THIRTY EIGHTH

LONDON INTERNATIONAL YOUTH SCIENCE FORUM

1996

LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1996

Founded by the late Philip S Green, MBE in 1959, the Science Forum aims to give a deeper insight into Science and its applications for the benefit of all mankind and to develop a greater understanding between young people of all nations.

10 DOWNING STREET
LONDON SW1A 2AA

THE PRIME MINISTER

I am delighted once again to send greetings to students from all over the world gathering in London to attend the International Youth Science Forum.

We are in Britain extremely proud of our scientific tradition. Some of the greatest discoveries ever in the fields of physics, biology, astronomy, medicine and others were made by British scientists. The names Newton, Faraday, Darwin, Fleming, among so many others, are a treasured part of our history.

As science is part of our history, so it is our future. This year we have seen astonishing photographs from the Hubble space telescope and information from the Galileo space probe which, quite literally, open our horizons to the infinite. Back on Earth, science continues to demonstrate its capacity for raising the human condition with discoveries both to satisfy and stimulate our curiosity and which improve the quality of our lives.

Science is an international pursuit - one reason why your Conference is such a valuable event. The scientists of history were often gentlemen of leisure, with time and private income enough to quench their thirst for knowledge. Today a relatively straightforward experiment might cost millions of pounds and the brains of several nations to undertake. Science enriches us all. We must work together to realise its full potential. Britain, and the British Government, will play its part.

John Major

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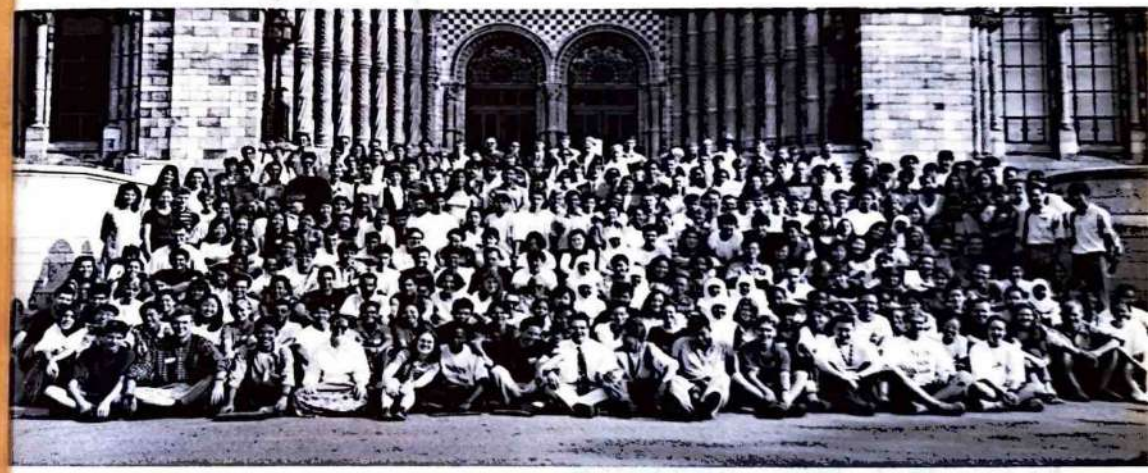
The British Council is the principal sponsor of international participants.

This list was based on attendance at the London International Youth Science Forum in 1995.

LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1995



The following countries were represented

Albania
Australia
Bahrain
Belgium
Bulgaria
Canada
Croatia
Czech Republic
Estonia
France
Germany
Ghana
Greece
Guernsey
Hong Kong
Hungary
India
Indonesia
Ireland
Israel
Italy
Jamaica
Japan
Korea
Kuwait
Latvia
Lithuania
Malaysia
Malta
Montenegro
Namibia
New Zealand
Norway
Oman
Peru
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Puerto Rico
Romania
Russia
Sierra Leone
Singapore
Slovak Republic
South Africa
Spain
Sweden
Switzerland
Taiwan, ROC
Thailand
Trinidad & Tobago
Tunisia
Turkey
United Arab Emirates
United Kingdom
United States of America
Venezuela
Yakutia
Yugoslavia
Zambia

ACKNOWLEDGEMENTS

The Science Forum offers its thanks to all those who so generously assisted in the planning and preparation of the 1996 meeting, and in particular to:

The Commonwealth Institute, Royal Institution of Great Britain, University College London and King's College London for providing premises and facilities for lectures and seminars.

The Lecturers and Speakers whose contributions are invaluable.

The Academic, Commercial and Industrial Organisations, Research Establishments and Museums which have arranged visits and lectures.

The Biochemical Society, ICI Group R&T Affairs, Genetic Interest Group and Unilever Port Sunlight Research Laboratory which have provided Specialist Lecturers and Seminar Leaders.

RTZ for its generous support and particularly for the donation of this programme booklet.

The Wardens, Bursars and Staff of College Hall, International Hall and Nutford House where participants are accommodated.

Chef in a Box Ltd, and Michael Warner for assistance with catering arrangements.

Capital Group Travel, and Peter Campling for coach transportation.

Jim Green for sound systems and programmes at the Welcome and Farewell Discos.

Competitive Systems and David Evans for computer programming and backup.

British Airways plc and Gary Gray for generous assistance with travel facilities for participants from a number of overseas countries, and for arrangements for the visit by all participants to London's Heathrow Airport.

Cathay Pacific Airways for assistance with travel for students from Kobe, Japan.

ICI Group R&T Affairs and ICI Paints Division for their generous sponsorship of overseas participants.

British Nuclear Fuels plc, Fife Industry Council, Engineering & Physical Sciences Research Council, 3M Healthcare, Pfizer Ltd, Roche Products Ltd for their continued sponsorship of participants from the United Kingdom.

The schools and colleges who nominate candidates from Britain to attend the Science Forum and the industrial, commercial, foundation and charitable sources which sponsor them, notably the International Contact Trust.

The British Association for Central & Eastern Europe for its support and assistance with recruitment.

The British Council, the principal sponsor of overseas participants, for its generous support, assistance and unfailing courtesy in so many countries, where participation is made possible through its involvement.

Gene Shaw of New York for the photograph on page 9, and Hendryk Mohnfeld for various photographs of speakers throughout the booklet.

All those who have assisted, and who are not included in this list, whose support has made the organisation of the Science Forum possible.
(List compiled 5 February 1996)

UNIVERSITY OF CAMBRIDGE
DEPARTMENT OF CHEMISTRY
Lensfield Road
Cambridge CB2 1EW

Brian F. G. Johnson FRS
Professor of Inorganic Chemistry (1970)

These are exciting times for the scientific community. There are opportunities a-plenty and the potential for new advances is enormous. Science has been evolving for centuries and with each generation new problems have arisen which demand rapid and satisfactory solutions. In today's world, scientific endeavour will continue to play a central role in advances of great significance for diverse areas of human activity, such as medicine and healthcare, environment, materials, transport, communication and so on.

During your participation in this meeting you will have the opportunity to visit many of the institutions contributing to these endeavours and to listen to lectures delivered by acknowledged experts in their chosen areas.

Enjoy yourselves on this exciting occasion, and I welcome you all to this year's London International Youth Science Forum.

Brian F C Johnson
President
London International Youth Science Forum

RTZ

As a world leader in the natural resources business, RTZ makes a major contribution to economic prosperity in many parts of the world. But beyond this it also believes firmly in contributing to the well being of the communities wherever it operates. In Britain more than £1.5 million is invested in a wide range of community support programmes each year, both nationally and in the localities where operating companies are active. Worldwide, Group contribution is just over £9.5 million.

RTZ's policy in Britain is to focus its main community support on education, the arts, the environment and world affairs. In education, RTZ seeks to develop the talents of young people, broaden their educational experience, and improve their understanding of science and technology, especially in the fields of natural resources, industry and the international economy.

With its own emphasis on youth and excellence, the company is proud to be associated with the Thirty Eighth London International Youth Science Forum 1996.

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LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1996

The *Oxford English Dictionary* devotes 37 lines and offers five variations based on the views current at various times over the last four hundred years on the meaning of the word *Science*. Despite this lengthy entry and carefully chosen definitions, the meaning of science remains less than totally clear even when the entry has been read, and re-read.

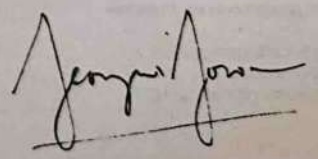
Is this really surprising? Is *Science* a tangible thing, or is it in part a philosophic attitude?

Throughout all the dictionary definitions, the word *knowledge* occurs most frequently. Perhaps the dictionary comes closest of all to what one hopes is the motivation of its students when it suggests that *Science is a branch of study which is concerned either with a connected body of demonstrated truths or with observed facts systematically classified . . . and which includes trustworthy methods for the discovery of new truth within its own domain.*

Science, then, is based on *knowledge* and *truth*. That presents the writer with an immediate problem, since there is only one page available to him and the definitions of these two concepts are as lengthy and vague as those offered in the dictionary for *Science*.

However, a solution will soon be to hand. Find out for yourself! You will shortly be meeting some three hundred students of the sciences of your own age from well over sixty countries. This will provide you with the opportunity to check your own knowledge against theirs and to find that your long cherished truths may not match those of others. In life, much that we regard as fact is too often opinion. Attending the Science Forum is your opportunity to check the position. You may find your views confirmed, or you may feel afterwards that they need redefinition. So, too, will others who have been influenced by your point of view. You can learn much at the Science Forum, but its organisers do not seek to teach you anything. It is for you to decide what is important and relative, what is significant, and whether your perceptions and perspectives were fully accurate.

You may find that as your knowledge increases, so too do your doubts.



George McGowan
Director
London International Youth Science Forum

PROGRAMME OF EVENTS

Wednesday, 24 July
Arrivals
Welcome & Orientation in Halls of Residence

Thursday, 25 July
10.00 Introductions & Programme Briefing*
11.00 OPENING CEREMONY*
14.15 Lecture/Demonstration*
'Hello, Who have we here?'
20.00 Welcome Disco at the Carisbrooke Hall

Friday, 26 July
Half Day Visits to Research & Industrial Establishments
15.00 Lecture/Demonstration†
'Codemakers versus Codebreakers – an introduction to Cryptography'
20.00 Student Topics at College Hall

Saturday, 27 July
10.00 Lecture/Demonstration**
'Thunder & Lightning'
14.15 Optional Half Day Panoramic Sightseeing Tour of London
17.30 Inter Hall Swimming Gala
Optional Theatre Visits

Sunday, 28 July
09.00 Optional Day Excursions to
(a) Stonehenge and Salisbury
(b) Portsmouth
20.00 Feature Film in College Hall:
'Blazing Saddles'

* *at the Commonwealth Institute Kensington High Street*

** *at University College London Edward Lewis Lecture Theatre*

† *at King's College London (Strand Campus) New Theatre (Room 2B18)*

Monday, 29 July
10.00 Specialist Lecturer†
14.15 Lecture/Demonstration†
'Living Control Systems'
20.00 Student Topics at College Hall

Tuesday, 30 July
Day Visits to Research & Industrial Establishments
21.00 Topics for Tonight
(Informal discussions in Halls of Residence)

Wednesday, 31 July
09.15 Group Photograph at the Natural History Museum
10.00 Visits to Scientific Museums
14.15 Seminars†
20.00 Lecture/Demonstration
'Chemistry and Light'
at the Royal Institution of Great Britain

Thursday, 1 August
08.00 Day Visit to Oxford and Cambridge
Morning: Visits to University and Research Establishments
Afternoon: Free

Friday, 2 August
10.00 Specialist Lecturer†
14.15 Seminars in Halls of Residence
(introduced by former participants)
20.00 International Cabaret at Carisbrooke Hall

Saturday, 3 August
10.30 Lecture/Demonstration**
'Musical Squares'
14.15 Inter Hall Rounders Match in Regent's Park
Optional Theatre Visits

Sunday, 4 August
09.00 Optional Day Excursions to
(a) Hampton Court & Windsor Castle
(b) Canterbury
20.00 Feature Film in College Hall
'Tootsie'

Monday, 5 August
10.00 Visit British Airways at London's Heathrow Airport
20.00 *'Songs of Home'* – Folk Songs in Nutford House

Tuesday, 6 August
10.00 Participants' Forum*
14.15 Lecture/Demonstration*
'Immunological Approaches to Cancer Diagnosis and Therapy'
16.15 CLOSING CEREMONY*
20.00 Farewell Disco at the Carisbrooke Hall

Wednesday, 7 August
Departures

PRINCIPAL LECTURES & DEMONSTRATIONS

Thursday 25 July — 11.00 OPENING CEREMONY

Presiding
Professor Brian F G Johnson, FRS
President London International Youth Science Forum

at the Commonwealth Institute, High Street, Kensington

Thursday 25 July — 14.15 *'Hello, Who have we here?'*
Dr David Lowe, MD, FRCS, FRDPath, FIBiol
Department of Histopathology
St Bartholomew's Hospital Medical College, London
at the Commonwealth Institute, High Street, Kensington

In forensic medicine, the full identification of human tissues and secretions needs input from many scientific services. These include biochemistry to identify proteins, molecular biology to investigate DNA, haematology to type bloodstains and histopathology to show a microscopic picture of the tissues and allow them to be examined for damage by poisoning, drowning, strangling and other untoward events. The most basic variable is the sex of the patient.

Relatively simple examination of bones has allowed us for years to distinguish the remains of human beings from those of other animals and to determine the sex, weight and approximate height of a person, whether alive (using x-rays) or deceased. Some of the person's life history may also be apparent. New techniques of DNA fingerprinting permit almost certain identification of a person from any secretion that contains cells. It is now easier than ever to tell a man from a woman.

The ways of identifying a person will form the basis for discussion and the practical session will include examples of bones, x-rays, DNA analysis, and blood grouping for participants to try their detective skills. The six ways of defining sex will become apparent.

Friday 26 July — 14.15 *'Codemakers versus Codebreakers – an introduction to Cryptography"*
Professor Fred C Piper, BSc, PhD, ARCS DIC FIMA
Royal Holloway & Bedford New College, University of London
at the New Theatre, King's College London, The Strand

For centuries armies, governments and spies have been exchanging secret information over insecure (public) channels. The art (or science) of inventing secret codes is called cryptography while the science of breaking them is known as cryptoanalysis. In the lecture we shall look at some aspects of the fascinating 'duel' between the codemakers and the codebreakers and, in particular look at the effect which computers have had on both sides.

The use of cryptography has broadened from its traditional (somewhat mystical and glamorous) areas and has spread to the financial and commercial sections. Thus, in addition to discovering secret information, the codebreakers are now trying to rob banks and/or raid databanks containing personal information about us. There is no doubt that cryptography now impinges on all our lives.

Saturday 27 July — 10.00 *'Thunder and Lightning"*
Dr T Frank Palmer, BSc PhD
formerly of Department of Chemistry, University of Nottingham
at the Edward Lewis Theatre, University College, London

Some of the most spectacular events in chemistry are to be found amongst those processes which emit sound and light and give rise to the phenomenon of explosions and luminescence.

Explosions can be classified as mechanical or chemical. The purely physical effects of heating to bursting several small sealed ignition tubes which have been filled with water will be demonstrated and the audience will be reminded of the effects and consequences of the Krakatoa Island explosion. Twin themes of combustion and chemical explosions will be developed going from the gentle deflagration of unconfined gunpowder to more powerful detonations which can occur in intimate mixtures of fuels and oxidisers. Missile projectiles including the properties of very soft materials when propelled with high velocity will be examined and the first part of the lecture/demonstration will be concluded by examination of the combustion properties of oxygen and hydrocarbon gases.

When a piece of metal is heated in a flame or has an electric current passed through it, the metal becomes hot and radiates heat. If the metal is heated to a sufficiently high temperature it will also emit light and this is called *INCANDESCENCE*. By contrast many materials can, under certain conditions emit light without heat and this cold process, which is known as *LUMINESCENCE*, forms the subject of the second part of the lecture/demonstration.

The yellow light of phosphorus burning in oxygen cannot be explained by incandescence and provides the starting point for examining the nature of luminescence. The absorption of light by chemical compounds and subsequent emission (photoluminescence) will be investigated through demonstration and the terms *fluorescence* and *photofluorescence* will be defined. Commercially important luminescence materials such as optical brighteners will be shown. A classification of luminescence will be given and electro-luminescence, bio-luminescence and chemi-luminescence will be introduced by simulations and demonstrations.

Monday 29 July — 14.15 *'Living Control Systems'*
Dr George Savage, BSc PhD
Queen Mary & Westfield College, University of London
at the New Theatre, King's College London, The Strand

For biologists, one of the principal fascination of living things is the way in which they cope with a changing environment.

The sight of warm-blooded penguins standing for days in Antarctic gales which would freeze us solid in minutes, gives us a great respect for the hardiness of life. Less dramatic, but equally vital are processes that we take for granted in our everyday lives, processes for example that keep constant the levels of oxygen and carbon dioxide in the blood.

The maintenance of constancy in living systems is known as *homeostasis*, the study of which forms a major part of the discipline of physiology.

It will be the aim of the lecture to demonstrate how some of the body's systems keep themselves constant. We will start by looking at some of the processes involved in breathing, then turn to the control of the blood system, and also examine the control of body temperature. Moving from these 'simple' systems, we will then discuss the nervous system, and examine some aspects of the control of movement and how our senses respond to the outside world.

While some of the topics will be illustrated by the use of models, and in others the lecturer will perform the procedures on himself, he will also need a few volunteers, to help with simple and safe demonstrations. Please be prepared to help!

Wednesday 31 July — 20.00 *'Chemistry and Light'*
Prof Andrew Mills, BSc PhD FRSC and
Dr Peter Douglas, BSc, PhD
Department of Chemistry, University of Swansea
at the Royal Institution of Great Britain, Albemarle Street, London W1

The aim of the lecture is to increase the awareness of the audience of the importance of photochemistry in our modern world. The lecture begins with a series of illuminations to show how light may be generated electrically, thermally and chemically. In some cases light can generate light and this is demonstrated by the luminescence of everyday objects such as plastics, powders and drinks. We then look at the uses of chemistry and light and highlight its applications in medicine, communications, electronics, photography and plastics through a series of demonstrations. Finally we consider ways in which sunlight, an alternative source to fossil fuels, can be converted into electricity or a chemical fuel with state of the art devices.

Saturday 3 August — 10.30 *'Musical Squares'*
Dr Mike Gluyas, BSc PhD and
Mrs Wendy Gluyas, BA CertE DipTEFL
at the Edward Lewis Theatre, University College, London

'Musical Squares' is a scientific 'fun' lecture which is packed with sound and visual illustrations.

The lecture explores many exciting aspects of sound and examines the vital role that it plays in our everyday lives – from communications and the production and enjoyment of music, to its medical and industrial uses. Covering the whole range from infra-sound to ultra-sound, the physical properties of sound are highlighted to illustrate its importance both to human beings and in the animal kingdom. The amazing capabilities of the human ear are discussed and demonstrations of ways in which our ears may deceive us are given. The causes and effects of various types of deafness are considered and 'lie detection' tests are presented which will reveal people who are feigning deafness!

Colour slides, music, sound effects, the sounds of animals – and even the internal sounds of the human body – are used throughout the lecture to highlight the features and uses of sounds and hearing! Several 'on the spot' experiments and demonstrations are performed and some of these involve the participation of (volunteer) members of the audience.

Tuesday 6 August — 14.15 *'Immunological Approaches to Cancer Diagnosis & Therapy'*
Professor Richard O'Kennedy, BSc MIBiol MIBiolI DipFS DipCS
Head of School of Biological Sciences
Dublin City University, Ireland
at the Commonwealth Institute, Kensington High Street

The immune system is a vital part of the body's defence mechanism, that detects and destroys disease and removes worn out components. Recent advances in research on cancer have highlighted the role that the immune system plays in the detection, development and elimination of tumour cells. This lecture will examine these studies and describe how we can use components of the immune system to detect, localise and destroy malignant cells and tissues. For example, scientists have now managed to manipulate the immune response so that antibodies can be produced, labelled with drugs, toxins or pharmaceuticals and targeted to tumours. It is also possible to produce a range of antibody derivatives that may provide novel ways of detecting and treating cancer. New sensors are also under construction that allow the detection of tumour-related molecules, secreted by cells, which have been characterised and may act to destroy or inhibit tumour growth. By combining basic knowledge of the molecular events occurring in cancer development and immunological approaches the potential for understanding and treating cancer can be greatly increased.

16.15 CLOSING CEREMONY

SEE MAPS ON INSIDE BACK COVER FOR LOCATION OF VENUES

SPECIALIST LECTURES

All of these Lectures take place at King's College London, The Strand, London WC2R 2LS

Monday 29 July — 10.00

Lecture A — *'Exploration of the Solar System'*
Professor Alan Johnstone, BA MSc PhD
Mullard Space Science Laboratory, University College London

Over the last 30 years most of the large bodies of the solar system have been visited by spacecraft from Earth. They have revealed a richness and variety of worlds which are fascinating in their own right but which, when compared with the Earth help us to understand much better our own place in the Universe. Amongst the discoveries there have been many new planetary satellites, volcanoes, both alive and dead; massive canyons, hostile atmospheres; methane seas; and radiation almost as intense as in the heart of a nuclear reactor. I will review these discoveries and attempt to draw some conclusions about their implications for the Earth.

Lecture B — *'Elementary, my dear Watson'*
Martin L Perkins, MA(Oxon) CMath FIMA FRSA
Senior Master and Head of Mathematics
St Olave's Grammar School, Orpington

'Mathematics' said Bertrand Russell 'may well be defined as the subject where we do not know what we are talking about, neither whether what we are saying is true.' In this lecture we shall be considering together the roles of logic and other rational processes in extending and confirming our knowledge. We will cover reasoning and inference – how much we can safely assume? – looking at formal methods and the contributions of John Venn and Lewis Carroll. We shall look at the differences and similarities between scientific proof and mathematical proof and examine more closely some methods of proof. We shall consider deduction, induction and proof by contradiction, for, as Sherlock Holmes would remind us, 'when you have eliminated the impossible, whatever remains, however improbable, must be the truth'.

Approximations to the truth, and even lies, will lead to a consideration of fallacies, false proofs and paradoxes, starting with the Greeks such as Zeno and Epimenides and coming through to the twentieth century and Russell. We shall include in our discussion logical paradoxes, paradoxes of the infinite and visual paradoxes. As Tweedledum remarked: 'Contrariwise, if it was so, it might be, and if it were so, it would be; but as it isn't, it ain't. That's logic.'

Lecture C — *'Ecstasy or Agony? Potential Neurotoxic Effects of the Psychoactive Drug Methylenedioxymethamphetamine (MDMA)'*
Dr Marcus Rattray, BSc PhD
United Medical & Dental Schools, Guy's & St Thomas's Hospitals

The psychoactive drug 'ecstasy' (methylenedioxymethamphetamine) is a widely used illegal substance, but the consequences of its effect on people are not well known. Over the past decade, evidence has accumulated from studies on animals that this drug may be a potent neurotoxin. Upon administration of between four and eight high doses of the drug the level of a chemical, serotonin, drops to very low levels. Nerves which contain serotonin become broken and abnormally swollen. Since many thousands of young people regularly use this drug, it is clearly important to determine what the long term effects actually are.

In this presentation, I will describe the way in which ecstasy is thought to produce its psychoactive effects, and how the drug may cause death of nerve cells. As well as introducing the role of the chemical neurotransmitter serotonin, in the function of the brain, my presentation will include details of recent work from my own laboratory, where we study the ways that drugs influence the activation of genes in specific types of nerve cells. I will also discuss the problems and similarities of extrapolating findings from animal studies to humans.

This Lecture has been arranged by the Biochemical Society.

Lecture D — *'Fossils, Evolution, and the Origin of Species'*
Dr Peter R Sheldon, BSc PhD FGS FLS
Department of Earth Sciences, The Open University, Milton Keynes

Fossils – the remains of ancient animals and plants – give us a historical perspective on evolution that cannot be obtained from a study of living organisms alone. Fossils are more easily found than most people realise and, unlike most progress in science today, significant discoveries are often made with little more than a hammer and chisel. The lecture will begin with illustrations of a wide range of fossils, and we shall see how organisms often get preserved in rocks for hundreds of millions of years.

One of the hottest debates in evolutionary biology concerns the pattern of change by which new species evolve from their ancestors. Until the mid-1970's it was generally believed that if a fossil record was complete we would see a continuous series of gradual changes between successive forms of life. The theory of punctuated equilibrium challenged this picture of gradual evolution. It was proposed that evolution took place in remarkable jumps, with new species appearing suddenly and then persisting with little or no change before becoming extinct. We will look at some of the latest evidence in this debate, including work on trilobites, beautiful extinct marine creatures distantly related to the crabs and lobsters of today. A recent general model suggests a surprising relationship between patterns of evolution and different environments.

We will end by discussing a variety of intriguing mysteries of evolution that remain to be solved in the years ahead.

All of these Lectures take place at King's College London, The Strand, London WC2R 2LS

Friday 2 August — 10.00

Lecture E — *'Dissecting Problems: Can We Improve on Nature?'*
Dr Alan Berry, BSc, PhD
Department of Biochemistry & Molecular Biology, University of Leeds

'Tailor-made' enzymes and proteins are already finding use in many areas of modern life and will find ever more important and increasing uses in medicine, agriculture, industry and bio-technology as we move into the next century. In order to effectively create new proteins for useful functions we need a complete and detailed understanding of the structures and mechanism of action of a variety of proteins.

In this lecture I will consider a number of proteins which are important to our everyday lives. We will explore the structures of some of these proteins and will look in detail at how this information can be used to understand their function. We will then consider why we may wish to alter the naturally occurring protein and I will describe how the protein engineer tackles this objective. Finally, I will describe some of the latest results in the most topical area of research today – to tailor make a new protein designed from first principles to adopt a specific shape and function.

Lecture F — *'To Die or Not to Die'*
Dr Frances M B Calman, MB BS FRCP FRCR
Guy's & St Thomas' Cancer Centre, St Thomas' Hospital, London
and Dr John Ellerenshaw, MB BCh MRCP
Liverpool Marie Curie Centre

Throughout history, the physician's guiding rule, which is central to the essential doctor-patient relationship, is that he should 'first do no harm'. Medical care is directed towards sustaining and supporting life, even within the severe limitations of chronic disablement or a terminal illness.

Increased patient participation in medical and ethical decisions, in some countries spearheaded by a young and articulate Aids patients' lobby has led to a re-examination of the traditional philosophies. In the Netherlands, physician-assisted death is now condoned in hopeless terminal illness. In the United States of America, many patients carry Advance Directives, clearly setting out what resuscitation and support measures are acceptable to the patient. In both the United Kingdom and America the law has allowed the withdrawal of life support from patients whose existence has been perceived to be meaningless.

We will examine some of the ethical, philosophical and practical arguments for and against active euthanasia, and discuss where we as patients and as future physicians and scientists stand in the debate.

Lecture G — *'From Oil Barrel to Market Place - The Role of the Chemical Industry'*
Dr David Parker, CChem FRSC
ICI Group R&T Affairs

In this presentation I propose to demonstrate the various ways in which raw materials derived from oil are transformed into products recognised in the market place. Products such as the clothes we wear, the food we eat and our methods of transport all depend on chemicals derived from oil.

However, recognition is given not just to the chemistry involved in the various transformations, but also the role played by process technology, with particular emphasis on the importance of catalysts and catalytic processes.

Route to simple molecules such as methanol and ammonia will be covered, followed by a discussion of the important raw materials for films and fibres – polyethylene terephthalate (polyester). The lecture will be concluded with a review of some recent developments in Agrochemicals and Pharmaceuticals linking these important 'final products' back to their raw material source.

(This lecture has been arranged by ICI (Group R&T Affairs, Middlesborough).

Lecture H — *'What does it mean, to see? Some answers based on Neuroscience, Magic and Illusion'*
Amir Raz, MSc
Hebrew University of Jerusalem, Israel

Most of our ideas about the world and our memory of it is based on sight. How do we see? How do we perceive the movement of objects in space? How do we distinguish colours? Studies of artificial intelligence and of pattern recognition by computers have made us realize that the brain recognizes movement, form and colour using strategies that no existing computer begins to approach. Simply to look out into the world and recognise a face or enjoy a landscape entails an amazing computational achievement, more difficult than that required for solving logic problems or playing chess. Vision is the process of discovering from images *what* is present in the visual world, and *where* it is. It turns out that these two tasks, identifying what and where, are carried out by distinct anatomical pathways. Furthermore, it has recently become clearer that visual processing involves parallel pathways rather than one serial pathway. This lecturer will attempt to demonstrate how insights into the visual cortex, mechanisms of visual attention and neural integration teaches us a great deal about why some blind individuals can actually see and how we can use our scientific knowledge to concede visual illusions and magic tricks. 'Believe nothing that you see and half of what you hear!'

SEMINARS

All Seminars take place at King's College London, The Strand, London WC2R 2LS

Wednesday 31 July — 14.15

Seminar 1 — *'Marconi – a Dramatised Enactment'*
Ralph Barrett, CEng, MIEE, MIERE

Guglielmo Marconi was born in Italy in 1874. As a teenager he called himself 'the ardent amateur of electricity,' and was soon sending wireless messages the length of his parents' mansion; then, into the garden. To make use of his invention for ships, at the age of 21, he came to Britain, then at the height of marine power. Signals across the Atlantic in 1901 brought world wide acclaim, and success to his wireless company.

The event takes place in 1936; Marconi died in 1937; a dramatised enactment, with demonstration apparatus and illustrations of his life and achievements.

'I was on a good road, the invention had taken life . . .' 'The gunshot signalled the birth of wireless . . .' 'Spark that changed the world . . .' 'Surprised no-one had thought of it before . . .' 'Feted in New York by Titanic survivors . . .' 'Popov aboard the Carlo Alberto . . .' 'Italy is in the war . . .' 'Mussolini and the Fascist Party . . .' 'The eligible bachelor, the stormy marriage, divorce and remarriage . . .'

The year, 1995, is considered the centenary of the invention of radio communication; due to Marconi's experiments in Italy in 1895.

Seminar 2 — *'Space Astronomy'*
Dr Graziella Branduardi-Raymont, PhD
Mullard Space Science Laboratory, University College London

Scientists in virtually all branches of astronomy make use of instruments in space to learn more about the Universe. Space is a harsh environment, satellites go through tough ground preparations, and are tested to the limit of destruction, to ensure they will survive launch and an extended life in orbit; precise ground calibrations are the key to the success of a satellite mission, if we are to disentangle with confidence the mysteries of the cosmos.

Once in orbit, reliable and frequent communications are the vital link by which commands are sent to configure the instruments for observations and useful data are retrieved. This is only the starting line for the space astronomer. The Universe is just beginning to unravel.

This is a fascinating, often personal, account of how space astronomy is carried out, and of some of the most recent and exciting astronomical discoveries. The focus is on some of the most energetic, violent and exotic objects in the Universe: The most dense stars, where energy production is more efficient than in nuclear reactions; the explosive death of stars; the mysterious power house in the active, ever changing nuclei of galaxies; the immense energies stored in the hot gases embedding galaxies in clusters; ultimately, the origin and fate of our Universe.

Seminar 3 — *'The Role of Nuclear Power in World Energy Requirements'*
Harry A Cole, MIEE
Formerly of UK Atomic Energy Research Laboratory, Harwell

Present and future world energy requirements are discussed and compared with the world's current resources. The relationship between standards of living and energy consumption is considered and comparisons made between the richest and poorest countries in the world.

The political, economic, social, environmental and safety aspects associated with burning of fossil fuels (coal, oil, gas) are discussed and comparisons made with alternative forms of energy and the introduction of conservation measures.

Renewable energies (sun, wind, waves etc) are introduced and an assessment made of their likely impact on future energy requirements. Energy density, reliability and predictability are discussed and comparisons made with the established sources of energy.

The present world nuclear power programme is reviewed and comparisons made between the installed nuclear generating capacities of various countries. Different reactor types are briefly discussed and an introduction given to the expressions 'nuclear fuel cycle', 'reprocessing', 'burn up', and 'plutonium production'.

The seminar ends with a discussion on nuclear accidents, waste disposal sites and the relationship between nuclear power and nuclear weapons.

Seminar 4 — *'Water Use in Hill Slope Agroforestry Systems – Problems and Possibilities'*
Nicholas Jackson, BA(Hons) MSc PhD
Institute of Hydrology, Wallington, Oxfordshire

In many parts of the Tropics, forests are being cleared or degraded at a rapid rate, mainly to satisfy the basic subsistence needs of poor rural communities. Monitoring studies in the Sahel and East Africa shows a considerable reduction in wood cover in the past thirty years. Fuel-wood provides 63% of the total energy consumption of developing African countries. One possible solution for the resulting problems of degradation and desertification is the use of multi-purpose tree species (MPT's) in agroforestry systems. These are able to fulfil several roles simultaneously – improving soil stability and fertility, providing shade, fodder and firewood.

The presentation will comprise data from field trials of agroforestry species in Israel and in Kenya, looking at potential uses of such species in improving productivity and water use efficiencies. The problems of implementing scientific recommendations at a local level will be discussed in the seminar.

Seminar 5 *'Sebum, Stains and Surfactants: The Chemistry of Washing'*
Dr Christopher C Jones, BSc PhD CChem MRSC
Unilever Research Port Sunlight Laboratory

With 500 million articles washed every day, laundering clothes is arguably the most frequently deliberately carried out chemical process. Throughout history, the nature of the process has changed reflecting current technology, local resources and social conditions. Consequently the wash process today varies widely around the World. The nature of the soils and stains encountered in a typical washload is as varied as the process itself. Despite the everyday nature of washing, it involves a vast range of science including physical chemistry, colloid science, oxidation chemistry, photochemistry and biochemistry. As the detergents industry strives to produce increasingly effective products, the understanding of the wash process and the armoury of methods used to remove soils and stains becomes more and more advanced.

The presentation will give an account of the development of the wash process throughout history and will illustrate the geographical diversity found today. It will then concentrate on the key elements of the underlying chemistry giving an insight into the scientific complexity of a modern washing product.

This Seminar has been arranged by Unilever Research Port Sunlight Laboratory.

Seminar 6 *'The Genetics Revolution – Blue Genes or Panacea?'*
Dr Patricia Walsh, PhD
Centre for Medical Law & Ethics
King's College London

Dr Rachel Bartlett, DPhil
Nuffield Council on Biotechnics, London

The genetics revolution is taking place. The advances are dazzling. The implications for all are limitless. There is a growing awareness amongst scientists, politicians and the public, that the ethical and practical implications for society need to be addressed urgently.

The seminar brings together a geneticist, an ethicist and someone affected by a genetic disorder. They will tell you of their work and perspective and then ask for your input.

This Seminar has been organised by the Genetic Interest Group, a charity which aims to raise awareness of issues of importance to those affected by genetic conditions. In the end that includes all of us!

These seminars are conducted by former participants of the Science Forum and will take place in Halls of Residence as indicated.

Friday 2 August 10.00

Seminar I *'The Physiology of Human Behaviour. What is known and what are the Perspectives'*
Ariane Bazan, Bachelor in Biology (Participant in 1986 and 1988)
PhD Student at Ghent University Hospital, Belgium

COLLEGE HALL

Stimuli are continually produced by man's natural environment. Conceived by his sense organs, they eventually lead to a pattern of motor performance (eye, lip, and hand movements,) which we generally designate as 'behaviour patterns'. Associated events in the brain link these incoming (sensitive) and outgoing (motor) pathways. When neurons are activated simultaneously, they form a *network*, encoding sensitive information as a primary image of the perceived environment. Access is gained to previously encoded networks and the neuronal activity shifts to associative areas, resulting in a new representation of 'reality' via a process of 'internalisation'. For decades, psychologists approached cerebral events in terms of immaterial concepts. Nowadays, advances in neurobiology show that underlying tissue structures and physiological pathways are entirely responsible for bringing forth specific behaviour patterns to given stimuli. Three parameters determine the internationalisation process.

1 Genes are responsible for setting the principal features of a general and individualised pattern of neurological organisation. **2** During development, redundant neuronal and synaptical communications are eliminated via 'epigenesis through selective stabilisation'. **3** Finally, a memory of past experience will facilitate certain synaptical connections.

Seminar II *'Drugs in Sport – Good or Bad?'*
Ewan Jack, BSc MB (participant in 1989)
Final year Medical Student, University of Glasgow, Scotland

COLLEGE HALL

The sporting world has been rocked by various drug scandals in recent times. Just how rife is drug abuse in the sporting world? What drugs can enhance your performance in the sporting arena and how safe are they? What 'natural' methods are used to improve sporting achievements and how safe are they? If we have the technology to improve the limits of human achievement why don't we use them? All of these questions will be presented and supported, if not answered! See you there, sports dudes!!

Seminar III *'A "complex adaptive" talk on Genetic Algorithms'*
Mehul Khimasia (participant in 1990)
Postgraduate Student, University of Cambridge

INTERNATIONAL HALL

Science is undergoing a revolution.

There has long been an inertia within the scientific body for reductionism; if we can model smaller and smaller parts of the universe then we shall one day have the whole. However, in life we often find that the whole is greater than the sum of its parts or 'simple local rules when applied to a many body system can give us complex behaviour'. With today's computers we can programme the simple rules, tweak a few parameters and watch how the global effects evolve. This is the science of complexity.

This is a vast subject covering everything and anything. It attempts to break down barriers between disciplines and cross-fertilizing ideas to reveal the similarity. Genetic algorithms are an example of this 'new' science. Broadly speaking, they are optimization methods that abstract ideas from Darwin's theory of evolution.

Seminar IV *'Supersonic transports after Concorde: Do we really need them?'*
Dr Sam Mallinson, BSc (ANU) PhD (UNSW) (participant in 1985)
Imperial College of Science, Technology & Medicine, London

INTERNATIONAL HALL

Concorde has provided the first commercial supersonic transportation and has been operating successfully since the 1960's. Recent proposals by a group of nations, notably the United States, Japan and Germany, have suggested that supersonic transportation could replace most of the trans-Atlantic and trans-Pacific services presently convered by the standard subsonic aircraft. This presentation will discuss the history and development of supersonic aircraft for commercial transportation. It will also examine the potential problems that may arise from the proposed future developments which could include over reliance on fossil fuels, noise on take off and landing and the economic outlay of about $100 billion to develop the aircraft, and whether there are other more obvious and pressing needs within the world community.

Seminar V *'Computational Fluid Dynamics:*
The Role of Numerical Techniques in Modern Fluids Research'
Mark Shaner (participant in 1992)
Undergraduate Student, University of Maryland, United States of America

NUTFORD HOUSE

Whether gas, liquid, or suspension, anything that flows can be classified as a fluid – from the fuel used by automobiles, to the air we breathe, to the blood that flows through our veins. For hundreds of years scientists have sought a reliable model of fluid flow. This model has been provided by the Navier-Stokes equations which have been described as 'the most pivotal equation in all of theoretical fluid dynamics'.

Unfortunately, there is currently no known general analytical solution to the Navier-Stokes equations. However, the recent explosion of computer power and the increased sophistication of numerical methods promise to allow accurate, direct solutions on the Navier-Stokes equations. This seminar will focus on the role of Computational Fluid Dynamics (CFD) in aerospace applications and how, when successful, CFD greatly decreases the expense and time of conducting research and development by drastically reducing the need for wind and water tunnel testing.

Seminar VI *'Corporate Philosophy and the Leadership of Change'*
Mark Shuttleworth BBus Sci (participant in 1991)
Management Consultant, South Africa

NUTFORD HOUSE

Change is a necessary consequence of discovery, and is thus intrinsically part of the life of a scientist. Scientists have often unwittingly been catalysts of tremendous change in society and industry alike: we are all familiar with the fact that entire organisations can 'die' because of scientific innovation, that is partly what makes being a scientist exciting.

The questions I'd like to pose are simple. Is there a way for organisations to weather, and even profit from change and discovery? Is there a way to lead a company, or a country, through continuous scientific evolution and revolution? As scientists, what can we do to manage the consequences of our research and development? How does an understanding of the technology adoption process affect our planning for new research?

I hope to show you how I believe organisations adapt to technological change, and to demonstrate that it is a social, political as well as a scientific phenomenon. I hope that this will give you, whether you are commercially or academically inclined, some insight into the momentum scientists set up when they do what they do best – discover.

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STUDENT TOPICS

Participants who wish to give a paper based on a project or investigation they have undertaken will be allocated a period during one of the sessions listed below. Papers will be grouped by category and a schedule giving summaries and details of presentation times will be circulated at the beginning of the Science Forum.

Friday, 26 July

20.00 College Hall,
Malet Street, London WC1

Monday, 29 July

20.00 College Hall,
Malet Street, London WC1

TOPICS FOR TONIGHT

Tuesday, 30 July **Informal discussions in Halls of Residence**

21.00

COLLEGE HALL
'Is freedom good for you?'
Introduced by John Needle

INTERNATIONAL HALL
'Is this the end of human contact?'
Introduced by Roberto Lenti

NUTFORD HOUSE
'Who's in charge here?'
Introduced by George McGowan

MUSEUM VISITS

The visits will be preceded by a group photograph which will be taken on the steps leading to the Main Entrance of the Natural History Museum.

Wednesday, 31 July

10.00 Natural History Museum
Cromwell Road, South Kensington,
London SW7

10.00 Science Museum
Exhibition Road, South Kensington,
London SW7

10.00 Wellcome Centre for Medical Science
183 Euston Road, London NW

SOCIAL PROGRAMME

Thursday, 25 July
20.00 Welcome Disco
Carisbrooke Hall, Seymour Street, London W2

Saturday, 27 July
17.30 Inter Hall Swimming Gala
University of London Union, Malet Street,
London WC1

Sunday, 28 July
20.00 Feature Film: *'Blazing Saddles'*
College Hall, Malet Street, London WC1

Friday, 2 August
20.00 International Cabaret
Carisbrooke Hall, Seymour Street, London W2

Saturday, 3 August
14.15 Inter Hall Rounders Matches,
Regent's Park, London NW1

Sunday, 4 August
20.00 Feature Film: *'Tootsie'*
College Hall, Malet Street, London WC1

Monday, 5 August
20.00 *'Songs of Home'*
International Folk Song Evening
Nutford House, Brown Street, London W1

Tuesday, 6 August
20.00 Farewell Disco
Carisbrooke Hall, Seymour Street, London W2

HALF DAY SCIENTIFIC VISITS

Friday, 26 July

26/1 **British Broadcasting Corporation, Television Centre**
The visit will begin with an introductory talk on the structure of the British Broadcasting Corporation, followed by a general tour of the studios, viewing them from the observation galleries. The group will view the live transmission of the One O'Clock News, and it is hoped that the BBC's Science Correspondent will be able to meet the group.

26/2 **City University, School of Engineering**

CITY University

City University is situated to the north-west of the City of London. The School of Engineering teaches and conducts research in the main disciplines of engineering: Aeronautical, Air Transport, Civil, Mechanical and Electronics. It has excellent laboratory and computational facilities, including exceptional wind tunnel testing capabilities.

During the visit we will show examples of the way in which scientific principals are applied to engineering problems and in particular how stresses can be measured in aircraft structures and oil rigs. We will demonstrate some of our current research projects, focusing on aerodynamics and fluid flow, but also looking at some of our other projects, including work on robots. The importance of generating information for design engineering by testing models of major projects will be illustrated by examples from recent work we have been involved in. These include generation of power from the wind, high lift wing flows or the wind effect on major urban developments.

26/3 **Imperial College of Science, Technology & Medicine, Department of Biochemistry**
The visit will give an insight into exciting new developments in Biochemistry. The rapid progress which is being achieved in the subject is largely dependent on the development of sophisticated techniques for investigating and controlling biochemical reactions. You will view such research areas at Imperial College.

Laser Spectroscopy
Extremely fast energy transfer reactions within protein complexes are studied by laser technology. The capture of sunlight in photosynthesis is a major interest in this laboratory. In this process the initial energy transfer reactions involving chlorophyll molecules takes place in just femtoseconds (10^{-15} sec) and the process which produces electrical energy is completed in no more than picoseconds (10^{-12} sec). The speed of light and differences in the path length of laser beams are the basis for some of the techniques used.

Biochemical Pharmacology and Mass Spectrometry
The discovery of biologically active substances depends on techniques for their purification from biological sources, measurement of their physiological functions and exact determination of their identity. A group of scientists work together to make these discoveries at Imperial College. A range of pharmacological bioassays are in use and significant achievements have been made by the development of mass spectrometry equipment which exploits high field atom bombardment and electrospray techniques. The group has had many successes, including identification of the Enkephalins (the brain's natural opiates,) the Asthma Factor (leukotriene D,) differentiation including factor and human Calcitonin Gene Related Peptide.

26/4 **Imperial College of Science, Technology & Medicine, Department of Chemical Engineering**
The Department of Chemical Engineering is one of the largest in the United Kingdom. There are 300 undergraduate students in the department who attend a four year course. There are also about 200 research students (MSc and PhD). The visit will be a general tour of the department. Some of the laboratories will be opened up for the visit and the pilot plant and computing facilities of the department will be shown.

26/5 **King's College London, Department of Pharmacy**
The work of a university pharmacy department is extremely varied. Drug substances must be analysed and assayed, formulated into medicines, packaged and tested for stability before being put on the market. New therapeutic substances from all sources are constantly being sought and tested in the laboratory. The multidisciplinary work brings together the various expertise of pharmacy, pharmacology, pharmaceutical chemistry, pharmacognosy and pharmaceutics, with additional input from toxicology and drug metabolism. The exhibition and demonstrations arranged will illustrate some of this varied work and include aspects involving the detection of drug misuse in sporting competition.

26/6 **King's College London, Department of Biophysics**
The work of the department covers a wide range in the area of cell and molecular biology. The main areas of interest include neurobiology, muscle and cell motility and the structure of aukaryotic genome in relation to expression of genetic material.

26/7 **National Institute for Medical Research**
The morning's programme will begin with an introduction to the function of the National Institute for Medical Research. Thereafter there will be a series of talks given by members of the scientific staff and an opportunity to visit the laboratories.

28/8 **Royal Botanic Gardens, Kew**
The Royal Botanic Gardens, Kew is primarily a botanical research institute. The central role is to ensure the better management of the Earth's environment by increasing knowledge and understanding of the plant kingdom.
The organisation has five departments
The Living Collections Department which maintains at Kew and its satellite garden at Wakehurst Place, the largest and most diverse living plant collection in the world.
The Herbarium which is the repository of one of the largest collections of preserved plants in existence, and whose staff undertake research on plant classification and distribution.
The Jodrell Laboratory, which is a centre for taxonomy-related research on the anatomy, physiology, cytology, genetics and biochemistry of plants.
An Administrative Department and Education & Marketing Department.
There is also a School of Horticulture which administers the Kew Diploma, a three year full time course offering a broad training in amenity horticulture. The aim of the course is to provide students with an opportunity to study scientific technical and management subjects at first degree level, whilst gaining practical experience and responsibility working in this foremost botanical garden.
The visit to Kew will consist of a guided tour of part of the living collections.

28/9 **Royal Naval College Greenwich, Department of Nuclear Science & Technology**
The Department of Nuclear Science & Technology conducts post-graduate courses for Naval Officers and civilians who have been appointed to the Nuclear Propulsion Programme. The visit includes a health physics demonstration together with demonstrations of the electron microscope and the simulator. If time permits a tour of the Painted Hall with a short talk on the history of the college will be given.

26/10 **The Royal Hospital of St Bartholomew, Department of Histopathology**
St Bartholomew's Hospital is one of the main teaching hospitals in London. The visit to the Department of Histopathology will include:

- the Pathology Museum, which houses tissue specimens, historical collection and medical instruments
- the electron microscopy unit, where cells can be magnified up to 140,000 times, and related X-Ray particle analysis unit
- the image analysis unit, in which computer assessment of the shapes and textures of tissue components takes place.
- the diagnostic department, where biopsies and excision specimens are examined and discussed with the referring clinician.
- the immunohistochemistry unit, which uses antibodies to demonstrate hormones, viruses and other tissue components.
- the cytology department, where slides are screened for breast and cervical cancer and lung, bladder and stomach and other tumours are investigated.

26/11 **University College London, Department of Chemistry**
Modern Chemistry is a blend of the traditional and the new and both will be found in this programme. Most people are impressed by the many dramatic chemical phenomena, such as explosions, vivid colour changes, smells the formation of beautiful crystals and so on. Most practicing chemists were first attracted to the subject by such observations and have searched for the chemical basis for their observations through careful applications of physical methods.
The visit will start with a lively lecture-demonstration by Andrea Sella and Graeme Hogarth showing some of the phenomena attracting them to the subject. The visit continues with visits in small groups to a number of research activities in the Department of Chemistry at UCL to gain some insight into how modern physical methods are employed in widely different areas of chemical research to understand the real world in terms of molecular structure and behaviour.

26/12 **Zoological Society of London, Institute of Zoology, Department of Veterinary Science**
The Department of Veterinary Science is a part of the Institute of Zoology, which is the scientific arm of the Zoological Society of London. The department is responsible for the health and welfare of the zoo's animals and undertakes research in fields of relevance to the zoo and wild animal medicine.

26/13 **English Heritage: Conservation & Technology: Ancient Monuments Laboratory**
The Ancient Monuments Laboratory was formerly part of the Research & Professional Services Group of English Heritage. It is divided into:
Environmental Studies, concentrating on human, animal and agricultural archaeology and soil science.
Conservation & Technology, preserving artefacts, paintings and painted surfaces, conservation studio, and researching ancient technologies and materials.
Archaeometry, carrying out non-destructive site investigations and scientific dating of artefacts, sites and buildings.
There is also an Information Systems section.

SCIENTIFIC VISITS

Tuesday, 30 July

30/1 **Esso Petroleum Company Ltd/Exxon Chemical Ltd, Fawley, Hampshire**
Situated on Southampton Water is the UK's largest petroleum site and home of ESSO PETROLEUM and EXXON CHEMICAL. Both companies are part of the worldwide Exxon Corporation.

The combined site occupies a total of 3,200 acres of which about a third has been developed. It provides a fascinating example of science at work. The huge Steam Cracking Plant and Catalytic Cracker are at the heart of the operation, taking the raw material through a series of processes, turning it into refined product and feedstock for a number of chemical uses. This is all carefully monitored and controlled by skilled operators who use the latest and safest technology in their work.

One of the plants you may visit is the Energy Chemicals Plant which makes a variety of products used in drilling for oil. Or you may look in on the Butyl Rubber Plant which makes products primarily for the tyre industry.

It will prove to be an interesting and informative day for any student, as the site tour is generally conducted by young graduates who can still vividly remember the excitement they found in studying science. So come and join ESSO and EXXON CHEMICAL and have a good day out.

30/2 **Nuclear Electric, Dungeness, Kent**
The visit will be in two parts. The morning will be spent on Dungeness 'A' Power Station, Magnox type, which has been in commission since 1965 and was one of the first such power stations developed in Britain. After a buffet lunch at the Information Centre, the afternoon will be spent at Dungeness 'B' Power Station, which became operational in 1983 and is of the Advanced Gas Cooled Reactor type.

In addition there will be an opportunity to spend time on the nature trail and environmental exhibit (created in 1993) and to study the formation of shingle ridges and water tables from the ice age to the present.

30/3 **Pfizer Limited, Sandwich, Kent**
Pfizer is a research-based diversified health care company with operations in nearly every country of the world.
Pfizer at Sandwich on the Kent coast near Dover employs some 2,700 people of whom about 1,250 are engaged in research which is mostly involved in the search for new and more effective human medicines.

The visit will give an opportunity to follow the process of new medicine from concept to manufacture and marketing. This will include visiting some of the most modern and up-to-date research laboratories in the world, including the latest analytical techniques and molecular modelling.

Once a new compound has been discovered the challenge is then to manufacture it as efficiently as possible. The tour will include the manufacturing area to see how the latest techniques in control technology are utilised in one of the oldest biotechnology processes, fermentation.

30/4 **Royal Air Force School of Aviation Medicine, Farnborough, Hampshire**
The RAF School of Aviation Medicine is based at Farnborough in Hampshire. The school is responsible for aviation medicine research and teaching for both military and civil aviation medical aspects. After two illustrated lectures there will be visits to departments of the school to see the work of investigators in their laboratories.

30/5 **RTZ: The Exploratory, Bristol**
The Bristol Exploratory was the first Hands-on Science Centre in the UK. Started in the early 1980's and occupying the splendid Engine Shed built by Isambard Kingdom Brunel, the great 19th century engineer, in Temple Meads Railway Station. Hands-on Science Centres encourage their visitors to investigate scientific phenomena for themselves, without direct supervision and with the emphasis on enjoyment. The Exploratory has around 150 such experiments, called plores, and also provides demonstrations and supports school programmes.

The RTZ Corporation plc is one of the world's leading mining companies. It is based in the UK and operates in most parts of the world. RTZ operations are directed towards making use of the best contemporary practice in the mining and processing of ores while taking the best possible care of the environment. This requires good science together with good scientists and engineers. The Exploratory shows visitors how exciting and useful science can be. It improves public understanding of scientific matters and encourages the recruitment and education of the next generation of scientists. Therefore RTZ has been a major sponsor, deciding to pioneer a chemistry programme in the Exploratory since much of the previous development is related to physics.

After travelling by train to Bristol Temple Meads along the route of Brunel's Great Western Railway, the day's programme opens with a brief introduction by RTZ staff. This is followed by a short address from the distinguished scientist, Professor Douglas Everett, a Trustee of the Exploratory. Much of the rest of the morning is devoted to individual exploration and fun with the plores. An Exploratory shop is available which carries a wide range of scientific games and materials to provide souvenirs of the visit as well as a continuation of these activities away from the Exploratory. A demonstration finishes the morning with a bang – quite literally since the staff enjoy making explosions as a teaching aid!

Lunch is provided aboard a boat during a tour of the Bristol Docks. This large area is undergoing development for modern business and leisure purposes, but still containing landmarks from medieval and early Industrial Age periods. Not least of these is the first iron, propellor-driven, ocean going steam ship, Brunel's SS Great Britain, was launched from Bristol in 1843 and returned in 1970. There are memories from even earlier periods including the exploration of North America at the end of the 15th century.

Back at the Exploratory, further time will be spent with the plores during the afternoon before the return to London.

30/6 **Rutherford Appleton Laboratory, Chilton, Didcot, Oxfordshire**

CLRC

Rutherford Appleton Laboratory (RAL) is a multi-disciplinary laboratory offering world-class facilities at the forefront of science and technology to over 8000 users annually from the UK and abroad. RAL's facilities support work across many fields of science and engineering including physics, chemistry, space, materials, the environment, microelectronics and information technology.

There are a number of scientific facilities at RAL

ISIS is the most powerful pulsed neutron source in the World, used by groups from academia and industry to carry out materials research in many areas of physics and chemistry.

Vulcan is a neodymium glass laser able to deliver over ten thousand joules of energy in a pulse lasting just one billionth of a second. Sprite, a krypton fluoride gas laser using a novel technique of combining laser beams, is capable of producing one hundred thousand joules of energy.

The Space Environment Test Facility is used to study the response of space instruments to various forms of vibration, and to heating and cooling under vacuum. Scientists and engineers at RAL are involved in providing instruments for various satellite launches to study the surface of the sea and oceans, the cosmos and solar system.

30/7 **Severn Trent Water Ltd, Birmingham**

Severn Trent Water

Clean water for drinking has contributed more towards health than anything else. Do you know how raw water is treated for drinking? What happens after you flush the loo?

Water is a precious resource – vital for life. Come and see for yourself how a major UK and International company provides a drinking water and sewage disposal service for over eight million people and industry every day. The integrated service Severn Trent Water provides for its customers reflects the highest international quality.

Severn Trent Water, serving the heart of England, has over 200 water treatment works supplying over 1900Ml of drinking water each day; and 1062 sewage treatment works treating 2800Ml of sewage and disposing of over 175,000 tonnes of sludge each year completes the integrated system.

The day's visit will focus on these two major aspects of Severn Trent Water's internationally acclaimed work carried out in five continents. A presentation, guided tours of water treatment and sewage works will form an interesting and informative day.

30/8 **SmithKline Beecham Pharmaceuticals, The Frythe, Welwyn, Hertfordshire**

SmithKline Beecham is a transnational pharmaceutical company specialising in all areas of Health Care. The Frythe is a research and development site concentrating on the development of ethical drugs to cure and alleviate diseases prevalent in man. It has modern laboratories for carrying out research and specialised facilities, including a new tissue culture facility, for ongoing development work. The focal point of the site is an old house which acts as the administrative centre and the restaurant. In addition there are highly sophisticated computing facilities, a number of service operations such as engineering, human resources, facilities management etc, a first class library, various conference suites and a lecture theatre. These facilities are located in extensive landscaped grounds and the combination provides an attractive campus-like environment.

Students visiting SmithKline Beecham will attend a presentation given by senior members of Discovery Research which will outline the process of drug development from innovation through to registration. They will be given an overview of the various activities of the site and have the opportunity of visiting appropriate areas and of asking questions.

30/9 **Unilever Research, Port Sunlight, Bebbington, Wirral, Merseyside**

Unilever

The visit will take place on Merseyside, some 300 kilometers from London and will be reached by travelling by train from London to Liverpool.

Unilever is an Anglo-Dutch company which makes and sells food, detergents, perfume and toiletries in nearly every country of the world.

In the Unilever Research Laboratory at Port Sunlight, the technology for new products is created from an intimate blend of physics, chemistry, chemical engineering and sensory science. At the heart of the research programme is a deep understanding of the science behind the everyday processes of caring for teeth, skin, hair and clothes. The visit will give direct experience of how research progresses over several years from the very fundamentals of chemistry and biochemistry to products on the supermarket shelf.

Port Sunlight on the southern shores of the River Mersey is also the site of a fascinating 'industrial garden village' built about a hundred years ago by William Hesketh Lever to provide high quality housing for his workers. A tour of the Port Sunlight village is also planned as part of the day visit to Merseyside.

1/11 **University College London, Department of Space & Climate Physics, Mullard Space Science Laboratory**

UCL

The Laboratory contains the largest University space science research group in the United Kingdom. By exploiting the capabilities of rockets and spacecraft as platforms for scientific instruments it tries to understand our physical environment and our place in the Universe. The fields of research include the climate of the Earth, spectacular natural phenomena such as the aurora borealis, the sun and its effects on the Earth, exotic objects in the Universe, such as comets and black holes. The laboratory includes academic scientists, engineers and technicians who devise, design and build instruments which have been flown on more than 250 rockets and satellites in the British, American, Japanese and European programmes. In the future instruments will be flown on Russian spacecraft as well. The programme is global in its scope and international in its approach.

VISITS TO SCIENTIFIC MUSEUMS

Wednesday, 31 July

XXXI/A **Natural History Museum, Cromwell Road, South Kensington, London SW7**

The Museum is renowned throughout the world for its exciting interactive exhibitions about the natural world. Dr Bob Bloomfield will give an introductory talk. This will include information about scientific research, and the background behind some of the displays.

The talk will be followed by a behind-the-scenes tour. Each student will have the opportunity to visit one of the five scientific departments (Botany, Palaeontology, Mineralogy, Zoology and Entomology) and see the spectacular collections. The students will be able to talk to the scientists about various aspects of their work and the many projects undertaken by the Museum.

After the tours there will be a chance to explore the exhibitions. The Ecology exhibition shows how air, water and the sun's energy are critical to the survival of living things and examines the impact of human beings on the environment. Dinosaurs have become extinct around 65 million years ago, but the animated display brings them very much alive! In the dinosaur exhibition, see the amazing selection of dinosaur skeletons and gain an insight into the dinosaur's fascinating way of life. Other exhibitions worth a visit are Human biology, Origin of Species and Creepy-crawlies.

XXXI/B **Science Museum, Exhibition Road, South Kensington, London SW7**

The visit to the Science Museum will include a presentation by Simon Joss, who is a Research Fellow, currently working on various forms of public debate on biotechnology in different cultural concepts.

Science is seen by many people as an entity evolving independently from the rest of our culture. However, the view that science develops only according to its own rules and mechanisms is flawed. Science and technology are as much part of our culture as are, for example, art and philosophy. And as such the interaction between science and society is not a one way process, but a multiple one in which society not only takes from science but also feeds back into it.

This dual relationship between science and society can be exemplified on the new biotechnologies. The more recent history of biotechnology shows how its development has been as much a subject of debate among the general public as among scientists.

The basics of the new biotechnologies will be explained and the most relevant applications explored. It will be demonstrated that the development of the new biotechnologies is part of an ongoing societal debate. A few examples of practical initiatives in the public understanding of biotechnology will be presented and discussed.

XXXI/C **Wellcome Centre for Medical Science, Euston Road, London NW1**

'Science for Life' is a permanent exhibition about biomedicine, featuring extensive use of the latest interactive technology. A wide range of sophisticated and imaginative exhibits allows the visitor to become a scientist for a few hours. The highlight is a walkthrough cell magnified a million times.

If you thought Science could be dull, be prepared for the surprise of Life! This exhibition is a unique insight into the workings of the body and the science that has made these revelations.

OXFORD AND CAMBRIDGE SCIENTIFIC VISITS

Thursday, 1 August

University of Cambridge

1/C/1 **Department of Chemistry, University Chemistry Laboratory**
The visit to the University of Cambridge Department of Chemistry will provide an opportunity to see some of the sophisticated analytical instrumentation in action, preceded by an introductory talk by a member of the Department's teaching staff.

1/C/2 **Department of Engineering**
After an introductory talk outlining the Department of Engineering's teaching and research activities, small group tours of the department will see something of current research activity, including:
Computer Speech Recognition — Engineering Structures — Aero and Fluid Dynamics

1/C/3 **Department of Physics, Cavendish Laboratory**
An introductory talk will describe the history of the laboratory and the many discoveries which have been made, followed by a tour of the museum. Participants will visit two of the research groups and will have a choice of visiting:

A) MICROELECTRONICS RESEARCH CENTRE to see examples of novel nanometre-scale structures and advanced microelectronic devices, such as single-electron memory and logic devices, together with the state-of-the-art facilites used for fabricating and evaluating them.

B) OPTOELECTRONICS GROUP where research spans basic physics explored with ultrashort laser pulses through to the performance of novel polymer materials in specific device geometries; various aspects of these experiments will be demonstrated.

C) HIGH SPEED PHOTOGRAPHY GROUP which studies the effects of erosion on liquid drop, solid particles and cavitation. Fracture processes are also studied and will be illustrated with exploding Rupert's drops.

D) LOW TEMPERATURE PHYSICS GROUP where studies are carried out on high-temperature superconductor materials and heavy-fermion systems in very high magnetic fields and at very low temperatures.

1/C/4 **Physiological Laboratory**
The programme will demonstrate aspects of the teaching and research currently undertaken in the laboratory. Participants will be introduced to the breadth and fascination of studying Physiology. Theoretical and practical examples taken from the undergraduate course will illustrate the importance of the subject, as a scientific discipline in its own right, and as an essential foundation for clinical research.

1/C/5 **British Antarctic Survey**
The British Antarctic Survey is responsible for almost all the British Government's research in Antarctica. The Survey began in 1943, as a wartime naval operation. BAS is one of the research institutes of the Natural Environment Research Council. Four scientific stations in the Antarctic are manned: Halley is a geophysical observatory; Signy and Bird Island are biological stations; and Rothera is the centre for studies in Earth Sciences. All aspects of the research programme are organised from Cambridge. The stations are supplied annually from Britain by two Royal Research Ships, and the Air Unit's Twin Otter and Dash 7 Aircraft from Rothera Research Station.

University of Oxford

1/O/6 **University Botanic Gardens**
The Botanic Gardens will be described and there will then be a tour of the gardens and greenhouses. The educational and scientific roles of the collection will be explained, using plants to explain aspects of Plant Science. The Oxford Botanic Garden is the oldest in Britain. For over 370 years it has stood on the banks of the River Cherwell in Oxford. It has evolved from a collection of medicinal herbs for seventeenth century physicians to the most compact diverse collection of plants in the country. In two hectares 8,000 species, representing almost every botanical family, can be found.

1/O/7 **Department of Engineering Science**
The Department of Engineering Science at Oxford provides teaching and research facilities for approximately six hundred undergraduates and one hundred and seventy post graduates, as well as academic and research staff. All the main fields of engineering are covered in the Department: Mechanical, Electrical, Civil, Chemical and Information Engineering.
Exhibitions and demonstrations of the work and teaching undertaken in the department will be provided. For example: visits to robotics and computer vision laboratories; medical engineering; turbo machinery; wind and power engineering; control engineering; illustration of soil reinforcement techniques. During the tour visitors will have ample opportunities to ask questions and discuss items of interest.

1/O/8 **Pitt Rivers Museum, South Parks Road, Oxford**

The visits above are scheduled to take place during the morning. Participants will have an opportunity to explore Oxford and Cambridge on their own before returning to London late in the afternoon.

BRITISH AIRWAYS AT LONDON HEATHROW AIRPORT

Monday 5 August

Participants will travel in groups by Underground to Hatton Cross (Piccadilly Line)

The visit will begin with a presentation outlining the scope of operations at Heathrow Airport of British Airways. After lunch small group visits will be paid to a range of up to fifteen aspects of the airline's activities. Each participant will visit three or four of the range of options available. Details of these will be included on the *options form* which will accompany registration documentation.

The visit will end with a question and answer session with senior personnel and a debriefing before participants travel back to Central London by Underground.

BRITISH AIRWAYS

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Final year:
Aylesbury Grammar School

Justin Smith
(United Kingdom: England)
Final year:
Myton Sixth Form College

The resident staff of the Science Forum is selected from former participants.
Membership of the staff team is by invitation only, direct applications are NOT considered.

HALLS OF RESIDENCE

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NUTFORD HOUSE
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LECTURE VENUES

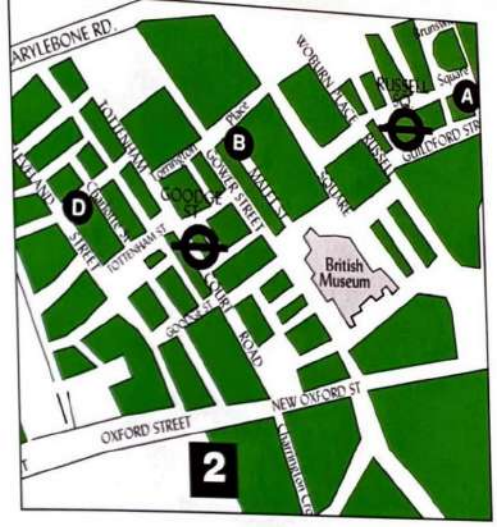
Edward Lewis Theatre

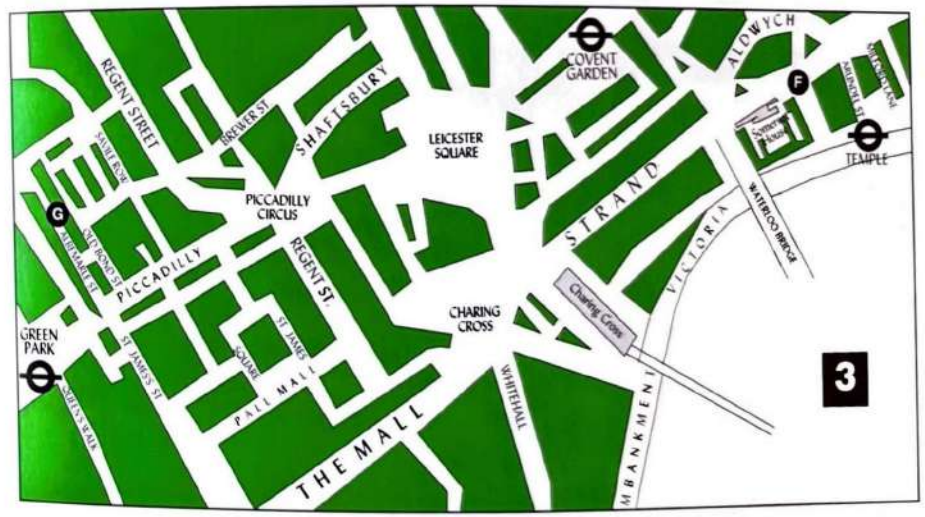
Carisbrooke Hall

King's College, London

Royal Institution of Great Britain

Commonwealth Institute





KEY

		Lecture Venue	Underground
MAP 1	C	Nutford House	Edgware Road
	E	Carisbrooke Hall	Marble Arch
MAP 2	A	International Hall	Russell Square
	B	College Hall	Goudge Street
	D	Edward Lewis Theatre	Goodge Street
MAP 3	F	King's College London	Temple/Covent Garden
	G	Royal Institution	Green Park
MAP 4	H	Commonwealth Institute	Kensington High Street