TECHNOLOGY INNOVATION AND SOCIETY

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LIFELONG LEARNING FOR AN INDUSTRIAL SOCIETY – CHALLENGES?

The Foundation held a lecture and dinner discussion on "Lifelong Learning for an Industrial Society – Challenges?" on 27 January 1998 at the Royal Society. The event was sponsored by the Engineering and Marine Training Authority and The Rt Hon The Lord Jenkin of Roding was in the chair. The speakers were Professor M P Thorne, Vice-Principal, Napier University, Mr Chris Yapp, Managing Consultant, Interactive Learning, ICL plc, and Mr J Baumber, Head Teacher, Prudhoe Community High School.

UNIVERSITY FOR INDUSTRY PROJECT

Professor Mike Thorne* and Helen Milner**

Summary: Professor Thorne described a pilot project established in early 1997, in the North East of England, to prototype the University for Industry (UfI) proposed by the Government and aimed at increasing the competitiveness and the employability of the UK workforce. The model of the project was one of private-public partnership where the UfI was not a new provider but a broker of new and existing courses and a catalyst to create a culture which would embrace lifelong learning. Mr Yapp said the need was to re-engineer education to support lifelong learning. At the heart of this new renaissance was the breaking down of barriers between the arts, and science and technology.

Introduction

The UK needs a skills revolution, if it is not to slip down the international league table of competitiveness. This revolution requires step-changes in people's demand for learning and in their ease of access to education and training opportunities. The new UK Government of 1 May 1997 stressed their commitment to education and training; one element of their new education policy is proposed to be a University for Industry. The UfI will increase the competitiveness and the employability of the UK workforce.

In the UK, each time there is an educational transition – people moving from school to college, or from college to university – individuals are lost from the educational system and they never return to learning. This is relevant at all levels from basic skills, through university and into post-graduate study. At the basic levels, literacy is a problem for those both in and out of work. At the highest level doctors and engineers need to update their skills every 8 to 10 years. In some professions the need for lifelong learning commitment is recognised, in most it is not.

In December 1996 the Institute of Public Policy Research (IPPR) published a report *The University for Industry: creating a National Learning Network*. It was the culmination of over two years research by IPPR's Josh Hillman which had included work with key figures, in particular working with the University of Sunderland. The research was based on approaches made by prominent members of the (at that time) Labour Party in opposition, Gordon Brown and David Blunkett (now Chancellor of the Exchequer and Minister of State for Education respectively), and was supported by them.

The IPPR model

The University for Industry (UfI) model as set out in the report (Hillman 1996) describes a new type of organisation which would not be another provider, but would rather be a broker, connecting individuals and companies to learning programmes that best met their needs.

The University for Industry will move learning out of the institutions and nearer to where people are, culturally as well as geographically. By bringing together organisations which already exist into a network it will enable education to be sold to millions of people across the UK rather than in small isolated pockets. The University of Sunderland has been working on this agenda for the past seven years

The IPPR model has the following key elements:

- The UfI as one gateway to education and training: an impartial broker.
- The UfI must increase the demand for learning.
- The UfI must increase participation.
- It needs to be user-led, not provider-led.
- It will stimulate lifelong learning.
- It will commission courses or materials.

A pilot project was established in early 1997 to prototype the UfI and test some of the techniques which a national implementation might use. The project is led jointly by IPPR and the University of Sunderland and is based in the North-East of England. There is a strong, strategic collaboration between regional and national partners, including companies, TECs, local authorities, colleges, universities and voluntary agencies. Funding is based on major sponsorship from Sunderland City Training and Enterprise Council, Sunderland City Council and the NatWest Bank Group, but highlights a public-private partnership with many other companies and organisations providing substantial benefits "in kind", including the National Extension College and the BBC. The evaluation of the pilot is funded by the Department for Education and Employment (DfEE).

The UfI is a broker

The UfI is drawing on existing provision into a framework based on a computer network; using this people can choose between different courses being offered by different providers. All of the courses are delivered by provider organisations and the role of the UfI is to broker these opportunities and not to deliver them.

The pilot has established a one-stop-shop for education and

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training. There is a freephone line which is available 14 hours a day, 7 days a week providing easy and efficient access to information and advice as well as to telephone booking for a range of tasters and courses. Over 800 calls were made to 0800 26 26 39 during October (1997) indicating an instant response to this mode of information provision.

At the heart of the University for Industry Pilot is innovative use of the Internet. Wherever someone is in the region they can use the Internet to browse information, course details, opening hours of learning centres, make a request for a full pack or book onto a free taster or a course. In the home, the workplace and at all of the learning centres people have access to the on-line UfI system.

The system includes an on-line database of courses which can be searched by staff in the call centre as well as by anyone on the Internet. It includes on-line booking for courses and on-line learning for those who want it.

The Internet is the medium-tech approach for the UfI pilot project. A sophisticated on-line system has been designed for the pilot by two small companies: The Leighton Group, in Sunderland, and Telematica in Swindon.

The pilot is embracing the benefits of here-and-now technology. There have been no new cables put into the ground. Some centres have high-speed links to the Internet, others have modem links with standard telephone lines. If UfI is to be egalitarian, it must rely on a range of access points with a range of types of interaction. The pilot has chosen the Internet as the common channel as it is the only cost effective solution to carry the service. It is also scaleable to include more learners and more partners with an affordable level of investment at a future date if required.

One of the most innovative aspects of the project is that the providers are able to add, modify and delete course details directly onto the database over the Internet from work or from home. This allows them to take responsibility and control for their own course listings rather than having to channel all information through a central administration.

Learning Centres

The University for Industry is based around a network of learning centres (in November 1998 there were 34). These centres are closely matched to people's lifestyles. Of course there are centres in the University, colleges and schools; they are also in resource or training centres in companies and big organisations, and in leisure locations such as the Sunderland Football Club stadium and Learning World, a joint University of Sunderland and Gateshead College learning centre at the MetroCentre shopping complex (the biggest indoor shopping centre in Europe). There are learning centres in the communities in which people live, recognising learners' loyalty to their local environment.

The minimum requirements for a UfI pilot learning centre are one computer linked via the Internet to the University for Industry project computer system – the virtual engine for the UfI – a named contact person and advertised open access times. Some centres have one computer, others have over 250.

The University of Industry is not a provider

The University for Industry Pilot has established a brokerage between the potential learners and the providers who can support their learning. The brokerage provides information about courses. All of the content of the courses on offer via the UfI pilot project are the responsibility of the providers involved. These providers are the University of Sunderland, the colleges of Gateshead, Newcastle and the City of Sunderland and some school and community provision, as well as commercial providers such as distance learning offered by the National Extension College.

The Pilot is focused on what might be called "skills for work". Courses fit into areas such as IT and the Internet, communication, using number and finance, the business environment and skills for small businesses.

Free tasters are being used as one of the elements in the marketing armoury. They can allow those nervous, disinterested in or out of the habit of formal learning to develop, or regain, confidence in their ability to learn. There are five tasters currently on offer – *IT for the Terrified, Internet for All, Time Management, Writing Successful Job Applications* and *Communicating in the Electronic Office.*

These are all offered free of charge and are available at all 34 learning centres – content is based within workbooks which are sent to the learners at home and can be used in the centres; tutor support is available face-to-face at the centres or via telephone. These are not courses, they are not assessed or examined (all concepts which are barriers to participation) but they are a first step towards a course – and progression is a key factor to the pilot project.

As "Learning Works" (Kennedy 1997) addresses: "The inequality of the current arrangements is the most compelling reason for change. Those who have already succeeded are now most likely to take part in further learning".

One of the pilot UfI success stories is a young man, 17 years old, who left school with no qualifications and was unemployed; he was outside an education system which had failed him. He was attracted to the *Internet for All* taster and then progressed onto another taster, *Communicating in the Electronic Office*. These were free and interesting. He spent time in the learning centre in the local library with support from a tutor, but has spent more time on his own with the workbooks using the computer in independent study. He has now registered on a course and is working; he has developed confidence as well as essential employability skills.

A fundamental idea behind the Pilot is to allow learners to start learning as soon as possible rather than wait until the start of the next academic term. A face-to-face course will start just as soon as the minimum number required for a cohort have been registered.

For those who wish to start immediately or are forced by circumstance to study on their own the Pilot offers a number of distance learning courses. These are from many providers, including the National Extension College (largely paper-based) and Cambridge Training and Development (multimedia and on-line learning).

The pilot UfI project is removing barriers to learning – there is one simple access point for all information, there is a range of subjects, at a range of levels and using a range of delivery mechanisms. The UfI as broker begins with the marketing and ends when the learner is booked onto a full course with a provider; it is at that moment that the provider takes over as contact point.

Effective marketing

Money must be spent to tackle under-participation. As "Learning Works" (Kennedy 1997) says: "A society which is so expert in selling goods should be able to find ways of selling education".

Education must compete with business in selling. The marketing of learning must be very professional and needs to consider the marketing messages as well as the media used.

Tele-access, via the pilot project's free 'phone telephone number, offers truly innovative ways of selling educational opportunities, monitoring learners and providing information about the next appropriate step. Follow-up calls to all those who have previously enquired maintains contact and enables further direct selling.

The backbone of the pilot project is telemarketing, leaflets through household doors, a poster campaign on buses and at a range of lifestyle locations, as well as events which includes family learning. We are working with partners in newspapers, radio and television to raise the local profile of the unique access to learning opportunities the Pilot is bringing to the region.

A range of messages are being tested – all aimed at making people currently not engaged in learning to pick up the telephone and ring. Messages such as "Earn More, Learn More" and "No More Excuses" highlight the benefits that learning will bring as well as find answers for all the reasons people give for not wanting or not needing courses. These are aimed both at employed and unemployed people.

The initial marketing effort is directed at achieving one single key response – dial 0800 26 26 39 for more information. The telematic management tools gather details for market research as well as market intelligence, indicating marketing successes and

information regarding important gaps in provision.

The UK needs to effect a change in attitude to learning. Society needs to value learning and to appreciate the necessity of the lifelong nature of it. The BBC are working closely with the pilot to discover ways in which a national broadcaster can support this shift in social beliefs. Senior managers in companies are also involved in demonstrating the value which they place on training.

Companies

Improving competitiveness and performance of individuals and of companies is important for UfI. The project involves a number of companies in the region. The strategy includes working alongside current training plans and in-house provision to ensure that employees have access to the opportunities that the Pilot offers as well as integration with existing development.

Lite-On, an electronics firm in Ashington Northumberland, has opened up their training room to all employees, employees' friends and family and parents and staff of a local school. All the UfI tasters are on offer there, as well as access to the on-line system, to book onto further courses that might interest them.

Vaux, a Sunderland-based brewery, and Sainsbury's, a supermarket, both see that there is a dual benefit in providing opportunities to the general public at the same time as involving their staff.

Roadshows in the canteen at lunchtime is one way in which the Pilot is directly interacting with employees – discussing the ways in which the Pilot can interest them as well as listening to ways in which the Pilot does not meet their needs.

The nature of a provider is changing during the project. Companies such as Siemens and Black and Decker are offering places on their own training courses to other companies and to the long-term unemployed. This helps to increase both the competitiveness of the supply chain (Siemens) and the skills of their future workforce (Black and Decker). The role of UfI is to broker the courses to the individuals interested in taking part. Unions too are running courses and supporting learning centres within factories.

Summary and conclusions

The Pilot will be completed in July 1998. It is attempting to allow potential learners to be active not passive, making active choices about their learning from realistic and relevant information which the pilot UfI manages.

The DfEE will be formally evaluating the pilot project enabling all of the key elements and issues to be discussed and analysed. Other important issues such as funding and quality have been debated locally and a working model put into practice. The Further Education Funding Council is working closely with the Pilot and is keen to explore ways in which the current funding methodology does and does not match the learning support in the project.

The project puts learning right at the centre of people's lives – using commercial marketing techniques to sell learning and to link individuals into new and existing educational opportunities. The one-stop-shop approach provides flexible access to hundreds of courses. People can learn when and where it suits them. In the first four months of operation over 1000 registrations have been made using the UfI project brokerage. The University for Industry will continue to evolve until it is embedded as an essential plank in the lifelong learning culture of the UK.

Hillman, J. The University for Industry: creating a National Learning Network IPPR 1996 ISBN 1860300510.

Kennedy, H. Learning Works – widening participation in further education Widening Participation Committee Report, FEFC 1997, p. 50.

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The Renaissance of Learning

Christopher Yapp*

This article is abridged from a presentation given at the meeting.

Introduction

There is much discussion today about the revolutionary nature of modern information and communications technology, ICT. Over the next generation the combination of new technologies and the globalisation of the economy will revolutionise many aspects of work, life and indeed citizenship. The language of revolution, however, concerns me. In a revolution there are many victims, and after the revolution the revolutionaries are shot.

The young generation now entering our schools will live, work and be citizens of a different world to today. If ICT is driving many of the changes, it is clear that ICT skills are the key to employability in the new economy. At the same time, the rate of obsolescence of skills across many sectors of the economy is creating the need to move from a focus on education for the young to lifelong learning for all. We should be honest enough to admit the huge risks and uncertainty that face all of us.

What I have so far described may seem bewildering and a cause for pessimism. I would argue for exactly the opposite case. As we stand at the start of the new Millennium I believe that we are in one of the most exciting and challenging phases of history. If we are bold and confident about ourselves I believe that what we are facing is a global renaissance, where the UK can be a major contributor to building a knowledge-led economy and a learning society across the globe.

* *ICL Fellow*

The learning agenda

The government proposals for the National Grid for Learning, the University for Industry and the New Library all see the potential of the technology to contribute to the skills and citizenship agenda of the new era. I would be concerned if we lose sight of the learning agenda and focus solely on the ICT infrastructure, important though that may be.

The question I wish to address is: "What are the educational *ends* for which the National Grid for Learning is the *means*?".

1998 is the 50th anniversary of the development of 'Baby' in Manchester, the first modern programmable computer. That the UK's presidency of the EU should be marked by a conference on Learning at Manchester is more than a coincidence.

What we know about ICT after 50 years is that throwing technology at an ill-defined problem can and often does make things worse. The organisations that gain most from ICT are not those that automate what they already do, but rather those that rethink their aims, objectives and organisation in the light of technological progress. Ten years ago this gave rise to the concept of re-engineering. The challenge that we face is not to connect every school to the Internet nor to find a PC for every child, but rather to re-engineer education to support lifelong learning.

By this, I mean that there are four key characteristics of success. What we need to meet the goals of competitiveness with social inclusion are as follows:

- A culture of lifelong learning
- Access to lifelong learning on a socially inclusive basis
- Content and services for the individual lifelong learner
- A social context for learning

How can we build a coherent approach to lifelong learning

when we have a society which believes "those who can do, those who cannot teach" or "he's too clever by half". A complete waste of time is often described as "an academic exercise". Similarly, a politician who changes his mind in response to a reasoned argument is labelled as unprincipled and his learning called a U-turn. Technology cannot change these factors. We have to start with the people, not with the computers.

Over the last few years I have seen many examples of the use of ICT to support the learning needs of people with disabilities, both children and adults. This is one way in which ICT can increase access to learning for those who would otherwise be excluded. One repeating factor of many experiments with technology in education is that even for adults whose own experience of education was poor, they did not "fail" with ICT. Many educators have described to me the problem of the first generation learner. If the parents learn, by and large the children learn. What we have seen is the potential for ICT to underpin community learning for all ages. In the ICL Cyberskills programmes we have seen people as old as 86 acquire their first experience of computers. Given a supportive environment we can all be involved, participants not recipients of the information society.

The needs

The educational software industry requires to bring together the creativity and talent of the UK across publishing, broadcasting, advertising, animation, computer games and education for instance. This breaking down of the barriers between arts, and science and technology, is at the heart of this new renaissance. We are world class at media; let's use it to make the nation of shopkeepers the educators of the world.

Finally, but not least, technology does not replace teachers. Computers and communications are tools to add to the armoury of good teaching and learning practice. At its heart, learning is a social and a socialising experience.

More than any generation in hundreds of years we have the opportunity to shape the future for the many. Be bold! The times demand it of all of us.

FOUNDATION NEWS

"Quality of life for the Millennium Generation – living & working space". The first in a series.

"Quality of Life for the Millennium Generation" is the theme for up to seven lecture and dinner discussions preceded by workshops during the day for 18 younger scientists, engineers and potential leaders discussing the topic under the theme. The first of the series was for the subject of *Living and Working Space* and the second was *The Third Age*, both workshops being held at the Royal Academy of Engineering through their generous support.

The series, initiated by Dr Geoff Robinson, the Foundation's Deputy Chairman, is involving more younger people and industries in the Foundation's events, and at the same time bringing a further service to science, engineering and industry. The project is being run in association with DETR, DoH, DTI, ESRC, HSE, NERC, The Royal Academy of Engineering and The Royal Society.

The day is described by Dr Sally Cairns, a Research Fellow with the ESRC Transport Studies Unit at University College London:

"I write ... to invite you to participate in a workshop during the day, followed by an evening lecture and dinner discussion, on the subject 'Living and Working Space' ... We intend to assemble about eighteen people between the ages of 25 and 35 to discuss the needs of those in the millennium generation".

The blurb sounded exciting, if somewhat challenging!

Arriving at the workshop, the day was introduced by Geoff Robinson with a series of paradoxes. For example, why is business travel increasing at a time of such major improvements in our ability to communicate remotely?

After a brief discussion, participants were split into two groups and told to each come up with a presentation. Nominally one group was to focus on work, and the other on non-work, although neither really stuck to this division, perhaps highlighting how much each affects the other. Resulting debate was wide-ranging, and informed by the diversity of people there. Participants came from government, industry, academia etc., with specialisms varying from terrestrial ecology to future technologies.

Everyone met for lunch, and then formally reconvened in the afternoon. Interestingly, the main difference was in the approach the two groups had taken. One had focused on the trends that they thought were occurring, attempting to clarify these further. The other had defined one 'ideal' world for 2020 AD, illustrated by describing a 'typical day' in the life of two characters [eventually called Matthew and Jessica].

The next stage was to merge the two presentations, and it was remarkably easy to agree on three key points. First, social contact is always going to be important, as there is something about meeting people face-to-face that technology cannot provide. Second, technology has the potential to improve the choices people have, although harnessing it is a difficult challenge, and making it accessible to all is another. Third, there is an increasing desire for more 'quality' time and living space, including cleaner cities and better opportunities to combine work with family life and leisure pursuits.

The workshop then transferred to the splendour of the Royal Society for the evening. Formal lectures were given by Martin Boddy and Dave Hampton, followed by a presentation of the workshop output from Monica Smith (Health & Safety Executive) and Kevin Holland-Elliott (BUPA). This was followed by questions, dinner and further discussion. Findings from the workshop came under attack from various directions, many points being issues that had come up during the day but which had been impossible to include in an 18 minute talk.

By now a sense of solidarity had developed between workshop members, and when one critic argued 'your story's fine for a future 'Matthew and Jessica', but what about the likes of Kylie and Jason?', everyone grinned. The characters had originally been called Kylie and Kevin, but renamed for fear of sounding too trivial to a Royal Society audience. Officially, the evening finished around 10, whilst many of the workshop participants continued the occasion down the pub.

In all, the day provided a remarkable opportunity to discuss ideas and to meet some interesting people. And whilst the workshop didn't 'solve' anything, it was fascinating how much everybody agrees on the issues to be faced in the future.

SCIENCE FOR SUSTAINABLE DEVELOPMENT

The subject of a Foundation lecture and dinner discussion held on 27 May 1998 was "Science for Sustainable Development". The Rt Hon The Lord Jenkin of Roding was in the chair and the speakers were Professor John R Krebs FRS, Chief Executive, Natural Environment Research Council, Mr Roderick Paul CBE, Chairman, CBI Environmental Affairs Committee, and Dr Robin Bidwell, Chairman and Chief Executive, Environmental Resources Management. The evening was sponsored by AEA Technology and the Natural Environment Research Council.

Relationships Between Industry and Science

Mr Roderick S Paul CBE*

Summary: Mr Paul said environmental protection was usually seen as an open-ended cost, conflicting with the interests of shareholders. It was necessary to change this attitude. He suggested ways in which industry and management could involve science and technology in the 'stakeholder debate'. Dr Bidwell said there was no need for there to be a conflict between economic, social and environmental goals. Science and technology, he argued, would be the essential underpinning for redirecting economic development.

The main drivers that come from the top of industry and business are towards the objectives of growth, profit, wealth creation, shareholder value and even straight survival.

Larger organisations are mor focused on shareholder value while the very small businesses must satisfy the needs of the owner and may be very individual.

Managers within all businesses are under great pressure to perform and are driving for results both in the short term and the longer term of a career.

There is a change taking place in attitudes to the environment, but it is still seen as a softer issue that is very difficult to measure in every respect except that of the cost of taking positive action.

Environmental protection is seen as a cost and even an open-ended cost, and this in spite of many well known issues in "win win" situations.

There is a move from the shareholders – the pension funds – to take account of environmental issues, but we must remember that they are measured by trustees – the businesses themselves – on a quarterly performance index. The circle is powerful, and not helpful to the environment.

The notion of sustainable development is gaining acceptability with its three legs of growth, environmental protection with social justice and is a really powerful tool for industry. Debate with stakeholders is almost always defensive on the issue of environmental protection, but can be balanced between all parties who accept that growth and social justice are also needed.

So, where is science and technology in the stakeholder debate?

Industry and management need help and look for it!

- Issues need promoting in industry for friendly ways
- Science must try to show more certainty or probability
- Research results need to be shown in simple bites
- Seek areas of research and development that answer business issues
- Engage in dialogue with industry on its own ground
- Engage in debate on issues that promote sustainable development in simple business terms
- Publish views in general media

It is not that these things are not happening; more than enough of them are happening, and need to happen in more companies and in more industries.

Science needs to engage with individual businesses with a knowledge of the business objectives.

Industrialists are very focused and, at the top, the board have very short-term pressures that all have to add up to long-term performance.

With the lack of certainty that colours many scientific views, it is all too easy to look for another scientist who has the view that matches your objectives.

Global warming is a great example that is often hampered by the view that "even if it were true, there is little I can do anyhow". Science can simplify the issue of global warming to demonstrate the need to cut air pollution, for instance, that may be the vital drive for the business in question, or at least a meaningful contribution.

Scientists are used to create too many scares in the media.

It is, of course, very true that there are many companies that are powerful models for the use of science and technology, and indeed whole industries focused on such issues as global warming, but general progress is still too slow.

In all too many cases it can be said that industry does not believe scientists.

Without wishing to defend this assertion any more, it is a large enough problem for us all to need to take action to correct the position.

So what now? We all have to show leadership and make real progress with the stakeholder debate. We would take advantage of the numerous reviews the new government is leading to make sure that our grandchildren will enjoy the real benefits of sustainable development.

▲ *Professor and Mrs Hiroyuki Yoshikawa with the Foundation's chairman at the event. Professor Yoshikawa is President of the Japan Society for the Promotion of Science, and was a keynote speaker at the seminar mounted by the Japan Society for the Promotion of Science and the Foundation through the British Council (see Journal, Summer 1998).*

** Chairman, CBI Environmental Affairs Committee*

Dr Robin Bidwell*

Introduction

Why was the concept of Sustainable Development as articulated by the Brundtland Commission[1] so powerful?

Primarily because it offered a way out of the development versus environment debate that had dominated the 1970s and 1980s. It argued that there was no need for there to be a conflict between economic, social and environmental goals; indeed, looking to the future, continuing economic development could be seen to depend on shaping our economic activities to also achieve these other aspirations.

A new form of reference

The concept provided a new frame of reference for decision makers: public or private sector, at national or local level.

(1) It made clear that it is the decisions of today that will determine the type of world we will live in – in ten, twenty, thirty years time. It is the policies of the past ten, twenty years that have delivered the environment at the local, regional, global level that we now live in. Could we have done better? Could we have managed transport more effectively? Have our household energy conservation standards been high enough? Could we have eliminated more toxic materials quicker? Perhaps we could have done better, perhaps not. But we have certainly learned enough to understand how to take better decisions in the future. Operationally, this means we need to be smarter about how in the long term we will approach transport, agriculture, land-use planning, education, physical and social; and we need to align these policies to ensure that social environmental and economic goals are achieved.

(2) If we are to shape decisions to meet future aspirations, we need to have some sense of what are the goals we are trying to achieve. We need to have some sense of what sort of future we want for ourselves, our children and our grandchildren. Such 'indicators' of sustainability are an important step in moving from a concept to a reality and governments around the world have been focusing on what measurements we need to use to determine whether we are moving towards a more sustainable world. Examples from different countries include:

- percentage of 17 year-olds that have ever attempted suicide – Minnesota
- number of days of the year that the inhabitants can see the mountains behind the city without being obscured by haze – Seattle
- percentage of housing stock with energy rating of 8 or above – UK
- investment in public transport as a percent of expenditure on roads – UK

There are many others relating more specifically to biodiversity and environment and resource goals.

(3) The sustainability message makes it clear that we cannot deliver on the future goals solely by addressing environmental concerns (global warming, biodiversity, loss of forests): we must address the direction of economic development. It is clear that if we are to seriously deal with the major global concerns we must find alternative ways of meeting our needs: using less hazardous chemicals, different transport modes, less non-renewables; reducing the quantities of materials used for goods and packaging and reducing the amount and type of energy we use for transport, space heating, production, etc.

▲ *Sir Robbin Ibbs talking with Lady Butterworth at the evening event.*

Science for sustainability

What does this mean for the direction of science policy?

(i) We should encourage research that will help society in the long term 'produce more with less'. We need to achieve a step change in energy efficiency domestically as well as industrially, in the quality of products (reducing the resource and waste impact of 'throw-away' consumer goods) and in the impact of these products in production use and disposal.

(ii) We should encourage research that reduces the risks posed by man's activities. Specifically, we should support work on alternatives to fossil fuels and alternatives to chemicals that are widely used and which by their nature are damaging when released into the environment. However careful we are, such releases occur and we should be looking for less harmful alternatives to chemicals that are widely used and which by their nature are damaging when released into the environment. We should find better ways of screening GMOS to avoid potential risks.

(iii) We should encourage research on new ways of meeting society's needs in relation to food, power, consumption of goods, travel and other activities; again, our goal is to use less resources and reduce long-term impacts.

(iv) We should encourage research that enhances our understanding of natural systems and the role that man plays in putting these systems under stress. We know surprisingly little about how these systems function and the implications of resource exploitation. We would place particular emphasis on research into potentially irreversible damage to the resource base.

(v) We should of course continue our focus on the important issues of climate change, impacts on biodiversity or other research on the global environmental threats. The Natural Environment Research Council has recently developed an excellent strategy best placed to address these issues.

Science and technology will be the essential underpinning for redirecting economic development. In the words of Brundtland:

"*In the end, sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs. We do not pretend that the process is easy or straightforward. Painful choices have to be made. In the final analysis, sustainable development must rest on political will*".

Reference

1. World Commission on Environment and Development 'Our Common Future', 1987.

* *Chairman & Chief Executive, Environmental Research Management*

CHALLENGES FACING CHEMISTRY HIGHER EDUCATION

The Foundation held a lecture and dinner discussion on 24 March at the Royal Society with The Lord Butterworth CBE DL in the chair. The subject for the evening, which was sponsored by the Chemical Industries Association, the Council for Industry & Higher Education, ICI plc and The Royal Society of Chemistry, was "Are We Preparing Students for a Changing Professional World?" The speakers were Dr Tom Inch, Secretary General, The Royal Society of Chemistry, Professor Dr H Konig, Senior Science & Technology Adviser, BASF AG, and Professor Sir Gareth Roberts FRS, Vice-Chancellor, University of Sheffield.

Dr Tom Inch*

Summary: Dr Inch referred to a study sponsored by The Royal Society of Chemistry and the Council for Industry and Higher Education to find out how higher education in chemistry could prepare graduates for an unpredictable and rapidly changing world of work and continuous education. It had become apparent that there were problems from the points of view of both students and industry. Dr Inch suggested ways in which this situation could be rectified.

Introduction

The Royal Society of Chemistry and the Council for Industry and Higher Education recently sponsored a study to find how higher education in chemistry can prepare its graduates for an unpredictable and rapidly changing world of work and continuous education.

Chemistry was chosen as a good exemplar subject since although many who read chemistry become professional chemists, many do not and enter a variety of different employments.

The background to the study was the greatly increased number of graduates from 1965 (32,000 overall with 2,011 in chemistry) to 1995 (225,000 overall with 3,879 in chemistry) coupled with grade drift overall (20% with first and upper second class honours in 1965 compared with 50% for those grades in 1995).

For chemistry training the problems are magnified by a reduction in jobs in traditional chemical industries brought about by technological achievements in increasing output per employee very substantially. However, this reduction in traditional chemical industry jobs is more than compensated by new and more varied jobs in the pharmaceutical and biotechnology industries, in speciality chemicals and in other manufacturing industries. The problem now is the increasingly wide range of technical skills required.

The study took the form of surveys of published data plus workplace interviews concentrating on chemists, interviews with staff in university chemistry departments and a questionnaire of members of The Royal Society of Chemistry under 32 years of age.

Findings of the study

When employers were asked why they now employed graduates in jobs previously carried out by non-graduates, 43% said the jobs were more demanding whereas 48% indicated graduates were the only people available since the output from further education institutions was now very low. Answers to other questions also made it clear that many jobs are now more demanding.

On the subject of graduate quality, a quarter of recruiters said they had difficulty in meeting their recruitment targets because of factors such as weak subject knowledge, lack of commercial understanding and lack of work experience. However, most employers were satisfied with their recruits – their criticisms were more about rejected job applicants.

The message from this part of the study was clear. Employers are more concerned with quality than quantity. The demands of industry for faster and better working practices can only be achieved by highly trained people.

All university staff referred to a common set of problems, viz growing variability in the academic background of students, problems of an overcrowded syllabus, diversity of career training required and a reduction in funding. Also, student to staff ratios continue to increase.

Unfortunately, there did not appear to be any agreed solutions. Competition for students was more evident than partnership. Four year courses (MChem/MSci) had been introduced partly to respond to the diversity of intake and the overcrowded syllabus but whether the extra year was remedial or enhancement was usually not made clear.

New courses such as chemistry with accountancy or business studies or chemistry plus a language have been introduced for those not wanting a career in chemistry. Some, but not all, university departments had researched the market need.

From the questionnaire to young chemists under the age of 32, it appeared that 80% thought the courses they had attended were adequate preparation for their current jobs. There were, however, variations between chemical business sectors. However, most

▲ *Dr H Konig (left) talking with Professor Sir Gareth Roberts, both speakers at the event.*

* *Secretary General, The Royal Society of Chemistry*

young people were critical of the careers guidance they had received. Only 16% said that they had received advice on the relevance of module/course choices in relation to their employment aspirations and prospects.

The information from the study overall reinforced much of the findings of the Dearing Report and of two Royal Society of Chemistry workshops held in early 1995 called "Chemistry in the UK – Will it Survive".

Conclusions

Now, as then, the conclusions must be that to make sense of a confused situation and to maximise the value and services that can be delivered from the resources we have available for chemistry in the UK, each department must have a mission which:-

- can be delivered;
- does not disappoint students;
- does not disappoint employers.

Having spelt out their mission, and their objectives, each department should make it clear what the courses it provides are intended to do. Both students and employers should know what each department is trying to achieve. We are not suggesting fewer departments – only that they should have a clearer focus.

Students must know whether a particular course is designed to make best use of their abilities – i.e. whether it is suitable for those with high A-Level grades in maths, physics and chemistry or whether it meets the needs of those with A-Level chemistry plus other varied qualifications, who may not wish to become practising chemists.

One other important point was the poor quality of career advice. Academics need to develop a greater awareness of the variety of careers of chemistry graduates, and provide appropriate educational and careers guidance to students. If university chemistry department staff are not or cannot provide such advice, it is no small wonder that some employers complain about the quality of some graduates. To get this corrected should not be a major task and The Royal Society of Chemistry is exploring possible options.

FOUNDATION NEWS

Visit to The British Library

The Foundation organised a very popular visit and discussion to the British Library at St Pancras, London, on 21 July 1998. The Chairman of the Board, Dr John Ashworth, explained that the building was open for business although it was not yet finally complete despite the foundation stone having been laid in 1982 following the passing of the British Library Act in 1972. There were mixed views about the look of the building from the outside but there was agreement that the inside was exceptionally pleasing and worked well as a library. It houses 12 million books; and the electronic retrieval system, which had worked from the first day, would produce a book within an hour – its target was 30 minutes. This was a national library housed in the largest public building constructed in this century.

Building delays had diverted management attention from library matters and, now, attention was being given to the purpose of a national library: to that end, the BL Board had issued a consultation document as part of a review of its activities to meet the changing times and to address the problem of lack of resources. The book had been invented in the fifteenth century and had been so successful that its format had hardly changed, yet, in recent years, a competitor had appeared in the form of electronic publishing. Such publishing comprised 5% of the market at the moment but, although its considerable growth was forecast, it was unlikely to supersede the book entirely. Nevertheless, libraries would increasingly have to cope with the storage and retrieval of electronic material and the national libraries would be the legal depositories not only of all published books but also of all electronic publications. London alone had nineteen BL sites which, with the completion of the St Pancras building, were being reduced to four or five. There was also a large BL centre in Boston Spa for document supply to some 20,000 customers around the world.

Richard Rowan then gave a tape/slide presentation of this work, called "Inside". This work was the searching of the most read and internationally respected 13,000 scientific and 7,000 humanities, law, arts and business journals; orders for articles in them were placed, journals were searched and articles were delivered – all electronically – within two hours; 8,000 articles were put into the system each day. In addition, the papers of 16,000 conferences were catalogued to paper titles/authors and put on the system within 72 hours of receiving the journal. The watchwords were "speed of delivery". The amount of information to be made available was being expanded and the Library was working with the British Council to allow access throughout its libraries world-wide. Additionally, universities were developing degree courses by virtual learning in co-operation with the Library. Libraries were about access to information: one of their problems was that the technology for access was changing (e.g. the appearance and demise of the fiche) and such change was costly.

The visitors were then taken in small groups to visit areas of the Library. They began in the Piazza, the large courtyard developed to welcome activities such as book fairs and which serves also as the roof for a five-storey underground storage building. This basement is tanked because of the rising water table in London and the expectation was that the new building will last for at least 250 years.

They were then taken into the large and imposing information area which leads into the bookshop, the three museum galleries (open free to the public) and the stairs to the Reading Rooms for which a reader's pass is needed for entry. Time allowed us to visit one gallery only, the John Ritblat Gallery, which houses the 'treasures' of the BL (the others are the Pearson Gallery of Living Words, reflecting the astonishing range and diversity of the BL's collection, and the Workshop of Words, Sound and Images, showing, in a 'hands on' environment, how the book has been made through the centuries). In the Ritblat Gallery, they saw such historical documents as the Guttenberg Bible, the Magna Carta, the Beatles' manuscripts and the Lindisfarne Gospels; all were in glass cases in controlled conditions and open at whichever page the Curator had chosen. However, in an adjacent room there were television monitors on whose screens the closed Gospels was shown and, by touching the screen, the books could be opened and each page turned, enlarging any part of any page at will for detailed study.

They then entered the Readers' section of the building, passing the beautiful King's Library – that of George III given to the nation for use and permanent display by George IV – which is very much a working library. Working is also the description of the large General Humanities Reading Room – one of several reading rooms – where actual books are delivered to readers who order through the electronic catalogue. The room comprised three levels and was impressive in size and use, although not comparable with the grandeur of the old Round Reading Room in Bloomsbury. They passed on to the Oriental and Indian Reading Room – established but not yet in use – which is the greatest single collection of Far Eastern culture, and thence to the Science Reading Room which was largely empty and due to open in the Spring of 1999. In the event of fire, the books would be dowsed by the sprinklers and then frozen in the basement so that each book could be thawed and dried in its own good time.

This was a fascinating visit to a modern marvel of conservation and technology, which closed with a valuable question and answer session conducted by the Chairman of the Board.

K. Lawrey

INNOVATION AND INVESTMENT IN R&D

The Foundation held a lecture and dinner discussion on the subject "Innovation and Investment in R&D – Fresh Thoughts" on 1 July 1998. The Rt Hon The Lord Jenkin of Roding was in the chair and the evening was sponsored by the Department of Trade and Industry, HM Treasury and Railtrack plc. The speakers were Mr Cliff Hardcastle, Chairman and Chief Executive, Densitron International plc, Mr Chris Baker, Partner, Technology Industry Group, Price Waterhouse, and Sir David Cooksey, Chairman, Advent Ltd.

Mr Cliff Hardcastle*

Summary: Mr Hardcastle argued that current accounting practices did not value R&D and productive capacity at all, defining them to be intangible assets. They should be defined as integral assets with high value that were the determining factor in the future success of the company.

Introduction

There is currently a very considerable public debate concerning the low level of investment, particularly in research and development by British companies. This is an undoubtedly complex subject and there is no one answer that will by itself deal with the problem.

It is my belief, however, that there are some subtle effects arising from the way by which firms are audited by the accountancy profession and valued by the City that devalues the importance of research & development in particular.

Aims of a company

The directors of a company are charged with running the company on behalf of shareholders. In very simplistic terms, their duties can be categorised and prioritised as follows:

1. Not to lose the invested capital
2. To provide a return on the invested capital which is reasonable against the return from that same money invested in banks or bonds, etc.
3. To endeavour to increase the value of the capital to exceed any inflation but also to provide an adequate reward on the original speculation.

Originally, a company will have been formed around a new product or service. Often this will have had some years of development before the company was created. If the company is to continue into the future, it is essential that the product offering remains up to date technically and competitive in price against other newer offerings.

All actions by directors should safeguard the future of the company and its investments by development of new products and productive methods of making them more efficiently. The investment in machinery can fall within the orbit of 'tangible' assets but, in this case, the accountants measure the financial value of the investment and not its productive capacity. For example, you can now buy a computer-controlled piece of production machinery which costs half its non-automated predecessors, but is capable of producing more than 10 times the output. It is therefore 20 times more productive but would show on the balance sheet as having a lower value. How are we to make judgements on whether the directors are discharging their duties in this matter? An increase in capacity has occurred with a lower investment than before.

R&D and accountancy

Moving now to the topic of research & development and its description by accountants as 'intangible'.

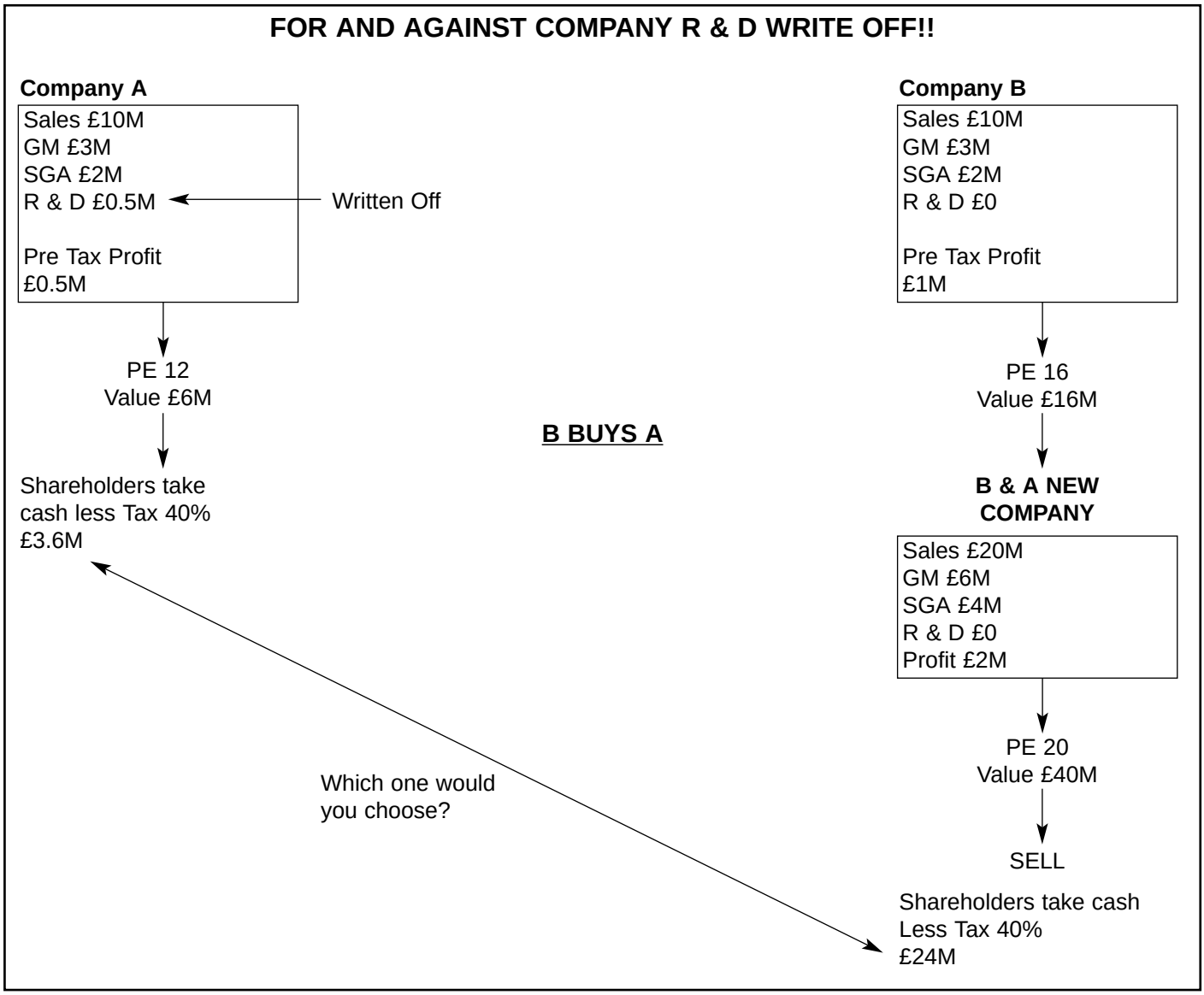
It is only called 'intangible' because accountants cannot understand it. Even the term itself is wrong – research is a totally different process to development and development can take many forms being either a development of a totally new product or the improvement of an older one. These terms should be separately identified in companies' accounts.

Companies in general can mostly manage without carrying out fundamental research but it is extremely unlikely they can manage

* *Chairman & Chief Executive, Densitron International plc*

▲ *Sir David Cooksey (left) and Mr Chris Baker flanking the chairman, The Rt Hon The Lord Jenkin of Roding.*

▲ *Mr Cliff Hardcastle (speaker) on the right with Mr Jeff Gill (Foundation rapporteur).*



without an adequate product design and development programme. By lumping research and design together and writing them off with a contemptuous word like 'intangible', we fail to meet the need of valuing directors' stewardship of the moving value of the investment.

It is my submission that to improve this situation, some relatively simple but very fundamental changes must take place.

First, drop the terms 'intangible' and 'goodwill' from the vocabularies associated with investment.

Secondly, we must develop a measurement system that values the company as an on-going entity rather than its break-up value. In particular, we should avoid the use of the PE ratio on an historic basis, being the determining factor in valuing a company above its break up value. The use of the PE ratio rewards lack of investment and values financial manoeuvring above the improvement in a company's product offerings. (See attached diagram of an example of how R&D can seriously damage shareholder value.)

The chartered accountancy profession arose to regulate the process of insolvency in private and public companies. Its particular concern, above all others, is to identify the disposable assets that exist within the company and have value that can be realised in the event of a company failure to enable creditors avoiding losses.

As detailed above, the job of the accountant is concerned with showing that the original capital can be identified and exists within the assets of the company. However, what the accountancy methodology cannot address is the ability of the company to maintain that position into the future and to project the likely increase in value. In its very nature, it is a retrospective system. The word 'accountancy' by itself is a past tense word.

It is very noticeable that in all the investigations into corporate governance (Cadbury, Greenbury, Hempel), none have tried to address the directors' responsibility for continuous product development. They have concentrated on purely financial governance

▲ *A group of those attending the lecture.*

and this, in my opinion, missed fundamental deficiencies in the operating systems in our companies.

Involve engineers and scientists

My submission is that engineers and scientists should become much more involved in the company reporting process. They should not blindly accept the accountants' limited objectives and should work hard to develop a value system for investment in development and productive capacity. This will not be the apparently precise method of the accountant but will depend upon an understanding of statistics and quantum theory so that a spread of values and uncertainties are seen to be acceptable.

As an illustration of this principle we can use the electronics industry. No-one can define what an electron is and neither can we say where it is at any time. All that exists are various propositions and theories based upon statistical probabilities. Nonetheless, we can build computers that guide us to the moon based upon these mathematics of uncertainty. The accountants use arithmetic, they add and subtract from fixed values. We engineers and scientists can build bridges, cure disease and travel the universe. By using the mathematics of uncertainty, we should use these skills in defining companies in a new way so that shareholders and new investors can make a better informed judgement.

Finally, all these items should become known as integral assets instead of intangible. Fixed assets will determine the ability to pay creditors in the event of a company ceasing to trade. Integral assets will measure the ability of the company to trade continuously into the future.

▲ *Mr David Ball contributing to the discussion.*

Conclusion

In conclusion therefore my proposition is a simple one: if we wish to see more investment in R&d and productive capacity, we must value them more highly. Present accounting conventions do not value them at all and define them to be *intangible*. To make them *tangible* we must define them in a different way and read them as integral assets with high value that are the determining factor in the future success of the company. Engineers and scientists must take the lead in this process otherwise it will not happen.

SOCIETY – KEEPING PACE WITH SCIENCE?

The Foundation held a lecture and dinner discussion on "Science – Keeping Pace with Science?" on 10 February 1998 at The Royal Society. The Rt Hon Lord Jenkin of Roding was in the chair for the event, which was sponsored by the Health & Safety Executive, Pfizer Central Research, The Royal Society and Zeneca Group plc. The speakers were Dr George Poste FRS, Chief Science and Technology Officer, SmithKline Beecham plc, The Rt Revd Stephen Sykes, Bishop of Ely, and Professor Ian Kennedy, School of Public Policy, University College London.

The Rt Revd Stephen Sykes*

Summary: In his paper, The Rt Revd Stephen Sykes spoke as a layman of the need for care and persistence in ethical issues which needed serious and deep thought, and concerned an objective reality. He talked of the need for a global ethic, applicable to all living things which could not merely be treated as a neutral, non-ethical backdrop to human life.

Introduction

I think I owe you a word of personal explanation. Despite my academic background, I am, in relation to the urgent matters we are considering this evening, a layman. I approach these questions very much from a lay, common-sense perspective, that of a general reader who picks up the fag-ends of serious conversations from the media and puzzles about them.

What follows then is a jobbing bishop's perspective on life, science and the human good. The brief I have adopted is not to discuss the particular ethics of cloning or gene technology, but the ethical interest of humankind in neither being too strict or too lax in the control of scientific activity.

It is said that G E Moore's proof of an external world consisted of his holding up his hand and inviting his audience to state how many fingers they saw. Renford Bambrough, another Cambridge philosopher, adapted this technique for his proof of the objectivity of morals. He tells a story sufficiently morally unambiguous for all (or nearly all) his readers to be clear in their mind of the right course of action. In relation to this evening's discussion, I could use the example of painful experimentation upon a live, non-consenting or mentally incompetent person. It would be possible for me to describe in graphic detail an experiment upon a child who had been chained to a bench, involving excruciatingly painful procedures. No-one (or nearly no-one) would hesitate to say that such actions were wrong. Thus we should feel confident in concluding that there is such a thing as right and wrong. The fact that we know there are much more difficult cases in which a confident judgement is less certain, or about which reasonable people might differ, does not mean that right and wrong are merely matters of opinion.

* *Bishop of Ely*

Ethical argument

If this be true, it is vital to the subject in hand. For one of the obvious features of arguments about the ethics of this or that scientific technique is that competent people differ in their conclusions. This is memorably expressed by Professor Raymond Tallis, geriatrician at Manchester University and consultant physician in Health Care of the Elderly, in a recent book review on *Physician Assisted Suicide* (TLS. Jan 30 1998, 5-6). He writes:

"If doctors are somewhat sceptical about the help they may receive from medical ethicists in resolving their uncertainties, this may also be because there is no medical ethical principle which cannot be questioned in the light of another such principle of seemingly equal validity" (p. 5). Further:

"This gap between the discourses of professional ethicists – philosophers, theologians, jurists, and so on – and the decision-making processes in the real mess of the real world of everyday medical practice probably explains why so few doctors I know actually read books on medical ethics. Even fewer consult such books to resolve specific ethical dilemmas" (p. 6).

And though he goes on to defend the importance of what he calls a 'loose meshwork' of ethical practice (which is perhaps what our conversation this evening is about), there are undoubtedly those for whom the complexity, uncertainty and professional abstraction of the arguments is a justification for a more thoroughgoing sceptical irritation. How can apparently competent ethicists differ in their conclusions if ethics deals objectively with reality? It is more than tempting to conclude that the claim must be wrong, that ethical judgements are the rationalization of emphatic feelings; or, in more sceptical mode, to hold that we dress up what we want or what it is in our interests to do in fancy ethical clothes, but that underneath it is all will to power. Power is certainly involved in the topic we are considering, both individual and corporate. To deny that ethics is simply a disguise for exercises of power is not to be naive about the need to be alert to matters of interest or control when scientific techniques are under discussion.

What I am arguing for is care and persistence in ethical argument. Gut instinct is not a satisfactory arbiter, nor is public opinion. A science correspondent of a national daily charmingly reports the practice of a working scientist, who tests the ethical status of his techniques by seeing whether they elicit from his friends the reaction 'Yuk'. But, notoriously, first responses yield to the processes of normalization. A headline proclaims, 'Internet sperm bank delivers a new male order service'. Yuk. But on further reflection might not a desperate woman be better served by Sperm Donor #1049, a dimpled 25 year old Californian professional surfer called Christopher, than by a one-night stand? If one cannot outlaw the latter, why get upset about the former?

Or, more insidiously, are we not obliged by the modern history of eugenics to recognize that professionals of various kinds, including physicians, mental health professionals and biologists, offered solutions to social ills attractive to various publics? The Nuremberg Code and the 1964 Declaration of Helsinki on Medical Research have had to be invented because neither gut reaction nor public opinion has proved to be an adequate protection against abuse. As Roy Porter observes:

"Subsequent scandals made it frighteningly clear that it was not only fascist powers who had been engaging in unethical research" (*The Greatest Benefit to Mankind*, 1997, p. 651).

A good and fair society

Secondly, I should like to argue that what is at stake in all ethical argumentation is an indivisible understanding of a good and fair society in which all human beings flourish. I should like to underline indivisibility because of our habit of moral parochialism, caught from a rather unreflective type of politics. An action or activity cannot seriously be regarded as good if it is advantageous to citizens of the UK but disastrous for Tanzanians. A proposition of this kind contains a host of complex, detailed considerations which I have not the time to argue (and probably not the competence either). But in the area of research into the safety of a new drug, exploitation of the vulnerability of people in one part of the world solely in order to benefit people in another part of the world would be unethical.

Furthermore, the abstraction of a particular line of scientific enquiry from its total human context, which is easy enough to understand as a consequence of overspecialization, would be an example of a failure to accept the indivisibility of the common good. In a world in which millions of people suffer from malnutrition there is an ethical problem about how rich societies choose to spend their wealth. This is not just a conventional argument about what we might otherwise do with the millions of pounds devoted to space-travel or armaments research – it is not lost on me that precisely the same type of argument applies to the upkeep of ancient cathedrals. To argue ethically is, rather, to argue a case relating to human flourishing as such, not just the good of the company, nor of the nation state, nor even of one group of human beings. As a matter of fact globalization is making this matter somewhat clearer, which is not to say that the intricacies of any given argument become any simpler for any particular company operating globally. It may well be no bad thing that a disaster in Bhopal is also a disaster in New York, even if of a different order for particular individuals. Once again it must be said that the argument for the indivisibility of the human good is no excuse for simplemindedness. An armchair in the Royal Society is not a secure vantage point from which to judge the good of the Bush people of the Kalahari Desert. But that their flourishing matters to our flourishing is a consequence of insisting on the indivisibility.

We may briefly consider one example. Science fiction has it that we shall in due course be able to select the kind of offspring we have for ourselves. Why should not prospective nurturing parents mail order the foetus of their choice from a catalogue? Why put up with the lottery of their own genetic make-up? If we concede such choice to the single or infertile, why withhold it from anyone?

It concedes too much, in my view, to abstract an argument on this point from the ethical context of modern Western societies. The extension of control over reproduction has been deeply affected by contraception. Successive popes have had a good deal to say about the 'mentality' produced by this invention. And though my own church has, since the 1950s, approved of 'artificial' techniques for the planning of conceptions within marriage, it has struggled with the tidal wave of moral and social consequences of the demystification of human sexual relations. No prospective biological parent is unaware that children cost a lot of time and money. But the commodification of children which would result from the unrestricted exercise of choice in relation to reproduction would have devastating social consequences. And is there not something obscene about a global social order in which certain infants might be handpicked for their genetic desirability, while others are born already disabled by the preventable malnutrition of their mothers?

I have argued for the necessity of considering what is needed for a good and fair society in which all human beings flourish. I should want to add that the same argument can and should be extended to embrace animals and the natural order too. Animals, plants and the earth are not an ethically neutral backdrop to the activities of humankind. Again, climatology is making the importance of this matter clearer, even if particular arguments become no simpler as a consequence.

Thirdly, and finally, in a rather striking and controversial image, Professor Pinker has recently claimed that human beings appear to have Stone Age intellectual equipment for Space Age problems. This is a sharpening of the problem set for this evening, of scientific developments outstripping the regulatory framework. This mode of portraying the difficulty characterizes it as having two main groups of agents: scientists on the one hand and law commissions on the other – except that between the layers of the sandwich you have wheeled in a soft filling, an ethicist! *This* ethicist is arguing that human beings belong as such to a single moral community, with the ineluctable responsibility of choosing the objectively good and rejecting the objectively evil. How on earth can that happen, given the much trumpeted (indeed more trumpeted than examined) state of moral pluralism?

Need for co-operation

I have already argued the necessity of patience and persistence; to that I want to add, explicitly, the need for co-operation. Globalization imposes upon commercial enterprises the necessity of examining and taking into account the differences of culture between different nations. The practice of co-operation has to be respectful of difference before any question of generalizable interests can properly arise. Plainly, we are in need of a global ethic in order to address the issues of scientific advance; patching up local codes of practice without attending to the plurality of contexts and cultures in which these questions arise is a less than adequate response. But co-operation in this area is incredibly hard to achieve.

Attention has recently been drawn to the need for trust in relation to the creation of prosperity, and to the existence of high-trust and low-trust societies. But, according to Francis Fukuyama, trust is 'not the consequence of rational calculation; it arises from sources like religion or ethical habit that have nothing to do with modernity' (*Trust*, London 1995, p. 352). Economic globalization on the other hand, which has everything to do with scientific and technological advance, needs to be accompanied by a deliberate and sustained effort to promote co-operation based on trust, specifically in the ethical sphere.

Trust, however, is a personal human attribute and it is undermined by the habit of suspicion. Suspicion, in which our century excels, has its roots in our knowledge of the extent to which power and self-interest dominate our motivation. If trust is to flourish between people it has to be based on a confidence born of experience. You have to have some evidence that the other, who might have taken advantage of you for his or her own betterment, did not do so because of some greater good. For trust to flourish there has to be a certain human transparency. Concealment is the climate in which suspicion arises. It is not that one denies the existence of power and self-interest, but that within a mutual acknowledgement of such drives there is specific, identifiable evidence of non-self-interested behaviour, sufficient to lay the foundation for mutuality and co-operation.

Against that somewhat utopian proposal one reads of the realities of biotechnology company competition. Last week British Biotech shares (I quote)

"tumbled by 41p to 92p on news that the European launch of Zacutex, its treatment for acute pancreatitis, will be delayed for a year. Biotech stocks are ruled by sentiment. It is hard to believe that less than two years ago British Biotech was valued at more than £2bn and vying for a place in the FTSE 100. Delays in product launches had a devastating effect on the share price, and the group is now valued at £607m". (*The Independent*, 6 Feb., p. 2).

It is plain that there needs to be some kind of countervailing power working for mutuality, openness and co-operation, if the very intense forces at work sustaining and sharpening competitiveness and commercial secrecy are not to predominate. Again, we confront what Roy Porter calls 'a key factor and paradox of the history of medicine', namely:

"The unresolved disequilibrium between, on the one hand, the remarkable capacities of an increasingly powerful science-based biomedical tradition and, on the other, the wider and unfulfilled health requirements of economically impoverished, colonially vanquished and economically mismanaged societies" (p. 12).

I conclude that there is an inescapable ethical requirement laid upon human politics precisely in the area of the management of scientific and technological advance.

FOUNDATION NEWS

Lord Lloyd of Kilgerran Prize

The 1998 Lord Lloyd of Kilgerran Prize was awarded to Professor Ian Wilmut of the Roslin Institute "for developing and using embryo manipulation techniques in farm animals, leading to many potential uses in bio-medicine and livestock breeding". The prize of £2,000 is given annually to a person for the application of science and technology for the benefit of society, and commemorates aspects of the life of the late Lord Lloyd of Kilgerran, second Chairman of the Foundation for Science and Technology.

▲ *Professor Ian Wilmut (centre) with the Rt Hon The Lord Jenkin of Roding and Lady Lloyd of Kilgerran shortly after he had received the Lord Lloyd of Kilgerran Prize.*

LECTURE & DINNER DISCUSSION SUMMARY SHEET

EXPLOITING RESEARCH – INGREDIENTS FOR SUCCESS

This lecture and dinner discussion was held at the Royal Society on 14 October 1998. The Rt Hon The Lord Jenkin of Roding was in the chair and the evening was sponsored by Amadeus Capital Partners Ltd, Microsoft Research Ltd and Zeneca plc. The speakers were Professor Roger Needham FEng FRS, Managing Director, Microsoft Research Ltd, Dr Hermann Hauser, Director, Amadeus Capital Partners Ltd, and Mr Simon Anderson, Chairman, The Cambridge Greater Partnership.

Summaries of the discussions during the Foundation's events are now being produced and sent to those who attended. Sir Geoffrey Chipperfield and Jeff Gill kindly act as rapporteurs. This is an example of such a summary.

The invited speakers had drawn attention to the advantages which flowed from the concentration of science-based enterprises in and around Cambridge. The area was not unique in having similar businesses located close to each other: in Yorkshire, for example, there were clusters of manufacturers of caravans and also of prostheses. It was hard to bring such dynamic groupings into being or to understand how the virtuous circle got started. Low-risk technology helped in the early stages, so that individuals could launch a new venture without burning their boats. The recent commercial development in Cambridge had been facilitated by the falling price of computing, which allowed a range of disciplines to take off, and by the University's policy of not appropriating the intellectual property created by researchers.

It was observed that some of the benefits might be achievable without so close a geographical focus, with the Cambridge enterprise community perhaps fostering satellite operations in less crowded parts of the country. Business expansion in the area had placed a strain on the infrastructure, with serious road congestion and, in the experience of one contributor to the discussion, long delay in obtaining a digital telephone line. It was one of the few focal centres for business to survive without an international airport. The planning system did not always deal sympathetically with development proposals, a notable set-back being the refusal of permission for a modest science park next to the Sanger Centre. Local electors did not necessarily welcome even high-tech developments in their backyard. The Greater Cambridge Partnership was using quiet diplomacy to promote better understanding between business people and planners.

In principle telecommunications might eventually make place of residence immaterial, but for the time being companies still benefited from being close to similar businesses. In California's "Silicon Valley" the co-location of electronics companies was found to promote a fluid labour market, because people already employed in an established business could join a new enterprise without having to move house. Moreover, a business with a workforce dispersed across different locations might solve the problem of internal communications but still had to deal with contractors, customers and other outside contacts.

People starting new high-technology companies needed not only physical resources but also good advice, especially if their own background was scientific rather than commercial. One such group had succeeded in raising finance but were under pressure to part with more equity than they wished. They wondered how they were to become businessmen and learn to deal with commercial world. A number of thoughts were offered in response. It was indeed difficult to get advice but a good venture capitalist should be able to help steer the fledgling enterprise. This would be easier when there were more investors prepared to back new businesses: there was a lot of venture capital in the UK, but only a few specialised funds dealt with starter firms. A better supply of finance for new businesses would also mean that newcomers could get a better deal. In California capital was available for any new business if the right basic ingredients were there, but venture capitalists in the UK could still pick and choose. Another contributor commented that people starting new companies had to be prepared to give up equity. This was well recognised in the US, but in the UK persuading entrepreneurs to part with shares was like pulling teeth. Another piece of advice was that it was crucially important for new entrepreneurs to be prepared to listen. It helped also if they could recruit the right non-executive directors.

Ideally, it was suggested, there should be formal education in the skills of entrepreneurship. It was often questioned whether this could be taught, and it was certainly true that, like concert pianists, entrepreneurs had to have the right genes. A pianist also, however, needed a piano, and entrepreneurs similarly needed the right tools and environment. Formal training for enterprise was not widely available as yet. A teacher was concerned that the schools were helping to clone business people with yesterday's skills, contributing to the disappearance of leading companies when they failed to re-engineer. The problem was how to fit entrepreneurship into a crowded programme. There were some schemes aimed at young people, but it was hard for the curriculum to cover entrepreneurship at GCSE or A-level. Against this it was argued that entrepreneurship could be taught without time being allotted for the purpose: it was a question of encouraging the right attitudes. When teaching ways to solve problems, for instance using algorithms, it took no longer to motivate students to find solutions that would be commercially successful. Another possibility would be for the schools to offer a platform to business people who could teach entrepreneurship: currently the schools were not bombarded with such proposals. In higher education sandwich courses were an established solution, but it was increasingly hard for universities to find industrial partners. The Research Councils (MRC and BBSRC) had a joint initiative to encourage enterprise among researchers.

Attention was drawn to a wider problem of persuading organisations in the UK to exploit solutions, when the culture was on the whole not enthusiastic about people making money. Innovators who chose to sell their ideas overseas could hardly be criticised for it. Tax rules in the UK were not helpful to start-up companies, which could not, for instance, write off the costs of research against profits when they had not yet begun to make money. The granting of an option was liable to carry a tax liability even if the option proved worthless. It was pointed out that in Germany the tax on patents had been halved in order to encourage innovation, and investors could benefit from government loan guarantees. As a result, venture capitalists scrambled to invest in Germany. They were in any case generally wary of businesses where the main

assets were the skills of the people in them. Pension funds in the UK were also reluctant to invest in start-up companies: one major British pension fund would do so in the US but not in the UK. Nevertheless, there was room for optimism. American venture capitalists were finally beginning to accept that companies in the UK were worth backing, because they had at last been persuaded that high technology industry could make money in Europe.

Jeff Gill.

The discussion was held under the Chatham House Rule. None of the opinions stated are those of the Foundation, since by its nature and constitution, the Foundation is unable to have an opinion.

FOUNDATION NEWS

Lecture Summaries

Summaries of the discussion during the Foundation's events in London are being produced and sent to those who attended. This new scheme is going well, and Sir Geoffrey Chipperfield and Jeff Gill kindly act as rapporteurs, providing a page of summary which might remind those who attended of the principal points, and matters which they might take away for action. Each note ends with a statement: "The discussion was held under the Chatham House Rule. None of the opinions stated are those of the Foundation, since by its nature and constitution, the Foundation is unable to have an opinion".

An example of a summary is shown on page 15.

Joint Meeting in Ireland "Building Closer Irish/UK Collaboration in the Fifth Framework Programme"

The Foundation met with The Royal Dublin Society at the Society's impressive headquarters at Ballsbridge, Dublin, on 28 October 1998 for an afternoon and evening of talks and discussions on "Building Closer Irish/UK Collaboration in the Fifth Framework Programme". The timing was apt since it coincided with a visit by the Rt Hon David Blunkett to his opposite number in Dublin on the same day.

A team of 22 from the UK joined some 70 from Ireland, mainly from the science, government and industrial community. Noel Treacy TD, Minister for Science, Technology and Commerce, gave a warm welcome on behalf of the Irish Government, and Liam Connellan, President of the Royal Dublin Society, opened the meeting which was chaired jointly by Professor Dervilla Donnelly, Past President of the Society and Professor of Chemistry at University College Dublin. Academics and businessmen gave their opinion and thoughts, followed by John Travers, Chief Executive of Forfás (very broadly the equivalent of DTI) and Michael Fahy from the European Commission gave the final talks before a reception in the presence of the British Ambassador, and then a dinner with further discussion.

It is intended that some of the papers will be published in a future issue of the Journal. During discussion there was naturally concern that the budget for the Fifth Framework Programme would be agreed by the deadline. However, there were reassuring and authoritative words. Some felt that there should be provision for basic scientific research. There was some concern that expenditure on research continues on projects, sometimes months after cancellation. It was reported that the recent joint talks between Ireland and the UK had been found productive and worthwhile, and that there was much common ground.

The Royal Dublin Society, and, indeed, all those who attended, made the UK team feel warmly welcomed and it is hoped that the Foundation will be able to retain many helpful contacts for future meetings, both in the UK and in other partner states of the Union.

On the following morning, 29 October 1998, part of the UK team was given an impressive and powerful series of presentations by Dr Daniel O'Hare, the President, and senior colleagues of Dublin City University. There was a description of the University from the time it started in 1980, of its development under 67% private funding. It has been research-driven from the start, and they have a generous incentive scheme for invention. This gives only the slightest flavour of a very packed and fascinating morning for rather a small number of the UK team.

▲ *Noel Treacy TD, the Irish Minister for Science, Technology and Commerce, with Professor Dervilla Donnelly, Past President of the Royal Dublin Society, who chaired the meeting jointly with the Rt Hon The Lord Jenkin of Roding.*

▲ *The Lord Butterworth, the Foundation's President (right), talks with Mr Liam Cornnellan, President of the Royal Dublin Society, and another guest during the recent joint event in Dublin.*

Workshop for Younger Scientists

Dr David Metz (left) facilitating one of the Foundation's recent workshops for younger scientists and engineers.

Joint Science Forum with the French Embassy

The Foundation held a Science Forum jointly with the French Embassy on 26 October at the Lycée in South Kensington. About 100 younger scientists from France and the UK gathered to hear about the pharmaceutical, agro-chemical and bio-chemical industries, and employment in each of the two countries. Eight industries were represented and, after presentations and discussions in the morning, they held "round table" talks with the younger scientists in the afternoon.

▲ *Some of those who attended the recent Science Forum held jointly with the French Embassy at the Lysée in South Kensington.*

▲ *Maggie Semple of New Millenium Experience and Ian Horsbrugh, Principal of the Guildhall School of Music & Drama, attended a recent meeting of the Foundation.*

Visit to CERN

As reported in the last issue, 22 people from the Foundation visited on the World Trade Orgainisation on 26 June 1998. They went to visit CERN, which lies near the French border in Switzerland, and there Professor Chris Llewellyn Smith, the Director-General, explained that over 7000 users from 50 different countries, largely university staff, make use of the Centre, probing the deep structure of matter through a wide variety of experiments. Most significant to the outsider is the 27km circular tunnel around which particles circulate 11,200 times per second, and when colliding provide almost unimaginable quantities of data. CERN's future Project Atlas will collect the equivalent information as 10,000 Encyclopaedias Britannica every second.

There are many spin-offs from the activities of CERN beneficial to the 19 member states subscribing to the infrastructure costs. One is the immense enthusiasm for engineering and physics caught by anyone visiting or learning about it. To this end CERN has a major visits programme, especially for schools, bringing many young into science and engineering. There have been considerable political and social benefits gained from its international nature, bringing in the Germans into international science at an early stage after the last World War, involving Russia in science there before as well as directly after the end of the Cold War. There are more concrete benefits such as the invention at CERN of the World Wide Web brought about by the need for scientists there to communicate internationally. The inventor of the World Wide Web, Tim Berners-Lee, won the Lord Lloyd of Kilgerran Prize of the Foundation for Science and Technology in 1997. Crystal photon detectors developed at CERN are now widely used in medical applications. The far-reaching science requirements are a great stimulus for technology, forcing tough contracts and extending skills and knowledge in industry. It has been estimated that broadly for every £1 industry spends on CERN their turnovers increase by £3. Some 300 PhDs are trained at CERN each year, and half of these go into industry.

The team from the Foundation was taken into France to the far side of the circle where they descended 100 metres by lift to a cavern in which there was a massive building packed tight with electronics. This massive installation in the tunnel was one of the detectors where the particles were recorded colliding. Some of the current research is to try and find an answer to the mystery of mass. Why are some particles enormously more massive than others? The solution to this problem would be a great leap forward in knowledge, confirming ideas on the Universe's formation and – who knows? – eventually leading to related benefits in other disciplines which could greatly affect wealth and the quality of life.

The visitors were met in the cavern at the detector by teams of scientists, most of whom were young working in international teams. The morale and enthusiasm were immensely encouraging; so much so, in fact, that the visitors could not be dragged away to keep to the full programme ending with a dinner discussion with the Director-General and some of his staff where more was learnt about the future programmes of CERN.

The next major project is the Large Hadron Collider which is being constructed through a global partnership with Japan and the USA joining CERN's 19 Member States. It will be installed in the present 27km tunnel, and the associated detectors involve highly advanced and challenging technology and engineering. This major project, taking particle physics experiments a major step forward, and supported so broadly internationally, is due to be switched on in 2005, and it is believed that the last person to gain a PhD using the facility has not yet been born!

Schools and others wishing to know more about CERN and about possible visits can obtain information on: *Http://www.cern.ch*

▲ *Dr Charles Kim, Deputy Director-General, World Trade Organisation, hosting the luncheon discussion at WTO.*

▲ *Lord Chorley, Patrick McHugh and Mr W Drautz being shown part of the detecting equipment at CERN.*

PROFILES OF COUNCIL MEMBERS

Sir Ernest Ronald Oxburgh KBE, FRS

Sir Ron Oxburgh is Rector of Imperial College and thus the leader of one of the largest educational institutes in the country, but his journey there was a reluctant one, from an unusual departure point. He was educated at the Liverpool Institute and the University of Oxford where he initially read classics but, with a love of science and enjoying mountaineering (as he still does), he changed academic direction to geology, thus embracing both interests and opening up more appealing career prospects. He was pleased with the change and, after Oxford, went, in 1957, to America to study with Harry Hess at Princeton University, which he found to be a stimulating period. His research studentship led to his PhD in 1960 after which he expected to join Shell, with whom he had had much contact as an undergraduate although fate seemed to have other plans. He was committed to a postponed period of national service in the armed forces which was, unexpectedly, cancelled and he found himself looking for a temporary job – which appeared amongst the 'dreaming spires': he was to remain in Oxford for the next eighteen years.

The immediate post was that of a departmental demonstrator and this led to a lectureship in Geology a year later together with a Fellowship of St Edmund Hall (to become an Emeritus Fellow in 1978 and an Honorary Fellow in 1986). This was a time of substantial involvement in scientific research and in college and university administration. He had developed an early interest in the large-scale mechanical process within the earth which led particularly to the creation of the great mountain ranges and he spent much time unravelling those processes which formed the Alps and the Pyrenees. This interest encompassed the thermal processes within the earth and its rate of heat loss which, in turn, led him to matters concerned with conservation of the earth's gases and mankind's stewardship of this arena.

His period in Oxford took him to the California Institute of Technology in 1967 (where he was also the Sherman Fairchild Distinguished Visiting Scholar in 1985) and to Stanford and Cornell Universities in 1973 as a visiting professor; he was awarded the Bigsby Medal of the Geological Society in 1979. His time in Oxford also developed his administration and political skills: he was Admissions Tutor for his College for twelve years which gave him excellent training in the selection process and he was involved in university activities, becoming, inter alia, Chairman of Physical Sciences where he learned much about the distribution of resources.

Oxford at that time was interesting with so many talented people, so much natural advantage and such an archaic system of government. He wanted the Report on the Governance of the University by Lord Franks, with whom he was greatly impressed, to be fully implemented: the fact that it was not led to the establishment, thirty years later, of the North Committee, on which Sir Ron himself then served. Shortly before leaving Oxford, he was elected to the Royal Society.

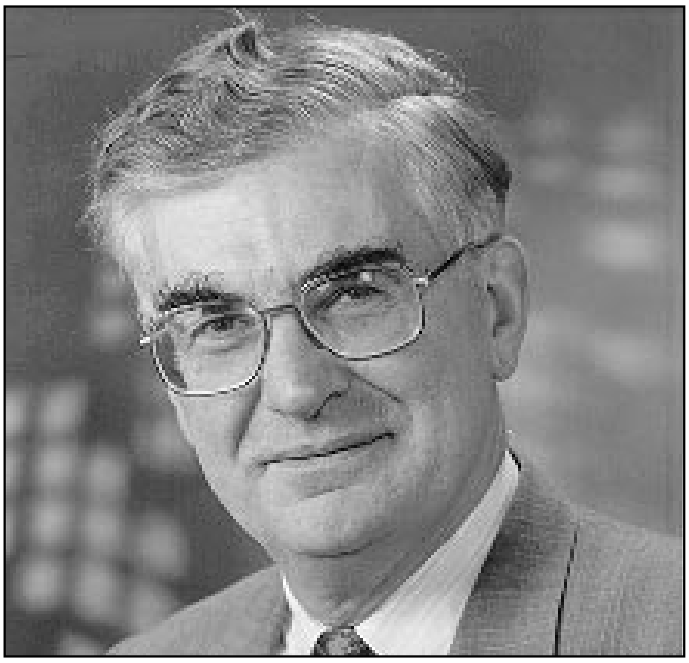
He moved to Cambridge in 1978 to become Professor of Mineralogy and Petrology and Fellow of Trinity Hall (later Honorary Fellow), Head of the Department of Earth Sciences in 1980 and President of the Queens College in 1982. He had not sought the move but it presented a different challenge from Oxford: Cambridge was larger in science, but it had three specialist science departments which needed to be brought together. This he achieved in three years – although it took much longer for the personnel to think as one! – and led to the recognition that Cambridge had the most influential earth science department in the country and one that was a major world player in that field. He paid tribute to the contribution of supportive colleagues for this success as he did for all his achievements.

His appointment as Chief Scientific Adviser to the Ministry of Defence in 1987 was also unsought, but it was a challenge he could not resist. He reflects on the unrivalled opportunity he then had to observe the interaction of the five very different cultures in operation: the professional civil service (which he holds in high esteem), industry, the government scientists, the military and the politicians. He was at the Ministry during the most interesting years of the century: he joined it when the Cold War and the Berlin Wall were in place and he left it when both had disappeared and the international scene had been changed permanently by the communication explosion. He was in the centre of the corridors of power at this most interesting time and remains grateful for the fascinating experience.

He had intended to remain a civil servant, although he wonders if he had the necessary detachment from the professional outcomes of policies which he had helped to develop because the service has to live with changes of direction – perhaps he cared too much, but the Rectorship of Imperial College beckoned in 1993 and so he returned to academe.

The major challenge put before him when he arrived at Imperial was to negotiate the entry into the College of a number of free-standing medical schools that a succession of national reports had recommended should join Imperial to make a single united medical school. This was a task that taxed his powers of persuasion and diplomacy to their limits. The Imperial College School of Medicine came into being on 1 August 1997 due in no small measure to experience he had gained in his time in the Civil Service. "Doctors", he commented ruefully, "are different". During this period he also served as a member of the National Committee of Inquiry into Higher Education under Sir Ron (now Lord) Dearing.

He does not have a conventional religious faith – he is too rooted in the physical aspects of the earth – but he is intrigued by phenomena which science cannot explain and recognises the limitations of the present picture of the human condition and especially



▲ *Sir Ernest Ronald Oxburgh KBE, FRS*

of the mind and its interaction with the human body. It is of satisfaction to him that Imperial now includes medicine amongst its disciplines. Faith, he opines, may come from experience and observation but not from reasoning which is too fallible for his comfort.

The record lists honorary degrees from Paris, Leicester, Loughborough, Edinburgh, Birmingham and Liverpool and fellowships or membership of Geological Societies in Europe and America. He was knighted in 1992 and he has published widely. Despite what must be a punishing workload, he still finds time for mountaineering and orienteering and his family life. He claims to be a practical man who enjoys woodworking, repairing and decorating (his most satisfying moment was the instant starting of the engine of a small car which he had lovingly taken apart and reassembled over a two year period), although he regrets he is only now able to play a little at his research.

FOUNDATION NEWS

"New Partnerships between Universities and Industry, in the 21st Century" REPORT ON JAPAN SYMPOSIUM

The Foundation's report on the symposium held jointly with the Japan Society for the Promotion of Science has been published, and copies are available from the Foundation.

The Report covers an account of the findings and conclusions of the visits to a university, research institutes and to an industry as well as the papers and discussions of the symposium itself held on 21 April 1998 at the Japan Academy. Throughout the visit and symposium there were extremely frank exchanges of views, especially on the main theme of universities and industry co-operating in the research and the exploitation of it.

Copies are available from the Foundation's offices. Those requiring a copy sent to them are asked to send an A3 stamped addressed envelope (60p).

THE 1998 ZUCKERMAN LECTURE "Europe Needs Research, Research Needs Europe"

Once again the Foundation ran the Zuckerman Lecture jointly with the Office of Science and Technology, the speaker being Madame Edith Cresson, European Commissioner for Science, Research and Development. The Lecture was reported in the last issue of the Foundation's Journal.

Copies of the text of her speech with an introduction by John Battle MP, Minister for Science, Energy and Industry, are available from the Foundation's offices. Those requiring copies are asked to send an A3 stamped addressed envelope (31p).

New Associate Members

The following have become Associate Members of the Foundation for Science and Technology:

Yamanouchi Research Institute
Contact: Dr John Lackie, Director

Association of the British Pharmaceutical Industry (ABPI)
Contact: Dr Jeff Kipling, Director, Science & Technology

Napier University
Contact: Professor J Mavor FEng FRSE, Principal and Vice-Chancellor

Wates Technology
Contact: Michael C Beer, Divisional Manager

Research Fortnight
Contact: Ian Mundell, Editor

Emblem Research Associates Ltd
Contact: Martin Bloom, Director

Microsoft Research Ltd
Contact: Professor Roger Needham FEng FRS, Managing Director

R & D Efficiency
Contact: Dr David Fishlock OBE

UCAS
Contact: M A Higgins, Chief Executive

Mainprice Napier & Co
Contact: James Burchett, Partner

Accredited and Affiliated Societies

The Foundation's Council agreed the following new societies:

Accreditation to the Foundation:
The Royal College of Veterinary Surgeons
The Royal Society for the Promotion of Health
International Union of Crystallography

Affiliation:
The Chartered Institute of Management Accountants
The United Kingdom Institute for Conservation

Learned and Professional Society News

The 1998 Salary Survey in respect of the staffs of learned and professional societies is available at a cost of £10 per copy and 39 copies have so far been sold. The revision of the Register of Learned and Professional Societies is well in hand and should be published early in 1999.

The bi-monthly Newsletter has included the following occasional papers, copies of which are available from the Foundation: the Report of the Foundation's Working Party on the Charity Commission's Review of its Register, the Report of the Foundation's Working Party on SORP, and a paper provided by the Home Office on the proposed Criminal Records Agency which will allow all voluntary societies to make application for disclosure of information about applicants for those posts that require such disclosure.

The above-mentioned Working Parties have completed their deliberations and their reports have been sent to the Charity Commission.

Recent Foundation seminars have been: Charities and Trading and a Databases Workshop. Reports of both have appeared in the Newsletters.

Council sets a Misson Statement

At its meeting on 24 November 1998, the Foundation's Council agreed a Mission Statement: The Foundation shall provide a neutral platform for the better understanding of science, engineering and technology, especially as they contribute to the greater effectiveness of industry in the United Kingdom, and to enhancing the quality of life now and for future generations. The Foundation will recognise the need to work towards its objects with other countries. The Foundation shall provide a focus for learned and professional societies on matters of common interest.

SUBSCRIBING LEARNED AND PROFESSIONAL SOCIETIES

One of the principal activities of the Foundation for Science and Technology is to act as a focus for learned societies on all matters of common interest, and these include, for example, organisational, administrative and training aspects of learned societies. The Foundation publishes the two-monthly Learned Societies' Newsletter which is sent to all subscribing societies which number over two hundred. Keith Lawrey, the Learned Societies Liaison Officer, prepares this and also "occasional papers" on topics such as "Standards in Public Life" and "Review of the Register of Charities: a Response", to name but a few. In the course of each year he organises six or so seminars and workshops on matters of common interest to the societies. He also puts one society in touch with another where one can learn from another's experience, and he provides advice. The work of the Learned Societies' Liaison Officer is supported through the annual grants to the Foundation from The Royal Society, The British Academy and The Royal Academy of Engineering.

Learned societies subscribe in two ways. Those of the sciences, engineering or technologies may apply for accreditation to the Foundation, and these have a constitutional right to be represented by three elected members of Council. At present they are: Professor R T Severn, an Officer of the Institution of Civil Engineers, Sir Geoffrey Allen, an Officer of the Institute of Materials, and Dr C A P Foxell, an Officer of the Institution of Electrical Engineers. They have a vote at the Foundation's General Meetings. Societies of the arts and humanities can apply for Affiliation to the Foundation, but have no constitutional benefits.

Every four or five years the Foundation produces a Register of Learned and Professional Societies, and is at present preparing a 1999 edition. It gives the names and addresses of over 700 learned societies, and fuller details of over 400 of them. The list below shows the societies Accredited and Affiliated to the Foundation, and also those who support the work through an annual grant.

Academia Europaea
Agricultural Economics Society
Anatomical Society
Antiquarian Horological Society
Architects and Surveyors Institute
ASSET
Association for Learning Technology
Association for Project Management
Association for Science Education
Association of Applied Biologists
Association of Clinical Biochemists
Association of Clinical Pathologists
Association of Medical Research Charities
Association of Teachers of Mathematics
Bibliographical Society
Biochemical Society
Botanical Society of the British Isles
British Association for the Advancement of Science
British Biophysics Society
British Cartographic Society
British Computer Society
British Crop Protection Council
British Dental Association
British Ecological Society
British Entomological & N H Society
British Grassland Society
British Horological Institute
British Institute of Facilities Management
British Institute of Radiology
British Medical Ultrasound Society
British Mycological Society
British Nutrition Foundation
British Ornithologists Union
British Pharmacological Society
British Phycological Society
British Psychological Society
British Records Association
British School of Archaeology in Iraq
British Society for History of Mathematics
British Soclety for History of Science
British Society for Immunology
British Society for Parasitology
British Society for Plant Pathology
British Society for Rheumatology
British Society for Strain Measurement
British Society of Audiology
British Society of Soil Science
British Sociological Association
British Sundial Society
BSES Expeditions
Cambridge Philosophical Society
Challenger Society for Marine Science
Charles Close Society
Chartered Institute of Arbitrators
Chartered Institute of Building
Chartered Institute of Loss Adjusters
Chartered Institute of Management Accountants
Chartered Institute of Public Finance & Accounts
Chartered Institute of Purchasing & Supply
Chartered Institute of Transport
Chartered Institution of Building Services Engrs
Chartered Society of Designers
Chartered Society of Physiotherapy
College of Teachers
College of Radiographers
Consortium of University Research Libraries
Council for British Research in the Levant
Council for Professions Supplementary to Medicine
C S T I
Ecclesiastical History Society
Economics & Business Education Association
Egypt Exploration Society
English Association
Ergonomics Society
Experimental Psychology Society
Federation of British Artists
Fisheries Society of the British Isles
Galton Institute
General Optical Council
Geographical Association

Geological Society
Geologists Association
Guild of Air Pilots & Air Navigators
Heraldry Society
Historical Association
Hydrographic Society
Incorporated Society of Musicians
Institute for Supervision and Management
Institute for the Management of Information System
Institute of Acoustics
Institute of Actuaries
Institute of Automotive Engineer Assessors
Institute of Biology
Institute of Biomedical Science
Institute of Brewing
Institute of British Foundrymen
Institute of Building Control
Institute of Chartered Shipbrokers
Institute of Corrosion
Institute of Cost & Executive Accountants
Institute of Energy
Institute of Export
Institute of Field Archaeologists
Institute of Fisheries Management
Institute of Food Science & Technology
Institute of Heraldic & Genealogical Studies
Institute of Highway Incorporated Engineers
Institute of Horticulture
Institute of Information Scientists
Institute of Leisure & Amenities Management
Institute of Linguists
Institute of Logistics
Institute of Management
Institute of Marine Engineers
Institute of Materials
Institute of Maths and its Applications
Institute of Measurement and Control
Institute of Operations Management
Institute of Packaging
Institute of Paper Conservation
Institute of Petroleum
Institute of Physics
Institute of Plumbing
Institute of Psycho-Analysis
Institute of Quality Assurance
Institute of Refrigeration
Institute of Risk Management
Institute of Road Transport Engineers
Institute of Science Technology
Institute of Translation and Interpreting
Institute of Trichologists (inc)
Institution of Agricultural Engineers
Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Electrical Engineers
Institution of Engineer Designers
Institution of Gas Engineers
Institution of Incorporated Engineers
Institution of Lighting Engineers
Institution of Mechanical Engineers
Institution of Structural Engineers
Institution of Water & Environmental Management
International Association on Water Quality
International Glaciological Society
International Union of Crystallography
Landscape Institute
Linnean Society of London
London Mathematical Society
Manpower Society
Marine Biological Association of the UK
Medical Society of London
Multimedia and Primary Education
Mineralogical Society
National Association for the Teaching of English
Natural History Museum
Nautical Institute
Newcomen Society
Nutrition Society
Oil & Colour Chemists Association
Operational Research Society
Overseas Development Institute
Palaeontological Association
Palestine Exploration Fund
Pensions Management Institute
Photogrammetric Society
Physiological Society
Pipeline Industries Guild
Quekett Microscopical Club
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