Thirty
Sixth

LONDON INTERNATIONAL YOUTH SCIENCE FORUM

1994

LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1994

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 impact of science on society, on economic performance and on the global environment continues to grow apace. The world we live in is becoming smaller; the impact of science is becoming greater.

I thus welcome this year's London International Youth Science Forum, a forum which has come a long way since it was first established in 1959.

It brings together scientists from around the world, different customs, different backgrounds and different scientific areas. Just as travel, trade, industry, commerce and the environment are becoming issues that must be considered against a global backcloth, so also must science.

As we look towards the end of this century and beyond, it will be the young scientists of today who will be responsible for ensuring that science is used positively in support of a better and safer world in which to live: better medicines and health care; improved food quality and supply; better communications which bring better understanding. No one country can do all that is possible. We must pool and share scarce resources.

I should like to emphasise one point. Scientists must be an integral part of the fabric of a modern society, not a body apart. This means getting the message of the benefits of your work across to the general public in an interesting and readily understood way. Within the United Kingdom, we have an active policy to promote the public understanding of science. That is a policy well worth pursuing across the world.

I wish your forum and the discussions which ensue, every possible success.

March, 1994

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Zimbabwe
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Surrey County Council

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The British Council is the [illegible]

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LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1993

The following countries were represented

Australia	India	Portugal
Austria	Indonesia	Puerto Rico
Bahrain	Ireland	Romania
Belgium	Israel	South Africa
Bulgaria	Italy	Spain
Canada	Japan	Singapore
China	Jordan	Sweden
Croatia	Korea	Switzerland
Cyprus	Kuwait	Taiwan
Czech Republic	Latvia	Thailand
Estonia	Lithuania	Trinidad & Tobago
Ethiopia	Malaysia	Turkey
Finland	Malta	United States
France	Mexico	Venezuela
Germany	New Zealand	Yugoslavia
Greece	Norway	Zambia
Hong Kong	Oman	Zimbabwe
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Brockenhurst:	Brockenhurst College
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Hull:	South Holderness School, Preston
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The International Contact Trust has offered part scholarships towards participation fees in a number of cases

This list was compiled on 1 March 1991 and is therefore incomplete

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This is my first year as President and I am especially pleased to welcome you all to this, the thirty-sixth meeting of the International Youth Science Forum.

The rigour and diversity of modern science offers a challenge to us all. As a participant in this event you will have the opportunity to meet and hear experts from many fields of scientific endeavour. Men and women who are acknowledged experts in their chosen fields and who I hope will kindle in you a passion for science and an appreciation of the importance of its role in the modern world. But above all, to enable you to meet the challenge which it offers.

You will also make many new friends from all over the world. Friends who like you wish to understand and appreciate the pleasures that an understanding of science can bring. An appreciation that has driven many of our great scientific forbearers to achieve fame and success in this highly demanding field of human endeavour.

Enjoy your stay in our capital city, and enjoy your science.

Brian FG Johnson

March 1994

ACKNOWLEDGEMENTS

The Science Forum offers its thanks to all those who so generously assisted in the planning and preparation of the 1994 meeting, and in particular to:

The Council and Staff of the Institution of Electrical Engineers 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 ROCT Affairs, 3M Health Care Ltd and Unilever Port Sunlight Research Laboratory which have provided Specialist Lectures and Seminar Leaders.

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

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

Capital Group Travel, and Mr Peter Campling for coach transportation

Competitive Systems and Mr David Evans for computer programming and backup.

British Airways plc for its generous assistance with travel facilities for participants from a number of overseas countries.

Cathay Pacific Airways Ltd for assistance with travel facilities for participants from Hong Kong

The Great Britain Centre for Eastern and Central 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

All those who have assisted, and who are not included in this list, whose support has made the organisation of the Science Forum possible

BRITISH AIRWAYS

LONDON INTERNATIONAL YOUTH SCIENCE FORUM 1994

"What use is Science, if Mankind does not survive?" HRH The Duke of Edinburgh – the Founder Patron of the Science Forum – posed this question, almost forty years ago, to a meeting of the British Association for the Advancement of Science.

In the years since he asked the question, enormous advances have been made in science and technology. But have these been for the benefit of mankind, or improved the quality of life for the world's citizens? Sadly, not in all cases: Research and Development in many scientific fields seems to continue without regard to the wider implications to the human race, and its frail hold on the Earth.

The Science Forum promotes two aims. Firstly, it seeks to give participants, a deeper insight into science ***and its application for the benefit of all mankind***. The challenge in planning the Forum's programme is to reflect this idea, within a stimulating range of events demonstrating the latest scientific progress, research and endeavour. The contributions, detailed in the following pages, will demonstrate clearly the advances that have been made, but will also show how much yet remains for scientists to understand and achieve.

The second aim of the Science Forum is to develop a greater understanding between young people of all nations. This can only be achieved if you, as a participant, approach the Science Forum with an open mind and welcome the views and opinions of others, as you would wish them to welcome your own.

Each year, the Science Forum reaches out to make links with more and more countries. This year, students from well over fifty countries will share the 1994 Science Forum with you. You will have the opportunity to learn about their lives . . . to discuss ideas . . . to exchange hopes . . . and to develop your own views of the world though this shared international experience.

Science Forum participants before you have found their two weeks in London to be an exciting and memorable experience. For a great many the Science Forum provided a new perspective on their choice of career, and – for many more – new ideas, different views and lasting friendships. I have no doubt that, like your predecessors, you will enjoy and take full advantage of this unique experience

George McGowan
Director
London International Youth Science Forum

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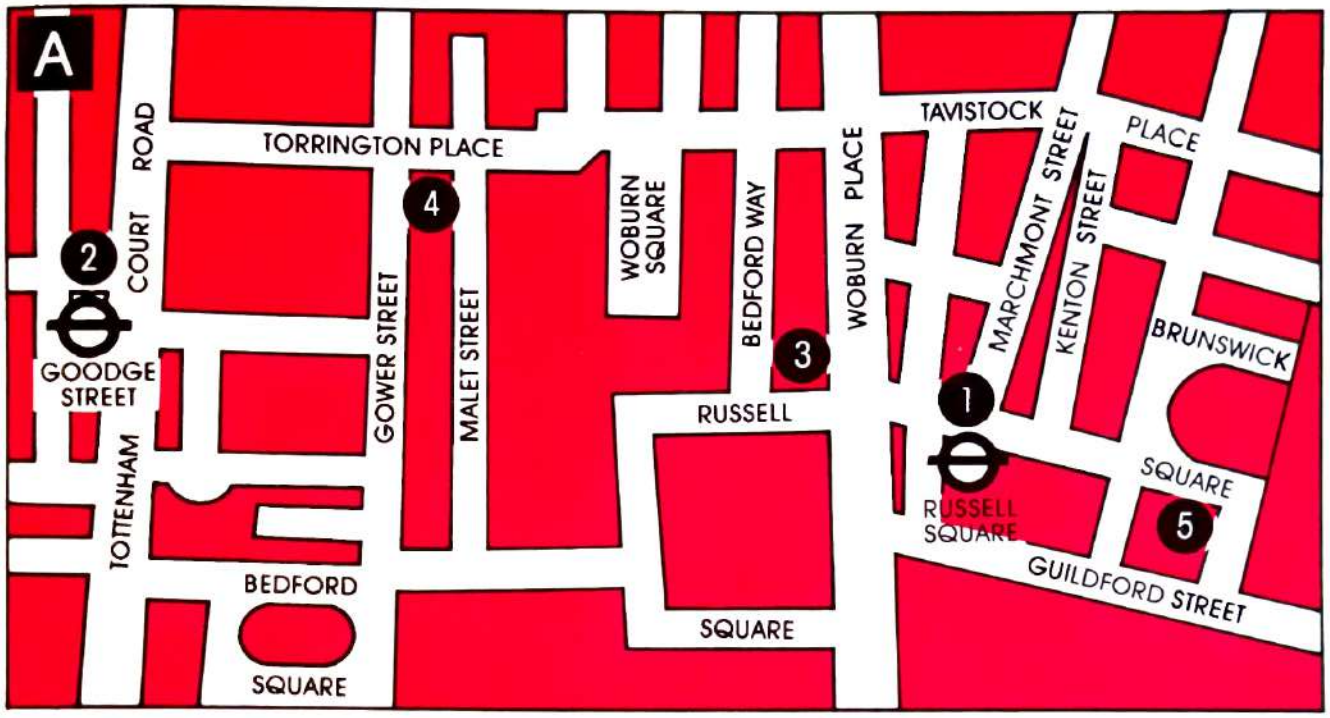
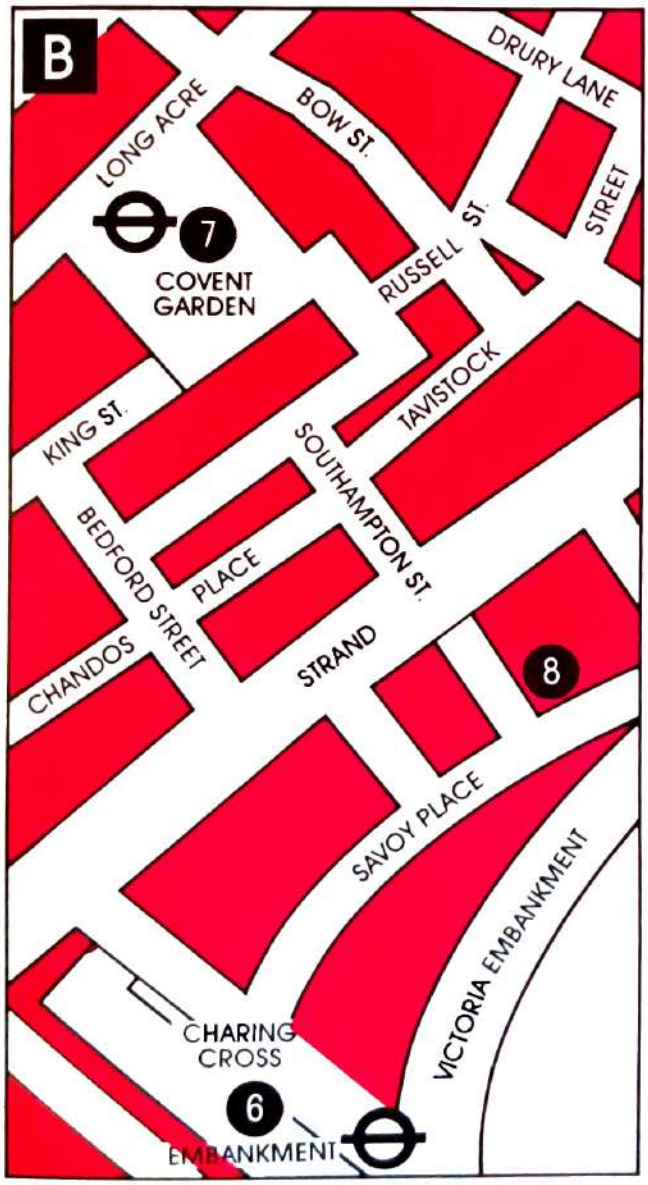
The resident staff of the Science Forum is selected from former participants. Membership of the staff team is by invitation only.





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

MAP C (Marble Arch Area)

9 Marble Arch Underground Station (Central Line)
10 CARISBROOKE HALL

PROGRAMME OF EVENTS

Wednesday, 27 July

Arrivals
Welcome & Orientation in Hall of Residence

Thursday, 28 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, 29July

Half Day Visits to Research & Industrial Establishments
20.00 Student Topics at University College, London

Saturday, 30 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, 31 July

09.00 Optional Day Excursions to
(a) Stonehenge and Salisbury
(b) Portsmouth
20.00 Feature Film in College Hall
Tootsie

Monday, 1 August

10.00 Specialist Lectures*
14.15 Lecture/Demonstration*
'Ion Channels in Health & Disease'
20.00 Student Topics at University College, London

Tuesday, 2 August

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

Wednesday, 3 August

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'

Thursday, 4 August

08.00 Day visit to Oxford and Cambridge
Morning: Visits to University and Research Establishments
Afternoon: Free

Friday, 5 August

10.00 Specialist Lectures at University College London
14.15 Seminars led by Former Participants at University College London
20.00 International Cabaret at Carisbrooke Hall

Saturday, 6 August

10.00 Lecture/Demonstration*
'Musical Squares'
14.15 Inter Hall Rounders Match in Regent's Park
Optional Theatre Visits

Sunday, 7 August

09.00 Optional Day Excursions to
(a) Hampton Court & Windsor Castle
(b) Brighton
20.00 Feature Film in College Hall
'Blazing Saddles'

Monday, 8 August

10.00 Day Forum*
'Water and Life'
20.00 Songs of Home – Folk Songs in College Hall

Tuesday, 9 August

10.00 Participants' Forum*
14.15 Lecture/Demonstration*
'The Immune System and its Involvement in Cancer Diagnosic, Therapy & Management'
16.15 CLOSING CEREMONY
20.00 Farewell Disco at the Carisbrooke Hall

Wednesday, 10 August

Departures

**Events marked thus take place at the Institution of Electrical Engineers, Savoy Place, London WC2*

PRINCIPAL LECTURES & DEMONSTRATIONS

Thursday 11.00 OPENING CEREMONY
28 July

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

Principal Address
The Rt Hon John Smith, MP
Leader of the Opposition

Thursday 14.15 *'Hello, who do we have here?'*
28 July Dr David Lowe, MB BS MD FRCPath
Department of Histopathology
St Bartholomew's Hospital Medical College, London

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 contain 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 analyses, and blood grouping for participants to try their detective skills. The six ways of defining sex will all become apparent.

Saturday 10.00 *'Thunder and Lightning'*
30 July Dr T Frank Palmer, BSc PhD
Department of Chemistry, University of Nottingham

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 material 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 process is call INCANDESCENCE. By contrast many materials can, under certain conditions, emit light without heat and this cold light 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 *phosphorescence* will be defined. Commercially important luminescence materials such as optical brighteners will be shown. A classification of luminescence will be given and electro-luminescence, bioluminescence and chemiluminescence will be introduced by simulations and demonstrations.

Monday 14.15 *'Ion Chanels in Health and Disease'*
1 August Professor Brian Harvey, BSc PhD DSc
Director Cellular Physiology Research Unit
University College, Cork, Ireland

Ion channels are large proteins which span cell membranes to form pores which allow ions to flow passively into and out of cells. Ion channels are like tiny batteries which can create electrical potentials by discharging current through the membrane resistance. The electrical current generated by the opening of ion channels is essential to life. For example, the initiation of the heart beat depends on the opening and closure of Na^+, Cl^-, Ca^{++} and K^+ channels in strict temporal sequence. Many genetic diseases have their basis in ion channel dysfunction. Cystic fibrosis (CF) is an example of particular relevance to Europe and North America (where approx 1 in 2,000 people carry the mutant CF gene). CF is a fatal disease and is caused by a defect in a Cl^- channel in cells of the lungs, pancreas and intestine.

This lecture will discuss why ion channel function is essential to life and the presently available options and future therapeutic possibilities for correcting ion channel dysfunction in disease.

Wednesday 3 August — 20.00 *'Chemisty and Light'*

Dr Andrew Mills, BSc PhD GRSC
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 everday 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.

Saturday 6 August — 10.00 *'Musical Squares – Adventures in Sound'*

Dr Mike Gluyas, BSc PhD and Mrs. Wendy Gluyas, BA CertEd DipTEFL
formerly of the University of Salford

'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 sound of the human body – are used throughout the lecture to highlight the features and uses of sound and hearing! Several 'on the spot' experiments and demonstrations are also performed and some of these involve the participation of (volunteer) members of the audience!

Monday 8 August — 10.00 DAY FORUM: *'Water and Life'*
presented by Severn Trent Water Ltd

Professor Gerald Noone, MBE PhD FIWEM
Director of Marketing, Severn Trent Water Ltd, Birmingham
Visiting Professor School of Civil Engineering, University of Newcastle upon Tyne

Severn Trent Water is the major business within Severn Trent plc group of companies and is the fourth largest water company in the world. Set in the heart of England, it is the second largest water untility in Britain, operating an integrated quality drinking water and sewage treatment service, serving the daily needs of over eight million customers. Seven Trent plc provides a service to over fifteen million customers worldwide. The company has a workforce of ten thousand and a turnover in excess of £1 billion.

Cleaning water to the highest international standards is a day to day accepted practice within the company. Returning cleaned water to the river basins of the Severn and Trent demands that the company has a vital environmental role to play. In carrying out its work the company recognises the important contribution that science and engineering make as innovative disciplines, however, must be tempered by society and the needs of the comunity and customers. The needs of employees must also be nurtured and be the subject of care.

The morning session will outline how technical achievement and innovation support the company's aims and objectives. The afternoon will be devoted to engaging your minds in applying a range of skills to unravel problems which will exercise your ability both as leading scientists and as citizens of tomorrow.

Tuesday 9 August — 14.15 *'The Immune System and its involvement in Cancer Diagnosis, Therapy and Management'*

Dr Richard O'Kennedy, BSc MIBol, MIBioll DipFS DipCS
Head of School of Biological Sciences
Dublin City University, Ireland

The immune system is a vital party of the body's defence mechanism, that detects and destroys disease and removes *worn out* components. Recent advances in research on cancer have high-lighted 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 anitbodies can be produced, labelled with drugs, toxins or pharmaceuticals and targetted to tumours. It is also possible to produce a range of antibody derivatives that may provide novel ways of detecting tumour-related molecules, secreted by cells, which have been characterised and may act to destroy or inhibit tumor growth. By combining basic knowledge of the molecular events occuring 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
1 August

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.'

Appoximations 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 properites 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?' and 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, drop to very low levels. Nerves which contain serotonin become broken and abnormally swollen. Since many thousands of young people reguarly 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 British Toxicology Society

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

Friday 10.00
5 August

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
St Christopher's Hospice, Sydenham, London

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 - polethylene 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 organised by ICI Group R&T Affairs, Middlesbrough.

ICI

All of these Lectures take place at
The Department of Engineering, University College London, Torrington Place, London WC2

SEMINARS

Wednesday 14.15
3 August

Seminar 1 *'David Edward Hughes, FRS - Radio Waves and the Microphone'*
Ralph Barrett, CEng, MIEE, MIERE

In 1879 David Hughes would have been found walking the pavement near London's Oxford Circus, holding an earphone to his ear. Using a needle and a coke detector he was listening to signals from a clockwork interrupter sending device, 500 yards distant, in his Victorian house. It was the world's first radio transmission.

Hughes had discovered radio waves nearly twenty years before Marconi. 'The whole atmosphere would have a momentary invisible charge, which became evident if a microphonic joint was used as a receiver with an earphone.'

The Globe newspaper recorded 'Hughes's experiments were virtually a discovery of Hertzian waves before Hertz, of the coherer before Branly, and of wireless telegraphy before Marconi. The clock had been held back twenty years.'

London born, American educated, Hughes invented a synchronous printing telegraph which made him his fortune. He then devoted himself to science, and after settling in London in 1857 he invented the instrument he named the microphone. 'It does for sound what the microscope does for vision.' He invented the metal detector, it was used to look for the bullet in President Garfield's body.

With numerous demonstrations, we will look at the work of Hughes and the principles of his inventions.

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 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 strored 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, Stain 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 mundane household practice.

3M

Seminar 5 *'Drug Delivery to the Lungs'*
Dr T S Purewal, BSc(Hons) MRPharmS PhD MBA
3M Health Care Ltd, Loughborough, Leicestershire

The treatment of ailments such as Asthma and Bronchitis is a major area of activity within the Pharmaceutical Industry. The design of the medicines used to treat Asthma involves many different scientific disciplines. This seminar will present a short overview and then focus on some of the scientific/engineering aspects involved in the design and development of one type of medicine, namely the pressurised metered dose inhaler (MDI). This medicine currently depends on the use of chlorofluorocarbon chemicals (CFCs.) The implications of the international ban on CFC usage on the MDI will also be discussed.

This Seminar has been arranged by 3M Health Care Ltd

Seminar 6 Neurocomputation within the Visual System
Amir Raz, MSc
Weizmann Institute of Science, Rehovot, Israel

Believe nothing you see and half of what you hear!
I am especially fond of this adage as it brings out a good point about vision and the brain. What does it mean, to see? The plain man's answer would be, to know what is where by looking. In other words, vision is the process of discovering from images what is present in the world, and where it is. Vision is therefore, first and foremost an information processing task, but we cannot think of it just as a process. For if we are capable of knowing what is where in the world, our brains must somehow be capable of representing this information – in all its profusion of colour, form, texture, motion and other details. We are remarkably visual animals. Much of our conception of the world and our memory of it is based on sight. But how do we perceive visual images? How do we detect the movement of these visual images in space? What line of computation does the brain lead in order to recognize a familiar face? We shall examine research that is addressed to these questions. In particular we will come to realise that it is possible to be motion-blind, and that there are blind individuals who can actually see!

This Seminar has been arranged by the Biochemical Society

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

Friday 14.15
5 August

These seminars are conducted by former participants of the Science Fourm

Seminar 1 *'Molecular Studies of Human Genetic Disease'*
Lourdes R Desviat, BSc PhD (Participant in 1983)
Centro de Biologica Molecular, Universidad Autonoma Madrid, Spain

Genetic human diseases can derive from a multitude of molecular lesions. Single gene disorders can be analysed when cloned material from that gene has been obtained, or if the chromosomal location of the gene is known and closely linked markers are available. A gene can be disrupted in many ways. Coding regions may be altered, promotor and other regulatory sequence may be disturbed or processing signals such as splice sites may be modified. Therefore the variety of techniques for mutation detection is very wide. In this respect the polymerase chain reaction (PCR) has revolutionised the practice of molecular biology. This in vitro method of nucleic acid synthesis enables the specific amplification of a targeted segment of DNA and its versatility and power have encouraged its involvement in almost every aspect of human genome research.

In this Seminar we will focus on the way genetic disorders (sickle cell anemia, ß-thalassemia, cystic fibrosis etc) are studied, reviewing both methods that recognise specific mutations as well as scanning methods for the detection of new mutations. The medical applications of these studies and the goals of the Human Genome Project will be discussed.

Seminar 2 *'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 representaion 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 behavious 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 3 *'Aviation Medicine - Effects on Man During Flight'*
Mark Xuereb (Participant in 1988)
Undergraduate Medical Student, University of Malta

Ever since the Wright Brothers carried out their daring experiment to imitate birds, aircraft have evolved to become frighteningly sophisticated. This imposes heavy demands on the pilots and crew. Such aircraft create new hazards which aviation medicine attempts to counteract. Researchers continue to devise 'g' suits, helmets, oxygen systems etc for both civilian and military situations. Pilots are thus adequately equipped to perform well in the airborne environment. There is still much to be explored, especially when dealing with the special senses during flight and aviation psychology. Without aviation medicine, flying aircraft would mean certain death to the pilot. (Tom Cruise and Kelly McGillis are invited should they wish to fly high again in 'Topgun 2'.)

Seminar 4 *'Business and Science: The Unholy Alliance?'*
Nigel L Lee, MEng(Hons) acgi MBA CIM (Participant in 1984)
Business Manager, Dwr Cymru plc

What do we think about when we think about business? Towering glass office blocks, Wall Street and Gorden Gecko, pin striped shirts and outrageous salaries?

Think again! Fifty years ago a letter travelled by ship form London to Tokyo. Today the Mitsubishi Corporation headquarters receives 4.5 million words every day from around the world. Scientific development and new technology change every facet of life. Consumer electronics sophisticated 16 valve engines, optical fibres, computer aided design, even the humble washing powder is the product, and victim of frantic innovation.

What role does business play in these innovations? For every one product that reaches the market place as a success, between sixty and one hundred ideas and concepts will be rejected. Even when a product makes it 'to market' the chance of it failing is around 40%. So why bother with 'New Product Development (NPD)' at all?

Victor Hugo once stated *'Nothing in the world is so powerful as an idea whose time has come'*. Understanding and improving the line between the laboratory and the market place has ***never*** been so important.

In the seminar we will discuss the process of 'New Product Development' and its relation to business strategy. We will talk about the management of the NPD process by drawing on many examples in a variety of industries, and together we will identify the problems along the tortuous path from test tube to test market.

Seminar 5 *'Water Use in Hill Slope Agroforestry Systems - Problems and Possibilities'*
Nicholas Jackson, BA(Hons) MSc PhD British Council Research Fellow. (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. 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 Kenya, looking at potential uses of such species in improving productivity and water use efficiencies. The project in question comprises a mixed tree-crop system on sloping land in central Kenya. The long-term sustainability of mixing trees and crops at this scale is being investigated. The problems of implementing scientific recommendations at a local level will be discussed in the seminar.

Seminar 6 *'At the Speed of Light'*
L James St Ville, MA CEng MIEE (Participant in 1984)

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.

Many researchers are looking at methods of including gain, modulation and processing using optical technology alone. Devices such as the distributed feedback laser Mach-Zehnder interferometer, Fabry-Perot etalon and the digital optical switch are the building blocks of these systems.

The Seminar will be looking at the state of current technology. We will enter into a discussion as to the limitations of electronics in composition with optics and will ask if the electronic computer will soon become obsolete.

HALF DAY VISITS TO INDUSTRIAL, RESEARCH AND UNIVERSITY ESTABLISHMENTS

Friday, 29 July

British Broadcasting Corporation,
BBC Television Centre
British Gas plc, South Eastern Gas, Croydon
City University Department of Aeronautics and Mechanical Engineering
Imperial College of Science, Technology & Medicine
Department of Biochemisty
Department of Chemical Engineering
King's College London
Chelsea Department of Pharmacy
Department of Biophysics
National Institute for Medical Research, Mill Hill
Royal Botanic Gardens, Kew
Royal Naval College Greenwich
Department of Nuclear Science & Technology
Royal Hospital of St Bartholomew's Medical College
Department of Histopathology
University College London
Department of Chemistry
Department of Electrical & Electronic Engineering
Zoological Society of London, Institute of Zoology,
Department of Veterinary Science

DAY VISITS TO INDUSTRIAL AND RESEARCH ESTABLISHMENTS

Tuesday, 2 August

Esso Petroleum Company Ltd/Exxon Chemical Ltd
Esso Refinery, Fawley, Hampshire
Nuclear Electric, Dungeness, Kent
Pfizer Ltd, Sandwich, Kent
Royal Air Force, Institute of Aviation Medicine,
Farnborough, Hampshire
Royal Marsden Hospital, Sutton, Surrey
The Exploratory, Bristol, Avon
Rutherford Appleton Laboratory, Didcot, Oxfordshire
Seven Trent Water Ltd, Birmingham
Smith Kline and Beecham, Welwyn, Hertfordshire
University College London
Mullard Space Science Laboratory,
Holmbury St Mary, Dorking, Surrey
Unilever Research Port Sunlight Laboratory,
Wirral, Merseyside

VISITS TO OXFORD AND CAMBRIDGE

Thursday, 4 August

Cambridge

University of Cambridge
Department of Chemisty
Department of Engineering
Department of Physics, Cavendish Laboratory
Physiological Laboratory

British Antartic Survey

Oxford

University of Oxford
University of Botanical Gardens
Department of Engineering Sciences

Oxford Scientific Films Ltd

Details of the above visits are included in the Notes for Participants enclosed separately.
Participants should select which visits they wish to attend and indicate their preferences on the form provided.

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 presentaion times will be circulated at the beginning of the Science Forum.

Friday, 29 July

20.00 University College London
Engineering Building, Torrington Place,
London WC1
Lecture Theatres: G6, 421, 422, 508

Monday, 1 August

20.00 University College London
Engineering Building, Torrington Place,
London WC1
Lecture Theatres: G6, 421, 422, 508

TOPICS FOR TONIGHT

Friday, 29 July

21.00

COLLEGE HALL

INTERNATIONAL HALL

Informal discussions led by Science Forum Staff

'A Brave New World?'
Introduced by Rhian Hayward, BSc

'Life – what is it, and why?'
Introduced by Ewan Jack, BSc

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, 3 August

10.00 Natural History Museum: Life Space Galleries
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, 28 July

20.00 Welcome Disco
Carisbrooke Hall, Seymour Street, London W2

Saturday, 30 July

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

Sunday 31 July

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

Friday 5 August

20.00 International Cabaret
Carisbrooke Hall, Seymour Street, London W2

Saturday, 6 August

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

Sunday, 7 August

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

Monday, 8 August

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

Tuesday, 9 August

20.00 Farewell Disco
Carisbrooke Hall, Seymour Street, London W2

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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 £2 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 under £9 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 Sixth London International Youth Science Forum 1994.

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37th LONDON INTERNATIONAL YOUTH SCIENCE FORUM
26 July to 9 August, 1995