

The Royal Society of Edinburgh

Lecture and Conference Reports

**Session 1999-2000
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LECTURES

Monday 8 November 1999
"ANDREW FLETCHER OF SALTOUN
AND THE POLITICAL USEFULNESS OF SCOTLAND'S PAST"
Dr John Robertson
St Hugh's College, Oxford
Delivered to the First Ordinary Meeting

With a Scottish parliament sitting for the first time since 1707, it is perhaps surprising that Andrew Fletcher of Saltoun (1653-1716), known as "the Patriot", is not receiving more recognition from those who would like the new parliament to have a "useful past". In an attempt to explain why, Dr Robertson explored both the history of Fletcher's reputation, and the present state of scholarly enquiry into his life and thought. Fletcher's reputation, it was argued, has itself changed with times and circumstances. The respect he enjoyed in his lifetime was as an individual, feared for his temper as well as admired for his intelligence. By the end of the eighteenth century the singular patriot has been transformed into an exemplary political radical, being depicted with a cap of liberty over his head. A hundred years later he had become "the father of Home Rule". It is only in the second half of the twentieth century, however, that he has been clearly identified with the cause of Scottish nationalism.

Turning to the scholarship devoted to Fletcher, Dr Robertson traced this to the late nineteenth century, but argued that the major breakthrough came in the 1950s, when Fletcher's writings were treated as contributions to a distinctive British tradition of "Machiavellian" or republican thinking in the late seventeenth and eighteenth centuries. More recently, research had also begun to yield fresh information about his life. Four aspects of this were underlined. It is now known that he was educated first by Gilbert Burner and then at St Andrews; that he travelled all his life, regularly repairing to London, the Netherlands and Paris; that he was a keen book-collector, acquiring the largest private library in Scotland at the time; and that he had a relish for modern city life, particularly enjoying himself in London. The impression of diffidence towards his native country is only reinforced, Dr Robertson argued, when we look at his relation to the intellectual life of Scotland at the time. Not only was Fletcher indifferent to natural philosophy; he seems not to have shared the enthusiasm for Stoic moral philosophy propagated by the Latitudinarian churchmen with whom he had close personal connections.

But it is his distance from contemporary Scottish historical writing which is most revealing. Fletcher had no interest in establishing the ethnic origins of the nation, or in vindicating the antiquity of its monarchy or its church. Instead he adopted Machiavelli's philosophy of history, according to which men must confront the circumstances in which they find themselves from their own resources. Faced with the successive economic and political crises of 1698 to 1707, therefore, Fletcher urged the Scots to respond to these circumstances, and not to imagine that solutions lay ready-made in the past. Andrew Fletcher, at least, did not believe in a politically useful past; perhaps therefore, Dr Robertson concluded, we should not try to make him part of one.

The controversial address stimulated a number of comments and questions. Fletcher had spent most of his life out of Scotland, but it was uncertain whether he had ever seen military service against the Turks; nor was it clear why he had attracted the attention of Rousseau. Professor Peter Jones, FRSE, Director and Professor of Philosophy, Institute for Advanced Studies in the Humanities, University of Edinburgh, expressed the thanks of those present for an enjoyable address; to understand the present it was necessary to understand the past, and the speaker faced up to the challenge of finding out where an important figure at the time of the Union stood on issues which were still of relevance today. The extent of the debate showed the interest he had aroused.

Monday 6 December 1999
"DR BLACK'S PHILOSOPHICAL PERFORMANCE"
Dr Robert Anderson
Director, The British Museum, London
Delivered to the Second Ordinary Meeting

Two hundred years ago, on 6 December 1799, Dr Joseph Black, Professor of Medicine and Chemistry at Edinburgh University, died at his house at 58 Nicholson Street. He was a Founding Fellow of the Royal Society of Edinburgh. One of a group of brilliant savants of the Scottish Enlightenment, his teaching was legendary and his early research (though he published little) was renowned throughout Europe. His

chemistry classes, with skilfully performed practical demonstrations, attracted hordes of students and he lectured extramurally to fashionable audiences.

Joseph Black was born in Bordeaux in 1728, the son of an Ulster merchant. He was sent to school in Belfast and went on to take the arts course at Glasgow University when he was sixteen. Having graduated, he chose to study medicine, soon coming under the influence of William Cullen, in whose laboratory Black conducted his first experiments. He migrated to Edinburgh University in 1752, and completed his medical degree with a dissertation describing quantitative experiments on the nature of alkalinity of magnesium compounds. He went on to study the effects of acids and heat on chalk and in 1755 presented his results to the Philosophical Society. Black showed that the gas evolved had a clear chemical identity, which he called "fixed air". This, carbon dioxide, was the first gas to be clearly characterised.

In 1766 Cullen moved to Edinburgh University and Black took his place as chemistry lecturer at Glasgow. Here he met James Watt; they were to become life-long friends. The two performed related experiments on heat, but apparently they did not collaborate. Black's work was influenced by Cullen's earlier experiments on the reduction of temperature noticed when alcohol evaporates from the bulb of a thermometer. Black was fascinated by the phenomenon that ice does not suddenly melt when heated above its melting point and, likewise, that water does not immediately boil away at its boiling point. He referred to these qualities as "latent heat".

Returning to Edinburgh in 1766 as Professor, Black's philosophical chemical investigations came to an abrupt end. His attention turned to the developing chemical industries and he was much consulted by those promoting these activities. In particular, he was concerned with bleaching processes, advising the Board of Manufactures. He invented a widely used portable laboratory furnace and was asked for his judgement on sugar refining, alkali production, ceramics glazing, dyeing, brewing, metal corrosion, salt extraction, tar manufacture, glass making, mineral composition, water analysis and vinegar production.

Black's teaching, though successful in many ways, did not embrace Lavoisier's theory of combustion, the most important chemical concept of the age. Neither did Black's term as professor lead to the emergence of a research school of chemistry; the initiative was to be taken up by Germany in the early 19th century. Black's teaching has to be understood in the context of the education of medical graduates, though his influence on students was much more widely felt. The rise of Edinburgh science and medicine in the 18th century was part of a planned process to enhance the economic and intellectual status of the city and, indeed, Scotland itself. In this, Black played a key role.

The address stimulated a number of questions. Black, the speaker believed, did not understand his observation of latent heat, but it was relevant to Watt's experiments. His public lectures were rigorous and part of the University's course; originally they were excellent, but were not updated, and only his philosophic demonstrations enlivened them. No reason has been found for his short tenure of the office of Manager of the Infirmary, and it could only be assumed that he was too busy to retain the office; it was also unknown whether he was paid for the advice he gave to the entrepreneurs who consulted him.

After the speaker had answered these and other questions Professor Mark Jones proposed a vote of thanks to Dr Anderson, who had found time in his busy role at the British Museum to carry on this research work; Black's charm and application were shared by the speaker whose masterly talk had covered every aspect of Black's life.

Monday 10 January 2000

"SYNAPTIC PLASTICITY: WHAT ROLE DOES IT PLAY IN LEARNING AND MEMORY"

Professor Richard Morris

Department of Neuroscience, University of Edinburgh

Henry Dryerre Prize Lecture

Delivered to the Third Ordinary Meeting

Since the writings of Ramon y Cajal around 1900 and Donald Hebb in the middle of the 20th century, it has been widely assumed that patterns of neural activity encoding experience can induce enduring changes in the strength of neural connectivity. With appropriately re-activation, these traces enable a memory of that experience. The discovery of long-term potentiation (LTP) by Tim Bliss and Terje Lømo in 1973, (whereby brief high frequency stimulation of a neural pathway can induce long lasting changes in synaptic efficacy), provided a reproducible model with which to investigate the assumption. Studies of the possible role of LTP or LTP-like changes in learning and memory have led to the general

conclusion which was described in the lecture as the Synaptic Plasticity and Memory (SPM) hypothesis. This hypothesis states that:

“Activity-dependent synaptic plasticity is induced at appropriate synapses during memory formation and is both necessary and sufficient for the information storage underlying the type of memory mediated by the brain area in which that plasticity is observed.”

Put this way, the hypothesis is intended to capture the two reciprocal features of the hypothesis: (1) as many of the properties and mechanisms of LTP, long-term depression (LTD), and other activity-dependent changes that have been discovered over the past 30 years; and (2) that our understanding of different forms of memory has advanced to a point where we recognise these as being mediated by distinct brain areas.

The body of the lecture was built around a logical framework for describing tests of this hypothesis, specifically a set of formal criteria that it must meet. These are:

- (1) Detectability: If an organism displays memory of some previous experience, a change in synaptic efficacy should be detectable somewhere in its nervous system.
- (2) Mimicry: Conversely, if it were possible to induce the same spatial pattern of synaptic weight changes artificially, the organism should display "apparent" memory for some past experience which did not in practice occur.
- (3) Anterograde alteration: Interventions that prevent the induction of synaptic weight changes during a learning experience should impair the memory of that experience.
- (4) Retrograde alteration: Interventions that alter the spatial distribution of synaptic weights induced by a prior learning experience should alter the memory of that experience.

The lecture illustrated experimental evidence using a range of inter-disciplinary techniques that have been collected over the past few years, that collectively constitute rigorous tests of these criteria. And it ended with a brief discussion of a speculative new treatment of developmental learning difficulties introduced by Michael Merzenich and Paula Tallal, based on the SPM hypothesis.

The lecture generated considerable discussion about memory loss in geriatrics, the decay process of the hippocampus and the difference between short and long-term memory loss, and the recollection of dreams; in answer to a question about racing pigeons the lecturer explained the difference between the brain structure of mice and birds.

Professor David Milner proposed a vote of thanks for the tasty and scientific meal to which the lecturer had treated the audience; it would take time to digest, but it made clear the essential interdisciplinary nature of modern research, and the need to work with colleagues expert in other areas. The lecturer had illustrated how necessary it was to have converging approaches to the subject; however expert the hearers they had all learnt something from the excellent lecture.

Monday 7 February 2000

"TURNING OVER

A NEW PAGE IN THE PREVENTION OF CORONARY HEART DISEASE"

Professor Chris Packard

Department of Pathological Biochemistry, University of Glasgow

Delivered to the Fourth Ordinary Meeting

Cholesterol has long been linked to coronary heart disease (CHD). It is an important bulk constituent of the atherosclerotic plaque and its level in the blood stream is recognised as a predictor of CHD risk. As a lipid it is insoluble in plasma water and circulates as the core component (in its esterified form) of low density lipoprotein (LDL). Clinical trials with LDL lowering agents have proven the cause-effect relationship between plasma cholesterol and CHD. Inhibitors of the enzyme 3 hydroxy 3 methylglutaryl coenzyme A- "statins" – decrease LDL by 20-40% and have been shown in 5-year studies to reduce the incidence of coronary morbidity and mortality. Safety, of course, is a major concern with any long-term medication. The five major clinical trials of statins demonstrate clearly that these drugs are well tolerated, have few side effects and, indeed, improve survival. Surprisingly, they also seem to have a beneficial effect on the incidence of strokes.

A remarkable finding in the West of Scotland Coronary Prevention Study – one of the main statin trials – was that clinical benefit appeared within a few months of initiating treatment, too early to be due to decrease in the size of arterial plaques (a process that takes years). Pathology studies have now revealed that plaque fragility rather than size is the key feature that determines clinical outcome. Rupture of an atherosclerotic plaque precipitates intravascular clot formation, which in the confines of a “pencil-thin” coronary artery can block blood flow and cause oxygen starvation and muscle damage (a myocardial infarction). Statins are now believed to stabilise plaques not only through LDL reduction but also through other, as yet ill defined, direct effects on the cells of the artery wall. One possible mechanism is that the drugs exert an anti-inflammatory action and so lessen the influence that inflammatory cells have on plaque fragility. New research has shown that individuals in the population who exhibit a chronic pro-inflammatory state, possibly due to repeated infections or a genetic predisposition, are at increased risk of CHD. The white cells in their blood invade the cap of the atherosclerotic plaque and destroy the resident muscle cells and fibers that give it strength. The mechanism of the statin effect on inflammation is still a mystery.

Lowering LDL cholesterol is not the only route to preventing CHD. Changing the level of the other main plasma lipid, triglyceride, has also been found to be beneficial. In a clinical trial in the USA, reducing plasma triglyceride levels by 30% using a different kind of drug – a fibrate – led to fewer heart attacks and strokes. Interestingly, in this trial LDL levels were not affected by the drug. This raises the possibility that statins and fibrates have complementary actions and their impact on CHD prevention may be additive. Detailed metabolic studies in the laboratory reveal that fibrates change the nature of LDL rather than its concentration. Small LDL particles are the most atherogenic form of the lipoprotein. Treatments which lower triglyceride cause LDL to become larger and less dangerous.

The lipid hypothesis – that lowering cholesterol reduces CHD - is now accepted fact. A new page, or even a new chapter, in the story of CHD prevention has opened up. In addition to lipid regulation with easy-to-take effective drugs, we can now look forward to discovering agents that influence cells of the arterial wall and so promote plaque stability. Popping pills is, however, the answer only for those at high risk. For the majority a prudent diet, exercise and smoking cessation are still the cornerstone of CHD prevention.

The ensuing discussion covered a range of issues. Professor Packard was asked about the impact of other compounds, such as folic acid. It was noted that studies were underway on the effects of such dietary components. In response to a question on the sharp improvement initiated by statins it was speculated that the benefit to coronary arteries might occur more rapidly than elsewhere. On the topic of what we shall die of, if not heart disease, Professor Packard referred to a current study from which results are expected next year. Other programmes are exploring the observed link with inflammation and the distinction between chemical or infective mechanisms. Animal studies, using antibiotics, suggest a strong infective component. Finally, the reasons behind the geographical variations in level of heart disease were raised. In response Professor Packard noted that, in Finland, where levels had been worse than Scotland, through public health campaigns they had become much better. By moving from doing all the wrong things, in the context of diet and lifestyle, to a more Mediterranean diet and better fitness, the Finns had greatly reduced the incidence of coronary heart disease.

The vote of thanks was moved by Professor Charles Forbes. He congratulated Professor Packard on his excellent presentation, on a practical subject so near to all our hearts. He pointed out the pioneering nature of the work in Glasgow and the way it had had a major impact on the medical profession. Indeed the conclusions from the West of Scotland Study had been incorporated into the relevant guidelines for clinicians. He thanked Professor Packard for providing such a useful insight into his work and its significance.

Monday 14 February 2000

"NATIONAL DATABANKS OF MEDICAL RECORDS"

A Forum chaired by Sir William Stewart, with

Mrs Ragnheidur Haraldsdottir

Deputy Permanent Secretary, Icelandic Ministry of Health and Social Affairs

Professor Nicholas Hastie

Director, MRC Human Genetics Unit, Western General Hospital

Dr Donald Bruce

Society, Religion and Technology Project, Church of Scotland

The potential benefits of a medical (ultimately genetic) database from a discrete community were well illustrated in the presentations made by Ragnheidur Haraldsdottir and Professor Hastie, whilst Dr Bruce's critique of the ethical dilemmas which could arise, provided a useful contrast.

The population of Iceland is 280,000 and, by private funding, a database has been produced from the medical records of almost all the inhabitants. Only key information from each record is included. Individuals are included by default and may only opt-out by writing to the Department of Health. The database is secured by anonymity and encryption.

The exciting possibility of such data being enlarged by genetic information was explored. The ethical problems presented and future developments were thoroughly examined. It was clear that informed consent for the use of such data would be almost impossible to obtain, as future applications and consequent implications cannot necessarily be foreseen.

Finally it was emphasised that, because of recent controversies, such a method of data collection in Scotland would, almost certainly, require an opt-in consent from individuals.

Friday 18 February 2000

"BIOLOGICAL MESSAGES BETWEEN GENERATIONS"

Professor Malcolm Peaker

Hannah Research Institute, Ayr

Joint Lecture with Edinburgh Centre for Rural Research and the Institute of Biology

This lecture was concerned with the relations between a mother and her offspring, with particular reference to the influence a mother has on the development and programming of the offspring for later life and even beyond the life of that offspring. This is an area of science that has grown organically - evidence of such phenomena has accumulated over the years but very recently it has attracted much more attention.

The phenomena included under the generic heading of maternal effects are those in which the mother affects the phenotype of her progeny other than through the genes. Major effects are now known in plants and in all animal groups that have been studied; some involve the passing of environmental information to the offspring while others reflect the nutritional status of the mother. Using examples from all parts of the animal kingdom, maternal effects affecting such phenotypic properties as sex ratio, birthweight, immune responses, organ development, vulnerability to predation, play, photoperiodic control and food preferences were described. Some of the effects are very long-term, lasting for at least three generations and can be induced by even short-term exposure of a mother to different or adverse conditions. The poor condition of offspring produced in poor environmental conditions can therefore be described as 'phenotypic depression' by analogy with 'inbreeding depression' but the cause is entirely environmental and not genetic. Some maternal effects appear to be adaptive in that they aid survival under poor conditions but have such long-term influences that they are detrimental if conditions improve. Therefore, there are implications for the reversal of poor conditions or diet in that things may get worse before they get better.

These biological phenomena have implications for human populations, particularly for those living in (or previously exposed to) poor living conditions and nutrition, for the survival of species in degraded habitats and for the welfare of farm animals. They also raise important mechanistic questions of how such messages are transmitted down the generations; in a few cases the signals are known but in most they are not. The point was made that although we are looking at major biological phenomena in animals and plants which have a direct bearing on current social and environmental concerns, a complete knowledge of every genome of every living organism would not be able to provide the answers to some of the most pressing questions and problems for life on earth. It was abundantly

evident that there are still discoveries to be made at the higher levels of biological organisation and integration.

Professor Mary Bownes, ECRR, proposed a vote of thanks.

Monday 21 February 2000

"RADAR IMAGES OF THE EARTH'S SURFACE - FUNDAMENTAL LIMITS AND HOW TO CHEAT"

Sir David Davies, CBE

*President, The Royal Academy of Engineering
Joint RSE/Royal Academy of Engineering Lecture*

There have been massive improvements in the performance of radar imaging of the earth's surface ever since centi-metric radars were first tested in aircraft during the Second World War. The applications of such imaging are not confined to military uses but include many civil applications such as environmental monitoring and large-scale earth surveillance.

Although most of the basic theory of radar was broadly understood by the 1950's, engineers have continued to develop new systems offering large improvements in performance and giving higher resolutions, way beyond that previously predicted – seemingly breaking the rules that defined the limits of performance.

In the late 1940's, Doppler principles were used to separate out moving targets from background clutter. This offered many improvements for radar including applications to civil air traffic control to suppress ground clutter. This was followed a decade or so later by the invention of synthetic aperture radar (SAR). This process made use of a coherent radar located on moving platforms such as an aircraft. By storing and processing the signals received over many pulse repetition intervals, it became possible to synthesise a radar picture whose resolution was associated with an antenna a mile or so long. The length of the antenna was determined by the ability to store and process signals while the aircraft was flying. This represented a massive increase in performance and since most targets were located within the "near-field" of the synthetic antenna, the processing could be further adapted to produce "near-field" focusing of each resolution cell, providing yet further improvements in resolution.

The resulting analysis of such systems produced the apparently staggering result that the width of the resolution cell was half the width of the physical antenna located on the aircraft. Thus a better resolution required a smaller antenna! Furthermore this resolution was both independent of wavelength and of range. In principle it extends out to infinity, although there is the associated inconvenience of having the aircraft fly from minus infinity to plus infinity and possessing sufficient processing and storage to handle the signals!

In examining such developments, one is struck that the MTI radar was based upon the assumption that the radar was fixed and targets were either fixed or moving, while the SAR radar assumed that the radar was moving and all the targets on the ground were fixed. Needless to say this was not always the case, and moving vehicles on the ground such as ships, trains or cars are detected by the SAR radar but are shown to be at the wrong bearing relative to the radar axis. This is because the Doppler principle is also being used in order to produce the synthesised radar picture. This threw up the new additional challenge of trying to build a radar, which could generate a high-resolution SAR image and work with moving targets. The way ahead was to produce an antenna which could also be made to stand still while the aircraft was flying forwards. This apparent paradox was achieved by having a longer array on the aircraft and electronically moving the active part of the array backwards as the aircraft flew forwards. Such radars have been used to present impressive pictures of ground movements showing, for example, cars travelling at different directions on motorways, but the main application is seen as battlefield surveillance for military applications.

Although SAR radars were developed primarily for military applications from aircraft, they were quickly adopted for satellite use. Here they have been used to detect deforestation in South America, ice flows, oil slicks and many environmental monitoring roles. Several current satellites are equipped with such radars and various research groups at universities can have access to the data so produced and can process the data in their own way for their own specific research uses. Polarisation information has also been used to distinguish between different shapes of objects, such as man-made buildings compared to forestation and shrubbery.

The most recent step forward in such radars has been the interferometric synthetic aperture radar (ISAR). If two SAR images of the same part of the earth's surface taken at different times are compared,

they will in general show no difference. If, however, they are added coherently, the resulting image will show interference lines imposed upon them due to the fact that the precise locations of the synthetic radar for the two images was not identical. Similarly, if the shape of the landscape has changed slightly, this will show up with interference fringes, and such work was done to show small changes in the landscape following an earthquake in California. This can show up very small changes of, say, one half wavelength (often a few centimetres). With the combination of several such synthetic images, it is also therefore also possible to build up 3D images from the information on the interference fringes.

In looking at how this additional capability has been achieved, we see that there is a new assumption behind this type of radar – it assumes that all the targets observed lie on a plane or more precisely a continuous surface. This additional subset of all targets enables us to use new information to generate radar pictures with a resolution way beyond that previously contemplated, and indeed way beyond that previously predicted from theory.

It is of course important to realise that the theory was not wrong, but merely that we had not appreciated how to make use of additional information known about certain classes of targets and how to derive very large orders-of-magnitude improvements in performance. Doubtless there are further such features yet to be exploited.

Monday 6 March 2000
"ULTRAFAST LASERS: FROM SCIENCE TO TECHNOLOGY"
Professor Wilson Sibbett
School of Physics and Astronomy, University of St Andrews
Delivered to the Fifth Ordinary Meeting

In this address Professor Wilson Sibbett began by presenting a summary review of the up-to-date status of representative ultrashort-pulse lasers. Particular highlighting was given to the technique called "Kerr-lens modelocking" that was first demonstrated by his research group at the University of St Andrews. With this methodology he explained how modern optical sources such as femtosecond-pulse titanium sapphire lasers could offer both practicality and versatility in terms of pulse durations, energies, peak powers and spectral tunability. He also showed how the latest compact versions of diode-pumped femtosecond lasers could be powered with AA-type "penlight" batteries and thereby operate at a total input electrical power level of just 1W. It was explained that this represented a 100,000 times improvement over the femtosecond dye laser systems that were common place up to the late 1980s!

From the basis that femtosecond lasers have now matured into practical system configurations, Professor Sibbett then proceeded to describe a range of applications that demonstrated how basic science had led to new technologies. In particular, he described the uses of ultrashort-pulse lasers in imaging, where the femtosecond pulses were either used for taking snapshots through highly-scattering tissue or where their high peak powers could be used with two-photon absorption for the imaging of live cells by fluorescence microscopy. Examples were presented of specialist micro-machining of metals, hard materials (tantalum, titanium), tissue and even explosives, where the advantages of the high intensity but low average-power ultrashort pulses were made clear.

A significant part of this lecture was devoted to a description of a planned Interdisciplinary Research Collaboration, based at St Andrews University but involving six other university research groups and seven industrial companies. This "IRC" entitled UPDATES (for "Ultrafast Photonics for Datacomms Above Terabit Speeds") will be funded at a level of around £11M by the Engineering and Physical Sciences Research Council for a period of six years. The underlying structure of the programme as outlined by Professor Sibbett is that leading-edge research science in femtosecond lasers, novel III-V semiconductor and organic/polymer materials, quantum-dot and photonic bandgap techniques and novel network concepts would be actively coupled to technological pull-through. He pointed out that this combination of new science and new technologies was aimed at achieving the next generation of datacomms with speed expectations up to 100Tb/s, which is 100 times higher than that presently available. He predicted that the principles of integration which the latest processing technologies make available offered the exciting prospect of "femtosecond networks", where we would have "photonics-based datacomms networks on a chip" and that this would be truly revolutionary.

From Professor Sibbett's very comprehensive description of this topic, it was clear to everyone in the audience that ultrafast lasers were moving from the lab to the workplace. His claim that "femtoscience" was leading to new and exciting visions for an over-growing sector of

“femtotechnology” was given a compelling and exciting justification and we look forward to seeing the realisation of at least some of his aspirations.

A lively discussion ensued covering further applications of the technology described and possible new advances that might be expected. The latter included the prospects for generation of ultrashort pulses at shorter wavelengths, including the x-ray regime. This opened up the issue of creating electromagnetic pulses of even shorter duration - for example, significantly less than one femtosecond.

Professor Carl Pidgeon proposed the vote of thanks. He noted the leading position the speaker held in this field, as recognised by the Rank Prize award that he had received. He also recalled the unusual method by which some of Professor Sibbett’s results had reached America: via a Dundee newspaper, an observant mother and a Scottish scientist at Bell Laboratories! Professor Pidgeon also contrasted the laser techniques described in the lecture with the alternative Free Electron Laser, but admitted that the latter could not compete when it came to the shortest pulse durations. In conclusion he thanked Professor Sibbett for a well presented and highly stimulating talk.

Thursday 13 April 2000
“THE CREATION OF THE UNIVERSE”
Professor Joseph Silk, FRS,
Department of Astrophysics, Nuclear and Astrophysics Laboratory,
University of Oxford
Delivered to the Robert Cormack Bequest Meeting

The Universe began fifteen billion years ago in a brilliant flash of light whose dim relic we observe today as the cosmic microwave background radiation. Professor Silk described how, for a brief instant, the universe inflated in size to reach and even vastly exceed the enormous extent that it presently observes. Inflation induced infinitesimal fluctuations in the density of matter that seeded the growth of such structures in the universe as cluster of galaxies. The fossil traces of these fluctuations are observed as infinitesimal temperature angular variations in the cosmic microwave background.

The universe began as an exploding fireball of radiation. Galaxies formation proceeds with the growth of density inhomogeneities once the density of the universe is first dominated by matter. Density fluctuations grow by accreting matter from their surroundings. Once the density contrast is sufficiently large, the fluctuations develop into self-gravitating clumps of matter that merge together as larger and larger regions of the universe become dense enough for self-gravity to overcome the pull of expansion. Galaxy mass halos form. The halos are made of weakly interacting particles, the dark matter that constitutes 90 percent of the universe.

Within the different halos, the ordinary baryonic matter contracts and becomes dense enough to start fragmenting into stars. The star formation process can be greatly accelerated by the occasional mergers between two galaxies, which generate a fresh supply of gas. The gas is driven into the central regions of the merged system as it undergoes shocks and loses kinetic energy and angular momentum. In this way, great bursts of star formation are induced that mark the earliest phase of the more massive galaxies. These are generally elliptical galaxies.

Spiral galaxies develop more quiescently. Such galaxies are characterised by thin, relatively fragile disks that are fed by slow infall rather than by violent mergers. Spirals populate low density regions, whereas ellipticals predominate in the rich clusters of galaxies. By studying the universe with the world’s most powerful telescopes, both terrestrial and in space, one can probe the early moments in the evolution of a galaxy, and verify that galaxies indeed underwent a far more interactive and brilliant past than characterises their current state.

Monday 17 and Tuesday 18 April 2000
"HOW TO BE A EUKARYOTE"
Dr Iain Mattaj, FRSE
European Molecular Biology Laboratory (EMBL)
Caledonian Research Foundation Prize Lecture

All living organisms on earth are made of cells. Many simple organisms, including bacteria and yeast, are unicellular. More complex organisms, including mammals and higher plants, are made of large numbers of cells which include many different specialised cell types. A major area of research in modern biology is aimed at understanding the internal structure and workings of the cell as the basic building block of life.

Dr Mattaj addressed a fundamental question in cell biology in his lecture entitled "How to be a Eukaryote: mechanisms and regulation of traffic between the cell nucleus and cytoplasm".

All animals and plants are eukaryotes. The hallmark of eukaryotes is the fact that their cells contain a separate internal compartment called the nucleus. All the genes of eukaryotes are kept inside the cell nucleus, where they are separated from the rest of the cell (the area called the cytoplasm) by a double membrane made of lipid and protein. The genes are not only stored in the nucleus, but also regulated there and copied during every round of cell division. The regulation, packaging and copying of the genes is carried out by a host of protein factors. These factors are produced in the cytoplasm and must therefore move across the nuclear membrane to gain access to the genes. Furthermore, the genes themselves generate RNA products that have to exit the nucleus to reach their sites of activity in the cytoplasm. To complicate matters further, we now know that certain factors must shuttle continually between the nuclear and cytoplasmic compartments. How then does this molecular traffic between the nucleus and cytoplasm of the cell take place? What are the mechanisms involved and how does the cell know the inside of the nucleus from the outside and keep track of the directional flux of molecules?

There have been spectacular advances made recently in understanding how molecules move to and from the nucleus and Dr Mattaj has played a prominent role in this field of research. We now know that all the traffic of molecules into and out of the nucleus moves via pores in the nuclear membrane (termed Nuclear Pore Complexes or NPCs) and all of these pores allow movement in both directions, ie, there are not separate pores for entry and exit. While small molecules can simply diffuse through the pores, larger proteins must be actively transported in an energy-dependent process. The transport mechanism involves soluble receptor proteins that recognise the factors to be transported (the molecular cargoes) by binding to specific peptide motifs built into the primary structure of each protein cargo. Multiple types of transport receptor have now been characterised, some involved in nuclear import, some in nuclear export and some in bidirectional shuttling to and fro. All the receptors ferry their cargoes to the nuclear pores where they are then moved through with the help of another protein, called ran. The ran protein can exist in two distinct forms, one form found in the nucleus and the other in the cytoplasm. The cell can sense direction between the inside and outside of the nucleus by virtue of the form of ran present in each compartment.

Needless to say, many important questions in this field still remain to be answered. Dr Mattaj also highlighted in his lecture many of the practical difficulties that make the conduct of scientific research so challenging, but ultimately rewarding when obstacles are overcome by ingenuity and hard work. Dr Mattaj's lecture illustrated the excitement of current research in cell biology and showed how close we are getting to providing some of the basic answers to understand how the key processes in living cells function at the molecular level.

Tuesday 18th April
"A MATERIAL WORLD: MOBILE PHONE TECHNOLOGY
COMMUNICATION BEYOND 2000"
Professors Peter Grant, University of Edinburgh and
Sadahiko Kano, Executive Adviser, NTT, Tokyo, Japan
Edinburgh International Science Festival Lecture

This talk discussed the current second generation (2G) and new 3G mobile phone systems explaining the competing time division multiple access (TDMA) and code division multiple access (CDMA) subscriber radio access techniques. 2G systems, such as the European developed GSM system, which is now deployed almost worldwide, and the Japanese PDC system uses TDMA. In comparison all the 3G systems (UMTS in Europe and IMT-2000 worldwide) will use the newer CDMA approach. The major advance in 3G systems is to move from speech and low rate data transmission to medium and high speed data for video (TV) transmission and internet searching. The talk discussed the data rate

requirements for these different applications which range from < 10 kbit/s up to 2 Mbit/s and which, unlike symmetric voice transmission, involve a mix of symmetric and asymmetric, continuous and bursty signal transmissions.

The advent of the Third Generation Mobile Systems will thus increase the data rate by 200 times. As well as improving the audio quality, this means that mobile phones will be able to transfer a great deal more electronic information, marking a total change in telephone usage from exclusively voice to predominantly data services.

The faster and more power 3G technology, soon to be introduced into the UK, will make the mobile phone an indispensable consumer good which will allow people to communicate from any place in the world to another person located anywhere, at any time and by various means. The new miniaturised mobile appliances will allow people to interface conveniently with other terminals including PCs and digital cameras.

Existing technology will see the creation of mobile phones which will look like a credit card with an antenna. These high-powered phones will interface with other devices and will allow us to communicate anywhere in the world. Someone sitting on a beach in the Caribbean could email digital photos from their camera with an associated message back home to their friends and family in the UK. The postcard as we know it today, with its long postal transit delay, will rapidly become a thing of the past.

Mobile internet technology was launched last year in Japan and there are already over five million users for whom their mobile phone is as necessary as their wallet. They are now using their phones to download music, complete their banking transactions and access their emails.

In addition to new telephone installations in developing countries being all wireless based, the traditional land line in the developed countries could become virtually obsolete – our grandchildren will probably find it amusing when we tell them that phones used to have wires attached to them! Instead of a home or business phone being a fixed device that is shared between people, new generation mobile phones will create a situation where phones become a personalised object on which individuals can communicate and be communicated to, regardless of where they are in the world.

Mr James Smith, FRSE, Formerly Assistant General Manager, Ferranti Limited, proposed the vote of thanks.

Tuesday 18 April 2000

“ORGANIC AGRICULTURE: HOW TO IMPROVE ON SOUND PRINCIPLES”

Dr Carlo Leifert

*Aberdeen University, Centre for Organic Agriculture
Regional Lecture at Strathclyde University*

Dr Carlo Leifert is a microbiologist/plant pathologist with 14 years R&D management experience in both industry and academia. He is currently Director of the Aberdeen University Centre for Organic Agriculture (AUCOA).

In his lecture, Dr Leifert described how at a time when an increasing number of scientific approaches (e.g. GMO-crops, livestock growth hormones and promoters) to increase the efficiency of conventional agriculture are rejected by consumers, demand for organic food has risen rapidly.

On the other hand, criticisms from the “scientific community” about a range of organic farming practices have, so far, had no impact on consumer confidence. Criticisms focus on the risk of pathogen transfer through use of manure; concern about environmental impacts of Cu and S-fungicides; the risk of mycotoxin contamination if synthetic fungicides are not used; and the lower yields in organic production systems.

His review focused on describing the underlying “holistic” principles of organic agriculture. He presented results from systems studies showing increased soil biological activity and habitat biodiversity, crop and livestock disease/pest resistance, reduced pollution potential and increased sustainability and improved food quality in organic systems to explain the underlying reasons for consumer confidence in organic food. Recent criticisms of organic farming systems were addressed by describing the production system based approach to weed, disease and pest control and food safety. Finally, Dr Leifert described the applied, strategic and fundamental R&D requirements necessary to improve the sustainability and productivity of organic agriculture in Scotland.

Monday 8 May 2000

"CHALLENGES OF DEVELOPMENT POLICY IN THE CONTEXT OF GLOBALISATION"

Bishop Diarmuid Martin

Secretary, Pontifical Council for Justice and Peace,

The Vatican, Rome

Delivered to the Sixth Ordinary Meeting

The subject is a very simple yet basic one. Despite a century of extraordinary scientific progress, millions of persons across the world live in extreme poverty. Why have we not been able to find the science of applying science in order to resolve the inhuman divisions, inequalities and exclusions which mark our world? Have development strategies failed? Has science failed?

We must ask above all: what kind of policies will be required in order to foster a new development mix?

In a knowledge-based economy, it becomes much clearer that it is people and their creativity and capacity for innovation who are the driving force of an economy. To enhance human capacity we need a mix of:

- sound macroeconomic policy, including open markets;
- investment in education, basic social progress and a qualified workforce; and
- functioning modern infrastructures and transparent good governance.

Fighting poverty is not about applying policies, it is about enabling people. It is interesting to note that one of the great success stories of the global era is something by definition very small: micro credit. Sustainable community building through innovative forms of local financing is possible. It is, indeed, essential. The strong global requires the robust local.

The Catholic social tradition has long stressed the principle of "the universal destination of created goods". When God created the goods of creation he created them for the benefit of all.

Today it is essential to apply this principle to knowledge. It is not acceptable to hoard up knowledge which is useful and essential for the common good. This applies especially in the area of health. Medical research is too often dominated by the need to cover the high costs of research. The health situation of the poorest remains dramatic. In Africa life expectancy has dropped in many countries to below 40. Childhood diseases kill 11 million children under five each year and maternal mortality is 870 per 100,000 as opposed to only 5 to 6 per 100,000 in developed countries.

Poverty cannot be defined only in terms of lack of income. It must be linked to the question of human capacities. In Bishop Martin's view, poverty is primarily the inability to fully realise one's God-given potential. Also, an economy or a society which leaves large sectors of the population on its margins is for that very reason less effective and more fragile. Inclusion is not just a moral good, it is an economic and social good. An economic policy which does not look at its social consequences is short-sighted. Social cohesion and social equity are essential prerequisites for a strong and sustainable economy.

Development policy also requires investment in governance and social infrastructures. It is not possible to privatise banks when there is no adequate banking legislation in place. It is not possible to protect human rights when police and the judiciary are untrained or corrupt. There will not be useful foreign investment if there is no legal protection for investments. Essential social expenditures cannot be covered without an efficient, modern and just tax system. Corruption must be fought and military and unproductive spending reduced. Efficient government is needed to guarantee the ethical and juridical framework within which the market can flourish and within which ethical market behaviour will be fostered.

The private sector, finally, is the one which stands most to gain from the new international economic situation. It must assume social responsibilities commensurate with the advantages it gains.

At the close of his clear and moving address Bishop Martin responded to the numerous questions which it had stimulated, reiterating that there was no simple way to deal with the challenges which he had outlined. Health research, provision of information, reduction of tariff protection all interlocked with the tackling of corruption and the building of sound administration. Bishop Holloway thanked the speaker for his detailed and easily understood presentation in which he had shown no ideological anger, but had sought the best of both socialism and market forces. His fascinating talk had given hope that the problems were capable of resolution.

Wednesday 24 May 2000

"MAN AND ANIMALS; CONTROLLING THE DISEASES THEY SHARE - RARE OR WELL DONE?"

Professor Stuart W.J. Reid

Professor of Veterinary Informatics and Epidemiology,

University of Glasgow Veterinary School

Regional Lecture held in Kings College, University of Aberdeen

Recent major epidemics have heightened the public's awareness of the potential for animals to act as a source of disease. But are we really more at risk than our ancestors? Can we ever be totally safe from zoonotic disease? And is the science we need to answer these questions rare or well-done? Comparative epidemiology is one discipline that embraces the concepts of "One Medicine" capable of delivering at least some of the answers.

The utility of epidemiological modelling has been at the forefront of recent advances in the scientific understanding of the occurrence and dynamics of diseases in populations. Whilst, for a proportion of observers, the assumptions embraced and the "smoke and mirrors" appearance of these techniques lead to distrust, the ability to describe and simulate epidemics and interventions should not be underestimated. More recently and perhaps more accessible, the concept of risk assessment is now firmly embedded in approaches to production animal trade and intervention strategies in food safety. Yet risk is ultimately quantified by the consumer; acceptable risk and perceived risk are real quantities that we ignore at our peril. The implementation of, for example, Hazard Analysis and Critical Control Point procedures provides a practical approach to risk mitigation and although some argue that variation in biological systems renders these approaches less than perfect, in the absence of an ideal they are useful tools.

However, epidemiological modelling without data is fraught with danger and intelligent surveillance must be a key component in any rational public health strategy, a fact recognised by recent consultation documents. Information and communication technologies offer major new opportunities for integrated animal and human health monitoring systems.

So are we more at risk than our ancestors? The question is not trivial; arguably, the population has never been more healthy, food has never been more available or of higher quality. In truth the risks are different and continue to change. Less than optimal practices in food preparation and storage counterbalance advances in processing and packing; antimicrobial resistance poses a series of hazards and risks of a different type; emerging diseases carry with them the risks of tomorrow. Learning to live in an ecological niche where the opportunity afforded to the microbial population is minimised is the challenge that will undoubtedly require major changes in our behaviour and how we communicate policy to the public. Yet the best interventions may be the simplest. Now wash your hands.

Professor Hugh Pennington, FRSE, Professor of Bacteriology, Department of Medical Microbiology, University of Aberdeen, proposed the vote of thanks.

Monday 5 June 2000

"THE P53 TUMOUR SUPPRESSOR GENE"

Professor Sir David Lane

Department of Surgery and Molecular Oncology,

Ninewells Hospital and Medical School, University of Dundee

Bruce Preller Prize Lecture

Delivered to the Seventh Ordinary Meeting

The p53 tumour suppressor gene was first discovered by the finding that its protein product p53 was tightly bound in SV40 virus transformed cells to the SV40 virus encoded oncogene T antigen. In the last twenty years intense research has revealed that this gene is mutant in more than half of all human cancer. The mutations occur somatically and are typically point missense mutations that inactivate the protein. Even in those cancers where the p53 gene appears intact, other mechanisms may act to block its function, for example in Cervical cancer p53 is blocked by the Human papilloma virus encoded E6 protein. The p53 protein acts as a sequence specific DNA binding protein that is able to direct the transcription of specific genes. These p53 induced genes in turn act to block the cell cycle or induce programmed cell death (apoptosis). The p53 protein is normally only present in minute amounts, but when cells and tissues are exposed to a whole range of insults ranging from UV light to ionising radiation, the protein becomes active and thus acts to protect the organism from the proliferation of damaged cells. This pathway appears critical for mammalian resistance to neoplasia, as mice that lack

the p53 gene are extremely tumour prone. In man, the germ line inheritance of a mutant p53 allele is the basis for the Li-Fraumeni family cancer syndrome. This syndrome is characterised by early-onset breast cancer and brain tumours in children. The pathway is also important for the response to many chemotherapeutic drugs used in the treatment of cancer and, in general, tumours that retain wild type p53 have a better prognosis and respond better to many therapies.

The activity of the tumour suppressor protein p53 is critically controlled by proteolysis. Two cellular proteins, Mdm2 and ARF, have been discovered to play a critical role in regulating the specific stability of p53. Mdm2, binds to the N terminus of p53, recognising a specific peptide motif and targets p53 to the proteasome. *In vivo* and *in vitro* assays for the ubiquitination of p53 by Mdm2 have been established. The Mdm2 protein acts as a specific E3 ubiquitin ligase and the ARF protein binds to Mdm2 and inhibits its ligase activity. The recognition of p53 as a substrate for ubiquitination requires several discrete properties, including the N terminal Mdm2 recognition motif, the oligomerisation domain and C terminal lysine residues. It also requires that the Mdm2 protein and p53 enjoy the correct sub cellular localisation. It has been possible to identify small potent peptides that block the p53 Mdm2 interaction, and these are now being developed as potential novel agents for the treatment of cancers that retain wild type p53. More recently, the ARF-Mdm2 interaction has been localised using pepscan libraries of ARF. In addition to its effects on the subcellular localisation of Mdm2, ARF and ARF derived peptides act directly as inhibitors of the E3 activity of Mdm2. It has also been discovered that p53 is modified by the small ubiquitin-like protein SUMO, and this modification may inhibit the degradation of p53. The ability to induce the p53 response with non genotoxic agents, combined with the recognition that p53 mutant human tumours lack the Mdm2-dependant degradation pathway, opens up many exciting new approaches to drug discovery in the p53 pathway.

Following the lecture, the President invited questions and discussion. A question raised was, why, if p53 is implicated, members of families with inherited defects tend to develop particular cancers rather than the full spectrum. Professor Lane responded that this could be a consequence of the defect being present throughout development. The point was followed up by the suggestion that we should be looking for familial mutations involving other components, such as ARF and Mdm2. The speaker agreed that this could well be worthwhile. The discussion concluded with the issue of exploring clinical potential. Professor Lane noted that this is being investigated in new collaborations.

A vote of thanks was moved by Professor C Michael Steel. He noted that, as usual, the lecturer gave an original and highly stimulating presentation. He praised Professor Lane's work and his generosity in assisting the research of others in his field. Noting his ability to explain a complex subject to many people, he thanked him for an excellent talk.

Wednesday 27 September 2000
"THE BIRTH OF GALAXIES"
Professor John Peacock
Professor of Cosmology, Institute of Astronomy,
University of Edinburgh
Delivered to the Eighth Ordinary Meeting

Throughout the universe, matter is organised into the fundamental building blocks of galaxies: groups of 100 billion stars. Professor Peacock described how, for many years, this simple fact was one of the central mysteries of cosmology. However, several strands of recent research have now come together in a way that allows astronomers at least a partial understanding of the origin of these beautiful systems. New telescopes can observe very distant galaxies, looking back to a time when they were newly born. He noted that the task of theory is to relate these pictures to a process where small quantum fluctuations are created in the earliest phases of the big bang, and are subsequently amplified by gravity into collapsed systems. With the aid of powerful computers this sequence can be followed, leading to a deeper understanding of the structure of the universe and our place within it.

Professor Peacock emphasised how many of the concepts involved in this work, and the results from it, can be communicated more readily in images than in words. He presented some remarkable graphics, illustrating the points being made.

[The main visual content of the presentation can be viewed on the world-wide web at: <http://www.roe.ac.uk/japwww/pust/gbirth/index.htm>]

Following the talk, there were numerous questions from the audience. It was noted that "dark matter" had not been mentioned. Professor Peacock admitted that this was excluded intentionally as there remains no confirmation of what this may be. Nonetheless, it is generally believed that unusual

particles do exist in order to provide the missing mass which must be there in some form. The possible impact of a "fifth force" was raised. In reply it was noted that there is no consistent theory available for attempting to include such an additional force and consequently it was assumed to be zero.

The issue of the assumptions made about the magnitude of the initial density ripples was raised. How sensitive was his model of the evolution of the universe to this factor? Professor Peacock responded that they chose the initial fluctuations so as to give the right answer for the current state of the universe. However, these assumptions are plausible, and the general picture obtained is not so sensitive to this parameter.

Local movement of the earth/solar-system/galaxy, etc. was agreed to be another factor that had to be incorporated into the model. It was noted that in the neighbourhood of local galaxies, some are moving towards us rather than receding.

A vote of thanks was moved by Professor John Brown, Astronomer Royal for Scotland. He observed how we had come a long way since the beginning of the 20th Century, when we did not even know how stars worked. He recalled how Fred Hoyle had claimed stars were simple and went on to observe that John Peacock was treating galaxies as simple. Professor Brown went on to note that Professor Peacock has a strong record of giving excellent talks in difficult circumstances, including taking up the challenge of refuting astrology on the television! He concluded by thanking Professor Peacock for once again making an excellent, highly stimulating presentation.

Friday 29 September 2000
"THE UNIVERSE IN A NUTSHELL"
Professor Stephen Hawking, CBE, FRS
First Edinburgh Lecture

To a capacity crowd in the McEwan Hall of the University of Edinburgh on 29 September, Professor Stephen Hawking explained the developments in cosmology that have contributed to the way we view the universe today. From Hubble to Einstein and Penrose to Feynman, Professor Hawking described these scientists' ideas and made some predictions of his own about the origin and fate of the universe and how near we are to understanding it.

Stephen Hawking is perhaps best known for his discovery, in 1974, that black holes emit radiation, and for his best seller *A Brief History of Time* and his later book, *Black Holes and Baby Universes and Other Essays*.

Wednesday 4 October 2000
"DEVELOPMENTS IN CHILD WELFARE & CHILD PROTECTION POLICIES"
Professor Christine Hallett
Deputy Principal, University of Stirling
Regional Lecture held in Tower Building, University of Dundee

The lecture reviewed selected developments in child welfare services with particular reference to juvenile justice and child protection. Child welfare policy involves striking a balance between the responsibilities and rights of parents, the rights and needs of children and the role of the state and other service providers.

The first trend identified was the emergence of the protectionist concern for children's welfare. The widespread development of specialised jurisdictions for children in difficulty took place in many countries at the end of the nineteenth and early twentieth centuries. There was a belief in the effectiveness of intervention and reform.

In more recent decades, one of the most significant developments in many countries has been a retreat from welfare associated with a concern for due process. This entailed strengthening young people's access to formal justice and a move away from discretionary, individualised welfare. An important aspect of the emphasis on due process was the extension of the children's and young people's rights to representation and advocacy. This was accompanied by changing conceptions of the nature of childhood. There were changing views of the status of childhood and greater recognition of children's agency, individualism, autonomy, competence and capacity within the 'new' sociology of childhood. These changes were reflected in the UN Convention on the Rights of the Child, which stated explicitly that children have a right to participate in processes and decisions affecting their lives.

An important trend evident in some but not all countries was separation of the systems for responding to children and young people in need of care and protection from those who had offended. The move to separate these groups of children is not, however, universal. France, for example, and Scotland, with its Children's Hearings system established in 1971, have unified systems.

Perhaps the most striking development in child welfare in recent decades has been the re-discovery of child abuse as a social problem. Definitions of child abuse are historically and culturally specific. While changing definitions of abuse lead to difficulties in establishing incidence and prevalence rates, it is clear the number of children reported to agencies and/or identified by child welfare and other agencies as having suffered child abuse rose markedly in many countries

There is an important distinction between inquisitorial and adversarial systems. Jurisdictions in English-speaking countries (USA, Australia, Ireland, England etc) tend to operate on adversarial principles, contrasting with the inquisitorial mode adopted in Continental Europe. The emphasis is on legalism, formality and concern for rights. The inquisitorial system is operated more flexibly on the basis of an inquiry rather than a formal legal battle – the judge or adjudicator seeking information in order to decide.

Achieving a balance between legitimate intervention by the state (or its agents) and respect for privacy and parental autonomy and between providing help and protection for vulnerable children while respecting their own capacity and right to make decisions concerning their own lives remain key challenges.

CONFERENCES, SYMPOSIA AND WORKSHOPS

SEVERE PERSONALITY DISORDER:
SETTING THE RESEARCH AGENDA IN SCOTLAND
Wellcome Trust Research Workshop
Tuesday 26 October 1999

The Workshop was organised by Dr Lindsay Thomson, Senior Lecturer in Forensic Psychiatry, University of Edinburgh and chaired by Professor Eve Johnstone, University of Edinburgh.

At the time of the Workshop there was much public, political and media interest in people with severe personality disorder. Since then, Lord MacLean's Committee reviewing the sentencing and treatment of serious violent and sexual offenders, including those with personality disorders, has reported. This Workshop considered the history of the concept of severe personality disorder and the process of its assessment and diagnosis; examined data available on the prevalence of this disorder; discussed appropriate settings for its assessment and management; and looked at possible treatment programmes. Many questions arose from the discussion which will assist in formulating future research directions.

Dr Derek Chiswick, Consultant Forensic Psychiatrist with Lothian Primary Care NHS Trust and Honorary Senior Lecturer at the University of Edinburgh, outlined the historical perspective and legal background of severe personality disorder.

Professor David Cooke, Consultant Psychologist and Director of Forensic Clinical Psychology Services for the Greater Glasgow Health Board, Mental Health and Community Trust and Professor of Forensic Psychology in the Department of Psychology, Glasgow Caledonian University, discussed the classification and prevalence of severe personality disorder in Scotland and issues of definition and measurement. Professor Cooke is a member of the Scottish Prison Service Research Advisory Committee, the SPS Accreditation Panel for Treatment Programmes and the MacLean Committee, and is also visiting Professor in the Department of Psychological Medicine, University of Glasgow.

Professor Steven Hart, Associate Professor of Psychology and Associate Dean of Graduate Studies at Simon Fraser University, examined the methods assessment of risk of violence.

Professor Pamela Taylor, Professor of Special Hospital Psychiatry at the Institute of Psychiatry in London and Broadmoor High Security Hospital, discussed the approaches to the management of severe personality disorder in a high security psychiatric setting and in prison. She outlined in particular the strategies adopted in England and Wales.

Dr Lindsay Thomson, Senior Lecturer in Forensic Psychiatry at the University of Edinburgh and Honorary Consultant Forensic Psychiatrist at the State Hospital, Carstairs, concluded the presentations with an overview of some of the issues and research available in a Scottish context; Dr Thomson went on to summarise the key research issues identified in the workshop.

CREATING SCHOLARLY RESOURCES IN THE DIGITAL AGE:
UNLOCKING THE NATION'S RICHES
Thursday 18 November 1999

There is increasing interest in converting manuscripts, text, statistical and graphic records (such as maps and photographs) into digital form to facilitate their analysis, and a corresponding search for funds to make this possible. Many of those responsible for such projects have in mind, at least in the first instance, a limited body of users, but one of the prime advantages of such conversions is the possibility of making these resources accessible to a much wider body of scholars nationally and internationally.

Such conversions should be to agreed standards and in formats that will maximise their use. The task of converting is costly in time and money, involving the employment of staff or using specialist agencies to undertake such conversion, and those bodies being approached for funds for such projects are increasingly concerned that the national interest must be a condition of such funding. For this reason and because many of those working on small projects have limited experience and knowledge of what conversion involves, a number of national bodies agreed to hold a symposium at which experts in the field could bring their experience to bear to address these digital issues.

Accordingly, the Scottish Higher Education Funding Council, the National Library of Scotland, the National Archives of Scotland, the Royal Society of Edinburgh and the Carnegie Trust for the Universities of Scotland funded this one-day symposium to examine and illustrate the methods of creation, use and funding of scholarly resources in the digital age.

The symposium attracted 140 delegates involved in digital date programmes or from within the higher education sector in Scotland.

THE NEUROPSYCHOLOGICAL SEQUELAE OF SYSTEMIC ILLNESS
Wellcome Trust Research Workshop
Monday 22 November 1999

The background to this workshop is that brain damage caused by systemic illnesses and their treatment largely goes unrecognised in medicine, and in society as a whole. In contrast to the paralysis and other overt physical signs of neurological diseases, the manifestations of illness-related brain damage are very subtle, as they are usually in the form of cognitive deficits. However subtle, this brain damage is of no lesser importance, as vital aspects of thinking, such as memory, verbal and visual-spatial skills, may all be permanently affected and, thereby, severely impair quality of life.

This workshop brought together diverse groups of clinicians and researchers along with specialists in the assessment of brain injury to discuss their current approaches to assessing cerebral damage. The workshop started with two lectures that addressed the suitability and potential pitfalls of techniques for assessing brain damage: One lecture addressed cognitive assessment and the other, imaging of cerebral damage. Both lecturers stimulated participant interaction and lively discussion and so set the tone for the rest of the workshop. The majority of the day consisted of short presentations by different research groups on their methodology and findings. Presentations included the cerebral effects of hypoglycaemia, cardiac arrest, sleep apnoea, cardiac surgery, liver failure and endogenous steroids. Ample discussion time after each presentation and session allowed many more areas to be discussed by the participants. This proved to be one of the most successful aspects of the workshop as there were many participants who contributed their experiences of other areas of research from the floor.

The workshop allowed workers to share their knowledge of the main investigational techniques, that is cognitive assessment, brain imaging and biochemical markers. It became very apparent during the course of the workshop that none of these methodologies is robust, as all have their failings, and a sound understanding of the techniques is therefore an important basis of any research. The workshop was a valuable experience for all the participants and, most especially, for researchers early in their careers, as it brought together a wide range of researchers with a common interest who would not normally have had the opportunity to share their ideas.

THE PHYSICS OF STRANGENESS AND BEAUTY
Thursday 3 February 2000

Seventy five physicists met at the RSE for the fifth annual Particle Physics workshop "The Physics of Strangeness and Beauty". The title may seem mystifying to some, but it is aptly named. In 1935 Yukawa had predicted that an elementary particle (the pi-meson) must exist to carry the nuclear force. Early in 1947 this was discovered in Bristol, to general satisfaction, but within the year some unwanted cousins had appeared. They seemed so odd and unwanted that they were named 'strange particles'.

By the time of the 1954 Glasgow conference there was a framework for describing their behaviour, but only in the 1960's did Sakharov relate this to a crucial part of the mystery of our existence, following essentially shocking discoveries of small differences in the way strange particles treat matter and antimatter. Antimatter arose as the extra solution of the quadratic equation relating energy and mass in Dirac's unification of relativity and quantum mechanics. It was subsequently found just as he predicted. A universe that began with the Big Bang would naturally create matter and antimatter equally. So where is original antimatter - nowhere near earth for sure - and why has so much matter survived without annihilating itself on its mirror image? Sakharov showed that strangeness has a crucial role to play, provided it has a big cousin which gained the name 'beauty' as it was sought, and discovered in 1977.

Chris Sachrajda of Southampton University set the scene by describing the mathematical framework and the latest theoretical and experimental techniques being used to study the properties of beauty quarks and the B-mesons made from them. Steve Playfer of Edinburgh University updated us on the experiments to make precision measurements of matter-antimatter differences in B-physics. All of these take place in a time of about a millionth of a millionth of a second. Such times are easy to measure precisely if the particles are produced moving close to the speed of light. Detectors using silicon microchip technology can easily measure the flight paths of fractions of a millimetre. Edinburgh University is involved in the Babar project, which started operating at Stanford, California in 1999, and Glasgow is helping to build the relevant items for the CDF upgrade at Fermilab, Chicago, to access mesons containing both beauty and strange quarks.

Rick St Denis of Glasgow University compared the achievements, potential and techniques used at electron-positron colliders and proton storage rings. Victoria Martin of Edinburgh University took us through asymmetries she is measuring in strange meson decays, and Peter Boyle of Glasgow updated us on lattice-gauge calculations using massively parallel computers to predict rates of B-decay. Ray Gamet of Liverpool University gave us the final results on matter-antimatter differences in the decays of strange mesons produced in proton-antiproton annihilations at CERN, Geneva.

Finally, in a visionary talk, Paolo Franzini of Rome compared the potential of strangeness and beauty measurements for establishing the mechanics of matter-antimatter differences in weak radio-active decays. He then outlined the new DAPHNE facility at Frascati, Italy and the design and operation of the KLOE detector which will measure the elusive antimatter differences to unprecedented precision, and will allow us to access rare decays that have so far eluded study. It is important to measure both strange and beauty properties. The theory built up since Sakharov makes precise predictions on how these are related, yet frustratingly does not give any prediction of the overall rates. Any departures from this standard-model picture will lift the curtain on new secrets of nature.

This was the fifth workshop in the series on Elementary Particles, supported again by BNFL and with extra support from the Italian Embassy. Plans are underway for 2001.

THE FUTURE OF RETAILING: DRIVERS OF CHANGE
Friday 11 February 2000

The first in a series of annual symposia on The Future of Retailing was held at the Society on 11 February 2000 and attracted some 123 participants. Sir William Stewart, President, opened the meeting by emphasising the importance of retailing to the Scottish economy and society and pointed to the substantial changes occurring in the sector.

Michelle Harrison from The Henley Centre presented results of social surveys on consumer behaviour and attitudes; John Hoerner, Chief Executive of Arcadia PLC, explained how Arcadia is using multi-channel strategies to respond to the consumer changes; Professor Barton Weitz, Professor of Marketing at University of Florida described some of the developments in e-retailing in the USA and how these were addressing the changes in consumer demand, and Alistair Mackenzie, Chief Planner for Scotland, reviewed the evolution of retail planning, emphasising the current moves towards sustainable development.

After a buffet dinner, a question and answer session took place chaired by Clive Vaughan.

The three main conclusions generated by the seminar were:

There is an erosion of consumer confidence caused by fragmentation of consumer wants, and the explosion of choice. The solutions (product, shop, place, etc) may lie in trust issues, brand issues, and responses by situation. The implications are more complex consumer databases which will raise issues of privacy and accuracy, and attempts to make it easier for the shopper to make choices.

There is increased power of the unexpected caused by faster change and new interactions, deflation, new competitors, and the new consumer wants solutions - there is no set solution other than highly responsive management. The implications are multi-channel strategies, more complex market research, and more flexible planning policies.

There is increased activity in e-retailing. The causes are not clear, but may possibly be the failure of current retailers to satisfy consumers. The solutions are based in the technology that can facilitate many different e-retail variants. Implications are concern about the impact on existing stores, the property market, rent/rate receipts, planning policy, and consumer confidence.

The meeting was sponsored by Archibald, Campbell and Harley, WS

GENETICAL KNOWLEDGE, PREDICTION OF HEALTH
AND THE PROVISION OF LONG-TERM CARE : ETHICAL TECHNICAL AND ECONOMIC ISSUES
Tuesday 7 March 2000

Some of today's most distinguished practitioners gathered at a symposium entitled "Genetical Knowledge, Prediction of Health and the Provision of Long-Term Care: Ethical, Technical and Economic Issues", held in association with the Royal College of Physicians of Edinburgh. They asked what have recent developments with the Human Genome Project enabled us to know; to what obligations does this knowledge give rise; what better understanding of health and disease and which new ways of developing treatment and prediction of disease may we expect.

Modern genetics does not disclose much about the age of onset, severity, or progression of a disorder in a particular individual. Nor does it explain the influence of environmental factors. Yet, it does now identify genes and indicate which will contribute to a person's liability to certain diseases. Such knowledge already enables twenty-three regional centres throughout the UK to diagnose and treat thousands of people every year, and to inform them about the associated risks. But as it becomes possible to screen for individual susceptibility to disorders likely to require long-term care, and to predict with greater accuracy who will develop which diseases, many new questions are raised about what should be done. What predictive testing should be allowed? Who should set the pace as the focus of genetics shifts from diagnosis to prediction? How will the NHS assimilate advances in genetics into cost-effective provision of health-care? Such issues cannot be resolved easily. This said, several suggestions were made for fresh approaches to estimating the implications for insurers, legal concepts of genetic privacy and systems of data-collection to handle the "ownership" of genetic information obtained from individuals.

Participants expected that the Human Genome Project would soon deliver the complete sequence of human DNA. Many hoped that media focus on questions of determinism, etc, would give way to more balanced representation of causative gene combinations and multifactorial disorders. Most hoped for a policy framework to enable modern genetics to meet education and training needs in the NHS, and to ensure that no genetic health-care divide opened up between rich and poor.

THE FUTURE FOR THE ENVIRONMENT IN SCOTLAND -
AN AGENDA FOR ACTION
Scottish National Heritage/RSE Millennium Conference
Friday 17 March 2000

The Royal Society of Edinburgh and Scottish Natural Heritage convened a Millennium environmental conference on 17 March 2000. A schools event was also held on 15 March 2000.

Participants discussed how the environment of Scotland might change in the future and what policies and priorities were needed to enhance the quality and value of the environment to society. The conference was preceded by a one day school's discussion forum on balancing tourism and landscape protection.

SCOTLAND'S ENVIRONMENT - A DIVERSE AND CHANGING ASSET

Scotland's environment is one of our greatest national assets and is internationally renowned. Its rich variety of landscapes, flora and fauna has ancient foundations but has been subject to rapid and major changes in recent centuries and decades. These changes result from the major driving forces of climate change and the impacts of human endeavour.

Lessons of Historical Change

Our environment is the result of both natural processes and human activity. Changes in rural areas are driven by the needs of urban populations for food, timber, energy, tourism and leisure pursuits. In an increasingly globalised economy and society, rural and urban environments can no longer be considered in isolation.

Future Challenges

Decisions about the environment need to be informed by the likely effects of climate change, itself influenced by the activities of people.

Current socio-economic trends affecting rural areas suggest a decline in the value of agricultural output, reductions in the numbers of farm businesses and in the amount of land in agriculture, and changes in its intensity of use. In forestry, we are witnessing a move away from purely economic objectives to the development of multi-purpose forestry, including greater diversity of planting and increased integration with other land uses. Other demands on rural land are increasing rapidly, including widespread demand for access and enjoyment by urban populations. Land management will also include new forms of resource use, such as energy generation from the renewable sources of wind, waves, tides and plants. Changing social values may lead to a desire for more active conservation of natural and cultural assets. All of these changes will present immense challenges in the future.

A Future Based on Sustainable Development

Our environment is what people have made it within the envelope of constraints and opportunities presented by natural processes. Our policies for the future need to be based on a sound assessment of natural process and society's demands, and the balancing of opportunities and constraints. In particular, we need to recognise the need for local strategic planning and resource allocation and the balancing of objectives within a sustainable development framework. The Scottish Executive and

Scottish Parliament provide us with the opportunity to create Scottish solutions to manage change within this framework.

A NEW AGENDA FOR SCOTLAND'S ENVIRONMENT

The future for our environment rests firmly on the proposals for sustainable development. Market forces alone have a poor record in managing environmental quality and delivering social equity. Intervention in the free market needs to be firmly based on clearly defined societal and environmental objectives. Within this framework, economic priorities should be developed with a clear understanding and evaluation of indirect costs and benefits - the so called "externalities".

The Government's commitment to placing sustainable development at the heart of all policies is one step towards the creation of a new framework of integrated decision making. However, strong leadership is needed from Government, particularly in setting a vision and clear objectives.

The proposals from the conference call for:

- a new ethic of resource use;
- new approaches to policy integration;
- new policy instruments;
- new approaches to legislation;
- new approaches to defining and achieving a healthy economy; and
- new ways of involving people.

These are consistent with the Scottish Parliament's aims of consensus and partnership.

A New Ethic and Understanding of Resource Use

There has been a major shift in attitude towards the environment in the last 25 years but much remains to be done. Sustainable development is a radical philosophy that challenges conventional wisdom. However, there remains a gulf between widespread acceptance of the principles of sustainable development and their translation into practice. There is a continuing need for education for sustainable development at all levels and in all sectors of society to shape attitudes. New opportunities for communities and individuals to contribute to sustainable development through their own actions are called for.

We need to agree absolute values on which to base minimum standards of environmental stewardship in order to shape the policy framework of regulation and financial incentives. These values need to reflect the importance of services provided by environmental systems to society and the economy. These services include clean air, drinking water and healthy food, as well as natural defences against coastal erosion and new approaches to flood mitigation.

A common understanding is required of what is meant by environmental stewardship, setting out a broad picture of how we want to use and look after Scotland's environment.

New Approaches to Policy Integration

We must recognise that the future of Scotland is inextricably linked to the future of the rest of the UK, Europe and the wider world. We should seek to influence policy formulation at all of these stages. Sustainable development policies are influenced by government actions at national and international levels. Scotland must remain sensitive to its national and international setting and seek early involvement in economic, social and environmental policies, especially at EU and UK levels.

Agreement on sustainable development objectives for Scotland and the achievement of the integration of environmental objectives into all sectors is essential. The Scottish Executive and Scottish Parliament has begun the debate on sustainable development issues and their relevance, for example, to the Scottish economy. We would like to see equity and environmental concerns more centrally placed in these discussions and the development of sustainable development objectives taken on board by Scottish Enterprise and other bodies with an economic development remit. The sustainable development framework should promote diversity in the use and management of natural resources and be flexible in response to local needs.

We must recognise the constraints of environment and history so that we work with the grain of nature and informed social choice. Although we know a great deal, we are still ignorant of many ecological and wider environmental processes and need better tools for forecasting and management as well as better assessment of possible attitudes. There is a need for further investigation and for the results to be presented in an accessible and understandable way for all of those involved in decision making. This may require changes in higher education, for instance, in the way research is commissioned and in the training on communication.

New Policy Instruments

New policy instruments should comprise a balance of financial incentives and regulation, derived from clear objectives and a shared vision, to manage a changing environment. Policy instruments are useless without a guiding vision, preferably a consensus, about the way ahead. The objectives for Government intervention in the market need to be clearly stated and measured. Government needs to intervene if and when the market does not otherwise deliver the desired solution. This can happen because the market does not value environmental goods and services sufficiently, or penalises indirect costs. It clearly makes sense to reward the provider of 'environmental goods' and to penalise the provider of 'environmental bads'.

There are some notable examples of using economic instruments to redress such imbalances. These include agri-environment payments, grants for woodland planting and maintenance, taxes on landfill and pollution and tradable permits for greenhouse gas emissions and water abstraction.

The key to rewarding environmental stewardship is to recognise that people pay attention to economic signals. Economic instruments can be more flexible and can achieve environmental targets more cheaply and efficiently than regulation. However, regulation can and has worked, such as in improving water quality, and should continue. Economic instruments should be used to encourage environmental stewardship and to deter environmental damage.

The resulting framework of policy instruments needs to promote diversity and to accommodate local needs. Indicators are required to ensure that the instruments achieve the desired objectives.

A New Approach to Legislation

Legislation should conserve Scotland's cultural and natural heritage for society, including its use as a resource for studying past and predicting future environmental change. From an environmental perspective legislation has two key functions. First, it ensures that the services provided by the environment to society remain intact, and, second, it delivers local social and economic benefits. In this context, the environmental services include the conservation of our natural and cultural heritage for a variety of reasons, including its use as a resource to understand past environmental change. Our legislative framework sits in a wider UK and EU context. Those who impose policy and legislation should be accountable to the Scottish Executive, including, it was argued, the Chancellor of the Exchequer in setting the budgetary framework and the Chairman of the Bank of England in determining interest rates.

Legislation should be used to underpin minimum standards of environmental stewardship and so ensure that the services provided by the environment to society remain intact. The precautionary principle has been enshrined in legislation at the EU level (Treaty of Maastricht, 1992) and, at the UK level, the Government has adopted the precautionary principle within the UK Strategy for Sustainable Development. However, there remain fundamental differences between interpretations of the precautionary principle at international levels. The World Trade Organisation has maintained that genetically modified organisms can be introduced and used until there is scientific evidence of harm. We need a better informed debate on these issues. Our legislative framework also needs to be better aligned to our social objectives and to provide the basis for implementation of sustainable development and the precautionary principle.

A New Approach to the Definition and Achievement of a Healthy Economy

New ways to measure the value of services provided by the environment to the economy should be developed as an intrinsic part of economic assessments and linked to indicators of sustainable development. We live in an increasingly market-driven economy, in which continuing competitiveness is the key to economic success. This does not mean that environmental and social equity considerations cannot be taken into account in determining priorities for economic programmes. However, Scotland will need to continue to compete internationally and to maintain influence at EU and UK levels of economic policy formulation. We need better policy integration of environmental and equity values at the macro-economic level (UK and wider) to provide the framework in which micro-economic (Scotland and more locally) drivers operate. We need to find new ways to measure these values as an intrinsic part of economic assessments and link these to indicators of sustainable development.

Decisions on development should reflect a long-term assessment of the environmental, social and economic costs and benefits. Society may be prepared to accept lower rates of income growth in the short term if this is associated with less negative or more positive externalities in the medium-long term. In order to reach such a decision the following are essential:

objective information and open debate on the extent and nature of trade-offs; placing values on things which lie outside the market place; understanding the importance of environmental systems in

underpinning economy and society and in identifying carrying capacities and critical resource capital; taking into account environmental services and damages in accounting procedures; and developing indicators to measure progress.

New Ways of Involving People

It is essential to stimulate debate on environmental values, priorities and risks, and to establish a new programme of education for sustainable development in Scotland. There are many examples, large and small, of good practice for sustainable development, including *Dùthchas* in NW Scotland and the Borders Foundation for Rural Sustainability. These provide a sound basis for greater involvement. Programmes of education for sustainable development should build on this experience and provide people with information, understanding and skills to help them to take better informed decisions and to encourage actions consistent with a sustainable future.

Strengthening the opportunities and providing support for communities to put sustainable development policies into practice, recognising best practice, and celebrating achievements are essential ingredients. The aim should be to promote community's engagement to influence and guide changes, such as Community Plans and Local Agenda 21 projects. Encouraging local audits for sustainable development, assessing the environmental effect of projects and establishing local indicators of change are among the possibilities. Small changes and actions can make a big difference when there is community support. To make progress, the accountability and legitimacy of representative bodies must be ensured and all groups, including young people, should be involved in decision making and action.

IMPLEMENTING THE AGENDA FOR ACTION

Politicians and advisers across all parties in the Scottish Parliament and Scottish Executive, and in local authorities and other public bodies, have a responsibility for the future of Scotland's environment. The agenda needs to be reset. The proposals and suggestions from participants in the seminar summarised here provide a new agenda which it is hoped can be taken forward and acted upon.

THE SCIENTIFIC BASIS OF CLINICAL EFFECTIVENESS

Thursday 11 May 2000

There is wide acceptance among health professionals that care should be based on evidence of clinical effectiveness. The aim of this one-day symposium was to examine the scientific basis for clinical effectiveness and the impact of this information on clinical practice. The symposium was organised by the Royal Society of Edinburgh and the Royal College of Physicians of Edinburgh, with support from the Clinical Resource and Audit Group.

The day began by considering the scientific base for clinical effectiveness. Professor Warlow argued that while scientific evidence of clinical effectiveness is growing, many gaps remain. In particular, little is known about non-drug and non-surgical interventions, or treatments for rare conditions. For Dr Grant, the complexity and diversity of general practice makes it the most difficult area of the NHS in which to ensure clinically effective care. The challenge here is to create a science base that supports decision-making without losing a 'whole patient' perspective.

Evidence of clinical effectiveness is rarely used to prioritise health care services. Dr Burns identified political pressures on the NHS that create national and local obstacles to the use of effectiveness data in decision-making. Professor Maynard urged a shift towards "economics based medicine", with an emphasis on cost effectiveness data in order to achieve equitable and ethical distribution of limited health care resources. The responsibility for providing advice on the clinical and cost effectiveness of health technologies to the NHS in Scotland falls to the Health Technology Board for Scotland. Its chairman, Dr Mackay, described the remit of the Board and outlined a vision of Scotland as a centre for large pragmatic clinical trials, co-ordinated through existing clinical networks.

Evidence-based medical practice requires the assimilation of increasing quantities of effectiveness data. Professor McDonald described the potential of intelligent decision support systems as a means to ameliorate data overload. The identification of sub-optimal clinical performance was the concern of the next paper. Drawing on experience in the Bristol paediatric cardiac surgery inquiry, Professor Murray demonstrated the technical difficulties and difficult value judgements involved in determining an acceptable level of performance.

Increasingly, medical consultations are based on information about the effectiveness of different treatments, and a wide range of publicly available health information. Professor Watt argued that doctors need to respond to these changes by facilitating informed, shared decision-making within consultations, often acting as 'interpreters', to present information to patients accurately and appropriately. Professor Brunt echoed these thoughts, and identified the need to maintain high standards of professionalism while being responsive to the pressures of the twenty-first century. The

limited extent to which these goals have been achieved was demonstrated by Professor Coulter, using data from international surveys of the quality of health care. Two-thirds of the patients surveyed in British hospitals did not feel involved in decisions about their care, whilst a third reported that doctors talked about them as though they were not there.

The idea that clinical practice should be based on evidence of clinical effectiveness has been accepted rapidly by health professionals and policy makers. This symposium demonstrated that putting the idea into practice is more difficult. As Professor Petrie noted in his closing remarks, evidence-based practice requires resources and a strong commitment by all involved to turn the rhetoric into reality.

PUBLIC CONFIDENCE IN BIOMEDICAL SCIENCE
Tuesday 30 May 2000

This symposium was held by the Royal Society of Edinburgh in association with the Chief Scientist Office, Scottish Executive Department of Health.

The public is interested, but frequently concerned, about advances in biomedical science. There is a disparity between public acceptance of biotechnology when related to the prevention and treatment of human disease, and rejection when the same technologies are applied to agriculture. The way in which the public perceives risk may reflect whether the risk can be controlled by the individual or not (Walter Bodmer - ICRF, Oxford). Listening to the public, to their fears and concerns, is a key part of the scientific process, and of the public understanding of science, in which the media play a crucial part.

The management of uncertainty and decision-making involves not only the scientific evidence but also other factors. The difficulties arise not when the evidence is clear but when it is lacking or conflicting. The pros and cons of genetically modified foods are a case in point (Kenneth Calman - Vice Chancellor, Durham University).

The importance of clinical trials in health care interventions was emphasised by Iain Chalmers. It is irresponsible to extrapolate from theories to clinical practice; many deaths had resulted from the lack of properly controlled clinical trials. Systematic reviews of the "totality" of the available evidence are essential. Commercial interests, unethical research, protection of participants in clinical research and research fraud are all matters for concern. It is somewhat remarkable how much public confidence actually exists (Iain Chalmers - UK Cochrane Centre, Oxford).

Probably no development in the past few years has attracted more public attention than the prospect, realistic or otherwise, of cloning human beings. The public interest and imagination was caught in 1997 with the birth of "Dolly"- cloned by nuclear transfer using adult mammary gland (differentiated) donor cells. Possible spin-offs from this finding include the potential to supply organs for human transplantation, the manipulation of the germ line and the prospect of copying people. This has stimulated wide-spread scientific, ethical and public debate. The academic and commercial communities have a clear obligation to explain their research objectives, the potential value of new knowledge and the potential risks to the public associated with new uses (Ian Wilmut - Roslin Institute, Edinburgh).

The relations between science and the media are complex, a variety of political and economic influences. Consideration should be given to the way in which science is funded, promoted (or attacked) by public relations consultancies, corporations or campaigning groups, and to the way in which the science policy system works. Public confidence might be increased by more public funding of research, monitoring of the interests of so-called expert committees that may make "political" rather than public interest decisions, more public service sponsored media presentation, public focus groups and consensus meetings (David Miller - University of Stirling).

Science has high profile, so stories with a "yuk factor" boost sales! The media does not see its role as that of influencing confidence in any direction. Journalists believe that they are reflecting justifiable popular concern when they challenge high-profile innovations and seek easily understandable explanations. In some cases it is the inability of scientists to communicate complex issues that limits public confidence. Add the controversies over BSE and the recent genetically modified grain mix up, together with commercial and political interests, and it is not surprising that an atmosphere of public mistrust prevails. Only genuine openness about the science and the potential risks and benefits can attempt to restore trust (Pennie Taylor - Lothian University NHS Trust, Edinburgh).

There is public concern as to whether research is "clean" or carried out with a political or social bias. The legitimacy of top-down information being disseminated as truth was challenged. Patients should be involved in monitoring research at all levels and in deciding priorities. Involvement must be more than token. Direct involvement of patients in clinical trials is resulting in more efficient use of resources. We

must remember that patients are the reasons for research not interruptions to it! (Vanessa Bourne - Chairman, Patients Association, Harrow).

The day concluded with a stimulating and diverse panel discussion chaired by John Reid (Professor of Medicine, Glasgow University). Topics and questions included "Science is in Trouble", "Lay people in Health Policy", "Good news versus Bad news", "Spin Doctors", "Alternatives to Journalists" and finally the notion that "The media response does not reflect the public response!" The comment that best encapsulated the day was that used by Kenneth Calman: "Knowledge is neutral".

MEDICAL PRACTICE AND THE GROWTH OF LITIGATION
Monday 15 June 2000

Some 9 Fellows and around 60 other participants, mainly from medical and legal backgrounds, took part in this Symposium organised by the Society in association with the Faculty of Advocates. The Symposium, which was also supported by the Medical & Dental Defence Union of Scotland, the Medical Defence Union Limited, and the Medical Protection Society, took place in the Society's Rooms.

After a welcome from the President, proceedings were opened by Lord Kilpatrick of Kincaid, former President of the GMC and BMA, and Convener of the Organising Committee. Papers were delivered by Professor Peter Bell, Leicester, Dr William Mathewson, Glasgow, Dr Patrick Hoyte, Manchester, Mrs Anne Smith QC, Edinburgh, Mr John Grace, QC, London, Dr Lindsay Burley, Borders, and Mr David Johnson, Leeds.

There then followed discussion of the papers, and after lunch the Symposium broke up into four Panel Workshops. Each Workshop considered the following three questions:

1. The levels of medical litigation were significantly lower in the NHS in Scotland compared to those in England. What factors lead to this difference, and what are the implications?
2. Is there a difficult but valid difference between medical error and medical negligence? If so, what are the legal and other consequences?
3. If a patient suffers damage when undergoing medical treatment, is a court of law the correct forum to decide whether negligence has occurred and compensation be awarded?

The Workshops were followed by a Plenary Session when the Panel Chairmen presented each Workshop's conclusions which were then the subject of further discussion. The Symposium concluded with a summary given by Lord Ross.

There was general agreement that medical litigation will not go away, and that attempts must be made to control and, if possible, reduce it. No one wished to see medical negligence claims reaching the levels which obtain in the USA. Equally no one wished to see doctors being reluctant to practise in certain specialties because of the high risks arising from procedures in these specialties.

The lower number of claims in the NHS in Scotland as compared to England might be due to a number of different factors including, the fact that it is more difficult to obtain legal aid for medical negligence claims in Scotland than in England, the fact that medical practices tend to be smaller in Scotland, the fact that there are relatively more general practitioners per head of population than in England, and the fact that there may be less of a "claims culture" north of the border.

It was recognised that even good doctors make the occasional mistake. However, a doctor will not be held liable for mere error of judgment, but only for want of reasonable skill and diligence. The legal participants explained that to establish negligence on the part of a doctor, it must be proved (1) that there is a normal practice applicable to cases such as the one in question; (2) that the doctor did not adopt it; and (3) that the course which he took was one which no doctor of ordinary skill would have taken had he been taking ordinary care. Most participants felt that a court of law was the best forum to decide whether there had been negligence and, if so, what damages should be awarded, but it was recognised that there might be a place also for mediation.

It was suggested that a number of things could be done to try to reduce the number of medical claims in both England and Scotland, and these included improved communication between doctor and patient particularly when things go wrong, maintaining better medical records, clinical governance, risk management, improving standards, continuing professional development, improving the quality of expert witnesses, and mediation in preference to litigation. When a claim has been made, the experts on both sides should be brought together to see what common ground there was. Some felt that the possibility of introducing no-fault compensation should be re-visited. In England it was doubted whether the introduction of the Woolf reforms would have a beneficial effect on medical litigation.

Since the Symposium took place, the Organising Committee has concluded that it would be helpful if further consideration could be given to some of these matters aimed at reducing the number of claims, and, as a first step, it has been proposed that the issue of mediation should be examined in greater detail by a smaller group. The Organising Committee considers that in due course it may be desirable for another Symposium to be held where there can be further discussion regarding all or some of these matters.

NEW FRONTIERS IN SCIENCE
27-29 June 2000

On 27-29 June 2000, the Royal Society's annual summer exhibition, "New Frontiers in Science", was held for the first time outside London, when it was mounted in Edinburgh jointly by the Royal Society of Edinburgh and the Royal Society of London, in association with Edinburgh University. It was an opportunity to see some of the best UK science and technology research in action - and to talk to leading researchers themselves.

In addition to the exhibits already displayed in London the previous week, the RSE brought together a further exhibition, "Inside Information", specially put on by Scottish Institutes to showcase advances in Scottish science and technology, featuring Robot Crickets, a Lab-on-a-Chip, Plants that glow bright in the night, The Biggest Bangs since the Big Bang, E-Everything, and lots more besides.

Two school teams from Hutcheson's Grammar, Glasgow and Archbishop Tenison's School, Croydon, winners of Darwin Trust Awards, also presented their research projects and attracted a great deal of positive acclaim. Senior school pupils from throughout Scotland and the North East of England were invited to attend, and 208 students and 100 Chemistry and Biology teachers were taken on accompanied tours of the exhibition.

In all, around 2000 visitors attended, keeping staff and exhibitors busy throughout.

The exhibition was formally opened by Heather Reid, Chairman of the Institute of Physics and renowned for her TV weather reports. Evening soirees for Fellows and key decision-makers were held on 27 and 28 June, with Mr Nicol Stephen MSP delivering the keynote speech. Mr Henry McLeish, Minister for Enterprise and Lifelong Learning also enjoyed a tour of the exhibition. A ceilidh was held in the George Hotel on 29 June, as a thank you to exhibitors, marking the end of the exhibition and its successful run in Scotland.

HUMAN NATURE
14-19 August 2000

In August this year the Royal Society of Edinburgh returned to its intellectual roots by mounting a conference of scholars which included the wide range of disciplines traditionally encompassed within the Society. It was an experiment, but it worked. A year and a half ago a small organising committee under the joint chairmanship of the then President, Professor Malcolm Jeeves, and the Principal of Edinburgh University, Sir Stewart Sutherland, began the planning of the conference and the selection of speakers. It was decided to hold it at the time of the Edinburgh International Festival so that the five plenary sessions could be open to the general public.

The speakers at the five plenary sessions introduced the topic for discussion for the participants on the following day. These were *DNA and Its Implications*, introduced by Sir David Weatherall, FRS, Regius Professor of Medicine at Oxford University; *Biological Evolution and Human Nature*, introduced by Professor Francisco Ayala, Professor of Biological Sciences, University of California, Irvine, Past President of the American Association for the Advancement of Science, member of the National Academy of Sciences and presidential adviser on science; *Brain, Mind, Behaviour and Personality*, introduced by Professor Richard Morris, FRS, FRSE, Department of Neuroscience, University of Edinburgh; *Human Nature, Culture and History*, introduced by Professor Timothy Ingold, FBA, FRSE, Professor of Anthropology, Aberdeen University, and, on the final day, *Society*, introduced by Professor Gananath Obeyesekere, Department of Anthropology, Princeton University.

The distinguished group of international scholars covered disciplines ranging from medical genetics, structural biology, developmental psychology, neuropsychology, cognitive neuroscience, evolutionary psychology, social anthropology, social psychology, forensic medicine, philosophy, philosophical theology and divinity. The challenge to cross traditional intellectual boundaries was met enthusiastically by the participants. Questions raised in discussions during the week included the following:

How far are the expectations based on the completion of the human genome project justified?

What about some of the ethical concerns already raised by this new approach to medical research?

- What can be learned from the human genome project about human evolution and biology?
- What is the relative role in humans of the two kinds of evolution, the biological and the cultural?
- Since people all over the world differ, are there any human universals?
- Is it the case that human nature can only exist in the process of its ongoing historical formation?
- What implications has the accumulating evidence from cognitive neuroscience for our understanding of the human person?
- Is there still a place for the traditional concept of the soul?
- How may we assess those modes of thinking outside the usual framework of "rationality" such as some of those in South Asian societies?
- Does the present evidence pointing to unsustainable consumption present the greatest challenge to human nature in the next century?
- What are some of the implications of current debate surrounding the pre-embryo/ embryo distinction and the concept of brain birth for ethicists and policy makers?
- Are we really more than naked apes, products of fortuitous contingency?
- How are modern techniques revealing new things about the workings of the human brain and body as they grow and are re-born in each infant?
- How do present attitudes to life and death fuel current concern with health care provision?
- Since 20th-century psychology focused more on pathology than on positive aspects of behaviour, how may the new emerging emphasis on positive psychology affect society?

CLOWING, STEM CELLS AND CELL THERAPY
CRF INTERNATIONAL CONFERENCE
7-8 September 2000

The creation of Dolly the sheep extended the horizons of biology. Dolly was produced from an adult mammary gland cell by nuclear transfer, providing the proof that the generation of specialised cell types does not involve the loss of genetic material. In principle, therefore, the normal developmental process of cellular differentiation may be reversible. In a different avenue of research, scientists have over the last two years provided the first reports of pluripotent stem cells derived from human embryos that are capable of differentiation into many mature cell lineages. Other researchers have uncovered evidence of previously unsuspected degrees of cellular plasticity in adults, provoked by mutation of single genes or by altered environment. Collectively these observations have raised the exciting prospect that it may become possible to control and even to redirect cell specialisation. Ultimately this could lead to development of new cell-based therapies for repair and reconstitution of damaged human tissue. At the same time, however, there are legitimate issues of public concern and ethical debate raised by this research.

This two-day conference brought together, in many cases for the first time, the pioneers of nuclear transfer and stem cell research along with chromatin biologists and transplantation researchers working at the clinical interface. Such was the interest in the meeting that an overflow room had to be set up within the RSE and even then it was not possible to accommodate all of those who wished to attend.

In the first session on **Nuclear Transfer** the audience was informed of successful implementations of cloning technology in sheep, cattle, goats, mice and most recently pigs. Participants also heard the first report of derivation of pluripotent embryonic stem cells from a cloned embryo. However, nuclear transfer remains very inefficient and the molecular processes involved in reprogramming a differentiated cell nucleus remain obscure. In this and the subsequent session on **Chromatin Remodelling**, speakers addressed the likely impacts of cell cycle, imprinting, nuclear architecture and chromatin structure on nuclear reprogramming. The first day concluded with two presentations on **Transdetermination** indicating the potential plasticity that may reside in adult stem cells, either within the haematopoietic system, or most spectacularly in cells derived from the adult brain that appear able to produce a wide range of cell types.

Day 2 began with **Stem Cells and Differentiation** and consideration of the biology of pluripotent stem cells derived from embryos in either mice or humans. Progress was reported in harnessing the pluripotency of ES cells in order to produce defined cell types *in vitro*. Similar advances in the control of nervous system stem cell differentiation were described, prefacing a presentation in the final session,

Therapeutic Prospects for Cell Therapy, on the application of cell transplantation to treat Parkinson's disease. Research on cardiac differentiation and grafting was then outlined, followed by discussion of the existence and nature of haematopoietic stem cells residing in adult tissues outwith the bone marrow. Finally, the meeting concluded with consideration of the regulatory and legislative considerations that impact on stem cell research and the development of cell therapies.

In summary, the Conference presented a very timely review of this emerging and highly topical field that appeared to be very well-received by those who attended.