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PREM 19/3157

MT.

PART TWO

NEW FILE COVER

CONFIDENTIAL FILING.

Public Seminars / Reception on Science, Technology and Industry

Chequers Seminar

SCIENCE AND TECHNOLOGY

PT1: March 1983

PT2: March 1984

Referred to	Date	Referred to	Date	Referred to	Date	Referred to	Date
~~1.3.88~~							
~~16.5.88~~							
~~21.2.89~~							
~~3.5.89~~ PA							
~~19/7/89~~							
~~10.8.89~~ PA							
~~21.9.89~~							
~~5.9.90~~							
~~26.9.90~~							
1.10.90							

Series CLOSED.

PREM 19/3157

Published Papers

The following published paper(s) enclosed on this file have been removed and destroyed. Copies may be found elsewhere in The National Archives.

The Genghis Khan Guide to Business
Cash Flow Handbook
Brian Warnes MA FCA
Published June 1985 Osmosis Publications
ISBN 0-9509432-1-2

Signed _____ Date 8/10/2016

PREM Records Team

SIR JOHN FAIRCLOUGH'S FAREWELL

Appointed Chief Scientific Adviser from IBM in 1986
Initially for two years. Invited to stay on.
Served 4½ years in all.
Many changes and achievements in that time.

- Has focused on way Science and Technology are managed within Government

- Sought to strengthen the Science Base, in particular by identifying priorities and releasing money from near market research

- Major role in setting up Government Research Establishments as Next Steps Agencies.

- Set up regular assessment of research and development by departments

- Reconstituted Advisory Board for Research Councils

- Sought greater integration of science and technology advice into wider policy making

- Promoted more effective international collaboration.

No doubt that the science budget is much better organised and much better managed than when took over. Professor Stewart will be delighted to inherit these changes.

Wish Sir John well, in particular at Oxford Instruments.

FILE

KW

cc John Reynolds
ACOST Secretariat

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

2 October 1990

Dear Dr. Winter,

Thank you very much for your presentation at our seminar on 28 September. I very much enjoyed learning about the progress you have made in the engineering of proteins by genetic manipulation and the problems associated with both the clinical trials and exploitation of the results. I wish you every success in this research which is likely to be of immense benefit to so many people.

The seminar was a great success and I am grateful to you for the trouble you took in preparing your contribution. You are expert in communicating your work & its results.

Yours sincerely

Margaret Thatcher

Dr. Greg Winter

FILE

KW

cc Acost Sec.

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

2 October 1990

Dear Dr. Evans

Thank you very much for your presentation at our seminar on 28 September. I very much enjoyed learning about the novel materials and fabrications you have been working on which explore the properties of a negative poisson ratio. I wish you every success in this research which I am sure will lead to many exciting applications.

The seminar was a great success and I am grateful to you for the trouble you took in preparing your contribution.

Yours sincerely

Margaret Thatcher

Dr. Kenneth Evans

L

TILE KW

cATCOST See.

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

2 October 1990

Dear Dr. Mason

Thank you very much for your presentation at our seminar on 28 September. I very much enjoyed learning about the experiments you have been undertaking on atomic collision physics. I wish you every success in this research which should increase our understanding of atmospheric physics.

The seminar was a great success and I am grateful to you for the trouble you took in preparing your contribution.

Yours sincerely

Margaret Thatcher

Dr. Nigel Mason

FILE

cACOST See.

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

2 October 1990

Dear Dr. Efstathiou,

Thank you very much for your presentation at our seminar on 28 September. I very much enjoyed learning about the progress you have made in trying to understand the nature of the universe. I wish you every success with this work.

The seminar was a great success and I am grateful to you for the trouble you took in preparing your contribution.

Yours sincerely

Margaret Thatcher

Dr. George Efstathiou

FILE KW

a ALOST See

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

2 October 1990

Dear Professor Gani,

Thank you very much for your presentation at our seminar on 28 September. I very much enjoyed learning about the progress you have made when gaining an understanding of how enzymes control their catalytic chemistry. I wish you every success in this research at your new department in St. Andrews.

The seminar was a great success and I am grateful to you for the trouble you took in preparing your contribution.

Yours sincerely

Margaret Thatcher

Professor David Gani

D

T1LE

cc ACOST Sec.

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

2 October 1990

Dear Dr. Davies

Thank you very much for your presentation at our seminar on 28 September. I very much enjoyed learning about the research you have been doing on the details of genetic and physical mapping of the human X chromosome. I wish you every success in this research which will be of immense benefit in understanding the problems associated with the fragile X syndrome.

The seminar was a great success and I am grateful to you for the trouble you took in preparing your contribution.

Yours sincerely

Margaret Thatcher

Dr. Kay Davies

c:\pps\seminar
(MEM)

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

MR. J. REYNOLDS,
CABINET OFFICE

YOUNG SCIENTISTS SEMINAR

You asked for advice on the terms in which those attending the seminar could discuss it publicly. I think the best guidance is to adopt "Chatham House" rules. Participants are allowed to acknowledge the existence of the event, to discuss the ground covered and to report their contribution. They can also report points made by others but should not attribute those to named individuals.

ANDREW TURNBULL
1 OCTOBER 1990

D85

R29/9

ACOST
Advisory Council on Science and Technology
70 Whitehall, London SW1A 2AS
071-270-

Qh 0833

FIle No. ST 310/10

The Rt. Hon. Margaret Thatcher MP
The Prime Minister
No.10 Downing Street
London
SW1A 2AA

September 1990

Dear Prime Minister

I would like to thank you for your hospitality at the seminar on 28 September. Speaking to everybody afterwards, it was clear that both the ACOST members and the young scientists very much enjoyed the occasion and appreciated the time and interest you devoted to it. I am sure that it will be a great boost to the scientists and their research teams.

I look forward to you chairing the ACOST Council meeting on 14 November at 3pm.

Yours ever,
Robin Nicholson

SIR ROBIN NICHOLSON

Secretariat:
Telephone 071-270 0105
Telex 27582 CABOFF G
Fax 071-270 0302
Prestel 21 999 3466
Gold 74:SKK 319

GR
PC type these letters

Qh 0832

File No. ST 310/10

MR TURNBULL **September 28, 1990**
10 DOWNING STREET

YOUNG SCIENTIST SEMINAR

1. Speaking to the scientists after the seminar they all greatly appreciated the Prime Minister's interest and hospitality and found the day most enjoyable. I attach draft letters of thanks for the Prime Minister to send to each of them.

2. The scientists were asked not to talk about the seminar before today. Can you please advise if it would now be in order for them to discuss the seminar in scientific fora and to the responsible scientific press. We would instruct them to restrict themselves to general comments and in no circumstances to report views expressed by the Prime Minister and others present.

JOHN REYNOLDS

SEMINAR WITH YOUNG SCIENTISTS

FRIDAY 28 SEPTEMBER 1990

AGENDA

10.00	Opening remarks by the Prime Minister and the Chairman of ACOST
10.05	**Dr Greg Winter** Antibody engineering
10.45	**Dr Ken Evans** Novel materials
11.25	Coffee
11.40	**Dr Nigel Mason** Collision physics
12.20	**Dr Kay Davies** Human genetic disease
13.00	Lunch
14.30	**Professor David Gani** Enzymology
15.10	**Professor George Efstathiou** Astronomy
15.50	Closing remarks

PRIME MINISTER

YOUNG SCIENTISTS SEMINAR

The seminar, which will be held in No.12, will follow closely the successful format last year. The running order of the presentations is at Flag A and notes on the six presenters at Flag B. Each session has 40 minutes allocated to it which should allow around 10-15 minutes for questions.

In your introductory remarks you probably need to do no more than

- welcome the participants

- welcome Sir Robin Nicholson, appearing for the first time, in Downing Street at least, as Chairman of ACOST

- express the value of hearing at first hand about developments going on at the frontier of science almost as they are happening.

You can then invite Sir Robin Nicholson to say a few words. He will introduce the new members of ACOST, Professor Brady, Sir Martin Wood and Dr Nigel Horne.

A few biographical details on some of the people you will meet at lunch - proposed seating plan at Flag C

- Dr Greg Winter who will make the first presentation and who, it is proposed, should sit next to you at lunch is Deputy Director of the Interdisciplinary Research Centre in Protein Engineering at Cambridge. Professor Keith Peters invited you to visit it and you have agreed subject to finding a suitable date. This is most likely to be in the Christmas or Easter vacations. Some notes on the Centre are at Flag D.

- Dr Nigel Mason is the son of Sir John Mason.

- Dr Kay Davies is married to Dr Stephen Davies who gave the brilliant presentation last year on left-handed and right-handed molecules using 3-D slides.

- Professor Gani is the youngest Professor of Chemistry in the country, having been appointed at the age of 32. He has an unusual career, having worked for Wellcome Research Laboratories for four years before starting his first degree.

Friday is Sir John Fairclough's last day as Chief Scientific Adviser. It would be much appreciated if you were to say a few words of thanks at lunch. I attach at Flag E some notes about his work for you to draw on.

This would be an appreciative audience for the piece about Administratium. The text is attached at Flag F.

AT

Andrew Turnbull
26 September 1990

c:Young (MJ)

Ref. A090/2199

MR TURNBULL

Sir John Fairclough's Departure

You asked for information on Sir John's achievements as Chief Scientific Adviser, to enable the Prime Minister to say a few words of farewell over lunch at the seminar on Friday. I --- attach a note of the main areas where Sir John has made a particular contribution, and also a copy of his 'Who's Who' entry, and the Press Notice issued on his appointment. After leaving the Cabinet Office, Sir John will be taking up a non-executive directorship with Oxford Instruments.

Sonia Phippard

MISS S C PHIPPARD

26 September 1990

Sir John Fairclough's Contribution

Has focused on the organisation and management of Science and Technology both within Government and in the Science Base.

Particularly keen to see a strengthening of the Science Base together with the development of mechanisms for transfer of Science and Technology from Higher Education Institutions to industry and the promotion of international collaboration.

Because of personal background particularly interested in the development of telecommunications and optoelectronics.

Achievements:

Domestic

Near-market review that released money for Science Base.

Setting up of Government Research Establishments as Next Steps Agencies: His moves to:

i) introduce rigorous customer-contractor principles into the commissioning of intramural research and provision of Science and Technology support services;

ii) promote competition between the Government Research Establishments and other public sector laboratories in order to create an 'internal market'

have become embodied in what are now widely known as the Fairclough Guidelines.

Programme of reviews of the assessment of research and development by departments.

Reconstitution of the Advisory Board for the Research Councils with clearer role.

Latterly has been concerned to see that there is greater integration of Science and Technology advice into wider policy making.

International

Has been at the forefront of advocating increased international collaboration eg satisfactory outcome of new EC Framework Programme.

The present excellent relationships with France, Germany and Japan on S&T issues owe much to his efforts - these are demonstrated not in intangible terms but by those countries contributing real money to large facilities and other international projects.

The signs that the US are becoming more internationally minded on S&T issues owes not a little to John's persuasive efforts at high level within the Administration.

FAIRCLOUGH, John Whitaker, FEng, FIEE, FBCS; Chief Scientific Adviser to Cabinet Office, since 1986; *b* 23 Aug. 1930; *m* Margaret Ann; two *s* one *d*. *Educ:* Manchester Univ. (BScTech). Ferranti, 1954; IBM: Poughkeepsie Lab., US, 1957; Hursley Lab., UK, 1958; Director of Development, IBM UK Ltd, 1964; Asst Gen. Manager and Dir Data Processing IBM UK, 1968; Dir, Raleigh Development Lab., USA, 1970; System Develt Div. Vice Pres., Raleigh, USA, 1972; System Communication Div. Vice Pres. and Man. Dir, Director of Development, Hursley Lab., UK, 1974; System Product Div. Vice Pres. and Man. Dir, Hursley Lab., UK, 1982; Dir of Manufacturing & Development, IBM UK Ltd, and Chm, IBM UK Laboratories Ltd, 1983. Mem., Engineering Council, 1982–. Pres., BCS, 1987. Hon. DSc: Southampton, 1983; Cranfield, 1987; Manchester, 1988. *Recreations:* gardening, carpentry. *Address:* The Old Blue Boar, St John's Street, Winchester, Hants.

TEXT OF PRESS NOTICE (issued at the time of appointment)

The Prime Minister has approved the appointment of Mr John Fairclough to be Chief Scientific Adviser, Cabinet Office, in succession to Sir Robin Nicholson FRS, with effect from 1 May 1986.

NOTES FOR EDITORS

John Whitaker Fairclough CEng, FIEE, FBCS (aged 55) was educated at Manchester University, where he became a Bachelor of Science and Technology. He joined IBM(UK) in 1957 and became Director of Development in IBM(UK) in 1964. After various other appointments in IBM he became Director of Manufacturing and Development in IBM(UK) and Chairman of IBM(UK) Laboratories Ltd in 1982. He is a member of the Engineering Council.

Mr Fairclough will come to the Cabinet Office on secondment from IBM(UK) Ltd for a period of two years in the first instance, with the possibility of extension by mutual agreement [extended to April 1990 - Sir John then agreed to stay on to September 1990]

Qh 0830

File No. ST 310/10 September 26, 1990

MR TURNBULL
10 DOWNING STREET
cc Sir John Fairclough
Dr Lumley

SEMINAR WITH YOUNG SCIENTISTS: 28 SEPTEMBER

1. I attach the information from last year's seminar on Dr Steven Davies, who is Dr Kay Davies's husband.

2. Professor Brady's christian names are John Michael and he is Head of Engineering Science at the University of Oxford. I am sorry for the confusion over this. At the start of the seminar I expect Sir Robin Nicholson will wish to introduce the new Council members to the Prime Minister. In addition to Professor Brady the new members attending are Sir Martin Wood and Dr Nigel Horne.

3. Dr Greg Winter is Deputy Director of the Interdisciplinary Research Centre for protein engineering at Cambridge, which is due to start work in mid October. I understand that Professor Keith Peters has invited the Prime Minister to open this. As Dr Greg Winter is likely to be sitting next to the Prime Minister at lunchtime, I attach some information on the new IRC.

JOHN REYNOLDS

Encl.

Qh 0828

MRS SUSAN GOODCHILD
10 Downing Street

25 September 1990

YOUNG SCIENTISTS SEMINAR

I attach a draft lunch seating plan for your consideration. This includes suggestions made by Sir Robin Nicholson.

We have assumed that the format for the introductory remarks and presentations will be the same as last year. The scientists have been briefed to talk for thirty minutes, which will be followed by ten minutes for discussion. It is assumed that questions during the presentation will be restricted to points of clarification.

I understand that you do not require any further briefing material. However, you may wish to note the following:

- it is Sir John Fairclough's last day in Cabinet Office;

- Dr Nigel Mason is Sir John Mason's son;

- Dr Kay Davies is married to Dr Stephen Davies who gave a presentation last year;

- and, Professor Gani is the youngest Professor of Chemistry in the country, which is particularly noteworthy as he worked for Wellcome Research Laboratories for four years before starting his first degree.

JOHN REYNOLDS

Enc

LIST OF GUESTS ATTENDING THE YOUNG SCIENTISTS SEMINAR ON FRIDAY, 28 SEPTEMBER 1990 AT 10.00 AM FOLLOWED BY LUNCH

The Prime Minister	
Rt Hon Kenneth Clarke, MP	
Dr Ken Evans	Department of Materials Science & Engineering, University of Liverpool
Dr Greg Winter	The Laboratory of Molecular Biology, Cambridge
Dr Nigel Mason	Department of Physics and Astronomy, University College, London
Dr Kay Davies	Molecular Genetics Group, Institute of Molecular Medicine John Radcliffe Hospital, Oxford
Professor David Gani	Professor of Organic Chemistry, University of St Andrews
Professor George Efstathiou	Savilian Professor of Astronomy, University of Oxford
ACOST	
Sir Robin Nicholson	Chairman, ACOST. Director, Pilkington plc
Professor C. Llewellyn Smith	Chairman of Physics, University of Oxford
Professor Roy Anderson	Department of Pure and Applied Biology, Imperial College of Science Technology and Medicine
Dr David Smith	Consultant
Sir Martin Wood	Deputy Chairman, Oxford Instrument Groups plc
Professor Gareth Roberts	Director of Research, Thorn EMI
Dr Nigel Horne	Management Consulting Partner, Peat Marwick and McLintock
Professor J.M. Brady	Head of Engineering Science University of ~~Liverpool~~ Oxford
Dr David Lumley	ACOST Secretariat
Mr John Reynolds	ACOST Secretariat
Cabinet Office	
Sir John Fairclough	Chief Scientific Adviser
Professor W.D.P. Stewart	Sir John Fairclough's successor

Department of Education and Science

Mr John Caines

10 Downing Street

Mr Andrew Turnbull

Mr George Guise

DRAFT SEATING PLAN FOR LUNCH ON FRIDAY, 28 SEPTEMBER

Mr George Guise

Dr David Lumley	Sir John Fairclough
Professor Gareth Roberts	Dr. Nigel Horne
Professor David Gani	Professor George Efstathiou
Professor Roy Anderson	Professor Michael Brady
Dr Greg Winter	Professor Bill Stewart
THE PRIME MINISTER	Rt Hon Kenneth Clarke
Sir Robin Nicholson	Dr Kay Davies
Dr Ken Evans	Professor Christopher Llewellyn Smith
Mr John Caines	Dr Nigel Mason
Sir Martin Wood	Dr David Smith

Mr Andrew Turnbull Mr John Reynolds

ENTRANCE

NAME: GREG WINTER MA, PhD, FRS

AGE: 39

ADDRESS: Medical Research Council
Laboratory of Molecular Biology,
Hills Road,
Cambridge, CB2 2QH

TEL: 0223 402284
FAX: 0223 412178

EDUCATION: BA - Trinity College, Cambridge 1973;
PhD-MRC Laboratory of Molecular Biology (University of Cambridge) 1976

RESEARCH FIELD: Engineering of proteins by genetic manipulation, particularly of antibodies as novel therapeutic reagents.

TOPIC FOR SEMINAR: ANTIBODY ENGINEERING

The properties of a protein (or enzyme) are dictated by its linear sequence of amino acids. This sequence can be readily altered by manipulating the DNA of their genes, helping us to understand how proteins (and enzymes) work, and to introduce new properties to the proteins. We have applied this approach to antibodies. Antibodies are natural therapeutic proteins present in serum used to kill invading viruses and bacteria. They bind to the invader and flag it for destruction. Antibodies can be raised by immunisation, and in 1976 Cesar Milstein (at the Laboratory of Molecular Biology) devised a way of making cell lines that secrete mouse "monoclonal" antibodies (of a single specificity) in tissue culture, making available a wide range of mouse antibodies with exquisite specificity to human pathogens and even cancer cells. Unfortunately humans recognise the mouse antibodies as foreign, so limiting their therapeutic potential. We have therefore tried to humanise mouse antibodies. Working with the genes, we grafted the antigen binding site from a mouse antibody to a human antibody and so built a "human" antibody that kills white cells (with potential to treat lymphoma and arthritis).

However the power of gene technology also offers entirely new prospects for making antibodies. Not only can we hope to harvest antibody genes from humans and build them into antibodies, but also to build artifical immune systems that make human antibodies.

NAME: KENNETH EVANS BSc, PhD

AGE: 35

ADDRESS: Department of Materials Science & Engineering
University of Liverpool
P.O. Box 147
Liverpool
L69 3BX

TEL: 051-794-5370 (direct) or 051-794-4661
FAX: 051-794-4675

EDUCATION: BSc-Imperial College, London University, 1977
PhD-Cavendish Laboratory and Trinity College, Cambridge University, 1980

RESEARCH FIELD: Materials engineering, in particular the mechanical properties of materials and the development and fabrication of novel material microstructures to improve mechanical performance.

TOPIC FOR SEMINAR: MATERIALS WITH A NEGATIVE POISSON RATIO

Usually, when a material is stretched it also becomes thinner. The Poisson ratio is a measure of how much a material thins down whilst being stretched. If a material becomes thinner it has a positive Poisson ratio (for example, rubber has a Poisson ratio of 1/2, steel of about 1/3). However, if a material becomes fatter whilst being stretched it has a negative Poisson ratio. Although it is theoretically possible for a material to have a negative Poisson ratio no such material had been seen; until very recently.

The study of the Poisson ratios of different materials has received very little attention, despite the fact that it is as fundamentally important in determining the mechanical properties of a material as, for example, the stiffness. Changing the Poisson ratio also changes many of the other important mechanical properties; such as flexural stiffness, indentation resistance and toughness.

During the last three years novel material microstructures have been produced that exhibit a negative Poisson ratio. Fabrication routes are now being developed (so far on the laboratory scale) to produce novel plastics, foams and composites. Novel chemical synthesis routes should also lead to a range of other new materials. The potential for materials exhibiting this unusual property will be examined and examples given from structural, aerospace and biomedical engineering applications.

NAME: NIGEL JOHN MASON Bsc, PhD

AGE: 28

ADDRESS: Department of Physics and Astronomy
University College London
Gower Street
LONDON
WC1E 6BT

TELEPHONE: 071-380-7140
FAX: 071-380-7145

EDUCATION: BSc University College London 1989
PhD University College London 1987

RESEARCH FIELD: Experimental atomic collision physics with special emphasis on:

The study of electron-atom collisions in the presence of strong laser fields; and

the production by electron impact of metastable atomic/molecular species of aeronomical interest.

TOPIC OF SEMINAR: ELECTRON COLLISION PHYSICS

Electron scattering from atoms and molecules play an important role in many diverse areas of modern physics. Our undertanding of the physics of planetary and stellar atmospheres, including those of the earth and the sun requires a detailed knowledge of a greater variety of scattering processes. There is currently a dearth of data on electron impact dissociative excitation of the aeronomically important molecules O_2, CO_2, N_2O and O_3. Recent experiments to determine the cross sections for such processes and the kinetic energy spectra of dissociative fragments will be reviewed.

Further advances in our understanding of the electron-atom collision process have become possible through the combination of highly monochromatic electron beams and intense lasers. Novel experiments to study the three body excitation process known as simultaneous-electron photon excitation will be described and possible future progress discussed.

NAME: KAY ELIZABETH DAVIES MA, DPhil

AGE: 39

ADDRESS: Institute of Molecular Medicine,
John Radcliffe Hospital,
Headington, Oxford OX3 9DU

TELEPHONE: Work: 0865 752403 Home: 0865 58318
FAX: 0865 752500

EDUCATION: Somerville College
Oxford University

BA Chemistry 1973
DPhil, Biochemistry 1976,

RESEARCH FIELD: The application of DNA recombinant technology to human genetic disease. The major effect of the research programme is directed towards the molecular analysis of the human X' chromosome. This has involved detailed genetic and physical mapping of the human X chromosome.

TOPIC FOR SEMINAR: MOLECULAR ANALYSIS OF THE FRAGILE X SYNDROME

The fragile X syndrome is the most common genetic form of mental retardation after Down's syndrome affecting 1 in 1000 males. The mutation is characterised cytogenetically by the introduction of a fragile site at Xq27.3 in lymphocytes of affected patients after growth under thymidine stress. In addition to mental retardation, the affected patients have long faces, large ears and large foreheads and 80% of the males show macro-orchidism. The disorder has presented problems for the genetic counsellor because it is not inherited in a normal X-linked recessive manner. Normal males may transmit the mutation and there is a deficit of affected males amongst their sibs. Daughters of normal transmitting males are almost never mentally retarded and express only low levels of the fragile site.

Although the localisation of the fragile X mutation has been known for almost two decades, the isolation of many sequences close to the fragile site and the identification of the mutation itself has so far eluded scientists using standard reverse genetics approaches. We have recently developed novel strategies to analyse the fragile site. We are optimistic that these approaches will lead to the identification of the genetic basis of this important form of mental retardation in the near future. We are also using these novel methods to make a contribution to the international effort to construct a map of the whole human genome.

NAME: PROFESSOR DAVID GANI, BSc, DPhil, CChem, MRSC

AGE: 32

ADDRESS: Department of Chemistry
The Purdie Building
The University
St. Andrews, Fife KY16 9ST

TELEPHONE: 0334 76161 ext. 8213

FAX: 0334 78292

EDUCATION:

1974-78	Full-time employment at Wellcome Research Laboratories; part-time ONC in Science at Croydon Technical College.
1978-83	BSc Chemistry by thesis (first class Honours and prize) at the University of Sussex.
1981-83	DPhil in organic chemistry at the University of Sussex.

RESEARCH FIELD: Chemistry: physical and chemical basis for biological specificity, enzyme mechanism, medicinal chemistry, biomimetic chemistry and protein engineering.

TOPIC FOR SEMINAR: ENZYMIC CATALYSIS: CONTROL OF REACTION SPECIFICITY

Enzymes, nature's catalysts, are exquisite in their specificity and their efficiency. Although enzymes are no longer considered to be black boxes in which somehow a substrate is converted into a product, much still needs to be learned of how enzymes control their catalytic chemistries. Understanding the mode of action of enzymes is becoming to be, and will be even more so in the future, of paramount importance in designing highly specific inhibitors for use in the pharmaceutical and agrochemical industries as drugs, insecticides and herbicides. High specificity ensures less risk of side-effects in the use of drugs and less damage to the environment in the use of insecticides and herbicides.

Looking to the future, harnessing a complete understanding of enzyme mechanism will allow the rational design of new enzymes, engineered to fulfil a diverse array of user-defined objectives.

The seminar will use our recent work on different groups of coenzyme B_6 dependent enzymes to illustrate how reaction specificity might be achieved. Methods for probing the mechanisms of the enzymes will be out-lined and the usefullness of this information, within the context of the overall catalytic process, will be assessed. The chemical and evolutionary differences between these enzymes will be highlighted and problems in attempting to test hypotheses will be considered. The challenges of designing new enzymes rationally with specific catalytic abilities will be put into perspective compared to the present state of the art, and some possible shortcuts to designing enzymes will be discussed.

NAME: GEORGE EFSTATHIOU BA PhD
Savilian Professor of Astronomy
University of Oxford

AGE: 35

ADDRESS: Department of Physics
Nuclear Physics Laboratory
Keble Road
Oxford OX1 3RH

TEL: 0865 273300 (Direct)
0865 273302 (Secretary)

EDUCATION: BA-University of Oxford 1976
PhD-University of Durham 1979

RESEARCH FIELD: Cosmology and galaxy dynamics with special interests in the formation of cosmic structure

TOPIC FOR SEMINAR: STRUCTURE IN THE UNIVERSE

Astronomers and particle physicists have joined forces in recent years to try and understand the nature of the Universe. At first sight, this might seem an unlikely alliance since particle physicists traditionally study matter on the very smallest scales while astronomers study the Universe at large. However, it is now clear that the main characteristics of our Universe were determined just after the Big Bang, when the Universe was very small and the typical energies of particle reactions were many orders of magnitude larger than those achieved in the largest particle accelerators on Earth.

My research has developed along two lines. I have used ideas from particle physics to develop theoretical models for the formation of the hierarchy of structures in the Universe - galaxies, clusters of galaxies and clusters of clusters. More recently, my group at Oxford has mapped the large-scale distribution of galaxies in the Universe using several different techniques, including a photographic survey of over 2 million galaxies. To our great surprise we have found that the Universe contains much more structure than we had expected. One possible explanation of our results follows from an old idea of Einstein's which, if true, would have important consequences for theories of particle physics.

INTERDISCIPLINARY RESEARCH CENTRE FOR PROTEIN ENGINEERING
University of Cambridge

Greg Winter is the Deputy Director of the Cambridge IRC for protein engineering which will start work in October. In 1989 the Medical Research Council was awarded £5.9 M by the ABRC to set this up. The Director is Professor Alan Fersht who pioneered the engineering of enzymes with Greg Winter in 1982.

The aims of the IRC are to build on the discoveries of Fersht and Winter, to make new discoveries in the field, to train young scientists in protein engineering, and to aid the transfer of technology to Cambridge University Departments and to Industry. There will be two thrusts for protein engineering in the IRC - synthetic and analytical. Firstly to make new proteins, as exemplified by antibodies and other protein architectures. Secondly to use protein engineering to make small changes in proteins to dissect and understand the way in which proteins work and fold (in particular to dissect receptors for neurotransmitters as this may help in design of new drugs).

The MRC has leased and refurbished laboratories close to the Laboratory of Molecular Biology. After installation of NMR facilities and computers, and contributing to shared facilities of X-ray crystallography, the IRC has a running budget of about £800K pa for the next three years. There is sufficient space for about 50 workers and the IRC is looking for further external funds. Several companies will fully support some posts (ICI, Parke Davis Research, Glaxo, in total £400 K pa) as well as the Cancer Research Campaign (£70 K pa).

JOURNAL OF THE WINNING TEAM
J.E.E.P.

NEWS THAT DID NOT MAKE THE DU PONT NEWS NETWORK

DU PONT DISCOVERS NEW ELEMENT

The heaviest known element known to science was recently discovered by Du Pont physicists. The element, tentatively named Administratium, has no protons or electrons and thus has an atomic number of 0. However, it does have 1 neutron, 15 senior vice neutrons, 60 vice neutrons, 125 assistant neutrons, and 111 assistant vice neutrons. This gives it an atomic mass of 312. These 312 particles are held together in a nucleus by a force that involves the continuous exchange of meson-like particles called morons.

Sine it has no electrons, Administratium is inert. However, it can be detected chemically as it impeded every reaction it comes in contact with. According to discoverers, a minute amount of Administratium caused one reaction to take over 4 days to complete when it would normally occur in less than one second.

Administratium has a normal half life of approximately 3 years, at which time, it does not actually decay but instead, undergoes a reorganization in which the assistant neutrons, vice neutrons, and assistance vice neutrons exchange places. Some studies have shown that the atomic mass actually increases after each reorganization.

Research at other laboratories indicated Administratium occurs naturally in the atmosphere. It tends to concentrate at certain points such as government agencies, large corporations, and universities and can usually be found in the newest, best appointed, and best maintained buildings.

Scientists point out Administratium is known to be toxic at any level of concentration and can easily destroy any productive reaction where it is allowed to accumulate. Attempts are being made to determine how Administratium can be controlled to prevent irreversible damage, but results to date are not promising.

Submitted by:
Unknown Source

A.T.

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

MS. LYNN ANDREWS
ACOST SECRETARIAT
CABINET OFFICE

SEMINAR FOR YOUNG SCIENTISTS AT NO.10: 28 SEPTEMBER 1990

Thank you for your letter of 4 September about the agenda for the Seminar later this month. I have had a word with Andrew Turnbull about this and we agree that it might be better to have lunch later, and have only two presentations in the afternoon. This would also mean that the break for tea would not be necessary and would free-up some more time for the presentations. You will of course want to reserve your position on the order of the presentations until after ACOST has held a rehearsal, since last year it was only after such a rehearsal that you were able to be confident of the best sequence. It may also be that once you have the benefit of a rehearsal ACOST may advise that the logic of the sequence of presentations would point to an earlier lunch; but I suggest that we work on the basis of four presentations in the morning and two after lunch for the moment.

The ACOST Secretariat will of course be letting us know who from ACOST will be attending. As you know, the Prime Minister is anxious to keep numbers down and we agreed today that there would be no more than ten from ACOST present, including the ACOST Secretariat but excluding Sir John Fairclough and his successor. I think you know that the Prime Minister has invited Mr. MacGregor, Mr. Fallon, Mrs. Bottomley and Mr. Hogg and I am awaiting a reply from their offices. Also present will be Andrew Turnbull and George Guise from the Policy Unit.

As for last year's Seminar, I think we will need some notes on the scientists, in advance, perhaps touching on the universities at which they work, and giving a brief indication of the subject of their presentation. I think it would also be helpful if you were to circulate that briefing to everyone present, as you did previously. You would also wish to include in the briefing pack the agenda, once it has been agreed.

CAROLINE SLOCOCK
5 SEPTEMBER 1990

File

MR. GUISE

SEMINAR FOR YOUNG SCIENTISTS:

28 SEPTEMBER 1990

I have been copying you various papers for this Seminar and assume that you will be attending, as last year. If you have any briefing you wish to give the Prime Minister I am sure she would find it very useful.

CS

CAROLINE SLOCOCK

5 SEPTEMBER 1990

PRIME MINISTER (1)

SEMINAR WITH YOUNG SCIENTISTS, 28 SEPTEMBER

You have agreed to invite the scientists ticked on the attached list. 10 representatives from ACOST will be coming as well.

As far as Ministerial representation is concerned, you may like to invite:

- Mr John MacGregor and Mr Michael Fallon as the Ministers responsible for science;

- Mrs Bottomley, because of her Departmental interest in the work of Dr Greg Winter on the engineering of anibodies to treat human diseases and of Dr Kay Davies into the genetic causes of muscular dystrophy;

- and Mr Douglas Hogg, because of DTI's interest in the industrial applications of some of this work.

Content to do so?

CAS

Caroline Slocock
3 September 1990

YOUNG SCIENTISTS SEMINAR 1990:
SUGGESTIONS FOR POSSIBLE PARTICIPANTS

1. Dr Greg Winter (37)* ✓ Laboratory of Molecular Biology, Cambridge	Antibody engineering The engineering of antibodies to treat human diseases.
2. Prof David Gani (32)* ✓ Professor of Organic Chemistry, University of St Andrews (youngest UK chemistry Professor)	Enzymology The study of enzyme structure, how enzymes work and how new enzymes might be synthesized.
3.Professor George Efstathiou (34)* ✓ Savilian Professor, University of Oxford (and winner of 1990 Maxwell medal and Prize)	Astronomy The comparison of theoretical predictions for the distribution of galaxies with experimental observations leading to questions about the inflationary theory of the universe.
4.Dr Kay Davies (39)* ✓ Institute of Molecular Medicine, Oxford	Human genetic disease Molecular analysis of the human X chromosome and use of the results to study muscular dystrophy and fragile X syndrome and to contribute to work on human genome mapping.
5.Dr Ken Evans (35) ✓ Department of Materials Science & Engineering, University of Liverpool	Novel materials The development of novel materials which get fatter when stretched and which have a wide range of possible applications.

* particularly recommended

6. Dr Geoffrey Price (34)
Department of Geological Sciences, University College, London

Minerial physics
Properties of major mantle-forming minerals and the study of their effect on mantle dynamics, plate tectonics and planetary evolution. Also, as a spin-off, research into zeolite chemistry.

7. Dr Caroline Dean (33)
Institute of Plant Science Research, Norwich

Plant genetics
The use of molecular genetics to investigate how flowering is controlled in plants.

8. Dr David Stuart (36)
Laboratory of Molecular Biophysics, University of Oxford

Structure of viruses
The use of X-ray crystallography to define the structure of the foot and mouth disease virus and to study other virus structures including that of HIV.

9. Dr Nigel Mason (28)
Department of Physics, University College, London

Collision physics
The study of laser-assisted electron/atom collisions and of fundamental collision processes producing excited atoms and molecules.

10. Dr Michael Ferguson (33)
Department of Biochemistry University of Dundee

Carbohydrate chemistry
The analysis of carbohydrate chains attached to parasitic protozoa, contributing to work on the possible design of antiparasitic drugs for diseases such as African sleeping sickness.

File

PRIME MINISTER (1)

SEMINAR WITH YOUNG SCIENTISTS, 10.00-16.00, 28 SEPTEMBER

You have said that you want to hold another seminar of young scientists this year along the lines of last year's successful event.

ACOST have come up with the attached list of scientists who might be invited and suggest you choose six (the same number as last year). Those they particularly recommended have an asterisk by their name. I think you met Dr Kay Davies when you opened the Molecular Science IRC at Oxford last year. I would be grateful if you would put a tick beside those you would like to invite.

ACOST are wondering whether you would like to invite all the ACOST members this year (18-20 guests, including Sir John Fairclough, Professor Stewart and one member of the ACOST secretariat). Rather less than this came last year, and Sir Robin Nicholson has said he would select a smaller number from ACOST if you wanted to keep numbers down. Last year there were 10 representatives from ACOST; and I think it would help to keep the occasion informal and manageable if a similar number came this year.

Would you like to invite the Secretary of State for Education and Science and a small selection of other Ministers with direct interest in the subject matter of the presentations?

Content to invite six scientists again this year (please indicate which)?

Agree to invite about 10 people from ACOST?

Agree to invite Mr Macgregor and other relevant Ministers?

CAS

Caroline Slocock
24 August 1990

File

→ Caroline

I agree but I would add whichever of junior Ministers at DES handles Unions and Research Councils

~~Andrew~~

Do you have a view on which Ministers should be invited — the PM has already said she would like Mr MacGregor to be present and relevant Ministers. I would suggest Mr Hogg and Mrs Bottomley.

CAS 3/9

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

Mr. D.J.W. Lumley

SEMINAR WITH YOUNG SCIENTISTS, 28 SEPTEMBER

Thank you for your minute of 21 August to Andrew Turnbull, who is on leave.

I have consulted the Prime Minister on which scientists she would like to invite to the seminar and she has chosen the six which are ticked on the attached list. The Prime Minister would like to preserve the informal atmosphere of last year's seminar and because of this she would like to keep the numbers attending to as small as possible. In view of this she would be grateful if Sir Robin Nicholson would make a selection of no more than 10 people from ACOST to be invited to the lunch. I believe this was about the same number as were invited last year. The Prime Minister would like to invite a few Ministerial colleagues, namely the Secretary of State for Education and Science and Ministers who have a Departmental interest in the subjects covered by the presentations. Now that she has chosen the scientists she would like to attend I will consult her on the particular Ministers she would like to invite. Perhaps you could come back to me with a list of the members from ACOST who might be invited as soon as possible. In the meantime you will want to make approaches to the scientists I imagine, although we send out a formal invitation from No.10 in due course.

CASlocock

(CAROLINE SLOCOCK)

28 August 1990

CONFIDENTIAL

W0558

MR TURNBULL - No. 10

1 August 1990

SEMINAR WITH YOUNG SCIENTISTS

My minute of 17 July indicated that I would advise you definitely, before the end of July, on whether there would be time to prepare for a seminar on 28 September. On the basis of contacts with a number of possible candidates, I can now confirm that this date should be possible. We will put forward suggestions for the presenters and the guest lists as soon as possible.

SIR JOHN FAIRCLOUGH
Chief Scientific Adviser

CONFIDENTIAL

SCI + TECH:
Cheques Series
Pt 2

1. ABJ
2. CP

W0543

MR TURNBULL 17 July 1990

SEMINAR WITH YOUNG SCIENTISTS

Thank you for your minute of 4 July indicating that 28 September would be a possible day for a repeat of the kind of seminar held last autumn.

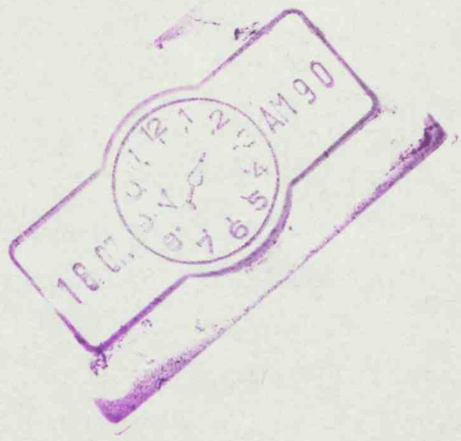
2. We are making arrangements accordingly and will put forward suggestions for the presenters and the guest lists as soon as possible. However, in order to formulate these suggestions the ACOST Secretariat will need to meet and talk to a range of possible candidates, for which there is very little time before the summer holidays. Although we hope 28 September will prove possible, there is therefore some risk that we may need to ask you to consider a later date. I will advise definitely on this, one way or the other, before the end of July.

John

SIR JOHN FAIRCLOUGH
Chief Scientific Adviser

Sci + TECH. Seminars PTL

18 OCT 1990



10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

SIR JOHN FAIRCLOUGH

SEMINAR WITH YOUNG SCIENTISTS

I have consulted the Prime Minister about repeating the kind of seminar held last autumn. She would be delighted to do this in more or less the same format, which she thought was very successful. Friday 28 September between 1000 and 1600 hours is a possibility.

Please could you put forward suggestions for the presenters and for the guest list.

ANDREW TURNBULL

4 July 1990

PRIME MINISTER

SEMINAR WITH YOUNG SCIENTISTS

Last autumn you held a seminar at which six young scientists made presentations on their research. Is this something you would like to repeat? If so, Sir John Fairclough is confident that another six good presentations can be found. One possibility would be Friday 28 September - a copy of the relevant page of the long-term diary is attached. Alternatively, this could be put on during the Christmas recess, though it might be a bit more difficult to get hold of people then.

Is this something you would like me to explore?
Do you prefer September or January?
Are you happy to reproduce the same format?

AT

September - same format.

Will really look forward to it.

ANDREW TURNBULL

3 July 1990

A:\pps\seminar (pmm)

NOT TO BE COPIED

COPY NO: 13

Friday 14 September

Keep free for speechwriting + BP
DEPART NO. 10
FINCHLEY

Saturday 15 September

? ATTEND BATTLE OF BRITAIN PARADE, WHITEHALL
c1315 BILL WALKER's BATTLE OF BRITAIN LUNCH - H/L

Sunday 16 September

ATTEND BATTLE OF BRITAIN REMEMBRANCE SERVICE - WESTMINSTER ABBEY
? DEPART FOR OVERSEAS

Monday 17 September-Saturday 22 September

OVERSEAS

Monday 24 September

1210 DEPART NO. 10
1220 ?RECEPTION AT INTERNATIONAL WOMEN'S FORUM CONFERENCE
1300 RETURN TO NO. 10
1600-1700 Sir Peter Lane + Area Chairmen + Officers of the National Union

Tuesday 25 September

Keep free for speechwriting
? NEWSPAPER PRESS FUND RECEPTION + BI
STATIONERS HALL

Wednesday 26 September

REGIONAL TOUR
WELSH CBI DINNER

Thursday 27 September

1030 Cabinet
?1530 President Museveni of Uganda
1830 Reception for North London Hospice + Joy

Saturday 29 September

? Lunch for Crown Prince of Thailand - Chequers

Wednesday 3 October

Keep free for speechwriting + JW
Lunch in flat

Thursday 4 October

1030 Cabinet
1730 OPEN THROMBOSIS RESEARCH INSTITUTE - CHELSEA
DINNER AT FISHMONGERS' HALL

Friday 5 October

Keep free for speechwriting + JW

From: G.H. Mallaband

Date: 11.1.90

Ms. Slocock.
No. 10 D/S.

I wonder if you can enlighten me about Dr. R.J. Nicholas's "presentation at Downing Street in September" for which, you will see from the attached copy minute, he may be somewhat aggrieved to have ~~received~~ been offered no fee!

I am content to answer the substantive point he makes about services to industry and the public sector, but it would be helpful to know something about the arrangements surrounding the September event.

A phone call would suffice.

Graham Mallaband

G.H. MALLABAND
Cabinet Office Finance Division.

PJA

I have spoken to Mallaband who will reply

G Mallaband
Finance 3
Room 70/2
GOGGS

From: M A Inness
Det: 10.1.90

Mr Mallaband

Regrettably, an incorrect vendor number was used and a payment was made to Dr R J Nicholas. He was kind enough to contact us in this regard and, although he banked our payable order, repaid us in full eventually.

He enquired, and I quote:

"I would be grateful if you would ascertain whether this payment was made erroneously by itself, or is it actually a substitution of one payment for another. I did in fact make a presentation at Downing St. in September, organised by the Cabinet Office, for which no payment has been made. It may be that this present government expects University academics to sell their services as consultants to Industry and other outside bodies, but with the proviso that government itself should not be expected to pay pro-rata for the same services. I would be grateful if you could explain this point to me."

I confirm that he was paid in error and no notification has been received in respect to a presentation at 10 Downing St.

I would be obliged to know if you wish to respond to the comments in Dr Nicholas' letter.

M A Inness.

M A Inness

File with papers on Science Seminar

10 DOWNING STREET

Prime Minister

Attached are two articles, one of them by Dr John Harvard who made a presentation at the Science Seminar.

Both reports indicate that the initial results point to there being only three families of particles, thereby confirming the Standard Model.

AT

NAME (inc degrees): **JOHN HASSARD PhD**

AGE: 33

ADDRESS: Blackett Laboratory
Imperial College
London
SW7 2BZ

TEL: 01-589-5111 ext 6780
FAX:

EDUCATION: BSc - Manchester University 1978
PhD - Manchester University 1981

RESEARCH FIELD: High energy particle physics, specialising in high energy electron/positron interactions and decays of heavy quarks.

TOPIC FOR SEMINAR:

I will introduce the LEP accelerator in the context of similar (but complementary) machines around the world, and its rôle in studies of the Standard Model of the universe. I will show how the physics 'reach' of an accelerator is not limited by its centre of mass energy, but how precision tests at machines like LEP will allow physicists to probe beyond the Standard Model and thereby throw light on the first fraction of a second of the universe itself.

European physicists narrow down the neutrinos in the Universe

David Dickson

PHYSICISTS at CERN, the European Laboratory for Particle Physics, said last Friday that they are now almost certain that only three families of neutrinos exist in the Universe. The first set of experiments on CERN's new accelerator, the Large Electron Positron (LEP), suggest that the chances of four or more families existing is now less than one in fifty.

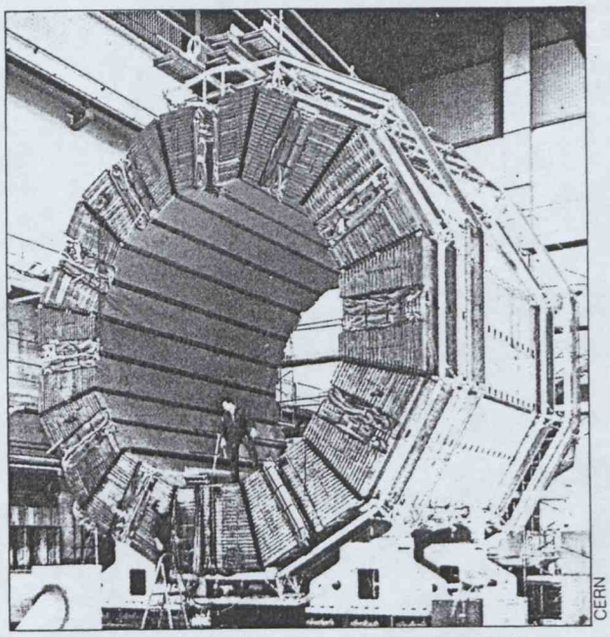
Neutrinos are thought to be stable elementary particles. Only three families of neutrino are known or suspected to exist—those associated with, respectively, electrons, muons and tau particles.

The physicists announced also that they had measured, with unprecedented accuracy, the mass of the Z^0 particle, itself discovered for the first time at CERN in 1983. The physicists observed 11 000 collisions between electrons and positrons—which produce Z^0 particles—in the first three weeks that the LEP operated. Analysis of the collisions suggests that the mass of the particle is 91·10 gigaelectronvolts (GeV, or a thousand million electronvolts), with a margin of error of 0·06 GeV.

Physicists at CERN presented both results at a crowded seminar in Geneva last Friday. Many of the 2000 scientists working with one of the LEP's four detectors had gathered to hear the details of results over the project's initial experimental period.

The first Z^0 particle was observed on 14 August, just four weeks after the machine had been switched on for the first time following a decade of construction. During the first three weeks of operation, 15 days were devoted to experiments in physics, and six to fine-tuning the machine.

Z^0 particles are produced when beams of electrons collide head on with beams of positrons (particles with the same mass as an electron, but having a positive charge). In the LEP, each beam had a variable energy of about 45 GeV and, over the initial experimental period, the precise energy of the collisions was set at seven separate values, from 89·25 to 93·25 GeV, allowing experiments at each of the four detectors to study the different rates at which the Z^0 particles were produced.



CERN

Accurate Aleph: the detector before installation

Each detector has different strengths and weaknesses. As a result, there had been intense speculation over which of the four—named Aleph, Delphi, L3 and Opal—would provide the most accurate conclusions from their initial experiments.

The laurels seem to have gone to Aleph, built and run through collaboration between scientists from universities and government research laboratories in seven countries, with a substantial contribution from British physicists.

Representatives of the team running Aleph said last Friday that, based on measurements of the width of the Z^0 particle, they had calculated the number of families of neutrinos to be 3·27, plus or minus 0·30. This means, according to physicists from Aleph, that the likelihood of there being more than three families of neutrinos is now less than 2 per cent.

The announcement by CERN came a day after physicists at the Stanford Linear Accelerator Center in California had announced a similar—but considerably less accurate—assessment (see Box).

While they recognise the technical achievements of the Californian team, scientists at CERN point out that the results from the Stanford Linear Collider (SLC), which is less powerful, are based on observations of only 500 Z^0 particles compared with 11 000 at CERN.

Physicists at CERN plan to increase the rate of production of Z^0s when the LEP starts up for its next run, and expected to approach 100 000 by Christmas. "SLC is finished now, at least as far as trying to compete with LEP is concerned," says John Ellis, the head of the theoretical division at the European laboratory. Ellis adds that, from a theoretical point of view, one of the most interesting prospects is a precise calculation of the number of neutrino families that are possible.

The LEP's success in pinning down the vital statistics of the Z^0 particle ahead of its American rivals comes at a time when CERN is already busy preparing plans for a new accelerator, known as a Large Hadron Collider. It would rival the US's planned Superconducting Super Collider—and would also be much cheaper. □

Academics in collision as Stanford says it was first

ON THE day before CERN's team announced its results, a rival group at Stanford University in California announced that it had already conducted experiments which showed that there were no more than three families of elementary particles. Scientists at CERN immediately accused the Stanford group of jumping the gun with inferior results, an accusation the Californians vehemently denied. CERN has done an excellent job of confirming the Stanford results, Michael Riordan, a spokesman for the group, told *New Scientist*.

Both groups are colliding beams of electrons and positrons—although with vastly different machines—in an effort to manufacture copious quantities of the Z^0 particle. By studying the decay of the Z^0, physicists expect to learn more about the fundamental types of matter.

The Stanford Linear Collider (SLC), with its radical design and nagging technical difficulties, is unlikely to produce 100 000 Z^0 particles until at least 1991, whereas the LEP is likely to produce this many by Christmas. So the discoveries that require a high degree of statistical significance for their validity will be made at the LEP.

But the physicists at Stanford say that they were the first to rule out the existence of four or more families of elementary particles with a confidence level of 95 per cent. They say that they announced this finding on 6 September in Madrid at a meeting of the European Physical Society. "We are not the Johnny-come-latelys in this," said Riordan.

The SLC began detecting Z^0s in April, about four months before LEP. This edge, although brief, is behind the claim that its announcement was not opportunistic.

Stanford delayed its press announcement until 12 October. The next day, the Californians sent a paper to *Physical Review Letters* and forwarded their results to CERN. The paper says that the chance of there being an extra family of quarks and leptons—the basic building blocks of matter—is less than one in 25. Because the experimenters in Geneva base their results on observations of many more Z^0s, they have narrowed the odds of a fourth family down to just one in 50, about half the margin of error of the results from America.

Scientists in California acknowledge that the LEP is likely to dominate the search for exotic particles, but they say that the tighter focus of the SLC's beams and the ability to polarise the electron beam will give their machine some important advantages. "We will find niches," said Gary Feldman, an experimental physicist at Stanford. These would include measurements of the mass of the Z^0 and the search for short-lived particles.

Burton Richter, the director of the Stanford Linear Accelerator Center, which houses the SLC, says his team will be well in the hunt for the top quark, the Higgs particle—the particle that is believed to provide the mass for all the other elementary particles.

Ian Anderson, San Francisco

THE GUARDIAN
Friday November 17 1989

The LEP accelerator is the biggest machine in the world and makes it possible to test conventional ideas on the creation of the universe. **John Hassard** explains the matter

Zappy families

WE HAD the official opening of our new accelerator, LEP, on Monday. The King of Sweden came, and the President of Switzerland; even Mr Mitterrand took time out from worrying about Germany to marvel at LEP's extraordinary engineering and our preliminary results.

The King and Presidents came to endorse our attempts to understand the very building blocks of the universe. Perhaps also significant for the statesmen and women who attended is the fact that particle physics is the best example of international collaboration towards profound goals and with technologies unrivalled in complexity outside the military arena.

The LEP accelerator is the biggest machine in the world (and probably also the most accurately made) and is the world's best tool for challenging what conventional wisdom says is the way the universe hangs together.

This model is unambitiously called the Standard Model, and describes the way the building blocks of nature — the quarks and leptons — are related, to each other and to the four known forces.

LEPers would like nothing better than to expose its weaknesses, find its flaws and, if possible, smash it to bits. It's more likely that we'll find something that says the Standard Model is OK as far as it goes, but is not the whole picture.

LEP will be a surgeon's scalpel to the Standard Model. Other accelerators take the blunderbuss approach; yet others the sledgehammer. LEP collides pin-thin bunches of electrons and their antiparticles to create bursts of energy. That energy is manifested in extraordinary numbers of the Z particle, a linchpin of the Standard Model.

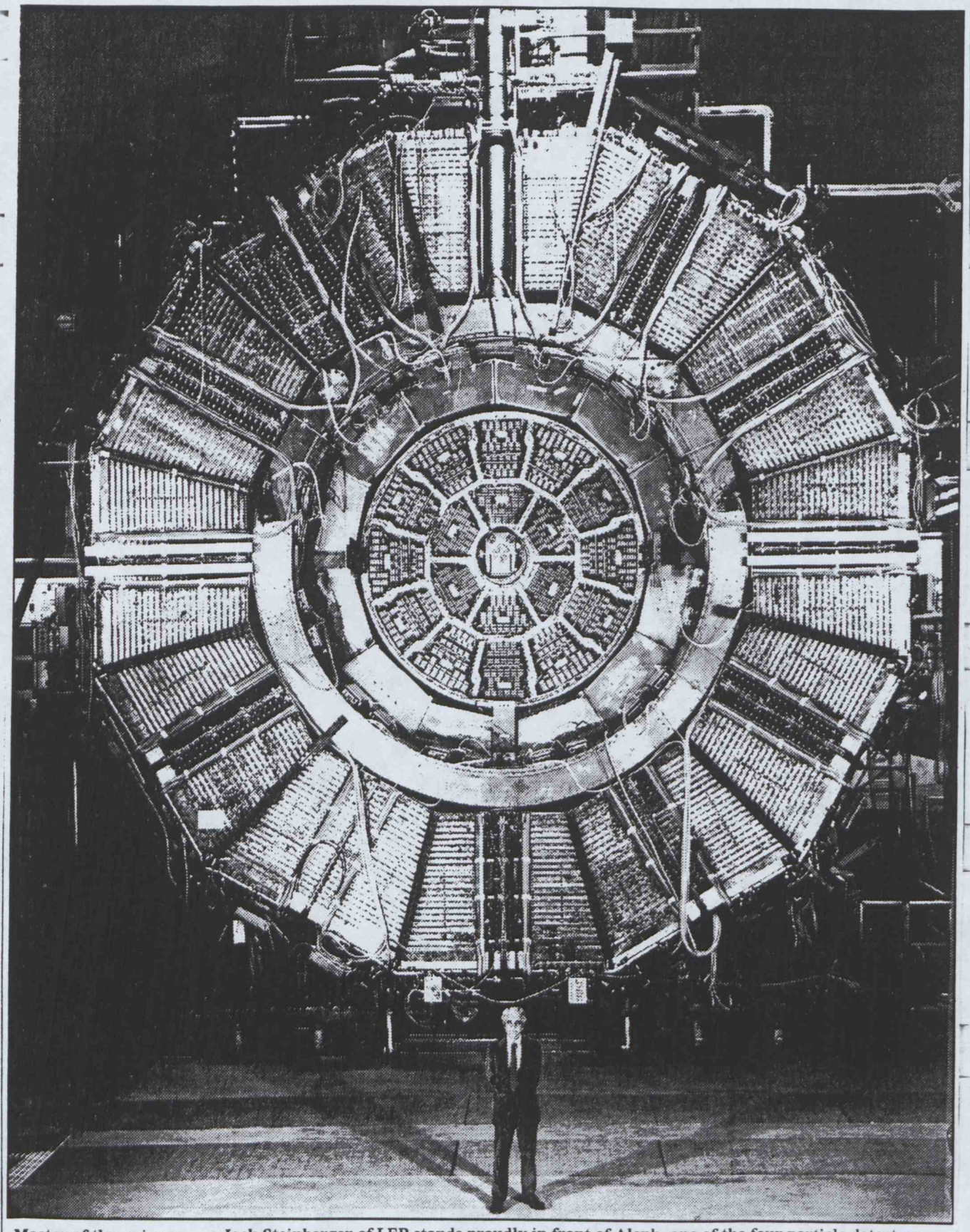
Already established, after being in operation for a couple of weeks, is the fact that there are likely to be only three families of the particles known as neutrinos in the universe. That information might not sound like it is worth the UK's £50 million investment, but it actually implies a lot. Physics relies on beautiful intellectual edifices which are dependent on symmetries. If there are just three families of neutrinos, then there are probably only three families of quarks. In other words, all visible matter, whether in Geneva or in the Crab Nebula, whether now, or a thousand millionth of a second after the Big Bang, belongs to one of these three families. In physics parlance, we say there are 3.2 + 0.3 families, meaning four are very unlikely.

Another result already out concerns the way that primeval bursts of energy turn into mass — how the universe began. The process is governed by Einstein's $E = mc^2$, certainly, but the precise process — known as hadronisation — is determined by a subject known as Quantum Chromodynamics. There have been many models over the past few years, the best of which were from the universities of Cambridge and of Lund in Sweden. Our first results suggest both have strong points, and our data will help the model builders in their next attempts.

What's next? We're going to have 10 million Zs by 1991. We'll surely keep tying down unknown quantities in the Standard Model. We may get a chance at seeing the particle some people think causes all mass in the universe. We have a shot at seeing the last missing quark, known as top. We'll study in depth the way leptons and quarks bind to the particles responsible for forces, and maybe the way they are related by a higher symmetry, known as supersymmetry.

For example, if in a few months' time we can say there are 3.2 + 0.01 families, then that will be interesting! Since a fractional number of families is impossible, it will tell us that We Do Not Understand. What makes up quarks? In the way atoms are made of nuclei and electrons, nuclei are made of protons and neutrons, and protons and neutrons are made of quarks, we might see substructure in quarks. Best of all, we'll get something not on this shopping list, something unexpected, something that gives us insight.

John Hassard of Imperial College is a physicist working on LEP.



Master of the universe . . . Jack Steinberger of LEP stands proudly in front of Aleph, one of the four particle detectors

Box 4

UNITED MEDICAL AND DENTAL SCHOOLS
OF
GUY'S AND ST. THOMAS'S HOSPITALS
(UNIVERSITY OF LONDON)

CF?

Paediatric Research Unit
The Prince Philip Research Laboratories

GUY'S TOWER,
LONDON BRIDGE, SE1 9RT
Telephone: 01-955 5000 Ext:
Fax: 01-407 1706

Martin Bobrow DSc MB BCh FRCP MRC Path
Prince Philip Professor of Paediatric Research

Our reference: AH/pem 01-955-4485

Date: Thursday 21 September 1989

Dear Prime Minister,

Thank you for your letter of 18th September 1989. I should like to tell you how much I enjoyed the Seminar on the 13th September and having the opportunity to present my work to you. I should also like to thank you for your hospitality on that day.

Yours faithfully,

Ann Harris

Ann Harris Ph.D

The Rt.Hon. Margaret Thatcher
The Prime Minister
10 Downing Street
LONDON SW1A 2AA

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

18 September 1989

Dear Professor Barrow.

Thank you very much for your presentation at our Seminar on 13 September. I very much enjoyed learning about the progress you have made towards determining the structure of the universe and wish you much success in the future for the dark matter experiment.

The Seminar was a great success and I am grateful to you for the trouble you took to make it so.

Yours sincerely

Margaret Thatcher

Professor John Barrow

SRW/MRM

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

18 September 1989

Dear Dr. Harris

Thank you very much for your presentation at our Seminar on 13 September. I very much enjoyed learning about the progress you have made in searching for the cause and possible treatment of cystic fibrosis. I wish you every success in this research which will be of immense benefit to so many people.

The Seminar was a great success and I am grateful to you for the trouble you took to make it so.

Yours sincerely

Margaret Thatcher

Dr. Ann Harris

SLW/MRM

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

18 September 1989

Dear Dr. Hassard.

Thank you very much for your presentation at our Seminar on 13 September. I very much enjoyed learning about the progress you have made in your experiments at CERN and wish you much success in the future for new discoveries in particle physics. Like you, I look forward with excitement to the results which may appear shortly.

The Seminar was a great success and I am grateful to you for the trouble you took to make it so.

Yours sincerely

Margaret Thatcher

Dr. John Hassard

File IAS

10 DOWNING STREET
LONDON SW1A 2AA

THE PRIME MINISTER

18 September 1989

Dear Sir Francis,

May I record my thanks to you and the ACOST Secretariat for arranging the Scientific Seminar. You did an excellent job in identifying such a talented group of scientists, working on so wide a range of subjects. It was most encouraging to learn at first hand of such high quality research at the frontiers of knowledge.

Thank you again for such a rewarding day.

Kind regards

Yours sincerely

Margaret Thatcher

Sir Francis Tombs

MRM

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

18 September 1989

Dear Dr. Davies.

Thank you very much for your presentation at our Seminar on 13 September. I very much enjoyed learning about the exciting progress you have made in establishing new scientific techniques for producing novel molecular compounds. I wish you much success in the future in this research which will be of important benefit to industry.

The Seminar was a great success and I am grateful to you for the trouble you took to make it so.

Yours sincerely

Margaret Thatcher

Dr. Stephen Davies

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

18 September 1989

Dear Dr. Nicholas,

Thank you very much for your presentation at our Seminar on 13 September. I very much enjoyed learning about the progress you have made in determining new crystal structures and wish you much success in the future for this work which should have considerable benefit for industry.

The Seminar was a great success and I am grateful to you for the trouble you took to make it so.

Yours sincerely

Margaret Thatcher

Dr. Robin Nicholas

SLW/MKM

10 DOWNING STREET

LONDON SW1A 2AA

THE PRIME MINISTER

18 September 1989

Dear Dr. Bibb,

Thank you very much for your presentation at our Seminar on 13 September. I very much enjoyed learning about the progress you have made in determining the potential for antibiotics based on streptomyces. I wish you every success in the future for this work.

The Seminar was a great success and I am grateful to you for the trouble you took to make it so.

Yours sincerely

Margaret Thatcher

Dr. Mervyn Bibb

SEW/MAM

REVISED

LIST OF GUESTS ATTENDING THE YOUNG SCIENTISTS SEMINAR ON WEDNESDAY, 13 SEPTEMBER 1989 AT 10.00 A.M. AND LUNCH

The Prime Minister	
Rt. Hon. Nicholas Ridley, MP	
Rt. Hon. John MacGregor, MP	
Mr. David Curry, MP	
Professor John Barrow	Astronomy Centre, University of Sussex
Dr. Mervyn Bibb	Institute of Plant Science Research, John Innes Institute
Dr. Stephen Davies	The Dyson Perrins Laboratory, Oxford
Dr. Ann Harris	Paediatric Research Unit, United Medical and Dental Schools
Dr. John Hassard	Blackett Laboratory, Imperial College
Dr. Robin Nicholas	Clarendon Laboratory,Oxford
Sir Francis Tombs	Chairman, Rolls Royce plc
Professor Roy Anderson	Department of Pure and Applied Biology, Imperial College of Science
Professor Thomas Blundell	Department of Crystallography, Birkbeck College
Dr. Peter Doyle	Director of Research and Technology, ICI
Mr. Ian Harvey	Chief Executive, British British Technology Group
Professor Sir David Phillips	Laborator of Molecular Biophysics, University of Oxford
Professor Keith Peters	Regius Professor of Physics, University of Cambridge, Clinical School
Sir George Porter	President, The Royal Society
Professor John Robertson	Department of Electrical Engineering, University of Edinburgh
Dr. Alan Rudge	Group Technology and Development Director, British Telecom
Dr. Clive Bradley	
Mr. Peter Finch	

Mr. John Fairclough	Chief Scientific Adviser, Cabinet Office
Mr. Andrew Turnbull	10 Downing Street
Mr. George Guise	Policy Unit, 10 Downing Street

Mr. Robert Jackson, MP attending the lunch only

REVISED DRAFT SEATING PLAN FOR LUNCH ON WEDNESDAY, 13 SEPTEMBER

Mr. George Guise	Mr. Peter Finch
Dr. Peter Doyle	Professor Roy Anderson
Dr. Mervyn Bibb	Mr. David Curry
Professor Keith Peters	Professor Tom Blundell
Dr. Ann Harris	Dr. Stephen Davies
Sir David Phillips	Sir George Porter
PRIME MINISTER	Rt. Hon. John Macgregor
Sir Francis Tombs	Dr. John Hassard
Rt. Hon. Nicholas Ridley	Professor John Robertson
Dr. John Barrow	Mr. Robert Jackson
Mr. John Fairclough	Dr. Robin Nicholas
Mr. Ian Harvey	Dr. Alan Rudge
Mr. Andrew Turnbull	Dr. Clive Bradley

ENTRANCE

CONFIDENTIAL

SEMINAR WITH YOUNG SCIENTISTS

WEDNESDAY 13 SEPTEMBER 1989

REVISED AGENDA

10.00	Opening remarks by the Prime Minister and the Chairman of ACOST
10.10	What is the Universe made of? **Professor John Barrow**
10.50	Coffee
11.10	Particle physics and the LEP accelerator **Dr John Hassard**
11.50	Band structure engineering **Dr Robin Nicholas**
12.30	Lunch
14.00	Development of a chiral auxiliary **Dr Stephen Davies**
14.40	Streptomyces **Dr Mervyn Bibb**
15.20	Tea
15.40	Cystic Fibrosis - towards an understanding of the basic defect **Dr Ann Harris**
16.20	Closing remarks

NOTE: To allow time for security checks and introductions you are requested to arrive by 09.45

CONFIDENTIAL

B

NAME (inc degrees): **JOHN D BARROW** BSc DPhil

AGE: 36

ADDRESS: Astronomy Centre
University of Sussex
Falmer
Brighton
BN1 9QH

TEL: 0273-606755 ext 3100
FAX: 0273-678097

EDUCATION: BSc - Durham University 1974
DPhil - Magdalen College, Oxford

RESEARCH FIELD: Cosmology

TOPIC FOR SEMINAR: WHAT IS THE UNIVERSE MADE OF?

The key to understanding the long-standing mystery of the identity of the dominant form of matter in the universe may be provided by new developments in particle physics. Conversely, astronomical observations are able to tell us important things about the elementary particle world which are not accessible to terrestrial experiments. A brief introduction to modern cosmology and these issues will be given.

NAME (inc degrees): **JOHN HASSARD** PhD

AGE: 33

ADDRESS: Blackett Laboratory
Imperial College
London
SW7 2BZ

TEL: 01-589-5111 ext 6780
FAX:

EDUCATION: BSc - Manchester University 1978
PhD - Manchester University 1981

RESEARCH FIELD: High energy particle physics, specialising in high energy electron/positron interactions and decays of heavy quarks.

TOPIC FOR SEMINAR:

I will introduce the LEP accelerator in the context of similar (but complementary) machines around the world, and its rôle in studies of the Standard Model of the universe. I will show how the physics 'reach' of an accelerator is not limited by its centre of mass energy, but how precision tests at machines like LEP will allow physicists to probe beyond the Standard Model and thereby throw light on the first fraction of a second of the universe itself.

NAME (inc degrees): **ROBIN NICHOLAS** MA DPhil

AGE: 35

ADDRESS: Clarendon Laboratory
Parks Rd
Oxford
OX1 3PU

TEL: 0865-272250 (Clarendon laboratory)
FAX: 0865-272400

EDUCATION: MA - Oxford University
DPhil- Oxford University

RESEARCH FIELD: Properties of novel low dimensional semiconductor heterostructures in high magnetic fields

TOPIC FOR SEMINAR: BAND STRUCTURE ENGINEERING

Modern techniques of crystal growth and microfabrication allow us to build new semiconducting materials and structures with completely new properties. The level of control has now reached the ability to deposit single layers of atoms. This allows us to look at 2-dimensional, 1-dimensional and 0-dimensional structures known respectively as quantum wells, quantum wires and quantum dots.

The electronic structure of these new building blocks can be studied, and we look at new ways to put them together, analogous to genetic engineering. Even more excitingly, new quantum phenomena appear which were previously unexpected from what was known of macroscopic structures.

NAME (inc degrees): **STEPHEN DAVIES** DPhil MA

AGE: 39

ADDRESS: Organic Chemistry Dept
Dyson Perrins Laboratory
South Parks Rd
Oxford OX1 3QY

TEL: 0865-275646
FAX: 0865-275674

EDUCATION: BA - Oxford University 1974
DPhil- Oxford University 1976

RESEARCH FIELD: Homochiral synthesis. A fundamental property of molecules is their ability (achiral molecules) or inability (chiral molecules) to be superimposed on their mirror images. The development of novel strategies for the synthesis of single enantiomers (left and right handed forms) of chiral molecules is of fundamental importance to the fine chemicals industry (pharmaceuticals, agrochemicals, polymers, electronic etc).

TOPIC FOR SEMINAR:

A chiral auxiliary has been developed which allows the construction of complex organic molecules via elaboration of attached small units. Extremely high degrees of stereochemical control may be achieved, resulting in the asymmetric synthesis of optically pure compounds (ie only left (or right) handed molecules are formed).

As well as being able to control the absolute stereochemistry of new chiral centres the auxiliary is also capable of recognising chirality already present in organic molecules. The recognition process involves the auxiliary reacting preferentially with one of the two enantiomers (left or right handed forms) of the substrate.

The design and mechanism action of the chiral auxiliary will be described and the implications for the chemical industry discussed.

NAME (inc degrees): **MERVYN BIBB** BSc PhD

AGE: 37

ADDRESS: Institute of Plant Science Research
John Innes Institute
Colney Lane
Norwich
NR4 7UH

TEL: 0603-52571 ext 2205
FAX: 0603-56844

EDUCATION: BSc - UEA, Norwich 1974
PhD - John Innes Institute, Norwich 1977

RESEARCH FIELD: Molecular biology and genetics of Streptomyces, with special interest in the regulation of gene expression and, in particular, the factors that elicit antibiotic production.

TOPIC FOR SEMINAR: STREPTOMYCES

Streptomyces are mycelial soil bacteria that undergo a complex process of morphological differentiation that normally results in sporulation. They also produce the vast majority of commercially useful antibiotics, including many compounds with important applications in medicine and agriculture. These include anti-infectives, anti-cancer agents, growth promoters, anti-parasitic agents, herbicides and agents for plant protection.

Despite the success of the pharmaceutical industry in developing new antibiotics, the need to provide new compounds with improved characteristics remains. In recent years it has become possible to isolate and manipulate genes involved in antibiotic production in these organisms. In addition to providing much-needed information on the biochemistry and regulation of antibiotic biosynthesis, gene cloning in Streptomyces can be used to effect improvements in yield and, perhaps more importantly, to produce antibiotics with novel structures and potentially improved activities. Examples of how gene cloning has been used to achieve both these goal will be described and prospects for the future beneficial manipulation of these organisms considered.

NAME (inc degrees): **ANN HARRIS** MA PhD

AGE: 32

ADDRESS: Paediatric Research Unit
United Medical and Dental Schools
Guy's and St Thomas' Hospitals
8th Floor
Guy's Tower
London SE1 9RP

TEL: 01-955-4485 or 01-955-5000 ext 2516
FAX: 01-407-1706

EDUCATION: BA - Oxford (St Hughes College) 1975-78
PhD - Paediatric Research Unit, Guy's Hospital Medical School 1978-81

RESEARCH FIELD: Human genetic diseases

TOPIC FOR SEMINAR: CYSTIC FIBROSIS - Towards an understanding of the basic defect

Cystic Fibrosis is the commonest genetic disease of its type, affecting about 1 in 2500 live births, hence some 350 CF babies are born each year in the UK.

It is eventually a lethal disease though many affected individuals now reach adulthood.

The most serious effects of CF are on the lungs and the pancreas and are caused by malfunctioning of the layers of cells lining the lungs and the ducts in the pancreas that carry digestive enzymes from the sites where they are made to the gut.

Furthermore, 97% of males with CF are sterile because they no longer have a vas deferens, the duct which carries sperm away from the testis. Disappearance of this duct is probably due to a similar abnormality in the layer of cells lining the duct.

We have developed systems to grow the cells lining the pancreatic ducts and the male reproductive ducts. These cells are being used to study the biochemistry, electro-physiology and molecular biology of the parts of the body directly affected by Cystic Fibrosis. In the long term they will provide ideal systems in which to understand how the CF gene defect works and, hopefully, to devise more efficient strategies for treating the disease.

A:SCIENTIS (PMM)

PRIME MINISTER

MEETING WITH YOUNG SCIENTISTS

You are attending a seminar tomorrow which will provide six younger scientists an opportunity to display work at the frontiers of ~~energy~~ science. This will complement your meetings with the Nobel Prize winners and with the professors you met at ACOST.

The programme - see Flag A - is arranged to progress from questions about the very existence of the universe through to issues of plant and animal disease.

On arrival at No.12 at 10 am, you will be met by Sir Francis Tombs who will introduce you to the speakers. You can then say a few words of welcome and set out the ground rules for the discussion. The format is that each speaker has been allotted 40 minutes about 25 of which will be taken up with the presentation, with the rest for questions and discussion. It is probably best to allow the speaker to go through without interruption other than for points of clarification. You will need to stick fairly closely to the timetable as you have another appointment at 1630. You may then want to invite Sir Francis to say a few words.

Also attached are:

Flag B-notes on the individual speakers.

Flag C-the participants. Lord Trafford is ill and will be unable to attend. I am in touch with the Department of Health to see if another Minister could attend the last session, dealing with cystic fibrosis.

Flag D-some notes by George Guise on CERN and on measuring the UK's scientific effort. Robert Jackson's letter at annex C is worth reading.

AT

ANDREW TURNBULL

12 September 1989

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

MR. CLIVE BRADLEY

CABINET OFFICE

SCIENTIFIC SEMINAR: 13 SEPTEMBER

The Prime Minister has now approved the attached agenda for Wednesday's seminar. I understand from Caroline Slocock that you have agreed to circulate this to those attending, and I should be grateful if you could now put this in hand.

You may also like to be aware that the Prime Minister has agreed that Mr. Robert Jackson (Parliamentary Under Secretary of State, Department of Education and Science) should attend the lunch, although he will not be attending all day.

PAUL GRAY

11 September 1989

PRIME MINISTER 8 September 1989

SCIENTIFIC SEMINAR

I attach some background information for next Wednesday's seminar.

1. CERN - INITIAL RESULTS FROM LEP

I visited CERN in early August, just after the LEP Collider had started initial operation. Everyone was very excited because the previous night a positron current of 0.6 milliamps had been achieved. This is the highest current of anti-matter ever achieved and the pulse lasted for several minutes. Since my visit, the electron beam has also been activated and collisions between electrons and positrons have taken place at energies of 45.5 Gev producing Z particles. (You will recall that W and Z particle detection provided the experimental confirmation for Salam's electroweak theory in 1983).

One of the early benefits from LEP should be an accurate measurement of the energy bandwidth over which Z particles decay. This should reveal any extra kinds of neutrino beyond the three already known and thereby settle a major theoretical debate. These are very early days and any such key discoveries made before the formal LEP opening ceremony on November 13 will probably be closely guarded for announcement then. You will recall that both John MacGregor and Robert Jackson are to represent the UK in November and indeed Rubbia invited yourself.

I shall however keep close to events and try to get advance warning if anything major is found, such as the Z bandwidth mentioned above. Longer term work on Higgs Particles and

supersymmetry will await the enhanced energy operation of the machine in future years.

The LEP construction project has been achieved on time and within the Swiss franc budget originally set. There is much trumpet-blowing about this but one statistic amazed me. The 27 kilometre length of tunnel, of similar diameter to the London Underground, has now been measured with enormous accuracy because the velocity of the particle beams is accurately known. This length is within 0.1 millimetres of the design figure - the thickness of a piece of tissue paper! I have never heard of a civil engineering project where such accuracy has been achieved.

A fuller note of my CERN visit is at Annex A. I also attach an article from the July NEW SCIENTIST on LEP by John Hassard who will be addressing us on Wednesday. It is an excellent read. Annex B.

2. UK EXPENDITURE ON SCIENCE

I also attach a letter from Robert Jackson at Annex C with some advance figures on international comparisons of academic research funding. I have always encouraged the DES to stop arguing input figures and look rather at outputs. Jackson's letter attempts to do this to some extent, pointing out that our share of scientific publications is still second only to the USA's. However, his argument goes back at the end to inputs.

It may be inevitable that any bureaucractic process trying to set spending levels which have no measurable return, such as basic science, can only take its yardstick from what others are doing. You, of course, have always said that the way to get the horse ahead of the cart is to identify the good people we have available and cost out the work which they

propose. This does not have to involve blank cheques. However great or esoteric a scientist may be, he can still identify what work he intends to carry out in the next three years and how much it is going to cost! The problem is that the research council machinery instinctively operates the other way around.

3. THE SPECIFIC SEMINAR PAPERS

They all look interesting and well worth the time. Apart from the physics work, I have not tried to expand on the detailed briefing on specific subjects.

GEORGE GUISE

ANNEX A

DISCUSSION WITH RUBBIA ON AUGUST 7TH

Inevitably, my conversation with Rubbia moved to the question of money and the importance of capitalising on LEP by building a hadron collider inside the same tunnel at a cost of Swiss Fr. 1.5 billion. Ideally, he would like to build it by 1996, starting in 1991 which would keep CERN ahead of the Americans who are to build the 60 mile SSC under Texas. I have warned Rubbia against putting forward this proposal unless he can guarantee a substantial part of the cost from the non-member countries who regularly use CERN.

One other financial point is worth noting. The Abragam savings can be achieved within the overall costs agreed last year. However this alone will not solve the rejuvenation problem at CERN. The average age at CERN is late forties and rising because of the cushy contracts which the incumbents enjoy. Rubbia is concerned at the scientific consequences of this and the importance of funding younger people while the hasbeens are working off their contracts. He has estimated that if he were allowed to pay redundancy money to the latter (UK contribution £8 million over three years), he could get the average age down considerably. He also claimed that this made long term economic sense because 60 year olds are far more expensive than 30year olds.

Although I showed no enthusiasm for any further expenditure, we should recognise that a oneoff payment to attack a structural problem often makes sense, whether it be the shipyards, British Steel or Rover!

More generally, Rubbia continues to impress me with the businesslike way he is dealing with CERN, so unlike his predecessor, Schopper. We should soon have a recommendation for a host country premium which France and Switzerland will hate! He is trying to buy more electricity from France at a third of the Swiss price despite great Swiss objection. He is also trying to instal a French telephone system which is more cost-effective and up to date.

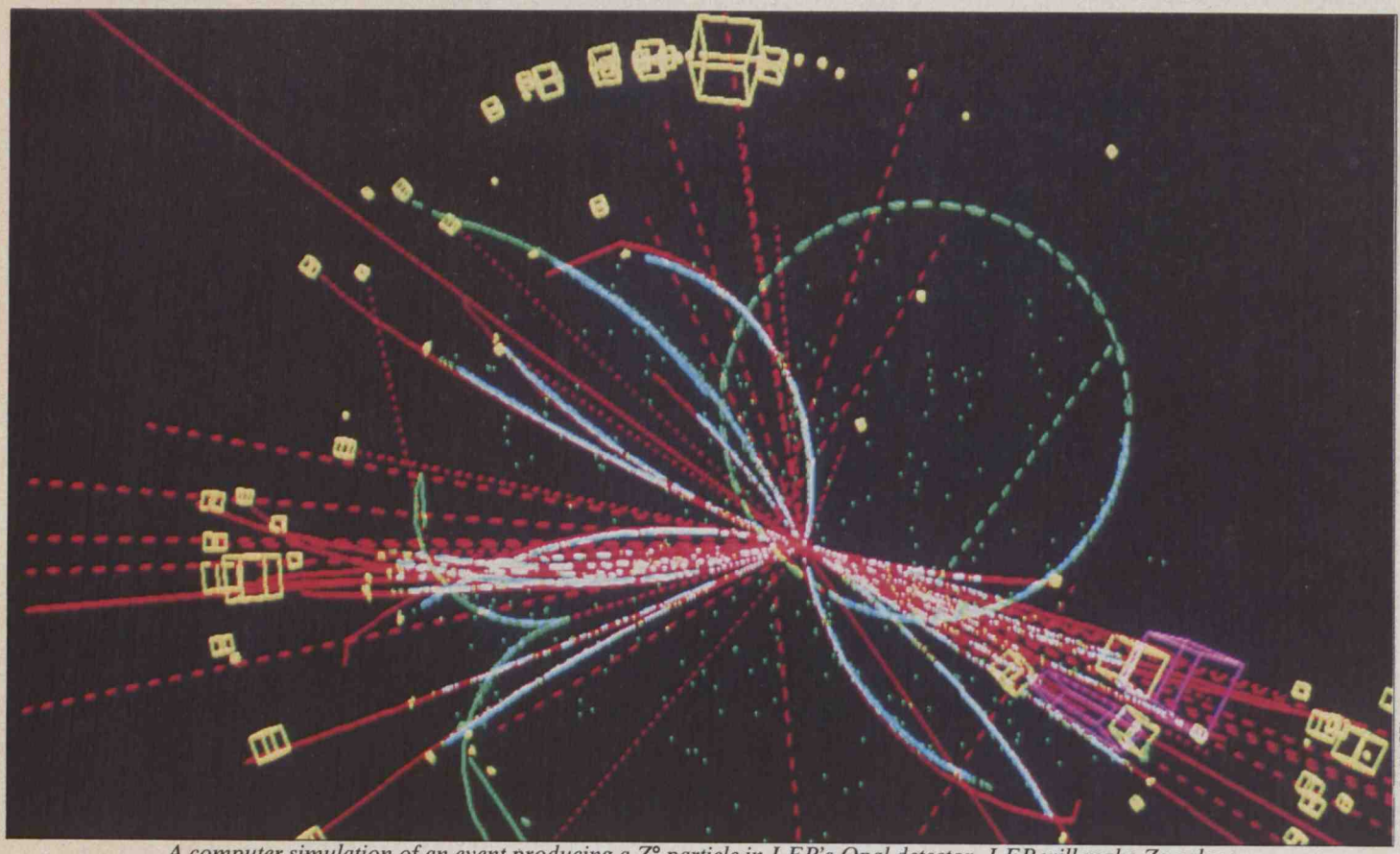
He is pushing ahead on wider membership, particularly with the Finns, Canadians, and Japanese, and has had some encouraging discussions with Russia. We should get the report of his working group by Christmas. I have encouraged him to press hard on wider membership because the present arrangement at CERN involves a free ride on the overhead even if non Members provide their own apparatus. (There is a similar problem at Rutherford Appleton). We must be very tough on the free ride issue. CERN is now recognised as the world's leading particle physics laboratory and has stolen an enormous march on the Americans. There are some occasions when a monopoly ought to be exploited!

ANNEX B

Light at end of the tunnel

LEP, the machine of the moment in big physics, will study the Standard Model of particle physics. It will also reveal the parts of fundamental theory that other accelerators cannot reach

John Hassard



Philippe Plailly/SPL

A computer simulation of an event producing a Z° particle in LEP's Opal detector. LEP will make Zs galore

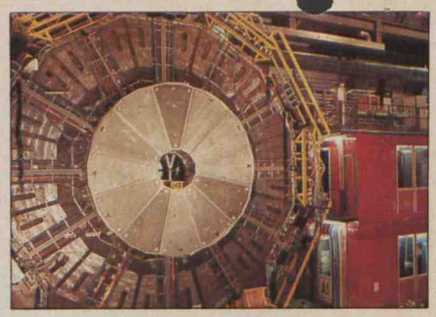
NEXT WEEK, LEP—the huge electron-positron collider at the European Laboratory for Particle Physics, CERN—will be ready to switch on. Physicists will begin to see the results of the hundreds of millions of pounds and the tens of thousands of work-years already spent in creating the massive tunnels, the gigantic detectors, and the gargantuan control and analysis computer programs.

LEP has been called the perfect tool for studying the Standard Model—the theoretical framework within which the forces and matter of the Universe interact. The Standard Model describes four fundamental forces in terms of so-called carrier particles. Gravity is carried by the graviton, electromagnetism is mediated by the photon, the strong force is carried by the gluon, and the weak force is carried by so-called vector bosons—the W^+, the W^- and the Z° particles. The particles of matter exist in three generations of quarks and leptons divided between six quarks, called up, down, charmed, strange, top and bottom, and six leptons, the electron, electron neutrino, the muon and its neutrino, and the tau and its neutrino. All these particles also have an antimatter partner.

The collider will allow physicists to test the theory behind the Standard Model using data from four detectors, Aleph, Delphi, L3 and Opal. These will detect and measure particles produced by colliding beams of electrons and positrons. But some people think that LEP might be able to do more. LEP might allow us to study deeper aspects of nature that at first sight seem beyond its reach. This impetus is partly due to the fact that LEP's rival, the Stanford Linear Collider in California (This Week, 22 April), is beginning to produce important results. LEP's great precision could reveal more subtle effects hinting at deeper, underlying truths that go beyond the Standard Model.

Physicists would like to test the predictions that are extensions of the Standard Model because although it can describe many aspects of fundamental physics, it has fatal flaws. It certainly cannot claim to be The Theory of Everything. The model predicts the existence of particles, but it does not explain their properties. There are many important parameters that you simply have to put in by hand because the model will not predict them. It is like glimpsing the peaks of a submerged mountain range breaking through the surf of an ocean. We know that there is something below, but all we can do is measure some of the peaks and note the similarities between them. We have to guess at what lies beneath the waves.

How could LEP explore the deep regions beyond the Standard Model? Machines, such as LEP, accelerate beams of particles, increasing their energies enormously. When the particles collide, their energy and mass is converted completely into energy. The energy then forms new masses according to Einstein's famous equation, $E = mc^2$, much as water droplets condense from steam. Nature picks out "mass structures", or particles, which for some reason it favours, although they may survive for only a trillion-trillionth of a second. These particles then decay to other particles, which in

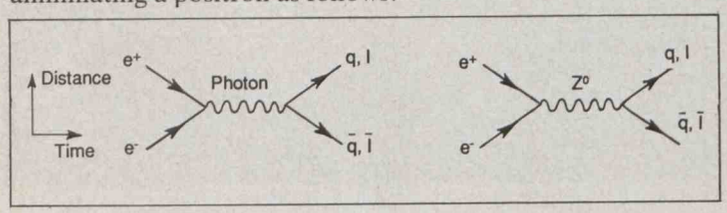


Philippe Plailly/SPL

LEP has four giant particle detectors: Opal, Aleph, Delphi and L3. They have an onion-like structure surrounding the point where the particles collide. The photograph on the left shows a technician working on one of the instruments inside the L3 detector. The photograph above shows one of the end-caps of the Aleph detector

turn decay until eventually stable particles are formed.

A convenient way of representing what happens during these decays was invented by the physicist Richard Feynman. Using these Feynman diagrams, we can represent an electron annihilating a positron as follows:



The axes represent the spatial distance and time. One possibility is that the electron ($e-$) and the positron ($e+$) collide and form a photon, which then decays into quarks and antiquarks (q and $\bar{q}$) or leptons and their antimatter partners (l and $\bar{l}$). At higher energies, the carrier of the weak force—the Z° boson—forms, which then decays into quarks. These zoom off at speeds close to that of light but then rapidly decay. We only ever see their decay products, the so-called hadrons and leptons. The heaviest leptons can decay into quarks, which again form hadrons.

The Feynman diagrams show that the particles formed after the collision depend on the energy of the accelerator. If the mass of the particle is greater than the equivalent energy available from the colliding beams, then it will not be formed. For this reason, one fundamental particle important to the Standard Model, the top quark, has not yet been made.

LEP will operate at an energy that will produce an abundance of Z° bosons. We hope to produce about 100 000 Z°s by next Christmas; a million in 1990 and 10 million by 1992. Many of the essential measurements for the Standard Model require between 1000 and 10 000 particle collisions.

Tracing the decays of short-lived particles, such as the Z°, allows us to probe the Standard Model, in particular, the relationship between the four forces and how they came into existence when the Universe was created in the big bang. According to our best theories, these particles last existed in the high-energy conditions just after the big bang. So in effect, the accelerator mimics these early conditions. As we increase the energy of the accelerator, we travel backwards in time to the beginning of the Universe. There is also a relationship between the energy of a particle and the scale at which we are studying the Universe. If you increase the energy of the particles, you can pick out smaller features in the structure of matter, rather like increasing the power of a microscope.

Theorists describe the relationships between the force particles, and between the matter particles in terms of the mathematical concept of symmetry, whereby one group of fundamental particles can be turned into another group of particles by undergoing what is called a symmetry transformation. The properties of symmetry become more apparent at higher energies, or equivalently, at smaller distances, and at a time closer to the big bang. In fact, theorists think that at the first instant after the big bang there was just one force. But then the symmetry of the Universe started to "break", after 10^{-43} seconds, as gravity separated, the strong force by about 10^{-34} seconds, and the electroweak force diverged into electromagnetic and weak forces after 10^{-10} seconds. Now, after 10^{-17} seconds, the four forces appear very different.

Because LEP will operate in an energy region that will produce directly the particle responsible for the weak force, the Z° boson, we will be able to study the symmetry between the electromagnetic force and the weak force. Also, aspects of symmetry between the strong force and the combined electroweak force will be more obvious than at lower energies.

Another key question concerning symmetry in the early Universe that we would like to answer is how the particles obtained their masses. At LEP, we will be searching hard for the so-called Higgs boson, which some people think gives particles mass, but, like the top quark, the chance of it being seen first at LEP is quite small because it also requires extremely high energies to be formed.

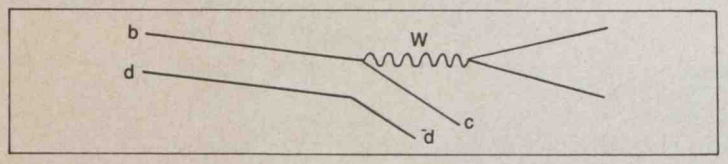
Physicists would also like to explore further symmetry relationships that are extensions of the Standard Model. One popular idea, which has no experimental support, is "supersymmetry". The "matter" particles, the quarks and leptons, are related to the "force" particles, such as the photons and the gluons, by an additional symmetry, that invoke the existence of further, supersymmetric particles. These particles have names ending with "ino", so the supersymmetric partner of a photon is a photino, and that of a gluon is a gluino. Again, they cannot be produced directly

because their masses are greater than the beam energy at LEP.

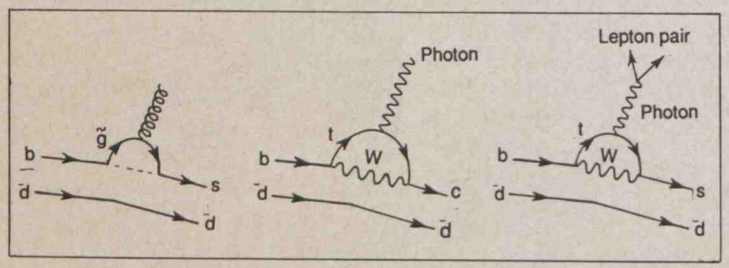
Nevertheless, there is a way of detecting particles that exist beyond the energy regime of LEP. It takes advantage of that strange property in quantum mechanics, whereby particles have a small probability of existing where you would not expect to find them. This property is called tunnelling. The probability of quantum mechanics predicts that the fabric of spacetime shimmers with "virtual" particles fluctuating, or tunnelling in and out of existence. According to Heisenberg's uncertainty principle, a particle mass can wobble out of the vacuum for a period of time such that the mass multiplied by the time is not more than Planck's constant. Particles that would normally come into existence at very high energies become accessible, therefore, at the lower energies of LEP because of quantum fluctuations causing particles to decay in unusual ways.

For example, the heaviest quark that we have detected is the beauty or bottom quark. It is almost always inside another particle, the B meson, which consists of a bottom quark coupled to a lighter quark, such as an up or a down quark. The Standard Model predicts that it decays predominantly into a charmed quark which is seen in another meson, known as a D meson (consisting of a charmed and the lighter quark). People have looked hard for other, non-charmed decays, but so far nobody has had undisputed success. The usual decay alternative to decaying into a charmed quark has been to the up quark. The proportions of decays of the bottom quark into up and charmed quarks are two examples of the unknown parameters that the Standard Model is saddled with.

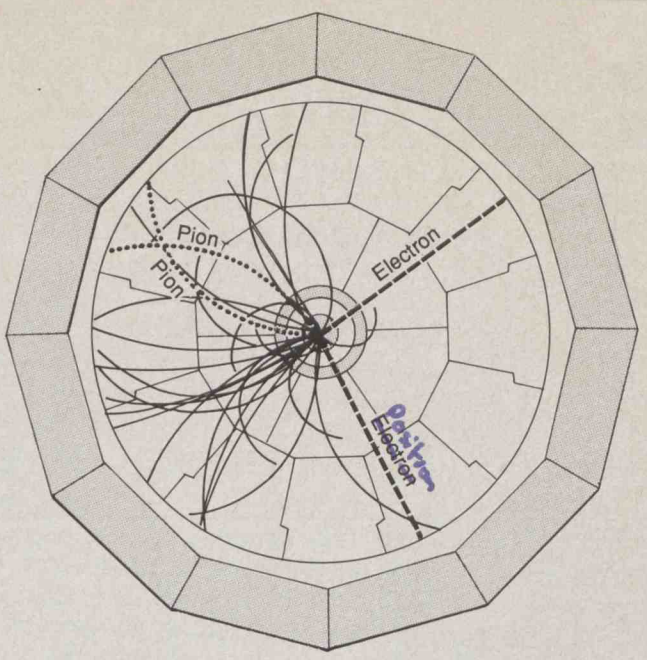
These decays occur mostly by what are known as "spectator diagrams". This is easily shown with the Feynman diagrams. In a spectator diagram, the bottom quark decays and the lighter antidown quark just keeps out of the way. This is illustrated here:



There is no obvious way that bottom quarks can decay by the spectator diagram into any other kind of quark, such as a strange quark. So the decays of bottom quarks into strange quarks would be interesting events to look for. The reason is that they are a window to higher energy conditions. By allowing mass and energy to trade with time in a way governed by the uncertainty principle, nature can find a pretty devious way to pull off these decays. Three important examples of such decays proceed through a so-called quantum chromodynamic (QCD) "penguin" diagram and through two electromagnetic (EM) penguin diagrams, illustrated here:



Looking at the QCD case first, the loop labelled $\tilde{g}$ represents the production of a supersymmetric particle known as a gluino—one that has appeared (as allowed by the uncertainty principle) as a quantum fluctuation. Its mass could well be much larger than the energy available from the beams at LEP. If supersymmetry is more than just the idle musings of a theorist, this process could increase the probability of the bottom quark decaying into a strange quark by about a factor of a hundred. For various reasons, this decay is hard to detect, so let us consider the second possibility.



A computer simulation of an event in the Aleph detector in which a bottom quark decays into a strange quark. The strange quark turns into a K° meson, which then decays into a pair of pions (dots), and a photon which decays into a pair of electrons (dashes)

In the second penguin diagram, the bottom quark tunnels and changes (again with the constraints imposed by the uncertainty principle) into a top quark and a W-boson. To conserve energy and momentum the top quark shoots off a photon and then recombines with the W to make the strange quark. The strange quark sails happily off with the spectator antidown quark. The photon—the particle of light at the end of the quantum mechanical tunnel—comes out at a gamma-ray. Now, if a fourth family of particles existed, as some theorists have suggested, there would be another quark heavier than the top quark. And this diagram could increase the rate at which bottom quarks decay to strange quarks by a factor of a hundred.

In the second EM diagram, the photon converts to a pair of leptons, for example, a muon and an antimuon. This decay explores the characteristics of possible Higgs particles, the particle claimed to induce mass in other particles. For example, if there were two pairs of Higgs bosons, then the rate at which bottom quarks decay to strange quarks by his diagram could increase also by a factor of a hundred.

In the two EM diagrams, you will see that the loop can be a top quark. The likelihood of this loop occurring depends heavily on the mass of the top quark: it increases as its fifth power. If you can find this decay, you are studying nature at energies way beyond the energy of your accelerator. It is like being able to do nuclear physics just using chemistry.

People have looked for these decays at the Electron Synchrotron (CESR) at Cornell University in New York and at the DORIS accelerator in Hamburg. They have not found one yet, but the upper limits they have imposed on the production rate are getting near what you would expect in the Standard Model. With a million or 10 million collisions from LEP, we will be able to constrain, hopefully reject, or even—just possibly—discover physics from beyond the Standard Model. When that occurs, physicists hope that those troublesome features of the Standard Model will be revealed for what they are: our misinterpretation, on incomplete evidence, of something much deeper and much more beautiful. □

John Hassard teaches at Imperial College, London and does particle physics at CERN in Geneva and at DESY in Hamburg.

Life, the Universe & Almost Everything

54 GENES & PROTEINS

Genes are the blueprints for proteins...

uh-oh-?

Proteins are made of amino acids, joined in specific sequences...

To give different proteins

...& the genetic code is a cunning way to store information about a protein's sequence of amino acids...

...in the form of the sequence of bases in the DNA molecule...

There are hundreds of different proteins – & the only variables are the sequences of the 4 bases. But there are 64 ways of arranging them into groups of 3.

T base C base A base G

containing traces of meteor!

– & only about 20 amino acids in nature!

Some of these 'triplets' – codons – are used as 'stop sequences' to mark the begining & end of a gene...

Nature's traffic lights...

The genetic code seems to be universal – the same base codons code for the same amino acids in all forms of life...

I never did meet any of your family...

...& genes only code for protein assembly...

no kidding?!

– none of that 'genes for eye colour or seed size' stuff...

These are phenotypic consequences of the protein coded for by the particular gene...

oh, she's got her mother's proteins!

Proteins generally act as enzymes – substances which control chemical reactions in the body...

BIO-PROBE ULTRA-WASH

HEALTH WARNING: NOTIFY YOUR DOCTOR IF GENETIC CHANGES OCCUR

FREE! GENETIC FINGERPRINT!

But genetic information itself only flows in one direction – from DNA outwards – the 'Central Dogma' of molecular genetics...

Potentially, open to a lot of abuse...

...it means that acquired characteristics are not inherited –

– there is no way that information can get back to the DNA & change gene structures...

GENETIC·SURGERY·CLINICS (TM) INC·CALIF

NATURE PLAY YOU A DIRTY TRICK? GENE RE-MODELLING – WHILE-U-WAIT!

PASS 'EM ON WITH CONFIDENCE!

* CLONING? – STEP INSIDE!!

Look – genes code only for proteins –

– so –

– take a Siamese cat...

– no thanks –

...its colouring is a result of a mutation affecting one enzyme involved in the synthesis of black pigment...

The enzyme has been made sensitive to heat – so is active in cooler parts of the creature's body...

SKRAWK!

What about me, then?

You? – Your mother was probably frightened by a jar of marmalade...

Next Week: MICROSCOPES!

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ANNEX C

DEPARTMENT OF EDUCATION AND SCIENCE
ELIZABETH HOUSE YORK ROAD LONDON SE1 7PH
TELEPHONE 01-934 9000

FROM THE PARLIAMENTARY UNDER-SECRETARY OF STATE

George Guise Esq
Policy Unit
10 Downing Street
LONDON SW1A 2AA

7 September 1989

Dear George

I said I would send you some interesting new data on international comparisons of inputs and outputs in respect of basic science. The Prime Minister might like to see them in advance of her seminar with young scientists on 13 September.

She may remember me giving her last year - I recall she wrote them down at the time! - input figures for 1982 comparing expenditure on academic and academically-related research. This study has now been updated to cover the period through to 1987. As you will see, we are likely to hear about these new comparisons from our scientific critics.

Trends in Government expenditure on academic and academically-related research as a percentage of GDP between 1980 and 1987 were as follows:

	1980	1982	1984	1986	1987
UK	0.404	0.420	0.415	0.402	0.403
FRG	0.459	0.440	0.462	0.472	0.472
France	0.370	0.439	0.477	0.462	0.453
Netherlands	0.623	0.628	0.567	0.552	0.543
US	0.299	0.300	0.299	0.323	0.332
Japan	0.257	0.250	0.238	0.225	0.232

Percentage changes in these figures between 1980 and 1987 have been:

UK	0%
FRG	3%
France	22%
Netherlands	-13%
US	11%
Japan	-10%

So much for the latest input figures. Outputs are, of course, notoriously more difficult to measure - but here, too, there are some new figures, using citations as a rough-and-ready yardstick for output.

The analysis looks at how the UK's world share of papers in the main scientific journals has been changing over time, starting in 1981 (note that there may be some bias because of the relative prominence of English Language journals).

From this it appears that the UK's share remained constant at 8.3 per cent between 1981 and 1986, while that of Germany declined from 6.3 per cent to 5.9 per cent, and that of France from 5.1 per cent to 4.8 per cent (cf. the massive increase in French spending on science!) A point to note is that Japan's share increased from 6.8 per cent to 7.8 per cent - but the UK still remains second only to the United States (35 per cent) in its share of scientific output, judged by this measure. Within the figures, it appears that our share of papers in applied scientific journals has held up better than the share of papers in journals concerned with basis science, where there has been a slight decline.

The Prime Minister may remember a related point made to her in the British Antarctic Survey presentation earlier this year, concerning "value for money". Over the period 1981 to 1986, the number of publications by British scientists in Antarctica per £1 million spent was 17.4, compared with 14.5 for FRG, 6.6 for Australia, and only 4.3 for the United States.

A comment on the significance of this. Because of the inherent difficulty of measuring outputs in basic science, it seems to me that overall funding in this policy area has to be largely based on inputs. Certainly, since 1979, this has been the Government's approach - to maintain "level funding" for the Science base. Last year, however, - led by the Prime Minister in her Royal Society speech - we accepted, by implication, that level funding was not

enough, and awarded a significant increase. In terms of the comparison of inputs, the only alternative to the historical approach - "level funding" - is via international comparisons. Which is why the new figures comparing inputs are significant and worrying. We must surely hope at least to maintain into the future the level which we reached in last year's PES settlement.

ROBERT JACKSON

PRIME MINISTER

SCIENTIFIC SEMINAR: 13 SEPTEMBER

ACOST have been thinking further about the order of the agenda for the Seminar and on reflection, feel that the attached would work more successfully.

When I put the proposed guest list to you, you thought that it was not necessary for Mr. Jackson to attend as well as Mr. MacGregor. Mr. MacGregor plans to come for the whole day but he would very much like Mr. Jackson to come to the lunch to meet the young scientists.

Content:

- with the revised agenda for the Seminar? Yes

- that Mr. Jackson should come to the lunch? Yes

GBS

CAROLINE SLOCOCK
8 SEPTEMBER 1989

MRMAOH

SEMINAR WITH YOUNG SCIENTISTS

WEDNESDAY 13 SEPTEMBER 1989

REVISED AGENDA

10.00	Opening remarks by the Prime Minister and the Chairman of ACOST
10.10	What is the Universe made of? **Professor John Barrow**
10.50	Coffee
11.10	Particle physics and the LEP accelerator **Dr John Hassard**
11.50	Band structure engineering **Dr Robin Nicholas**
12.30	Lunch
14.00	Development of a chiral auxiliary **Dr Stephen Davies**
14.40	Streptomyces **Dr Mervyn Bibb**
15.20	Tea
15.40	Cystic Fibrosis - towards an understanding of the basic defect **Dr Ann Harris**
16.20	Closing remarks

NOTE: To allow time for security checks and introductions you are requested to arrive by 09.45

MR. TURNBULL

cc Mr. Gray

SCIENTIFIC SEMINAR

Some time ago we discussed who would attend the Scientific Seminar and agreed that if I was on leave at that time you would probably want to take this over.

Most of the arrangements are now settled. The lunch will probably be taking place in the Pillared Room, because it was thought that the Dining Room would be full of furniture. I have told the Prime Minister that this would be the case and she has agreed to us using the Pillared Room. However, today Sue Goodchild tells me that it may be possible to use the State Dining Room and she will keep you posted.

Two other issues which need to be settled (and probably will be settled by the time you return from Cumbria) are whether Mr. Jackson should attend the lunch and whether the agenda, which has already been circulated, should be revised. I asked the Prime Minister about these two things in the weekend box and Paul will process the papers when they come out. If she agrees to the revised agenda, Paul will send it to Clive Bradley, in the ACOST Secretariat, who has promised to circulate it in time for the seminar.

There have been one or two problems over the attendance at the seminar. As you know the Prime Minister decided herself which Ministers should attend. I understand that the Secretary of State for Trade and Industry is a little bemused by his invitation. The Prime Minister deleted Mr. Jackson from the list I gave her saying "he was not necessary". Mr. Jackson was still very keen to come for the whole day in Mr. MacGregor's stead, but I persuaded his office to take this up with Mr. MacGregor's and the result is that Mr. MacGregor suggests that he should come to the lunch. The only other issue is whether David Curry from MAFF needs to come for the whole day. His office have asked whether this is necessary.

I have asked George Guise for advice on the briefing for this occasion and have also spoken to Clive Bradley. They agree that it is best to keep the background papers to the minimum and thought that the short notes prepared by John Fairclough's people (which I have circulated with the invitation and the agenda) are sufficient. However, George thought it might be useful by way of more general background to give the Prime Minister a note on CERN and one or two related issues. George has now sent me that note which, together with the notes on each of the scientists and the agenda could be put into the Prime Minister's box on Tuesday night.

CAROLINE SLOCOCK

8 September 1989

PM3ASZ

ACOST
Advisory Council on Science and Technology
70 Whitehall, London SW1A 2AS
01-270-0109

File

Qn 0456

Ms Caroline Slocock
10 Downing Street
London SW1

8 September 1989

Dear Caroline

PM'S SEMINAR - 13 SEPTEMBER

Sir David Phillips and John Fairclough have suggested that we re-order the list of speakers to reflect a more logical and scientific progress through the talks. Thus the first two which are concerned with cosmology and particle physics should stay as they are, but would be followed by Dr Nicholas' talk on crystals. After lunch we would have Dr Davies' talk on small molecules, followed by Dr Bibb and Dr Harris on large molecules (genes). I would be grateful if you would obtain the Prime Minister's views on this.

Yours sincerely
Chris Bradley

C C BRADLEY

Enc

Secretariat:
Telephone 01-270 0105
Telex 27582 CABOFF G
Fax 01-270 0074
Prestel 21 999 3466
Gold 81 MPO 005

VR1-29

ELIZABETH HOUSE
YORK ROAD
LONDON SE1 7PH
01-934 9000

Caroline Slocock
10 Downing Street
LONDON SW1

7 September 1989

Dear Caroline

We had a word about attendance at the forthcoming scientific seminar chaired by the Prime Minister. As you know, Mr MacGregor will be attending for the whole of the seminar. He would very much like Mr Jackson to attend, for the lunch only.

I would be grateful if you could confirm whether the Prime Minister is content.

Yours

Stephen

STEPHEN CROWNE
Private Secretary

PRIME MINISTER

SCIENTIFIC SEMINAR: 13 SEPTEMBER

As you know, we had planned to hold the lunch for the seminar in the dining room at No.10. However I am told that this will be full of furniture on that day because of the refurbishment work going on.

Would you be content for us to set up a number of round tables in the pillared room for the lunch instead?

CDS

(CAROLINE SLOCOCK)

5 September 1989
DA2ADZ

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

10 August 1989

Dear Maria,

SEMINAR WITH YOUNG SCIENTISTS, 10.00 - 16.30, 13 SEPTEMBER

You asked for further details about this seminar, which is one of a series the Prime Minister has held. Six distinguished young scientists have been invited - details of their work are attached to this letter. She also plans to invite a number of representatives from ACOST, as shown in the second letter I attach, and John Fairclough.

The Prime Minister has also said that she thinks it would be valuable if the Secretary of State for Education and Science, the Secretary of State for Trade and Industry, the Minister for Agriculture, Fisheries and Food (who I now understand will be abroad at that time) and a Health Minister were present.

I am copying this letter to John Ratcliff (Education and Science), Stephen Lambert (Agriculture) and Flora Goldhill (Health). I would be grateful if Stephen and Flora could let me know which Minister from their Departments would be able to attend.

Yours sincerely,

Caroline Slocock

CAROLINE SLOCOCK

Maria Brydon
Department of Trade and Industry

PRIME MINISTER (1)

SEMINAR WITH YOUNG SCIENTISTS, 10.00 - 16.30, 13 SEPTEMBER

I am finalising the arrangements for the seminar. You will recall you agreed to the list of scientists sent over by Sir Francis Tombs and to about ten members of ACOST attending.

I have now received the list of ACOST members who will be present. This is attached.

You did not take a view then about who from the Government should be invited. In the light of the subjects covered by the scientists (I attach detailed descriptions of these), I suggested the following list:

The Secretary of State for Education and Science
The Secretary of State for Trade and Industry - will come back to us
~~Mr Jackson, DES~~ - Not necessary
A ~~MAFF Minister (Lady Trumpington?)~~ John Gummer ✓ (not available)
A Health Minister (Lord Trafford?)

I also suggest the following should be present:

Mr Fairclough
Mr Guise
Mr Turnbull/myself

Are you content with the list of those to be invited from ACOST and with what I propose above?

CMS

Caroline Slocock
4 August 1989

Yes as amended above

MT

Nor CF

Government Chief Whip
12 Downing Street, London SW1A 2AA

3 August 1989

AP 3/8 Please add to seminar papers

Dear Amanda,

Thank you for your letter of 1 August about the science seminar on 13 September.

We are, of course, happy for you to use the main room from about 1030 until 1630. I will keep an eye on the window replacement programme - currently running to plan - and ensure that it does not interfere with the seminar.

Yours

S R A COLLEY
Assistant Private Secretary

Mrs Amanda Ponsonby
Private Secretary to the
Prime Minister
10 Downing Street
LONDON SW1

File

memAJ9

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

1 August 1989

Further to my telephone call a few weeks back, I am writing to confirm that the Prime Minister is planning to hold a Science Seminar on Wednesday, 13 September. The format of this Seminar would be similar to the one held in No. 12 last April, ie, the talks would be held in No. 12 with the lunch taking place in No. 10. I envisage the Seminar beginning at 10.30 and ending at around 16.30. To date, invitations will be going to about 26 people.

Please could you confirm that you are happy with these plans.

MRS. AMANDA PONSONBY

S. Colley, Esq.

RJ

File

CS

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

19 July 1989

CONFIDENTIAL

Dear Sir Francis,

SEMINAR WITH YOUNG SCIENTISTS

The Prime Minister has asked me to thank you for your letter of 13 July.

The Prime Minister is happy with the list of young scientists you propose as speakers and is very much looking forward to this occasion. She confirms that she would like 10 members of ACOST to be invited and is grateful to you for agreeing to make a suitable selection. She is still mulling over who from the Government should be present, although I think we can assume for planning purposes that in addition to the Prime Minister herself and a Private Secretary there will be about 7 guests including Ministers, Mr Fairclough and Mr Guise from the Policy Unit.

BF Perhaps the ACOST secretariat could liaise with me about the final guest list and about the other details.

I am sending a copy of this letter to John Fairclough.

Yours sincerely,

CJ Slocock

CAROLINE SLOCOCK

Sir Francis Tombs

DSS

Prime Minister

When you saw him last, you did not reach a decision on Government representation. Now that the reshuffle has been done, do you agree to the list below?

CRS 4/8

PRIME MINISTER

SEMINAR WITH YOUNG SCIENTISTS, 10.00 - 16.30, 13 SEPTEMBER

Sir Francis Tombs has written the attached letter to you asking you to confirm the list of young scientists who should be invited to this seminar. These are listed in his letter; and I also attach further details from John Fairclough in case you want more information.

Sir Francis also suggests, following a conversation with you, that 10 members of ACOST should be invited; and asks who you else you would like invited.

On the latter, having consulted Andrew Turnbull, John Fairclough and George Guise, I would suggest the following:

The Secretary of State for Education and Science
PUSS at Education and Science, Mr Jackson
The Secretary of State for Trade and Industry
A MAFF Minister
A Health Minister
Mr Fairclough
Mr Guise
Mr Turnbull or myself

There is a danger that the seminar may be too large to give the young scientists a real chance to shine (with 6 scientists, 9 Government members and 10 from ACOST) and you might want to consider reducing ACOST representation to 6. On the other hand, Mr Fairclough has pointed out that one of the aims of the seminar is to put ACOST more closely in touch with the work of dynamic young scientists and with Government thinking.

Are you content for me to reply to Sir Francis saying that:

- you are happy with the list of young scientists he provides; Yes

- you confirm that 10 ACOST members should be invited; Yes

- you would like those listed above to also be invited?

CMS

Caroline Slocock
18 July 1989

Qn 0388

File ST 310/10

13 July 1989

MR TURNBULL

cc Mr Fairclough

PRIME MINISTER'S SEMINAR

John Fairclough has asked me to send you the attached CVs for the six scientists who will be participating in the Seminar arranged for the Prime Minister on Wednesday, 13 September. I hope these have enough detail for you.

Clive Bradley

CLIVE BRADLEY

Encs

Late – Scientific Seminar papers – 13 Sept.

NAME (inc degrees): JOHN D BARROW BSc DPhil

AGE: 36

ADDRESS: Astronomy Centre
University of Sussex
Falmer
Brighton
BN1 9QH

TEL: 0273-606755 ext 3100
FAX: 0273-678097

EDUCATION: BSc - Durham University 1974
DPhil - Magdalen College, Oxford

RESEARCH FIELD: Cosmology

TOPIC FOR SEMINAR: WHAT IS THE UNIVERSE MADE OF?

The key to understanding the long-standing mystery of the identity of the dominant form of matter in the universe may be provided by new developments in particle physics. Conversely, astronomical observations are able to tell us important things about the elementary particle world which are not accessible to terrestrial experiments. A brief introduction to modern cosmology and these issues will be given.

NAME (inc degrees): **MERVYN BIBB BSc PhD**

AGE: 37

ADDRESS: Institute of Plant Science Research
John Innes Institute
Colney Lane
Norwich
NR4 7UH

TEL: 0603-52571 ext 2205
FAX: 0603-56844

EDUCATION: BSc - University of East Anglia, Norwich 1974
PhD - John Innes Institute, Norwich 1977

RESEARCH FIELD: Molecular biology and genetics of Streptomyces, with special interest in the regulation of gene expression and, in particular, the factors that elicit antibiotic production.

TOPIC FOR SEMINAR: STREPTOMYCES

Streptomyces are mycelial soil bacteria that undergo a complex process of morphological differentiation that normally results in sporulation. They also produce the vast majority of commercially useful antibiotics, including many compounds with important applications in medicine and agriculture. These include anti-infectives, anti-cancer agents, growth promoters, anti-parasitic agents, herbicides and agents for plant protection.

Despite the success of the pharmaceutical industry in developing new antibiotics, the need to provide new compounds with improved characteristics remains. In recent years it has become possible to isolate and manipulate genes involved in antibiotic production in these organisms. In addition to providing much-needed information on the biochemistry and regulation of antibiotic biosynthesis, gene cloning in Streptomyces can be used to effect improvements in yield and, perhaps more importantly, to produce antibiotics with novel structures and potentially improved activities. Examples of how gene cloning has been used to achieve both these goal will be described and prospects for the future beneficial manipulation of these organisms considered.

NAME (inc degrees): STEPHEN DAVIES DPhil MA

AGE: 39

ADDRESS: Organic Chemistry Dept
Dyson Perrins Laboratory
South Parks Rd
Oxford OX1 3QY

TEL: 0865-275646
FAX: 0865-275674

EDUCATION: BA - Oxford University 1974
DPhil- Oxford University 1976

RESEARCH FIELD: Homochiral synthesis. A fundamental property of molecules is their ability (achiral molecules) or inability (chiral molecules) to be superimposed on their mirror images. The development of novel strategies for the synthesis of single enantiomers (left and right handed forms) of chiral molecules is of fundamental importance to the fine chemicals industry (pharmaceuticals, agrochemicals, polymers, electronic etc).

TOPIC FOR SEMINAR:

A chiral auxiliary has been developed which allows the construction of complex organic molecules via elaboration of attached small units. Extremely high degrees of stereochemical control may be achieved, resulting in the asymmetric synthesis of optically pure compounds (ie only left (or right) handed molecules are formed).

As well as being able to control the absolute stereochemistry of new chiral centres the auxiliary is also capable of recognising chirality already present in organic molecules. The recognition process involves the auxiliary reacting preferentially with one of the two enantiomers (left or right handed forms) of the substrate.

The design and mechanism action of the chiral auxiliary will be described and the implications for the chemical industry discussed.

NAME (inc degrees): ANN HARRIS MA PhD

AGE: 32

ADDRESS: Paediatric Research Unit
United Medical and Dental Schools
Guy's and St Thomas' Hospitals
8th Floor
Guy's Tower
London SE1 9RP

TEL: 01-955-4485 or 01-955-5000 ext 2516
FAX: 01-407-1706

EDUCATION: BA - Oxford (St Hughes College) 1975-78
PhD - Paediatric Research Unit, Guy's Hospital Medical School 1978-81

RESEARCH FIELD: Human genetic diseases

TOPIC FOR SEMINAR: CYSTIC FIBROSIS - Towards an understanding of the basic defect

Cystic Fibrosis is the commonest genetic disease of its type, affecting about 1 in 2500 live births, hence some 350 CF babies are born each year in the UK.

It is eventually a lethal disease though many affected individuals now reach adulthood.

The most serious effects of CF are on the lungs and the pancreas and are caused by malfunctioning of the layers of cells lining the lungs and the ducts in the pancreas that carry digestive enzymes from the sites where they are made to the gut.

Furthermore, 97% of males with CF are sterile because they no longer have a vas deferens, the duct which carries sperm away from the testis. Disappearance of this duct is probably due to a similar abnormality in the layer of cells lining the duct.

We have developed systems to grow the cells lining the pancreatic ducts and the male reproductive ducts. These cells are being used to study the biochemistry, electro-physiology and molecular biology of the parts of the body directly affected by Cystic Fibrosis. In the long term they will provide ideal systems in which to understand how the CF gene defect works and, hopefully, to devise more efficient strategies for treating the disease.

NAME (inc degrees): JOHN HASSARD PhD

AGE: 33

ADDRESS: Blackett Laboratory
Imperial College
London
SW7 2BZ

TEL: 01-589-5111 ext 6780
FAX:

EDUCATION: BSc - Manchester University 1978
PhD - Manchester University 1981

RESEARCH FIELD: High energy particle physics, specialising in high energy electron/positron interactions and decays of heavy quarks.

TOPIC FOR SEMINAR:

I will introduce the LEP accelerator in the context of similar (but complementary) machines around the world, and its rôle in studies of the Standard Model of the universe. I will show how the physics 'reach' of an accelerator is not limited by its centre of mass energy, but how precision tests at machines like LEP will allow physicists to probe beyond the Standard Model and thereby throw light on the first fraction of a second of the universe itself.

NAME (inc degrees): ROBIN NICHOLAS MA DPhil

AGE: 35

ADDRESS: Clarendon Laboratory
Parks Rd
Oxford
OX1 3PU

TEL: 0865-272250 (Clarendon laboratory)
FAX: 0865-272400

EDUCATION: MA - Oxford University
DPhil- Oxford University

RESEARCH FIELD: Properties of novel low dimensional semiconductor heterostructures in high magnetic fields

TOPIC FOR SEMINAR: BAND STRUCTURE ENGINEERING

Modern techniques of crystal growth and microfabrication allow us to build new semiconducting materials and structures with completely new properties. The level of control has now reached the ability to deposit single layers of atoms. This allows us to look at 2-dimensional, 1-dimensional and 0-dimensional structures known respectively as quantum wells, quantum wires and quantum dots.

The electronic structure of these new building blocks can be studied, and we look at new ways to put them together, analogous to genetic engineering. Even more excitingly, new quantum phenomena appear which were previously unexpected from what was known of macroscopic structures.

SRWB40

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

MR. FAIRCLOUGH
Cabinet Office

SEMINAR WITH RESEARCH SCIENTISTS

I have shown the Prime Minister the proposals set out in your minute to me of 28 April. She has confirmed that she would like to hold a seminar of the kind proposed. This would complement the meetings she has had with the very senior Nobel Prize winners and with the Professors who make up ACOST.

She felt that eight sessions would be too much to take in. I think she would prefer about six which would permit both slightly longer to be devoted to each subject and a slightly shorter day. She was not attracted to the poster session idea. While it would enable the audience to get closer to display materials, she felt it would be less efficient as a way for the presenters to get their points across. She would therefore prefer all the presentations to be in the conventional format.

The scientists who caught her eye were:

J. D. Barrow
Mervyn Bibb
Kay Davis
Ann Harris
John Hassard
R. J. Nicholas

She has not commented on the audience. Could you put forward more specific proposals in due course.

(ANDREW TURNBULL)
3 May 1989

EAMAUK

PRIME MINISTER

SEMINAR WITH THE RESEARCH SCIENTISTS

This meeting would enable you to extend your contact with the scientific community. You have already had lunch with the Nobel Prize winners and see the Professors who make up ACOST two or three times a year. The aim of this meeting would be to allow you to meet researchers in their late 30s, usually just below Professorships, but often at the peak of their research powers. The subjects chosen are intended to be at the forefront of British science.

John Fairclough has suggested 8 presentations, 5 in the form of mini-seminars, with a presentation followed by question and answer; and 3 as 'poster sessions'. In the latter, the guests would go to the presenters who would be able to set up models and posters.

i. Can you confirm that you would like to devote a day to this?

Yes

ii. Are you happy with about 8 sessions?
Or would you prefer, say, 6 with slightly more time devoted to each?

= 6 - no-one can take it of

iii. What do you think of the poster session idea? Useless.
On the one hand it enables the audience to get closer to display materials but, against this, it is less efficient as a way of getting points across orally as the presenters would find themselves having to repeat their presentations. What do you think?

iv. Any particular subjects or scientists which catch your eye?

Have talked 6. Don't think the theory of chaos would make good publicity!

AT

ANDREW TURNBULL
2 May 1989

File No. ST 310/10
ST 140/1

28 April 1989

W0104

MR TURNBULL

SEMINAR WITH RESEARCH SCIENTISTS

Your minute of 2 February sought advice on the format of a seminar to be held with young scientists. The suggested date was Wednesday 13 September from 1000-1630 in No. 12, with lunch in No. 10.

I have consulted colleagues and suggest that there should be three lectures in the morning, lasting 45 minutes each including discussion. If a break for refreshment is included this would take the time to 1300. Rather than a full programme of lectures, we favour a `poster session` immediately after lunch during which guests would be able to review static displays on perhaps three topics, and talk to the scientists resonsible for them. This would be followed by two further lectures.

The programme outlined above would give exposure to eight scientists and a list of eleven names is attached. These have been recommended by Sir George Porter, Sir David Phillips, Sir Peter Swinnerton-Dyer and others, but none has been approached concerning availability or willingness to participate. I would welcome your view on the selection of scientists and their fields.

As regards the audience which we expect to number around 30 we suggest that since the Prime Minister`s original invitation was made at an ACOST meeting, the full Council membership should be invited. This is twenty in number so we could expect perhaps sixteen to be present. The Prime Minister is likely to want Mr Baker and Mr

Jackson and perhaps other Ministers to be there. We might also invite the Departmental Chief Scientific Advisors and Chief Scientists who are assessors on ACOST.

If you are in agreement with the general outline of the programme and its contents, the ACOST secretariat will proceed to investigate the suitability and availability of the suggested scientists, identifying alternatives as necessary.

JOHN FAIRCLOUGH

SEMINAR WITH YOUNG SCIENTISTS

J D BARROW (37)
Astronomy Centre, Sussex University
Theoretical astronomy and Cosmology

MERVYN BIBB (30's)
Institute of Plant Science Research, Norwich
Researching soil-borne bacteria Streptomyces, which produce over 70% of antibodies used in human and agricultural practice.

KAY DAVIS (37)
Medical Research Council Unit of Molecular Genetics, Oxford
Researching molecular genetics, particularly the analysis of the human 'x' chromosome

GEORGE EFSTATHIOU (30's)
Department of Astro Physics, Oxford
Theoretical and observational astronomy

ANN HARRIS (32)
Paediatric Research Unit, Guys & St. Thomas' Hospitals
Research in genetic diseases, particularly cystic fibrosis

JOHN HASSARD (33)
Department of Physics, Imperial College London
Particle physics

R J NICHOLAS (30's)
University College, Oxford
Semiconductors, particularly low dimensional structures

COLIN SPARROW (30's)
King's College, Cambridge
Mathematics, particularly non-linear differential equations, e.g theory of chaos

DOMINIC TILDESLEY (37)
Department of Chemistry, Southampton University
Computer simulations in liquids

MARK WELLAND (30's)
Department of Engineering, Cambridge
Scanning, tunneling and ion microscopy

GREG WINTER (36)
MRC laboratory for Medical Biology, Cambridge
Humanizing of monoclonal antibodies.

SCIENCE & TECH: Public Seminars
pt 2

Kite ARW

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

MR. FAIRCLOUGH

ACOST MEETINGS WITH THE PRIME MINISTER

Andrew Turnbull has shown me your note of 15 February to him. In fact the seminar is to be held on Wednesday 13 September which rules out her attending ACOST on that date. The mid-November date is very difficult for her: it is very close to the State Opening of Parliament and the Lord Mayor's Banquet both of which are occasions for a certain amount of angst and we do not want to add any further to the diary at that time unless we absolutely have to.

I understand there is not yet an ACOST pencilled in for December or January but I think that is the time to aim for if a suitable date can be found.

(DOMINIC MORRIS)
21 February 1989

L

10 DOWNING STREET

Mr Turnbull.

1st question: did you have in mind Wednesday 13 Sept. or Tuesday ~~X~~ 12 Sept for the Service seminar (It is currently in the diary on 13/9)?

In either event an ACOST there is not a good idea. But nor is 15/11. It is near to State Opening / Guildhall Lord Mayor's Banquet time. I am loathe to clog it up.

If you agree I will ask JF the date of the December ACOST + plump for that if it fits. Otherwise I'd be inclined to go forward into early new year 1990.

JM

I agree. AT

Mr Morris
Advise pls
AT 16/2

W027

Mr TURNBULL

15 February 1989

ACOST MEETINGS WITH PRIME MINISTER

Thank you for your minute of ~~2~~ Feb February concerning a seminar with research scientists. I have started to identify suitable scientists who might be invited, and hope to respond to you with details early next month. I will also make proposals concerning the number of presentations, timing, audience etc.

2. Whilst planning the seminar, we should consider the Prime Minister's next opportunity to take the chair at a conventional ACOST meeting. I understand that she wishes to attend such meetings at roughly six monthly intervals, which would make the Council meeting on 13 September the appropriate date. However, in view of the seminar on the previous day I suggest that 15 November would be more suitable. I should welcome your views on this or possible alternative dates.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

FILE PM3AHT

10 DOWNING STREET

LONDON SW1A 2AA

From the Principal Private Secretary

MR. FAIRCLOUGH
CABINET OFFICE

SEMINAR WITH RESEARCH SCIENTISTS

During the course of yesterday's ACOST meeting, the Prime Minister suggested that she would like to hold a seminar with a number of younger scientists (aged 30-40?) whose work is at the frontiers of knowledge. This would complement the meeting which is under consideration with distinguished Nobel Prize winners who tend to be towards the end of their careers and the professors she meets at ACOST who are very much at the peak of theirs.

The format she suggested was an all day occasion, eg 10.00-4.30, with lunch in between. She envisaged using the large room in No.12 with lunch here.

Could you put forward suggestions on who might be invited, the optimum number of presentations for the time available, and the extent to which there is an audience. For example, would it be a good or bad idea to invite their professors or team leaders?

Finding a whole day during the week is likely to be difficult before the autumn but Wednesday 12 September would be a possibility. By then most of those involved would have returned from their holidays but not yet have started teaching.

I am copying this minute to Sir Robin Butler and George Guise.

ANDREW TURNBULL

2 February 1989

SA

10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

Mr. Brown,
Cabinet Office.

Thank you for your minute of 3 May about the proposed Science Seminar. I mentioned this to the Prime Minister today, but her view was that there was so much going on at the moment that it was too early to go firm on the date. Let us try in a couple of months time.

PAB

16 May, 1988.

Qd.091

Our ref: ST 102/4/1

added 4/5

MR BEARPARK
NO 10

3 May 1988

SCIENCE SEMINAR FOR PM

In your minute of 2 March you said the Prime Minister would like to hold a seminar on a Thursday evening, at No. 10, either just before or just after the summer recess. You asked us to prompt you in May about getting a date in her diary. May I ask if you could now do that? It will help to give us the maximum time to plan the event.

VIVIAN BROWN

fill

GA 53

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

MR. FAIRCLOUGH
Cabinet Office

The Prime Minister has now had a chance to consider your minute of 11 February about the next science seminar. She has said that she would like to do this on Thursday evening, very much on the timing you propose and followed by a dinner. But she has asked me to say that the health seminars which she is now involved in will take up her time in the next few months and the earliest time for the science seminar will be just before the summer recess or just after. She has asked that we look at the diary again around May to consider this. Could I please leave it to your office to prompt me at the appropriate time?

P. A. Bearpark
2 March 1988

PRIME MINISTER

Tessa and I have been looking at the diary to find a time for the science seminar. Although you agreed to a Thursday evening, we are still having problems in finding a suitable space. You have already agreed to do a number of seminars on the health side and it occurred to us that you might prefer to wait until later in the year for the science seminar.

One possibility would be to agree in principle not to do it before say June. We could then aim to look at the diary again after the Recess, with a view to considering whether June or September would be more appropriate.

Content?

P. A. Bearpark

1 March 1988

29/2.

10 DOWNING STREET

Paul.

The only 4 possibilities before the summer recess are: 4 + 11 March and 10 + 17 June.

But (a) what will this involve and (b) could we reason the DM if she really doesn't mind giving up a Friday evening?

Tg.

15/2

SRWBGW

1. Tessa
To note X and suggest possibilities for Y please.
ndm
PRCG 15/2

PRIME MINISTER

POSSIBLE SEMINARS ON HEALTH AND SCIENCE

2. Pl. return.

At the last health meeting you said you would want to arrange one or two Sunday seminars at Chequers and asked Tony Newton and John O'Sullivan to suggest names. I will be gathering in their suggestions next week. But in the meantime I have been looking with Tessa at possible dates.

I think it would make sense to have two more meetings of the Ministerial group, which will address the basic factual papers, before you have a Sunday seminar. These are now arranged for the weeks beginning 29 February and 14 March. So I suggest a first Chequers seminar on 27 March. This looks okay in diary terms.

If you wanted a second health seminar, 24 April looks the best date. Sundays during May look difficult, mainly due to speech commitments, and the next reasonable free Sunday looks to be 5 June.

John Fairclough has now sent you the attached minute of 11 February suggesting a science seminar, either during ~~the~~ a weekday evening or at Chequers during a weekend. I would have thought this was a lower priority for your weekends than health. So if you are attracted to the idea of a science seminar I suggest the weekday evening option - on a Friday

Content to pencil in health seminars at Chequers on 27 March and 24 April? If so, I will put possible names to you next week. Yes | X

Do you want to have a weekday evening science seminar on the lines suggested by John Fairclough? - on a Friday | Y

PRCG.

(PAUL GRAY)
12 February 1988

W0408 CONFIDENTIAL

PRIME MINISTER 11 February 1988

SCIENCE SEMINAR

When we discussed science policy in the Autumn, you said you would like to hold another seminar on science when a suitable subject presented itself. Robin Nicholson arranged a seminar for you in 1984 and one was tentatively planned last year but had to be put off because of your diary commitments.

2. I believe now would be a good time to arrange another seminar. The purpose would be for you to learn at first hand about some exciting new areas of scientific research, as background to the decisions you will need to take on the future organisation of research in Higher Education and Research Council Institutes. E(ST) is due to discuss in the Spring the Government's response to the ABRC strategy advice and the guidance to be given to the new Universities and Polytechnics Funding Councils. A major element in those decisions will be the case for more of higher education research to be conducted in interdisciplinary research centres as a way of improving exploitation, encouraging greater industrial participation and coping with the increased costs of the apparatus needed for world class science - and as one of the means towards greater research selectivity. This subject, on which ACOST have also been asked to advise, is likely to feature in the discussions when you meet them.

3. If you welcome the idea I propose a series of short presentations from say 5.30-7.00pm to be followed, if your diary permits it, by more informal discussion over dinner. An alternative would be to hold the occasion at Chequers during a weekend. I would suggest asking a couple of scientists to talk about their work in each of three areas which I regard as particularly exciting - the human genome, surfaces and interfaces and warm superconductors. I enclose brief notes on the topics. There are a number of others which I could suggest or you may have your own preferences.

4. Until knowing whether you would like to proceed with this, I have not tried to put together names of people who might be invited to make short presentations. But I would have no difficulty in drawing up a list and would seek to ensure that those invited did not use the occasion to lobby or parade their views on higher education generally - I would want the seminar to stick to science, and not get into funding or institutional questions. I am sure you would also want to invite the Secretary of State for Education and Science and, because of the importance of exploitation, the Secretary of State for Trade and Industry and the Chancellor of the Duchy. Sir David Phillips and Sir Peter Swinnerton Dyer might also attend to give you their particular perspectives.

5. I would be grateful to know whether you would like to proceed with this idea and I will then try and find a suitable date with your office.

6. I am copying this minute to Sir Robin Butler.

JOHN W FAIRCLOUGH
Chief Scientific Adviser

THE HUMAN GENOME

The human genome is the complete set of genetic instructions that describe each human being. It is now within the realms of possibility to attempt to "read" these instructions in their entirety. In doing so, we shall make fundamental new discoveries in biology, learn to predict and treat genetic diseases, and acquire new technology for medicine, agriculture and industry.

Each human being has two sets of 23 chromosomes, with a total of about 3 billion base pairs - letters in the genetic code - per set. The chromosomes contain an unknown number of genes, estimates of which range from 20,000 to 200,000. Only about 500 of these genes have so far been characterised. We also have very limited knowledge of how genes are turned on and off at the right time for correct development and differentiation. We do not understand what role the DNA that is not part of genes performs.

There are now international discussions on an effort to map and sequence the entire genome. Mapping implies arranging in order on the chromosomes large fragments of DNA. Sequencing implies determining the base sequences of each fragment. The detailed sequence will of course differ between individuals, but there is good evidence that the sequences of expressed genes will be common. This would mean that a working gene exists in only one form; a person either has it or they do not.

Although it is feasible to consider sequencing the genome, a very considerable improvement in techniques will be needed to make this goal attainable in reasonable time. These include new methods of separating, cloning, and purifying large DNA fragments; physical, chemical and biochemical methods of mapping and sequencing fragments; and above all new computing techniques to handle the vast amount of data involved, and to communicate the results to other workers.

Mapping and sequencing the genome will lead to the identification of the defective genes involved in genetic diseases (eg cystic fibrosis and muscular dystrophy) and those with a genetic component (eg diabetes). The gene product can then be identified, and it will become possible to discover the biochemical

and physiological links between the defective gene and the disease. This understanding may lead to treatment, by drugs or by replacing the defective gene, or simply to genetic counselling of affected families.

Besides its potential medical benefits, such a research programme would bring about a massive advance in our knowledge of human biology. There would be immediate benefits for biotechnology, and perhaps a more distant influence on areas such as computing and automation. Although the programme is necessarily a long term one, the benefits will be incremental and realised as it proceeds, rather than being dependent on reaching the final goal.

SURFACES AND INTERFACES

Surface science deals with the few layers of atoms at the surfaces of solids, which may behave very differently from the bulk of the material. In these few layers, the reactivity, bonding, electronic and magnetic properties of the solid are all modified, and it is these modified properties which govern many of the material's interactions with other solids, liquids and gases.

In recent years, a battery of new techniques (for example Auger electron spectroscopy, low energy electron diffraction and the use of synchrotron radiation) have made it possible to study the physics and chemistry of surfaces in much greater detail. They open up the possibility of developing a solid base of technology in important areas which until now have depended as much on art as on science.

In electronics, the unusual electronic properties of thin layers are being exploited by growing them in a controlled way. But the structure of a layer depends on that of the underlying solid, and we do not yet know how to "design" layers with desired properties.

Much of the chemical industry depends on heterogeneous catalysis, in which gas molecules are adsorbed onto a solid surface, where they undergo a chemical reaction. At present, catalysts are developed largely by trial and error. If they could be designed for specific reactions, it could have a major impact on the economics of the industry.

Adhesion is important to many industrial operations, especially where gluing or painting is involved, and also to medicine, where the interaction of body tissues with the surfaces artifical ones is the most important one in developing such implants as artifical joints and blood vessels. Marine fouling is also an adhesion problem.

Rusting and other forms of corrosion are surface phenomena, and the spread of corrosion is often closely connected with the properties of grain boundaries.

Surface science is thus a discipline ripe for major advance, and which feeds a wide range of economic activities.

SUPERCONDUCTIVITY

Muller and Bednorz' 1986 discovery of ceramics which were superconducting at temperatures well above those previously possible - brought them Nobel prizes within two years, and has generated worldwide scientific activity on an unprecedented scale and the prospects of a range of potential applications.

2. Metal superconducting (absence of electrical resistance) at liquid helium temperatures has been known since 1911, and exploited in applications such as the Magnetic Resonance Imaging - the basis of Oxford Instruments. But the difficulty and expense of working with liquid helium precluded more widespread use.

3. Ceramics superconducting at temperatures above liquid nitrogen (77K - 77 degrees above absolute zero, or -196 C) are exciting scientifically because they have so far defied explanation by conventional theories. Because the research is relatively cheap a worldwide race is on to learn more of how the compounds work; whether the present limitations on current capacity and effect of magnetic field can be overcome; and whether still higher, even room temperature can be achieved.

4. Research into their structure, properties and development requires the interaction of several disciplines. Basic physics is needed to understand the mechanisms involved at atomic level and to develop an alternative to the present model of how metal superconductivity works. Physical and chemical techniques have already been used to elucidate the layered crystal structure of the commonest superconducting ceramic (Yttrium Barum Copper Oxide). But more work is needed to understand for example the critical effect of oxygen on the superconducting properties. Material science research is needed on the the physical properties of the ceramics. Electronics and electronic engineering will be important in the development of applications in information technology; electrical engineering in due course will be important if larger scale applications can be developed.

5. One estimate has put the growth potential of superconductivity rising to a worldwide value of $27 billion in ten years. This is very broad. Much depends on whether the real revolutionary advance of room temperature superconductivity can be achieved. This could have a dramatic effect on power applications (transmission, generation, transport).

6. At liquid nitrogen temperatures, the current thinking is that the first significant applications will be in low current uses, eg thin film application in electronics (use of "Josephson" junctions and superconductivity interconnects to enchance computing efficiency), magnetic shielding, and ultra sensitive magnetic field detectors (known as SQUIDS, Superconducting Quantum Interference Devices). Larger scale applications in for example power generation, transmission and storage are expected to take longer, and may depend in the end on whether room temperature superconductivity can be achieved.

7. In the UK our academic research is as good as anywhere. Size for size we compare respectably with the US and Japan. We have made a start to co-ordinate our national efforts. Both DTI and SERC are making funds available. With my encouragement a joint DTI/SERC national committee of industrialists and academics has been set under Sir Martin Wood, and a national co-ordinator appointed. The subject is a clear case of the need for interdisciplinary research, and the first interdisciplinary research centre will be set up in Cambridge. In general our industries are doing enough to follow the state of the art, but not investing on the scale of the Japanese.

10 DOWNING STREET

LONDON SW1A 2AA

From the Private Secretary

MR FAIRCLOUGH
CABINET OFFICE

SEMINARS

Thank you for your minute of 2 December. I agree that no preparatory action is required for the Chequers seminar, except to fix the date, but the Prime Minister wants to look at the proposal for the seminar at the Conference Centre before we go firm on this. I have not therefore tried to earmark any specific dates in the diary, but I have noted the contingent liability for one seminar probably in February/March, and the second probably in the autumn.

P.A. Bearpark

3 December 1986

Sir Brian Hayes KCB
Permanent Secretary

DEPARTMENT OF TRADE AND INDUSTRY
1-19 VICTORIA STREET
LONDON SW1H 0ET
Telephone (Direct dialling) 01-215 4439
GTN 215) .....
(Switchboard) 01-215 7877

16 September 1986

John W Fairclough Esq CEng
Chief Scientific Adviser
Cabinet Office
70 Whitehall
LONDON SW1A 2AS

Dear John,

PRIME MINISTER'S SCIENCE SEMINAR

Thank you for your letter of 22 August about the planned Science Seminar at Chequers.

I very much like your plan and have no real changes to suggest. It does however occur to me that it might be helpful, in order to focus the discussion on potential action, to ask the participants to include in their presentations a practical suggestion for improving academic/industrial collaboration.

Unfortunately I shall not myself be able to attend on either date: I do apologise. Oscar Roith would however be pleased to deputise for me - and would be a much more knowledgeable contributor than I could be. My Secretary of State will be in Japan at the time, but Mr Pattie would be glad to attend if invited in his place.

CVs for the DTI sponsored participants are being prepared and will be with you shortly.

I am sending copies of this letter to Robert Armstrong and Mark Addison.

Yours ever,

Brian

BRIAN HAYES

file BM

10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

MR. FAIRCLOUGH

Tim Flesher's minute about the science seminar at Chequers refers. The Prime Minister considered this earlier this week, but concluded that the increasing pressure on her diary means that she must postpone it until next year. Could I please leave you to inform the others concerned? We can then try again in a couple of months to find a suitable time.

BF 11

(P.A. BEARPARK)
3 September 1986

OA

~~MR NORGROVE~~

cc Mr Addison

SCIENCE SEMINAR

I cannot remember where we have got to on this. I have got a 'keep free' for you all day on Sunday 19 October and an alternative on Sunday 26 October. Is this for the Science Seminar?

C.R.

27 August 1986

CC BG.

This letter has also been sent to Sir Brian Hayes

CABINET OFFICE

70 Whitehall London SW1A 2AS Telephone 01-233 7089

From John W Fairclough C Eng
Chief Scientific Adviser

Caroline

Where have we got to on dates?
MBA 26/8

W0208

Sir David Hancock KCB
Permanent Secretary
Dept of Education & Science
Elizabeth House
York Road
London SE1

22 August 1986

Dear Sir David,

PRIME MINISTER'S SCIENCE SEMINAR

I refer to our previous correspondence on this subject and your suggested names of participants.

I have had further contact with the Prime Minister and Saturday 22/29 November have been identified as possible dates. The exact date will be settled on the 10th September and in the meantime we should proceed with the next level of planning. 1/9?

Thank you for your suggested names. I have made a selection of ten people as shown on the attachment to this letter. They cover four themes which I believe will focus the discussion on the economic contribution of science and the links between industry and academia.

i. biochemistry, applied to agriculture and medicine

ii. information technology, covering opto-electronics and semi-conductors

iii. university-industry collaboration between small and medium sized companies and universities, with emphasis on the teaching company concept.

iv. leaders of small companies whose future commercial viability has a strong science foundation and whose existence has been built on scientific discovery.

I believe the individuals that I have chosen are all very able to describe their work and ambitions. The format of the meeting would be to ask each

participant to spend 8 or so minutes describing their work and subjecting themselves to cross-examination. This would be followed by a general discussion, perhaps over supper, though this latter point is still to be confirmed.

We need to consider who else should attend. I am assuming that you would wish to be present, and I suggest that your Secretaries of State are invited if you agree. Sir David Phillips and myself would also join the party.

Would you please consider this overall plan and let me have any further suggestion you care to make. It would be helpful to get curriculum vitae on each of the participants and I would ask that these be prepared. I will arrange for invitations to be sent to each of the participants with details of the arrangements when I know that you are content with these plans and the date has been finalised.

I am copying this to Mark Addison and Sir Robert Armstrong.

John

att JOHN W FAIRCLOUGH

Theme: BioChemistry
Surname: Pickett
First-name: John A
Discipline: Chemist/Pesticides etc
Age: 41
Title: Head of Insecticides & Fungicides Dep
Location: Rothamstead Experimental Station Harpenden Herts AL5 2JQ 05827-6
Sponsor: DES/AFRC
Field: Natural Product Chemistry
Comment: Chemical aspects of behaviour

Theme: BioChemistry
Surname: Coleman
First-name: Ronald
Discipline: Chemist/Biotech
Age:
Title: Director of Laboratory
Location: DTI
Sponsor: DTI
Field: BioTechnology
Comment:

Theme: BioChemistry
Surname: Brockes
First-name: Jeremy
Discipline: Molecular Biology
Age: 38
Title: Member MRC Cell Biophysics Unit
Location: Dep of Biophysics King's College London 26-29 Drury Lane London
Sponsor: DES/MRC
Field: Cell surface receptors.
Comment: Cal Tech until 82

Theme: IT
Surname: Midwinter
First-name: John
Discipline: Engineer/Opto-electronics
Age: 48
Title: Professor Telecommunications
Location: UCL Torrington Place WC1E 7JE 01-387-7050
Sponsor: DTI
Field: Optical Electronics
Comment: Was in Industry/Key technology

Theme: IT
Surname: Broers
First-name: Alec A
Discipline: Engineer/Semiconductors
Age: 48
Title: Prof. Electrical Engineering
Location: Cambridge
Sponsor: DES/RS
Field: Lithography
Comment: Was in Industry/Key technology

Theme: Industry/Academic Links
Surname: McCaskie
First-name: Charles
Discipline: ?
Age: ?
Title: Technical Director Baker Perkins
Location:
Sponsor: DTI
Field:
Comment: Member TCS Management Committee

Theme: Industry/Academic Links
Surname: Hampshire
First-name: Michael
Discipline: Engineer/Teaching Co
Age:
Title: Head of Dep. Electrical Engineering
Location: Salford
Sponsor: DTI
Field: Teaching Company
Comment: Runs Teaching Co

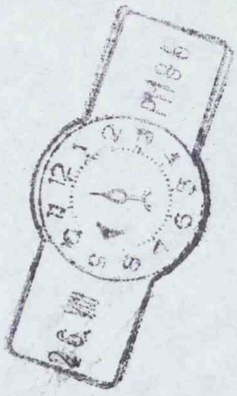
Theme: Small Industry
Surname: Williams
First-name: Peter M
Discipline: Instruments
Age: 42
Title: Group Managing Director
Location: Oxford Instruments
Sponsor: DTI
Field: Magnetics and Cryogenics
Comment: Science Based Company

Theme:	Small Industry
Surname:	Holmes
First-name:	Geoff
Discipline:	Small IT Co.
Age:	?
Title:	Deputy Chairman Systen Designers LTD
Location:	
Sponsor:	DTI
Field:	Alvey projects
Comment:	Start up Co.

Theme:	Small Industry
Surname:	Gilmore
First-name:	Roger
Discipline:	Chemist/Micro-biologist
Age:	44
Title:	Chief Executive, Agricultural Genetics Co Ltd
Location:	
Sponsor:	DES/AFRC
Field:	Business reputation. Spent time in US
Comment:	

Science + Technology

Science Seminars pt 2.



10 DOWNING STREET
LONDON SW1A 2AA

From the Private Secretary

MR. FAIRCLOUGH

The Prime Minister has now seen your minute of 1 August about a science seminar at Chequers. She was grateful for the work you have already done and agrees that you should proceed along the lines suggested. No doubt you will be in touch with Caroline Ryder here to talk about dates.

I am copying this minute to Mr. Stark in the Cabinet Office.

(TIM FLESHER)

5 August 1986

CC BG

Prime Minister

Agree this approach?

WO176

PRIME MINISTER

1 August 1986

4/8

When we met on 3 June you asked me to arrange a further science seminar at Chequers. I propose a theme of industrial-academic collaboration. You will be aware that considerable progress has been made during the last few years at improving the relationship between academic research and industry.

2. Although the progress has been good, there remains enormous opportunity to improve the economic contribution made by the science base. As you know we have a number of initiatives aimed at addressing this whole subject. It is therefore appropriate and timely to identify a number of individuals from both academia and industry whose work in science and technology is demonstrating economic contribution. The Department of Trade and Industry and the Department of Education and Science have provided me with lists of suitable names, and I am in the process of consulting other bodies. Although I have not yet finalised a list for your consideration, I am now confident that it will be possible to select an appropriate group of people to provide an interesting and stimulating discussion. Accordingly, and with your agreement, I would like to proceed with the next stage of planning.

3. Sir Robin Nicholson tells me that the format for the previous seminar was to allow each participant 10-15 minutes to describe his work and the seminar was concluded by a general discussion over a meal. If you are content with this format, I will proceed along these lines.

4. I expect you will wish to have the Secretary of States for Education and Science and the Department of Trade and Industry together with their Permanent Secretaries present. You will also wish to consider inviting Sir David Phillips (Chairman of the ABRC), Sir Francis Tombs (Chairman of ACARD) and Sir George Porter (President of the Royal Society).

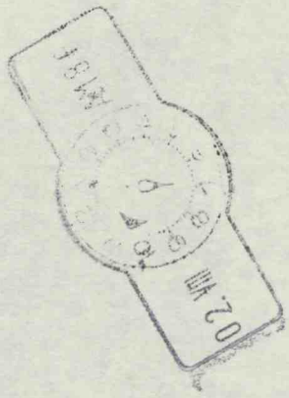
5. If you are in agreement with this outline, perhaps we could consult your diary for a suitable date.

6. I am copying this minute to Sir Robert Armstrong.

JOHN W FAIRCLOUGH

SCIENCE + TECH — Science Seminars

R-2



Sir Brian Hayes KCB
Permanent Secretary

DEPARTMENT OF TRADE AND INDUSTRY
1-19 VICTORIA STREET
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18 July 1986

John W Fairclough Esq CEng
Chief Scientific Adviser
Cabinet Office
70 Whitehall
LONDON SW1

CF?

NBPM.

Dear John Fairclough

Thank you for your letter of 20 June inviting nominations for a science seminar to be held later in the year at Chequers.

Improving industry/academic collaboration is a central part of DTI's S&T policy and I am delighted that you have proposed this subject for the next science seminar. The .... attached list contains names of people well able to discuss the overview of industry/academic collaboration while also being directly involved with projects at the interface. Most of the nominees are involved in collaborative programmes which DTI supports.

I am copying this letter to David Hancock and Mark Addison.

Yours sincerely

BRIAN HAYES

(approved by Sir Brian
& signed in his absence)

CATAAP

999-26

DTI NOMINEES FOR SCIENCE SEMINAR AT CHEQUERS

Alvey Programme

- Prof Jim Howe, Head of Department of Artificial Intelligence, Edinburgh University.
He is directly involved in projects collaborating with several companies, and also is a member of Sir Austin Bide's After-Alvey Committee.

- Mr Geoff Holmes, Deputy Chairman, Systems Designers Ltd.
This company is representative of the small/medium sized companies who are collaborating both with larger companies and the academic communities. Mr Holmes is directly involved in the collaboration and also is a member of Sir Austin Bide's committee.

Joint Opto-Electronic Research Scheme (JOERS)

- Prof John Midwinter, Professor of Telecommunications, UCL. (ex of British Telecom).
Expert in digital optics and acts as an assessor of proposals to JOERS.

- Mr William Stewart, Research Executive, Plessey Research (Casswell) Ltd. He is a co-ordinator of two JOERS programmes associated with fibre technology.

Teaching Company Scheme (TCS)

- Professor Michael Hampshire, Head of Department of Electrical Engineering, Salford Univeristy. In addition to being a member of the TCS Management Committee he participates in two programmes involving advanced production technologies. He also has wider industry involvement outside of the scheme.

- Mr Charles McCaskie, Technical Director, Baker Perkins Plc. He is also a member of the TCS Management Committee, but is involved with programmes at three Universities on behalf of Baker Perkins. The company is actively seeking wider academic collaboration.

Other

- Mr Ian Dalton, Director of Heriot-Watt Science Park. (The longest established Science Park in the UK).
He is also Chairman of the UK Science Park Association, a relatively new body but one which is developing as a good

DV1AAW

focal point in this area.

- Mr Peter Williams, Group Managing Director, Oxford Instruments plc. The first company in this group was established in 1959, having its origins in the highmagnetic field and low temperature research work of the Clarendon Laboratory at Oxford University. Very close collaboration with academia continues to underpin growth and development.

- Dr Ronald Coleman, Government Chemist, Director of the Laboratory of the Government Chemist, DTI. The Laboratory provides a wide variety of analytical investigatory and advisory services. It also houses the Biotechnology Unit which manages the Biotechnology in Industry support programme involving collaboration between industry and academia.

SCIENCE + TECH

SEMINAR

PTZ

CABINET OFFICE

70 Whitehall London SW1A 2AS Telephone 01-233

MB724

From John W Fairclough C Eng
Chief Scientific Adviser

W090

A J P Macdonald Esq
Dept of Trade and Industry
1 Victoria Street
London SW1

25 June 1986

Dear Alastair,

I have seen Catherine Bradley's letter to Mark Addison of 20 June following my meeting with the Prime Minister when, among other things, we discussed the need for a coherent European broadband network based on fibre optics. I am sorry that you and I have not had an opportunity to talk about this subject to understand each other's point of view. The DTI clearly believe that everything is proceeding satisfactorily. I do not. However, in no way am I critical of the DTI, the short term issues are being addressed satisfactorily. I believe that there are major problems ahead which, unless addressed soon, could lead to a further divergence of views and plans by member nations.

I suggest we meet to exchange views on this important subject. As you know I had previously requested an opportunity to meeting with you and your officials so I could understand the DTI's planned support of the new framework programme.

I am copying this letter to Mark Addison, Catherine Bradley, David Williamson and Michael Stark.

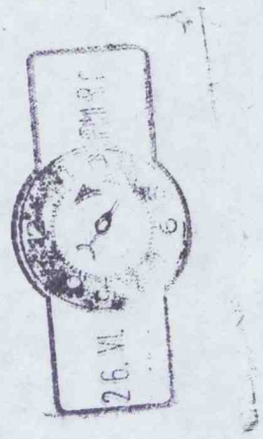
John

JOHN W FAIRCLOUGH

SCIENCE + TECH

SCIENCE SEMINAR

PTZ



Mr ADDISON

CABINET OFFICE

70 Whitehall London SW1A 2AS Telephone 01-233 7089

From John W Fairclough C Eng
Chief Scientific Adviser

W085

Sir David Hancock
Permanent Secretary
Dept of Education & Science
Elizabeth House
York Road
London SE1

20 June 1986

Dear Sir David

As I mentioned to you the Prime Minister has asked me to make a proposal for a further science weekend at Chequers.

As I indicated I am anxious to show her work that is representative of the growing inter-relationship between industry and academia. I am wondering whether the teaching companies would provide a source of suitable material. Alternatively there may be a bright case student who has made a significant contribution in science or engineering. I would be grateful for your help in making suggestions of suitable individuals. I understand you were involved with previous gatherings and are aware of the general format. I notice from the record that, on the last occasion 8 July 1984, there were ten scientists present. The programme started at 17.00 and was concluded at 19.30 with a dinner party.

I am copying this letter to Sir David Phillips and Sir Brian Hayes.

JOHN W FAIRCLOUGH

CABINET OFFICE
70 Whitehall London SW1A 2AS Telephone 01-233 7089

From John W Fairclough C Eng
Chief Scientific Adviser

W086

Sir Brian Hayes
Permanent Secretary
Dept of Trae & Industry
1 Victoria Street
London SW1

20 June 1986

Dear Sir Brian,

You may be familiar with the science seminars that have been arranged from time to time at Chequers. These meetings have proved very successful and are aimed at briefing the Prime Minister on important current activities, as well as providing an opportunity for the Prime Minister to meet the scientists involved.

The Prime Minister has asked me to arrange a further seminar to be held later this year. It is my wish to propose a seminar that introduces the Prime Minister to work that has resulted from collaboration between industry and academia. I am aware, of course, that DTI have been actively involved in establishing programmes of a collaborative nature.

I would very much appreciate your help in identifying suitable individuals, either from the industrial partner or academia or both, who could be present at a briefing session with the Prime Minister.

I have written to Sir David Hancock (copy attached) with a similar request. I am copying this letter to Sir David Hancock, Oscar Roith and Mark Addison.

John

JOHN W FAIRCLOUGH

JU541
Secretary of State for Trade and Industry

DEPARTMENT OF TRADE AND INDUSTRY
1-19 VICTORIA STREET
LONDON SW1H 0ET
Telephone (Direct dialling) 01-215) 5422
GTN 215)
(Switchboard) 01-215 7877

20 June 1986

Mark Addison Esq
Private Secretary to the
Prime Minister
10 Downing Street
London SW1

MBPMchtistyi,
MEA 23/6

Dear Mark,

Thank you for sending us a copy of your letter of 4 June to John Fairclough. There are a few points on which we should perhaps comment.

On the question of European-wide standards for optic communications networks there is considerable activity already in hand to establish a common European standard for isdn (integrated services digital network) (at 144 Kbit/sec) and for broadband systems (2Mbit/s and above). Work on isdn has been undertaken within the European Committee for Posts and Telecommunications (CEPT) on which DTI represents UK interests; a common standard has been agreed which, while different from that adopted by British Telecom for its pilot project in this area (Integrated Digital Access) will be adopted by both BT and Mercury over the next few years.

Broadband communications is the province of the EC's RACE programme (Research in Advanced communications for Europe), which has to date generated nearly one hundred collaborative studies intended to generate an agreed framework and a set of definitions/specifications for a common approach to broadband networks for the 1990s. UK companies have been prominent in this definition phase, with GEC and Plessey in particular taking the lead in the most important areas. The follow-up to this definition phase of RACE will be a matter for discussion during the UK Presidency. The Commission have entered a bid for a 1000 mecu implementation programme. There has also been considerable interest in this area within EUREKA, and we are currently considering two projects both involving Plessey, one for optical fibre transmission systems and the other for broadband switching. The broadband switching project will probably be announced formally at the June Ministerial. The other is still under consideration.

On your second and third points, we could provide some suggestions of possible candidates for the Prime Minister's proposed meetings with industrialists and scientists if that would be helpful. Mr Pattie for example holds regular meetings with R&D Directors and with members of the Department's Technology Requirements Board.

I am sending a copy of this letter to John Fairclough, Cabinet Office and to the other recipients of your letter.

Yours sincerely,

Bradley

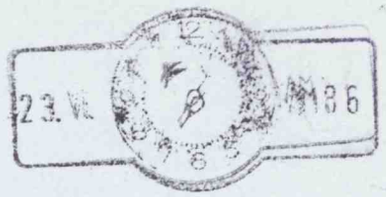
CATHERINE BRADLEY
Private Secretary

CONFIDENTIAL

SCIENCE + TECH

SEMINAR

PTZ



MEA

10 DOWNING STREET

Prime Minister (2)

You were right about your Cheques 'seminar' on science in July 1984. Professor Marsden discussed diseases of the brain (extract of the meeting record attached).

I have in fact asked John Knight for advice on ideas for another 'seminar' of this kind & staff shall be putting up a note in due course.

MEA 10/6

photosynthesis, and thus in the entire life cycle of the planet. Rubisco had several interesting features: first, its synthesis required two separate genetic systems, one in the chloroplast and one in the nucleus. Secondly, the two genetic systems combined only when stimulated by light, so that rubisco was present in the leaves of plants but not the roots; thirdly, and remarkably, the enzyme was surprisingly inefficient. Rubisco had a poor affinity for carbon dioxide at atmospheric concentration, which was why horticulturalists sometimes increased the concentration of CO2 in greenhouses to enhance production. It followed that as the concentration of atmospheric carbon dioxide increased, through the burning of fossil fuels, agricultural yields would tend to increase also.

Neuroscience

Professor Marsden spoke about the current understanding of diseases of the brain. The frequency and variety of brain disorders was a crucial health care problem. Traditionally, doctors had believed that the brain was incapable of regeneration, which made it very difficult to treat. Moreover, the brain was compartmentalised according to function, which made specific remedies hard to find.

More recent discoveries had, however, called into question these basic assumptions about the nature of the brain. For example, it had been found that Parkinsons Disease was associated with the absence of a single chemical (dopamine), which in normal subjects was concentrated in the caudate section of the brain. Dopamine acted as a messenger between nerve cells across their junctions (synapses). It had been found that Parkinsons Disease responded extremely well if patients were fed the chemical precursor of dopamine in order to compensate for the deficiency. There were many other messenger chemicals in the brain, which in effect consisted of a "wiring system" with a "chemical system"

/super-imposed

super-imposed.

As regards brain growth, transplants had been carried out in rats which suggested that foetal brain tissue could be used to replace missing functions. But it had yet to be demonstrated that the same was true in mammals. The crucial question which had not been answered was by what mechanism brain growth was switched on and off.

In parallel with these developments, there had been significant advances in the study of the brain in life. In particular, the C T and N M R scanners had made possible the "photography" of living brain tissue. Further advances in knowledge were likely through the use of radio isotope labels combined with N M R scanning.

Dr. Smith concluded the presentation by describing his research on brain function at the level of individual cells. The latest estimate was that the brain contained some 500 billion nerve cells, each of which was connected to approximately 10,000 others. Brain cells acted as a sort of electro-chemical switch, and his research had investigated the role of so-called "chandelier cells" in controlling the electrical discharges from sets of pyramidal cells. It was possible that the symptoms of epilepsy were caused by the momentary failure of a chandelier cell.

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10 DOWNING STREET

From the Private Secretary

MR. FAIRCLOUGH
CABINET OFFICE

SCIENTIFIC PRESENTATIONS AT CHEQUERS

I have now looked out the papers (as I said I would in my letter to you of 4 June), and established that the most recent Science Seminar at Chequers was held on 8 July, 1984. Sir Robin Nicholson set out proposals for the Seminar in a note to David Barclay dated 13 June. Your Secretariat also provided briefing for the meeting itself under cover of a minute to David dated 5 July.

I think the right course would be for you now to consider the subjects which might be tackled if we were to arrange a further Seminar, and the scientists who might be invited. I could then have a look at the diary, before putting forward a proposal to the Prime Minister.

MARK ADDISON
5 JUNE 1986

CONFIDENTIAL

SUBJECT cc MASTER

10 DOWNING STREET

From the Private Secretary

4 June 1986

Dear John

One or two particular points came up during your general discussion with the Prime Minister yesterday which we agreed would be worth recording:

(i) You were concerned there was a need for a European-wide standard for the development of fibre optic communication networks, so as to ensure that each country developed systems which were compatible. Such a standard might also help the UK to capitalise on the lead it had developed in some areas of this work. The Prime Minister said it was important to decide whether the priority was for our existing standard to be adopted across Europe as a whole, or whether the UK's interests would still be served by a standard based, if necessary, on the work being done elsewhere in Europe. She agreed to consider raising this at a forthcoming European Council meeting.

(ii) The Prime Minister said she would consider inviting a number of leading scientists to give presentations of their work at Chequers. She had held similar presentations in the past. (I will turn up the earlier papers and get in touch with you to discuss how to take this forward).

(iii) The Prime Minister would also consider giving a small lunch for industrialists and scientists. The aim would be to see how industry could be encouraged to increase its own investment in research and development.

(I think it would be helpful if as a first step you could let me have a note on who might be invited to such a lunch; I shall then look at the diary and put up a proposal to the Prime Minister.)

(iv) The Prime Minister mentioned the need to ensure strong industrial representation on the UGC, and suggested that Sir Kenneth Durham might make a most suitable member of the Committee. I should be grateful if Rob Smith at DES would bear the suggestions in mind.

CONFIDENTIAL

I am sending copies of this letter to John Mogg (Department of Trade and Industry), Tony Galsworthy (Foreign and Commonwealth Office), Rob Smith (Department of Education and Science) and Michael Stark (Cabinet Office).

Yours sincerely

Mark Addison

(MARK ADDISON)

J. W. Fairclough, Esq.,
Cabinet Office.

dile VC

10 DOWNING STREET

From the Principal Private Secretary

17 June 1985

Thank you so much for your letter of 13 June enclosing an advance copy of the Cash Flow Handbook to The Genghis Khan Guide to Business. I am afraid that your letter only reached me this morning and it was not possible for anyone to come to the press conference launching the book.

The Prime Minister will be pleased to know of your view that so much progress has been made in the last two years. I have glanced through the Cash Flow Handbook and it struck me as providing a very stimulating and compulsive illustration of the principles you advocate. I hope that it is very successful.

FCARB

B.C.J. Warnes, Esq.

6

Book sent to Sir R.N with request to return.

10 DOWNING STREET

From the Private Secretary

SIR ROBIN NICHOLSON

TECHNOLOGY 2000 SEMINAR IN SEPTEMBER 1983

I see from the record that you took the lead in setting up this seminar. The Open University have now sent us the published proceedings, the[re] letter is attached. I should be grateful for your advice on the terms in which the Prime Minister might reply.

BF

Mark Addison

14 June 1985

EA

OSMOSIS
PUBLICATIONS
8 HOLYROOD STREET
LONDON SE1 2EL
01-403 7575
Registered in England No. LN6571

Robin Butler Esq.,
Principal Private Secretary,
10 Downing Street,
London. S.W.1.

13th June 1985.

Dear Robin,

U.K. Employment

Filed at cover

You might like to know of the attached Press Conference taking place next Monday to launch the Cash Flow Handbook. The Press Release gives the relevant background. If someone would like to attend from the Prime Minister's office, and indeed from Norman Lamont's office they would be more than welcome. (An invitation has been sent to Lord Young.)

Pt 1 at flag

Ecu 81 June 81 attached

Much has happened since the previous exchange of correspondence with Mrs. Thatcher in September 1983 and March 1984. The bitter antagonism of the accountancy profession to any change of attitude (as it seemed), suddenly melted away in mid-1984 (after the issues were met - and dealt with - head on). Then a series of seminars in early 1985 (and no doubt many other factors) began to produce not just a willingness to change but active absorption of the new techniques. William Powlett Smith of Arthur Young was particularly impressive in this respect.

There is still an absence of essential knowledge in the profession before it is fully attuned to the scene but, given the fundamental change of attitude that appears to have taken place, this can quickly be put right (hence this publication of the Cash flow Handbook).

The timescale now is that it will take a few months for the profession to absorb the full range of techniques needed, and become sufficiently confident to start applying them, as a matter of routine, to an increasingly wide spectrum of companies.

Within 3 to 18 months of that happening, we should begin to see a fundamental change in the strength and confidence of the typical U.K. company, with significant implications for the strength and well-being of the business sector as a whole; and with it a chance to really eat into the unemployment problem.

Lord Young kindly came round earlier in the year to attend one of the seminars. I said at the time the climate was changing fundamentally but I still feared it would take 3-5 years. I now believe this timescale has considerably shortened, so good has been progress just recently (matched by equally good progress within the banking system).

All in all, although a great deal of tidying up still needs to be done, I am happier with the role of the accounting (and banking) professions in providing the degree of intensive support to industry needed, than at any time for the past 18 years. A breakthrough really has been achieved.

Fuller details will be given at the Press Conference.

Yours sincerely

Brian Warnes.

B.C.J. Warnes

OSMOSIS
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LONDON SE1 2EL
01-403 7575
Registered in England No. LN6571

THE CASH FLOW HANDBOOK

I have much pleasure in inviting you to a PRESS CONFERENCE at the ROYAL SOCIETY OF ARTS, 8 JOHN ADAM STREET, W.C.2. (just East of Charing Cross Station) from 12 noon to 3 p.m. on MONDAY 17th June 1985, to launch the CASH FLOW HANDBOOK. A wine and sandwich lunch will be served.

Yours sincerely,

B C J Warnes

RSVP

PRESS RELEASE

THE CASH FLOW HANDBOOK

by

BRIAN WARNES MA FCA

Published by

OSMOSIS PUBLICATIONS

8 HOLYROOD STREET, LONDON SE1 2EL.
(72 pages + 4 detachable appendices £9.95)

The HANDBOOK is a self-contained, follow-up, Supplement to THE GENGHIS KHAN GUIDE TO BUSINESS. The author is Managing Director of Midland Bank Venture Capital Limited, which he set up in October 1979. The book is being produced privately.

The Handbook applies an updated version of the Guide's CASH-FLOW, PROFIT-IMPROVEMENT and MONTHLY-MONITORING techniques to two REAL-LIFE CASE HISTORIES - a MANUFACTURING COMPANY and a SERVICE COMPANY.

FINANCIAL CONTROL is a particularly "live" subject at the moment. Spare monitoring forms are included to enable the reader to apply the same powerful techniques to his, or her, own company with equal success.

The purpose of the GENGHIS KHAN GUIDE is to provide company MANAGEMENTS with a simple, yet powerful, range of what might be termed LEVERS OF CONTROL in their business.

Thus the establishment of BREAKEVEN POINTS cuts through the swirl of paperwork and (half) information that envelops the average Board member, and sets up clear, immutable, BENCHMARKS against which the company can be navigated through to success, with increasing confidence and certainty.

The breakeven technique has accordingly been very widely welcomed and taken up, in all sizes of company, since the publication of the Guide in March 1984.

An equally powerful technique is that of VALUE-ADDED, which does for PRODUCTION and SALES what breakeven does for the Company as a whole. Again it has been very widely welcomed by company Managements and Advisers alike (as hopefully will be demonstrated at the Press conference).

The fact remains that however helpful and laudable are the adoption of such techniques on the PROFIT side, unless equally well done on the CASH FLOW side, the company will still founder ("unless the wages can be paid on Friday, every Friday, sooner or later there will be no more Fridays on which to continue in business, however good the (other) strengths of the management team"...).

The CASH FLOW HANDBOOK is thus designed to do for Cash flow what the main Guide does for Profit.

Examples are given of the (unsuspecting) Cash Flow traps that lie in wait for all but the most knowledgable, with sometimes fatal results (some of which have been very public in recent years).

With a population of around 100m, Japan's 6m businesses are providing 70% of employment and unemployment is down to under 3%. The Japanese business sector is working fully as it should.

With a population of around 50m, Britain's 1.5m smaller businesses provide 25% of employment and unemployment is over 13%. Britain's business sector is not working fully as it should.

America is half way between, unemployment having fallen from 10% to 7% since 1982 and a net 1.5m new jobs having been created by the small business sector in the last year.

There is strong evidence that the gap could be narrowed; and that a very major factor in achieving this would be to GIVE MANAGEMENT and THEIR ADVISERS direct ACCESS to the new sort of BUSINESS KNOWLEDGE being talked about here.

Such BUSINESS KNOWLEDGE is, for cultural and other reasons a bit thin on the ground in the U.K. However, happily, enormous strides have begun to be made to put this right, on the part of the BANKING and ACCOUNTING professions in particular.

To the extent it CAN be got right, the health and well-being of companies throughout the UK economy could benefit. What is needed, in a sense, is a fairly massive EDUCATIONAL exercise.

Here again, considerable strides are being made. Polytechnics, Enterprise Agencies and others are for instance beginning to structure some rather different business courses from anything hitherto available (typical details of which will be available at the Press Conference).

The MEDIA, too, of course have an absolutely key role to play - indeed have already played - in bringing about the necessary changes of attitudes and knowledge.

-----o0o-----

Science + Tech Pt 2

Summar

MARK

No ack. sent.

Walton Hall, Walton,
Milton Keynes,
MK7 6AA.
Telephone: Milton Keynes (0908) 653214
Telex: 825061

THE OPEN UNIVERSITY

Vice-Chancellor
J H Horlock ScD FEng FRS

C. F. GR-ppr please.

Our Ref. JHH/SW

Your Ref.

11th June, 1985.

13

The Rt. Hon. Margaret Thatcher, MP FRS
The Prime Minister,
10 Downing Street,
London SW1.

Dear Prime Minister,

#N As a follow-up to the Seminar you held in September 1983, the Open University, with the support of the Engineering Council, organised a Conference in April 1984 entitled 'Technology 2000'. Mr. Butcher opened the Conference for us and the Chairman of General Motors gave the keynote address. We invited senior people in various fields (and particularly in the so-called "enabling technologies") to give their view of new developments. Inevitably we were unable to cover the whole field, but I think we produced an interesting and challenging set of papers, which have now been published.

Since the Conference followed your personal initiative, I thought you would be interested to have a copy of the proceedings.

Yours sincerely,

J. H. Horlock.

SCI + TECH
Semina Part 2

Subject as matter

FILE

10 DOWNING STREET

From the Private Secretary

16 July, 1984

Dear Elizabeth.

CHEQUERS SCIENCE SEMINAR

I enclose a record of the seminar on current developments in science which was held at Chequers on 8 July.

I am sending copies of this letter and the enclosure to Roslyn Turp (Mr. Brookes' Office), and to Mr. Hancock, Sir David Phillips and Dr. Nicholson.

Yours ever,

David

(David Barclay)

Miss C.E. Hodkinson
Department of Education and Science.

dr

CHEQUERS SCIENCE SEMINAR

SUNDAY 8 JULY 1984

The Prime Minister held a seminar at Chequers on 8 July 1984 to discuss current developments in science. A list of those attending the seminar is attached.

Introducing the presentations, Dr. Nicholson said that the seminar would cover four important and exciting areas:

- Molecular Electronics and Low Dimensional Structures;

- Enzyme Engineering;

- Plant Genetics; and

- Neuroscience.

As would become apparent, there were links between these subjects, although they came from different disciplines.

Molecular Electronics and Low Dimensional Structures

Professor Roberts began his presentation by describing the basic transistor, which consisted of two closely spaced electrodes on a layer of silicon, separated by an insulating layer (usually of silicon oxide) from a third metal electrode which controlled the flow of current between the other two. Devices constructed on this basic principle had very much reduced the size of electronic components, and made possible the enormous progress in micro electronics which had occurred over the past decade. The question which scientists were now addressing was how the next reduction in size would be achieved. Two main routes were possible:

further advances in the technology of inorganic semi-conductors; or the development of new organic materials, which could be "self assembled". The goal in either event was a new technology of "molecular engineering".

Professor Roberts went on to describe the significance of Langmuir Blodgett Films in the construction of micron level electronic components. His Department had developed equipment, marketed through Vickers, which was capable of building stacked mono molecular layers in a way which had been christened "molecular lego". Components of this nature had a vast range of potential applications, and had given rise to extensive business interest.

Dr. Shanks spoke about two specific applications of molecular engineering: liquid crystals, and electronic biosensors. Liquid crystals operated on the principle that certain molecules changed their orientation, and hence their optical qualities, when an electric field was applied. Many more sophisticated liquid crystal devices were now possible. Applications included large displays, touch panels, digital thermometers, electro-optical devices, and optical computers.

At the same time, research was being carried out on new forms of biosensors, which could provide rapid and sensitive measurements of specific chemicals, e.g. hormone or antigen concentrations. Apart from the obvious applications in medical diagnostics, devices of this sort could be useful in monitoring and process control in industry.

Dr. Friend described his work on the semi-conductor and metallic properties of organic materials. Metallic behaviour in organic substances had first been demonstrated in 1972, and in 1980 had come the first organic superconductor.

Organic materials with these electric properties fell into two classes: charge transfer salts and polymers. Charge transfer salts were analogous in their structure to the benzene molecule, in that they possessed pi electron systems.

The most commonly researched salt was TMTSF perchlorate, which was a superconductor at a temperature of 1.2 degrees K. In polymers, electric conduction occurred along carbon chains formed from alternating double and single bonds. The simplest compound with semi-conductor properties was polyacetylene, though it was not easy to make and the "doping" agents required to turn it into an n or p type semi-conductor were highly toxic. The most likely application for semi-conducting polymers in the near future was probably rechargeable batteries. Further advances would follow, as the versatility of organic chemistry was applied to the search for better materials.

Dr. Kelly gave a presentation on Low Dimensional Structures. We were witnessing the marriage of two techniques: the construction of layered semi-conductors by Molecular Beam Epitaxy (MBE), and Fine Line Lithography. Both techniques were now highly developed. For example, wires had been made which were only 15 atoms wide and 30 atoms high. Possible applications included new forms of photo cells which operated at room temperature, faster electronic components through the decoupling of electron movements from lattice vibrations, and the development of crystals whose elements were themselves transistors.

Enzyme Engineering

Professor Fersht introduced a presentation on enzyme engineering. Major advances had been made over the past 20 years in our understanding of the nature of enzymes, which were highly specific natural catalysts. Enzymes were being

used increasingly in industrial processes, as well as in the laboratory. Protein crystallography had revealed new insights into the physical structure of enzymes. The major question in enzyme engineering was how existing structures could be altered. New genes could be synthesised or obtained through mutation, and then expressed as enzyme proteins in bacteria. In certain cases, it had been found possible to improve the performance of natural enzymes for particular experimental applications.

Dr. Rigby spoke about the mechanisms for gene expression and control, which were different in eukaryotic and prokaryotic organisms. The "front" sections of eukaryotic genes had elaborate control functions, including a start/stop mechanism. A fuller understanding of these controls offered the prospect of large advances in medical science.

Plant Genetics

Dr. Flavell described parallel developments in plant science. In experimental terms, plants were easier to deal with than animals, since the effect on the whole organism could be studied. The foundation of plant genetic manipulation was a soil borne bacterium which possessed a mechanism for inserting parts of its own genes into plant chromosomes in order to produce tumours. Scientists had been able to harness this mechanism to insert genetic material of their own choice.

Genetic manipulation was being used to attempt to produce disease resistant plant strains, and to alter control mechanisms in order to increase volumes of production. As yet, however, it had not proved possible to use the techniques to produce improved cereal strains.

Professor Ellis described the current state of knowledge about an enzyme know as Rubisco, which played a key role in

photosynthesis. Rubisco had several interesting features: first, its synthesis required two separate genetic systems, one in the chloroplast and one in the nucleus. Secondly, the two genetic systems combined only when stimulated by light, so that Rubisco was present in the leaves of plants but not the roots; thirdly, and remarkably, the enzyme was surprisingly inefficient. Rubisco had a poor affinity for carbon dioxide at atmospheric concentration, which was why horticulturalists sometimes increased the concentration of CO2 in greenhouses to enhance production. It followed that as the concentration of atmospheric carbon dioxide increased, through the burning of fossil fuels, agricultural yields would tend to increase also.

Neuroscience

Professor Marsden spoke about the current understanding of diseases of the brain. The frequency and variety of brain disorders was a crucial health care problem. Traditionally, doctors had believed that the brain was incapable of regeneration, which made it very difficult to treat. Moreover, the brain was compartmentalised according to function, which made specific remedies hard to find.

More recent discoveries had, however, called into question these basic assumptions about the nature of the brain. For example, it had been found that Parkinson's disease was associated with the absence of a chemical (dopamine), which in normal subjects was concentrated in the caudate section of the brain. Dopamine acted as a messenger between nerve cells across their junctions (synapses). It had been found that Parkinson's disease responded extremely well if patients were fed the chemical precursor of dopamine in order to compensate for the deficiency. There were many other messenger chemicals in the brain, which in effect consisted of a "wiring system" with a "chemical system" super-imposed.

As regards brain growth, transplants had been carried out in rats which suggested that foetal brain tissue could be used to replace missing functions. But it had yet to be demonstrated that the same was true in mammals. The crucial question which had not been answered was by what mechanism brain growth was switched on and off.

In parallel with these developments, there had been significant advances in the study of the brain in life. In particular, the C T and N M R scanners had made possible the "photography" of living brain tissue. Further advances in knowledge were likely through the use of radio isotope labels combined with N M R scanning.

Dr. Smith concluded the presentation by describing his research on brain function at the level of individual cells. The latest estimate was that the brain contained some 500 billion nerve cells, each of which was connected to approximately 10,000 others. Brain cells acted as a sort of electro-chemical switch, and his research had investigated the role of so-called "chandelier cells" in controlling the electrical discharges from sets of pyramidal cells. It was possible that the symptoms of epilepsy were caused by the momentary failure of a chandelier cell.

PARTICIPANTS IN SCIENCE SEMINAR AT CHEQUERS - 8 JULY 1984

The Rt Hon Sir Keith Joseph MP	Secretary of State for Education and Science
The Hon Peter Brooke MP	Parl. Under-Secretary of State, DES
Mr. David Hancock	DES
Dr. Robin Nicholson, FRS	Chief Scientific Officer
Sir David Phillips, FRS	Molecular Biophysics Laboratory
Mr David Barclay	Prime Minister's Office
Professor Gareth Roberts, FRS	Head of Dept. Applied Physics and Electronics, Univ. Durham.
Dr. Ian Shanks, FRS	Principal Scientists, Unilever
Dr. Richard Friend	Univ. Demonstrator in Physics, Cavendish Laboratory, Cambridge
Dr. Michael Kelly	Senior Research Scientist, Long Range Research Lab., GEC.
Professor Alan Fersht, FRS	Wolfson Research Professor, Royal Society
Dr. Peter Rigby	Reader in Tumour Virology, Imperial College
Dr. Richard Flavell	Head of Molecular Genetics Group, AFRC Plant Breeding Institute, Cambridge
Professor John Ellis, FRS	Professor of Biological Sciences, University of Warwick
Professor David Marsden, FRS	Professor of Neurology, Inst. of Psychiatry and King's College Hospital
Dr. David Smith	Professor and Head of Dept. of Pharmacology, Univ. Oxford.

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Professor Fersht.

Thank you very much indeed for giving such an excellent presentation at our Science Seminar at Chequers last weekend on the subject of enzyme engineering. It is an amazing thought that man is now in a position to improve on the enzymes found in nature, and it was heartening to hear how this new power is being harnessed for the benefit of us all.

My best wishes to you and to the members of your Department in the important work that they do.

Yours sincerely

Margaret Thatcher

Professor Alan Fersht, FRS.

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Dr. Rigby.

It was good of you to give up your Sunday evening to come to Chequers for our Science Seminar. I was fascinated by your talk on genetic expression in eukaryotes. The advances that have been made in this field of research in recent years are staggering, and the work you described on tumours, in particular, gives great hope for the future.

I hope that you also enjoyed hearing about other branches of science. I certainly did.

My best wishes to you, and to the members of your research group, in the vital work that you are doing.

Yours sincerely

Margaret Thatcher

Dr. Peter Rigby

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Dr. Flavell.

Thank you very much for coming to Chequers last weekend to tell us about your work on plant genetics. This is a fascinating and fast-developing subject - it is extraordinary how much we owe already to a single soil-borne bacterium.

As you said, plant genetics is very much an area for the creative scientist. I look forward greatly to hearing more about their creations.

With every good wish to you and your colleagues at the Plant Breeding Institute.

Yours sincerely

Margaret Thatcher

Dr. Richard Flavell

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear D. Smith,

Thank you very much indeed for your part in the success of our Science Seminar at Chequers last weekend. I think all of us, including scientists from other disciplines, were fascinated by your talk on brain function at the level of individual cells. Clearly, we are just at the beginning of our discoveries in this field. But the work that you have done on "chandelier cells" seems to me a tremendous advance, and I look forward to hearing about further progress as time goes by.

My best wishes to you and to your colleagues at Oxford in the important work which you are doing.

Yours sincerely

Margaret Thatcher

Dr. David Smith

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Professor Marsden

I am very grateful to you for giving up your Sunday evening to come to Chequers for our Science Seminar. Your talk on current developments in neuroscience was both fascinating and lucid, and I was glad to have the opportunity to talk further with you over supper. The importance of the work you are doing in combating diseases of the brain could hardly be overstated. It must be so rewarding when, as with Parkinson's Disease, our increased understanding leads to the discovery of an effective treatment.

With every good wish.

Yours sincerely

Margaret Thatcher

Professor David Marsden, FRS.

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Professor Ellis.

It was very good to see you again at our Science Seminar at Chequers last weekend. I was fascinated by your talk on the role of Rubisco in photosynthesis. There are very many questions still to answer - not least in relation to cereal crops. But the pace is hotting up, and I shall follow future developments with great interest.

With every good wish.

Yours sincerely

Margaret Thatcher

Professor John Ellis, FRS.

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Professor Roberts.

Thank you very much indeed for your part in the success of our Science Seminar at Chequers last weekend. I found it quite fascinating to have such a well-informed series of presentations on such exciting topics; and I particularly appreciated your own talk on "molecular lego", and the delightfully named "Langmuir Blodgett Films".

It was kind of you to refer to my own work on thin films. Technology has moved on such a lot since then, but I still have a special interest in the subject.

Please pass on my best wishes to your team at Durham for the continuing success of their important work.

Yours sincerely

Margaret Thatcher

Professor Gareth Roberts, FRS.

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Dr. Friend,

Thank you very much indeed for your part in the success of our Science Seminar at Chequers last weekend. Your talk on organic materials as semi-conductors and metals was both lucid and fascinating. I look forward to hearing more in the future about the children of this exciting marriage between physics and organic chemistry.

Please pass on my best wishes to the rest of your team at the Cavendish and elsewhere, and my congratulations on all that they have achieved so far.

Yours sincerely

Margaret Thatcher

Dr. Richard Friend

FILE

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Dr. Kelly.

It was good of you to give up your Sunday evening to come to Chequers for our Science Seminar last weekend, and I very much appreciated your talk on developments in semi-conductor devices at the atomic and molecular level. As you yourself said, we can be proud of our research in this area, but we must be determined also to ensure that the industrial benefits accrue to us and not to our competitors.

With best wishes for your forthcoming trip to New Zealand.

Yours sincerely

Margaret Thatcher

Dr. Michael Kelly

FILE JD

10 DOWNING STREET

THE PRIME MINISTER

14 July, 1984

Dear Dr. Shanks.

It was good of you to give up your Sunday evening to come to Chequers for our Science Seminar, and I greatly enjoyed your talk on liquid crystals and electronic biosensors. The industrial and medical applications you described are indeed exciting, and I very much share your hope that we in this country will remain in the forefront of research in this area.

My thanks once again for your invaluable contribution to our discussion.

Yours sincerely

Margaret Thatcher

Dr. Ian Shanks, FRS.

CM

GR

Ha 0321

Please amend as shown (on w.p.)

MR BARCLAY, No 10

13 July 1984

DWB 13/7

The note on the Chequers Science Seminar seems admirable to me. I have made just a few suggestions, on the attached copy of your text.

A V HARRISON

CHEQUERS SCIENCE SEMINAR JHRABQ

SUNDAY 8 JULY 1984

The Prime Minister held a seminar at Chequers on 8 July 1984 to discuss current developments in science. A list of those attending the seminar is attached.

Introducing the presentations, Dr. Nicholson said that the seminar would cover four important and exciting areas:

- Molecular Electronics and Low Dimensional Structures;

- Enzyme Engineering;

- Plant Genetics; and

- Neuroscience.

As would become apparent, there were links between these subjects, although they came from different disciplines.

Molecular Electronics and Low Dimensional Structures

Professor Roberts began his presentation by describing the basic transistor, which consisted of two closely spaced electrodes on a layer of silicon, separated by an insulating layer (usually of silicon oxide) from a third metal electrode which controlled the flow of current between the other two. Devices constructed on this basic principle had very much reduced the size of electronic components, and made possible the enormous progress in micro electronics which had occurred over the past decade. The question which scientists were now addressing was how the next reduction in size would be achieved. Two main routes were possible:

/ further advances

further advances in the technology of inorganic semi-conductors; or the development of new organic materials, which could be "self assembled". The goal in either event was a new technology of "molecular engineering".

Professor Roberts went on to describe the signicance of Langmuir Blodgett Films in the construction of micron level electronic components. His Department had developed equipment, marketed through Vickers, which was capable of building stacked molecular monolayers in a way which had been christened "molecular lego". Components of this nature had a vast range of potential applications, and had given rise to extensive business interest.

Dr. Shanks spoke about two specific applications of molecular engineering: liquid crystals, and electronic bio-sensors. Liquid crystals operated on the principle that certain molecules changed their orientation, and hence their optical qualities, when an electric field was applied. Many more sophisticated liquid crystal devices were now possible. ~~further advances in the technology in inorganic semi-conductors being developed using molecular engineering.~~ Applications included large displays, touch panels, digital thermometers, electro-optical devices, and optical computers.

At the same time, research was being carried out on new forms of biosensors, which could provide rapid and sensitive measurements of specific chemicals, e.g. hormone or antigen concentrations. Apart from the obvious applications in medical diagnostics, devices of this sort could be useful in monitoring and process control in industry.

Dr. Friend described his work on the semi-conductor and metallic properties of organic materials. Metallic behaviour in organic substances had first been demonstrated in 1972, and in 1980 had come the first organic superconductor.

/ Organic materials

Organic materials with these electric properties fell into two classes: charge transfer salts and polymers. Charge transfer salts were analogous in their structure to the benzene molecule, in that they possessed pi electron systems.

The most commonly researched salt was ~~T & TSF~~ TMTSF perchlorate, which was a superconductor at a temperature of 1.2~~K~~ degrees. In polymers, electric conduction occurred along carbon chains formed from alternating double and single bonds. The simplest compound with semi-conductor properties was polyacetylene, though it was not easy to make and the "doping" agents required to turn it into an n or p type semi-conductor were highly toxic. The most likely application for semi-conducting polymers in the near future was probably rechargeable batteries. Further advances would follow, as the versatility of organic chemistry was applied to the search for better materials.

Dr. Kelly gave a presentation on Low Dimensional Structures. We were witnessing the marriage of two techniques: the construction of layered semi-conductors by Molecular Beam Epitaxy (MBE), and Fine Line Lithography. Both techniques were now highly developed. For example, wires had been made which were only 15 atoms wide and 30 atoms high. Possible applications included new forms of photo cells which operated at room temperature, faster electronic components through the decoupling of electron movements from lattice vibrations, and the development of crystals whose elements were themselves transistors.

Enzyme Engineering

Professor-Fersht introduced a presentation on enzyme engineering. Major advances had been made over the past 20 years in our understanding of the nature of enzymes, which were highly specific natural catalysts. Enzymes were being

/used

used increasingly in industrial processes, as well as in the laboratory. Protein crystallography had revealed new insights into the physical structure of enzymes. The major question in enzyme engineering was how existing structures could be altered. New genes could be synthesised or obtained through mutation, and then expressed as enzyme proteins ~~assembled~~ in bacteria. In certain cases, it had been found possible to improve the performance of natural enzymes for particular experimental applications.

Dr. Rigby spoke about the mechanisms for gene expression and control, which were different in eukaryotic and prokaryotic organisms. The "front" sections of eukaryotic genes had elaborate control functions, including a start/stop mechanism. A fuller understanding of these controls, offered the prospect of large advances in medical science.

I know 'k' is correct, but am not sure if 'c' might be an alternative

Plant Genetics

Dr. Flavell described parallel developments in plant science. In experimental terms, plants were easier to deal with than animals, since the effect on the whole organism could be studied. The foundation of plant genetics manipulation was a ~~cell-borne~~ soil borne bacterium which possessed a mechanism for inserting parts of its own genes into plant chromosomes in order to produce tumors. Scientists had been able to harness this mechanism to insert genetic material of their own choice.

Genetic manipulation was being ~~had been~~ used to attempt to produce disease resistant plant strains, and to alter control mechanisms in order to increase volumes of production. As yet, however, ~~there was no technique available for influencing genetics of cereal crops.~~ it had not proved possible to use the techniques to produce improved cereal strains.

Professor Ellis described the current state of knowledge about an enzyme known as Rubisco (cap.), which played a key role in

/ photosynthesis

photosynthesis, and thus in the entire life cycle of the plant. Rubisco had several interesting features: first, its synthesis required two separate genetic systems, one in the chloroplast and one in the nucleus. Secondly, the two genetic systems combined only when stimulated by light, so that rubisco was present in the leaves of plants but not the roots; thirdly, and remarkably, the enzyme was surprisingly inefficient. Rubisco had a poor affinity for carbon dioxide at atmospheric concentration, which was why horticulturalists sometimes increased the concentration of CO2 in greenhouses to enhance production. It followed that as the concentration of atmospheric carbon dioxide increased, through the burning of fossil fuels, agricultural yields would tend to increase also.

Neuroscience

Professor Marsden spoke about the current understanding of diseases of the brain. The frequency and variety of brain disorders was a crucial health care problem. Traditionally, doctors had believed that the brain was incapable of regeneration, which made it very difficult to treat. Moreover, the brain was compartmentalised according to function, which made specific remedies hard to find.

More recent discoveries had, however, called into question these basic assumptions about the nature of the brain. For example, it had been found that Parkinsons Disease was associated with the absence of a single chemical (dopamine), which in normal subjects was concentrated in the caudate section of the brain. Dopamine acted as a messenger between nerve cells across their junctions (synapses). It had been found that Parkinsons Disease responded extremely well if patients were fed the chemical precursor of dopamine in order to compensate for the deficiency. There were many other messenger chemicals in the brain, which in effect consisted of a "wiring system" with a "chemical system"

/super-imposed

super-imposed.

As regards brain growth, transplants had been carried out in rats which suggested that foetal brain tissue could be used to replace missing functions. But it had yet to be demonstrated that the same was true in mammals. The crucial question which had not been answered was by what mechanism brain growth was switched on and off.

In parallel with these developments, there had been significant advances in the study of the brain in life. In particular, the C T and N M R scanners had made possible the "photography" of living brain tissue. Further advances in knowledge were likely through the use of radio isotope labels combined with N M R scanning.

Dr. Smith concluded the presentation by describing his research on brain function at the level of individual cells. The latest estimate was that the brain contained some 500 billion nerve cells, each of which was connected to approximately 10,000 others. Brain cells acted as a sort of electro-chemical switch, and his research had investigated the role of so-called "chandelier cells" in controlling the electrical discharges from sets of pyramidal cells. It was possible that the symptoms of epilepsy were caused by the momentary failure of a chandelier cell.

Science + Tech. : Chiquers Seminar
Pt 2

12 JUL 1984

10 DOWNING STREET

From the Private Secretary

DR. HARRISON
Cabinet Office

I enclose, with some trepidation a draft note of the Chequers Science Seminar. I should be grateful for comments and corrections as soon as possible, so that I can issue the note to those who were present from Government.

David Barclay

11 July 1984

JCRABR.

CHEQUERS SCIENCE SEMINAR

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file ECL.

10 DOWNING STREET

From the Private Secretary

David

Are there any other papers for filing, and what's the subject pl?

Kay
15/7.

DR HARRISON
Cabinet Office

I have now extracted the slide belonging to Professor Marsden, and enclose it herewith. I should be grateful if you could arrange for it to be returned to him.

David Barclay

10 July 1984

Kay
Science Seminar.
Pps are with the meeting record which Lil is typing.

DMB
11/7

10 DOWNING STREET

From the Private Secretary

DR. HARRISON,
CABINET OFFICE.

SCIENCE SEMINAR

I shall be sending you shortly a summary record of the Seminar held at Chequers yesterday. Meanwhile, you may like to have the enclosed papers which were left with me by Professor Roberts. I do not think that the Prime Minister will have time to look at these, though the quotation from Benjamin Franklin, at least, is of considerable interest.

DAVID BARCLAY

9 July 1984

PRIME MINISTER

Science Seminar

I attach the brief for your weekend Seminar on new developments in science.

A list of those attending is at Annex 1; the programme is at Annex 2; and there is a lengthy, but rewarding, brief on the scientific background at Annex 3.

The four subjects to be covered are:

Molecular Electronics and Low Dimensional Structures

Enzyme Engineering

Plant Genetics and

Neuroscience.

The Seminar is due to start at 5.00 p.m. and end at about 7.30 p.m., to be followed by a buffet supper.

You will see that one of the team on Plant Genetics is Professor John Ellis, F.R.S. You met him during your recent visit to Warwick University.

DAVID BARCLAY
6 July, 1984

PRIME MINISTER

Science Seminar - Chequers 8 July

BACKGROUND

This is the second of two discussions arranged following your conversation with Sir Keith Joseph on the science budget. Sir David Phillips and Professor Kingman attended the first discussion in which the management and efficiency of the Research Councils were reviewed.

2. The present discussion has the objective of giving you a glimpse of the current quality and excitement of science in this country through brief informal presentations by ten of our best young scientists in four key areas of science: electronics, enzyme engineering, plant genetics and neuroscience.

3. A list of the scientists and the other people coming is given in Annex I. Seven scientists are from universities, two from industry and one from a research institute.

HANDLING

4. I suggest that I introduce the programme (Annex II) very briefly and stress the need for the speakers to keep to time so as to be fair to the speakers at the end of the programme. Although questions of clarification will be welcome during the presentations, I suggest that the main discussion occurs in the places indicated in the programme. I have asked the speakers to concentrate on their science and its application, leaving wider considerations such as exploitation or competition with other countries as one option for general discussion. Some background on each of the scientific topics is given in Annex III.

5. We are due to finish at 7.30, but since supper is 7.30 for 8.00, there are a few minutes leeway if we are running slightly late.

CONCLUSION

6. There is no need for any specific conclusions at the meeting but you will wish to thank the scientists for coming to talk to you about their work.

RBN

ROBIN B NICHOLSON
Chief Scientific Adviser

Cabinet Office
5 July 1984

ANNEX I

Participants in Science Seminar at Chequers, 8 July

Speakers

Professor Gareth Roberts, FRS 1984; Head of Dept. Applied Physics and Electronics, Univ. Durham since 1976; educ. Univ. College of North Wales; Xerox Corporation New York (1966-68) and Univ. Ulster (1968-76).

Dr Ian Shanks, FRS 1984; Principal Scientist, Unilever since 1984; educ. Glasgow Univ. and Portsmouth Polytechnic; Scottish Colorfoto Labs. (1970-72), Royal Signals and Radar Establishment at Malvern (1973-82), Unilever since 1982 (working on electronic biosensors).

Dr Richard Friend, University Demonstrator in Physics at the Cavendish Laboratory, Cambridge from Oct. 1984; educ. Univ. Cambridge; Univ. Paris (1977-78), various research posts at Univ. Cambridge.

Dr Michael Kelly, senior research scientist working in Long Range Research Lab., GEC, since 1981; educ. Victoria Univ., Wellington and Univ. Cambridge; Univ. California at Berkeley (1975-76), various research posts at Univ. Cambridge (1974-77).

Professor Alan Fersht, FRS 1983; Wolfson Research Professor of the Royal Society, Department of Chemistry, Imperial College since 1978; educ. Univ. Cambridge; Brandeis Univ. (1968), MRC Lab. of Molecular Biology at Cambridge (1969-77), Stanford Univ. (1978).

Dr Peter Rigby, Reader in Tumour Virology at Imperial College since 1983 and Joint Director of the Cancer Research Campaign's Eukaryotic Molecular Genetics Research Group since 1980; educ. Univ. Cambridge; MRC Lab.of Molecular Biology at Cambridge (1971-73), Stanford Univ. Medical Centre (1973-76), Imperial College since 1976.

Dr Richard Flavell, Head of Molecular Genetics Group at the AFRC Plant Breeding Institute, Cambridge; educ. Univ. Birmingham and Univ. East Anglia; Stanford University (1967-69), Plant Breeding Institute since 1969.

Professor John Ellis, FRS 1983; Professor of Biological Sciences, University of Warwick, since 1976; educ. King's College London; Univ. Oxford (1961-64), Univ. Aberdeen (1964-70), Univ. Warwick since 1970.

Professor David Marsden, FRS 1983; Professor of Neurology, Institute of Psychiatry and King's College Hospital, London, since 1972; educ. St Thomas's Hosp. Med. Sch.; National Hosp. for Nervous Diseases (1968-70), Inst. of Psychiatry and King's Coll. Hosp. since 1970.

Dr David Smith, Professor and Head of Dept. of Pharmacology, Univ. Oxford, from Oct. 1984; educ. Univ. Oxford; research fellowships and lectureships at Univ. Oxford (1966-84).

Other Visitors

Sir Keith Joseph
Mr Peter Brooke
Mr David Hancock
Sir David Phillips FRS
Dr Robin Nicholson FRS
Mr David Barclay

ANNEX III

Scientific Background

Molecular Electronics and Low Dimensional Structures

1. Modern electronics is based on two concepts: the p-n junction in doped silicon and the integrated circuit which combines many junctions and other components on a single silicon chip. Increased density of components has meant faster circuits, lower power requirements and smaller size. Current component spacings are at the micron level and are nearing the limit of conventional techniques. The future lies in ultra-thin multi-layer structures and the use of organic materials. The synthesis of clever chemistry with electronic physics will revolutionize the preparation and properties of electronic devices.

2. Electrons behave totally differently at surfaces compared with bulk material. In most conventional devices, surface effects have a negligible effect on properties as a whole but in ultra-thin low dimensional structures or ultra-thin ultra-narrow one dimensional structures, the material is 'all surface' and the unique quantum properties of electrons at a surface dominate. This combination of variable dimensionality with variable chemistry allows a vastly greater range of devices to be invented which promises to put conventional silicon chips into the electronic steam age.

3. Professor Roberts will talk about Langmuir-Blodgett (L-B) films where a mono-molecular layer of an amphiphilic compound floating on the surface of a fluid is transferred to a substrate by dipping. Repeated dipping allows the build up of many layers of molecules (of different types if desired) to give a 'self assembled' layer in a process which has been likened to 'molecular lego'. The layers can be made with great purity and regularity - virtually a man-made single crystal.

4. Applications of Langmuir-Blodgett films include electro-optical displays taking over from current liquid crystal technology, magnetic mono-layers, integrated optical/electro-optical devices, biological membranes such as artificial chlorophyll, and very thin mask materials for conventional chip manufacture.

5. Some of the issues at stake are:

(a) The effect of the substrate on the structure of the L-B film.

(b) The effect of impurities and defects in the L-B films.

(c) The chemical, thermal and mechanical stability of the films.

(d) The range of organic and organo-metallic compounds which can be prepared in amphiphilic form.

6. Dr Shanks will speak on liquid crystals and biosensors. Liquid crystals were the first device which depended on the interaction of electrical potential and molecules rather than the interaction of electrons and atoms.

7. It seems likely that many naturally occurring biological membranes can be synthesised using L-B film technology. This opens up the possibility of biosensors which produce an electrical or optical signal in response to changes in, for example, oxygen or glucose concentration in the blood, blood pressure and temperature or concentration of chemicals in a food processing plant.

8. The issues which need research include:

(a) Whether man can make better membranes than nature.

(b) The robustness and reliability of membranes in life-preserving situations.

(c) The range of conditions and chemical environments which can be monitored through biosensors.

9. Dr Friend will talk about conducting polymers such as charge transfer salts and conjugated polymers. Charge transfer salts are benzene-like materials where the pi electrons (associated with the C=C bond) overlap from one planar molecule to the next and thus give some of the non-localised electron properties normally associated with metals. Conjugated polymers work by conduction of pi electrons along the polymer chain - a typical example would be polyacetylene. The composition of the side chains can be altered to give effects analogous to the doping of silicon.

10. Although conducting polymers only have 1/300th of the conductivity of metallic copper, their cheapness in, say, the film form and their chemical diversity through all the tricks of organic chemistry offer great promise for thin batteries, large scale solar arrays etc. They have even been made with superconducting properties.

11. Issues include:

(a) The feasibility of organic electronic materials with the properties of doped silicon and III-V compounds (like gallium arsenide).

(b) The range of polymers which can be given conducting properties.

(c) Whether a "bio-chip" i.e. a completely organic chip, is possible or desirable.

12. Dr Kelly will speak on low dimensional structures (LDSs). These are prepared as very thin films by molecular

beam epitaxy (MBE) or molecular organic chemical vapour deposition (MOCVD) techniques. Refinement to line structures (ie. one-dimensional) is possible by fine line lithography, a sophisticated development of the conventional lithography used for silicon chip manufacture.

13. Because the electron density of states curve is completely different at surfaces compared with bulk material, electron behaviour in LDSs is also totally different. For example the electron states in the confining dimension(s) are quantised so that the density of states is a multiplier for the probability of physical processes such as the absorption or emission of light - this has implications for amplifier and laser properties.

14. One property of LDS materials - the "quantum Hall effect" (the Hall effect describes the interaction of magnetic and electrical behaviour in atoms in a solid) - is regarded as the most important discovery in solid state physics since superconductivity. Another property is the creating of "quantum wells" in which electrons can be accurately confined to different parts of the device and some of the normal limitations of semiconductor devices overcome.

15. Some of the key areas for research are:

(a) The theory of electron behaviour at surfaces.

(b) The application of the theory to predict novel effects which can then be created through designing the right LDS material.

(c) The difficulty of preparing perfect two and one dimensional LDS materials by MBE and MOCVD.

Enzyme Engineering

16. Genetic engineering techniques have opened up the possibility of designing novel enzymes. These enzymes will

be used to study mechanisms of enzyme action, and will be of considerable interest to several branches of industry (eg. for use in the manufacture of food, pharmaceuticals, fine chemicals or detergents).

17. Professor Fersht will talk about the technique of "specific site directed mutagenesis", the first step in the production of a novel enzyme. Information in DNA is encoded in a linear fashion, in the order of the four bases A, G, T and C (adenine, guanine, thymine and cytosine). Three consecutive bases code for one of the amino acid building blocks of protein. A gene contains a code for the structure of a single protein. To change one amino acid in a protein it is therefore necessary to change up to three of the bases in the gene. In the last two years, this has been put into practice as follows. The DNA that codes for the desired enzyme is cloned. A small fragment of DNA containing a mutation is synthesised and inserted into the gene. Bacteria are then used to produce mutant proteins.

18. Some of the key areas for research are:

(a) Which amino acid residues are involved in the catalytic activity and specificity of enzymes.

(b) Whether enzymes can be made which are more robust and efficient, for use in industrial processes.

(c) Whether enzymes can be designed with entirely novel activities.

19. Dr Rigby will talk about gene expression, the term which covers all of the steps involved in decoding the information present in the DNA of the gene and producing a functional protein molecule. It can be divided into transcription (the copying of the information in the DNA into a messenger RNA (ribosenucleic acid) molecule), translation (the synthesis of a protein according to the

instructions of the mRNA) and post-translational modification.

20. The expression of genes in bacteria (or prokaryotic organisms) is reasonably well understood. Consequently it has been possible to express some foreign genes in bacteria and so produce proteins such as interferon and growth hormone, of medical and scientific importance. However, the major issues in modern molecular biology are: (i) how the expression of genes of higher (or eukaryotic) organisms is controlled; and (ii) what are the mechanisms which ensure that particular genes are expressed only at appropriate times in embryonic development or only in the appropriate tissues of the adult organism. These questions cannot be studied in bacteria and it has therefore been necessary to develop techniques whereby genes can be modified, reintroduced into eukaryotic cells and the effects of the modification studied. By the application of such methods, some of the mechanisms which control gene expression in eukaryotes have been elucidated; these are quite different to the long-studied mechanisms used in prokaryotes.

21. It is possible to use these methods to study what goes wrong with gene expression in certain disease states. A classic example is provided by the thalassaemias, diseases which affect the synthesis of the oxygen-transporting protein haemoglobin. In many cases the exact molecular defect which causes the disease can be defined. The use of gene transfer techniques has also been used to study oncogenes, the genes involved in causing cancer. It has been possible to identify several such genes and to define precisely the defect which converts a normal gene into an oncogene.

22. A key area for further research is how defects identified in gene expression can be corrected, and diseases treated.

Plant Genetics

23. Tools and techniques have recently become available for studying how genetic information is stored, expressed, shuffled and passed from cell to cell. They have created an excitement among plant biologists that could not have been imagined a few years ago; this is because it is increasingly possible that, as more details of plant genes are elucidated, new, faster and less expensive ways of breeding crop plants suitable for changing demands and conditions will be discovered.

24. Dr Flavell will talk about recent developments in the area of gene transfer. In 1983 three laboratories reported for the first time that they had modified the properties of a plant by inserting a new gene into the plant from the test tube. In each case a bacterial gene was isolated, modified by attaching new genetic information that would enable a plant to "read" the bacterial gene, and inserted into the plant. The plant expressed the bacterial gene exactly as predicted by the molecular biologists who designed the new gene. The new genes are passed on to the next generation like any other plant gene. This year a gene specifying a major protein in a bean seed has been isolated and transferred to a tobacco plant. The tobacco seed of this plant now has a high content of the bean protein which shows that the special information in a bean gene was also understood by the tobacco plant.

25. The ability to insert genes into many species of higher plants grew quite unexpectedly out of a decade's research on a soil bacterium (Agrobacterium tumefaciens) that causes tumours in plants. Remarkably, this bacterium transfers some of its own genes into the plant, and this transfer system has now been harnessed by the plant molecular biologist to transfer genes of interest to him.

26. Some of the key areas for research are:

(a) How viruses and bacteria manipulate the control of gene expression in the plant for their own benefit.

(b) How a plant controls the expression of its genes in normal growth and development.

(c) The basic biochemistry of plants (an area much neglected in comparison with animal biochemistry), to provide the fundamental knowledge required to exploit these techniques.

27. As an example of the novel opportunities presented by the application of genetic manipulation to plants, Professor Ellis will talk about recent research on the enzyme ribulose bisphosphate carboxylase-oxygenase (called Rubisco). This enzyme catalyzes the first reaction in the process of photosynthesis, which occurs inside chloroplasts, the complex structures containing chlorophyll which occur only inside plant cells.

28. Rubisco has three unusual features which make it interesting:

(a) Its synthesis requires the integrated activities of two genetic systems. Rubisco is composed of two types of protein, which must be bound together to produce a functional enzyme. One protein type is made by the nuclear genetic system while the other is produced by the chloroplast genetic system. The type produced by the nucleus enters the chloroplast by being transported across the membrane around the chloroplast.

(b) The expression of the two genetic systems is stimulated by light. Light is acting here not as any energy source but as an environmental trigger

to ensure that the enzyme is synthesised only where it will be of use, ie. in the leaves, and not in the roots.

(c) Rubisco is an inefficient enzyme because of a poor affinity for carbon dioxide, and often is the rate-limiting factor in the wild. This is why carbon dioxide is added to greenhouses for certain crops.

29. The issues which genetic engineering techniques are here being used to explore are:

(a) The mechanisms by which the two genetic systems are integrated, so that genes for novel and mutated chloroplast proteins can be introduced into the nucleus.

(b) The molecular basis of light-stimulation, so that the property of light-stimulation can be added to genes for other proteins.

(c) The precise function of each component of Rubisco, so that mutagenesis can be used to produce a more efficient enzyme.

Neuroscience

30. One nerve cell (or neuron) signals to another by means of a chemical (or neurotransmitter) that is released from nerve endings, crosses the synapse (the junction between one nerve and another) and triggers an impulse in a second nerve. Some fifty different chemicals involved either in transmission, or control of the transmission process, have so far been identified. (15 years ago this number was 5). Knowledge of the chemistry, structure and function of individual neurons and the ways they connect and communicate with one another to form networks and circuits, each processing a different sort of information, contribute to understanding and treating diseases of the brain.

31. Professor Marsden will talk about how malfunctioning brain tissue can be treated and how the brain can be examined in life.

32. Several types of neurological disorder have been linked with deficiencies of specific neurotransmitters. Parkinson's disease has for some time now been known to be associated with a deficiency of the transmitter dopamine in parts of the brain. The course of the disease can be alleviated by giving the patient L-dopa (L-dihydroxyphenylalanine), the precursor of dopamine, which will not itself cross the blood-brain barrier. In Alzheimer's disease (a form of dementia) there is good evidence that the synthesis of the transmitters acetylcholine and noradrenaline is abnormally low. Efforts are now being directed towards improving intellectual functions by compensating for these transmitter deficiencies.

33. A different approach to treatment involves transplantation of nervous tissue. While the peripheral parts of the nervous system are capable of anatomical and functional repair after peripheral nerve injuries, it was long held that brain tissue had no such regenerative capacity. Over the last few years this view has been challenged. Attempts have recently been made to replace damaged areas of the brain by transplants of nervous tissue. Transplants in rats can now survive for long periods and some connections within the host brain are restored.

34. In order to treat areas of dead or malfunctioning brain by drugs that mimic or modulate the action of transmitters, or perhaps in the longer term by transplants of nervous tissue, it is necessary to localise the lesions in the living brain. Three imaging techniques have led to advances in this area:

(a) CT (computerised tomography), in which the image is obtained by computing the average X-ray picture taken from all directions around the head.

(b) PET (positron emission tomography), in which the patient is injected with a short-lived radioactive isotope, positron emissions are recorded from every angle around the head and an average picture is built up.

(c) NMR (nuclear magnetic resonance), in which the head is placed in a large magnet, bombarded with radiowaves and the oscillations of atomic nuclei observed.

35. Key issues for research are:

(a) Whether the techniques for transplantation of nervous tissue can succeed in human beings, thus allowing brain injured patients to be treated with foetal tissue transplants.

(b) Whether NMR, which does not involve the use of ionising radiation, can be developed to replace other scanning techniques.

36. Imaging techniques are important in the diagnosis of disease, but to understand how neurotransmitters act at synapses it is necessary to use the higher resolution techniques of electron microscopy. Dr Smith will describe new procedures that combine in the same experimental material a study of the physiological properties and chemical constitution of an individual neuron with the morphological demonstration of its connections to nearby neurons and to other brain regions. One neural circuit under study could be involved in the origins of epilepsy.

37. Issues include:

(a) Whether these studies will help to devise new drug therapies for diseases of the brain;

(b) Whether they will help to understand behaviour.

ANNEX II

Programme

Introduced by Dr Nicholson

Molecular Electronics and Low Dimensional Structures

5.00	Introduction, Langmuir-Bludgett films	Professor Roberts
5.13	Discussion	
5.17	Liquid crystals and biosensors	Dr Shanks
5.27	Discussion	
5.31	Conducting polymers	Dr Friend
5.41	Discussion	
5.45	Inorganic semi-conductors	Dr Kelly
5.55	Discussion	

Introduced by Sir David Phillips

Enzyme Engineering

6.00	Specific site-directed mutagenesis	Professor Fersht
6.10	Gene expression	Dr Rigby
6.20	Discussion	

Plant Genetics

6.30	Genetic engineering in plants	Dr Flavell
6.40	Manipulation of the key enzyme in photosynthesis	Professor Ellis
6.50	Discussion	

Neuroscience

7.00	Studying the human brain	Professor Marsden
7.10	Chemical neuroanatomy of the brain	Dr Smith
7.20	Discussion	

7.30 End of programme.

RESTRICTED

Ha0308

6/7

MR BARCLAY, No. 10

5 July 1984

SCIENCE SEMINAR - CHEQUERS 8 JULY

1. I attach a brief for the Prime Minister, for the Seminar on Sunday.

2. I also attach a copy for Dr Nicholson, together with one or two other papers that we need to get to him before he returns to the Office. I believe that you kindly undertook to take these to Chequers for him.

3. The third attachment is an extract from a US report entitled "The Five-Year Outlook on Science and Technology 1982" which Sir David Phillips gave to the Secretary of State for Education and Science, as background reading. This covers a much wider range of subjects than those to be covered by speakers at the Seminar. But you may like to have it to hand in case the Prime Minister requires further reading.

A V HARRISON
Science and Technology Secretariat

W.0451 29 June 1984

MR DAVID BARCLAY, No 10

SCIENCE SEMINAR - CHEQUERS 8 JULY

If an additional helper is required, I suggest Dr Victoria Harrison from my Secretariat.

ROBIN B NICHOLSON

OF: please b/f to me on Thurs 5 July.

DAB 29/6

W.0450

29 June 1984

MR DAVID BARCLAY, No 10

SCIENCE SEMINAR - CHEQUERS 8 JULY

This is to confirm the visual aids requirements as:

1. Overhead viewer for transparencies together with blank roll and writing pencils

2. Flip chart with writing pencils

3. 35mm slide projector.

1. and 3. to each have a screen if possible.

RBN

ROBIN B NICHOLSON

cc: Dr Harrison

FILE

RG7

10 DOWNING STREET

From the Private Secretary

DR. NICOLSON
CABINET OFFICE

SCIENCE SEMINAR - CHEQUERS, 8 JULY

Thank you for your minute of 13 June. The Prime Minister is content with the proposals contained therein for attendance at the Science Seminar to be held at Chequers on 8 July. She also agrees your proposals on the format for the occasion.

I am sending a copy of this minute to Richard Hatfield.

MR. D. BARCLAY

(David Barclay)

18 June, 1984

8881

FLE

RD

10 DOWNING STREET

MRS GOODCHILD

SCIENCE SEMINAR - CHEQUERS, 8 JULY

Just to let you know that the Prime Minister has now approved the proposals for the Chequers Science Seminar on 8 July, which was set out in Dr. Nicholson's minute of 13 June (already copied to you).

May I leave it to you, please, to liaise with Chequers?

MR. D. BARCLAY

18 June, 1984

Prime Minister (1)

Content with these proposals?

DMS 13/6

W.0412 13 June 1984

MR BARCLAY

Yes

SCIENCE SEMINAR - CHEQUERS 8 JULY

After discussion with David Phillips I propose the following programme for the Prime Minister's science seminar at Chequers on 8 July.

Molecular Electronics and Low Dimensional Structures

Professor Gareth Roberts, FRS, University of Durham
Dr Ian Shanks, FRS, Unilever (lately RSRE Malvern)
Dr Richard Friend, University of Cambridge
Dr Michael Kelly, GEC

Enzyme Engineering

Professor Alan Fersht, FRS, Imperial College
Dr Peter Rigby, Imperial College

Neuroscience

Professor Charles Marsden, FRS, King's College, London
Dr A D Smith, University of Oxford

Plant Genetics

Dr Richard Flavell, Plant Breeding Institute, Cambridge
Professor Reginald Ellis, FRS, University of Warwick

2. I believe we have 2½ hours for the seminar so I envisage 1 hour for the first topic and ½ hour for each of the others with the presentation lasting about two-thirds of the time

i.e start at 1700 with a buffet supper at 1930 for 2000.

and discussion of each topic following its presentation.

3. The presentations have been designed as linked pairs (in one case a foursome) in order to give a reasonable limit on the number of different areas of science discussed and yet provide some diversity of approach. The authors are in their 30s or early 40s.

4. The other people attending the seminar will be:

Sir Keith Joseph
Mr Peter Brooke
Mr David Hancock
Sir David Phillips
Dr Robin Nicholson

5. If the Prime Minister is content with this programme I will approach the people concerned to establish their availability for 8 July.

RBN

ROBIN B NICHOLSON
Chief Scientific Adviser

cc: Sir Robert Armstrong

Done 12/4

MRS GOODCHILD

c. Mr Turnbull

There is going to be a science seminar at Chequers on Sunday 8 July. It will start at 1700 hours and be followed by a working buffet supper.

Andrew Turnbull is dealing. Nothing for you to do yet. You will be sent a list of people to invite soon. But perhaps you would just warn Vera.

CR

13 April 1984

10 DOWNING STREET

From the Private Secretary

8 March, 1984.

I understand that Mr. Baker will be launching the new journal of the British Association for the Advancement of Science on 21 March. The Prime Minister has agreed to a suggestion from Dr. Nicholson that she should provide a message to mark the launch, and has signed the enclosed text. I should be grateful if you could arrange for this message to be delivered to the British Association at the appropriate time.

I am sending a copy of this letter and its enclosure to Dr. Nicholson (Cabinet Office).

David Barclay

Neil McMillan, Esq.,
Department of Trade and Industry.

10 DOWNING STREET

THE PRIME MINISTER

I applaud the British Association's initiative in launching its new journal Science-Technology-Industry LINK UP. It is essential for us as a nation to develop closer links between science and industry, and to create a climate of opinion which will foster the inventiveness of the British people. The Seminar on Science, Technology and Industry which we held at Lancaster House last September emphasised the importance of strengthening the links between scientists and engineers in higher education and managers in industry and commerce. The British Association has an excellent record of achievement in enabling scientists and engineers to find a wide audience, especially among the young. Its recent decision to extend its activities to work more closely with British industry is therefore a most encouraging development. The new journal Science-Technology-Industry LINK UP promises to carry forward one of the Lancaster House Seminar's main objectives, by providing a forum in which managers and scientists can exchange ideas and information and make each other more aware of the extraordinary opportunities for the application of science. I therefore wish it every success.

Margaret Thatcher

March 1984

GR/CF

PRIME MINISTER

D 8/3

British Association for the Advancement of Science

You agreed at the end of last year to send a message to the British Association for the Advancement of Science to mark the launch of their new journal, which is designed to stimulate industry's interest in science and technology.

The journal will be launched by Mr. Kenneth Baker on 21 March. Agree the attached message, to be sent via Mr. Baker?

DMB

6 March 1984

J. Pilkington

W.0191

5 March 1984

MR BARCLAY

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Further to your minute of 23 December, I attach a draft message from the Prime Minister to the British Association, which I suggest is sent via Mr Kenneth Baker who is launching the BA's journal on 21 March.

ROBIN B NICHOLSON
Chief Scientific Adviser

cc: PS/Mr Baker

DRAFT MESSAGE FROM THE PRIME MINISTER TO THE BRITISH ASSOCIATION

I applaud the British Association's initiative in launching its new journal Science-Technology-Industry LINK UP. It is essential for us as a nation to develop closer links between science and industry, and to create a climate of opinion which will foster the inventiveness of the British people. The Seminar on Science, Technology and Industry which we held at Lancaster House last September emphasised the importance of strengthening the links between scientists and engineers in higher education and managers in industry and commerce. The British Association has an excellent record of achievement in enabling scientists and engineers to find a wide audience, especially among the young. Its recent decision to extend its activities to work more closely with British industry is therefore a most encouraging development. The new journal Science-Technology-Industry LINK UP promises to carry forward one of the Lancaster House Seminar's main objectives, by providing a forum in which managers and scientists can exchange ideas and information and make each other more aware of the extraordinary opportunities for the application of science. I therefore wish it every success.

Sci + Tech: Seminar Mar 83.

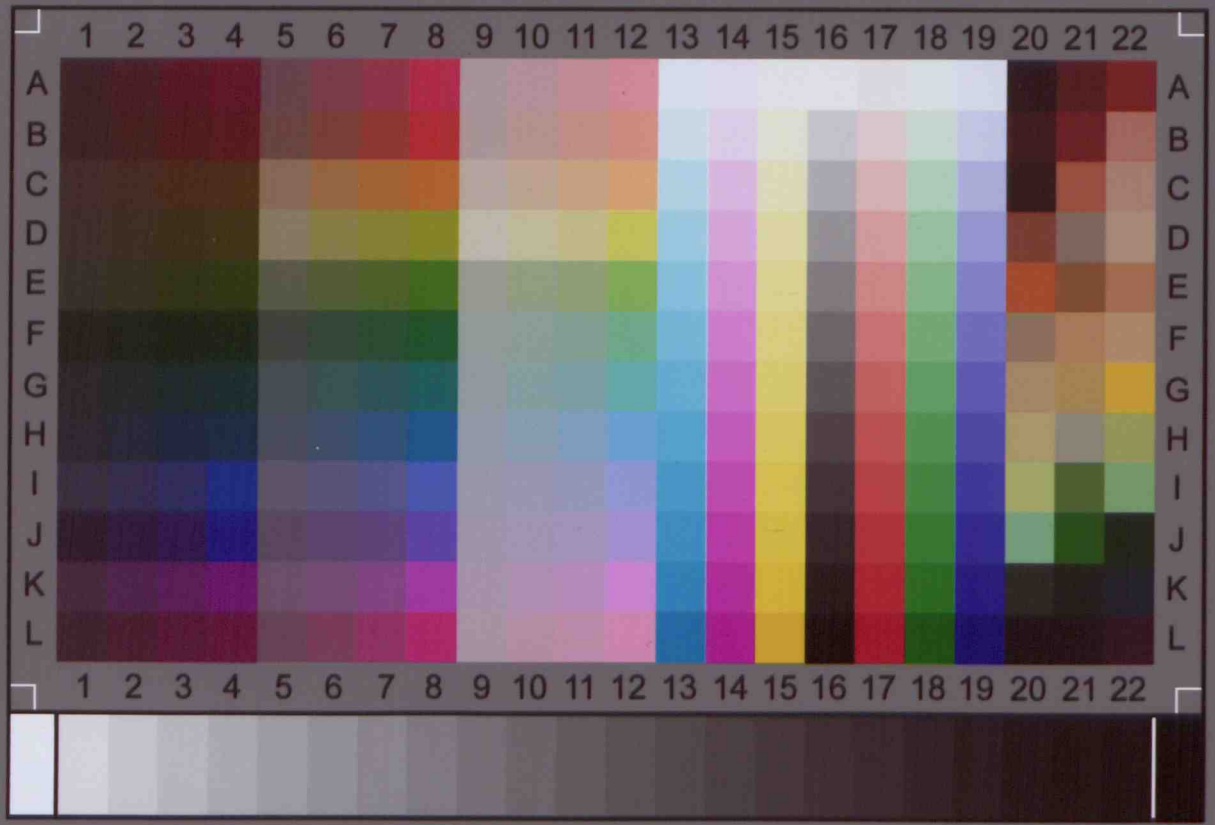
6 MAR 1983

PART 1 ends:-

Duty Clerk to DB 2/2/84.

PART 2 begins:-

Nicholson to DB W.0191 5/3/84.



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