THIRTY SEVENTH

LONDON INTERNATIONAL YOUTH SCIENCE FORUM

1995

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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

The London International Youth Science Forum has become a major event in the capital's calendar. There are at least three reasons for that.

First, the gathering together of some 300 young scientists to share ideas and aspirations with one another draws attention to the centrality of science to modern culture. For the United Kingdom and for all the countries represented at the Forum, science will continue to be absolutely vital to future prosperity and quality of life. The importance of science calls for our very best young people. The Forum reflects that.

Secondly, the Forum demonstrates the potential of science to bring peoples of different countries closer together. The scientific endeavour is international; the language of science crosses national boundaries and knows no distinctions of race religion or colour. In a fragmented world, that makes it all the more precious. But its potential to unite must be nurtured and would be lost without events such as the International Youth Science Forum.

Thirdly, the interchange of ideas at a Forum of this kind may well sow seeds for future scientific advance. That is part of the excitement and challenge of science. Scientists themselves debate on whether there are any limits at all to what can be achieved through science. Whatever the answer to that question in the long run, it is clear that the road to further discovery and achievement is wide open. It is today's young scientists who will take us further down that road, who will increase the bounds of human knowledge, who will win tomorrow's Nobel Prizes, in whose hands is the possibility of a better future.

I am delighted therefore to commend to you the London International Youth Science Forum. I wish it every success. I wish the young scientists who attend not only an enjoyable time but one that they will value as they pursue their futures in science.

March 1995

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Venezuela
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De Beers Mining Corporation

Zambia
British Council

The British Council

The British Council is the principal sponsor of international participants.

This list was based on attendance at the London International Youth Science Forum in 1994

LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1994

The following countries were represented

Albania
Australia
Austria
Bahrain
Belgium
Bulgaria
Canada
Croatia
Cyprus
Czech Republic
Estonia
Germany
Greece
Guernsey
Hong Kong
Hungary
India
Indonesia
Ireland
Israel
Italy
Jamaica
Japan
Korea
Kuwait
Latvia
Lithuania
Malaysia
Malta
Namibia
New Zealand
Norway
Oman
Papua New Guinea
Peru
Phillipines
Poland
Portugal
Puerto Rico
Romania
Singapore
Slovak Republic
South Africa
Spain
Sweden
Switzerland
Taiwan
Thailand
Trinidad & Tobago
Tunisia
Turkey
United Arab Emirates
United States of America
Venezuela
Yakutia
Zambia
United Kingdom

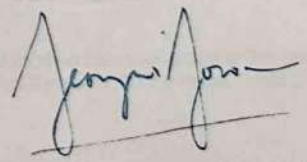
LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1995

The immediacy of the day's events preoccupies us all. The urgency with which the media report changes and the drama they seek to bring to every new development may help sell newspapers, or win adherents for particular television channels, but the distortions in perception are hardly justifiable. This page is being written some twenty weeks before the Science Forum is due to begin. In the weeks just before its production, one of the major natural disasters of the century – the Kobe earthquake – destroyed the lives of many thousands. And in Europe the Rhine flooded much of the Netherlands, destroying homes and causing many thousands to flee. These natural disasters took place at the same time as 'man's inhumanity to man' flourished in Afghanistan, in former Yugoslavia, in parts of the former USSR and in Somalia, where neither the might of the world's greatest powers or of the United Nations could secure peace.

And we take it all for granted. Each week brings another account of tragedy and violence. If Nature fails to provide such a scenario, *homo sapiens* seems to be ready and waiting to oblige.
During the Science Forum you will probably find that you have less time to keep yourself up to date with the world's events. Instead you will find an opportunity to find out for yourself and to make up your own mind about issues which previously seemed remote. Students like you, of your own age, studying the same subjects as you are, with the same ideals and plans for their lives and careers will be all around you. they will come from some sixty lands and territories, from the five continents of the word.

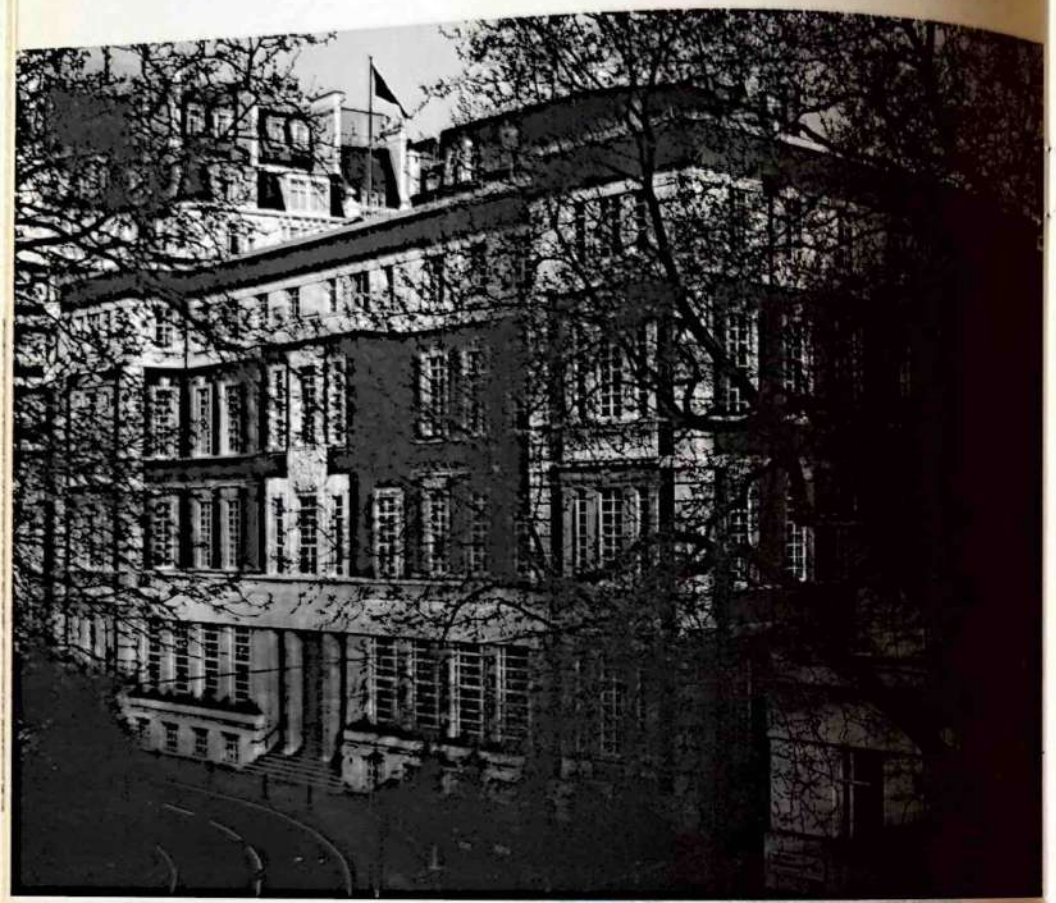
The Science Forum is not concerned only about ***science***. It is concerned with the application of science ***for the benefit of all mankind***. Being a part of it is your chance to tell others what you think, and what you hope, and to listen to their views and their aspirations. It is a time to talk and a time to learn that your views will only gain respect if you have respect for those of others.

You won't miss much during the Science Forum if you don't read the newspapers or watch the news on television, these second-hand sources of information can be unreliable and often sensationalise situations rather than examine them logically or scientifically. But being part of the Science Forum offers an unrivalled chance to find out for yourself the views and thoughts of people across the globe. Exchange ideas at first hand, debate issues, form friendships, agree to differ and take full advantage of this unique opportunity to be part of a truly international community.



George McGowan
Director
London International Youth Science Forum

THE INSTITUTION OF ELECTRICAL ENGINEERS
Savoy Place, London WC2



The Council of the institution of Electrical Engineers supports the Science Forum by providing its facilities for the series of plenary presentations, specialist lectures and seminars listed on the following pages. Its generosity in having done so each year since 1963 is gratefully acknowledged.

PRINCIPAL LECTURES & DEMONSTRATIONS

Thursday 27 July — 11.00 — OPENING CEREMONY

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

Principal Address
Dr Mary Archer, MA PhD FRSC CChem
formerly of Newnham College, Cambridge
Chairman: National Energy Foundation

Thursday 27 July — 14.15 — *'Chaos & Fractals in the World Around us'*
Dr Gareth McKinley, BA MA(Cantab) PhD
Assistant Professor of Engineering Sciences
Harvard University, United States of America

The apparently irregular and random behaviour of many natural biological and physical systems is often described as *chaotic* and is considered to be beyond simple mathematical description. However, over the last fifteen of so years mathematicians and physicists have come to realise that underlying the apparently randomness lies a high degree of mathematical order. A process may be completely deterministic, ie governed by simple differential equations, yet its outcome can remain completely unpredictable in advance. This lecture will introduce some of the basic mathematics used to describe such nonlinear processes, including the concepts of *limit cycles* and *strange attractors* together with simple computer-based simulation techniques which can represent the results of chaotic processes as *fractal objects*, or geometric shapes with a fractional dimension. The wide variety of natural processes which can be described with these concepts will be illustrated with examples drawn from the fields of chemistry, physics and medicine.

Friday 28 July — 15.00 — *'The Divided Brain'*
Dr George Savage, BSc PhD
Department of Physiology, Basic Medical Sciences,
Queen Mary & Westfield College, University of London

We take it for granted that the two sides of our bodies are virtually identical. Some organs like the heart lie to one side of the midline, however, and often the closer we look, the less symmetry we see.

The human brain, on the other hand, does look symmetrical. Despite this, it was realised as long ago as 1836 that the two halves of the human brain do not function identically. We shall look at what modern work has shown us of such differences. Because the two halves of our brain work differently, they must continuously be kept in contact, so that we have the experience of being single personalities.

Our main sense organs, the eyes, send information to the brain and from the information they provide, we form maps and models of the world outside, in order to build up a picture of the world as a whole. This integration is done by way of *commisures*, which are bands of nerve fibres running across from one side of the brain to the other.

Earlier this century, in an attempt to alleviate disease, neurosurgeons first split the major commissure between the two sides of the human brain. Surprisingly, there were few obvious effects. We now know that the operation has profound effects, and some surprisingly simple tests show us that in such a person we have two separate systems (or should we call them personalities?) with which to communicate. Do they have separate memories, characters and consciousness?

Saturday 29 July — 10.00 — *'Colour is Fun'*
Dr Arthur Tarrant, PhD FInstP FCIRSE CPhys CEng
Honorary Fellow, University of Surrey

The precise specification of colour is vital to many branches of science and industry, and particularly to the consumer industry; just as we have been able to specify engineering dimensions with tolerances. But colour is not just a physical thing like the diameter of a crankshaft, it is a psycho-physical phenomenon which occurs as our eyes and brain try to make sense of the physical signals that come into them.

The lecture will describe the processes by which a specification of a colour can be achieved and will go on to examine some of the many factors that may affect the appearance of colours. It will indicate how a plain commercial problem can on analysis offer an intellectual challenge of the highest kind to scientists and will convey something of the delight of the scientist who works in this field.

Monday 31 July — 14.15 *'The Cosmic Onion'*
Professor Frank Close, BSc DPhil FInstP
Deputy Chief Scientist
Rutherford Appleton Laboratory

The Universe began 10-20 billion years ago and the seeds of matter were made within the first microsecond. Today this has clustered into stars, galaxies and even people. How did it all begin? What is matter made of? The lecture will take a voyage into matter and show images of atoms, nuclei and even the primeval quarks revealed in modern particle accelerators. It will raise (but probably not answer) some of the major questions currently being investigated.

Wednesday 2 August — 20.00 *'Michael Faraday's Influence Still Lives, The Excitement of Chemical Demonstrations'*
Professor Ronald Ragsdale, BA MS PhD
Dr Jerry Driscoll, BS MS PhD
University of Utah, United States of America

Michael Faraday, a gifted lecturer, set the standard for all of us to aspire. He opened the world of science to the general public through lectures which were filled with demonstrations of the wonders of nature. Faraday did all he could to urge his listeners to see and judge for themselves, to experiment – to question nature directly – whenever they discovered something out of the ordinary. We strongly advocate the hands on approach to the study of science. Our lecture will convey the importance of illustrating chemical and physical phenomena with dynamic demonstrations. The audience will be involved in making observations, drawing hypotheses, and developing theories to respond to questions raised by the spectacular demonstrations. The hand is not faster than the eye, so the Science Forum participants will discover answers to many chemical phenomena. By the conclusion of the lecture, the audience will agree with us that chemistry is both exciting and exhilarating. Woven into the lecture will be vignettes of Michael Faraday, Joseph Priestley and Ira Remsen.

Friday 4 August — 14.15 *'Mining – A Suitable Neighbour'*
David Richards, BSc MPhil MIMM
Dr R Gaunt, MA MB CHb MFOM

The distribution of elements in the Earth's crust is controlled by geological processes. Mines can only be located in areas where these processes have concentrated elements or minerals to levels at which extraction becomes viable. Unfortunately, nature frequently concentrates undesirable elements in the same places in the same way. Mining and purifying the target metal therefore usually generates wastes containing these accessory elements. Unless appropriate care is taken before, during and after mining, harm can be caused to the environment and to the health and safety of those working in or living near the industry.

The presentation will explore the methods by which RTZ, one of the world's leading mining companies, seeks to achieve best contemporary environmental, health and safety practices in its operation throughout the world.

Saturday 5 August — 10.00 *'Musical Squares'*
Dr Mike Gluyas, BSc PhD and
Mrs Wendy Gluyas, BA CertE DipTEFL

'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 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 involved the participation of (volunteer) members of the audience.

Monday 7 August — 20.00 *'Chemistry and Light'*
Prof Andrew Mills, BSc PhD CRSC
and Dr Peter Douglas, BSc PhD
Department of Chemistry
University College, Swansea

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, washing 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.

Tuesday 8 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

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

All of the above events take place at
The Institution of Electrical Engineers, Savoy Place, London WC2.

SPECIALIST LECTURES

Monday 31 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 *'Proteins, Structures and Molecular Properties'*
Dr Sheena E Radford, BSc PhD
Centre for Molecular Studies, University of Oxford

The size and the apparent complexity of typical proteins may make the understanding of their role and biological function a seemingly impossible task. However, once a few principles of protein structure are grasped, proteins can be comprehended and even admired, and their biological properties can be rationalised.

The first step is to recognise the individual building blocks which make up a protein and to become familiar with their properties. Next we will look at how these units are linked in the finished protein.

We will then review several known protein structures and see how Nature uses certain functional domains in many proteins and how the same basic framework is used in a variety of proteins with many different functions. We must also realise how important the shape of the protein is to its eventual function.

Finally, we will discuss one of the currently most exciting areas in the study of proteins. 'How do these large and complex structures take up their correct shape?' We will look at some of the latest results from research in this area.

Lecture D *"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.

All of these Lectures take place at
The Institution of Electrical Engineers, Savoy Place, London WC2

Friday 4 August 10.00

Lecture D *'To Die or Not to Die'*
Dr Frances M B Calman, MB BS FRCP FRCR
Department of Radiotherapy & Oncology, King's College Hospital
and Dr John Ellerenshaw, MB BCh MRCP, Liverpool

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 E *'Codemakers versus Codebreakers – An Introduction to Cryptography'*
Professor Fred C Piper, BSc, PhD ARCS DIC, FIMA
Royal Holloway & Bedford New College, University of London

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 this lecture we shall look at some aspects of this 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 sectors. Thus, in addition to discovering secret information, the codebreakers are now trying to rob banks and/or raid databases containing personal information about us. There is no doubt that cryptography now impinges on all our lives.

Lecture F *'Fossils, Evolution, and the Origin of Species'*
Dr Peter R Sheldon, BSc
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 tribolites, 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.

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).

All of these Lectures take place at
King's College London, The Strand, London WC2 2LS

SEMINARS

Wednesday 14.15
2 August

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 re-marriage . . .'

This 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 with 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 *'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 produce.

This Seminar has been arranged by Unilever Research Port Sunlight Laboratory

Seminar 5 *'At the Speed of Light'*
L James St Villa, MA CEng MIEE

In the age of optical communications, are the days of electronics numbered? Is the time for all-optical processing upon us?

Since the development of high quality optical fibres in the 1960's we have all become used to the concept of communication with light. It is a most efficient and economic medium, large volumes of information can be transferred at higher rates using a link that is cheaper, lighter and smaller than conventional cable. But many modern systems are ultimately limited by the shortcomings of electronics, as optical information is converted into electrical signals for switching, amplification and display.

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7 August

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Seminar 1 *'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

Stimuli are continually produced by man's natural environment. After being conceived by his sense organs, they eventually lead to a pattern of motor performance (such as 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. Indeed when neurons are activated simultaneously, they form a *network*, encoding sensitive information as a primary image of the perceived environment. Access is then 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'. During decades, psychologists approached these cerebral events in terms of immaterial concepts. Nowadays, advances in neurobiology show us that underlying tissue structures and physiological pathways are entirely responsible for bringing forth a specific behaviour pattern to given stimuli. Schematically, 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 a process called 'epigenesis through selective stabilisation'.
3 Finally, a memory of past experience will facilitate certain synaptical connections.

It will be my aim to illustrate the physiological events underlying each of these stages.

Seminar 2 *'Water Use in Hill Slope Agroforestry Systems - Problems and Possibilities'*
Nicholas Jackson, BA(Hons) MSc PhD British Council Research Fellow, 1990-91
(Participant in 1984).
Research Office, 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 & East Africa shows a considerable reduction in woody cover in the past 30 years. Fuelwood provides 63% of the total energy consumption of developing African countries. One possible solution to the resulting problems of land 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.

SEMINARS

Wednesday 14.15
2 August

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 re-marriage . . .'

This 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 with 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 *'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 produce.

This Seminar has been arranged by Unilever Research Port Sunlight Laboratory

Seminar 5 *'At the Speed of Light'*
L James St Ville, MA CEng MIEE

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Seminar 3 *'A "Complex" adaptive talk on Genetic Algorithms'*
Mehul Khimasia, BSc, ARCS (participant in 1990)
Postgraduate Student, University of Cambridge

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 of '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, tweek 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 and genetic.

Seminar 4 *'How to Teach Computers to Understand Human Speech'*
Jan Kybic (participant in 1992)
Undergraduate Student
Faculty of Electrical Engineering, Czech Technical University, Prague

Science fiction writers always dream about computers being able to communicate with people in spoken language. Unlike the very well developed speech synthesis techniques, reliable, fast and robust algorithms for speech recognition are still being searched for. To convert speech into numbers is a standard task.

But then the magic begins. The first spell should filter out all the background noise from the input signal. The second spell should then turn the endless string of numbers into intelligible words. The researchers have taken inspiration from the way the human ear and brain is believed to perform the desired tasks. Various modern mathematical and programming methods, like Fast Fourier Transform, neural nets or self organising maps, are used. However, no approach has given totally satisfactory results so far. Already, some speech recognition programmes exist, but they are far from perfect, though they are usable. There is much yet to be improved, but the task is rewarding – who would not like to have a little chat from time to time with his ever friendly computer?

Seminar 5 *'Are Straight Lines Curved, After All'*
Dragan Masulovic, BSc (participant in 1991)
Teaching Assistant, University of Novi Sad, Yugoslavia

One of the most beautiful and most powerful ideas mankind has ever reached is the idea of axiomatic foundation of a mathematical theory. It is almost unbelievable, but true, that the idea of the axiomatic approach appeared 25 centuries ago in Euclid's masterpiece *'The Elements'*.

Each mathematical object is defined in terms of several simpler mathematical objects. For example, to define the notion of a circle one needs notions of plane, point, set and distance. But what happens with the simplest mathematical objects? How are they defined? They cannot be defined in terms of their properties! A system of axioms is nothing but a list of the properties fundamental objects have. Thus, we do not know what they look like, but we know how they behave, and that suffices!

This gives rise to infinite possibilities of experimentation. Firstly, we can find some unusual objects that are models of fundamental objects (ie have the same behaviour, although look weird.) Secondly, we can make some changes to axioms and thus obtain new theories. This way of playing with theories was especially fruitful in geometry, where many 'curved' geometries have been discovered. This led to ideas of differential geometry (in which everything is curved, even the space itself), and we all know how Albert Einstein exploited that idea in his work on relativity.

Seminar 6 *'Applied Mathematics and Tuned Circuits'*
Nikhil Nair (participant in 1994)
Undergraduate Student, Trinity College, Cambridge

Tuned circuits play an important role in our day-to-day lives, most obviously in the form of radio/television receivers. They are also of great interest to scientists, being probably the most accessible form of the phenomenon known as *resonance*.

In this seminar we will look at the typical make-up of a resonant circuit, i.e. *inductance* and *capacitance*; we will first define these in terms of more familiar electrical quantities (charge, current and voltage) and then go on to examine their behaviour in a.c. circuits – this leads directly to their resonant behaviour.

It is at this point that we can start to apply mathematics to the situation. The type of equations we will derive are not unique to electrical systems, but also apply to other types of resonance, to help us deal with these equations, we will make wide use of *complex numbers*. These are comprised of two independent parts a *real* part, which resembles ordinary numbers, and an *imaginary* part, which contains the square room of -1. Resonance provides an excellent illustration of the immense power of complex numbers in practical situations.

Our examinations of a simple circuit will now allow us to look at more complex circuits with wide-ranging applications, e.g. filtering of 50Hz a.c. "hum". These will demonstrate the true importance of the tuned circuit.

All of the above seminars take place at The Department of Engineering, University College, London, Torrington Place, London WC2.

STUDENT TOPICS

Participants who wish to give a paper based on a project or investigation have 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, 28 July
20.00 College Hall,
Malet Street, London WC1

Monday, 31 July
20.00 College Hall,
Malet Street, London WC1

TOPICS FOR TONIGHT

Tuesday, 1 August
21.00

Informal discussions in Halls of Residence

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

NUTSFORD 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, 2 August
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, 27 July
20.00 Welcome Disco
Carisbrooke Hall, Seymour Street, London W2

Saturday, 29 July
17.30 Inter Hall Swimming Gala
University of London Union, Malet Street,
London W1

Sunday, 30 July
20.00 Feature Film: *'Blazing Saddles'*
College Hall, Malet Street, London WC1

Friday, 4 August
20.00 International Cabaret
Carisbrooke Hall, Seymour Street, London W2

Saturday, 5 August
14.15 Inter Hall Rounders Matches.
Regent's Park, London NW1

Sunday, 6 August
20.00 Feature Film: *'Tootsie'*
College Hall, Malet Street, London WC1

Monday, 7 August
20.00 Songs of Home:
International Folk Song Evening
College Hall, Malet Street, London WC1

Tuesday, 8 August
20.00 Farewell Disco
Carisbrooke Hall, Seymour Street, London W2

HALF DAY SCIENTIFIC VISITS

Friday, 29 July

28/1 **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 BBC's Science Correspondent will be able to meet the group.

28/2 **City University, School of Engineering**

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.

28/3 **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.

Bioreactor Technology

Micro-organisms are incubated in fermentation vessels under carefully regulated conditions to produce biochemicals needed in industry and medicine. The laboratory contains several small scale bioreactors in which new techniques and potentially useful organisms are studied. Interests include: biotransformations for the production of chiral compounds, production of ethanol from biomass sources such as straw by thermophilic bacteria; and methods for recovery or removal of metals from mineral ores.

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.

Mass Spectrometry

The discovery of biologically active substances depends on techniques for their purification from biological sources, measurement of their physiologal functions and exact determination of their identity. A group of scientists work together to make these discoveries at Imperial College and they have developed mass spectrometry equipment which exploits high field fast atom bombardment and electrospray techniques. The group has had many successes, including identification of the Enkphalins (the brain's natural opiates,) the Asthma Factor (leukotriene D) and human Calcitonin Gene Related Peptide (the most potent vasodilator).

28/4 **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.

28/5 **King's College London, Chelsea 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 use of radioactive drugs and the detection of drug misuse in sporting competition.

28/6 **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.

28/7 **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.

28/10 **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.

28/11 **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.

28/12 **University College London, Department of Electrical and Electronic Engineering**

The visit will include a tour of the department and a detailed description of some research activities selected from:

semi conductor circuit CAD; microwave devices, antenna and propagation; electronic and optical processing; medical electronics; chemical sensors, high temperature super conductors; applications of neural networks; short pulse laser techniques; quantum-well semi conductor optical devices; integrated optics.

28/13 **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.

SCIENTIFIC VISITS

Tuesday, 1 August

1/1 **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 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.

1/2 **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.

1/3 **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 2,600 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.

1/4 **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.

1/5 **Royal Marsden National Health Service Trust, Sutton, Surrey**

After an introduction to the work undertaken by the Institute of Cancer Research and the Royal Marsden Hospital, the group will be divided. Each group will visit the Radiotherapy Research Unit, CT (Computerised Tomography) and MRI (Magnetic Resonance Imaging) Units, Radiotherapy treatment areas and the Department of Nuclear Medicine and Ultrasound. There will also be a discussion on the psychological aspects of cancer. The combined group will see a film on Bone Marrow Transplantation and will visit the Leukemia Ward.

1/6 **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 will be taken aboard a boat during a tour of the Bristol Docks. This is a large area currently undergoing redevelopment for both business and leisure purposes, but still containing landmarks from the development of the Industrial Age. Not least of these is Brunel's SS Great Britain, the first propeller driven, ocean going, iron steam ship which was launched from Bristol in 1843 and returned in 1970. There are memories from even earlier periods from medieval industry to Bristol's role in the exploration of North America by Europeans from the 15th century onwards.

During the afternoon further time will be spent with the plores at the Exploratory before returning to London.

1/7 **Rutherford Appleton Laboratory, Chilton, Didcot, Oxfordshire**

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.

1/8 **Severn Trent Water Ltd, Birmingham**

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. 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.

1/9 **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.

1/10 **Unilever Research, Port Sunlight, Bebbington, Wirral, Merseyside**

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**

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, 2 August

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

The Museum is renowned throughout the world for its exciting interactive exhibitions and 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.

II/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 the UK National Consensus Conference on Plant Biotechnology and the European Genetics Debate.

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 well 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. Two examples of practical initiatives in the public understanding of biotechnology – the UK National Consensus Conference on Plant Biotechnology and the European Genetics Debate – will be discussed.

II/C **Welcome Centre for Medical Science, Euston Road, London NW1**

'Science for Life' is 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 a 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, 3 August

University of Cambridge

3/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.

3/C/2 **Department of Engineering**

After an introductory talk outlining the Department of Engineering's four year undergraduate course, small group tours of the department will see something of current research activity, including

Computer Speech Recognition
Engineering Structures
Nanotechnology
Aero and Fluid Dynamics

3/C/3 **Department of Physics, Cavendish Laboratory**

The visit will begin with an introductory talk describing the history of the laboratory and the many discoveries which have been made there. This will be followed by a tour of the museum which includes many of the pieces of apparatus with which the discoveries were made. Participants will then visit two of the research groups. Each participant will have a choice of visiting Physics and Chemistry of Solids, Microstructural Physics, Polymers and Colloids, or the Radio Astronomy research groups.

3/C/4 **Physiological Laboratory**

The morning's programme will demonstrate some aspects of the teaching and research currently being undertaken in the laboratory. Participants will be introduced to the breadth and fascination of the study of Physiology. Both theoretical and practical examples taken from the undergraduate course will be used to illustrate the importance of the subject both as a scientific discipline in its own right, and as an essential foundation for clinical research.

3/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. Five scientific stations in the Antarctic are manned throughout the year. Halley and Faraday are geophysical observatories; 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

3/O/6 **University Botanic Gardens**

The history of the Botanic Gardens will be briefly described and there will then be a tour of the gardens and greenhouses. During this tour the educational and scientific roles of the collection will be explained, using the plants to explain various aspects of Plant Science.

The Oxford Botanic Garden is the oldest in Great Britain. For over 370 years it has stood on the banks of the River Cherwell in the centre of Oxford. In that time 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.

3/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 graduate, 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.

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.

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Membership of the staff team is by invitation only.

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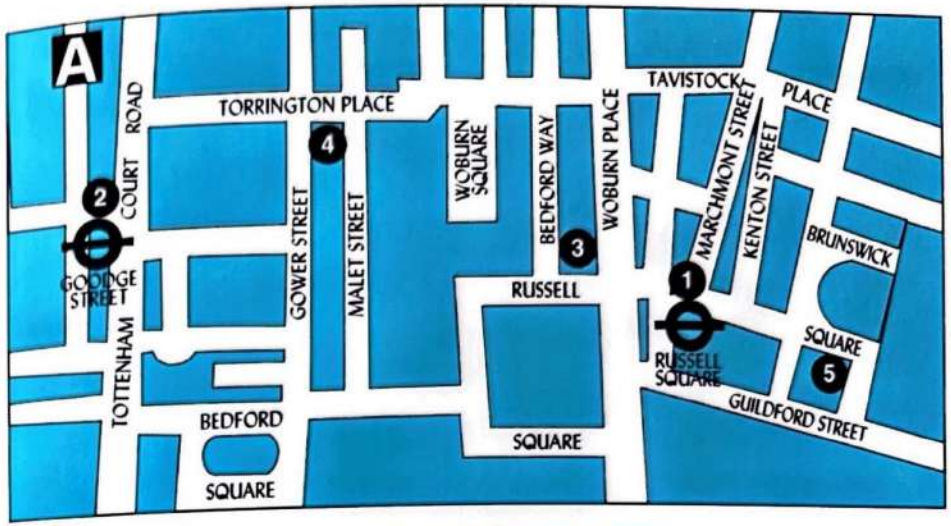

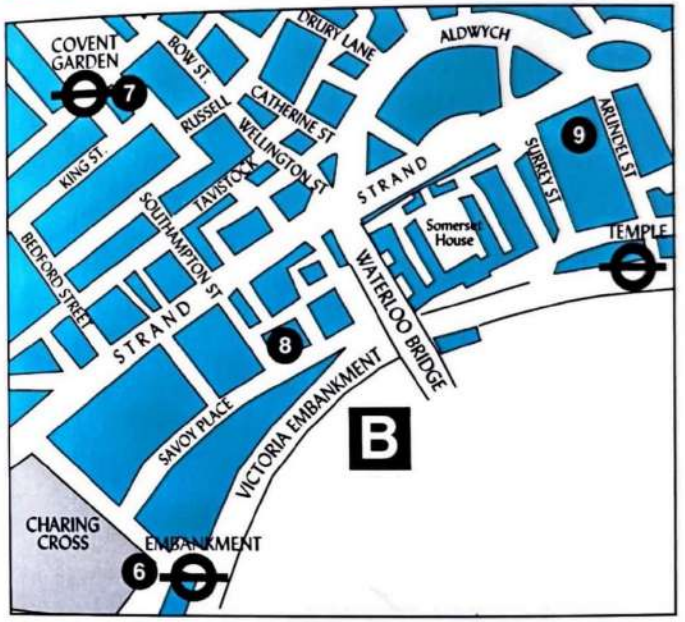

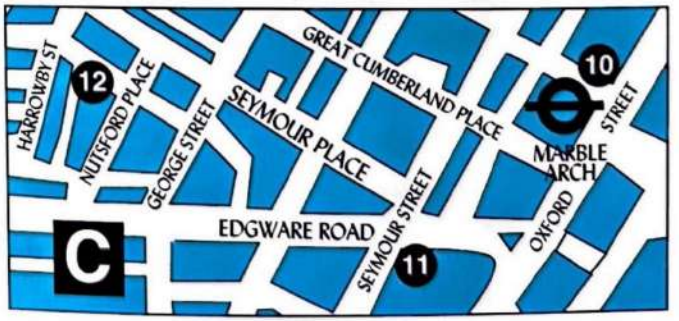

MAP A (University Precinct)
1 Russell Square Underground Station (Piccadilly Line)
2 Goodge Street Underground Station (Northern Line)
3 Airbus Stop (service to and from Heathrow Airport)
4 COLLEGE HALL
5 INTERNATIONAL HALL

MAP B (Covent Garden & Strand Area)
6 Embankment Underground Station (Northern Line)
7 Covent Garden Underground Station (Piccadilly Line)
8 INSTITUTION OF ELECTRICAL ENGINEERS
9 KING'S COLLEGE LONDON, STRAND CAMPUS

MAP C (Marble Arch Area)
10 Marble Arch Underground Station (Central Line)
11 CARISBROOK HALL
12 NUTFORD HOUSE

38th LONDON INTERNATIONAL YOUTH SCIENCE FORUM

24 July to 7 August, 1996

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