least, as a caring husband and father. But, irrespective of his work at any time, he was above all a practical educator, and the man and his role came together in harmony.

After his wartime service in the R.A.F. he studied at Dundee's Bonar School of Economics, culminating in an outstanding external degree from London University (1949). Marriage followed, and then he became, in order, a research assistant at Leeds, a lecturer at Sheffield, a lecturer at Aberdeen, before being appointed to a new chair of economics at Strathclyde and Dean of the Scottish Business School.

In his teaching of economics he was sceptical of the undue emphasis that was being placed on mathematical certainty; not surprisingly, what was increasingly regarded as his desirable commonsense in solving practical problems was quickly recognised.

The Trade Union movement had noted this early in his career, and, as an example, it seemed quite natural that Kenneth Alexander should represent miners on the National Coal Board's industrial relations Tribunal: or that he taught members of the Transport and General how to use a slide rule!

It soon became widely accepted in Scotland that if there was a serious difficulty to be solved, especially where politics intruded and widespread agreement was required, the call went out for Professor Alexander. The 1960s and 70s were an uncertain time for shipbuilding. He was appointed a non-executive director of Fairfields (Glasgow), and did much to help it continue in business. When the Government took it over it was no surprise that he should become Chairman from 1974 to 1976.

In 1976 he was given leave from Strathclyde to chair the Highland and Islands Development Board. The major (and continuing) problem was highland land use, a matter which never seems to attract solutions. Helpfully Sir Kenneth (Knighted 1978) had the strength of acceptance across the political spectrum, not least because of his belief in rational argument and his honesty of purpose. These qualities were equally required when he became Principal and Vice-Chancellor of Stirling, at the time a fine-looking University with an uncertain reputation. Sir Kenneth, with a splendid grasp of the circumstances and his wise and steady leadership, did much to save from extinction what is now a substantial jewel in the education crown. This was yet another example of his ability to get things right, and mirrors his report on adult education in Scotland which is the guiding light for community learning in Scotland.

Then followed, from 1986, a decade as Chancellor of the University of Aberdeen. It was a return to a seat of learning for which he had a great regard. Like so many universities, Aberdeen was going through a trying period arising from a reduction in grants; in his inimitable way he prodded the University to plan fully and sensibly for its quincentenary. In between times Sir Kenneth gave willingly and vigorously to the work of a large number of public bodies, among them the Scottish Development Agency, the Technical Change Centre, the Saltire Society and the National Museums of Scotland.

Helpfully, Sir Kenneth did not neglect the private sector, although his directorships were few and carefully chosen. In his busy life he was a positive contributor to Scottish Television, the Scottish *Daily Record* and *Sunday Mail* group, and Stakis Plc.

The amazing amount of work Sir Kenneth was asked to undertake and successfully completed, often under difficult circumstances, is clear proof of his dedication to his fellow men and women. What should never be forgotten is how kindly, courteous and good-humoured he was in the midst of all his remarkable achievements. Needless to say in everything he did he was greatly helped by marrying the right lady and having a supportive family.

Sir Campbell Fraser

Kenneth (John Wilson) Alexander. Kt, DL, BSc(Dundee), HonLLD (CNAA, Aberdeen, Strathclyde, Dundee), DUniv(Stirling, Open), Hon DLitt (Aberdeen, Heriot-Watt). Born 14 March 1922; Elected FRSE 6 March 1978; Died 27 March 2001.

RSE Council Service: Councillor, 1990-93; Vice-President, 1993-1996.

John Graham Comrie Anderson

26 April 1910 - 20 February 2002

Emeritus Professor J. Graham C. Anderson, who died at his home in Lisvane, Cardiff, on 20th February 2002, aged 91, was born in the Hillhead area of Glasgow on 26th April 1910, the son of Edmond Archibald Anderson, at that time an aerated water manufacturer, and Annie Maude Anderson, née Comrie. His mother was born in Rothesay, the daughter of James K. Comrie, a Glaswegian stockbroker, and his Irish-born wife Mary J. Comrie. The family lived in Cardiff before moving to Glasgow, but they also had a second home in Rothesay. His paternal grandfather was Secretary, i.e. General Manager, of the Callander and Oban Railway from its beginning until 1910.

Graham attended Glasgow Academy and entered Glasgow University in 1928. He was taught his first year geology by Professor J.W. Gregory FRS, this being the last year before Gregory retired in 1929. More influential on Graham were Professor E.B. Bailey FRS, a tectonic geologist, who succeeded Gregory and under whom Graham graduated MA, BSc (with 1st Class Honours in Geology) in 1932, and G.W. Tyrrell, the renowned igneous petrologist. Graham Anderson spoke and wrote French fluently, as Glasgow University then offered Honours Science students the opportunity to take a pass degree in an Arts Subject and Graham took French. He never lost his pronounced Glaswegian bluff manner and accent and his origin was always immediately recognisable, even if sometimes the meaning of his words, especially to students unfamiliar with the dialect, was somewhat puzzling. His geological work was mainly in the fields of petrology, tectonics and, with time, increasingly in engineering geology.

Supervised by Bailey and Tyrrell, whose influences are apparent in his choice of subject, he stayed on in Glasgow University to complete, in 1935, a PhD entitled *Contributions to the Caledonian igneous geology of the SW Highlands*. This was unusually forward-looking in being composed of the drafts of three distinct papers, two of which were even published in 1935. One was on the marginal intrusions of Ben Nevis including the Coille Lianachain complex, another on the Arrochar intrusive complex and the third, on the SE margin of the Etive Granite complex, was subsequently enlarged to include the whole of the Etive Granite, whilst Graham was a Carnegie

Research Fellow in Glasgow, and published in 1937. With commendable industry, he also published in 1935 a paper on the Dalradian succession in the Pass of Brander. This no doubt represented field work done on low ground, from his camp near Loch Awe station, on days too misty or wet for work on the nearby high ground of Ben Cruachan, with its bevy of Munros and Corbetts (near-Munros). Field work in the summers of 1932, 1933 and 1934 involved some very long hikes and camping, which suited a young man keen on mountain walking who had been trained by Bailey. Eventually, before he left Scotland, he had climbed no less than 218 of Scotland's Munros - a very considerable feat, especially as, without a motor car, some involved in-and-out walks totalling tens of kilometres. In 1936 he joined the Geologists' Association and was a member for 66 years, only slightly longer than his 1937 Life Fellowship of the Geological Society of Edinburgh. He spent a year (1936-37) as a temporary Lecturer in geology at the University of St Andrews before being appointed in 1937 to HM Geological Survey of Scotland, based in Edinburgh.

In the Survey he worked in the Scottish coalfields and the Lothians oil-shale field as well as in the Scottish Highlands. In particular he developed a flair for engineering geology which had emerged first while he was a student, as shown by two papers published in the *Quarry Managers' Journal* in 1934 and 1935. Whilst with the Survey, he published a lengthy study on Scottish Sands and Gravels among other applied subjects with the Institute of Quarrying, and was made an Honorary Member of that Institute. He also published, often jointly, in the Wartime Pamphlet Series of the Survey on limestones, silica rocks, slates, sands and gravels and also in applied Memoirs such as *The Granites of Scotland* (1939) and *The Limestones of Scotland* (1949). Indeed, he actually did only limited mapping during his time in the Survey, partly because it was mostly wartime and the Survey then worked largely on strategic geological materials. In the Survey he was popular and regarded as a good colleague, although like the writer, he was not a smart dresser, especially with wartime clothes restrictions. Typical field gear was an aged Trench coat with a rear hacking cut, riding breeches, sometimes perforce repaired with safety pins, an old 'Biggles'-type airman's helmet with the ears cut out and boots which alarmingly quickly became worn through at the soles; on one such occasion forcing a longer walk back along the sleepers of the West Highland Railway to avoid the sharp heather of the shorter way across the Moor of Rannoch! Later he was seconded from the Survey to advise on the crucial aspects of the engineering geology of five major projects, those of the Sloy, Cruachan, Shira, Nant and Grampian Hydro- Electric Schemes, which gave him exceptional expertise in the engineering problems associated with dam foundations, tunnelling, fractures and joints and slope stability. He obtained a DSc from Glasgow University in 1945, was made a Fellow of the Geological Society of London in 1944 (becoming a Senior Fellow in 1994) and was elected FRSE in 1947, being a Fellow for 55 years. He rose to become a Senior Geologist in the Survey and, like several of his Geological Survey contempories, (e.g. S. E. Hollingworth who went to University College London; F. W. Cope, Keele; W. D. Evans, Nottingham and J. H. Taylor, Kings College London), he later moved to academia. In 1949 he was appointed to the Chair of Geology at University College, Cardiff, succeeding Professor A. H. Cox, and remained there until retirement in 1977, being Head of Department for 28 years.

His main mapping in the Highlands was largely undertaken outside of his Survey duties in his own time, apart from time spent in some quarries, and the field work was helped by the award of a grant from the Clough Memorial 2 Research Fund of the Edinburgh Geological Society. His major work was on the Dalradian rocks of the Highland Border, and he published on those in Angus, Kincardine, Bute and Arran, and eventually, in 1947, on the whole Stonehaven to Arran belt in an important paper in the Royal Society of Edinburgh's *Transactions* (Vol 61, pp 479-515). This firmly ("not a shred of valid evidence") disposed of the Gregory concept of the 'Lennoxian' in which Gregory erroneously considered the southern Dalradian to be Lower Palaeozoic rocks unconformable on the Dalradian. Graham's paper, submitted in May 1945, was the first to describe in some detail the Aberfoyle anticline, initially identified by Henderson in 1938. Unequivocally, Graham considered the anticline to 'close upwards', although perceptively, he did realise that such a NW-facing fold was inconsistent with the SE-facing structures identified by Clough and elaborated by E.B. Bailey, but was unable to deduce a satisfactory solution. Nevertheless, the conundrum posed by Graham's 1947 paper did spark the interest of Robert Shackleton, whose brilliant solution of a downwardfacing Aberfoyle anticline not only elucidated the closure of the whole Tay Nappe structure, but whose method in so doing revolutionised the mapping and interpretation of folds in metamorphic rocks. Graham never accepted Shackleton's solution. By a curious coincidence, Anderson and Shackleton were both elected to the Council of the Geological Society of London simultaneously and served for the period 1958 to 1962.

In view of the interest of his mentor, E.B. Bailey, (who was Director of H. M. Geological Survey from 1937-45), in extending the knowlege of Dalradian stratigraphy and structures into Ireland, it was understandable that Graham, probably on Bailey's suggestion, should have also turned to Ireland, and in papers in 1946 and 1947, again completed outside Survey duties, he correlated the enigmatic rocks south of Lough Derg with the Moine rocks of Scotland, their first recognition outside Scotland. This was an important discovery which he carefully argued, based on 370 km^2 of mapping. Later in 1954, as Professor, he went on to reconnaisance-map the Slieve League Peninsula in Donegal and extended the claimed area of Moine rocks to include the whole of the Killybegs Group, which was not generally accepted. The problems of the Moine-Lower Dalradian contacts, which his Irish work only emphasised, encouraged a return to the Highlands and his last paper in the Society's *Transactions* (1956), was on the Moinian and Dalradian rocks between Glen Roy and the Monadhliath Mountains; a vast wild area 30 x 60 km. He retained his resilience and ability to walk long distances for many years. His final foray in Ireland was to study the Wenlock rocks of South Mayo (1960).

He did not take to the mid-50s advances in structural geology, with the new emphasis on mapping multiple folding in metamorphic rocks and noting of structural information. Graham was a 'broad brush' mapper, not given to intricate data recording or looking at every outcrop, and with his large, rather clumsy handwriting, which almost embossed the paper, his field maps were notable for broad generalisation of ground walked over quickly rather than examined in detail. But many of his walk-over surveys filled in urgently needed information (eg for a proposed hydroscheme) where no geological mapping existed. After the 1950s, most of his work was in engineering geology or in simple pre-plate tectonic geology summaries such as *The Pre-Cambrian of the British Isles* (1965), *The structure of the British Isles* (1968; with T. R. Owen); and *The structure of Western Europe* (1978). He was not enthusiastic about building a school of graduate research students, but W. R. Church worked on the Irish Moines, T. E. Smith on the Laggan district in Scotland, D. Powell on Dinorwic in Wales, G.G. Lemon (a staff member in Cardiff) on the Ox Mountains, Co Sligo and J. M. C. W. Baker (also staff) on the Rosslare Complex, and all were clearly influenced by Graham.

During his long tenure of the Chair in Cardiff he progessively became more and more involved in consulting as an engineering geologist and less concerned with academic geology. Indeed, he was interested in practical things and with his blunt down-to-earth pronouncements and way of speaking, he projected the antithesis of a 'head in the clouds' academic don. As his engineering reputation spread, he was increasing in demand, not only in the UK, but also abroad in problems related to dams, tunnels and cuttings associated with reservoirs and hydro-electric projects. He was consulted over the Clywedog Dam, the Ffestiniog and Dinorwic Pumped Storage and the Rheidol Hydro-Electric schemes, the Craig Goch project, the Kielder Dam and tunnels, the Calder Reservoir and tunnels in Renfrewshire, the Irvine Bay sewage tunnel and abroad the Volta River (Ghana) scheme, the Kariba North Bank Power station (Zimbabwe-Zambia) and the Kotmale Dam, Sri Lanka. He became a Member of the South Wales Institute of Engineers, was awarded a medal by this Institute, and served as President in 1976-7. He obtained diamond drilling equipment for the Department of Geology so that local engineering geology problems in the South Wales valleys, such as depth through 'the drift' to rockhead, could be established, often to the chagrin of the Departmental technicians who did the drilling. He and Dr C. R. K. Blundell published such a map for the Cardiff district in 1965. Graham became a most successful engineering geology consultant and he summarised some of the expertise acquired through his wide experience in a most readable book, jointly with C. F. Trigg, *Case-histories in Engineering Geology* (1976), which is still used today. This includes summaries of the dangers of steep valley slips and tip failures, based on experiences in South Wales, as well as a general review of building dams, tunnels, bridges, cuttings, foundations and harbours.

Inevitably, with anyone expected to be Head of a Department for 28 years, during which the Universities changed almost unbelievably, Graham found some changes hard to adjust to, such as staff involvement in policy-making and implementation through staff meetings. Such consultations were almost unknown in British Universities before the 1950s and Graham did not readily adapt to them even when new University regulations required them. He suffered from unusually poor coordination and so never learnt to drive and this, together with his phenomenal walking ability and a deep interest in railways and train travel, prompted him to continue to take field classes by train for a long time, although coaches were also used. Extended walks, unthinkable today, between widely-scattered teaching localities on day-trips from Cardiff, were common, such as from Pontypool Road to Usk and beyond and Bridgend to Southerndown, with diversions and back, 16 km minimum. His Honours student excursions to the French Alps and the Massif Central were remembered not only for the geology but also the education in French life and the Professor's expertise in the French language. He was noted for his extremely modest requests to the University College for Departmental capital and running costs, and he was most reluctant to apply for new equipment for staff research (although he early acquired a range of geophysical equipment). This, together with his lack of interest and encouragement for forging new scientific developments in the Department, caused considerable staff discontent and eventually left the Department weak in research. However, this has to be understood against a background of extremely limited funds in the College and of poor administration of what there was, which eventually led the College to the point of bankruptcy. He oversaw the enforced move of the Department from Newport Road to the splendid Natural History Wing which completed the impressive Main Building in Park Place in 1962, although initially the space allocated to geology in the new building was minimal, as more ambitious Professors exploited his lack of politicking and his reticence to insist on a reasonable space allocation.

This memorable move prompted Graham and D. Bidgood, following an invitation from the Director of the Geological Survey of Norway, Sven Foyn, to organise a summer expedition in 1962 to Porsangerfjord in Finnmark, Norway, to commemorate the opening of the new Departmental accommodation. From this small beginning, the first Cardiff Arctic Norway Expedition was launched under Dr R A. Gayer in 1966. Graham supported this mapping project, led by Dr R A. Gayer, and although he himself did not undertake any research in Norway, this was the main academic project he encouraged over many years, and he nominally supervised many of the postgraduates. In 1967 he participated in a week-long excursion across Finnmark into Russia. He also attended several International Geological Congresses, including Prague, 1968, (disrupted by the Russians), and Sydney, 1976. He enjoyed photography and in retirement he was an enthusiastic leisure traveller. In 1983 he published the first single volume field guide to geological excursions in England, Wales, Scotland and Ireland, *Field Geology in the British Isles*, which unfortunately was not well received.

In a sense, the most impressive and lasting memorials to him are not in the University but in the permanently stable dams and tunnels, robustly constructed, in wild surroundings, about which little or nothing is heard because they were so soundly built on secure foundations.

He married Margaret Firth in 1938 and they had two children, Alison and Neil. Alison's two sons, Iain and Andrew Lovejoy are Graham's only grandchildren. In 1990, he married Joan Truman, whom I particularly thank for assistance and information, together with J. M. C. W. Baker, H. Bartlett, C. J. Burton, J. W. C. Cope, R. A. Gayer, G. S. Johnstone and J. W. Leake.

Bernard Elgey Leake

John Graham Comrie Anderson. MA, BSc, PhD, DSc (Glasgow), FGS. Born 26 April 1910; Elected FRSE 3 March 1947; Died 20 February 2002.

Edward Raymond Andrew

27 June 1921 - 27 May 2001

Raymond Andrew was one of the first physicists in the UK to get involved with the technique of nuclear magnetic resonance (nmr), developed just after the second world war in the USA. His career in this subject spanned the years from 1948 until his death. His contributions included the development of the technique as a structural tool in organic solids, the invention of the magic-angle method of narrowing the resonance lines in solids, an understanding of the effects of the nuclear quadrupole moment on both the static and dynamic aspects of nmr, and an early recognition and development of the application of the technique to biological studies. This later work included a contribution to the massive success of Magnetic Resonance Imaging (MRI), now widely used in most hospitals as an imaging technique for the human body. He held Chairs in the Universities of Wales in Bangor, Nottingham and Florida, Gainesville, during his career and wrote the first textbook for nmr, published in 1955, with a Russian translation following shortly after.

Born in Boston, Lincolnshire, the only child of English parents, but with some Scottish blood in the lineage of both parents, he was educated at Wellingborough School, where he was head boy, before going up to Christ's College, Cambridge in 1939, obtaining first class honours in both Part I and Part II of the Natural Sciences Tripos, and taking a BA in 1942. His college tutor here was the novelist and two cultures polemicist C P Snow. Sir Lawrence Bragg FRS was the Cavendish Professor at this time and other supervisors included David Shoenberg FRS and Norman Feather FRS. Thereafter followed three war years as a Scientific Officer at the Air Defence Research and Development Establishment in Malvern, where his project involved the effects of gunflashes on X-band radar.

1945-48 were years as a research student at Pembroke College and the Cavendish, working with David Shoenberg on problems of the penetration of magnetic fields into Type I superconductors and a PhD ensued in 1948; Kapitza having been Shoenberg's PhD supervisor, Andrew later won a USA-wide competition for the most distinguished academic 'parentage'. A Commonwealth Fund Fellowship then took him off to Harvard for a year's 'post-doc' appointment, where he rubbed shoulders with the nmr pioneers around Ed Purcell. He collaborated closely with Bersohn on a paper concerned with the nmr lineshape of an interacting triangular array of nuclei, the next step up in complication from the famous Pake doublet due to a pair of interacting nuclei. He returned in 1949 to join former Cavendish and low temperature physics colleague Jack Allen FRS , recently appointed to the chair at St Andrews, where he set about building up an nmr presence. Early experiments with students and colleagues Bob Eades, Dan Hyndman and Alwyn Rushworth focused on dynamic effects on nmr linewidths in organic solids such as cyclohexane and benzene. The broadening of the linewidths due to modulation in these continuous wave experiments was quantified.

His appointment to the Chair at the University College of North Wales, Bangor, in 1954, was followed rapidly by the publication of his nmr book (the first monograph on the subject) and to the development of the magic angle spinning technique. Andrew and Eades developed the idea, that if a solid sample is spun fast enough in the main nmr magnetic field, and at the magic angle, the resonance line will narrow markedly in a way that mimics the sharp narrowing in resonance that occurs when solid samples are melted into liquids. The importance of this advance is difficult to overstate, although it took a while, maybe twenty years, before its true significance for the chemistry of materials was realized. Having solved all the technical problems of rapid spinning, the group even toyed for a while with the radical idea of generating the same effective narrowing by leaving the sample static but rotating the main magnetic field. About this time, in the late 50s, funding became available for a state-of- the-art 60MHz commercial nmr machine, with AEI winning the contract. There followed many experiments exploring the effects of the nuclear quadrupole moment on resonance lineshapes and on relaxation; 30 years on, in the late 80s, the high temperature superconductors needed these relaxation ideas to explain their relaxation curves. Whilst at Bangor he also became the founder Chairman of a UK group, the British Radio-frequency Spectroscopy Group, BRSG, which flourishes to this day. 1964 saw him move to the Lancashire-Spencer Chair of Physics in Nottingham, succeeding the magneticist L F Bates; nmr flourished there under Raymond's leadership for the next nineteen years, and he appointed several others who became prominent team leaders. He continued to forge ahead with his own experiments. It was in the early 70s that he began using nmr as an application to biological topics, such as amino acids and proteins. A short step here took him into the then new field of nmr imaging, the now common-place imaging method used in hospitals known as M R I . Nottingham became an important centre for this application of nmr, and is a world centre to this day. His early colloquia on this topic used to feature a slice through a lemon, where the pip could be clearly distinguished. His lecturing method was admirable; he always seemed able to gauge the audience's abilities and adapt his exposition accordingly.

An offer of a research chair in Florida with no retirement stipulations tempted Raymond to move in 1983 and he continued there as the Graduate Professor of Radiology, Physics and Nuclear Engineering until his death. The themes of his work in Florida continued those of his later years in Nottingham. He published in all *circa* 300 papers in his working lifetime. He was a great traveller throughout his career and this led on to many honours and participation in the upper echelons of the magnetic resonance world. He was the President of the Groupement Ampere from 1974-80, and presided over a very successful Ampere Congress in Nottingham in 1974. From 1976-79 he was the UK Chairman of the Standing Conference of Professors of Physics, and from 1983-86 he presided over the International Society of Magnetic Resonance. Journal editorships included *Magnetic Resonance in Medicine*, *Physics Reports*, *Journal of Magnetic Resonance*, *Chemical Physics Letters* and the *Bulletin of Magnetic Resonance*. Honorary Degrees were awarded by Leipzig, Poznan, Turku and Wales, and he won the Wellcome Foundation Medal and Prize in 1984. The Distinguished Service Medal of the Society of Magnetic Resonance in Medicine was awarded in 1991. Elected to the Fellowship of the Royal Society of Edinburgh in 1952, he became a Fellow of the Royal Society in 1984.

He first married Mary, with whom he had twin daughters; Mary died in 1965 and Raymond married Eunice in 1972. He is survived by her and by his daughters, Patricia and Charmian.

David Tunstall

Edward Raymond Andrew. Born 27 June 1921; Elected FRSE 3 March 1952; Died 27 May 2001.

Frederick (Derick) Valentine Atkinson
January 25 1916 - November 13 2002

Frederick (Derick) Valentine Atkinson, scholar, enthusiastic teacher and gifted researcher passed away on November 13, 2002, after a long illness, in Toronto, Canada. A native of Pinner, Middlesex in England he saw light on January 25, 1916, the elder son of George Arthur Atkinson and Dorothy Boxer. His father was a journalist and film critic for the *Daily Telegraph*; his mother's grandfather was Admiral Lord Boxer, Harbourmaster of the City of Québec during the 19th Century. Atkinson read books about Calculus at age 12 and mathematics came easy to the young Derick.

In June 1929, he attended the old and legendary St. Paul's School in West Kensington. Here he spent his formative years, 1929-1934, in a place that educated the minds of the poet John Milton, the diarist Samuel Pepys, the mathematicians J. E. Littlewood, FRS, (of Hardy and Littlewood fame) and G.N. Watson FRS, among scores of others. When Atkinson was 15 the High Master of St. Paul's wrote: "Extremely promising: He should make a brilliant mathematician", prophetic words that would echo into his future. He entered the Queen's College, Oxford, in 1934 with a Scholarship. While a Tabardar at Queen's he was secretary of the Chinese Student Society and also a member of the Indian Student Society. Although it was not well known, he was fluent in many languages including English, Latin, Ancient Greek, Urdu, German, Hungarian, Russian with some proficiency in Spanish, Italian and French. His fluency in Russian was all the more remarkable given that he never (officially) followed a Russian course at Oxford. He also played the accordion and the piano with a passion and a pleasure that was remarkable. During the years of Atkinson's stay in Oxford, A.E.H. Love, FRS, held the Sedleian Chair of Natural Philosophy and it is well known that Augustus Love inspired G.H. Hardy, FRS FRSE (Hon), into reading Camille Jordan's *Cours d'Analyse*, a book that would eventually lead to Hardy's own monograph (*A Course of Pure Mathematics*) thereby forever changing the face of pure mathematics in the UK. This connection with Augustus Love may have led Atkinson to work with his later mentor, E.C. Titchmarsh, FRS, (the Savilian Professor of Geometry) with whom he took his D. Phil. in 1939. His dissertation comprised the finding of asymptotic formulae for the average value of the square of the Riemann zeta function on the critical line, a work that is still under scrutiny today. He was fond of recounting to students and colleagues alike that his final Examining Board at Oxford consisted of G.H. Hardy, J.E. Littlewood and E.C. Titchmarsh!

Appointed Senior Demy at Magdalen College, Oxford, in 1939-1940, his appointment was cut short by WWII. In 1940 he accepted a commission into the Intelligence Corps and he worked in the Government Code and Cypher School at Bletchley Park. He met his wife and great love Dusja Haas, some time during this appointment. He was promoted to Captain in 1943 and achieved the rank of Major in the British Intelligence Corps some time in 1945. Offered an appointment in late 1945 (declined) as an Assistant Professor in the Department of Mathematics at Marischal College, in the University of Aberdeen, he opted instead for a Lectureship in Christ Church, Oxford, his first (accepted) formal academic appointment until 1948. During the period 1948-1955 he was a Full Professor in Mathematics (as well as Chair, and Dean of Arts as well) at University College, Ibadan, in Nigeria. He left Nigeria in 1955 for Australia, where he joined Canberra University College (now part of Australian National University) to become Head of its Department of Mathematics. After a brief stay in Canberra he departed (1960) for his final destination, the University of Toronto, Canada, where he was a Professor until his retirement in 1982 and Professor Emeritus until his death in 2002. Among his many honours and activities we cite: his election as a Fellow of the Royal Society of Canada (1967), UK Science Research Council Visiting Fellow at the Universities of Dundee and Sussex (1970), British Council Lecturer to UK universities (1973), Consulting Editor of the *Proceedings A of the Royal Society of Edinburgh* (1974), Honorary Fellow of the Royal Society of Edinburgh (1975), Royal Society of Edinburgh Makdougall-Brisbane Prize recipient for 1974-1976, 29th President of the Canadian Mathematical Society (1989-1991), and Von Humboldt Prize recipient (1992).

Atkinson was the author of two books and more than 130 papers[1]. Among these we find 13 articles in the Society's *Proceedings A*, including joint papers with Society members J.B. McLeod, M.S.P. Eastham and W.N. Everitt among others (see references). He is best remembered for his classic text on discrete and continuous boundary problems (1964), and his seminal contributions to differential equations (e.g., Atkinson-Wilcox Theorem in ellipsoidal geometry and his generalization of Fredholm operators currently known as Atkinson's Theorem). His kindness and humility was legendary.

Derick is survived by his wife Dusja and three children, Stephen, Vivienne and Leslie, the latter two having joined the ranks of academe as professional psychologists, and his sister Ann Harland.

Angelo B. Mingarelli

Frederick (Derick) Valentine Atkinson. Born January 25 1916; Elected Honorary FRSE 3 March 1975; Died November 13 2002.

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[13] (with C.T. Fulton) Asymptotics of the Titchmarsh-Weyl m-coefficient for non-integrable potentials, IV *Proc. Roy. Soc. Edinb*. 129A (1999), 663-683. 1 See a detailed account of his scientific works in the recent paper "A glimpse into the life and times of F.V. Atkinson" by Angelo B. Mingarelli, *Mathematische Nachricten* 278 (12-13), (2005), 1364-1387

Terence George Baker
27 May 1936 - 22 February 2006.

Professor Terry Baker was the son of George William John Baker of Lymington, Hants and Eugenia, née Bristow. He was born on 27 May 1936 and was educated at Coventry Technical Secondary School and the University College of North Wales, Bangor where he obtained his BSc. He got his PhD at the University of Birmingham and his DSc at the University of Edinburgh. He also obtained an honorary Doctorate from the University of Ulster in June 2002 and another from Universiti Kebangsaan, Malaysia in August 2003. He married Pauline, his childhood sweetheart, and daughter of Alfred Archer on 23 August 1958. He had three sons, Paul Stephen born in 1960, Noel Terence in 1961 and Martin Christopher in 1966.

He was a Career Science Master at Woodlands Boys School, Coventry, 1959-1961. He claims that his gift for university teaching came about as a result of teaching at high school level. At the University of Birmingham he was a Research Student, 1961-1964 and a Medical Research Council Research Fellow, 1964-1967. He became a Lecturer in Anatomy with the University of Birmingham, 1967-1968, and a Lecturer in Obstetrics and Gynaecology in the University of Edinburgh, 1968-1975. He was promoted to a Senior Lecturer in Obstetrics and Gynaecology in the University of Edinburgh in 1975 and became the Professor and Head of Department of Biomedical Sciences at the University of Bradford in 1980. He spent some time as Dean of Natural and Applied Sciences and later, he was Pro-Vice-Chancellor, University of Bradford 1986-1989. From 1980 to 2001 he held the Established Chair in Biomedical Sciences at the University of Bradford, after which he became Emeritus Professor in the same Department in 2001. As a man of vision, he incorporated external research units within the Department, such as the Plastic Surgery and Burns Unit after the Bradford City Football Stadium fire in the late 80s. He also successfully established new degree courses in Bradford University in the School of Life Sciences. He was external examiner for numerous PhD, MSc and BSc students at various universities in the UK and abroad (Australia, Ireland, Kuwait, Malaysia, Malta, Sweden and Zambia). He also won research grants from the UK and America and was referee and assessor for staff promotions at universities both in the UK and abroad.

He was the author of numerous publications in international journals and contributed chapters to many books. He became a Fellow of the Royal Society of Edinburgh in 1980, Fellow of the Institute of Biology (1979), Fellow of the Royal College of Pathologists (1981), Fellow of the Institute of Biomedical Sciences (1982) and Fellow of the Royal Society of Arts (1994).

'Prof Baker' also had a sense of civic as well as national duty and was a member of Bradford Health Authority 1982-1986, and member of the sub-Committee on Education of the Institute of Medical Laboratory Sciences 1985-1986. He became President of Bradford Medico-Chirurgical Society 1990-1991 and was Deputy Chairman of the Research and Development Committee of the Yorkshire Regional Health Authority 1990-1994. As a Governor of Bradford Hospitals Trust, he was an active participant from 2004 until he died. He was Chair of the Yorkshire Region of the Institute of Biology 1991. In 1992, he was instrumental in bringing Institutes involved in Biomedical Science education together by helping found the Heads of University Centres of Biomedical Sciences (HUCBMS) of which in turn he has been Chairman, Treasurer and Secretary.

With all this academic and administrative activity, he still found time to pursue other interests including wood-carving, photography, music, natural history and computing. Above all, he had a very kind, caring, warm, people–centred, gregarious personality and was very much appreciated both by colleagues, young and old, and students. He had a keen interest in following the progress of his students long after they left the University. He also encouraged students from disadvantaged backgrounds and with physical disabilities to pursue university qualifications. He was a good loyal friend and mentor to young academics. Right up until the end he never lost his wonderful and delicious sense of humour.

Diana Anderson

Terence George Baker, DSc(Edin), HonDUniv(Ulster), HonDMedSci(Kebangsaan), FIBiol, FRCPath, FIBMS, FRSA. Born 27 May 1936; Elected FRSE 3 March 1980; Died 22 February 2006.

Cecil Arnold Beevers

27 May 1908 - 16 January 2001

The death of Dr C. Arnold Beevers, Reader Emeritus in Crystallography at the University of Edinburgh on 16 January 2001 was the passing of a great man, who was scientist, teacher, inventor, humanitarian and humorist in a rare combination. He was born in Manchester on 27th May 1908, but his family moved shortly afterwards to Liverpool, a city of which he was always proud. He obtained a BSc in Physics from the University of Liverpool in 1929, and a DSc in 1933. While there he was greatly influenced by Professor Lionel Wilberforce, whose well-designed springs and clamps Arnold never tired of demonstrating. After graduation he was asked to work in the relatively new subject of X-ray diffraction, together with Henry Lipson, a colleague and friend for many years. The two of them made frequent trips to the University of Manchester to get advice from Lawrence Bragg, and Arnold eventually moved to a post there. After a short appointment at Hull, in 1938 Arnold became Dewar Fellow in Crystallography at the University of Edinburgh, a post offered jointly by the Departments of Physics and Chemistry, and he was elected a Fellow of the Royal Society of Edinburgh later that year. He remained in Edinburgh for the rest of his life, coming into his office in the Chemistry Department for the last time less than two months before he died.

Arnold's scientific contributions were many. From his early days he is most remembered now for the Beevers-Lipson strips, and the technique by which they reduced the huge calculations of three-dimensional Fourier summations to sums of manageable one-dimensional ones. These attractive boxes of strips of card were produced in great quantity until the digital computer became generally available in the late 1960s. The technique is still used in many computer programs. Arnold's earliest structural publication was a correct and beautiful reinterpretation of the structure of beryllium sulfate tetrahydrate as interpenetrating tetrahedra of Be $(H_2O)_4^{2+}$ and SO_4^{2-} ions. Previously, a remarkably imprecise treatment had found that the sulfate ions were planar! Arnold rapidly became involved in determinations using Fourier methods and the new Patterson method; important examples were the alums, copper sulfate pentahydrate, and particularly the so called b-alumina, $NaAl_{11}O_{17}$, which he published with the late Dr

Marion Ross. Originally studied as a troublesome impurity in Al_2O_3 production, it is now an important solid-state ionic conductor, and two sites in the structure are known as Beevers-Ross and anti-Beevers-Ross sites.

Arnold's arrival in Edinburgh was soon followed by the outbreak of the Second World War. As a member of the Society of Friends and conscientious objector, he was sent to assist Professor Norman Dott at the Western General Hospital in work on electroencephalography. Arnold threw himself enthusiastically into this, particularly as it threw light on the nature of sleep, and this interest remained with him for the rest of his life.

After the war, Arnold joined the staff of the Department of Chemistry and built up an X-ray diffraction laboratory there, mainly with equipment he designed himself. His generators and cameras were characteristically robust and precisely engineered. The arrival of Professor E.L. Hirst and the growth of his carbohydrate group encouraged Arnold to investigate the then daunting structures of sugars, including glucose and sucrose in the form of its sodium bromide adduct.

As a teacher, Arnold gave lectures of a highly individual nature, which generations of students found memorable. As an experimenter he delighted in demonstrations and younger colleagues were surprised (to say the least) to see him showing the bones of his hand to visitors by using the direct beam from the lab X-ray generators. Again, his crystallography lectures featured a collection of plasticene elephants he used to occupy the sites of a lattice. He also had a large assortment of collecting boxes for Dr Barnardo's Homes for this purpose, frequently pointing out that this was an excellent charity and that the boxes had another useful function!

Possibly his most lasting impact as a teacher was in teaching chemistry to dental students over many years. In 1946 he published an elegant interpretation of the structure of fluorapatite, the ideal bone and teeth mineral, showing the function of the fluoride ions in holding it together. Thereafter he became devoted to the cause of improving dental health by adding fluoride to drinking water supplies deficient in it and often spoke at rallies on this subject, cheered on by his students. He was very proud to receive life membership of the Edinburgh University Dental Society on his retirement in 1978.

Arnold was for many years active in the Edinburgh Cripple Aid Society and was much in demand as a helper, particularly as Master of Ceremonies at plays and concerts. He was not fazed by events such as an epileptic seizure affecting a leading lady and could immediately take over, often leading the audience in community singing. He displayed similar ability at international scientific meetings and was particularly famous for his version of "My Bonnie lies over the Ocean" in which the singers must stand up or sit down on each word beginning with "b". Generally by the third chorus even a group of scientists were coping with all the "bring backs"!

His involvement with disabled people was very important in Arnold's last major scientific contribution – now known as Beevers Miniature Models. Moving away from structure determination after 1960, as he was never really happy with the advent of the digital computer, he sensed the need for accurate ball-and-spoke models on a much smaller scale than that of the inch to Ångstrom models then available, and developed precision drilling machines to enable the scale to be reduced to 1 cm per Ångstrom. After some experimentation he fixed on the 7mm perspex spheres and 1mm steel rod now used, being determined that the models must be both accurate and elegant. Typically he published his methods and did not consider the idea of a patent which he saw as unfairly denying public access to his ideas and methods. The calculations required for drilling he carried out manually, using a Wulff net for his stereographic projections. From the start, much of the work was done by disabled workers, including at one time Brian Wilson, the world's longest surviving patient on renal dialysis (as listed in the Guinness Book of Records!) These workers clearly took great pride in their products, which are now found all over the world from a school in Port Moresby, New Guinea, to IBM Research. The Models were eventually taken over by the University and Arnold accepted that lesser mortals would have to use a computer even for drilling calculations. The continuation of the Beevers Miniature Models Unit shows that he was right in thinking that, in museums, teaching or research, computer modelling would not replace completely the elegant, permanent model.

Arnold's deep faith in and with the Society of Friends (Quakers) greatly influenced his approach to science and to life. He was unswervingly committed to humanitarian causes, particularly world peace, and strongly disliked any form of superstition or other obscurantism, and any sort of pomposity. His life was touched by tragedy, especially the severe dementia which overtook his wife, Marjorie, in the late 1950s and worsened progressively until her death in 1992. Sadly, a similar problem affected Yvonne, his second wife, who died in 1998. In these circumstances his never-failing sense of humour was all the more remarkable.

Arnold is survived by his daughter Lois and son John and by four grandchildren and five great-grandchildren. Many former students and colleagues world-wide have joined in sending them their sympathy and happy memories of a great and kind man.

From an obituary in *Crystallography News* reprinted by kind permission of the Editor.

Cecil Arnold Beevers DSc, FInstP. Born 27 May 1908; Elected FRSE 6 March 1939; Died 16 January 2001

RSE Council Service: Councillor, 1959-62

John Berry

5 August 1907 - 19 February 2002

John Berry, the longest serving Fellow of the Royal Society of Edinburgh, died in February 2002 at the age of 94. He was the son of a Fife landed family, and his father, William, an Edinburgh advocate, was deeply involved in the early stages of bird protection and nature conservation in Scotland, to which John Berry came ultimately to devote his life. He was born into a very different world from ours. In 1907, there was no electricity in the family home at Tayfield, and there was to be none for several decades. There were no pine trees on Tentsmuir, where he roamed as a boy and accompanied his father on shooting and natural history trips. There were no votes for women, but Miss Baxter and Miss Rintoul, friends of the family, were laying the foundations of the modern knowledge of birds in Scotland, and persuaded the Berrys to shoot any bird for them on Tentsmuir that they could not otherwise identify. There was no such thing as Town and Country Planning, but that extraordinary polymath Patrick Geddes, father of town planning, came over from University College, Dundee, for tea and taught little John botany on Tayfield lawn.

John Berry's mother died shortly after John was born, and he was brought up by devoted aunts. He did not enjoy good health as a child - indeed, throughout his long life he was dogged by illnesses. But his immense zest for life and his great love of natural history were evident even when he was young. After his father found him carrying horse droppings up to his bedroom to feed his pet dung beetles, he built him a little "bug house" in the garden at Tayfield, and in due course he graduated from keeping insects to keeping wildfowl. Hampered by brittle bones and dyslexia, he nevertheless prospered at Eton and later at Trinity College, Cambridge, where he shared digs with Peter Scott, and, of course, shared a famous enthusiasm for geese, correcting the paintings of his artist friend from his own greater knowledge of the anatomy of wildfowl. "Gooseberry" they called him in those days. It was at Cambridge that he met the sister of a school friend who was also another young birdwatcher, Bride Freemantle, at Girton; Bride knew all about the small brown birds of Buckinghamshire, John about the shore birds of the Tay. Together they went off to study the waders on Fulbourne Fen, fell in love, and in due course married.

When John left Cambridge, his career began to prosper as a researcher into fish biology, first at University College, Dundee, then at the University of Southampton. He attracted the attention of Professor D'arcy Thompson at St. Andrews, who persuaded him to enrol for a PhD there, and in 1936 he was elected to a Fellowship of the Royal Society of Edinburgh, at the age of 29. He was a Fellow for 66 years, a tenure of Scotland's premier learned society of extraordinary length. From this period, too, comes his authorship of his only book. In collaboration with Misses Baxter and Rintoul, he amassed the data for the *Wild Geese and Wild Duck of Scotland* (1939), which for the first time for any region of the world, described not only the distribution of wildfowl but also gave a scientifically-based estimate of their numbers. It was a Doomsday book, a classical and standard account on which all further work of the group in Scotland came to be based.

Wild Geese and Wild Duck was published a month before the outbreak of the Second World War. If John's fragile health precluded him from service on the front, he certainly served his country in other and remarkable ways. He was appointed press censor but that was really cover for important work in counter intelligence. He was not a complete novice on this side of things, evidently having become involved with the secret service in the 1930s, and combining a scientific trip to Germany and later to Hungary with intelligence gathering in the national interest. He had nearly died of typhus on a trip down the Danube in 1935, and was to be rescued by gypsies after he had already written farewell messages to his family.

We shall probably never know all of what went on in those days of the 1940s, and John himself, for all his love of a good tale, would never speak even to his nearest and dearest of most of it. But there is the well authenticated story of the visit to Tayfield of a Spanish gentleman known by the authorities to be a German spy, who was entertained with lavish butter, cream and eggs to show there was no shortage of food in Britain; who found warships offshore and endless Spitfires screaming overhead (actually the same small number flying round) to show how well defended Scotland was; who wanted to see Leuchars but could not see past the lines of army trucks drawn up outside, and who was persuaded by his genial host and by his German-speaking relations that the landed classes did not think too badly of Hitler after all. When, some weeks later, Hess parachuted into Scotland in an attempt to meet up with the Duke of Hamilton, the only man who did not seem entirely surprised was John Berry.

By this time, he had gained the confidence and respect of Tom Johnston, wartime Secretary of State for Scotland and later head of the fledgling Hydro Board, and when the war came to an end John was appointed both as fish scientist and head of public relations to the Board, posts he neatly combined by designing the fish ladder at the new and highly controversial dam at Pitlochry, so that people could enjoy the sight of salmon moving up river: a demonstration of his long-held belief that development, if well planned, did not have to harm wildlife or spoil the pleasures of nature for people. There are also stories that at this time his counter-intelligence days were not entirely behind him, and even rumours that the early Hydro Board was secretly involved in the production of heavy water for atomic weapons. We cannot know the whole truth of this, nor of his post-war visits to Eastern Europe and the Caribbean as a government scientist after the war, when he may once again have been sent to observe rather more than ducks and geese.

In the post-war years, however, he was moving closer and closer towards the world of professional nature conservation, where, both nationally and internationally, there were exciting initiatives. In 1948 he was sent by the Secretary of State to Fontainbleau for the founding meeting of what was to become the International Union for the Preservation (later Conservation) of Nature, and helped to draft the subsequent agreement. He was to have much involvement with IUCN in subsequent years and made many friends in India, America and Eastern Europe through its conservation committees. At much the same time he was approached to become the first Director of the Nature Conservancy in Scotland. The Nature Conservancy was established by the 1949 National Parks and Access to the Countryside Act, but the new Scottish Director was actually in post before the NC itself came into being. The Secretary of State was determined not to be outflanked by London and made a pre-emptive strike to get Dr. Berry, a man he could trust, in place first. John's tenure as Head of Nature Conservancy in Scotland lasted until 1967, eighteen momentous years in which the character of the organisation was formed and its operations became part of the fabric of Scottish government and life. It is difficult to over-estimate the importance of his contribution, though he was again dogged by debilitating periods of ill-health.

Perhaps his greatest and most personal achievement of these years with the Conservancy, however, was to get established the great series of Scottish National Nature Reserves, beginning with Beinn Eighe in 1951. The story of how he was sent to negotiate the purchase of a pine wood for £4,000 and returned with the whole mountain has often been told. His superior in London, Captain Diver, was furious at his presumption, and John told him that if he did not like it, he, John Berry would buy it as a private individual and resign from the conservancy and perhaps sell Beinn Eighe to them later at a higher price, once they had come to their senses. Captain Diver did not last long, but was replaced by the much more sympathetic Max Nicholson. John and Max lasted a very long time, and John added to Beinn Eighe a whole stream of other nature reserves - Tentsmuir itself and Morton Lochs, of course; Loch Leven; the Cairngorms, by agreement with a range of touchy and sensitive landowners who lived in dread of a National Park appearing there instead; Rum, purchased from its wealthy lady owner over the horses at Newmarket,;and many more. Whether you go to Unst in Shetland, to St. Kilda, or to Caerlaverock on the Solway, you see the fruits of his vision. John's charm, his persuasive powers, his love of a good story, his passion for nature conservation combined with his understanding of the world of landowning, shooting and farming, enabled him to move with great skill and considerable speed to secure the best places as nature reserves. Critics will say that not all the agreements were watertight, that not all the management was good, that chances were lost: and they will be right. But it is easy to be a critic, difficult to be a man of action, and John worked with the opportunities he had, with the knowledge that was available and in a political climate that was often downright hostile. I would say he achieved wonders, and the award of a CBE at the conclusion of his labours was some recognition of this. 'I am not a Scottish Nationalist', he was wont to say, 'I am a Scottish Naturalist', and Scottish people owe him a debt for his stewardship of Scottish nature that is hard to calculate.

When he retired from the Nature Conservancy, he threw himself into the activities of nature conservation world-wide, following the contacts he had long forged with the IUCN, busy in India, in New Zealand, in Australia, repeatedly making the point in his consultancies that development could be made friendly to wildlife and that even failed development could sometimes be simultaneously a boon to nature and the tourist trade. He retained his links as adviser to the Hydro Board at home and to the South of Scotland Electricity Board until he was over 80; he furthered marine research on the Tay; he was a member of Court of Dundee University for ten years, and a delegate to the Commonwealth Universities Congress for eight years; he helped to found Dundee Botanic Gardens; he received Honorary Degrees both from Dundee and St. Andrews; he was busy everywhere with societies that were involved in wildlife, the Royal Zoological Society of Scotland, the Scottish Ornithologists' Club and the Scottish Wildlife Trust especially. He was also a deputy Lord Lieutenant of Fife.

When the time came for him to leave Tayfield for a home in the grounds with fewer stairs, he built himself a new bug house and bred tropical butterflies. There I remember him in his last years, so friendly, so talkative, so amusing, surrounded by books, so rightly proud of what he had done yet so unassuming in other ways, always willing to help a student or pass the time of day with a naturalist of any description. Scotland and nature conservation have much to be grateful for in the life of John Berry. He is survived by his wife, Bride, and their two sons and one daughter.

Thomas Christopher Smout

John Berry CBE, DL, MA, PhD, HonDSc, Hon LLD. Born 5 August 1907; Elected FRSE 2 March 1936; Died 19 February 2002

Hermann Alexander Brück
15 August 1905 - 4 March 2000

Hermann Alexander Brück died on 4th March 2000. He had retired from the joint post of Regius Professor of Astronomy at the University of Edinburgh and Astronomer Royal for Scotland in 1975, having transformed the Royal Observatory Edinburgh into a major player in world astronomy.

Born in 1905 in Berlin, he attended the universities of Kiel, Bonn and Munich. At the latter, working amongst many of the great physicists of the twentieth century, his doctoral studies - on the wave mechanics of crystals – were supervised by Arnold Sommerfield. His interest in astronomy had been ignited early in life, and in the new physics in which he was immersed it was natural that he should turn to astronomical spectroscopy. After completing his doctoral studies, he followed his friend A. Unsöld into this field by securing a post at the Potsdam Astrophysical Observatory. There he joined the physics colloquium which included von Laue, Grotrian and Einstein.

In 1937 he moved from Potsdam to Cambridge, via a short appointment at the Vatican Observatory, to join the circle around Sir Arthur Eddington, whom he regarded as leader of the new astrophysics. Brück became in time Assistant Director of the Observatories and John Couch Adams Astronomer, specialising in solar spectroscopy. Here he taught a well–remembered course in classical astronomy, and started the student astronomical society that has been nursery to many distinguished astronomers.

In 1947, at the invitation of Eamon De Valera, he moved to Dublin and took charge of the moribund Dunsink Observatory, transforming it into the centre of a vigorous astronomy programme as part of the Dublin Institute of Advanced Studies, where he enjoyed the company of Erwin Schrödinger. In 1950, the Observatory, with the Royal Irish Academy, hosted the first meeting of the Royal Astronomical Society furth of the United Kingdom, and in 1955 the International Astronomical Union held their triennial Assembly in Dublin. At this, the observatory demonstrated equipment for photoelectric photometry developed by M.J. Smyth, who had been Brück's student in Cambridge; and the UV solar spectroscopy which extended the Utrecht Atlas and formed part of the revised Rowland tables of the Solar spectrum and in which work Brück's wife (née Mary

Conway) had been a leading figure.

He moved to Edinburgh in 1957 and immediately started the transformation of the Royal Observatory into an internationally-ranked research centre. He collected a team of astronomers and engineers, headed initially by P.B Fellgett and later by V.C. Reddish, with the skills he required for creation of new automated instrumentation for scanning spectra, for measuring star and galaxy images, and for operating telescopes remotely. The first projects were the adaptation of instruments to scan automatically the contents of photographic spectra onto paper tape for processing by computer, and the concomitant creation of software for data reduction. This technology enabled spectra to be reduced in minutes rather than months, changing the whole focus of astronomers' work.

The next major undertaking was the design and construction of machines to scan the myriads of stellar images on a photographic plate, and the acquisition of observing facilities that would produce high quality source material. This programme gave birth to a dynasty of scanning machines (GALAXY, COSMOS and SuperCOSMOS), and to the evolution of the use of Schmidt telescopes for precision mass photometry of stars and galaxies. This went hand-in-hand with the setting up of overseas observing stations. Brück's warm relations with astronomers at Rome University (particularly M. Cimono and L. Gratton) made it natural to capitalise on good Italian weather by siting a 16/24 inch Schmidt telescope at Monte Porzio near Rome in 1967; later the UK Schmidt Telescope at Siding Spring in Australia would be operated from the Royal Observatory Edinburgh. These developments put Edinburgh in the lead in the technological revolution sweeping through astronomy.

In 1965, at a critical time for British observational astronomy, and as the Anglo-Australian Observatory was coming into being, Hermann Brück first proposed that a large (150-inch diameter) telescope be built in the Northern hemisphere. The deliberations over the possible organisation of such a facility by the Northern Hemisphere Review Committee during 1969-70 were protracted, and constituted the only anxious period of his career, when the future of the Royal Observatories appeared to be under threat. Site testing was started and carried out under Edinburgh management. The final outcome was the Northern Hemisphere Observatory operated by the Royal Greenwich Observatory on La Palma, only an island away from where Piazzi Smyth in the previous century had demonstrated the excellent properties of the atmosphere; and the UK Schmidt telescope which, run by the Royal Observatory Edinburgh (the project directed by V.C.Reddish), completed an internationally important survey of the southern sky. During this empyrean phase, the Royal Observatory Edinburgh was charged with the commissioning and operation in Hawaii of the UK Infrared Telescope, the first four metre class telescope devoted entirely to infrared observations, which had a major impact on the direction of astrophysical research.

In parallel with this scientific development, astronomy teaching at the university expanded, with a new honours degree in Astrophysics starting in 1967. Brück was an enthusiastic teacher and encourager.

On arrival in Edinburgh, he started the student astronomical society and gave it access to Observatory facilities, and the Astrophysics degree grew out of courses which he offered in the Physics degree at Edinburgh. For a period he served as Dean of the Faculty of Science.

On his retirement in 1975, he and his colleague and wife Mary launched into historical studies of nineteenth century astronomy. This led to the definitive work on the life of one of his predecessors, Piazzi Smyth, *The Peripatetic Astronomer*, as well as a history of Edinburgh Astronomy, *The Story of Astronomy in Edinburgh*; and an extended paper in *Vistas in Astronomy* describing Lord Crawford's Observatory at Dunecht, which was the parent to the nineteenth century rebirth of the Royal Observatory Edinburgh.

Throughout his busy career he served as member and councillor of the Pontifical Academy of Sciences, and was proud and delighted when at the age of 90 he was made Knight Grand Cross of St Gregory the Great, the highest possible distinction. He was made CBE in 1966 for his work at Edinburgh and was awarded honorary degrees by the National University of Ireland (1972) and the University of St Andrews (1973). He was a Member of the Royal Irish Academy, and a Member of the Akademie der Wissenschaften und der Literatur, Mainz.

Despite his personal drive and the lasting success it brought, and despite his awe-inspiring and elegant presence, he was a modest and gentle man, seen to be best effect in the heart of his family.

Peter Brand

Hermann Alexander Brück. CBE, D.Phil (Munich), D. Phil Habil (Berlin), Ph.D (Cantab), Hon D.Sc (NUI, St Andrews), MRIA. Born 15 August 1905, Elected FRSE 3 March 1958, Died 4 March 2000.

Malcolm Murray Campbell
22 August 1933 - 29 October 2001

Malcolm Murray Campbell, Murray to his family and Malcolm to his colleagues and friends, was born in Glasgow on 22 August 1943, the eldest of four children. Both his mother's and father's families came from Isle of Lewis but his father's parents migrated to Canada after the First World War. Malcolm's father grew up in Canada and returned to Scotland at the outbreak of war, becoming a gunner in the Royal Navy.

Malcolm was educated at Bellahouston Academy and took First Class Honours in Chemistry at Glasgow University. As a Salters' Scholar in Glasgow he joined the group of Professor Charles (C J W) Brooks in the developing new field of gas chromatography-mass spectrometry and obtained his PhD in 1968. In the same year he married Brenda Simpson, herself a graduate in classics at Glasgow University, and after the award of his PhD they both went to Madison, Wisconsin, USA where Malcolm undertook postdoctoral work on mechanistic organic chemistry with Professor Jerry (J A) Berson.

In 1969 Malcolm Campbell was appointed to a Lectureship in Organic Chemistry at Heriot-Watt University. It was clear from the outset that he was an outstanding scientist with wide interests and the energy and vision to make things happen. His arrival in Edinburgh coincided with the appointment of the first Professor of Organic Chemistry. Reorganisation of lecture courses and practical classes was undertaken and Malcolm introduced a number of innovations in the teaching of new experimental techniques. A visit to the department of Professor Olly Runquist from Minnesota led to the joint publishing of a programmed learning text *Spectral Analysis of Organic Compounds* in 1972. Malcolm also played an active role in the Open University.

Research funds were short in a small department and Malcolm soon established links with the pharmaceutical industry - Beecham, Organon and Pfizer in particular. His research programme focused on the chemistry of beta-lactam antibiotics such as the penicillins and cephalosporins, together with steroidal amino alcohols. He was promoted to Senior Lecturer in 1978. Malcolm spent six months on secondment to Organon Laboratories in Newhouse and in 1979-80 had a further period of leave in Pfizer's research department in Groton, Connecticut, USA. While there he was appointed to the Chair of Organic Chemistry in the University of Bath and at the time was one of the youngest Professors of Chemistry in the UK.

In two periods as Head of the School of Chemistry in Bath (1984-87 and 1990-93) Malcolm Campbell was given the opportunity to modernise and upgrade not only the organic chemistry section but the whole School of Chemistry. The main emphasis was on synthetic organic chemistry, his own interest, and he was able to attract a number of very bright young men who have since made their mark in other larger departments. He saw the potential of both computational chemistry and bioinorganic chemistry and under his influence appointments were made in these areas as well as the establishment of a Chair of inorganic chemistry. Under his dynamic leadership and with the active encouragement of the Vice-Chancellor, the School was able to attain a Grade 4 rating in the Research Assessment Exercise of 1992. He himself carried out research on the synthesis of phosphorus-containing and other peptide mimics, shikimic acid, together with some antibiotics and toxins. He actively encouraged his younger members of staff to be independent and resourceful.

Malcolm took a keen interest in the progress, both academic and sporting, of his students. He became Senior Resident Tutor at Eastwood Halls of Residence on the Bath campus from 1987-95, which meant that both he and his family were in day-to-day contact with undergraduates.

In character Malcolm Campbell was inspirational. In scientific conversation he sparkled with ideas and was therefore much sought after as a consultant in the pharmaceutical industry. He played a major role in organising Conferences in Medicinal Chemistry and was Chairman of the Organising Committee of the 4th Medicinal Chemistry Conference held in Cambridge in 1986. He served on the Council of the Perkin Division of the Royal Society of Chemistry, the Fine Chemicals and Medicinals Group Committee of the RSC Industrial Division and on the Committee of the Biological and Medicinal Chemistry Sector of the RSC. He was a member of the Board of Governors of Bristol Polytechnic. In the University of Bath he served as a Member of the Long Term Planning Committee.

Malcolm Campbell's life was enlivened by his attraction, not to say addiction, to competitive sport. While at school he won medals for sprinting. He boxed at Glasgow University and played chess to a high standard. He was a keen footballer and, for a time, played in an amateur league; he became an accredited referee of the Scottish Football Association. At Heriot-Watt University he was an active member of the Chemistry Department soccer team and of the University Staff Golf Club. In Bath he was a stalwart follower of Bath Rugby Club and acted as a steward at home matches. Both of his sons played rugby and soccer and he was a tireless supporter at school matches. He helped to set up and run a village boys' soccer team. He was a keen amateur archaeologist and later developed an interest in fly fishing.

After his second term as Head of the School of Chemistry Malcolm suffered from ill health for the first time in his life. Although he remained active in the University he was heavily involved in major conferences with a European connection. In 1998 he was Chairman of the Organising Committee for the XVth International Symposium on Medicinal Chemistry, held in Edinburgh under the auspices of the European Federation for Medicinal Chemistry. In the same year he was on the Organising Committee for an International Meeting in Dublin on Drugs from Natural Products. Malcolm took early retirement in 1996 and moved to a croft in Lewis. He died on 29 October 2001.

In his memory, the Biological and Medicinal Chemistry Sector of the Royal Society of Chemistry have instituted the Malcolm Campbell Memorial Prize, which is open to individuals or a team based in academia or industry. It is to be awarded biennially and consists of a substantial monetary prize, together with a medal and certificate.

On 7 December 2001, in the Chaplaincy Centre of the University of Bath, more than one hundred friends of Malcolm Murray Campbell met in a celebration of his life. Contributions and recollections were given by senior members of the University, colleagues, friends and, most movingly, by his daughter Janet.

There emerged a man of many talents, enthusiasms and achievements who will be much missed by all who knew him. A tree was planted in his memory on the campus of the University to which he had given so much. He is survived by his wife Brenda and their children Janet, Calum and Alasdair. I am much indebted to Mrs Brenda Campbell for her help in the preparation of this memoir.

J Grant Buchanan

Malcolm Murray Campbell BSc, PhD, DSc, CChem, FRSC, FSA(Scot): Born 22 August 1933; Elected FRSE 5 March 1984; Died 29 October 2001.

William Ewart John Farvis

11 December 1911 - 12 October 2005

Ewart Farvis was born on 12th December 1911 in Bristol and educated there at the bluecoat school, Queen Elisabeth's Hospital. On leaving school he served a four-year engineering apprenticeship. He entered Bristol University with a Merchant Venturers' Scholarship, graduating BSc(Eng) in 1936 with First Class Honours in Electrical Engineering and was awarded the Institution of Electrical Engineers Prize for the best student in the class. He was elected to Fellowship of the Royal Society of Edinburgh in 1958. He was awarded a CBE in 1978 and, towards the end of his career (1987) he was elected to an Honorary Fellowship of the Institution of Electrical Engineers.

In 1937, he was appointed Lecturer in Electrical Engineering at University College, Swansea. By that time he had acquired experience, notably at British Thomson-Houston (BTH) in Rugby, of power station operation and maintenance, and also of heavy-current plant manufacture. He remained at Swansea until called away in 1940 to war service.

Ewart Farvis was appointed to the scientific civil service to assist with repelling the invasion forces. His first task was to extend or modify the chain-home (CH) radars to detect low flying targets. These had been originally designed to detect high flying bombers. In this capacity he was located at Dover where, under Pinkerton, he installed the new antennae and other radar parts behind the existing CH radar masts.

He subsequently met with Churchill's scientific adviser, R V Jones, and was asked to assist at Swanage in detecting the signals from the new navigator aids which the enemy were using to direct their bombers on to British targets. This was achieved first by finding the transmission frequency and modulation format they were using and then countering with an appropriate jamming signal to disrupt and disable the navigation aid.

In May 1942 this very sensitive group was moved from Swanage, which was too close to occupied France, to Malvern - where they were offered House 6 of Malvern College as their laboratory. Ewart led the interception group, with Martin Ryle in charge of the associated radio jamming group. All this was coordinated by Dr (later Sir) Robert Cockburn. They were the kernel of the "scientific intelligence" which assisted

Whitehall and MoD in operational planning.

Ewart Farvis' speciality was aerials and electromagnetics and his group developed a multiband search receiver, flown by RAF 109 Squadron in 1943, to locate and measure the frequencies of the enemy transmissions. He also designed and developed "bag-ful", an automatic search receiver. This was flown by bomber command during bombing missions over Germany, in order to collect information on the electromagnetic transmissions which were being used. The information was ultimately used by Ryle and Cockburn to build the necessary jammers.

One of Professor Farvis' major achievements was to counteract a sophisticated new German navigation aid called "Benito" which used three tones. Alex Harley Reeves (the later inventor of PCM telephony) deduced how the system operated. Ewart Farvis was sent to London and, with a jammer built by Hardwick (an ex EMI engineer), they switched on and used the silent BBC sound transmitter at Crystal Palace to jam the German navigation system. Professor Farvis' working knowledge of German was vital when, while listening to the German bombers' radio telephone traffic, they heard the bewildered German controllers asking the prestigious KG26, who were the cream of the Luftwaffe, to "thump the box" as they suspected equipment malfunction, rather than the intentional jamming. Thus many enemy bombing missions were completely ruined. At the end of the war, Ewart went to Germany and he debriefed the German equipment designers, discovering exactly how "Benito" operated and obtaining the detailed circuit diagrams.

These achievements were not without substantial personal risk. He installed radars at Dover with an imminent invasion expected, and at Malvern he was once rather close to a navigation jamming equipment when it was subject to enemy bombing. Luckily the bomb that landed beside his wooden shed did not explode!

As one of the extremely innovative civilian defence scientists, he clearly had a significant impact on enhancing the capability of our armed forces both in their defensive and offensive capabilities. When demobilised, he made the decision to resume his Swansea lectureship, as he felt that the Physics Department had superior lecturers due to their increased research activities. There he developed new, more appropriate, courses in electronics and, far-sightedly, somehow found the time to earn an External London degree in Physics.

Academic appointments at Edinburgh University followed his Swansea position. Initially as Lecturer in Applied Electricity (1948), he pioneered these new courses at Edinburgh, and was promoted to Senior Lecturer in 1952.

In 1950 he was invited to put forward a plan to the UGC for setting up a one-year Postgraduate Diploma course in Electronics & Radio. Southampton was similarly approached, but no other Universities. It is interesting, and probably more than a coincidence, that almost 30 years later, the two centres selected for Microelectronics facilities were still Edinburgh and Southampton. The immediate fillip from the launch of the Postgraduate Diploma in 1951 was an earmarked UGC grant of £5000 to appoint four Lecturers and the University provided four Diploma scholarships per year.

Around this time in the 1950s, he concentrated on gaseous electronics. His research work included studying heavy-duty switch gear problems and associated gas discharge phenomena and this led, amongst other things, to a notable British Patent for a novel circuit breaker of advanced design. He was closely associated in ionospheric research with the late Sir Edward Appleton when he was University of Edinburgh Principal, and in particular, Ewart Farvis was responsible for the design and construction of the ionospheric station in Shetland that monitored solar blackspots throughout the International Geophysical Year (1957-58).

On New Year's Day 1961, Ewart Farvis became the first Professor and Head of the new Department of Electrical Engineering, on a starting salary of £1080! Following this, his interests moved into the rapidly expanding field of solid-state electronics. In 1964 he took the bold move to follow the then emerging trend and build up a successful, industrially-based centre for solid-state devices and materials science research at Edinburgh, by covering over the courtyard to build the first cleanrooms for semiconductor device fabrication.

In 1969 a successful initiative by Professor Farvis resulted in the setting up, with £130,700 of financial aid from the Wolfson Foundation, of the Wolfson Microelectronics Liaison Unit (WMLU), initially directed by James Murray, a former lecturer in the Department. This was one of his initiatives to increase university–industry interactions. This coincided with the first appointment of part-time paid visiting Professors in a UK university, (in association with WMLU). Later in the 1980s WMLU expanded into an independent VLSI system design company under Professor David Milne.

The final part of his University career was in the 1970s when he rapidly expanded the size of his Department. In 1970 he attracted back Jeffrey Collins from the USA to a SRC-funded Research Chair, from which the two-professor Department spearheaded further expansion into microelectronics devices, and initiated electronic systems research and teaching.

Subsequently, with UGC support, he also played a key role in the development of the University's Centre for Industrial Consultancy and Liaison. Improved liaison between University departments of engineering and the manufacturing industry had long been a prime aim of Professor Farvis, and it was with this motivation that he made individual project work an important feature of undergraduate courses leading to the BSc Honours degree in Electrical Engineering.

During his career, Professor Farvis pioneered new undergraduate courses appropriate to the rapidly changing needs of industry, and developed new forms of post-graduate training, both of young engineers intending to go into industry, and of mature engineers already in the industry. Many post-war innovations in the undergraduate curriculum were tried out at Edinburgh before catching on elsewhere, including open-book examinations, individual experimental project work and in-depth dissertation writing. He also pioneered short modular courses for re-training engineering graduates in modern technologies, with the participation of experts from industry and scientific civil service. He was innovative too in moving the final honours' examination diet from June to January, to achieve better student focus on project work. He became prominent in engineering education at national level with an outstanding record of service in such national policy forming organisations as the Electrical Industries' Training Board, the Science Research Council and the Institution of Electrical Engineers. Ultimately he was a Council member of each of the latter two bodies.

Held in high esteem within his profession and in Whitehall, Professor Farvis has chaired or been a member of numerous important committees. In particular, he served on the CEI Board of Moderators; was a member of a UNESCO International Working Group on Continuing Education; was President of the Education & Training Committee of the Fédération Européenne d'Associations Nationales d'Ingénieurs (FEANI) 1974-1977; and was also Chairman of one of the four official enquiries into the engineering profession in the 1970s.

He retired on 30 September 1977 after 29 years of University service and he is remembered each year by the award of The Ewart Farvis Prize, funded by donations from the Wolfson Foundation, industrial companies, former colleagues and personal friends. This prize commemorates a distinguished career and provides an incentive for potential recruits to the electrical and electronic engineering industry.

Music was a major part of his life from childhood throughout his life, and as a young man he was a church organist and choirmaster. He was a good craftsman, and he would turn his hand when necessary to a remarkably wide range of DIY activities. He was interested also in language and, as a good European, he could conduct professional business in both German and French. We all owe much to this notable pioneer in electronics teaching and research.

He is survived by his wife, Margaret, his children, Sheena and Keith, and grandchildren, Rachel and Mark.

Peter Grant

William Ewart John Farvis CBE, BSc, BSc(Eng), CEng, Hon FIEE. Born 11 December 1911; Elected FRSE 3 March 1958; Died 12 October 2005.

John Robert Stanley Fincham
11 August 1926 - 9 February 2005

The death of John Robert Stanley Fincham on February 9th 2005 marked the passing of an exceptional academic who will be remembered for his extraordinary dedication and intellectual contribution to science, most particularly to genetics.

John's university career began at Peterhouse College Cambridge. He graduated in Botany in 1946 and remained at Cambridge to complete his PhD in 1950. From the outset of his career, John was recognised as having an outstanding intellect. In 1948 he went to the California Institute of Technology as an Agricultural Research Council Scholar where he worked with George Beadle, Norman Horowitz and Sterling Emerson in what was a stronghold of *Neurospora* genetics. Shortly after he married Sterling Emerson's daughter, Ann, so John's visit was productive on both a scientific and personal level. He was appointed to a lectureship in the Botany Department of Leicester University in 1950 and was made a Reader four years later. A year as an Associate Professor in the Massachusetts Institute of Technology preceded his appointment as Head of the Genetics Division of the John Innes Institute in 1961. He remained at John Innes until 1966 when he was appointed as Professor and Head of the newly established Department of Genetics at Leeds. In 1976, John was appointed to the Buchanan Chair of Genetics in Edinburgh and was head of the Department of Genetics until 1984 when he moved to take up the Balfour Chair in Cambridge. He is the only person to have held both of these prestigious chairs. On his "retirement" from Cambridge in 1991, John returned to Edinburgh where he continued to take an active part in teaching and research.

The disruption that each new appointment must have brought to John's research did not inhibit his publications and writing. He published well over 100 journal articles from 1949 until 2004. In addition he found time to write major monographs and textbooks. His first, *Fungal Genetics*, originally written with Peter Day, remains the yardstick by which all other texts on this subject are judged, and went through several editions and major revisions as the subject expanded. Four other books followed; all single author works, including a textbook on Genetics. He also edited symposium volumes and wrote influential reviews on several quite different topics.

John published on a variety of topics, including unstable pigmentation genes and transposons in *Antirrhinum*, but his main research interest remained focused on genetics of fungi and on the model organism *Neurospora crassa* in particular. His research began with his doctoral work in the laboratory of David Catcheside in 1946. John's initial work demonstrated that several species of *Neurospora* all had seven chromosomes. At this time the groundbreaking experiments of Beadle and Tatum, which led to the 'one gene-one enzyme' hypothesis, were pointing the way towards a combined biochemical and genetical approach to the analysis of metabolic pathways, and John was quickly involved in the analysis of mutants that were deficient in the enzyme glutamate dehydrogenase. These mutants identified the *am* locus. In 1957, he and his former student John Pateman made the unexpected discovery that some combinations of alleles at the *am* locus were able to complement each other and restore enzyme function. John Fincham provided the correct explanation for this observation, and subsequent experiments from his group showed that the active enzyme was a hexamer of identical subunits. Allelic complementation could occur if the aggregation of two different types of alleles of defective polypeptides generated hexamers with some enzyme activity.

The discovery of allelic complementation was the start of an in-depth investigation of the *am* gene using traditional genetics and biochemistry. Many mutants were isolated and analysed and the amino acid sequence of the wild-type enzyme was determined.

In 1982 John went on to clone the gene using what was, at that time, a novel approach. He used information from compensatory frameshift mutations, and the fact that his group had determined the amino acid sequence of the enzyme, to deduce a 17 base pair nucleotide sequence. This was used to probe the *Neurospora* genome and isolate and identify the *am* gene. The discovery that the stretch of DNA was interrupted by a sequence of bases that did not encode amino acids identified an intron in the *am* gene. This was only the second example of an intron in a protein-encoding gene from a lower eukaryote. John went on to characterise further *am* mutants by integrating what was known from earlier studies with the DNA sequence information obtained following the successful cloning of the gene. This provided gratifying verification of earlier conclusions based on complementation and enzyme assays.

Latterly, John was anticipating the elucidation of the three-dimensional structure of glutamate dehydrogenase so that amino acid interactions he had predicted from his earlier work would be verified.

In *Neurospora*, transformants that contain duplicate DNA segments undergo frequent mutation of these repeat sequences when any transformant is crossed to another strain. This phenomenon, called Repeat Induced Point mutation (RIP), was discovered by Eric Selker. John, who had always had an interest in gene instability, was intrigued by RIP and investigated the phenomenon. He analysed disruption of the *am* gene in transformants that contained three copies of the gene. He found that RIP tended to disrupt two out of the three copies but there were some cases where all three copies had been disrupted, leading to the conclusion that there could be multiple rounds of disruption during the sexual cycle. In addition to gene disruption which produced non-functional alleles, John demonstrated that RIP could produce new functional alleles, which specified glutamate dehydrogenase with altered heat sensitivity and enzyme kinetics.

John always had a very range of interest in many aspects of genetics, and stimulated discussion over a wide range of science issues with his penetrating questions and insightful analysis. This talent was never more evident than after seminars when John, almost invariably, led off a discussion by a succession of stimulating questions. He was a geneticist of the old school; his diligent reading of the literature often resulted in his alerting colleagues to publications in areas of genetics that were quite remote from his primary interests.

John was elected a Fellow of the Royal Society in 1969 and made a Fellow of the Royal Society of Edinburgh in 1978. He was President of the Genetical Society of the UK from 1978 to 1981. In 1977 he was awarded the Emil Christian Hansen medal for his contribution to research into fungi.

Outside science, John had an interest in music, mountaineering and many sports. He played rugby, cricket, and squash and he continued playing the latter despite the handicap of a hip replacement that affected his ability, but not his enthusiasm, for chasing the little ball about the court. An incident at the time he underwent the hip replacement operation illustrates his dedication to science. John cycled to the Princess Margaret Rose Hospital and, after undergoing the pre-operation tests, persuaded the medical staff that he was quite capable of not eating and obeying any other strictures placed upon him just as well if he was in the library as in the hospital bed. So he was allowed to cycle away from the hospital to return a few hours later when the operation was more imminent!

John leaves a wife, Ann, a son and three daughters.

Dr Jeff Bond, Professor Noreen Murray

John Robert Stanley Fincham, BA, PhD, ScD(Cantab), FRS. Born 11 August 1926; Elected FRSE 6 March 1978; Died 9 February 2005

William Whigham Fletcher

11 August 1918 - 4 April 2001

Professor Bill Fletcher was a well-known figure in the world of academia and beyond. He stood above most of his contemporaries in most things, as a larger-than-life character whose achievements, intellect and influence were quite simply outstanding, if not phenomenal, for his generation. Students at Strathclyde University, where he spent most of his career, recognised him as one of their own, always willing to listen to their grievances and to right them where appropriate.

Bill spent the formative years of his childhood and schooling in the Burgh of Airdrie, and freely acknowledged the value of his upbringing in an unprivileged family dedicated to education. His academic pedigree was to reach the heights.

From being school captain and dux at Airdrie Academy, he went on to Glasgow University in 1937 to read Botany, and joined the Territorial Army in the summer of 1939. He was then mobilised immediately for active service on the outbreak of war three months later. He served for six years as an officer in the RAOC and the RAMC, much of that time overseas in Egypt, Libya, Lebanon, Syria, Greece and Italy.

Resuming his studies in 1945, he was able to graduate two years later with First Class Honours in Botany. He then stayed on as assistant lecturer and lecturer in the Department of Bacteriology at Glasgow University to undertake research under the well-known authority Professor Carl Browning, and later graduated PhD. There followed a research study programme at Cornell University in the USA under the newly-inaugurated Glasgow Council Exchange Fellowship Scheme.

In 1952, he was appointed head of the Botany Department of the West of Scotland Agricultural College, and ten years later became a Senior Lecturer in Biology at Glasgow's Royal College of Science and Technology, soon to become the University of Strathclyde. His research interests lay in crop protection and weed science. He published prolifically, and, after much sterling work, he was appointed in 1966 to the newly-created Chair of Biology in the new Department of Biology. Two years later he became of the School of Biological Sciences.

Despite the weight of these administrative duties, he continued to contribute to the field of

Botany. His studies focused on a group of herbicides known as the phenoxyalkanoic acids which were, and still are, widely used in agriculture. The phenoxybutyric acid compounds (e.g. 2, 4-DB) were inactive *per se*, but on âoxidation to the corresponding phenoxyacetic analogue (e.g. 2, 4-D) became active in plants which possessed the appropriate â-oxidising enzymes. Legumes such as clovers were found to be tolerant since conversion of the butyric to active analogue appeared not to take place. Thus, cereal crops undersown with a grass/legume sward could be sprayed with a phenoxybutyric herbicide and the legumes would be unaffected.

A major manufacturer of these herbicidal compounds, May & Baker Ltd (later to become Rhône Poulenc Ltd), was very interested in these findings, and thus began the "May & Baker Studentship" which continued for the next three decades. A succession of postgraduate students studied the mode of action of herbicides in the Biology Department of Strathclyde University achieving the degree of PhD with May & Baker sponsorship. Bill Fletcher's research and wider vision helped many young people to achieve a firm foothold in their chosen specialist field.

Other fields in his range of research interests included the impact of pesticides on soil microbial populations. In an extensive authoritative review presented at an International Symposium held in Oxford in 1960, he concluded that any pesticidal effect on soil microbial populations was transient. The microbial "vacuum" created was soon overcome by microbial invasion from adjacent unaffected zones. He saw little point in his continuing with these studies! Much more interesting to him was the possible effect of pesticide residues on developing embryos. He devised a simple, ingenious test system which involved drilling a minute hole in quail or hens' eggs, enabling the injection of a dose of test pesticide. Using this system, he examined the *in vitro* effect of pesticides on embryo development. It was work of this type which helped to demonstrate that teratogenic effects could result from exposure to certain pesticides.

Another field of research interest concerned the "Chemical Control of Bracken" which was, and still is, a pernicious poisonous perennial weed of upland pastures in Scotland and elsewhere. Bill commenced this work while Head of the Botany Department at the West of Scotland Agricultural College, and his interest continued at Strathclyde University. In association with a number of agrochemical companies he and his colleagues carried out field trials at representative sites in the West of Scotland. The performance of candidate systemic herbicides sprayed on trial plots was assessed the following year by growth analysis of the bracken canopy. The results of each day's work were written up in the evening in some convenient hostelry! These convivial sessions ensured lifelong friendships between 'Prof', his staff and their industrial collaborators.

Bill Fletcher published many research papers resulting from such studies, and he ensured that the findings reached the public domain by his writing of popular books such as *The Pest War.* He was also co-author of specialist volumes such as *Herbicides and Plant Growth Regulators* and editor of monographs such as *Bracken and its Control* (proceedings of RSE Symposium). He was greatly in demand as a speaker at conferences in the field of 'Weed Science', delivering his presentations with style, humour and punctuality. As a Session Chairman, he insisted on good presentational style and good time-keeping.

Professor Fletcher's shrewd perception of useful scientific effort and his ability to bridge the academic and practical worlds were recognised by several agrochemical companies, but perhaps particularly by May & Baker Ltd. From 1964-1988 he was firstly their Consultant and then Senior Consultant in the field of agrochemicals. As such, he served on their main scientific advisory committee in Lyon, France. In the 1980's he was chairman also of their Inter-Universities Committee on "Diflufenican"- a revolutionary new herbicide which acted as a leaf bleaching agent thus inhibiting photosynthetic activity of susceptible species. The Committee acted as a forum for the exchange of academic research findings on this herbicide and the implications for weed control in cereal crops in the field. Another example of his breadth of vision and keen perception of good ideas with practical application lay in his support for the formation of the subsidiary "May & Baker Diagnostics" which he was instrumental in having based in Glasgow. The Company was formed to exploit aspects of the monoclonal antibody studies carried out in the Immunology Department of Strathclyde University, and Professor Fletcher subsequently chaired the new company's Scientific Advisory Board.

In addition to being an outstanding teacher and researcher, Fletcher built up his Department and helped shape the School of Biological Science in which it was based. He steered his Department and School through stirring times of achievement and change - and sometimes difficulty. His immediate colleagues considered themselves fortunate in having someone so steadfast to work with and to guide them in these heady, formative days. His advice to colleagues was sparing but always crystal clear. It was never overpressed and always fair. He also contributed widely as a prominent senior academic officer in developing both the academic and corporate life of the "young" Strathclyde, and did more than his share in shaping its future under his mentor, and later very close family friend, Sir Samuel Curran. He was a great supporter and he loved innovation in the broadest sense.

One of the greatest legacies which Bill bequeathed in his life was time; the time he gave to people; not only to his wife and family, but also to an ever-expansive network of students, universities, academic and research institutions, and societies. For example, the time taken to lecture regularly to American visitors on aspects of Scottish life, and then produce books relating to these lectures and on many other topics such as *Great Scots;* the time to take on the Vice-presidency of the Royal Society of Edinburgh and participate in the education committee of its London counterpart; the time to lead the Botanical Society of Scotland and sit on so many other important national scientific and education Boards and review groups; the time to found his University's staff club (where his knowledge of wine was a particular asset) and to oversee the development of its beautiful gardens at Ross Priory on Loch Lomond; the time to promote and enjoy his many club connections (particularly the Glasgow Art Club, the XIII Club and the Town and Gown "Working Party").

And still he found time to be a scientific correspondent for several Scottish newspapers and journals, writing scripts for, and taking part in, many BBC radio programmes and STV. One could fill a book; and that may yet come.

His life was lived to the full, and the sheer depth and expansiveness of his work has had repercussions far and wide. He was, quite simply, an academic statesman of the first order - a great credit to his family, his native Scotland, his universities and his subject.

His friends will have many an anecdote that speaks of Bill. His warmth, his hospitality, his dry (almost arid sometimes) sense of humour, and his modesty all complemented his outstanding skill as a scientist. Essentially a Lanarkshire man in attitude and in speech, he always had his wits about him. One of the qualities that many people valued most was his openness and down-to-earth approach, even though, on occasion, he could be quite penetratingly assertive.

These governed matters temporal and spiritual. Who would have imagined that Bill would have been the one at Strathclyde to push for the great Scottish theologian, the late Rev. Professor William Barclay, to be appointed there to a Visiting Professorship in Biology and how their friendship and association in philosophical discussion would blossom into something phenomenal?

In odd conversations, Bill would speak wryly of his Presbyterian roots. For a scholar of the "structure of life", he was well aware that there was more to life than chemistry and the compounds that construct our humanity. This made him agnostic, but in a profoundly spiritual way. He was a genuine polymath, with his interests and expertise in art and literature, with the international bonds of research and friendship that he created and sustained, and in his dynamic skills as a leader.

Of particular note was his association over many years with Poland, which led to a number of honours including the conferment of an Honorary Doctor of Science degree and the award of the Polish Order of Merit for services to science. His home provided hospitality over many years to dozens of Polish scientists and students who have never forgotten this kindness.

In academic life it is customary sometimes to speak of scholars as "those who stand on the shoulders of giants". In this phrase, one is inferring that scholars are often not original thinkers, great men or women of learning, or figures of particular (historical) importance. Rather, the scholar may be simply an interpreter, and their perspective is gained by climbing on and above their subject. In Professor Bill Fletcher we did not just have a scholar, but a veritable tower of wisdom and strength. Yet more than that, he has given many people in all walks of life a "frame" on which they can climb and gain clearer insights, deeper perspectives and broader horizons. For the man devoted to studying "the structure of life", he therefore truly emerges as a master, because his life-gifts enabled so many others.

The picture then that we shall always carry of Bill Fletcher is of an upright, self-effacing man of great experience in the world of men and science, and with a real personality within and without. He was a man of considerable integrity with an unswerving regard for the truth, pleasing or otherwise. He was not a "trimmer", and had no room for bureaucracy. He sought neither power nor compliments, and in all his services to his University and other institutions, he was content that his reward would be their smooth and correct running.

He will be remembered as a man of dignity and integrity; indeed of the same highest standards that he wished for everything that he did. A 'Great Scot' himself he was, to quote Burns, "a social, friendly, honest man" of sharp wit and great courage; and he also had all the characteristics of Wordsworth's *Happy Warrior*: "Whose high endeavours were an inward light That made the path before him always bright".

Ralph Kirkwood and David Tedford

William Whigham Fletcher OM(Poland), BSc, PhD, ScD, FIBiol: Born 11 August 1918; Elected FRSE 6 March 1967; Died 4 April 2001.

RSE Council Service: Councillor, 1976-78; Secretary, 1978-83; Vice-President, 1983-86

Kenneth Boyd Fraser

10 March 1917 - 17 July 2001

Kenny Fraser was a noted virologist who had a distinguished military record during the Second World War. He graduated in medicine from Aberdeen University in 1940 and joined the RAMC in 1941. He was posted to the Chin Hills in Burma where British and Indian troops together with forces from the local Highlanders, were holding outposts near Japanese emplacements. In 1943, he was awarded the MC for gallantry in the rescue under heavy fire of an injured sepoy whom he carried to safety – and to recovery – over exceedingly difficult terrain for a mile and a half. In retirement, he published privately, a memoir of his time there entitled, rather intriguingly, *Don't believe a Word of it!*. Despite the apparent frivolity of the title, this is a factual and fascinating account of an area of the world and its village peoples which few can now have the opportunity to see. The book is dedicated to the Chin Highlanders with whom he served.

After return to civilian life, he joined the Department of Bacteriology in Aberdeen University as Junior Lecturer and, in 1950, was awarded the MD with honours for work on the antibodies produced in infectious mononucleosis. With the help of a Nuffield Grant, he then spent two years from 1951-2 with Sir MacFarlane Burnet in the Walter and Eliza Hall Institute in Australia studying recombination in influenza virus: this resulted in brilliant series of experiments which enabled Sir Mac to predict the segmented nature of influenza virus genome. Later he demonstrated phenotypic mixing between the antigens of different strains of influenza virus – an early example in a mammalian virus.

Against Sir Mac's advice, he returned to academic life in his old department in Aberdeen where he showed that the neurotropism of the NWS strain of inflenza virus was due to its localization in the Purkinje cells of the mouse cerebellum. In 1959, he moved to the University of Glasgow as Senior Lecturer in the Institute of Virology and it was here that he first developed his interest in immunology and, in particular, the technique of immunofluorescence. He was awarded the degree of DSc in 1960 for his work on virus genetics in the University of Aberdeen.

In 1966 he was appointed to the Chair of Microbiology at the Queen's University of Belfast. His contribution to the Department in Belfast encompassed research, his interest in the development of immunology, and a major contribution to teaching in the Faculties of Medicine and Science. His research into the immunology of persistent virus infections was initially based on his expertise in immunofluorescence and centred on the measles virus, for which, in 1974, the Medical Research Council awarded a five-year Project Grant to study the relationship between multiple sclerosis and the immunology of the measles virus. This was only possible with the full involvement of clinicians and reflected the high degree of mutual respect in which Kenny and his clinical collaborators held each other. His belief in the value of clinical science was seen in the number of junior medical staff from different disciplines who held research fellowships in his department and were subsequently awarded MD degrees.

He was very aware of the need to incorporate the new science of Immunology into both the scientific and clinical fields so that the Department was later renamed Microbiology and Immunobiology. By the mid 1970s immunology was accepted as a discipline in its own right by the NHS in Northern Ireland, in large part due to his foresight and encouragement. In teaching he expanded an existing honours course in Microbiology for science students from which several graduates later became members of the academic and research staff of the department. He was particularly enthusiastic about the benefits of intercalated BSc courses for medical students and made a major personal contribution to this course in his own department despite a heavy commitment to the teaching of medical and dental students.

Kenny did not enjoy administration yet approached it with the same rigour and honesty that he brought to his scientific work, sometimes to the chagrin of professional managers. During his time in Belfast the "troubles" were at their worst, but under Kenny's leadership and ably supported by his Chief Technician Mr Jimmy McAlister, staff members at all levels and from diverse backgrounds worked harmoniously together. Unlike his staff, Kenny was very happy to work through the Christmas break: he was unavailable at Hogmanay. In 1948, Kenny married Leslie Fraser, herself a doctor. They had a happy home life and were the most hospitable of hosts. Kenny was a delightful companion with a dry, typically Scottish sense of humour enhanced by his enjoyment of malt whisky of which he was a connoisseur. In 1982 he and Leslie retired to a cottage in Altnaha near Tomintoul in the Highlands where, predeceased by her, he died on 17 July 2001.

Morag C Timbury, Thomas A McNeill and Margaret Haire.

Kenneth Boyd Fraser MC, MB ChB, MD, DSc: Born 10 March1917; Elected FRSE 6 March 1961; Died 17 July 2001.

Sir John Currie Gunn

13 September 1916 - 26 July 2002

John Currie Gunn was born in Glasgow on 13 September 1916 into a well-known Glasgow family. After being an outstanding student at Glasgow University and Cambridge University followed by wartime scientific research and early academic posts, he was appointed to the Cargill Chair of Natural Philosophy in Glasgow University in 1949. He held that post until his retirement in September 1982 and thereafter continued to live in Glasgow until his death on 26 July 2002.

His early education was at Glasgow Academy and Glasgow University, graduating in 1937 in Mathematics and Natural Philosophy and winning the Logan Prize as the best Arts student of the year. Wishing to enter research in theoretical physics he went to Cambridge, then an outstanding world leader in physics. From 1937 to 1939 he took parts II and III of the Mathematics Tripos as a Scholar of St. Johns College, graduating and being awarded the Mayhew Prize. In autumn 1939 he started a brief three months as a research student of the thermodynamicist R.H.Fowler before the war supervened. He worked in the Admiralty scientific service from January 1940 to September 1945, first at Teddington and then at the Mine Research Department attached to HMS Vernon, Portsmouth. At both Laboratories Gunn worked in a group led by Harrie Massey first on counter measures to magnetic mines and later on design and development of a series of British non-contact mines. Massey first developed a high regard for Gunn's abilities at this time; it may be remarked that this group included a number of young physicists who later contributed significantly to pure science, the most notable in that respect being Francis Crick. Apart from the operational research aspects, Gunn's work involved much classical applied mathematics.

This latter experience was one of the influences in him accepting a Lectureship in Applied Mathematics at Manchester University with Professor S, Goldstein, rather than taking up the Research Fellowship at St. Johns College, Cambridge to which he had been elected in 1943. After one year at Manchester, giving ten lectures a week in term time and producing two papers on supersonic flow and turbulence, he moved to University College London in 1946. There he was a Lecturer in Professor

Massey's Department for three years and moved his research interests from classical applied mathematics to the quantum mechanical subjects of nuclear and particle physics.

Meanwhile, at Glasgow University, with the advent of Philip Dee to the Chair of Natural Philosophy, the Department was undergoing a transforming expansion into nuclear physics - later branching also into particle physics. The Cargill Chair in Applied Physics falling vacant, Dee was able to transform its subject into theoretical physics. Here an opportunity, very much in conformity with his new interests in nuclear and particle physics, presented itself to Gunn and he was successful in being appointed to the Chair in 1949.

When the new Professor Gunn arrived in Glasgow the other active researchers in theoretical physics were few but able. One was his then research student, Edwin Power, coming with him from University College; another was Bruno Touschek, who having miraculously survived through the war as a young scientist in Nazi Germany, had been recruited by Dee in 1946. Gunn collaborated with these two on the production of mesons in protonproton collisions, one of the new found phenomena signalling nuclear physics generating the subject now known as particle physics. In 1953 Touschek went permanently to Rome where he notably became the originator of electron storage rings. Derek Pursey was also a Glasgow research student until 1951 and John Irving was a research fellow. Irving and Gunn collaborated on the photo-disintegration of light nuclei, postulating configurations for deuterium, tritium and helium nuclei, which were known as Gunn-Irving wave functions.

With the natural departure of all these people to pursue successful academic careers action was necessary. As a Professor - a post then carrying great weight - Gunn was able to recruit research fellows and lecturers to form what resembled a sub-department (though never so called) of theoretical teaching and research, seamlessly integrated into the Natural Philosophy Department. Besides teaching and administration Gunn pursued research and supervision of research students until the mid 1950s. But then came a change which was to set the rest of his academic life.

Through Dee's initiative, Glasgow then had a 300 MeV electron accelerator for particle physics. There were three particle accelerators in the UK, but a need for more advanced particle accelerators became apparent leading to the construction of a proton accelerator at the Rutherford-Appleton Laboratory near Harwell and somewhat later to an electron accelerator at Daresbury in the north of England. Gunn took a notable part in the country wide planning which led to these developments and especially to that of the Daresbury machine. (Serendipitously the radiation coming from the accelerating electrons at Daresbury and later similar circular electron accelerators proved to have practical applications in many areas of science.) It was perhaps a second best for Gunn that the electron accelerator was sited in the north of England rather than Scotland, but he and Dee obtained finance to build a linear, rather than circular, electron accelerator for nuclear physics research sited near Glasgow; this had a long and successful research life.

Gunn's influence increased with his appointment to the Science Research Council (SRC) from 1968 to 1972. At that time the question of building a much bigger European proton accelerator at the CERN Laboratory in Geneva had arisen. The Nuclear Physics Board of the SRC oversaw both nuclear physics and particle physics, and advice to the Government on CERN came mainly via that Board and the SRC. Gunn was Board Chairman (1970-72) at the time the Government took the positive decision that Britain should join in the new CERN project. That project was an enormous success for European particle physics, putting it for the first time on a level with American accelerator efforts in that field. Eventually in 1983 it led to the discovery of the W particle, which finally verified the great 1960s theory unifying the weak interaction with the electromagnetic interaction.

Gunn was a member of the University Grants Committee from 1973 to 1981. From 1973 to 1976 he was Chairman of its Equipment Sub-committee which dealt with all University requests for equipment money, both in science and arts subjects; demands from the latter were increasing with the rise of computing. In that role he gained and organised information which persuaded the Government to increase the grant to something like a proper level using a model devised to reduce the subjective element in the assessment of need. He was awarded a CBE in 1976.

He then became Chairman of the Physical Sciences (physics, chemistry and geology) sub-committee of the UGC from 1976 to the end of 1981. He obtained a strong impression of the increasing problem set by the skewed academic staff age distribution in these subjects, to become evident later in other subjects. So his sub-committee put a proposal to the UGC for so-called 'new blood' appointments to alleviate the situation. Its development and implementation became a matter involving the dual support system for University research (support both by the UGC and the Research Councils) of which he was a strong proponent. John Gunn was knighted in early 1982, nine months before his retirement.

All through his professorship he played a significant role both in the University and in the Department and was regarded as a mentor by a number of experienced people both within and without Glasgow. Gunn was elected FRSE in 1959. He was member of the University Court from 1969 to 1977, and was one of the first two Vice-Principals (1972-1977). In the Department he gave very strong support to the continuing Glasgow project to detect gravity waves coming from the cosmos when it was initiated by Ronald Drever in the 1960s, providing much of the early impulsion to the present international work. And at about that time Gunn was able to recruit additional academic staff to help form three distinct self-managing theoretical research groups. One of these, appropriately that in particle theory, naturally with some changes of personnel, continues very actively today.

In personal interaction, alertly clever, he had a comprehension of others; often people who only met him once or twice commented on this feeling that he gave. It showed itself in the clarity and interest of his undergraduate lectures; in fact he always did everything thoroughly and well, beyond the call of duty. Mingling in the Department and University he had humour and lively and persistent conversation. From 1972 to 1982 he was the benevolent Head of a remarkably happy Department.

A cello player, he had strong musical interests; chess and particularly golf (naturally) were other recreations. In 1944 he and Betty (Russum) were married, she predeceasing him by only six months, after many active years in public life. Their son is a theoretical physicist, a professor at Birmingham University. John Gunn was a man of outstanding talent, which for most of his academic life he devoted to the cause of science in British Universities, and many remember affectionately the pleasure of his company.

Gordon Moorhouse

Sir John Currie Gunn CBE, MA (Glasgow, Cambridge); Hon.DSc (Heriot-Watt, Loughborough, Glasgow); Hon.DUniv (OU): Born 13 September 1916; Elected FRSE 2 March 1959; Died 26 July 2002.

Neil Hood

10 August 1943 - 2 February 2006

Neil Hood had a remarkable career, spanning both the academic and commercial sectors in a way that maximised the advantages to all parties. Neil was born in 1943 and left school at 18, initially going straight into the steel industry. From there he left to go to Glasgow University to read Regional Geography and Economic Development. On graduation in 1968, Neil joined first the Scottish College of Textiles and subsequently Paisley College of Technology. He finally left Paisley at the end of 1978 to join the Government Economic Service in Edinburgh as economic advisor. This brief spell ended in September 1979 when Strathclyde University secured his services as Professor of Business Administration, whilst encouraging him to remain involved with the then Scottish Development Agency as consultant in inward investment and small firm development.

Neil rose rapidly through the academic ranks, becoming Associate Dean in 1982 and Dean in 1985. In partnership with Professor Stephen Young, he established the Strathclyde International Business Unit at Strathclyde in 1983. He saw it develop into a highly regarded centre of excellence for research, particularly in the study of the subsidiaries of multi-national enterprises, co-writing innumerable articles and book chapters, as well as complete texts, and working closely with national and international funders. His involvement in the world of financial management also grew during this period, with several Directorships. In 1986 he was approached by the Scottish Office to become Director of ‘Locate in Scotland’, having been one of its advisors for some years, and the University had the foresight to offer Neil leave of absence, initially for two years and then extended for a third. His time at ‘Locate in Scotland’ was highly fruitful: Neil brought a keen understanding of the determinants of foreign direct investment to bear elegantly on the practical business of actually winning inward investment projects, including the successful negotiations with Sun Microsystems. During his secondment to ‘Locate in Scotland’, Neil lectured on a one-day-a-week basis in the university, and then agreed the unusual but highly appropriate offer of a part-time position starting in 1990, whilst also holding the new post of Director of Employment and Special Initiatives within the SDA. This load included a part-time appointment as a special advisor to successive principals, initially to enhance the reputation of the university and to help the profile of the Development Office, and latterly to advise the principal on matters of strategic importance; advice that always proved immensely valuable.

Throughout the nineties, Neil's involvement with the private and public sectors grew in parallel with his growing academic reputation. Neil's attitude to those companies with which he became involved was exemplary; he was not interested in short-term associations, believing that a minimum association should be for three years. Faced with an industrial problem, his first response was not: 'I have written a textbook in this area; have you read it?' but rather: 'I have a set of analytical skills that may be helpful; can we work together?' The experience he gained by this approach not only enriched his teaching but caused him to become wholly accepted by the commercial sector, his proudest moment coming when one contact commented: 'We had forgotten that you are an academic'. Neil had been elected as a Fellow of the Royal Society of Edinburgh in 1987. In recognition of his contribution to the public and private sectors in Scotland, he was awarded the CBE in 2000 and an honorary doctorate of Strathclyde University in 2003.

In January 2001 Neil became Deputy Chairman of Scottish Enterprise, a post he held until February 2004. His background as both a practitioner and a distinguished academic added considerable value to the work of Scottish Enterprise, and he took the lead in reviewing the enterprise network's project activities. A major success during his time with SE was his role as founding Chairman of Scottish Equity Partners Ltd., which developed quickly under his guidance into a major venture capital house. More recently he took up the role of Chairman of the Clyde Waterfront Strategic Partnership Board, charged with driving the regeneration of the Clyde corridor.

The weaving of the three strands of academic life, Government policy and direct involvement in business was Neil's life-work, but there was another strand to Neil's life, equally important: Neil was a committed and active Christian, seeing this as imbuing his whole life. As an undergraduate, though one from a family of strong faith, he fell under the influence of writers such as William Barclay, a man of immense erudition, who demonstrated that the Christian Life was entirely consonant with the intellectual life.

Neil passionately believed in the relevance of Christianity to all peoples at all times; he put his extraordinary skills to the benefit of many charities, including 'Send the Light Ltd'. He found his ethical and moral principles to be the key to many of his business decisions, and persuaded many a board not to adopt strategies that might be of financial benefit in the short term if they carried with them long-term risks to the moral reputation of both the company and its directors. He also wrote a series of books in his final years, distilling his unique blending of Christianity and Business; the final book was written during his last illness, and completed only weeks before he died. Its title, *A Seeker's Guide to Christ,* perhaps summarises his own life of seeking and finding; it will be published in August of this year. Neil was supported strongly in his extraordinarily busy life by his wife Anna and his PA, Irene, and his debt to both is incalculable. He will be remembered across the University, by Scottish Enterprise and by very many of his friends and business partners not just for his broad economic expertise and keen academic mind, but for his integrity, his warmth and his compassion. His untimely death has deprived Scotland of one of its most influential and remarkable citizens; he represented the true embodiment of the Strathclyde University ethos of Useful Learning.

Neil Hood is survived by his wife, Anna, whom he married in 1966, and their two children, Annette and Cameron.

Andrew Hamnett

Neil Hood CBE. MA, MLitt (Glasgow), HonDBA (Strathclyde). CCMI. Born Netherton, Wishaw, 10 August 1943; Elected FRSE 9 March 1987; Died Hamilton, 2 February 2006.

Eric Duncan Grant Langmuir

3 May 1931 - 18 September 2005

(A fuller version of this obituary is on the Society's web page)

Eric Duncan Grant Langmuir was born in Glasgow May 3rd 1931, the second son of Dr James Langmuir OBE. He died on September 18, 2005, aged 74 and richly fulfilled, at his unique and uniquely hospitable home with its wonderful views of the Cairngorms. He died peacefully, surrounded by family, and still able to join in an impromptu ceilidh in his bedroom on the final day. His funeral in Inverness on September 24th was attended by about three hundred family, friends and colleagues gathered from the whole of Britain, paying their respects and fulfilling Eric's own recipe for the best way to express one's support in a bereavement "I really think if you can possibly manage it, the best thing is to be there". Well we were there, with many more there in spirit, but of course a lot more than mere physical presence is implied in Eric's remark.

Eric loved fireworks, despite getting a nasty injury once when discharging a rocket from a bottle held in hand. His family had put together a spectacular display for his entertainment that final weekend but events moved too fast. Instead, on the evening of the funeral, the inhabitants of the Spey Valley were treated to a pyrotechnic celebration of a life well-lived.

Educated at Glasgow Academy (1936-1940), he was evacuated during the war, first to Achiltibuie, then Callander where he attended McLaren High School (1940-1943) moving on to Fettes College, Edinburgh (1943-1950). He did national service in the Royal Artillery (1950-1952) and was commissioned in May 1951. He went up to Peterhouse, Cambridge in 1952 and in 1955 (MA 1959) he graduated with an honours degree in Natural Sciences (Geology, Zoology, Physiology). Subsequently Eric was certificated by the General Teaching Council of Scotland.

Eric's interests lay in outdoor pursuits, covering cross-country running, potholing, canoeing, sailing, skiing, rock climbing, hillwalking, mountaineering, conservation, adventure education, orienteering and above all the pursuit of safety while taking controlled risks – because the rewards justify those risks. Toby Mallinson, old Fettes friend and climbing companion of nearly 60 years, was witness to Eric's claim to have made a 5-minute run down the 550 metre Stoneshoot on Sgurr Alasdair in the Cuillin (in the days before 1952 when it still had stones in it), and has commented on his phenomenal coordination of eye, limbs and balance. Bob Downes (*Cambridge Mountaineering* 1956, p.18) wrote "To try and race Langmuir downhill is the surest lost cause in mountaineering". During his National Service he won the army cross-country championship.

We first met at the opening meeting of the Cambridge University Mountaineering Club in October 1952, finding that we were in the same college and beginning a friendship of 53 years duration. Eric in due course became president of the Cambridge University Mountaineering Club in its 49th year and he was present at the CUMC's centenary dinner in 2005. He was an active member of a substantial group of revolutionaries who wanted to see women admitted to full membership back in 1953 (Heavens, was life really that stuffy?). He was a member of the Alpine Climbing Group, the Climbers Club, the Scottish Mountaineering Club, and an honorary member of the Club de Montagne Canadien.

Cambridge colleges in the 1950s operated a 10pm curfew policy, backed by the requirement to wear gowns after dark, and enforced by proctors, bulldogs, porters and high walls topped by rotating spikes. For Eric, the rules were merely theoretical, for he found seemingly impossible ways of entering the college after hours.

Eric's quick and intuitive reactions were certainly needed on the CUMC meet of 1955 in the French Alps. Carrying coils and moving fast on easier ground during an attempt on the Sialouze Arete on the Pic Sans Nom, his companion, Ted Maden (later also to be elected to the Fellowship), was swept away in a major rock fall behind him. Eric jammed himself into a crack, arrested the fall after some 30 metres, then marshalled his injured companion down to safety in a further fifteen hours of intense concentration.

After graduation Eric was employed as a field exploration geologist with British Newfoundland Exploration (1956-1957) and in Northern Ontario, British Columbia and Alaska with the Mining Corporation of Canada (1957-1958). One product of this was a trio of bear stories.

He was awakened one morning by the thunder of a highly adjacent gunshot, to find a dead bear just outside his tent. A few days later while mapping in the bush he was approached by the sounds of yet another bear and took off at cross-country speed (Not adequate against bears and there was no companion to outrun!), eventually shedding rucksack, map-case and spare clothing in search of speed and made the shelter of the camp and the welcome presence of the rifle. He was joined soon after by a perspiring colleague bearing an urgent message, his rucksack, map-case, etc. Then there was the face-to-face meeting with a bear when both fled in opposite directions.

After his return from Canada he was employed as a science teacher at Wimbledon Independent Grammar School (1958-1959) before being requested by Sir Jack Longland, Everest mountaineer and Director of Education for Derbyshire, to take up the post as Principal at the Whitehall Centre for Open Country Pursuits run by Derbyshire Education Committee (1959-1963), where among others he employed as instructors Joe Brown and Bob Downes. After Whitehall he was appointed Principal at Glenmore Lodge National Outdoor Training Centre at Aviemore, Inverness-shire (1964-1970), then on to the newly created post of Lecturer, soon promoted to Senior Lecturer in charge of Outdoor Education at Moray House College of Education, Edinburgh (1970-1975) and finally the post of Assistant Director of the Recreation and Leisure Planning Department of the Lothian Regional Council which he held until his early retirement to enjoy life in 1988. In this latter post he was involved in setting up the Pentland Hills Country Park, developing the Port Edgar marina and sail training establishment on the Forth, and had responsibility for the Hillend Ski Centre, Britain's largest artificial ski centre and ski training establishment. Ever youthful, ever fit, Eric achieved a reputation in the Recreation and Leisure Planning Department for physical prowess demonstrated by his ability to run up the stairs of the office from the ground to the 6th floor much faster than anyone else. Junior members of staff learned to jump to the side when he was trying to beat his own record.

Enjoying life after 1988 included being appointed to the Countryside Commission in 1990, serving a term on the NE board when that organisation became Scottish National Heritage and being a member of the Cairngorm Working Party 1991-93, entering a minority report with John Hunt, Reserves Manager for the Royal Society for the Protection of Birds, rejecting the voluntary partnership structure as a means of delivering good management, and playing an important role in the eventual foundation of the Cairngorms National Park contrary to the initial inclination of the government in Westminster.

From the earliest days his career was deeply involved with the improvement of instruction and technique, with the particular aim that young people should be able to "Adventure in Safety". He was a member of the original Mountain Leadership working party in England 1962-1964 and launched a parallel scheme for Scotland in 1964. He gained extensive practical experience as leader of the Glenmore Mountain Rescue Team 1963-1969 and as rescue coordinator in the Northern Cairngorms during the same period. He was a member of the Mountain Rescue Committee of Scotland from 1964 and its Chairman from 1968.

He studied avalanche prognosis and avoidance both in the Cairngorms and in Switzerland with Andre Roch, later setting up Scotland's first avalanche warning programme and laying the foundation for the Scottish Avalanche Information Service. In the course of one search for an overdue party of schoolchildren he and his party were swept six hundred feet in an avalanche, and was dug out only 'at the true blue stage' as he put it wryly.

How many lives have been saved through Eric's work and how much grief avoided? Impossible to estimate but I have heard rumour of two expert estimates suggesting that the avalanche studies alone may be saving as many as thirty lives a season in these days of greatly increased access to the hills. How much exhilarating adventure has been enjoyed in safety by young people as a result of his work?

His book *Mountain Leadership*, later *Mountaincraft and Leadership*, is the official handbook of the Mountain Leadership Training Board of Great Britain. It was first published in 1969, then extended and revised in 1973, rewritten and revised in 1984 and again in 2004. It has become the bible, widely known simply as *'Langmuir'*, for all who would go safely among the British mountains and especially for those who must be responsible for the safety of others. The book has never been out of print and has sold over 150,000 copies – it was available in three shops in Aberystwyth when I checked last week.

In 1957 he married Maureen Lyons, a Londoner whom he met in Canada when she was working for the Canadian Film Board and there are four children, Catriona (now a journalist), Roddy (an architect, who designed Eric's retirement home), Moira (a geologist and now a DTI inspector) and Sean (now a ski coach in Canada).

Maureen died of cancer in 1980 and her ashes were scattered by the family in the mountains they all loved. It was a shattering blow but Eric enthusiastically took on the extra housekeeping and parenting roles in addition to all his other activities, and discharged them with distinction. The three younger children were brought up in a ski-rich environment and all became expert ski racers who represented Britain internationally. At the time of his death he was delighting in his eight grandchildren. His partner Marion MacCormick, an enthusiastic orienteer (of which more below) joined him in 1989.

Eric was a pioneering rock climber in Great Britain until family responsibilities curtailed his activities – and responsibility was ever the name of Eric's game. 1954 saw the start of serious exploration of the climbing potential of the Trilleachan Slabs at the head of Loch Etive. Eric's attention had been drawn to the slabs by his father, an enthusiastic fisherman, mine had been aroused in the course of a camping trek along the south shore of Loch Etive in the spring of 1952. December 1953 saw the two of us washed out in a tent at the head of Loch Etive, but in the summer of 1954 we made multiple visits and attempted several of the obvious lines. Subsequently the Etive Slabs have become a climber's playground, with 41 routes listed in the latest Scottish Mountaineering Club guidebook, ranging in standard from Very Difficult to Extreme 7 and in length from 100 to 460 metres. Four of those routes gain the top quality ranking of 4 stars. *Spartan Slab*, the name given to the 190 metre Very Severe route first ascended on June 13 1954 by a party led by Eric Langmuir is in that category and ranks today as one of the most popular climbs in Britain.

Eric's best season in the Alps was in 1955 when, after the club meet in La Berarde, Alan Blackshaw, Bob Downes, Geoff Sutton and he went on to the Ecole Nationale de Montagne et de Ski in Chamonix. Highlights were ascents of the South Face Direct (ED) of the Punta Gugliermina, and the first British ascent of the North Face of the Badile (ED), significant contributions to the post-war renaissance of British alpine climbing.

In October 1991, at the age of 60, he joined an expedition to the Bhutan Himalaya where he made several first ascents, including that of Wohney Gang, 5589m, with George Band.

Eric was a Grade 1 Ski Teacher with the British Association of Ski Instructors and a member of the British Ski Instruction Council, becoming its Honorary President in 1993. In 1964, together with John Disley, John Peacock, Peter Steele and a guide he made one of the earliest traverses of the Haute Route by a party of British mountaineers.

With his partner Marion MacCormick he began a serious, and as ever fiercely competitive, interest in Orienteering following his retirement. Together they set up the local Spey Valley Orienteering club. He was the main organiser of the Scottish Orienteering Championship in the Spey Valley in 2003. He was the winner in his age class of the Scottish 6-day event in Lochaber 2001; was British National Champion in his age class in Northern Ireland 2002 and competed in international events.

In 1973 the Royal Society of Edinburgh sought to broaden its membership base in Scottish life beyond the dominantly academic. When Eric's name was suggested at Council it received instant recognition and support around the table. He was elected a Fellow in 1978 for his pioneer work on avalanche prognosis in Scotland and for his publications and personal contributions to outdoor education and safety in the mountains. He was awarded an MBE in 1986 for his contributions to safety in mountaineering and adventure training, but he had greater and far more highly valued rewards – the total respect and affection of the outdoor and mountaineering communities. His enduring monument, however, is the strength and cohesiveness of his family, a tribute to his parenthood and an indication also of just how sorely he will be missed.

In 1999 Eric had the rare experience of reading notices of his death issued by the Royal Society of Edinburgh and was able to assure friends that the reports were 'greatly exaggerated'. The error was understandable – his sister Marjorie Langmuir was a doctor practicing in Aviemore until her death the previous year, who also received literature from the Royal Society of Edinburgh. When her clinic wrote to the Society requesting that Dr Langmuir of Aviemore be removed from the mailing list, it was assumed that it referred to Eric.

The man had fantastic energy and drive, celebrating his arrival into his 70s in 2001 with an ascent of Mont Blanc in the company of friends. That same year he made a traverse of the Cuillin Ridge in the company of Andy Munro and his children Moira and Roddy. These are two expeditions which mountaineers forty years his junior would have prized. Optimistic plans were afoot for a fiftieth anniversary ascent of Spartan Slab in 2004 by the original team, to be led by daughter Moira (I suspect that at least one of us could no longer have cocked his leg above his right ear as required on the third pitch). Only four weeks before his death he spent three days with John Cook walking vigorously over the roughest Lakeland fells, still impressing his companions with his downhill technique over screes.

We had a twenty minute telephone conversation the day before he died, marked by a deep appreciation of all the good times enjoyed, characteristic realism and a mutual absence of stiff upper lip.

Goodbye, Eric old friend. You did all things well and it is my privilege to have known you.

Michael J O'Hara

Eric Duncan Grant Langmuir MA (Cantab), MBE. Born May 3 1931; Elected FRSE 6 March 1978; Died September 18 2005.

Sir Cyril Lucas
30 July 1909 – 14 January 2002

Dr Lucas, as he always preferred, was elected a Fellow of the Royal Society of Edinburgh in 1939.

He was a scientist who knew how to work for government by working with administrative civil servants. In particular, his partnership with John Aglen at the Scottish Office during the 1950s and 60s was productive by reason of the trust and respect in which each held the other.

Lucas was Director of Fisheries Research for Scotland from 1948 to 1970 and was based at the Marine Laboratory, Aberdeen. He delegated day-to-day responsibilities to Section Leaders, but no publication emanated from his laboratories that had not been scrutinised by his critical eye. His comments always improved the text and his criticisms saved many of us a statement, calculation or indeed entire paper that we would have later regretted. In the main his staff held him in awe, not because of fear but out of respect for his intellect, ability and integrity.

To me he showed interest and kindness. He had selected me as a Development Commission student and at interview we had discussed the links between external and internal environments in commercial fish, and how they might be mediated through endocrine and ion-regulatory systems. He suggested I explore that field.

I needed extensive laboratory and aquarium facilities and he met those needs with characteristic generosity, giving me sole use of his own laboratory, adjacent to his office and a short step from the aquarium. As usual in those days I brewed coffee in a beaker over a bunsen burner and he was a periodic, questioning visitor – the smell having percolated through a crack in the shared wall.

Years later, when we both served on the Natural Environment Research Council, we travelled north on the same sleeper train. It lacked a dining car and for about five years, we dined at least monthly "al fresco" in his sleeper (where his mail was delivered). We sat on suitcases and his bunk served as a table. He was partial to smoked salmon and rare, cold roast beef. We shared a taste for gin, only slightly tainted with tonic and under its influence we set the world to rights.

He was a thoughtful liberal with clear ideas of right and wrong. He was an agnostic and humanist, holding himself accountable for his own strengths and weaknesses. He was generous in his forgiveness of others, but hard on himself. Eventually he grew weary of growing political correctness, cynical of the worth of politicians and sad at the demise of personal responsibility. He expressed regret at living quite so long; I among many others, find the world a lesser place without him.

Sir Frederick Holliday

Sir Cyril Lucas, CMG, DSc, FRS. DSc(Lond), HonDSc(Hull), HonLLD(Aberd):
Born 30 July 1909; Elected FRSE 1939; Died 14 January 2002.

RSE Council Service: Councillor, 1949-52; Vice-President, 1961-64

William Hepburn Russell Lumsden
27 March 1914 - 13 May 2002

Scotland has a proud history of nurturing distinguished contributors to our understanding of disease in the tropics. Among these must be numbered Russell Lumsden, medical entomologist, virologist and parasitologist, but above all a man with boundless enthusiasm for the entire natural world.

Russell became a keen naturalist while still at school. Born in Forfar on 27 March, 1914, he moved with his family to Darlington in 1919 when his father became Schools' Medical Officer for Durham County. He was educated at the Queen Elizabeth Grammar School there, but in 1931 he was awarded a Carnegie Scholarship to read Zoology at Glasgow University under Sir John Graham Kerr. Russell took part in successive student expeditions to Canna in the Inner Hebrides and wrote detailed reports on the entomology of these and on various projects in marine biology.

His dedication to natural history is splendidly illustrated by a paper in *The Entomologist's Monthly Magazine*, recounting how, while sunning himself on a jetty at Lake Windermere after swimming, he found an old nail and kept a tally of the different prey of pond skaters by making scratches on the woodwork.

After graduation with First Class Honours, Russell went on to qualify in medicine at Glasgow and wrote articles for *Surgo*, the Glasgow University Medical Journal, acting as its editor in 1938. His companion in all his student activities was Alexander J Haddow, (later FRSE, FRS): both were later to become world authorities on mosquito-borne disease.

After receiving his medical degree in 1938, Russell was awarded a Medical Research Council Fellowship for work at the Liverpool School of Tropical Medicine. The MRC wished to promote research on drug treatment (chemotherapy) of tropical diseases, an endeavour in which the Liverpool School under Warrington Yorke was particularly distinguished. So, after taking the Diploma in Tropical Medicine and Hygiene, Russell began to look at the effect of antimalarial drugs on the development of mosquito-infecting stages of the malaria parasite in the laboratory. But with the outbreak of World War II in 1939, of necessity his interest in malaria became more directed to mosquito transmission of the disease in the field.

In 1941 he joined the Royal Army Medical Corps on the staff of No 3 Malaria Field Laboratory, later becoming its commanding officer and rising to the rank of Lieutenant Colonel. The main task of the Laboratory was to investigate the malaria hazard to troops advancing into new territory. As a threat to health and survival, malaria assumes even greater importance in times of war.

Russell saw active service in the Eastern Mediterranean, North African and Italian Campaigns, ending up in India in preparation for the Allied landings in Malaysia. His duties required extensive travel, often on solitary expeditions to remote places, and on dangerous ones to forward areas; in Sicily he miraculously survived when the truck in which he was travelling was blown to pieces by a land mine.

The extensive London School of Hygiene and Tropical Medicine Memoir, *Anophelism and Malaria in Transjordan and in the neighbouring parts of Palestine and Syria* that he later (1950) published (with Jacob Yofe), exemplifies Russell's inexhaustable capacity for amassing relevant data and the thoroughness of his ecological approach to vector-borne disease transmission. The report that he wrote for Advanced Headquarters on Malaria in Malaya, in anticipation of the 14th Army attack, was equally breathtaking in its scholarship, but never put to use as Allied landings were cancelled when the Japanese surrendered following the bombing of Hiroshima and Nagasaki in August 1945.

After demobilisation in 1946, Russell took up a MRC Senior Research Fellowship in Medical Entomology at the London School of Hygiene and Tropical Medicine. Here he met and married Pamela Bartram, a librarian at the School, who was to be his devoted companion for the rest of his life. He continued work he had started in Liverpool on factors affecting the biting activity of *Aedes aegypti*, the mosquito transmitting the virus of yellow fever in the urban environment. A year later he entered the Colonial Medical Research Service and joined the staff of the East African Virus Research Institute (EAVRI) in Entebbe, Uganda, as entomologist, alongside his friend of Glasgow student days, Alex Haddow, who later became its Director.

Yellow fever wreaks havoc in urban populations when *Aedes aegypti* is around to transmit it. EAVRI had originally been set up by the Rockefeller Foundation to answer the question “Where does the virus of yellow fever hide between epidemics?" Based in Entebbe and a field station in Bwamba, just to the west of the Ruwenzori, the Institute was largely concerned with the investigation of the cycles of maintenance of the yellow fever virus in the forest environment and the avenues by which it entered the human population. Russell was soon in his element as a naturalist investigating possible transmission routes for the virus. He studied the biting patterns of forest canopy mosquitoes in relation to the behaviour of monkeys and bush babies which, he demonstrated, served as reservoirs of the human disease. He also sorted out those mosquitoes that had a predilection for humans - and *Aedes africanus* emerged as the main culprit. The Rockefeller had their answer!

Over time, however, his interests became more virus-centred. He learned techniques for the isolation and identification of viruses, and in the laboratory, he isolated and characterised several viruses of medical importance. A WHO Fellowship for visiting virus laboratories in Canada and the USA assisted his conversion. He came to regard concepts of purification, standardisation and preservation of infective agents as essential prerequisites for critical study of their epidemiology - conclusions that profoundly influenced the rest of his career as a scientist.

In 1957, while serving as Assistant Director of EAVRI, Russell was appointed Director of the East African Trypanosomiasis Research Organisation (EATRO) and forsook viruses for protozoan parasites. He embarked immediately on a radical revision of the Organisation's activities. These covered the diseases caused by the tsetse fly-transmitted trypanosomes, blood-dwelling protozoa responsible for sleeping sickness in humans and the wasting disease nagana in livestock. For a start he did not like EATRO's activities being split discipline-wise between three stations geographically distant from one another. His EAVRI experience had taught him that research on vector-borne disease demands close interaction of experts on pathogen, host and vector, not their isolation from one another, so he concentrated all the Organisation's staff at Tororo in Uganda. In addition, despite his entomological background, he believed that the time had come to break away from preoccupation with the tsetse fly vector and expand research on the trypanosome itself and on the mammalian host's immune response to it. This was a brave move.

In medical science, understanding of the mammalian immune response was currently deepening rapidly. But since pioneering work at the beginning of the century, it had been known that while trypanosomes induce a powerful antibody response to their presence, these parasites can repeatedly change the nature of the antigen inducing the response and so evade immune destruction. In this way they give rise to a chronic relapsing infection in the blood. This ability of the parasite to undergo 'antigenic variation' was seen as an insurmountable barrier to much-needed vaccination against trypanosomiasis in both man and beast. The nature of this variation was a complete mystery. What little recent research had been done on it had been conducted on old laboratory isolates, syringe-passaged through rodents for decades with ever-increasing virulence. Such parasites bore about as much resemblance to their wild ancestors as a chihuahua does to a wolf. In addition there was the problem of standardising test materials to compare the antigens of trypanosomes at different points in an infection.

At EATRO, however, Russell had ready access to recent trypanosome isolates from patients and sick animals, and he quickly introduced the novel practice of cryopreservation (deep-freezing of living material) to set up a bank of such isolates, later termed 'stabilates'. He devoted much time to developing the technique so as to ensure that stabilate populations were truly frozen in time, thus preserving their antigenic character and infectivity indefinitely. In this way he solved the standardisation problem. He became fascinated by the variable infectivity of trypanosomes and, drawing on his experience in virology, suggested that their infective properties should be measured as if they were invisible viruses. As a visiting researcher at EATRO in 1960, the writer was enthralled by the atmosphere of excitement and enthusiasm that the new director had generated in the laboratories.

In 1962 Russell became a Member of the Expert Advisory Panel on Parasitic Diseases of the World Health Organisation. But Ugandan independence was looming, and in 1963 he had to make way for a native African director. He returned to the UK and accepted a lectureship in the Department of Bacteriology of the Medical School, Edinburgh University. Here he met the veterinarian John Herbert and they struck up an alliance to pursue the nature of trypanosome antigenic variation further. This was made possible by Sir Alex Robertson inviting Russell to head an Applied Protozoology Unit in his new Centre for Tropical Veterinary Medicine at Easter Bush.

A basic question concerning trypanosome antigenic variation was whether it was due to survival of genetic mutants in the face of host antibody attack, or was the result of phenotypic change in a genetically constant population of trypanosomes, possibly induced by host antibody. Study of the pattern of switching from one antigenic type to another in relapsing clone infections was an obvious start to answering this question.

Lumsden and Herbert in a series of classic papers showed that backswitching in clones ruled out genetic mutation and that the unrelapsed trypanosome population was already heterogeneous with respect to antigenic type, so antibody induction of change was unlikely. One of their most enduring contributions was the invention of a widely accepted notation for describing different trypanosome populations and the pedigrees of antigenic types. It paved the way for our present concept of the mechanism of antigenic variation - that it involves the switching on and off of different variable antigen genes from the clone's repertoire (genome), but the mechanism of switching contains the seeds of genomic change (mutation) and so the repertoire is evolving continuously.

In 1967 Russell addressed the Royal Society of Edinburgh on "Changing emphases in attempts to control African Trypanosomiasis." In 1968 he was elected FRSE and spent three months as Visiting Professor in the School of Hygiene of the University of Toronto before taking up the Chair of Medical Protozoology in the London School of Hygiene and Tropical Medicine.

The Department of Medical Protozoology at the School had an outstanding history of seminal discovery, especially in life cycle studies of malaria parasites, and these had had a profound effect on the control of parasitic diseases. Undaunted by this tradition, Russell again initiated profound changes. Creatively and imaginatively, he moved the department forward towards rigorous parasite population studies and succeeded in establishing a reliable collection of cryopreserved reference material, since used by various research groups around the globe.

With intense workshops supported by the World Health Organisation, he formalised nomenclature for isolates, clones and other parasite populations further, and so laid the groundwork for the broad research in parasite variation and diversity which is very much in vogue today. In his personal research he developed a miniature anion exchange technique for diagnosis of trypanosomiasis and filariasis in patients. In all his posts he expressed strong appreciation of the contributions of technicians to research and encouraged them to study for higher degrees.

Russell's changes at the School were painful and viewed by some as over-diligent; but they induced a necessary catharsis. He encouraged and expanded existing interest in parasite immunology and recruited additional expertise - David Evans in microbial metabolism and David Godfrey in genotype identification by isoenzyme electrophoresis. With his first PhD student, Michael Miles, the molecular approach to epidemiology and the vexed question of genetic exchange in protozoa began to flourish. Under David Warhurst, he set up an exotic disease research group which evolved into the Malaria Reference Laboratory. With David Evans he edited the two-volume *Biology of the Kinetoplastida* (1976, 1979) bringing together a vast variety of research on trypanosomes, leishmanias and related organisms; it remains a much-cited publication. There is no doubt that Russell was a man of vision who would have enthusiastically embraced and championed the current dramatic progress in molecular biology, population genetics, phylogenetics and evolution.

He was also an energetic and able manager, blessed with administrative credibility attained in previous appointments. In driving changes in direction, he was aided by a personality that combined honesty, fairmindedness and encouragement of initiative with rigorous and even ruthless determination not to be diverted from his aims. Courageous and outspoken at times, he was very much the gentleman, loyal, considerate, kind and caring with an endearingly mischievous sense of humour.

Russell retired from the Chair in 1979 and returned to Scotland. He continued research part time at Dundee and Edinburgh Universities, and wrote papers on an amazing diversity of topics - from human venereal trichomoniasis to bush baby behaviour and the arrows of Zambian hunter-gatherers. He also edited the *Journal of the Berwickshire Naturalists Club*. He was never short of hobbies: piping, Scottish poetry, trout fishing, even DIY in renovating cottages in the Borders, all claimed his attention.

Throughout his eventful career, Russell was supported by his charming wife Pamela. Whether living in a magnificent villa in Uganda or in a tiny flat in Bloomsbury, they enjoyed entertaining and were much-appreciated hosts. They were widely perceived as the idyllic loving couple, with a life-long bond - and so it proved. They raised two sons and a daughter, though sadly the latter died in 1985. Russell died in Edinburgh on 13 May 2002, after a long illness following a heart attack in 1999. He was lovingly tended by Pamela to the end. I warmly thank Mrs Pamela Lumsden, Dr W John Herbert and Professor Michael Miles for their comments and help in writing the above memoir.

Keith Vickerman

William Hepburn Russell Lumsden. BSc, DSc, MD, FIBiol, FRCPE. Born 27 March 1914; Elected FRSE 4 March 1968; Died 13 May 2002

Charles William McCombie

12 September 1926 - 25 February 2006

Charles McCombie was born in Monifieth, Angus, in September 1926. He was fortunate to be brought up in a close family where his parents, recognising his ability and the value of a good education, gave him constant encouragement. He won a place at Robert Gordon's College, Aberdeen, where he gained many distinctions culminating with the award of top place in his home town's University Bursary Competition. Charles was an undergraduate at the University of Aberdeen from 1944 to 1948, initially intending to take a degree in Chemistry but switching to Mathematics and Natural Philosophy at the end of his second year. After graduating with First Class Honours in 1948 he continued in Aberdeen as a research student supervised by Professor R. V. Jones. He started on a project in solid state physics but was soon diverted into providing the theoretical analysis to back up his supervisor's experimental study of methods of enabling detectors to achieve close to the ultimate limit of accuracy set by inevitable thermal fluctuations. The detector studied was a simple galvanometer and, in order to detect the small displacements of the optical lever spot corresponding to these fluctuations, an ingenious amplification system involving a pair of back-to-back photocells in the circuit of a second galvanometer was designed. The analysis of the galvanometer amplifier became McCombie's PhD project and, as is almost always the case, the crucial ideas in his thesis formed an important part of the intellectual machinery that he was to make use of in subsequent work: in his case the key element was the relation between damping and the fluctuating forces that operate on a system as it oscillates around thermal equilibrium. He extended his PhD work in an important and substantial review of Fluctuations and Physical Measurement published in Reports on Progress in Physics.

In 1951, after completing his PhD he spent a fruitful summer at M.I.T. during which he had preliminary ideas on two themes that were to become important in his later work: through discussions, mainly with Gene Gross, he began to consider the role of imperfections in modifying the vibrations of crystals and, as a result of attending an extended course on probability, he discovered the value of casting physics problems in probability terms if possible. He also benefited in the next few years from attending the Summer Schools introduced by Sir Neville Mott at Bristol. He saw such schools as being of immense value to young researchers and later, in the 1960s, became strongly involved in the Scottish Universities' Summer Schools in Physics. He continued to make contributions to vacation training and always encouraged and assisted his own research students to broaden their horizons by attending such courses.

In 1955 he was awarded a Commonwealth Fund Fellowship to work at the University of Illinois, the leading centre for Solid State Physics at that time. It was suggested that he look at a puzzling discrepancy that had been found between theory and experiment for the ratio of electrical conductivity to isotope diffusion in silver chloride. The problem was not in an area that was familiar to him but he succeeded in solving it by considering the migration of ions with the same care and clear-headedness that had been a hallmark of his work on fluctuations. The Fellowship was extended to allow him to work with Charles Kittel at Berkeley on resolving some apparent inconsistencies between transport theory and the Onsager relations. This period of visiting other laboratories and discussing problems with some of the greatest minds in Solid State Physics was one that Charles recalled with great enjoyment and later he strongly supported his own research students in similar enriching postdoctoral visits to other countries.

After his return to Aberdeen to rejoin the staff of the Department of Natural Philosophy under Professor R. V. Jones, he initially continued with his work on fluctuations but, by the late fifties, his main interest had become the optical absorption bands associated with electronic transitions at defects in crystals. The first defect he studied, helped by his research students Sandy Murray and James Matthew, was the F-centre (an electron trapped at a negative ion vacancy) in alkali halides. The work was in many ways no great departure from his earlier work: the broad (essentially Gaussian) optical absorption band for the F-centre was interpreted as arising from fluctuating radial displacements of the neighbours. A new feature however was the extensive use of computers to perform what were at the time very ambitious calculations. Charles was always happy to leave computations, or 'brute force calculations' as he often called them, to his research students. The ideas were developed further in a study with another student, John Slater, of the absorption associated with a centre in diamond, in this case a sharp line with an attendant structured band.

The diamond spectrum had been measured at the Physics Department of the University of Reading and this made Charles an obvious choice for their newly created Chair in Theoretical Physics which he took up in 1964. At Reading he continued with his studies of optical absorption at defects in crystals, looking at spectra from transition metal ions in magnesium oxide when I was his student and, with Roger Loader, returning to the optical properties of the F-centre which were, by that stage, much more fully measured. He was elected a Fellow of the Royal Society of Edinburgh in March 1970. Later he returned to the type of problem in defect dynamics that he had first explored during his Commonwealth Fund Fellowship: with Arthur Every and Shane Heaney he looked at questions in the re-orientation of defects and the entropies of formation of defects and through this became interested in the range of validity of the widely used Vineyard theory for hopping rates of defects between their possible sites. Along with his Research Assistant, Manoj Sachdev, he compared the Vineyard theory results for the hopping rates of a simple model defect with results found from computer simulation and from the discrepancies they were able to propose an improved theory, their 'minimum surface' theory.

Charles did more than his share of administration at Reading, in particular as Head of Department between 1980 and 1984. Shortly after this he took early retirement with part-time re-employment. Later he did retire from teaching but continued to visit the department several times a week. He particularly enjoyed discussing physics with colleagues. Over the last few years his interests turned to interpretations of wavefunctions in quantum mechanics. He was pursuing a little exploited suggestion by Einstein that an ensemble interpretation of the wavefunction would avoid the conceptual difficulties that arise from the Copenhagen interpretation. As with much of his work at Reading this remains unpublished.

His gift for reducing complicated problems to simple examples that retained the essential features of the original problem made Charles an inspiring teacher and research supervisor and a valued colleague. I was lucky enough to benefit in all three ways: as an undergraduate in Aberdeen and as his PhD student and colleague in Reading. He particularly enjoyed working on presenting physics to students in a way that was best suited to their level of skill.

Outside physics Charles had many interests. He played a prominent part in the social life of the University, particularly in the Senior Common Room, where he was Senior Steward from 1971 to 1972, and at Windsor Hall, where he was Senior Resident from its founding in 1964 until 1991. It is fitting that a recent building extending the Hall has been named in his honour. Many at his funeral in Reading were aware of his skills on the ballroom floor, but were surprised to learn from his brother that as a youngster he had excelled at gymnastics. He had a life-long love of books and amassed an enormous collection reflecting his knowledgeable interests in art, literature, philosophy, religion, history, oriental rugs, Arabic and, of course, physics. Having been introduced to the world of antique oriental rugs during a stay in America, he became a well-informed collector, even teaching himself some restoration techniques. His breadth of interests and gentle manner made him a widely-respected member of the University community at Reading and also at Aberdeen, where he maintained contacts through regular visits to his sister, brother and the community in which he spent his formative years. Charles is remembered fondly by his friends and colleagues not only as a distinguished physicist but as a person of great humility and integrity.

In the last few years Charles McCombie devoted considerable time to preparing and writing obituaries for friends and colleagues. Perhaps with this in mind, he made available his own hand-written notes for a lecture that he gave in Reading reviewing his life in science. I have made extensive use of these notes in writing this obituary.

Michael Sangster

Charles William McCombie MA, PhD (Aberdeen). Born 12 September 1926; Elected FRSE 2 March 1970; Died 25 February 2006.

Sir Harry (Work) Melville

27 April 1908 - 14 June 2000

The Society lost one of its most distinguished and long-serving Fellows on 14 June 2000 at the age of 92 with the death of Sir Harry Melville, Fellow of the Society from 1937, Bruce-Preller lecturer (1943), Gunning Victoria Jubilee Prize (1952-56).

Born in Edinburgh on 27 April 1908, the only son of Thomas and Esther Cumming Burnett Melville née Nicol), who resided in the southside at 233 Dalkeith Road, he went first to Preston Street School before entering George Heriot's School in 1916. It does not appear that his school recognised his abilities as the summary report on his leaving in July 1925 recorded "Average intelligence, fairly good worker, quiet unassuming manner, always courteous". Beneath this modest outward appearance was a young man of the highest ability. He entered the Heriot-Watt College probably contemplating a career in engineering and after a year entered the Chemistry Department of the University of Edinburgh with a bursary and graduated with first class honours in 1930. He was awarded a Carnegie Research Scholarship to undertake his PhD studies during the years 1930-1933, the topic proposed being 'Investigation of molecular structure and chemical change by means of band spectra'.

His research supervisors were John E. Mackenzie and Ernest B. Ludlam, both Fellows of our Society. From the latter, whose research experience was in both chemistry and physics including a period with the Nobel Prize physicist Philipp Lenard, Melville would have been stimulated in his development of a wide range of physical properties applied to problems of chemical kinetics of gas phase reactions. It does not appear that Ludlam's deep pacifist convictions, which had led to several terms of imprisonment in the first world war, had the same impact.

His first three years of research were highly productive and papers on the oxidation of phosphorus vapour, the photochemistry of phosphine and of ammonia, the diffusion coefficients of gas mixtures, absorption spectra, surface reactions and reactions of atomic hydrogen were published. In addition to these, some other papers illustrated his ability to design and build ingenious apparatus to expedite experimentation at higher levels of accuracy. Unusually for a research student under supervision there were many papers of which he was the sole or senior author. His PhD thesis *The oxidation of phosphorous at low pressures* was awarded the Society's Gunning-Victoria Jubilee Prize in Chemistry in 1932. The award of an 1851 senior exhibition took him to the Colloid Science Laboratory in Cambridge in 1933 to work with Professor Eric Rideal. This laboratory had research interests spanning a wide range of chemistry, physics and biology and, having a deservedly high reputation, attracted some exceptional workers.

In Cambridge the range of his research interests widened still further. A Fellow of Trinity College from 1933- 1944, he was appointed Assistant Director of Research at the Colloid Science Laboratory in 1938. Recognition of his work came in the award of the DSc degree from Edinburgh in 1935, the award of the Meldola Medal of the Institute of Chemistry in 1936 and election to our Fellowship in 1937. He continued to study a wide range of gas and surface reactions and his studies of explosion limits in gaseous oxidation reactions won international recognition. From 1936 onwards his studies extended to polymerisation, a topic that was to become the major focus of his research interests in subsequent years. Rideal's strengths lay in his abundant ideas but his co-workers had to put them into effect by experimental methods and in this particular aspect Melville's experience and inventiveness were invaluable to the whole team of research students and post-doctorals. His colleagues sought a ready sourcebook for experimentation to which they could refer whenever necessary. As a result Harry Melville together with a colleague Adalbert Farkas from the Hebrew University, Jerusalem took up the challenge. Their method was to forego drinks after dinner in the Senior Common Room in Trinity and write separate sections each in their own room. The following day, Farkas' English having been corrected by his co-author, material could be typed. Within a few months the manuscript was complete and then the authors went to Macmillan's office in London. In the late 1950's he told me "We were met by a young chap there called Harold. He's come on quite a bit since then don't you think?"

Experimental Reactions in Gas Kinetics duly appeared in 1939, published by Macmillan and became an invaluable book in the laboratories where gas kinetics was pursued. The print run was soon exhausted in the war years and secondhand booksellers would offer prospective buyers a place in a queue of twenty or more hopefuls.

Photochemical polymerisation reactions were becoming his major research interest and his growing reputation was apparent in his appointment to the Chair of Chemistry in the University of Aberdeen in 1940 and his election as a Fellow of the Royal Society in 1941 "for his outstanding contributions in the study of gaseous reactions and of the mechanism of polymerisation". The outbreak of war put a stop to most of his research work and in 1940 he became Scientific Adviser to the Chief Superintendent, Ministry of Supply from 1940-43 based mainly at Porton Down, and then became Superintendent of the Radar Research Station at Malvern 1943-45. Those who worked with him in later years realised that he never spoke of his work in these posts. In 1941 and in 1943 he gave review lectures on themes in polymer chemistry including industrial applications. His return to academic life in 1945 saw the beginning of new studies in gas kinetics and in polymer kinetics. In 1948 he was appointed to the Mason Chair of Chemistry in the University of Birmingham, and was accompanied by his research group whose equipment, including glass vacuum lines, was transported in furniture vans. For the next eight years the development of his previous research came to fruition with an enthusiastic group of lieutenants in the young members of staff and a growing school of research students and post-doctorals in the areas of polymer chemistry and gas kinetics. Those working in other areas of physical chemistry also benefited and Melville's support for the development of analytical chemistry in the department was invaluable to that often neglected, but vital, study. His stimulus was also felt at undergraduate level where his lectures created enthusiastic interest from his honours students. It is not surprising that his 1958 Royal Institution Christmas Lectures on "Big Molecules" to younger audiences were highly successful.

The award of the Royal Society's Davy Medal in 1955 and of the Bakerian lecture in 1956 were a recognition of his standing and achievements but also, in 1956, the prospects of his continuing to advance polymer chemistry and gas kinetics in Birmingham with his wise and stimulating leadership changed irrevocably with his appointment to the Secretaryship to the Committee of the Privy Council for Scientific and Industrial Research.

Henceforth he was to be an administrator, though he never ceased to be a scientist. His commitments to Government and other bodies were many and these had been made effective by his long-established and highly-effective use of his time. He had been Chief Scientific Adviser on Civil Defence for the Midland Region, had served as a member of the Ministry of Aviation Scientific Advice Council, the Research Council of the British Electricity Authority, the Royal Commission on University Education in Dundee, in addition to service on the various committees of the Royal Society, the Chemical Society and the Faraday Society. Such duties were supplemented by his cultivation of effective links with industrial research in companies such as Dunlop. His new post brought with it responsibility for the oversight of the fifteen or more governmental applied research laboratories, in addition to the support of pure research programmes in universities through grants to meet the cost of equipment and personnel. During his time at the DSIR there was a very large growth in the financing of scientific research by government. Of prime strategic importance was the provision of research studentships. It was typical of Melville's understanding of university financing at a departmental level that, when asked by the Cabinet Minister to whom he was responsible to suggest something that would enhance governmental standing with academics, he proposed the introduction of the research training support grant whereby an annual grant of £200 accompanied each DSIR research studentship.

A Whitehall reorganisation in 1965 saw the appointment of Sir Harry Melville (he had been knighted KCB in 1958) to the position of first Chairman of the newly formed Science Research Council, a position which he held for two years before moving to his last post as Principal of Queen Mary College, University of London. In 1968 he gave the Betts-Brown lecture in Heriot-Watt University on Science and Government in which his careful analysis and predictions offered a perceptive guide to those academics who wished to develop a realistic view of the policies necessary to support scientific research in universities for the remainder of the twentieth century.

In his position as Principal of QMC his administrative colleagues found him to be unflappable, open to argument yet decisive in judgment. Many academic members of staff rarely saw him; unlike his predecessor he never went to the Staff Common Room. His hard work, carried out behind the scenes, saw the College grow in numbers with expansion in law and economics, and particularly in developments in pre-clinical medical education where the linkage of QMC with St Bartholomew's and the London Hospital, the BLQ scheme of the

1968 Todd Report, was made possible through the acquirement of the adjacent Jewish cemetery for the construction of the necessary new buildings. The pioneering venture of QMC Industrial Research Ltd in 1973, which came to fruition in later years, was a further example of his leadership and continuing contact with industry. Melville was deeply concerned with the financial basis of his college and considered that in the division by Senate House of the block UGC grant made to the University of London, the needs of QMC were not being met. His efforts to change this through his membership of the University Court met with little success.

His final service to the University of London was his chairmanship of the Council of Westfield College from 1977 to 1983, a period marked both by further cuts in the UGC block grant to universities and moves toward amalgamation of some of the smaller colleges.

Although his personal involvement in the direction of research ended in 1956, his interest in polymer chemistry never ceased. He was the moving spirit behind the foundation and the work of the High Polymer Research Group and regularly attended its annual meetings in the Manor House, Moretonhampstead. For many years its Chairman, he last attended as a guest with Lady Melville in 1998. His marriage to Janet Marion Cameron in 1942 was a very happy one; they had two daughters and he was known as a devoted family man. For those who worked with him he leaves the memory of a stimulating personality whose gentle humour was often evident.

I acknowledge with thanks discussions with and contributions from friends, colleagues and associates, particularly Professors B J Aylett, J C Bevington, D C Bradley and T S West, the former Bursar of QMC, Mr W P Richards, the Carnegie Trust and the Headmaster of George Heriot's School, Mr A G Hector.

Brian G Gowenlock

Sir Harry (Work) Melville KCB, BSc, PhD, Hon. LLD, Hon. DCL, Hon DSc (Exeter, Birmingham, Liverpool, Leeds, Heriot-Watt, Essex), Hon. DTech, FRSC, FRS. Born 27 April 1908; Elected FRSE 1 March 1937; Died 14 June 2000.

Christina Cruickshank Miller

29 August 1899 - 16 July 2001

Christina Cruickshank Miller was born in 1899, and when about five years old was very ill with measles and rubella, which progressively and severely damaged her hearing. At primary school she was a good allrounder, excelling in spelling and mental arithmetic. At her secondary school all pupils were taught chemistry and physics, so she never thought of science as a male prerogative. The initial science teaching by untrained teachers resulted in mediocre work by Chrissie, but later tuition by first-class graduates improved her performance dramatically; and she discovered how important an influence a well-qualified teacher can have.

For a female all-rounder good at mathematics, school-teaching seemed the only career open, but was barred by her deafness. A magazine article suggesting industrial analytical chemistry as a career for girls led to her choice of study. She was advised that the Heriot-Watt College gave better laboratory training than the University, but an industrial chemist told her father 'I wish to God I had a university degree'. In 1917 she found she could combine a three-year university course in chemistry with a four-year diploma course at the Heriot-Watt, subject to provisos about ancillary subjects, and examinations to be passed.

Because of the war the three-term courses at the University were compressed into two terms, creating a very heavy workload, exacerbated by the hearing problems, but in spite of this she produced first or good second class results throughout. She was always first in chemistry at the Heriot-Watt, but was warned that at the University there were always some brainy men at the top. She made no comment, but won the class medal. She graduated BSc with special distinction and gained a Vans Dunlop Scholarship, giving her the means to undertake research for a higher degree.

She was so impressed by Professor Sir James Walker that she greatly desired to work under his direction at the University, and saw him in 1920 while still taking the Heriot-Watt course. He told her to learn German and see him again in 1921. She mastered the language during her daily train journeys between Edinburgh and her home in Kirkcaldy. In 1921 she obtained the Diploma in Applied Chemistry and the Associateship of the Heriot-Watt College and had done some research on organic arsenicals and mercurials, in which analysis played an important part.

In 1921-24 she worked under Sir James on diffusion in solution, testing the validity of the Stokes-Einstein Law. She had great difficulty in achieving reliable results, because the chemistry building was still under construction and the facilities were crude or totally lacking. In the diffusion work prevention of convection currents was essential, for which a constant temperature room would be desirable but was not available until two years later. However, she learned a lot through having to use her own ingenuity, aided by Mr Walter Murray, the chief technician 'a genius brimful of ideas' who taught her glass-blowing (with soft soda-glass) so well that she was able to make nearly all the special apparatus needed. The research was successful and resulted in a PhD and sole authorship of a paper in the Proceedings of the Royal Society, London.

She had held a Carnegie Research Scholarship in 1922-24 and was now awarded a Fellowship for two years, enabling her to conduct independent research on a topic proposed by Sir James, namely to find whether the glow exhibited by phosphorus trioxide was responsible for the glow of phosphorus. The first two years yielded two publications, and the Carnegie Fellowship was renewed (unusually) for a third year, but on Sir James's advice she renounced the Fellowship, to accept an assistantship in the Chemistry Department, as a means to achieve her goal of a DSc before she was thirty. She bought a typewriter and taught herself to type, with a view to typing her thesis. The assistantship involved supervising third and fourth year students in the Advanced Inorganic Chemistry Laboratory under Dr Kay, a zealot for accuracy and precision.

The work on phosphorus trioxide continued, with final success in preparation of the pure oxide, which did not glow, and demonstration that the glow hitherto reported was due to traces of dissolved phosphorus. In 1929 she was proposed for promotion to a lectureship and Sir James advised her to submit her DSc thesis in good time. This thesis was said by the external examiner to be the best he had ever read. She graduated DSc (at 29) and was granted the lectureship with tenure. In 1930 she was awarded the Keith Prize by the Royal Society of Edinburgh for her work on phosphorus trioxide. The citation for the award quoted the doyen of inorganic chemistry in this country as saying "I regard Miss

Miller's contribution to our knowledge of this subject as the most important advance made in the last twenty years". Her future was now assured, but earlier in that year a disastrous explosion in further work on the trioxide had cost her the sight of one eye, so that line of work was abandoned. She then turned to a new project in physical chemistry, but finding it too time-consuming to keep up with the rapidly expanding literature in both physical and analytical chemistry she decided to confine all further research to the latter, thus starting on what was the second high point in her academic career, with a long series of very good research students. Emphasis was placed on exploiting reduction in scale of operations in quantitative and qualitative analysis of inorganic samples. This led to an extensive range of research and publications.

After Dr Kay's death in 1933 Chrissie was appointed director of the teaching laboratory, and continuously updated the courses by introducing new instruments and techniques as they appeared, so that all chemistry students received a thorough grounding in analytical chemistry, with emphasis on accuracy and precision. All honours students received training in micro or semimicro quantitative analysis, the best of them being offered courses in organic and/or inorganic microanalysis, and were also used to test the new methods developed by Chrissie's research students. All student reports were carefully read and marked and the results entered in Chrissie's famous 'Black Book', a thick loose-leafbinder containing every result obtained from 1933 onwards, and used for statistical appraisal, and assignment of experiments to student demonstrators.

Besides the teaching and research load, Chrissie's expertise was much in demand for various purposes. During the war she prepared and equipped a laboratory for rapid detection of war gases, devised a scheme for twenty-four of these, prepared all the reagents, and tested the scheme extensively to ensure reliability. She also analysed numerous materials for the War Department, including samples of German origin. Her experience in microanalysis was often of use in examination of trace amounts of materials found in archaeology.

Her career was brought to an untimely end in 1961, when increasing hearing problems and family commitments (her mother and sister were semi-invalids) led her to seek early retirement.

As a teacher, Chrissie took endless care to give everyone the best training she could, spending countless hours at home marking practical reports and correcting errors in grammar, spelling and arithmetic. As a research supervisor she was enthusiastic and encouraging, appearing first thing in the morning to ask the plans for the day, and returning in late afternoon to hear the results. She had a quiet sense of humour, and was unfailingly polite, helpful and never seen to lose her temper (though she admitted to sometimes saying 'Grhhh'). Her memory was prodigious to the end of her life and could yield the name, degree and year of graduation for almost any student she had taught. After Chrissie's death, a 1958 graduate wrote 'She inspired logical thinking like no one else I've ever known; she would encourage endless debate and argument (reserving the option of switching off her hearing aid only in the most extreme of situations').

Chrissie was highly esteemed by many internationally renowned analysts and was noted for the clarity of her speech in public lectures. Her standing was recognised in 1949, when she was the only chemist among the first five women elected to Fellowship of the Royal Society of Edinburgh, and again in 1951 when she was awarded Honorary Fellowship of the Heriot-Watt College and was the only woman among the 25 Foundation Fellows. In 1945 she gave an invited lecture entitled Quantitative Inorganic Microanalysis for University Students, and in 1950 the Sir James Walker Memorial Lecture to the University Chemical Society.

There are many who feel that had she been less self-effacing she would have been one of Britain's first professors of Analytical Chemistry. To work with her was a privilege and a pleasure and to gain her approbation an accolade. She is well worthy of her inclusion in the Rayner-Canhams' book Women Chemists of the Twentieth Century.

Robert A. Chalmers

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Christina Cruickshank Miller BSc, PhD, DSc, FH-WC. Born 29 August 1899; Elected FRSE 7 March 1949; Died 16 July 2001.

Ian Robert Mackenzie Mowat
20 April 1946 - 6 September 2002

The tragic death of Ian Mowat in a hill-walking accident in Glencoe on 6th September 2002 at the age of fifty six shocked the world of librarianship and was a grievous loss to the academic community in Scotland.

Ian Robert Mackenzie Mowat was born in Dingwall, Ross-shire, on 20th April 1946, and educated at Robert Gordon's College Aberdeen. He read history at the University of Aberdeen (1964-1968), and history remained his passion throughout his life, but from the start of his career his chosen profession was that of librarianship. On graduation he took a post of graduate trainee for a year in Glasgow University Library, under Ogilvie MacKenna, before proceeding to the School of Librarianship at the University of Sheffield where he gained the MA in 1969. His first professional post was that of Assistant Librarian in the University of St Andrews under Dugald MacArthur, where he worked on the Special Collections (1970-1972). It was during this period that he began research for the BPhil which he gained in 1972; this led to the publication of his book *Easter Ross*, *1750-1850*: *the double frontier* by John Donald in 1981. He followed this with three years at Heriot Watt University as Assistant Librarian under Alex Anderson, working in the Social Sciences department which was then housed in Edinburgh city centre. In 1975 he was appointed Assistant Keeper at the National Library of Scotland where he was engaged in the compilation of the *Bibliography of Scotland*, and responsible for the publication of the volumes for 1976/77 and 1977/78. His research took him abroad across Europe through Belgium, France, Austria and Switzerland. In all these posts he drew on his training as a historian and a bibliographer and became a well-known and popular figure in the library community in Scotland.

In 1978 he returned to the university sector for his first management post, as Sub-Librarian in charge of Reader Services in Glasgow University where Henry Heaney was now Librarian, and in 1983 he became Associate Librarian, responsible for all aspects of collection management, from book selection to conservation. In Henry Heaney he had an outstanding mentor and the regard was mutual. He began to play a part at a national level, serving for example on committees of the Standing Conference of National and

University Libraries (SCONUL) and of the University, College and Research Section of the Library Association. In addition to his many professional involvements, he made time for more academic interests, in architectural history and in Scottish history.

After eight years of fruitful work there Ian Mowat was well equipped for the senior post in a university library, and in 1986 at the age of forty he became Librarian at the University of Hull, succeeding Philip Larkin who had died in post the previous autumn. There could have been no-one better fitted to rebuild the morale of a grieving staff and to refocus minds on new initiatives. His refreshing humour and friendly manner made him a congenial colleague and with his strong sense of purpose he was an inspiring leader. In Hull he was much involved in developing the first automated library system to be installed there, and in the use of electronic networks. It was in this period that he began to undertake work abroad on behalf of the British Council and UNESCO which brought him a new perspective on the opportunities afforded worldwide, and especially for developing countries, by information and communication technologies. During his career he undertook lecturing, consultancies and reviews in Scandinavia, Eastern Europe, Greece, the Middle East and Indonesia, and maintained contact, especially with Romanian and Polish libraries, until his death. He edited jointly with M. Sliwinska *Library Management: East-West relations* published in 1995. This was one of numerous publications on professional topics.

In 1991 he left Hull to become Librarian and Keeper of the Pybus Collection at the University of Newcastle-on-Tyne, again succeeding a distinguished and popular Librarian, Dr Brian Enright, whose sudden death in post came at a time of significant change for the Library. It fell to Ian Mowat to see through a major extension to the Robertson Library. He was back in a big-city environment, and used the opportunities which it offered to foster collaboration with other higher education libraries including the new University of Northumbria. On the national front he took the Library into the Consortium of University Research Libraries (CURL) as one of the leading research libraries in the country, and he involved himself enthusiastically in the Online Computer Library Center (OCLC), the world's largest bibliographic utility, based in Dublin, Ohio, serving on its Members' Council. Shortly before his death he was elected to the Board of Trustees. He chaired the UK Office for

Library Networking (UKOLN) and was a member of the Joint Information Systems Committee (JISC) of the UK Higher Education Funding Councils, chairing the sub-committee which monitored the non-formula funding made available in the 1990s for research collections. He was much sought as a chairman by library and academic organisations for his quick grasp of issues, his sensitivity to points of contention or of debate, his consummate diplomacy and his ability to manage meetings firmly yet with a light touch.

One of Ian Mowat's great qualities was his friendly relationship with his staff. They admired, liked and trusted him. He always had time to listen and encourage, and took a practical interest in their careers. He too had ambitions: he always wanted to return to Scotland one day, and his prime ambition was to become Librarian to the University of Edinburgh. (In a conference interval once in the early 1990s when a group of his generation was airing professional pipe dreams he turned to me, then holding the coveted office, with a typically mischievous air, and said 'I want your job!', which pleased me greatly.) On my retirement he was delighted to be appointed to the position, and took up office in Edinburgh in February 1997 as Librarian to the University for what he expected to be his last and longest tenure. In the event he had held it for only five and a half years at the time of his tragic death; yet his impact on the Library and the University in that brief time was immense. He moved the Library into a new generation of technical advances; he responded strategically to the growth in student numbers, to diminishing resources for higher education, to the impact of the swing from bound volume to online text in medical and biological sciences, and to their implications for staffing, buildings and resources. He had a genius for collaboration: when a new computer system was needed he worked jointly with the National Library of Scotland to ensure that a shared system was purchased, to the advantage of users of both libraries. He secured major funding under the Research Support Libraries Programme (RSLP) for projects relating to the cataloguing and conservation of Special Collections in his own and other Scottish libraries; he improved the physical effectiveness of the Main Library with redesigned areas and improved publicity. In the counsels of the University at large he played a wise and effective role.

Ian Mowat had a charismatic personality. He inspired trust and affection in those with whom he worked. He had a cheerful, even joyful, demeanour, a sparkling wit, an infectious laugh. He had a positive outlook on life: his enthusiasm and commitment made him a true champion of any cause which he espoused. His knowledge and experience carried weight and brought conviction, and if on occasion he did not win the day, he did not let it rankle, but sought new ways to his goal, which was always to improve support for research and teaching. As the news of his death travelled by email around the world, tributes came from Australia to Alaska, from Poland to Pakistan. He enjoyed his work, but he also enjoyed life out with work. He had been a keen hill-walker from his school days; he enjoyed travel, and family holidays in a cottage in Greece.

It was on a school trip to Paris at the age of eighteen that he first met the girl who was to become his wife, Margaret Louise Jackson. Four years later when he had graduated from Aberdeen University and she from Neville's Cross College, Durham, they were married. The birth of a daughter, Vari, and a son, Simon, completed the family in which he took great delight and pride. Throughout his career he was quick to acknowledge the debt he owed to their constant support.

Ian Mowat was elected a Fellow of the Royal Society of Edinburgh in 1998. It was a well-deserved honour which he greatly appreciated.

Brenda E Moon

Ian Robert Mackenzie Mowat. MA (Aberdeen), MA (Sheffield), BPhil (St Andrews). Born 20 April 1946; Elected FRSE 2 March 1998; Died 6 September 2002.

Mary Jessie McDonald Noble
23 February 1911 - 20 July 2002

Mary Noble passed away peacefully on 20 July 2002 at the Drummond Grange Nursing Home, Lasswade, in an area of Scotland with which she was intimately linked. Her parents were both from Leith, where her father had a chemist and druggist shop at Gladstone Place for over fifty years. Mary was born on 23 February 1911 and it was her father, himself a student in Glasgow of the eminent botanist Professor F O Bower, who introduced Mary to botany. Mary attended Mary Erskine School, before going to Edinburgh University where she gained a B.Sc. with Honours in Botany.

In 1935 she received a PhD under the tutelage of mycologist and plant pathologist Dr Malcolm Wilson, the family of whom she kept in touch with until her death. Her doctorate studies covered mycological aspects of seed pathology, which was to become one of her abiding interests, and her thesis gained her the Gunning Victoria Jubilee Prize of the Royal Society of Edinburgh.

After leaving university she joined the Plant Pathology service of the then Board of Agriculture, which was based at the Royal Botanic Garden, Inverleith Row, Edinburgh. She retired in 1971 as a Principal Scientific Officer, in charge of Seed Pathology and Mycology at what had become the Agricultural Scientific Services of the Department of Agriculture and Fisheries for Scotland, now based at East Craigs, Corstorphine, affectionately called the 'Seed Testing Station'.

In 1968 she became a Companion of the Imperial Service Order in recognition of her scientific work for the Department of Agriculture and Fisheries.

Mary's main activities in her working career were concerned with plant pathology especially aspects of seed pathology. Her abilities and knowledge within her chosen speciality were recognised by her election as a Fellow of the Royal Society of Edinburgh in 1958, and by her service as a Councillor of both the Association of Applied Biologists and the British Mycological Society (BMS). She was a Vice-President of the latter in 1969 and the Editor of the society's *Bulletin* (which is now *The Mycologist*) from 1972-78. She was a member of the International Seed Testing Association's (ISTA) Plant Pathology Committee from 1950-1971, and in 1958 produced, with Drs Paul Neergaard and Jo deTempe, the authoritative *Annotated List of Seedborne Diseases*, a 4th edition of which was published by ISTA in 1990.

Her long involvement with ISTA continued after her 'retirement' and in 1982 she was elected President of the First International Symposium of Seed Pathology held in Denmark, a country with which she had fond connections through her collaboration with Paul Neergaard, Founder and Director of the Danish Government Institute of Seed Pathology for Developing Countries. That organisation provided a springboard for Mary's travels all over the world, where she was a great ambassador for seed pathology, lecturing and running workshops in India, the Philippines, Australia, Argentina, Costa Rica and Israel, an activity which continued after her retirement.

Apart from Mary's ISTA publications, including the development of the *ISTA Handbook of Seed Health Testing*, her scientific publications included several popular accounts of plant diseases. Others, often with collaborators, covered such wide ranging topics as blind seed disease of ryegrass, stem eelworm of strawberry, various cereal diseases, blackleg, verticillium wilt and coiled shoot of potatoes, farmer's lung, and wart disease of potatoes, all of which were of great importance to Scottish agriculture at the time she worked on them. During WWII she spent time surveying flax fields in the West of Scotland to check the health of crops; disease in the flax could have affected linen production, linen being used for covering aircraft wings.

After her retirement Mary's energies were devoted to a much broader spectrum of interests, albeit with mycological connections and started off with a world tour visiting plant pathology institutes and former collaborators. In planning for retirement, she made the move a few years before to be opposite the 19th hole of Broomieknowe golf course, where she had played for many years, and where there is a hole named after her. Eventually her failing knees prevented her playing golf, but the Beatrix Potter story took over.

In 1975 the Botanical Society of Edinburgh (now Scotland) celebrated the centenary of the incorporated Cryptogamic Society of Scotland. It was for these celebrations that Mary researched the life of Charles McIntosh, a well-known and at the time an important Perthshire naturalist who, although employed as a postman working out of Dunkeld, contributed considerably to our understanding of Scottish cryptogams. She brought Mcintosh's great contribution to a much wider audience, and in so doing stumbled across a strong connection with Beatrix Potter. This single event changed the face of 'Potterism', not only in Britain but worldwide, and focused Mary's energies. She reinstated Beatrix Potter in the public domain as a mycologist as well as a popular but at that time rather out of fashion writer of children's books. She demonstrated that Potter was an accurate observer of nature and landscape, a competent illustrator and a very able scientific thinker. Mary was in great demand as a speaker and writer on Beatrix Potter's mycology, and co-authored *A Victorian Naturalist – Beatrix Potter's Drawings from the Armitt Collection* and became Vice-President of the Beatrix Potter Society. She uncovered many outstanding details of information about this amazing lady – it is a shame Mary and she never met!

It does not, however, stop there. During all this time she was active in the Scottish Rock Garden Club, where she developed a passion for heathers and annually grew from seed the endemic Scottish *Primiula scotica*; the Royal Caledonian Horticultural Society; and the National Trust for Scotland.

She played an important role in the establishment of the Suntrap, at Gogarbank, and visited regularly to help staff and deal with enquiries on plant disease and disorders. Her ability to harass and pressurise in a firm but friendly way to right what she felt had been neglected, as exemplified in dealings in connection with Potter and SNT, reaped its reward. No better example than nearer home, where an old cemetery (another of her interests!) of great historic significance had been allowed to fall into ruin. Almost single handedly the importance of the site and those buried there was demonstrated and thoroughly documented, which saw before her death a rekindling of interest in the burial ground, which goes back to the 13th century. One connection with the site was the Drummond family, some of whom emigrated to Australia – and yes, some were botanists, one even a mycologist! The circle is closed.

The scientific and local history communities have been therefore saddened by the death of Mary Noble; indeed the richness of society as a whole has been reduced by a measurable degree. Mary had a vast breadth of information and knowledge, of which only a part was committed to paper. The rest has sadly been lost with her death, especially that relating to interests which she took up with her typical enthusiasm in later years. Mary outlived a single brother John (Eoin) by a few months, and was aunt to Sandra, Gillian, Fiona and Alastair. She will be sadly missed by family and the many, many friends she made in all her walks of life in many parts of the world.

Roy Watling

Mary Jessie McDonald Noble ISO, BSc, PhD, FIBiol. Born 23 February 1911; Elected FRSE 3 March 1958; Died 20 July 2002.

Cecil Wilfred Nutt

27 December 1921 - 12 February 2001

Cecil Nutt was born in Fishponds, Bristol on 27 December 1921, son of Edgar and Ada Nutt. He attended Dr Morgan's School in Bridgwater, Somerset and from there proceeded to study chemistry at Bristol University. After graduating in chemistry in 1942 he joined the Armament Research Department of the Ministry of Supply, part of which was located in Bristol University, and carried out research on plastic explosives. At the end of the war in 1946 he was able to complete his PhD under the supervision of Dr W J Dunning and Professor W E Garner in one year using some of the material from his war work. He graduated PhD in 1947. By this time Cecil had married, in 1944, Betty Legg, whom he had met while still an undergraduate. Betty recalls the hazardous nature of some of the experiments carried out at that time. Cecil published two papers on the physical chemistry of concentrated nitric acid and the heat of its reaction with hexamine.

In 1948 Professor F H Garner was recruiting staff as Head of the Department of Chemical Engineering in Birmingham. On a visit to Bristol to see his brother Professor W E Garner he met Cecil Nutt and so it was that Cecil was appointed to a Lectureship in Chemical Engineering in the University of Birmingham. In 1948 chemical engineering was a comparatively new academic subject and many of the posts were filled by those who had received their earlier training in the established fields of chemistry.

Cecil began to make his name in the fundamental science of chemical engineering. His DSc thesis, in 1963, describes experimental and theoretical researches in a number of fields of chemistry and physics of importance in engineering science. He studied the enrichment of mineral ores by froth flotation. With Professor F H Garner he examined the role of detergent additives in lubricating oils and other properties of mineral oils. He developed a high speed rotor beam apparatus in order to investigate heterogeneous reactions and applied it to a number of diverse reactions. Cecil gained a reputation as a very able experimentalist who enjoyed designing and fabricating his own equipment, including a mass spectrometer. In Birmingham he was promoted to Senior Lecturer in 1958 and Reader in 1962.

In the late 1960s the Department of Chemical Engineering at Heriot-Watt University was in the process of evolution, following its separation from the joint Department with Edinburgh University. Professor John M Coulson of the University of Newcastle upon Tyne was given leave of absence for the year 1968-69, enabling him to become Professor and to give the benefit of his wide experience to Heriot-Watt. Cecil Nutt was appointed as Professor and Head of Department in 1970. At first the Department was based in the old buildings in Chambers Street in Edinburgh but eventually, renamed the Department of Chemical and Process Engineering, it joined the other parts of the University on the Riccarton Campus.

During the 1970s, under the influence of Principal George Burnett and Professor Tom Patten, Heriot-Watt University became increasingly involved with the challenge of North Sea Oil and the Institute of Offshore Engineering was set up with Tom Patten as Director. Cecil Nutt was Convenor of a Faculty Working Party on the Offshore Engineering syllabus in order to identify the features of the subject which would lead to a homogeneous and integrated syllabus from the various traditional disciplines. This interest was continued at a national level in the affairs of the Institution of Chemical Engineers, as Convenor of a Working Party on Offshore Engineering responsible for identifying the impact of these new developments on the training of chemical engineers and on the activities of the Institution. Cecil was Dean of the Faculty of Engineering at Heriot-Watt for a three year period.

Cecil Nutt played a full part in Society and Institution affairs. He initiated the foundation of the Chemical Society Molecular Beam Group and was its Secretary until 1970, becoming Chairman until 1975. He joined the Institution of Chemical Engineers in 1961 and became a Fellow, serving on its Board of Examiners, Research Committee and Scottish Branch Committee. He was a member of the International Committee organising European Symposia on Molecular Beams. He was a Member of the Faraday Society from 1948 until its merger with the Chemical Society to form the Royal Society of Chemistry, and a Member of the Society of Petroleum Engineers.

While at Heriot-Watt the Nutts lived in Linlithgow, in a house overlooking the Palace and Linlithgow Loch. The writer recalls many dinner parties hosted by Cecil and Betty. These parties enabled engineers and scientists, and their wives, to meet in a friendly atmosphere which contributed much to the fostering of good relations within the pure and applied sciences in the University.

In retirement Cecil and Betty Nutt returned to their roots in the west country. Cecil became very interested in genealogy and particularly in the ancestry of the Nutt family. Using his considerable computer skills he traced various sections of the family, mainly in the south-west of England. He was a Member of the Society of Genealogists. Cecil and Betty were also very enthusiastic caravaners and every year took their car and caravan to the Continent; these adventures continued even when Cecil was not very well. In character Cecil Nutt was enthusiastic, generous, modest, and a good friend. He died on 12 February 2001 after a long period of ill health in which he was lovingly supported by his wife Betty. She and their sons Donald and John and their families survive him.

I am greatly indebted to Mrs Betty Nutt, Professor Brian G Gowenlock, Dr Ronnie Long and Dr John E Parker for their help in preparing this memoir.

J Grant Buchanan

Cecil Wilfred Nutt BSc, PhD, DSc, FIChemE, CChem, FRSC. Born 27 December 1921; Elected FRSE 1 March 1982; Died 12 February 2001.

John Stewart Orr
10 August 1930 - 21 October 2001

Stewart Orr, who died on 21st October 2001, was an active, energetic, and helpful physicist, distinguished for both pure and applied research and practice, who greatly assisted medical colleagues, and their patients, most of whom had cancer. He became Professor of Medical Physics in the Royal Postgraduate Medical School, Hammersmith Hospital, and was soon known internationally for his accomplishments in cell and radiation biology, radiotherapy, imaging, and information technology.

He was born in Milngavie, near Glasgow, on 10th August 1930, second son of Neil Orr, a well known Glasgow lawyer, and lived there for all his life except for his highly productive period in London between 1977 and 1985. He went to Atholl school first, then to Glasgow High School, and lastly to the University of Glasgow where he gained a BSc in Physics. Stewart spent a year as a conscript in the British Army, remaining a private; although on one occasion, when there was a fire at night in his barracks, he displayed better leadership than some of the NCOs and officers, by organising systematic chains of buckets of water to put out the fire.

He worked first with Barr and Stroud, an enterprising Glasgow manufacturer of scientific instruments, who had earlier collaborated on the development of ultrasound as a diagnostic method to be used in medicine. He worked mainly on semi-secret defence projects concerned with infra-red radiation and missile guidance. Stewart undertook fundamental research, and devised "Orr's Spherule" as a teaching tool. He met Jean Williamson, their wedding soon followed, and they had one daughter and three sons. At that time, medical physics was expanding substantially in the West of Scotland under the redoubtable JMA Lenihan, who built up a large unit in the old Children's Hospital building, eventually having three hundred staff. Stewart was recruited by Lenihan as Senior physicist in 1960, working first at the Western Infirmary, and then later also at Belvidere hospital, on the technology of x-ray diagnosis and of radiotherapy. I first met him in 1966, and he was an invaluable friend, colleague, and helper, on the radiotherapy of cancer, on an abortive effort with Bob Lawson on the value of Neutron therapy using a new type of generator (from Manchester), on diagnosis and treatment using radioactive isotopes, and on research, especially in radiation biology, with Professor Tony Nias.

Like JMA, he would take up any medical problem, apply a fresh mind to it and produce new ideas for its solution. Publications began to flow from him in about 1968, beginning on thyroxine (thyroid hormone) kinetics, moving on to the concept of the 'Occupancy principle'. The latter was a useful model to enable assessment of the quantitative distribution of a compound, whether radioactive or stable, in different parts of the body; the method was also useful in detecting radiation damage. Blood cell kinetics was then studied in the same kind of way.

Every one of Orr's publications came from collaboration with other scientists or physicians, whose names were all cited, even though the first draft and most of the work frequently came entirely from him. He won over even the most old fashioned medical colleagues to the need for good science and statistics, and to regard physicists as equal partners rather then underlings. He was promoted to Top grade physicist in 1975 in charge of the radio-therapeutic physics division with a staff of 15 physicists and 12 technicians. He had gained his Glasgow DSc. in 1971, his thesis was entitled *The Kinetics of Biological processes and of Radiation effects*; it quoted over 60 publications. He used computers in the days when they were bulky, about twenty times as expensive as now, and similarly less powerful. Nevertheless they were well used under Stewart's guidance not only for radiation dosage calculation and treatment planning, but, more ambitiously, he and other physicists made a brave attempt at 'computer optimisation' of treatment planning so that there should be maximal tumour dose and minimal side effects.

In 1977 Stewart moved down to London to become Professor of Medical Physics at the Royal Postgraduate Medical School, Hammersmith Hospital, where he found great scope and new fields to study. Magnetic resonance imaging (MRI) was being developed there, its complex mechanism began to be elucidated, and he became involved in a European Commission project to assess its possibility in quantitative as well as diagnostic investigations; his work being under the auspices of the Department of Health. He was the main author of several of the seminal publications regarding MRI. His second major topic was wider use of the computer, building on his earlier work in Glasgow. Computers were installed not only in the departments of physics and of radiation oncology, but also in virtually every other department of the hospital and medical school, for medical reports and records, for imaging of all kinds, for research, and for word processing.

He left the Royal Postgraduate Medical School in 1987 as Emeritus Professor and returned to Glasgow as an independent consultant, continuing his European work on MRI, and on computing. One very important new subject was the coding and classification of medical terms, specifically relating to radiation oncology. Another fresh topic was the harmful effects of environmental radiation, especially carcinogenesis and leukaemogenesis. He played a major part in the assessment of this problem as a member of the Black Committee and of COMARE, the Committee On the Medical Aspects of Radiation. He had been elected President in turn of the Hospital Physicists Association and of the British Academy of Forensic Science, and had also been elected to Fellowship of the Institute of Physics and of the Institute of Physics and Engineering in Medicine. He was elected FRSE in 1976.

Stewart had been keen on hill walking and on mountaineering from childhood, and also on sailing off the West coast of Scotland. He had a great sense of humour and enjoyed life with his family and with many friends of every kind, who will miss him greatly.

Keith E Halnan

Acknowledgement is due to Professor John R Anderson and to the Orr family for assistance in composing this obituary.

John Stewart Orr BSc, DSc, FInstP, FInstPE M. Born 10 August 1930; Elected FRSE 1 March 1976; Died 21 October 2001.

Lord Polwarth

17 November 1916 - 4 January 2005

As a general rule successful business leaders do not make good ministers.

Harry Polwarth was an exception. In the short time that he was Minister of State at the Scottish Office, from 1972 to 1974, he played a crucial role in establishing a sound basis for the North Sea oil industry.

He had succeeded his grandfather as a 27-year-old in 1944. The ninth Lord Polwarth had been the enlightened chairman of the General Board of Commissioners in Lunacy in Scotland (a long-forgotten institution now but then very important), so continuing in a tradition of public service dating back to the creation of the Polwarth barony by William and Mary in 1690.

His grandson took very little part in the House of Lords, however, until Ted Heath appointed him to the Scottish Office. As a political opponent in the Commons, representing part of central Scotland suffering at that time from dire economic problems, I know at first hand that Polwarth was a constructive, effective, ever courteous and helpful minister who, once he said he would take a certain action, unfailingly carried it out. Many of my Labour parliamentary colleagues from Scotland had a similar favourable impression of the aristocratic peer when it came to helping their constituency problems.

Harry Hepburne-Scott was born in one of those tall buildings dominating the Edinburgh skyline just to the east of Edinburgh Castle, overlooking the ornate building which is the headquarters of the Bank of Scotland, over which he was to preside as Governor from 1966 to 1972.

His father died at the age of 52 as a result of illness contracted during the First World War and it was thus that Hepburne-Scott succeeded to the peerage as Lord Polwarth and was chosen as one of the 16 Scots Representative Peers.

After Eton, where he was in College, he went to King's College, Cambridge, where, I think, he was the last surviving pupil of John Maynard Keynes. His immediate supervisor Richard Kahn, whose seminal paper on the multiplier effect was so crucial to Keynes's General Theory, told me in 1972, "Harry Hepburne-Scott was the cleverest aristocrat whom I ever supervised." On leaving King's he studied accountancy in Edinburgh with Chiene & Tait, before volunteering in 1939 for the Lanarkshire Yeomanry.

He soon changed to become a captain in the Lothians and Border Yeomanry, who at that time were changing from horses to somewhat primitive tanks. In 1941 he was picked out by Maj-Gen (later Sir) Percy "Hobo" Hobart, who had been Inspector of the Royal Tank Corps and Director of Military Training at the War Office, as his ADC, later serving in the same capacity to Maj-Gen (later Lt-Gen Sir) Brian Horrocks. He was thus at the centre of military activity from Alamein to the action on the Rhine at Osterbeck when British tanks tried desperately, but in vain, to rescue the paratroopers who had dropped at Arnhem. Polwarth told me many years later that, in all his experience as a key aide to those who were planning D-Day and beyond, the failure to save those who had dropped at Arnhem was the greatest regret of his life.

After the Second World War he took his seat in the House of Lords, but concentrated on his business career. From being a partner in Chiene & Tait, he became director of General Accident Fire & Life Assurance Corporation, of which he was to be chairman in 1968-72. From 1969 to 1972 and from 1974 to 1981 he sat on the main board of ICI. He was also involved with the huge American company of Halliburton, made famous in recent times by the American Vice-President Dick Cheney.

From 1955 until 1972 Polwarth was the Chairman and then President of the influential Scottish Council (Development and Industry). Their director in those years, Willie Robertson, recalls:

"In 1955, at a relatively young age and comparatively inexperienced, he succeeded the heavyweight Lord Bilsland as chairman. He equipped himself very quickly with a considerable knowledge of the essence of the industrial situation in Scotland and proved to be an admirable leader of a team. His ideas on regional policy following the 1961 report of Sir John Toothill were influential not only in Scotland but throughout the north and south-west of England".

One of Polwarth's gifts was the capacity to translate non-political recommendations into effective political action. He was very good indeed in leading delegations to ministers, both Conservative and Labour. He was also a crucial supporter in the early stages of the University of Stirling at a time when serious people such as Sir David Phillips were thinking of closing it.

In 1972 he was chosen by the then Secretary of State for Scotland, Gordon Campbell, to be his Minister of State in the Scottish Office. Campbell says he chose Polwarth because "he would bring his great business expertise into government. And so he did." Another in a position to know, the future Governor of the Bank of Scotland Sir Thomas Risk, recollects:

"I was a director of the British Linen Bank and know of the considerable part that Polwarth played in the merger between the Bank of Scotland and the British Linen Bank. At close quarters I saw his enthusiastic support of the new merged banks' innovatory role in developing for Britain the techniques for financing the exploitation of North Sea oil. Polwarth, and Bruce Pattullo (another future Governor of the Bank of Scotland), who worked under Harry, were responsible for British success in financing the risks of the North Sea."

Professor Gavin McCrone, Chief Economic Adviser at the Scottish Office from 1972 to 1992, travelled a lot with Polwarth. "I got to know him as well as any civil servant gets to know a minister," he says:

"He had the interests of Scotland at heart. Albeit by no means a rich man he gave up the governorship of the Bank of Scotland and the chairmanship of General Accident in order to become Minister of State. The reason was simply that he saw it as a public duty for which he was prepared to sacrifice a considerable part of his salary."

Polwarth made his maiden speech as a minister in the House of Lords on 25 April 1972 on the third reading of an obscure administration measure. He was followed by Lord Hughes, the former Lord Provost of Dundee, who was a long-time minister in the Wilson and Callaghan governments. Hughes paid Polwarth the compliment of being "too effective" a spokesman for the Tory government. He was respected and well received, partly on account of his exquisite good manners and partly on account of his formidable reputation as a businessman by all sides in the Lords. One Labour peer told me with a sigh that they couldn't be more effective against Polwarth because "accountants rule the world".

As a baptism of fire Polwarth had to deal with issues of Town and Country Planning, which are mightily complicated for any politician. He proved himself a master of detail, and his training as an economist was put to excellent use. Considering the economic challenges of the time, not least the industrial consequences of a three-day week, Polwarth maintained the respect of the trade unions in Scotland - a remarkable feat, given the extreme temperature created by unemployment north of the border.

On the defeat of the Conservative government in 1974 Polwarth resumed his business career, particularly involving himself with the Sun Life Assurance Company of Canada. He found time, too, for other interests such as the Franco-British Council. He had been a passionate supporter of British entry into the European Community and, as the last surviving Labour MP who went in to Ted Heath's lobby in October 1971 to enter the Common Market, I recollect sharing pro-European platforms where he was clearly an unflamboyant but most effective and authoritative speaker.

From 1975 to 1979 he not only was chairman of the Scottish National Orchestra Society but was credited with saving it from economic bankruptcy on at least a couple of occasions. After leaving ministerial office he took a deep interest in the Scottish Forestry Trust and in Aberdeen University, of which he was Chancellor for 20 years from 1966.

Tam Dalyell

Henry Alexander Hepburne-Scott, chartered accountant, businessman and politician: born Edinburgh 17 November 1916; succeeded 1945 as 10th Baron Polwarth; a Scots Representative Peer 1945-63; partner, Chiene & Tait 1950-68; Chairman (later President), Scottish Council (Development and Industry) 1955-72; Governor, Bank of Scotland 1966-72; Chancellor, Aberdeen University 1966-86; chairman, General Accident 1968-72; Minister of State, Scottish Office 1972-74; Chairman, Scottish National Orchestra Society 1975-79; Chairman, Scottish Forestry Trust 1987-90; married 1943 Caroline Hay (died 1982; one son, three daughters; marriage dissolved 1969), 1969 Jean Jauncey (nee Cunninghame Graham; two stepsons, one stepdaughter); died Hawkchurch, Devon 4 January 2005.

The Independent, Obituaries, 8 January 2005

Hubert Lloyd David Pugh
11 May 1914 - 17 February 2005

Dr H L David Pugh, renowned internationally for his researches into metal forming and high pressure, died on 17 February 2005. He was born on 11 May 1914, the son of a Welsh tin plate worker.

After graduating from both the University of Swansea and University College London, he carried out research in the Second World War at the Road Research Laboratory. During this period he was associated with the great physicist, Professor Max Born, and jointly they were awarded the Telford Prize of the Institution of Civil Engineers in 1941.

After the war, David was appointed Head of the Plasticity Division of the newly created Mechanical Engineering Laboratory of DSIR, which became the National Engineering Laboratory, NEL. After a period of planning in *ad-hoc* accommodation in London, NEL moved into new laboratories in East Kilbride in Scotland, where David moved in 1951.

At NEL, David initiated researches into cold forging and other metal working processes, but his real love was in high-pressure research. He followed in the footsteps of P W Bridgman, a Nobel Laureate and internationally famous for his high-pressure researches. He was involved in the design and development of equipment to examine the effect of high-pressure on the mechanical properties of metals, and in particular to study and develop hydrostatic extrusion of metals and wire drawing under pressure. For a time, hydrostatic extrusion and wire drawing held high promise of commercial exploitation, but in the end they proved to be economically non-viable. David was the first in the UK to produce artificial diamonds under high-pressure and high-temperature, following the Swedes and the Americans in the mid nineteen-fifties.

During his lifetime David received many prestigious awards including the W. H. A. Robertson Medal of the Institute of Metals for a paper on hydrostatic extrusion, and the JSTP International Prize for Research and Development of Precision Forging. He authored many papers and books including the Bullied Memorial Lecture of Nottingham University, which is a high-pressure engineer's bible. He was also a member and officer of several international societies and organisations, and had been involved in the planning of many international conferences. In the seventies he was appointed the Republic Steel Distinguished Visiting Professor at the Case Institute of Technology, Cleveland, Ohio. He was elected a Fellow of the Royal Society of Edinburgh in recognition of his scientific contributions.

After retirement from NEL, David moved to Bristol, where he continued to contribute to learned societies, and he was also for some years a consultant on materials and forming processes to the Bristol Division of Rolls Royce. As a Welshman he had a great love of Rugby Football and his son noted in his father's diary for 5 February 2005, Wales 11, England 9. I guess he died a happy man.

Professor Sir Bernard Crossland

Hubert Lloyd David Pugh DSc (University College London). Born 11 May 1914; Elected FRSE 7 March 1977; Died 17 February 2005.

John Alan Richardson
10 November 1918 - 3 December 2000

Dr John Alan Richardson, who has died aged 82, married Jean Irving Wylie in 1946. They had a son and two daughters, all of whom survive him. He spent his entire academic career in the Department of Botany at the University of Newcastle upon Tyne (previously King's College in the University of Durham) and was a pioneer in research into the problems of industrial land reclamation. He graduated from King's College in Botany and Physics in 1940 and spent the War years first as an Anti-Aircraft Radar Officer and later as a Captain in the Royal Electrical and Mechanical Engineers. At the end of the War he returned to King's as a member of the staff of the Botany Department until he retired in 1984.

Alan Richardson, as he was universally known, was one of a small select band of botanists around the country who had taken physics as a major component of their degree and who brought fresh insights and understanding into physiological investigations of plants. Alan's expertise in the field led to the first major review of the interaction between these two subjects entitled *Physics in Botany* (Pitman, London).

His home town of Birtley in County Durham, where he lived for all of his life, was notable for the number of enthusiastic and very knowledgeable naturalists who held frequent meetings and field excursions into the biologically rich and diverse habitats which were easily accessible within a short distance. The leading light at this time was Professor J.W.H. Harrison who stimulated Alan's interest in the local Magnesian limestone area and its vegetation, where he later carried out detailed studies over many years. One outcome was the recognition of the importance of the outstanding Magnesian limestone grassland at Thrislington, Co. Durham, which ultimately became a National Nature Reserve. Alan studied the re-colonisation of abandoned limestone quarries and, from this work, developed a preoccupation with other industrial sites such as clay pits, ironstone and limestone waste heaps and, most importantly, colliery spoil heaps. The work initially involved detailed ecological and physiological surveys of such sites and, to further such studies, Alan and his students developed several instruments such as a portable automatic soil-temperature recorder and a micro-homogeniser. From these surveys, techniques were developed for the large-scale reclamation and landscaping of derelict sites to merge them with their surroundings. This was of great practical and aesthetic importance in the coastal belt of County Durham and part of Northumberland which, when the work began, was liberally peppered with seemingly innumerable, unsightly and bare colliery spoil heaps.

Much of the initial work had been done by the Coal Board on an *ad hoc* trial-and-error basis and it soon became apparent that not all attempts were equally successful. Alan's pioneering research led to the development of suitable planting methods and the selection of appropriate trees and shrubs to colonise these sites. He also undertook long-term surveys of the sites, assiduously measuring such factors as the growth of woody species over a period of a quarter of a century or so. Some results were unexpected; for example, he showed that alder, a favourite tree of Coal Board planting, did well in the initial stages but was then out-performed in growth and vigour by other species. It is hard to overestimate the value of such reclamation work - it has been of enormous benefit to the region and has transformed the scenery. Nowadays there is very little evidence left of the great industrial eyesores which only a few decades ago disfigured the two counties. There has even been a suggestion latterly that a spoil heap should be preserved in its original ugly state as part of our industrial heritage!

In recognition of his work in this field he was made a Secretary of State appointee to the North East Forestry Advisory Committee (1970-1975) and to the Northumberland National Park Committee (1973-1980). He was also President of the Newcastle branch of the Institute of Groundsmanship.

Alan gained a MSc and PhD and played a full part in the life of the University, serving not only on many academic committees but also as Treasurer of the Students Representative Council from 1946 to 1954. He spent much time and effort giving help and advice to students during his period as Assistant Senior Tutor in Science from 1976 until his retirement in 1984. In addition to these activities, he was Examiner in Biology in the Institutes of Education of Durham (1964-1967) and of Newcastle (1967-1970). He also served for many years as Examiner in Biology for the Cambridge local Examinations Syndicate and for the Joint Matriculation Board. For many years he was editor of the *Proceedings of Durham* (and later, *Newcastle*) *University Philosophical Society*. The very successful textbook, *Plant Physiology* (Churchill) by Meirion Thomas was first published in 1935 and underwent several reprints and editions, becoming the plant physiology "bible" of botany departments throughout the country and many parts of the world. The fourth (1956) and fifth editions (1973) were revised and greatly expanded with contributions from Alan and S L Ranson.

Alan had a consuming interest in athletics from school days. As a student he was an outstanding sprinter and became King's College Captain of Athletics in 1939. Subsequently he expanded his interest in, and support to athletics at all levels. He was President of the Chester-le-Street Athletics Club, Chairman of the North East Counties Amateur Athletics Association (1956-1990) and Life Vice-President of the Northern Counties Athletic Association. He also served nationally as a member of the A.A.A. General Committee for 20 years from 1968 and was a Secretary of State appointee to the Northern Sports Council (1964-1976). In recognition of his services he was awarded the Queen's Jubilee Medal in 1977 and appointed a MBE in 1980. Virtually all athletic events held locally, whether at school or international level, were assured of his presence and whole-hearted support and he was a track official at local and national events.

Birtley is a close-knit township that has produced many outstanding characters in all walks of life. Here Alan was known affectionately as "The Doc". His civic sense of duty saw his appointment as Justice of the Peace from 1968 and Deputy Chairman of Magistrates from 1976 to 1988. He was a leading light in the local natural history society and served as president of the Northern Naturalist Union in 1956. He contributed a gardening column to a local publication, writing humorously in the form of tales about Gladys and her friends at the gardening club. Injecting humour into his writing, conversation and lectures was typical of him and he was well known as a raconteur with a dry sense of humour and an appropriate anecdote whatever the occasion. There is no more fitting epitaph for Alan than to reprint a letter that he had published in the Daily Telegraph entitled Parting Shot:

"Sir, your obituary of Mario Zacchini reminded me of the comment of the circus owner when told that his human cannonball had died: This is a sad loss. Men of his calibre are hard to find."

Alan Davison and Trevor Walker

John Alan Richardson MBE, MInstP. Born 10 November 1918; Elected FRSE 7 March 1977; Died 3 December 2000.

James Henderson Sang

4 November 1912 - 10 February 2002

James Henderson Sang, who died on February 10th 2002, was born in Aberdeen to Scottish parents of slender means on November 4th, 1912. He received his secondary education at Robert Gordon's College, at a time when no biology was taught at school and science teaching, apart from chemistry, was very general. His interest in biology was encouraged by membership of the Aberdeen and District Working Mens' Natural History Society, whose ardent naturalists made regular forays into the countryside in search of insects, birds and plants. Naturally enough, in the Scottish context, he headed for Aberdeen University and a First Class Honours degree in Zoology in 1933. During his undergraduate career he was greatly influenced by working with Professor J. R. Macleod, Nobel Laureate of insulin fame, who, being arthritic, enlisted the assistance of able students. He profited also from the wide-ranging biological knowledge of James Ritchie, who occupied the Regius Chair of Natural History.

After graduating, he continued research for a year or so at Aberdeen with the aid of a Kilgour Scholarship and then, in 1937, a Hutchinson Research Scholarship took him to St. John's College, Cambridge and a PhD. His post-graduate research was devoted to an analysis of the ecological determinants of population growth in *Drosophila melanogaster*. This led to a series of papers, published mostly in *Physiological Zoology*. In 1938 he returned to Aberdeen as a Carnegie Senior Research Scholar and the following year was appointed Assistant Lecturer in the Department of Natural History, where Professor Lancelot Hogben, had succeeded Ritchie. It was in 1939, as a student in Hogben's department, that I first got to know Jimmy Sang. He subsequently supervised my Honours thesis and we became firm friends and remained so until his death.

The period 1939 – 1942 was very productive for Sang's research. He teamed up with Cecil Gordon, a bright South African post-graduate whom Hogben had got to know during his time as Professor of Zoology at the University of Cape Town and had enticed to the U.K. Gordon and Sang analysed the effects of diet on the variable expression of the gene 'Antennaless'. In this mutant, whether the antennae are entirely absent, perfectly normal or display one or other of every kind of intermediate between these extremes, depends on environmental, especially nutritional, conditions. Hogben, who had published his Nature and Nurture in 1933, recognised this work as a dramatic, experimental demonstration of the inter-play between heredity and environment. Published in 1941, the Gordon and Sang paper on Antennaless never received the recognition it merited, partly because it was published in the *Proceedings of the Royal Society (B)*, a journal which, at that time, was quite unfamiliar to American geneticists and partly because of preoccupation with the War.

In the latter part of 1942 Sang left Aberdeen for war-time operational research. First as Assistant Director for Aircraft Equipment, Ministry of Aircraft Production, and later, 1945 – 48, as Liaison Officer Directorate of Operations, Air Ministry, and Statistician (Civil Service), Ministry of Aircraft Production and subsequently in charge of the Factories and Airfields Branch, Ministry of Supply. His biological training and research experience stood him in good stead when often faced with conflicting demands in the allocation of resources.

In 1948 he returned to academic life as Principal Scientific Officer in the Agricultural Research Council's Animal Breeding and Genetics Organisation, which was based in Edinburgh. Professor C.H.Waddington of the Buchanan Chair of Genetics, University of Edinburgh, was a major player in the negotiations about how the organisation was to develop. Sang took on the job of general supervision of the affairs of the Institute of Animal Genetics, which housed the scientific staff of the Organisation. This led to probably the most traumatic period of his professional life. Sang, a man of unqualified probity, with a very clear perception of the duties and obligations of scientists employed in the public service, found cause for concern. At the same time there was a clash of aspirations and ambitions among various members of staff. This led to a polarisation of attitudes and eventually to a confrontation with Waddington on the part of about half the scientific staff, with Sang as chief protagonist. For all concerned this involved a period of acute stress which was finally resolved by a top-level A.R.C. enquiry. This came down in favour of Sang's case against the way affairs had been handled and a paper to that effect was sent around the scientific staff. Subsequently, the animal breeding division was hived off as a separate body, while the experimental geneticists were incorporated in the Unit of Animal

Genetics, under Waddington's supervision.

In 1951 Sang moved, as Senior Principal Scientific Officer, to the adjacent A.R.C. Poultry Research Centre where he became Assistant Director in 1958. During his period in the Institute of Animal Genetics and the Poultry Research Centre, he continued his studies on *Drosophila* nutrition and in 1956 published the important paper entitled *The Quantitative Nutritional Requirements of Drosophila melanogaster*, which demonstrated, for the first time, that it was possible to rear *Drosophila* axenically on an entirely chemically defined medium. This was followed by a series of papers, often with different collaborators, which exploited the new technique to discover how particular alterations in nutrition can affect the expression of mutants like Eyeless, and Abnormal Abdomen, influence the development of melanotic tumours and demonstrate the role of folic acid in oogenesis.

In 1965 he was offered a professorship in the biology school of the University of Sussex, where he alternated as Dean of the School of Biological Sciences with John Maynard Smith. This appointment opened the way to a most productive and influential period of academic life, enabling him to create a research school dedicated to the study of *Drosophila* development. Working with successive post-graduates, who often went on to achieve academic distinction, he developed methods of manipulating early embryos, studied the *in vitro* differentiation of larval cell types, perfected the cell culture of individual embryos, studied the extrachromosomal replication of copia-based vectors in cultured *Drosophila* cells etc. This final phase of his research career illustrates how successfully he took up the new methods of molecular biology to tackle, at a deeper level of understanding, problems which he had contemplated many years previously.

In 1959 Sang was elected Fellow of the Royal Society of Edinburgh. At various times he served as member of Council of the Society for Experimental Biology, as Chairman of the Poultry Breeders' Roundtable and also as member of the Editorial Board of the *Quarterly Review of Biology*, and was a Life member of the Genetics Society of Great Britain.

He retired in 1979 but, of course, that did not mean he stopped working. A clutch of collaborative papers followed on transfected *Drosophila* cells, the expression of an Epstein-Barr nuclear antigen, the transcriptional control region of the copia transposable element etc. In 1984 he published *Developmental Genetics* in the McGraw- Hill Encyclopaedia of

Science and Technology and also in the 1992 edition. In 1984 he published *Developmental Genetics* (Longman, London). He contributed some dozen reviews to the *Quarterly Review of Biology*, as well as articles in *THES*. and *The New Humanist*.

So much for the historical facts of his life but what of the man? From his student days, when he used to tour the Aberdeenshire countryside giving popular science lectures for the Workers' Educational Association, Jimmy Sang was a man of the Left, always committed to the welfare and aspirations of ordinary working people. He was among the first to join the British trade-union for scientists, the Association of Scientific Workers, which evolved into the present-day Association of Scientific and Technical Managerial Staffs (ASTMS). Always a union man, he was also an active member of the Association of University Teachers. Both in ASTMS and AUT he was elected Chairman of the local branches. During and after the War he was associated with the 'Visible College', a group of left-wing scientists, including J.D.Bernal, J.B.S. Haldane and H. Levy, who were concerned that science and technology should be effectively applied in the rebuilding of the country.

Jimmy Sang was a quiet and unassuming person whose critical acumen in the affairs of science was matched by an equally discriminating approach to daily life. He had an unerring ability to detect the feet of clay and the specious pretension. As his colleague, Dr Robert Whittle aptly observed in his *Guardian* tribute, Jimmy Sang was 'an unwavering conscience, never an easy companion but always a worthwhile one'.

He suffered from bouts of ill health and, in the 40s, underwent a major stomach operation. However, these slings of misfortune were borne with philosophical resignation. It is a pleasure to record that he enjoyed a happy family life. His wife Pauline Caddy, whom he met at Cambridge and married in 1941, had a wonderfully irreverent sense of humour and fully shared his political views and his lively interest in the arts. Sadly she died in 1993. Together, they provided a stable and civilised environment for their two sons and a daughter, who has followed in her father's footsteps as a distinguished, research geneticist.

Jimmy Sang had a long and fruitful career. In spite of physical frailty during his last years, he retained his intellectual acuity to the very end. He started his research career when the nature of the gene was a topic of philosophical debate and ended it applying the most sophisticated techniques of molecular biology. His work on *Drosophila* nutrition and development opened new avenues of research. He played a full part in academic life and professional affairs. He passed on his wisdom, experience and friendship to many postgraduates who know how much they owe to him. What better epitaph for a scientist?

Forbes W Robertson

James Henderson Sang BSc, PhD. Born 4 November 1912; Elected FRSE 2 March 1959; Died 10 February 2002.

Dame Sheila Patricia Violet Sherlock

18 March 1918 - 30 December 2001

Dame Sheila was born in Ireland and educated at Folkestone Grammar School. When she graduated from Edinburgh University with honours in 1941 she was the Ettles Scholar of her year and went on to spend a year as clinical assistant to Sir James Learmonth in Edinburgh.

She moved to London and worked at the Hammersmith Hospital before going to Yale University on a Rockefeller Fellowship. In 1948, at the age of thirty, she was appointed lecturer and honorary consultant physician specialising in hepatology at the Hammersmith Hospital and Post-graduate Medical School and three years later was elected FRCP, by far the youngest woman to be elected to the College. In 1959 she moved to the Royal Free Hospital and Medical School, retiring in 1983. Her department of hepatology was internationally famous as a centre for research and teaching. Sheila Sherlock was one of the founders of modern hepatology. She was exceptionally talented with a remarkable memory, strong intellect and the capacity to anticipate where the next advances in her discipline would occur. Her contributions to the study and clinical management of liver diseases were many and of fundamental importance.

She pioneered the use of percutaneous liver biopsy, elucidated the mechanism of portal hypertension, and was one of the first to appreciate the importance of immunological mechanisms in the pathogenesis of cirrhosis and hepatitis. After retiral she moved to the Department of Surgery where she worked, wrote and maintained her extensive international connections. She wrote *Diseases of the Liver and Biliary System* which ran to eleven editions and has been translated into several languages.

She was the first woman to be appointed Professor of Medicine in the UK and the first to be appointed Vice-President of the Royal College of Physicians. She was the recipient of numerous fellowships and honours and was appointed a DBE in 1978.

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Dame Sheila Patricia Violet Sherlock MB, MD, FRCP, FRCPE, FRS. Born 18 March 1918; Elected HonFRSE 6 March 1989; Died 30 December 2001.

Norman Willison Simmonds
5 December 1922 - 4 January 2002

Professor Norman Simmonds died at the Royal Infirmary, Edinburgh on 4 January 2002. One of four children, with a non-identical twin brother, Ralph, his father was a civil servant and his mother came from a Perthshire farming family, from whom he took his middle name. The family moved around in his early years, largely as a result of his father's career. By the time he entered secondary education, the family was established in Croydon, and he attended Whitgift School from 1934 to 1940.

At school he was stimulated, as were so many budding botanists, by a gifted notable teacher, Cecil T Prime. Norman Simmonds recognised this debt to C T Prime in 2000, when he contributed a small piece to the School Magazine, *The Whitgiftian,* under the title of "Prime's People". This piece listed over twenty distinguished biologists who had studied the fundamentals of their subject at Whitgift School, all of whom were eager to acknowledge the stimulation they had received at school under Prime's guidance.

He won an Open Exhibition (Scholarship) to Downing College, Cambridge where he was much influenced by Professor D G Catcheside who encouraged his interest in genetics and cytogenetics.

After a distinguished undergraduate career, he was awarded a First class degree in the Natural Sciences Tripos part II (Botany - but with a strong bent to genetics and plant breeding). In 1943 he was granted a Colonial Agricultural Scholarship and studied at Cambridge and the Imperial College of Tropical Agriculture (ICTA) in Trinidad and in 1945 was awarded AICTA. This award was to be followed by others from Cambridge, an MA in 1948 and a ScD in 1966.

The introduction to tropical agriculture afforded by the time spent in Trinidad was the start of a life-long interest in the crops and needs of developing societies. He stayed in the West Indies until 1959, initially as lecturer in Botany at ICTA and latterly as Senior Cytogeneticist in the Banana Research Scheme and became established as a vigorous researcher, initially with K.S.Dodds, developing a banana breeding strategy through constructed diploids crossed to triploids. This was also the time when he started to develop ideas on genetic resources, conservation and utilisation following two major collecting trips to East Africa (1948) and the Pacific, Malaysia, Thailand, and North India (1954/55). Material from those trips is still of value almost fifty years later but at that time led to enhanced evolutionary understanding of the group.

This extensive experience led to two key books, the standard monograph *Bananas* (1959,1966,and with R.H.Stover in 1987), long regarded as the banana researcher's bible, and *Evolution of the Bananas* (1962) in addition to 40 papers published during his period in Trinidad.

In 1959, Norman returned to the United Kingdom as head of the Potato Genetics Department at the John Innes Institute at Hertford, rejoining K.S.Dodds, the then Director. He characteristically threw himself into research on potatoes, publishing an array of papers covering tuber dormancy, seed germination, polyploidy, callus differentiation, virus transmission, chimeral and other mutants, linkage studies and disease resistance.

It was during this time that he developed the concept of base broadening, now found to be of fundamental importance and effective for potatoes. This proved to be a valuable recurring theme in much of his later more reflective work as it became accepted that such approaches had general applicability to a very wide range of crop species. It was one of Norman's rare regrets that, while his ideas on base broadening received wide theoretical acceptance, there was relatively little take-up of the concept in practice except in those crops where he had an opportunity to influence direction and approach, namely sugar cane, oil palm and rubber.

Other important changes in Norman's life occurred during this very busy period, most important of which was the willing change from bachelor to married man as Christa entered into his life. She was to remain at the centre of his life, a loyal and supportive partner, until his penultimate year.

For the third period of his professional life Norman Simmonds moved northwards nearer to his family roots when in 1965, he accepted the post of Director of the Scottish Plant Breeding Station, then at Pentlandfield on the outskirts of Edinburgh. This was a demanding role necessitating considerable administration and committee work, a requirement which Norman found irksome as it left little time for personal research and many of the ideas that he had initiated at the John Innes Institute had to be left for others to pursue.

It is probably true that Norman was never really attracted to management matters but he did find the time to re-establish his education links *via* various teaching initiatives with the Botany Department of the University of Edinburgh. These initiatives continued into the final phase of his career when he joined the staff of the Edinburgh School of Agriculture in 1976. This return to academia allowed Norman time for reflection and writing. During his active career he had built up a wide circle of friends and acquaintances. He recognised that the knowledge of a breeder of one crop could have benefits for workers dealing with other crop species. This culminated in the book, *Evolution of Crop Plants* (1976, now in second edition, Smartt and Simmonds 1995), edited by Norman but consisting of the authoritative contributions of 86 scientists, plus six chapters written by Norman as the appropriate expert. This extremely popular book did much to stimulate interest in crop plants and the systematic approach required by the editor (introduction, cytotaxonomy, background, early history, recent history and prospects) has proved to be particularly valuable to educators wherever crop evolution and breeding is taught. This book was complemented by *Principles of Crop Improvement* (1979). This highly regarded key text has provided students and practitioners with a synthesis of current breeding approaches along with a bibliography that would allow the motivated into the current literature in any particular area (now in 2nd edition, Simmonds and Smartt, 1999).

During this period, and continuing well after his formal retirement in 1982, Norman continued his interest in tropical agriculture and developed some important consultancies. He travelled widely throughout the tropics to some 20 countries, partly as Chairman of the Quinquennial Review of the International Board for Plant Genetic Resources and later on behalf of FAO and the World Bank.

The recommendations from these reviews were not always popular, but in typical fashion Norman did not skirt the problems but actively engaged in robust discussion, seeking to persuade all parties of the sense of his logic. He continued to make valuable contributions to breeding strategies in a number of economically important crops via consultancies with Sugar Cane Breeding in the West Indies, Copersucar of Brazil and the Rubber Research Institute of Malaysia. Even well into retirement, a term he only accepted with reluctance, he was still active academically, writing and publishing on a wide range of topics, not only within his broad subject area, but also in relation to his hobbies, most notably on trout fishing. Major recent reviews by him covered horizontal resistance to diseases in crops, potato propagation by seed as distinct from clonal propagation by tubers, tropical crops and their improvement, and an informal history of statistics.

Over the years, Norman received many accolades. He was elected a fellow of the Royal Society of Edinburgh in 1970, and Edinburgh University made him an Honorary Professor in 1975. One international award, which gave him considerable pleasure, was that of Distinguished Economic Botanist by the American Society of Economic Botany in 1991, the only non-American at that time to be so honoured.

Norman Simmonds was a unique and stimulating individual with many diverse interests. He will be remembered as an iconoclast, a gifted scientist, a profound thinker and a stimulating teacher. He did not develop a following of research students; preferring personal academic endeavour. Nevertheless, as a result of his writing and teaching he has profoundly influenced many students and researchers and has left his mark on the important subject of plant breeding, particularly of species of economic importance to man. Those who knew him well will remember his kindness and generosity and his delight in provoking discussion.

Norman was an active Fellow of the Royal Society of Edinburgh. One of the last meetings in which he played a major role was as a participant in a debate on the subject "Was Malthus right or wrong?". He argued passionately that Malthus was fundamentally correct in his thesis and he predicted that we were fast approaching a time when the increase in the world human population would outstrip the ability of global agriculture to produce enough food to avert widespread hunger, a view not completely accepted by some members of the audience. Norman was also a very regular attendee at the meetings of the Society's Coffee Club, and his pertinent questions and apposite comments were always greatly appreciated by all the Fellows present. Professor Norman Simmonds is survived by his twin brother Ralph. His wife Christa died in December 2000.

William Spoor and Peter Wilson

Norman Willison Simmonds ScD, AICTA, FIBiol. Born 5 December 1922; Elected FRSE 2 March 1970; Died 4 January 2002.

Thomas Stevens Stevens
8 October 1900 - 13 November 2000

With the death, some five weeks after celebrating his 100th birthday, of T. S. Stevens FRS, FRSE, Scotland has lost one of its most distinguished scientists.

Tommy Stevens, as he was universally known, was a highly original organic chemist who will be remembered in his field for the almost unique distinction of having discovered three reactions: the Stevens Rearrangement of quaternary ammonium salts; the McFadyen-Stevens synthesis of aldehydes; and the Bamford-Stevens elimination reaction, which converts ketones to either alkenes or cyclopropanes.

Tommy was widely admired for his erudition, his encyclopaedic knowledge, his modesty and his remarkable sense of humour. As a teacher, he was inspirational, his lectures and tutorials were a model of clarity and he showed great patience with students, whom he always sought to encourage.

Thomas Stevens Stevens was born in Renfrew on October 8, 1900, the only child of John and Jane Stevens. His father was an engineer and draughtsman who worked in the Clydeside shipbuilding industry and had married Jane Elliot Irving in 1896. Jane, who had been a teacher before her marriage, took charge of her son's education because of his frail health until he entered Paisley Grammar School in 1908. He transferred to Glasgow Academy in 1915 and entered Glasgow University in 1917, having been placed fourth in that institution's Open Bursary Examination and gained a Taylor Open Bursary.

Honours and prizes fell his way throughout his secondary and university education. He was First Prizeman in Mathematics in 1918 and in Natural Philosophy in 1920; he graduated with distinction in Applied Chemistry in 1921 and with First Class Honours in Science (Principal Subject Chemistry) in 1922. His performance earned him a William Ramsay Memorial Fellowship with which he went to Lincoln College, Oxford, in 1923, having spent a further year at Glasgow doing research (with S. Horwood Tucker) as a University Assistant.

At Oxford he worked under W. H. Perkin Jr., unquestionably the foremost British Organic Chemist of that era. Synthetic experiments in the alkaloid field were the early topics of his work both at Oxford and back at Glasgow, where he held posts as University Assistant (1925-1928), Carnegie Teaching

Fellow (1928-1933) and Lecturer (1933-1947). It was during such experiments that he sought to reduce a quaternary ammonium salt with sodium amalgam. He recognised that the product, formed in good yield, must have resulted from a molecular rearrangement: the first example of what quickly became known as the Stevens Rearrangement. Tommy elucidated the scope, variations and mechanism of this reaction with insight and skill and described the results in a series of ten papers, culminating in 1955 in the proof of the strictly intramolecular nature of the rearrangement.

In parallel with this investigation, related rearrangements were studied and elegant, carefully planned synthetic experiments were undertaken, mostly with a view towards alkaloid synthesis, and described in papers written in Tommy's characteristically concise but elegant style. Whereas an element of luck had obviously contributed to the discovery of the Stevens Rearrangement, both the McFadyen-Stevens aldehyde synthesis, first described in 1936, and the Bamford-Stevens reaction of 1952, were predicted by Tommy as the result of his brilliant analysis of the behaviour expected from the reactions of bases on the respective starting materials and were designed to avoid difficulties arising in other synthetic approaches to the target molecules.

I first met Tommy in 1943, when, on entering the second year of the chemistry course, I had the good fortune to be assigned to work in his laboratory. His encouraging attitude towards students was immediately evident when I told him that the first half dozen experiments of the course were preparations which I had done at school, and was promptly offered alternative tasks. Later, in my final year, he agreed to supervise my research project and offered several speculative ideas to work on. While I succeeded only in producing a string of negative results, I learned much from his approach to research, for which I have always been grateful.

I should have loved to continue and do my PhD under Tommy, but suitable grants for which I would have been eligible were unavailable. In the autumn of 1946 I therefore took up the offer of a research studentship at Sheffield to work under Professor R. D. Haworth, who soon told me that Tommy would be coming to Sheffield in the spring of 1947. He and Tommy had been friends and close colleagues working together under Perkin at Oxford. Haworth had invited Tommy to fill the vacancy created at Senior Lecturer level at Sheffield by the appointment of his second-in-command, Brynmor Jones, to the

Chemistry Chair at Hull. Although Jones (later Vice-Chancellor at Hull) was widely respected, he was clearly not as distinguished as Tommy. Rumour suggested that Tommy had also been a candidate for the Hull post. Had his own excessive modesty worked against him, or was it his slight stammer? Members of the selection committee who had not heard him lecture would not know that he suppressed this completely when lecturing, to the extent that students whose only contact was across the lecture bench, never knew that he had a stammer. He was in fact an excellent lecturer. Well, Hull's loss was Sheffield's gain. Moreover, in contrast to Glasgow University's apparent unwillingness to promote staff at that time, Haworth was not only able to get him appointed as senior lecturer, but promoted to reader in 1948 and finally awarded a personal chair – the University's first such appointment – in 1963. In the same year, with Professor Haworth and Lord Todd as his principal sponsors, Tommy was admitted to the Fellowship of the Royal Society (FRS) and he was pleased to be similarly recognised by its Scottish equivalent and created FRSE a year later.

Tommy was accompanied in his move to Sheffield by his widowed mother, whom he had long looked after and he was finally able to marry his friend of many years, Janet Wilson Forsyth (Netta to her friends) when her mother's death freed her from similar filial duties. They enjoyed 45 years of a very happy relationship before Netta (the elder) predeceased Tommy in 1994.

Although not working with Tommy in Sheffield, I benefited from the stimulus of being in the same laboratory in which he continued his own original work whenever time permitted. Then in 1949 I went to the USA, only to return in 1953, there joining Tommy as a member of staff for the next six years. During that time my wife and I frequently enjoyed Tommy and Netta's hospitality. They lived appropriately on Tom Lane and an evening at the Stevenses invariably meant a sumptuous meal followed by Bridge well into the night. When in 1959 we moved to Glasgow when I got the Chair at what became the University of Strathclyde, we knew that contact would be maintained since Tommy and Netta revisited their native haunts regularly once or twice a year. Moreover, we knew that they intended to move back there when Tommy had to retire in 1966, at the end of the academic year when he reached the age of 65. Well before that they bought the property in the Pollockshields area of the city, where they were to live out the rest of their years.

But I was convinced that Tommy was not ready to retire fully so soon. Having completed seven years at Strathclyde, six of them as head of the department, I was ready for a break and arranged a sabbatical year for myself and invited him to replace me as a visiting professor and to head the organic section of the department for the year 1966-67. This proposal was readily accepted and although we could not offer him a paid appointment beyond my return, Strathclyde agreed to confer on him the title of Fellow, which allowed him to remain a member of the university and to make what use he wanted of its facilities. That he did is reflected by the fact that his last nine publications were written at Strathclyde. They included four papers on the work of two students whom he took over from me and helped to complete their PhD degrees in my absence, four others on older work to which he was finally able to add the finishing touches and culminated in 1973 in the publication of his book "Selected Molecular Rearrangements", co-authored by Bill Watts, then a lecturer in the department (later Professor at the University of Ulster, Coleraine). Thereafter, many of my colleagues and I were delighted when his initially still frequent visits to the department allowed us to discuss chemistry or anything else with him, but gradually his visits became rare and then confined to the departmental library.

To his own and all his friends' considerable pleasure, his Alma Mater, the University of Glasgow, recognised his outstanding contribution by conferring on Thomas Stevens Stevens the degree of Doctor of Science *honoris causa* on 19 June 1985.

Physically he became very frail in his last years, but his mind remained active and his sense of humour undiminished to the end.

Peter L Pauson

Thomas Stevens Stevens BSc(Glasgow), DPhil(Oxon), FRS. Born Renfrew, 8 October 1900; Elected FRSE 2 March 1964; Died 13 November 2000.

Sir Frederick Henry Stewart
16 January 1916 - 9 December 2001

Fred Stewart was charming, canny, perceptive, patient, incisive, highly intelligent, ever so stubborn and completely laid-back. These qualities served him well in his career as an industrial chemist, academic geologist, Dean of the Science Faculty at Edinburgh University, Chairman of the Natural Environment Research Council and Chairman of the Advisory Board of the Research Councils for the UK.

He was born in Aberdeen. His father was a Lecturer in Civil Engineering at both the University of Aberdeen and at Robert Gordon's Technical College. The Stewart family can be traced back to John Stewart who arrived at Nether Downam in Glenlivet, Banffshire in 1636 and his descendants were farmers, landowners and army officers. His maternal grandfather was the owner of the Aberdeen 'Free Press' until it amalgamated with the 'Journal'. One of his uncles (Henry) became Lord Provost of Aberdeen. Stewart Grainger, the film actor was a cousin.

Fred was educated at Angusfield Preparatory School until 1927, Fettes College (1927-32) and briefly at Robert Gordon's College (January - April 1933). One of his uncles, William Alexander, an amateur geologist, had introduced Fred in his early youth to the pleasures of collecting rocks. Professor W.T. Gordon, a friend of his father, gave him a small collection of minerals and took him to hunt for fossil fish at Stonehaven. Fred's father was a keen bird photographer and natural historian. It was not surprising then that Fred entered Aberdeen University with the intention of pursuing a career in Zoology or Geology. After taking both subjects for three years he elected to concentrate on geology in his final year and graduated with a First Class Honours degree in Geology. After postgraduate research at Aberdeen and Emmanuel College, Cambridge he was employed as a mineralogist with ICI from 1941-43. He became Lecturer in Geology at the University of Durham (1943-56) and was appointed to the Regius Chair of Geology and Mineralogy in the University of Edinburgh in 1956 from where he retired in 1982.

Stewart's early researches were devoted to the igneous rocks in Skye and Belhelvie in Aberdeenshire – the latter also being the subject of his Honours research project - but his wartime translation to ICI (1941-43) confronted him with a very different set of problems associated with the genesis and distribution of the economically valuable salt deposits in Yorkshire. ICI asked him to examine drill cores left behind after an unsuccessful attempt by the D'Arcy Exploration to find oil and gas in Yorkshire. Stewart found valuable potassium salts in the cores. They were strategically vital to the Allied war effort because the German Stassfurt deposits were no longer available. These 250 million years-old Permian sediments, formed in salt lakes in ancient deserts were fiendishly complex. The water-soluble rocks were extremely difficult to prepare for microscopic examination and the minerals had undergone many changes after their formation. His meticulous work was recognised by awards from both the Geological Society of London and the Mineralogical Society of America. American geologists were especially intrigued because the Yorkshire salt deposits were very similar to those in Texas and New Mexico. Fred Stewart described himself at the time as a simple petrological policeman looking for places to put his large feet. The climax of his research on salt deposits was a major paper published by the US Geological Survey. He later returned to carry out further research on Scottish rocks in the NE of Scotland and the volcanic complexes of the Scottish islands. He was elected a Fellow of the Royal Society of Edinburgh in 1957 and the Royal Society of London in 1964.

On his appointment as Regius Professor of Geology, Stewart set about building up the Grant Institute of Geology. Through argument and hard work he tripled the size of the department and by the mid 60s had received enough funding to build and equip an experimental petrological unit, a high-temperature-and-pressure laboratory capable of examining the behaviour of rocks formed in the earth's mantle. The laboratory was chosen by NASA for the analysis of lunar samples under vacuum to simulate conditions on the surface of the moon. In 1965 Fred Stewart became Dean of the Faculty of Science at the University of Edinburgh. His somewhat unkempt look and friendly unassuming manner masked a brilliant intellect and formidable incisiveness in debate. As Dean he oversaw the birth of Science Studies, Geophysics, Microbiology, the development of Integrated Biology and Engineering Science - and the siting of the new Institute of Geological Sciences at King's Buildings. He brought about a fairer distribution of University funding for the Faculties, perhaps not surprisingly to the benefit of the Faculty of Science. He became a member of the Council for Scientific Policy in 1967 and for the next 12 years much of his time was spent in London as a scientific statesman.

Stewart was appointed Chairman of the Natural Environment Research Council in 1971. Initially few members of Council realised that Fred Stewart, mineralogist, was also a most competent natural historian. He had of course studied zoology for three years at Aberdeen and was moreover an expert ornithologist. Stewart was heavily involved in the emotional politics associated with the hiving-off of the Nature Conservancy from the NERC. He was also engaged in the aftermath of the Rothschild Report on the framework of Government Research and Development, and on the reorganisation of marine science in the United Kingdom. In 1973 he became a member of the Advisory Board of Research Councils and a year later Chairman of the Board. In that capacity he was responsible for advising the Secretary of the Department of Education and Science on science policy including the funding of the ARC, MRC, NERC, SERC, SSRC, the British Museum (Natural History) and the Royal Society with an annual budget at that time of around £500 million. He was Chairman of subcommittees on post-graduate support, the dual-support system and energy research and was heavily involved in modifying the worst excesses of the Rothschild report. During his six years of office he served under four Secretaries of State including Mulley, Prentice, Thatcher and Williams. They further honed his skills on the political intricacies of Government science. Public recognition of his work came with the conferment of a knighthood in 1974 and honorary degrees from five universities. Among honours bestowed on him were the Lyell Fund (1951) and Lyell Medal (1971) of the Geological Society of London, the Mineralogical Society of America Award (1952), the Clough Medal of the Edinburgh Geological Society (1971) and the Sorby Medal from the Yorkshire Geological Society (1975). He served as a Trustee of the British Museum (Natural History) from 1983 until 1987 and as a Member of Council of the Scottish Marine Biological Association from 1983 – 1989.

In 1980 the Stewarts bought a new house - a former hotel actually - in the village of Lochawe in Argyll and gradually converted it into their retirement home. There were 25 acres of garden for his wife, Mary, who was the gardener, and a newly built lab for Fred and his rocks. It was always a delight to visit them. Mary showed friends round her lovely garden of mature trees and huge rhododendrons sloping down below Ben Cruachan to Loch Awe, and Fred, happily identified birds, other wild animals and even animal droppings. But not plants! He had taught Mary to be an ornithologist but she failed to teach him to be a botanist. He had a great love for the Scottish hills and occasionally he and his wife were to be found strolling on the top of the Scottish mountains, through the simple expedient of hiring a helicopter.

Always a keen fisherman he was able to add the River Orchy to his love of the Tweed and the lochs of Caithness and Harris. His exceptional ability as a trout fisherman was recognized in an article in *The New York Times*, accompanied by a photo of him wearing his elderly fore-and-aft tweed hat. He was also an excellent salmon fisherman and held the local record for the River Orchy of a catch of eight salmon in one day. He brought to his sport shrewdness, patience and determination, qualities that had stood him in good stead as a scientist and administrator. He continued to collect fossil fish from the Old Red Sandstone, a passion he had had since childhood, and minerals in igneous and metamorphic rocks ranging from Precambrian to Tertiary. In his later years he founded MESS (Mull Expeditionary Sapphire Society) and collected from an igneous dyke in the Hebrides the largest sapphire, some three inches long, ever found in Scotland. It was exhibited in the National Museum of Scotland and then taken by special courier to the new museum in Valencia, Spain to be put on display in the year 2000 as one of Scotland's finest gemstones. He bequeathed his superb and so meticulously catalogued collection of some 3000 minerals and fossil fish to the Royal Museum of Scotland. Beneath this 20th century scientist was hidden a 19th century naturalist.

A school report once recorded that Stewart worked well under pressure, leaving the reader to speculate on what happened when the pressure was off! He was one of those rare men who achieved most when apparently working least. Beneath Fred's Model-T Ford exterior purred a Rolls-Royce engine. As one of his former students said 'They don't make models like that any more.' Fred Stewart married Mary Stewart (nee Rainbow) in 1945. She has a highly successful career as a writer and survives him. There were no children of the marriage.

Gordon Craig

Sir Frederick Henry Stewart KB, BSc, PhD, FRSA, HonDSc (Aberdeen, Leicester, Heriot-Watt, Durham, Glasgow). Born 16 January 1916; Elected FRSE 4 March 1957; Died 9 December 2001.

Professor Peter Alan Sweet
15 May 1921 - 16 January 2005

Peter Sweet was Regius Professor of Astronomy in Glasgow University from 1959 until 1982.

His pioneering research works on flows in stellar interiors and on magnetised plasmas are immortalised in the terms "Eddington-Sweet Circulation" and "Sweet-Parker Reconnection" and laid the foundations for future directions in these fields. In particular, the Sweet-Parker theory of magnetic energy release in solar flares, which have important terrestrial effects as well as being a key physics problem, is a widely used reference point for all subsequent work in this area of plasma astrophysics.

Sweet's interests were reflected in some of the subsequent appointments to Glasgow staff ; notably R.C. Smith (now at Sussex University) in stellar rotation, and R.M. Green and J.C. Brown in flare theory. Green further developed the Sweet-Parker theory while Brown (current holder of the Regius Chair and 10th Astronomer Royal for Scotland) led solar studies in the direction of combining theory and space mission data utilisation, at the same time forging (with Professor E.W. Laing) a productive Astronomy and Astrophysics union with the Plasma Physics Group in Natural Philosophy. This guaranteed the flourishing of Glasgow's long-standing reputation in solar activity, which dates back to the "Wilson Effect" in sunspots, named after Alexander Wilson the first incumbent of the Glasgow Chair (founded in 1760). Glasgow doctoral graduates in solar physics are now to be found in many corners of the academic world, and are currently heavily involved in NASA's dedicated solar flare mission RHESSI on which Glasgow has NASA Co-Investigator status.

While Sweet's own direct research contribution became less visible after laying these foundations, he continued to be a giant intellect and major influence whose opinions were widely sought, and at times feared. When he and Professor T.G. Cowling of Leeds appeared at meetings together (for instance, the International Astronomical Union Symposium in Paris 1970), many a speaker was in trepidation as to which of them would question his or her ideas.

More importantly, Sweet's astonishing mastery of mathematical physics and its applications, his perpetual search for both rigour and clarity, and his unrelenting patience as teacher and supervisor, were an unforgettable inspiration to generations and launched many a graduate into academia who might otherwise have been lost to the world of personal gain.

When N particle computer simulation codes were the new hot topic in plasma physics, Sweet took joy in devising codes showing the essential results on a pocket calculator with N= 8 particles when others were boasting of using 100,000. (As an undergraduate, Hugo Schwartz, now of CTIO Chile, said "You haven.t had Professor Sweet yet? He's the guy who writes in a scribble and speaks too quietly, but is the best teacher you could ever have"). Sweet's brilliant stamp lies hidden on the subsequent work of many, and in his later active years he was even persuaded to allow his name on several further papers to which his input had been invaluable.

Born in 1921 in Beckenham in Kent, Peter Sweet was educated at Kingsbury County Grammar School, London, and was Wrangler 1942 on a Major Open Scholarship in Mathematics at Sidney Sussex College, Cambridge. After three years as Junior Scientific Officer in the Ministry of Aircraft Production, he returned to Sidney Sussex (where he took a Master's degree and where his PhD was supervised by Fred Hoyle).

Thereafter he was Lecturer in Astronomy, first from 1947 in the University of Glasgow, then from 1952 until 1959 at University College London, where he was also Assistant Director of the Observatory, and a Visiting Fellow at the University of California at Berkeley 1957-58. During his subsequent 23 years in the Glasgow Chair, succeeding W.M. Smart, he was Dean of Science, 1973-75, and Senior Visiting Fellow at NASA's New York Institute for Space Studies, 1965-66. He had married Myrtle Parnell (deceased) in 1947 with whom he had two sons Geoffrey and Robert.

By the time of his retirement in 1982 he had, with Professor John Gunn of the Department of Natural Philosophy, prepared the ground for the eventual creation (in 1986) of the now joint Department of Physics and Astronomy; one of the earliest departments so titled and now one of many across the UK.

Sweet's teaching and research excellence stemmed from his perfectionism as well as his brilliance, traits which carried over into all his activities and consumed much of his time. The old University Gardens Observatory that Peter Sweet came to in 1959 had not been built for the staff and student numbers it soon had under his leadership, leading him into a major planning exercise for a new observatory to be sited on Glasgow University's estate at Garscube, on the outskirts of the city, and decanting of staff from University Gardens to other accommodation. By the time the Garscube Observatory was completed and opened in March 1969 by the 7th Astronomer Royal for Scotland, Professor H. Brück, staff and student numbers had grown so much that Astronomy has since occupied twin sites.

In short, Peter Sweet was a quiet man of enormous intellect whose teaching and research, both written and unwritten, was a great source of inspiration to many, and who made time for rigour and for others to an extent that few of his peers, past and present, can match.

J.C. Brown and A.E. Roy

Peter Alan Sweet:, BA, MSc, PhD (Cantab), FRAS. Born 15 May 1921; Elected FRSE 7 March 1960 ; Resigned FRSE 1989; Died 16 January 2005.

Adapted, with kind permission, from the obituary first published on 9 February 2005 in *The Independent*, 191 Marsh Wall, London.

Paul Egerton Weatherley

6 May 1917 - 8 August 2001

Paul Egerton Weatherley died on 8 August 2001. He was Regius Professor of Botany in the University of Aberdeen from 1959 to 1981 and was elected to the Royal Society of Edinburgh in 1960, and to the Royal Society of London in 1973. He was one of the foremost plant scientists of his generation, and he significantly advanced our understanding of plant water relations, and the movement of water and solutes in plants.

Paul Weatherley was born in 1917 in Leicester. As a schoolboy he was fascinated by science, and soon displayed the flair for ingenious experimentation which characterised his professional life. In 1936 he won an open scholarship in Natural Science at Keble College, Oxford, where he read Botany. After graduation he joined the Colonial Service and took the Diploma course at the Imperial College of Tropical Agriculture in Trinidad. From there he was given a post in the Uganda Protectorate, but on the way to Uganda his ship was torpedoed off the west coast of Africa and Paul spent 18 hours in a lifeboat before making his way ashore. He ended up on a research station at Serere in Eastern Uganda, where he was joined by Margaret his wife. She was the daughter of a prominent Aberdeenshire farmer, and their marriage was the start of an association with North-East Scotland which was to last for the rest of his life.

In Uganda he began his research on the water relations of cotton. He was able to show that a reliable measure of plant water deficit could be obtained by punching discs from leaves, floating them on water, and measuring how much water they required to become fully turgid. This 'relative turgidity' technique became widely used to assess crop water status in the field and to inform the design of irrigation schemes.

In 1949 he was awarded a DPhil from Oxford for his work. By that time he was back in the UK as an assistant lecturer at Manchester. He moved from there to Nottingham, where he spent ten enormously productive years. His research was characterised by great originality, and by the elegance of the experimental techniques. He was one of the first to use a climatological wind tunnel to manipulate the rates of water loss by plants. By now he had also become fascinated by how the products of photosynthesis move from leaves to other parts of the plant. He and his students made ingenious use of aphids feeding on willow. These insects feed through a fine stylet, which they insert into the phloem cells through which solutes move. By excising the aphid body they were able to collect the solutes which continued to flow through the stylet, and analyse its composition.

In 1959 he moved to Aberdeen where he built up a large Department of Botany. He was an outstanding teacher and PhD supervisor, and many of the colleagues he supported and the students he trained have gone on to successful careers. He entered fully into the life of North-East Scotland, where family connections were strong. He was a talented water-colourist, and a keen hill walker. Paul Weatherley retired in 1981. Tragically his activities were increasingly curtailed by the onset of Parkinson's disease, and his retirement was spent quietly in Torphins, cared for by Margaret and the family.

Ian Alexander

Paul Egerton Weatherley DPhil, FRS. Born 6 May 1917; Elected FRSE 7 March 1960; Died 8 August 2001.

RSE Council Service: Councillor, 1963-66

Maurice Hugh Frederick Wilkins

15 December 1916 - 5 October 2004

Maurice Wilkins, who shared the 1962 Nobel Prize for Physiology or Medicine with Francis Crick and James Watson, died in London on 5th October, 2004. He was a major player in one of the greatest scientific discoveries of the 20th Century, the discovery of the structure of DNA.

Wilkins was born in Pongoroa New Zealand on 15th December 1916, where his parents had moved from Dublin. His father was a doctor who became New Zealand Director of School Hygiene. The family moved to England when Maurice was six years old and he was educated at King Edward's School, Birmingham. As a child he was interested in science and, in a workshop built by his father, he developed technical and experimental skills, particularly in telescope construction.

He studied Natural Sciences at St John's College, Cambridge, which had many distinguished members of staff. He said that he was especially fortunate in his first year to receive one hour a week of the undivided attention of his supervisor, Marcus Oliphant, who was then Ernest Rutherford's deputy. In his second year his supervisor was John Cockroft.

At Cambridge Wilkins became fascinated with J D Bernal's X-ray diffraction studies, so much so that he gave a talk on Seeing Structures, based on Bernal's work, to the Natural Science Club. He also became influenced by the Cambridge Scientists Anti-War Group and became involved in their activities.

After graduating in 1938 Wilkins became research assistant to J T (later Sir John) Randall in the Physics Department, Birmingham University, where Oliphant was Head of Department. With Randall, he studied the luminescence of solids and obtained his PhD in 1940 for work mainly on a study of the thermal stability of trapped electrons in phosphors and on the theory of phosphorescence. He applied these results to war-time problems such as improvement of cathode ray tube screens for radar. This was the time when Randall and his colleague Harry Boot were developing the cavity magnetron, which played such a vital part in the war effort. Wilkins then worked with Oliphant on the mass spectrographic separation of uranium isotopes for use in the atom bomb, and eventually moved with Oliphant's group to the Manhattan Project in Berkeley, California, to continue these studies. There he found that the greatest pleasure was in sharing knowledge and working with a group. Following this he was strongly of the view that science should be a cooperative activity, with an open dialogue between participants.

After the war, disillusioned by the use of the atom bomb, and inspired by Erwin Schrödinger's book *What is Life?*, he was keen to start work in biophysics. Randall had been appointed Professor of Physics at St Andrews University and was also interested in biophysics, so Wilkins accepted an invitation to join him as a lecturer in physics in 1945. The stay at St Andrews, however, was brief and when Randall was offered the Headship of the Physics Department at King's College, London, Wilkins moved with him in 1946. Here he was a member of the Medical Research Council Biophysics Unit which had been set up within the Physics Department. Randall was Director of the Unit and Wilkins became Assistant Director in 1950, Deputy Director in 1955, and Director in 1970.

Wilkins's first biophysics studies were on the genetic effects of ultrasonics but soon changed to development of reflecting microscopes for ultraviolet studies of nucleic acids in cells. He also studied the arrangement of virus particles in tobacco mosaic virus crystals, using visible-light microscopy, and he applied interference microscopy to measure dry mass in cells.

Then, in 1950, with great foresight, Wilkins started his structural studies of DNA. He received a preparation of calf thymus DNA from the Swiss chemist Rudolf Signer, and from gels of this material he was able to draw thin fibres showing sharp extinction between crossed polarizers. With the assistance of Raymond Gosling, Wilkins obtained X-ray diffraction photographs from these fibres indicating a high degree of crystallinity. They achieved this by keeping the fibres moist during the exposure. It was one of these diffraction patterns that Wilkins showed at a conference in Naples in 1951 and so excited James Watson who was in the audience. Alec Stokes, working with Wilkins, pointed out that the diffraction patterns indicated a helical structure.

In 1951, Rosalind Franklin was recruited to King's to help in the DNA studies. Unfortunately, Wilkins and Franklin did not get on and this seems to have been more than merely a clash of personalities. Whilst Wilkins had assumed that there would be collaboration between Franklin and himself, she had been told by Randall, without Wilkins's knowledge, that only she and Gosling would be involved in the X-ray studies. Thus the seeds of future discord had been sown at the very beginning. Details of the situation at King's are described in Wilkins's autobiography *The Third Man of the Double Helix* which was published in 2003. The situation led to two groups at King's working independently. Wilkins had handed over the Signer DNA to Franklin, hoping that he could obtain other preparations of the same quality. However, it was some time before he was able to obtain these and show that DNAs from different sources had the same basic structure.

Using a microfocus X-ray generator developed by Werner Ehrenberg and Walter Spear, and a micro-camera, and by controlling the relative humidity in the camera, Franklin and Gosling showed that at high humidity the DNA structure changed from a crystalline to a paracrystalline structure. They called the crystalline form A-DNA and the paracrystalline form B-DNA, and the A B transition was reversible. One of the B-DNA diffraction patterns was of exceptional quality and better than similar ones obtained by Wilkins from other DNA preparations. Concentrating on analysis of A-DNA, Franklin believed that there was evidence that in this form DNA was not helical and this was confusing at the time.

The excellent B-DNA diffraction pattern, however, was highly characteristic of that from a helical structure, as Watson also appreciated when he was shown the photograph by Wilkins. But the question was, what kind of helix? This was answered by Watson and Crick when they built their double helix model. When they announced their discovery there were two accompanying papers from King's giving experimental support for the model, one by Wilkins, Alec Stokes and Herbert Wilson and the other by Franklin and Gosling. All three appeared in *Nature* on 25th April 1953.

Wilkins had also obtained X-ray diffraction patterns from intact squid and cuttlefish sperm that were similar to those from B-DNA, showing that the structure existed *in vivo*. He also showed that DNAs from different sources gave essentially identical diffraction patterns.

The task of rigorously testing the double helix model against the X-ray diffraction data was undertaken by Wilkins and his colleagues and over the next eight years the analysis confirmed the basic 'correctness' of the model although details of the original model had to be modified and refined. It was for this, as well as his pioneering work, that Wilkins was awarded a share of the 1962 Nobel Prize with Crick and Watson.

Following the DNA studies Wilkins and his colleagues analysed the structure of double helical RNA and also the structure of nerve membranes. He was Professor of Biophysics and Head of Department at King's College from 1970-82 and Director of the Neurobiology Unit of the MRC from 1974-80.

Wilkins had a highly developed social conscience and was President of the British Society for Social Responsibility in Science from 1969-91. He was an active member of the Pugwash Disarmament Group and he and his wife Patricia were active members of CND. At King's College he had organised an undergraduate discussion course on the Social Impact of the Biosciences – a course that he was attending until a few months before his death.

Apart from the Nobel Prize, Wilkins was the recipient of many honours. He also shared with Crick and Watson the 1960 Albert Lasker Award of the American Public Health Association. He was awarded honorary degrees from the Universities of Glasgow, Birmingham, London and Trinity College, Dublin. In 1959 he was elected FRS; Honorary FRSE in 1994; was made a CBE in 1962, and a Fellow of King's College in 1973. He was an Honorary member of the American Society of Biological Chemists and Foreign Honorary member of the American Academy of Arts and Sciences. His name is on two plaques at King's College commemorating the 1953 DNA studies and on a plaque in Pongoroa, where he was born. His portrait hangs with those of Rutherford and Alan MacDiarmaid, two other New Zealand Nobel Prize winners, at the Royal Society of New Zealand.

Most people found that Maurice's initial rather reserved demeanour soon changed to reveal a warm and friendly personality. He was self-effacing and modest and strongly believed that science should be used for benefit to humankind and not for profit or personal glory. He had a life-long interest in the arts and many of his friends were artists. It was as a result of this interest that he met his future wife, Patricia Ann Chidgey, at the Institute of Contemporary Arts. To Patricia, his sons George and William, daughters Sarah and Emily, and five grandchildren, we extend our sympathy.

Herbert R Wilson

Maurice Hugh Frederick Wilkins. CBE, MA(Cantab), PhD(Birmingham), Hon LLD(Glasgow), Hon ScD(Birmingham), Hon DSc(London), Hon DUniv(Trinity), FKC, FRS, Hon FRSE, Nobel Laureate. Born 15 December, 1916; Elected HonFRSE 1994; Died 5 October 2004.

Sir Alwyn Williams
8 June 1921 - 4 April 2004

Sir Alwyn Williams - an Appreciation.
First published on RSE Website April 2004

Sir Alwyn was President of the Royal Society of Edinburgh from 1985 to 1988 and his achievements in that role have been of lasting benefit to the Society. The purchase of the Society's fine premises, after tortuous negotiations, provided a secure base for subsequent developments of the Society and gave impetus to its wider recognition as Scotland's National Academy of Science and Letters.

This process was also much helped by Sir Alwyn being a Fellow of the Royal Society of London and Member of the Royal Irish Academy. As such, he was particularly well placed to foster much closer links with these sister Academies and the first tripartite meeting of their Presidents took place at RSE. This set the scene for continuing excellent relations based on a clear understanding of the complementary role of the RSE in relation to the other leading national academies of Britain and Ireland.

His Presidential Address *A Society for the Learned and the Leisured*, delivered as he demitted office in October 1988, was unforgettable. Beneath its very polished delivery, was a clear analysis (unsettling for many who heard it) of how the Society and the academic world would need to adapt, in order to have the relevance necessary to survive into the 21st century. Sir Alwyn was a most distinguished geologist, having held academic posts in that subject at Glasgow, Queen's Belfast and Birmingham, before returning to Glasgow University in 1976 as Regius Principal. It was, therefore, particularly fitting that the first in a continuing series of major international geological conferences - The Hutton Conferences - should have been held in Edinburgh during his Presidency. The conference proceedings were published in the Society's *Transactions: Earth Sciences*, thereby maintaining the link to James Hutton's own *Theory of the Earth* published in the first volume of *Transactions*. Sir Alwyn's reputation as a geologist was widely recognised, both nationally and internationally - he was an Honorary Fellow of the Geological Society of America and a foreign Member of the Polish

Academy of Sciences (PAN) and helped encourage closer links between PAN and RSE.

The many heavy demands of being Principal at an increasingly challenging time for the academic world did not bring his research activity to a halt and he continued to publish; but this was only possible by starting very early in the morning in the lab, before devoting a full day to the duties of being Principal. After retiring in 1988, he devoted his time enthusiastically to research and created a Palaeobiology Unit at Glasgow University where he worked tirelessly. His energy and devotion to research seemed almost limitless and he also played a key role in the substantial *Treatise on Invertebrate Palaeontology* and its subsequent revision.

In addition to his scientific achievements, Sir Alwyn was an outstanding committee man. He was a most skilful chairman, where his wit, Welsh eloquence and astute insight transformed many a gathering into a memorable, pleasurable occasion - even for those who did not get all they wanted! These gifts he not only deployed for the considerable benefit of the University of Glasgow and the Royal Society of Edinburgh, but for many other bodies, including the Scottish Agricultural Colleges and Scottish Hospitals Endowment Research Trust. He also played an important role in the development of the Scottish National Museums and the Williams Report on the National Museum of Antiquities helped shape their direction and subsequent transformation.

His scholarship and clear sense of vision, combined with the ability to translate this into convincing practical outcomes made him an inspirational leader. Although Welsh by birth and education, he long regarded Scotland, and especially Glasgow, as his true home where he will be sadly missed by many.

But no appreciation of Sir Alwyn would be complete without mentioning his remarkable wife, Joan, who so ably supported and encouraged him throughout 55 years of marriage. Individually they were delightful and most convivial company - together they were an unforgettable partnership. To her, their children Gareth and Sian, sincere sympathies on their great loss.

Sir Alwyn Williams

Slim and slight of build, Alwyn Williams would have been easy to overlook - until he spoke. His charismatic Welsh voice generated elegant prose and persuasive argument. It exuded power and authority. His piercing green-blue eyes mostly danced with mischief and charm but if the occasion warranted they would rapidly change into a disconcerting steely gaze. He was nobody's fool.

Alywn was born in Aberdare, South Wales in 1921. He was an outstanding pupil at Aberdare Boy's Grammar School and a talented rugby player, until an attack of tuberculosis in 1939 kept him in a sanatorium for over a year. He lost one lung in the process. Thwarted in his initial intention to join the Fleet Air Arm, he gained an open scholarship to the University College of Wales, Aberystwyth, and a first-class degree in geology in 1943. The college produced few, but outstanding graduates. For his PhD, Williams mapped Palaeozoic rocks in Wales and described new species of fossils – especially brachiopods. These small 'lamp-shells' were to fascinate him for the rest of his life. As his external examiner Professor O.T. Jones had mapped the adjoining territory it required a joint field excursion to reach a compromise! A Harkness Fund Fellowship to the National Museum of Natural History in Washington D.C. in 1948-50 led him to join a fellow workaholic, the legendary palaeontologist G. Arthur Cooper. Four years as a lecturer at Glasgow (1950-54), where he demonstrated his abilities as an inspiring teacher were followed by rapid advancement to the Chair of Geology at Queen's University, Belfast in 1954 at the tender age of 33. He remained there for 20 years, the last seven as Pro-Vice-Chancellor.

In a powerful address to graduands in 1972 he referred to the troubled community of Northern Ireland and identified a major cause - the dual educational school system. I quote: '…had these two groups of children been rich and poor or black and white, every syndicated columnist in America, every literate liberal in Europe, every racial moralist in the world and all the Churches in Christendom would have forthrightly identified such segregation as a flaw in our society. In terms of its educational system then, Northern Ireland, to put it bluntly, is the Alabama of Europe; and if desegregation of schools is accepted elsewhere in the world as one of the cures for racial discrimination and social injustice, it is time we started thinking about it here'. Forceful words – as was his habit. In addition to his responsibilities as Pro-Vice-Chancellor and Head of the Geology Department he continued research on stratigraphy and palaeontology in Wales and the Southern Uplands of Scotland.

He was appointed to the recently named Lapworth Chair and Head of the Department of Geological Sciences at Birmingham in 1974, and two years later was offered the Principalship of Glasgow University. He told me later that life during the troubled times in Northern Ireland made his job as Principal of the University of Glasgow seem relatively peaceful! He had returned to what he later came to consider his *alma mater*. Facing him was the need to modernise the university and develop computing and technology. He set out a tough and decisive programme of rationalisation, emphasizing the need for good teaching and research. On one occasion he pointed out firmly to the members of one laid-back department, nervously assembled under his three-line whip at 8.30 one morning, that he had published more research papers in the preceding year than the lot of them put together. He was a superb academic leader who really ran the University, although he encountered stiff opposition when he suggested selling some of the University's collection of Whistler paintings in order to help finances.

His outstanding flair as a chairman led to his appointment as President of the Palaeontological Association (1968-70), Trustee (1971-79) of the British Museum (Natural History) and its Chairman (1974-79), Vice-Chairman (1979-81) of the Committee of Vice-Chancellors and Principals, President of the Royal Society of Edinburgh (1985-88), Chairman of the Committee on Scottish Agricultural Colleges (1989), Chairman (1989-96) of the Scottish Hospitals Endowments Research Trust, and membership of numerous NERC and UGC committees. He became Chairman of the Committee on the National Museums and Galleries of Scotland in 1979. The resulting 1981 Williams Committee Report, *A Heritage for Scotland,* recommended that a new museum of Scotland should be built, based on the collections of the National Museum of Antiquities in Edinburgh. The stunning new National Museum of Scotland was opened in Edinburgh in 1999. Less enjoyable was his non-executive Directorship (1984-90) of the *Scottish Daily Record* and *Sunday Mail* Limited owned by Robert Maxwell.

Fellowship of the Royal Society, the Royal Society of Edinburgh, Membership of the Royal Irish Academy and honorary degrees from Belfast, Edinburgh, Glasgow, Paisley, Oxford, Strathclyde and Wales acclaimed his success as both scientist and administrator. Further recognition came from The Geological Society (the Bigsby and Murchison Medals), the Edinburgh Geological Society (the Clough Medal), and the Palaeontological Society (the Lapworth Medal), for his outstanding research work. He was knighted in 1983.

Alwyn retired as Principal in 1988 and at one of the university parties given in his honour, he and his wife responded to shouts of 'Geez us a song' by singing *I belong to Glasgow.* The city really had become their *alma mater*. Now freed from other responsibilities for the first time since his student days he was able to devote his full time to research – his passion and his recreation. He had worked a 16-hour day as Principal at Glasgow, pursuing research early in the morning before beginning his normal day's work. After he retired he was awarded grants to create a Palaeobiology Unit within the University so that he could continue to work on the molecular shell structure of his beloved lamp-shells.

Dr Robin Cocks of the British Museum (Natural History), wrote: 'He was a giant among brachiopod workers, being not only the editor and first author of the first brachiopod *Treatise on Invertebrate Palaeontology* (two volumes) in 1965, but fulfilled the same roles in the second edition: four volumes of which have been published (1997-2003), and there are another two in press. He successfully organised contributions from 43 co-authors for the second edition, an enormous political challenge which he tackled with a characteristic mixture of charm, terror and efficiency. But the originality of his brachiopod work was also outstanding; he was the first to evaluate shell structure across the whole phylum through pioneer electron microscopy; he was amongst the first to undertake DNA studies; over his long career he published and refined many times the overall classification of the Brachiopoda, with the end product of a robust and well-known phylogeny that will probably require little future change. His systematic work, although originally on Silurian faunas (he was the first to recognise and document the evolution of Stricklandia, a key zone fossil) was chiefly concerned with the Ordovician. His substantial and painstaking memoirs and monographs on the Ordovician brachiopods on central and northern Wales, Shropshire and Girvan, as well as many smaller papers, will stand for a long time. For many of these areas he also remapped the often difficult geology, and published correlation data. He was the lead author of the 1973 Ordovician correlation chart of Britain and Ireland, and the first Chairman of the IUGS Ordovician Subcommission'.

Increasingly severe macular degeneration forced him to use large computer monitors and giant hand-lenses. He taught himself to touch-type and recounted with great glee one message from his friendly Apple Mac typing tutorial 'Well done Alwyn'. Since 1999 he had been the author or co-author of 23 publications on brachiopods. When he learned that he had lung cancer he told his secretary to write to all of his contributors to shorten their deadline date. Just before he died he said to the consultant 'I need another four years to complete my research' and got the gentle response 'I can't guarantee that'.

Alwyn Williams married his Welsh fiancée Joan Bevan in Toronto in 1949. In every sense it was a wonderful partnership. Both were excellent hosts, loved good conversation and added greatly to social cohesion in the University and the city of Glasgow at large. Joan survives him as does their son Gareth, their daughter Sian and five grandchildren.

This obituary is compiled from fond and sometimes piquant memories of friends and colleagues of Alwyn. May I record in particular my thanks to Douglas Bassett, Robin Cocks, William Duncan, Laurie Hunter, Bernard Leake, Patricia Peters, Ian Rolfe, Andrew Skinner, and Annie Vaz.

Gordon Y Craig

Sir Alwyn Williams BSc, PhD (Wales), FRS, MRIA. Born 8th June 1921; elected FRSE 3 March 1958; died 4th April 2004.

RSE Council Service: President, 1985-88

Peter Northcote Wilson

4 April 1928 - 29 January 2004

Peter Northcote Wilson - an Appreciation
First published in ReSourcE, February 2004

Peter Wilson was elected a Fellow of the Society in 1987, and by 1992 was serving on Council as Secretary to Meetings. He excelled in this role because his open, warm personality was always able to put even the most nervous of lecturers at ease. A vote of thanks by Peter was always *a tour de force*, tantalisingly demonstrating his eloquent gifts as a public speaker.

But he was also an adept committee man and was therefore a popular choice to succeed Professor Bruce Proudfoot as General Secretary in 1996. This demanding role showed him at his best, and he served for 5 years under two Presidents; Professor Malcolm Jeeves and Sir William Stewart. The start of his period as General Secretary was particularly testing, involving the challenge of renovating the premises at 26 George Street, then recently acquired from Commercial Union. Along with the Treasurer, Sir Lewis Robertson, Peter and Malcolm Jeeves made an inspiring triumvirate: it was business as usual whilst the complex planning and fundraising to realise the potential of the new premises took place.

It was entirely fitting that Peter had a key role in the opening by HRH The Princess Royal in February 1999 of the enlarged and renovated premises. The building work completed, Peter again took a lead role in helping its then President, Sir William Stewart, reshape the Society, before handing over the reins as General Secretary in 2001 to Professor Andrew Miller.

In 2002, Peter was awarded the Society's Bicentenary Medal, an award reserved only for those who have given outstanding service to the Society. With almost a decade of unstinting service, and at a particularly challenging time in the Society's development, it was entirely fitting that the medal was awarded to him and presented at a Fellows' meeting.

Following a short illness, Peter died on 29 January 2004

Peter Northcote Wilson

Peter Wilson had a pivotal role in the emergence of ECRR in 1989 as an outward looking voluntary association of science based organisations linked by an involvement in one or more aspects of 'rural research'. On his retirement from the University of Edinburgh in 1990 he accepted an invitation to become ECRR'S Scientific Director, one of the many roles he fulfilled in what continued to be a very active period of his life. During his tenure ECRR grew in membership and reputation to the extent that the consortium was regularly recommended as a model that other clusters should try to emulate. ECRR demonstrated that seemingly disparate scientific organisations could come together on a regular basis to their mutual advantage and much of the credit for this development was due to the lead that Peter gave in making it happen. In the context of this appreciation it is worth recalling how it was that Peter and ECRR came together.

Peter came to Edinburgh in 1984 as only the ninth holder of the University of Edinburgh's Chair in Agriculture and Rural Economy since its establishment in 1790, an appointment that carried with it the Principalship of the then East of Scotland College of Agiculture, the other arm of the conjoint Edinburgh School of Agriculture of which he was *de facto* Head. (In a sense, however, it was a homecoming to an alma mater from which he had obtained a postgraduate diploma in animal genetics in 1950). He brought to the Chair an established international reputation in the science and practice of tropical agriculture gleaned from 13 years in academic centres in Uganda and Trinidad coupled, significantly as it turned out, with a further 19 years scientific and commercial experience with Unilever, principally in its agricultural businesses, in which he was recognised as an influential leader. To some, perhaps many, it was a surprise that a senior businessman should be tempted to return to the comparatively austere realms of academia but Peter had a life-long affinity for learning and communication at all levels and, for him, the time for a change was right. Fortuitously, his business background and acumen came to the fore almost as soon as he took up his new post and the squeeze on government funding of research, particularly that deemed 'near market', began to bite. The University, the School of Agriculture and ECRR were all beneficiaries of Peter's guidance during this difficult time. 'Cometh the hour, cometh the man' was most apposite.

One of Peter's responsibilities as Professor of Agriculture was to be Vice-Chairman of the Board of the Edinburgh Centre of Rural Economy (ECRE), a body established in 1947 to foster scientific interaction amongst its constituent organisations, at that time exclusively those with a locus on the Bush Estate, and to manage the Estate and Bush House. For its management roles ECRE employed a sizeable full-time staff whose salaries, together with estate running costs, were a charge on member organisations. Together with others Peter recognised that ECRE was placing an over burdensome financial demand on its members and, at the behest of the Board, he convened a Working Group to review ECRE and to recommend a way forward. The Group's findings and proposals were endorsed by the Board with the result that by 1988 ECRE had relinquished its role as employer and devolved estate management to individual member organisations. These steps dramatically reduced members' subscription rates and allowed the consortium and its Board to focus on science-oriented activities under the new banner of ECRR, which was formally launched in 1989. The Board decided that to co-ordinate these activities ECRR should have a part-time Scientific Director and with Peter's early retiral from the Chair of Agriculture he was the natural and unanimous choice. He readily accepted the offer and fulfilled his role with enthusiasm and distinction during his tenure from 1990- 1997.

From the outset Peter ensured that ECRR exercised a facilitating role in promoting collaboration, creating opportunities rather than directing alliances. To this end he introduced monthly working lunches of ECRR Directors that rotated round member institutions in order to raise mutual awareness of the spectrum of scientific resource and expertise embedded in ECRR. To enhance the profile of ECRR he arranged periodic visits by people of influence from the scientific, industrial and political communities and was instrumental in establishing the Annual ECRR Lecture, co-sponsored by the Institute of Biology and the Royal Society of Edinburgh and now an acknowledged prestigious event in the yearly calendar. Equally important was his encouragement of expansion of ECRR beyond the boundaries of Bush Estate and indeed of Edinburgh by attracting other 'rural research' organisations into membership. By 1996 the number of members had doubled giving ECRR a wider geographical spread and a greater register of scientific expertise with which to foster collaborations and to engage with the public on scientific issues.

When he stood down as Scientific Director in 1997 Peter did so because he felt that 6-7 years was about the right spell in the post given the natural turnover of senior staff in member organisations, the ever progressing nature of science and its governance with which he felt that he might be getting out of close touch. Though these contentions were arguable his wishes were respected. His insight and commitment had ensured a smooth transition from a Bush-focussed ECRE to a more outward-looking successor body. He set ECRR on a sure foundation as a facilitating consortium of scientific institutions unique within the UK, the EU and probably more widely. That is Peter Wilson's legacy in but one field of his many endeavours but it is the one closest to us.

Other tributes have been paid to Peter Wilson for his distinguished contributions in professional spheres –as an agriculturist, an academic, a consultant, scientific adviser, committee member and chairman and for his services to the Institute of Biology and to the Royal Society of Edinburgh among others, several of which were recognised in his lifetime by prizes, medals and awards. As a person Peter was an instinctive, persuasive and congenial networker who thrived on bringing people together to explore and develop common interests and opportunities, something he did equally well in a variety of settings be they scientific or social. He remained a warm supporter of ECRR and its activities after 1997 and attended its public events whenever possible. He will be missed.

Ian D Aitken

Peter Northcote Wilson CBE, MSc, PhD(London), DipGen (Edinburgh), HonDUniv(Stirling), FIBiol. Born 4 April 1928; Elected FRSE 9 March 1987; Died 29 January 2004.

RSE Council Ser vice: Secretary to Meetings, 1992-95; General Secretary, 1996-2001

Thomas Wilson

23 June 1916 - 27 July 2001

The latest Register of Members of the Royal Economic Society conveys the information that a T Wilson, BA PhD, reported his 'Current Position' as being 'Retired'. Such modesty disguises Tom Wilson's standing as the holder of the highly prestigious Adam Smith Chair of Political Economy at Glasgow University from 1958 to 1982.

Certainly Glasgow regarded Wilson's position as one of particular merit and importance and he and his family lived in one of the larger Professors' houses in University Square. If Wilson was the last holder of the Chair who preserved some of the patriarchal character consonant with this high regard for professional status, he nevertheless commanded the respect and affection of his staff and colleagues and listened to and responded to their views on how the affairs of the department should be conducted.

Inevitably the association of his Chair with Adam Smith typecast Wilson as a historian of economic thought. He was Joint Editor of the much-admired Glasgow edition of the works and correspondence of Smith and associated volumes of commentary by Smith scholars from all over the world. The series was launched as part of the 200th anniversary celebrations of the publication in 1776 of *The Wealth of Nations* and was universally acclaimed by Wilson's peers but, more interestingly perhaps, clearly did much to produce the astonishing revival of interest in Smith associated with the reassessment of the market economy in the 1980s.

The idea that one emulates the example of Adam Smith by being an authority on his work is fallacious and no one following Wilson's career could accuse him of any lack of analytical ability and practical sense. He was born (in 1916), brought up and educated in Belfast, and his forebears were Protestant farmers from Ballylagan, Co Antrim. He graduated BA from the Queen's University in 1938 and later in life he became one of the most respected economic advisers to the Northern Ireland Government.

As a graduate student at the London school of Economics (LSE) he fell under the spell of John Maynard Keynes. The central theme in much of his analytical work became an attempt to reconcile Keynesianism and Monetarism in offering an explanation of economic fluctuations. A succession of books, beginning with *Fluctuations in Income and Employment* (1941, revised 1947) and culminating in his *Planning and Growth* (1964) brought Wilson both professional and public attention, for he still followed a once time-honoured practice that even academic economists were expected to write intelligible prose. Wilson went further and garnished his text with quotations from contemporary poets.

The Second World War called for a major diversion of top economics talent into posts in which the estimation of resources available, and how they were to be allocated by central government, could be sensibly carried out. Tom Wilson spent six years in a series of posts, of most interest being as a member of Churchill's Statistical Branch of the War Cabinet. He worked directly to the Prime Minister's close friend and adviser Lord Cherwell, and with colleagues later to become well-known academics like himself, such as David Champernowne, Charles Kennedy, George Shackle and their 'boss' Roy Harrod, followed by Donald McDougall.

Devilling for Cherwell had its excitements, with Wilson once pounced on by Stalin's guards as a spectator considered rather too near Uncle Joe's emergence from a meeting with Churchill at Potsdam. Wilson's wartime service earned him an OBE, but he resisted a tempting invitation from James Meade to become a member of the Economic Section under the new Labour Government.

Wilson, in common with several senior economists serving the wartime government, was at pains to show that war-time planning was not to be taken as a guide to the operation of the peace-time economy. In an important article in *Oxford Economic Papers* (1948) – a journal of which he later became the energetic and forceful editor – he emphasised that physical controls in wartime were required to move resources quickly in line with an ever-changing military situation decided by only one purchaser – the state. The result was often inefficiency and waste, compounded by the rivalry between government departments reluctant to reveal information which would bring their motives into question.

However, in specifying the role of the state in the post-war economy, even amongst those who agreed that high employment, a satisfactory rate of growth and concern for the poor and old implied continuous state intervention, there were and remain pronounced disagreements about means. Today it may be difficult to understand that Wilson's intermediate Keynesian position, which supported fiscal policy to meet such objectives, but which rejected large-scale public ownership of capital, could lead him to be accused of being a capitalist lackey on one side and a crypto-Communist on the other. He found this amusing rather than disturbing.

Wilson, Thomas, succeeded Wilson, Harold, as the Economics Fellow at University College, Oxford in 1948, despite tempting offers from LSE. The list of his activities as a teacher, college bursar, editor, researcher and participant in public debate manifests extraordinary energy. The Titans such as the three Hs – Harrod, Henderson and Hicks – were still much in evidence, but their younger colleagues had to take concerted action to press for better professional training of economists if they were to keep up with Cambridge and LSE. By the time Wilson left for Glasgow, he and his generation could more than look Cambridge and London in the face. One could not forget that long before the war, Harrod and Meade had been sent by their Oxford colleges to Cambridge to study advanced economics!

Those academics who have travelled back north to be near their origins often encounter incredulity from their academic colleagues, although they might just concede that Glasgow is, like Edinburgh, one of the only other places to live outside the Golden Triangle. Wilson obviously had no such misgivings. He was going to an institution with a splendid tradition, a town with immense cultural advantages and a countryside nearby where he could indulge in his love of hill-walking. He immersed himself fully in Scottish economic affairs both as an adviser to the Scottish Office and as a director and for a while chairman of the Scottish Mutual Assurance Society.

If no further official recognition came his way – which is certainly surprising – academic appointments and honours abounded: Fellow of the British Academy 1976, Honorary Fellow of the LSE 1979 and Fellow of the Royal Society of Edinburgh 1980. While firmly anchored in Glasgow and playing his full part in academic life, he was in constant demand as a lecturer and visiting professor in Europe, the United States and Australia, where he spent a sabbatical at Canberra in 1982.

Wilson met Dorothy Parry at LSE and they married in 1943. She had an independent reputation as an expert on social policy and lectured on the subject in Glasgow. They collaborated in several studies on the welfare state. In their retirement both of them became crippled and bore this burden with immense fortitude. It did not prevent them enjoying the arts, entertaining their friends in their cottage in the Trossachs, and reminding their fellow social scientists that the ultimate object of their activities was to try to leave the world a better place than they had found it.

Alan Peacock

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Thomas Wilson OBE FBA FRSA. Born 23 June 1916; Elected FRSE 3 March 1980; Died 27 July 2001.

INDEX

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