

UNESCO – Kalinga Prize Winner – 1976

Sir George Porter Nobel Laureate in Chemistry – 1967



A handwritten signature in dark ink, reading "George Porter".

**One of the Most Distinguished Scientists of the Modern Age
&
One of Science's Greatest Popularisers**

[Born : 6th December ,1920, Stainforth, Yorkshire, England
Died : 31st August , 2002, Canterbury , Kent, England]

The Search for knowledge is the highest aim of Mankind.

....Lord Porter

Science is, on the whole, an informal activity, a life of shirt sleeves and coffee served in beakers.

...Lord Porter

George Porter – Biography



(b. Dec. 6, 1920, Stainforth, Yorkshire, Eng.), English chemist, corecipient with fellow Englishman Ronald George Wreyford Norrish and Manfred Eigen of West Germany of the 1967 Nobel Prize for Chemistry. All three were honoured for their studies in flash photolysis, a technique for observing the intermediate stages of very fast chemical reactions.

After undergraduate work at the University of Leeds, Porter earned his doctorate at the University of Cambridge under Norrish in 1949. He continued on there, developing the technique of flash photolysis with Norrish. In this technique, a gas or liquid in equilibrium is illuminated with an ultra-short burst of light that causes photochemical reactions in the substance. The extremely short-lived intermediate products of these reactions are illuminated by a second burst of light that enables an absorption spectrum to be taken of the reaction products before the gas has returned to a state of equilibrium. Porter specifically studied the equilibrium of chlorine atoms and molecules. In 1955 he joined the faculty of chemistry at the University of Sheffield, where he taught until 1966, becoming in that year director of the Royal Institution of Great Britain and Fullerian professor of chemistry. Porter was knighted in 1972.

George Porter was born in the West Riding of Yorkshire on the 6th December 1920. He married Stella Jean Brooke on the 25th August 1949 and they have two sons, John and Andrew.

His first education was at local primary and grammar schools and in 1938 he went, as Ackroyd Scholar, to Leeds University. His interest in physical

chemistry and chemical kinetics grew during his final year there and was inspired to a large extent by the teaching of M.G.Evans. During his final honours year he took a special course in radio physics and became, later in the year, an Officer in the Royal Naval Volunteer Reserve Special Branch, concerned with radar. The training which he received in electronics and pulse techniques was to prove

Glossary on Kalinga Prize Laureates

useful later in suggesting new approaches to chemical problems.

Early in 1945, he went to Cambridge to work as a postgraduate research student with Professor R.G.W. Norrish. His first problem involved the study, by flow techniques, of free radicals produced in gaseous photochemical reactions. The idea of using short pulses of light, of shorter duration than the lifetime of the free radicals, occurred to him about a year later. He began the construction of an apparatus for this purpose in the early summer of 1947 and, together with Norrish, applied this to the study of gaseous free radicals and to combustion. Their collaboration continued until 1954 when Porter left Cambridge.

During 1949 there was an exciting period when the method was applied to a wide variety of gaseous substances. Porter still remembers the first appearance of the absorption spectra of new, transient substances in time resolved sequence, as they gradually appeared under the safelight of a dark room, as one of the most rewarding experiences of his life.

His subsequent work has been mainly concerned with showing how the flash-photolysis method can be extended and applied to many diverse problems of physics, chemistry and biology. He has made contributions to other techniques, particularly that of radical trapping and matrix stabilization.

After a short period at the British Rayon Research Association, where he applied the new methods to practical problems of dye fading and the phototendering of fabrics, he went, in 1955, to the University of Sheffield, as Professor of Physical Chemistry, and later as Head of Department and Firth Professor. In 1966 he became Director and Fullerian Professor of Chemistry at the Royal Institution in succession to Sir Lawrence Bragg. He is Director of the Davy Faraday Research laboratory of the Royal Institution. Here his research group is applying flash photolysis to the problem of

photosynthesis and is extending these techniques into the nanosecond region and beyond.

Porter became a fellow of Emmanuel College, Cambridge, in 1952, and an honorary fellow in 1967. He was elected a Fellow of the Royal Society in 1960 and awarded the Davy Medal in 1971. He received the Corday-Morgan Medal of the Chemical Society in 1955, and was Tilden Lecturer of the Chemical Society in 1958 and Liversidge Lecturer in 1969. He has been President of the Chemical Society since 1970. He is Visiting Professor of University College London since 1967, and Honorary Professor of the University of Kent at Canterbury since 1966.

Porter holds Honorary D.Sc.'s from the following Universities: 1968, Utah, Salt Lake City (U.S.A.), Sheffield; 1970, East Anglia, Surrey and Durham; 1971, Leeds, Leicester, Heriot-Watt and City University. He is an honorary member of the New York Academy of Sciences (1968) and of the Academy "Leopoldina". He is President of the Comité International de Photobiologie since 1968. He was Knighted in January 1972.

He is interested in communication between scientists of different disciplines and between the scientist and the non-scientist, and has contributed to many films and television programmes. His main recreation is sailing.

From Nobel Lectures, Chemistry 1963-1970, Elsevier Publishing Company, Amsterdam, 1972

This autobiography/biography was written at the time of the award and later published in the book series Les Prix Nobel/Nobel/Nobel Lectures. The information is sometimes updated with an addendum submitted by the Laureate. To cite this document, always state the source as shown above.

Lord Porter died on August 31, 2002.



George Porter

A Brief Profile



George, Baron (1920-2002, Kt 1972, Baron 1990, OM 1989, FRS 1960, PRS 1985-1990, Copley 1992, Rumford 1978, Davy, 1971, Faraday 1991, Nobel Prize for Chemistry 1967)

Professor of Chemistry, 1963-1966;

Fullerian Professor of Chemistry, 1966-1988;

Director, 1966-1986;

Director of the Davy-Faraday

Research Laboratory, 1966-1986;

Emeritus Professor, 1988-2002

Born in Stainforth, Yorkshire, he attended Thorne Grammar School before studying chemistry at the University of Leeds. From 1941 until 1945 he served as a Radar Officer in the Royal Navy. After the war he continued his studies at Emmanuel College, Cambridge, of which he was a Fellow from 1952 to 1954. He was Demonstrator in Physical Chemistry at the University of Cambridge from 1949 until 1952 when he was appointed Assistant Director of Research. After a brief period working for the British Rayon Research Association, he was appointed Professor of Chemistry at the University of Sheffield where he remained until he moved to the Royal Institution. After leaving the Royal Institution he moved his research group to Imperial College. His research centred on photochemical techniques to understand fast chemical reactions. He was also very active in promoting science through various media as well as by his involvement in large number of organizations including being President of the British Association in 1986.

Source : Independent, 4 September 2002

George Porter

George Porter, Baron Porter of Luddenham, OM, FRS (December 6, 1920 – August 31, 2002) was a British chemist.

Porter was born in Stainforth, Yorkshire. He won a scholarship to the University of Leeds and gained his first degree in chemistry. He then served in the Royal Navy Volunteer Reserve during the Second World War.

Porter then went on to do research at Cambridge under Norrish where he began the work that ultimately led to them becoming Nobel Laureates.

His original research in developing the technique of flash photolysis to obtain information on short-lived molecular species provided the first evidence of free radicals. His later research utilized the technique to study the minutiae of the light reactions of photosynthesis, with particular regard to possible applications to a hydrogen economy, of which he was a strong advocate.

He was awarded the Nobel Prize in Chemistry in 1967 along with Manfred Eigen and Ronald George Wreyford Norrish. Porter was president of the Royal Society 1985-1990, having been elected a Fellow in 1960 and also winning the Davy Medal in 1971, the Rumford Medal in 1978 and the Copley Medal in 1992. He was knighted in 1972 and was made a life peer as **Baron Porter of Luddenham**, of Luddenham in the County of Kent, in 1990.

Porter was a major contributor to the public understanding of science. He became president of the British Association in 1985 and was the founding Chair of the Committee on the public Understanding of Science (COPUS). He gave the Romanes

Lecture, entitled "Science and the human purpose", at the University of Oxford in 1978; and in 1988 he gave the Dimbleby Lecture, "Knowledge itself is power". From 1990 to 1993 he gave the Gresham lectures in astronomy.

Porter served as Chancellor of the University of Leicester between 1984 and 1995. In 2001, the University's chemistry building was named the George Porter Building in his honour.

References :

- Profile (<http://www.rigb.org/rimain/heritage/ripeople/porter.jsp>) - Royal Institution of Great Britain
- The Lord Porter of Luddenham (<http://www.aps-pub.com/proceedings/149/490113ed.pdf>) (PDF)- Biographical memoirs, Proceedings of the American Philosophical Society, vol. 149, no. 1, March 2005
- The Life and Scientific Legacy of George Porter (<http://www.worldscibooks.com/chemistry/p452.html>), World Scientific Publishing 2006

External links :

- His obituary notice in The Telegraph, 2 September 2002 (<http://www.telegraph.co.uk/news/main.jhtml?xml=/news/2002/09/02/db0201.xml>)
- Biographical Database of the British Chemical Community, 1880-1970 (<http://www.open.ac.uk/ou5/Arts/chemists/person.cfm?SearchID=8585>)

Honorary titles		
Preceded by Sir Andrew Huxley	President of the Royal Society 1985-1990	Succeeded by Sir Michael Atiyah
Preceded by Sir William Bragg	Director of the Royal Institution 1966-1986	Succeeded by Sir John Meurig Thomas
Preceded by Sir Alan Hodgkin	Chancellor of the University of Leicester 1984-1995	Succeeded by Sir Michael Atiyah
Awards		
Preceded by Robert S. Mulliken	Nobel Prize in Chemistry with: Manfred Eigen and Ronald George Wreyford Norrish 1967	Succeeded by Lars Onsager



Biographical Database of the British Chemical Community, 1880-1970

PORTER, Geoge Lord

- BIRTH** : 1920 Stainforth, Yorkshire, England
- DEATH** : 2002 Canterbury, Kent, England
- REFERENCES** : Chem in Br Jan 1986, p.21; Chem in Br Sept 1986, p.788; Chem in Br May 1983, p.382;; CBC; Chem in Brit Apr 1999, p.31; McGraw-Hill, 1968; RSC File; The Independent, 4 Sep 2002, 16; The Guardian, 3.9.2002, 16; Chem in Brit, Nov 2002, 67; DNB;
- PORTRAIT** : CBC; Chem in Brit, Apr 1999, p.31; The Independent, 4 Sep 2002, 16; The Guardian, 3.9.2002, 16; Chem in Brit, Nov 2002, 67;

Education and Qualifications

- | | | |
|------|-----------|--|
| 1938 | Secondary | Awarding institution :
Institution of study : School – E & W, Secondary (Thorne Grammar School, Wakefield) |
| 1941 | BSc | Awarding institution : Leeds University
Institution of study :
Worked with : M G Evans |
| 1949 | MA | Awarding institution : Cambridge University
Institution of study: |
| 1949 | PhD | Awarding institution : Cambridge University
Institution of Study : Emmanuel College, Cambridge
Worked with : R G W Norrish |
| 1954 | Fellow | Awarding institution: Institute of Chemistry GBI
Institution of study : |
| 1959 | ScD | Awarding institution: Cambridge University
Institution of study : |

Career

1949 - 1952	:	Demonstrator, Cambridge University (Physical Chemistry)
1951 - 1954	:	Fellow, Emmanuel College, Cambridge
1952 - 1954	:	Assistant Director Research, Cambridge University (Physical Chemistry)
1954 - 1955	:	Assistant Director, British Rayon RA, Wythenshawe
1955 - 1963	:	Professor, Sheffield University (Physical Chemistry)
1963 - 1966	:	Professor, Sheffield University (Chemistry)
1963 - 1966	:	Head of Department, Sheffield University (Chemistry)
1966 - 1985	:	Professor, Royal Institution (Fullerian, Chemistry)
1966 - 1985	:	Director, Royal Institution
1967 - 2002	:	Hon. Fellow, Emmanuel College, Cambridge
1986 - 1995	:	Chancellor, Leicester University
1987 - 2002	:	Professor, Imperial College of Science & Technology, London
1988 - 2002	:	Emeritus Professor, Royal Institution
1990 - 1994	:	Professor, Gresham College (Astronomy)
1990 - 2002	:	Chairman, Imperial College of Science & Technology, London (Centre for Molecular Sciences)

Memberships and Roles

Institution :	Position:	Year (s) :
British Association for the Advancement of Science	Council Member	0-0
British Association for the Advancement of Science	President	1985-1986
Chemical Society of London	Fellow	0-0
Chemical Society of London	Council Member	1965-1966
Chemical Society of London	Vice-President	1968-1970
Chemical Society of London	President	1970-1972

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Chemical Society of London	Past-President	1972-1973
Chemical Society of London	Section Vice-President	1973-1974
Chemical Society of London	Council Member	1977-1980
Faraday Society	Member	0-0
Faraday Society	Council Member	0-0
Faraday Society	Vice-President	1966-1967
National Association for Gifted Children	President	1975-1980
Royal Society of London	Council Member	0-0
Royal Society of London	President	1985-1990

Honours

Year	Honour :	Awarding Body:
1951	Medal : Corday Morgan	Chemical Society of London
1960	Fellow	Royal Society of London
1967	Noble Prize for	
	Chemistry	Royal Swedish Academy of Sciences
1983	Hon PhD	Open University
1986	Hon DSc	Reading University



George Porter

A Biographical Note

Early Years :

George Porter was born in Stainforth in Yorkshire on 6 December 1920. He was educated at Thorne Grammar School, 1931-1938, and Leeds University, 1938-1941 where he was Ackroyd Scholar. The teaching of M.G. Evans at Leeds was influential in inspiring an interest in physical chemistry and chemical kinetics. During his final honours year he took a special course in radio physics which led to service, 1941-1945, as a Royal Naval Volunteer Reserve Radar Officer in the Western Approaches and the Mediterranean. His wartime training in electronics and pulse techniques was to prove useful later in suggesting new approaches to chemical problems.

From Cambridge to the Royal Institution :

In 1945 he went to the University of Cambridge to undertake postgraduate research with R.G.W. Norrish in the field of chemical kinetics and photochemistry. His research involved the study, by flow techniques, of free radicals produced in gaseous photochemical reactions. The idea of using short pulses of light, of shorter duration than the lifetime of the free radicals, occurred to Porter, and he began the construction of an apparatus for this purpose in the early summer of 1947 and, together with Norrish,

applied this to the study of gaseous free radicals and to combustion. Their collaboration continued until 1954 when Porter left Cambridge. His subsequent work was mainly concerned with showing how the flash-photolysis method could be extended and applied to a great variety of problems in physics, chemistry and biology. He made contributions to other techniques, particularly that of radical trapping and matrix stabilisation.

After nine years at Cambridge Porter spent a year as Assistant Director of the British Rayon Research Association in Manchester where he applied the new methods to practical problems of dye fading and the phototendering of fabrics. He then moved to the University of Sheffield as Professor of Physical Chemistry, 1955-1963 and Firth Professor of Chemistry, 1963-1966. Between 1963 and 1966 he was also Professor of Chemistry at the Royal Institution. Following the retirement of Sir Lawrence Bragg in 1966, Porter became Director of the Royal Institution and Fullerian Professor of Chemistry. Here his research group in the Davy Faraday Research Laboratory applied flash photolysis to the problem of photosynthesis and extended these techniques into the nanosecond and picosecond regions. Porter continued as Director until 1985.

Publications and Science Education :

Porter published extensively in leading scientific journals and *Chemistry in the Modern World*, 1962 and *Chemistry in Microtime*, 1996. He held many positions of leadership in the scientific community culminating in the Presidency of the Royal Society, 1985-1990. In 1990 he became Chairman of the Centre for Photomolecular Sciences, Imperial College London.

One of Porter's particular interests was scientific education and the interpretation of science to non-specialists, a field in which the Royal Institution has been famous for many years, making his appointment as Director especially appropriate. He spoke on scientific topics to the widest range of audiences from school children to scientific colleagues at specialized symposia. He was a successful science broadcaster on television including the 1965 BBC series of lectures entitled

"The Laws of Disorder: an introduction to chemical change and thermodynamics" and his Royal Institution Christmas Lectures: "Time Machines", 1969-1970 and 'Natural History of a Sunbeam', 1976-1977. His principal relaxation was sailing.

Honours and Awards :

Porter received many awards and honours in recognition of his scientific achievements. He was elected FRS in 1960 (Medals: Davy, 1971; Rumford, 1978; Michael Faraday, 1991; Copley, 1992; Lectures: Bakerian, 1977; Humphry Davy, 1985). He was awarded the 1967 Nobel Prize for Chemistry (with M. Eigen and R.G.W. Norrish) "for their studies of extremely fast chemical reactions, effected by disturbing the equilibrium by means of very fast pulses of energy". He was knighted in 1972, awarded the Order of Merit in 1989 and made a life peer in 1990. Lord Porter died in 2002.



The Nobel Prize in Chemistry - 1967



George Porter

Born	: 6-Dec-1920	Wife	: Stella Jean Brooke (m. 25-Aug-1949, two sons)
Birthplace	: Stainforth, Yorkshire, England	Son	: John
Died	: 31-Aug-2002	Son	: Andrew
Location of death	: Canterbury, Kent, England	University	: University of Leeds (1938-)
Cause of death	: unspecified	Nobel Prize for Chemistry - 1967	: (with Manfred Eigen and Ronald G.W. Norrish)
Gender	: Male	Davy Medal	: 1971
Race or Ethnicity	: White	Knighthood	: 1972
Sexual orientation	: Straight	Rumford Medal	: 1978
Occupation	: Chemist	Life Peerage	: 1990, as Baron Porter of Luddenham
Nationality	: England	Copley Medal	: 1992
Executive summary	: Studied Fast chemical reactions	Royal Society	: 1960, President 1985-90

Presentation Speech by Professor H.A.Ölander, Member of the Nobel Committee for Chemistry of the Royal Swedish Academy of Sciences

Your Majesty, Your Royal Highnesses, Ladies and Gentlemen.

The chemists of older times were chiefly interested in how to produce substances from natural products which might prove useful; for example, metals from ores and the like. As a matter of course, they were bound to notice that some chemical reactions took place rapidly, while others proceeded much more slowly. However, systematic studies of reaction velocities were hardly undertaken before the mid-19th century. Somewhat later, in 1884, the Dutch chemist, Van't Hoff, summarized the mathematic laws which chemical reactions often follow. This work, together with other achievements, earned for Van't Hoff the first Nobel Prize for Chemistry in 1901.

Almost all chemical reactions will proceed more rapidly if the mixture is heated. Both Van't Hoff and Svante Arrhenius, who for other discoveries was awarded the third Nobel Prize for Chemistry in 1903, set up a mathematical formula which describes how the velocity of a reaction increases with temperature. This formula could be interpreted by the assumption that when two molecules collide, they usually part again and nothing happens; but if the collision is sufficiently violent, the molecules disintegrate and their atoms recombine into new molecules. One could also envisage the possibility that the molecules moved towards each other at moderate velocity, but that the atoms in one molecule oscillated violently so that no severe impact would be required for that molecule to disintegrate. It was already then realized that higher temperature implied two things: the

molecules moved faster, and the atoms oscillated more violently. It was also realized that when a reaction velocity could be measured, only the merest fraction of the collisions involved really resulted in a reaction.

How fast were the reactions that could be measured in the old days? Considering that the substance first had to be mixed, after which samples had to be removed at specified times and then analyzed, the speed of the procedure was necessarily limited. The best case was if one could observe the change in some physical property such as colour; then it was not necessary to remove samples. The chemists had to read off his clock and measuring instrument, and then to make entries in his laboratory journal. If he was quick, he could keep up with a reaction which had run half its course in a few seconds.

How slow were the reactions one could measure? Eigen has said that this is determined by how long a time a young man wants to devote to his doctoral dissertation. If as a practical maximum we say that half the reaction is completed after three years, that comes to around 100 million seconds. Naturally, there are even slower reactions.

Many reactions were of course known to proceed at velocities so great as to defy measurements. For example, no one had succeeded in measuring the velocity of the reaction between an acid and an alkali. In such cases it was understood that the molecules reacted without the collision being very violent. In the study of reactions where a large number of molecules take part, it turned out that

the velocity often depended on the quantities of substances used in such a manner that a step-by-step sequence had to be assumed for the reaction: one of these steps was slow and hence determined the overall course of the reaction, while the other steps were immeasurably fast. The German chemist, Max Bodenstein, studied many such reactions at the beginning of this century.

A major advance was achieved in 1923 by the Englishmen, Hartridge and Roughton, who let two solutions arriving through separate tubes meet and be mixed, and then caused the mixture to flow swiftly through an outlet tube, in which the reaction could be observed as it proceeded. This method permitted measurement of reaction times down to thousandths of a second. But there are still many reactions that proceed still more rapidly. They could not be studied by this method for the simple reason that the substances cannot be mixed fast enough.

When nitric acid gets to react with a number of substances, a brown gas, nitrogen dioxide, is formed. This gas has certain properties which were interpreted by assuming that the brown molecules could form pairs, thus doubling their size. This was a typical example of a high-velocity reaction that no one has succeeded in measuring.

In 1901 a student studying for the doctorate with Walter Nernst investigated the velocity of sound in several gases, among them nitrogen dioxide. He found that the equilibrium between the single and double molecules was accomplished much more rapidly than the sound oscillations. But he perceived that the speed of sound ought to be modified if one used sufficiently high-pitched tones-far beyond the capacity of the human ear to hear. No less a person than Albert Einstein carried out a theoretical study of this phenomenon in 1920. However, many years were to elapse before instruments could be devised to measure it. A complication was found to be involved here in that the sound is absorbed by the gas. None the less, the principle is important; the essential point here is that one is not going to mix two things, but rather to start off from a chemical

system in equilibrium and to disturb this equilibrium, in this case by exposing the gas to the condensations and attenuations which constitute sound.

The fact that light produces chemical reactions has been known since time immemorial. Thus it bleaches colours and alters silver salts, which action is the very basis of photography. The ability of light to produce a chemical reaction depends on its absorption by a molecule, which then becomes so excited that it can react. Investigations of the energy states thus acquired by molecules were begun some fifty years ago. One of the findings was that the atoms of a molecule oscillated at rates of the order of billionths of a second. Chemical reactions inevitably take longer, for time must be allowed for the atoms to dissociate and re-combine into new molecules. For these purposes the times required come to, say, one ten thousandth part of a millionth of a second. In other words, such are the times for the fastest chemical reactions. They amount to one-tenth of one-millionth of the times Hartridge and Roughton were able to measure with their method. To convey an idea of what one ten thousandth part of a millionth of a second means, it can be said to form the same part of one second as one second is of three hundred years.

The 1967 Nobel laureates in Chemistry have opened up the whole of this vast field of reaction kinetics for research. They did so by applying the principle I have just mentioned: to start from a system in equilibrium and to disturb this equilibrium suddenly by one means or another.

If a molecule has absorbed light so that it can react, it usually does this so fast that too few of these activated molecules are present at any one time to reveal their existence by any known method of analysis.

Ever since the 1920's, Professor Norrish has been studying reaction kinetics and he was one of the leading scientists in this field. A younger associate joined him in the late 1940's in the person of George Porter. They decided to make use of a flash lamp,

the kind you have seen photographers use. The only difference was that they made their lamp thousands of times more powerful. Indeed, subsequent refinements have led to the construction of such lamps with an effect greater than the total effect which the whole city of Stockholm consumes on a winter afternoon with the lights turned on and the factories still humming before closing time-and that is 600000 kilowatts. There is just one catch, however; this enormous effect in the lamp lasts no more than onemillionth of a second or so. Still, in this way much if not most of a substance in a tube next to the flash lamp can be converted into an activated form, or the molecules broken up so as to yield atom groups with a high reactivity. It then becomes possible to study these newly formed molecules spectroscopically, but since they react so readily, this must be made extremely fast. Thanks to modern electronic equipment, however, these rapid processes can be recorded.

The new method developed by Norrish and Porter enabled them to study at first hand many fast reactions which one had previously only guessed that they took place. I cannot begin to enumerate even a sample of the reactions which Norrish and Porter, not to mention a great many other scientists, have investigated with this method. Suffice it to say that, in an earlier day, the study of these short-lived high-energy molecules and their chemical characteristics could hardly even have been contemplated as a wild dream.

The flash photolysis method of Norrish and Porter inflicts a drastic change of behaviour on the molecules. By contrast, Eigen treats his molecules more leniently. In 1953 he and two associates published a study on the absorption of sound in a number of salt solutions. The theoretical part of their report demonstrated how this absorption could be used to estimate the velocity of fast reactions which take place in the solution. Thus a solution of magnesium sulphate contains ions of magnesium and sulphate, as well as undissociated salt molecules. Equilibrium sets in after about $1/100000$ of a second. This causes that sound which

oscillates 100000 times a second is absorbed by the solution.

Eigen has invented several methods, however. If, say, a solution of acetic acid is subjected to a high-tension electric pulse, more molecules of this substance are dissociated than else would be the case in an aqueous solution. That takes a certain length of time. When the electric pulse is turned off, the solution goes back to its former equilibrium; this also takes some time, and that relaxation can be recorded.

The shock current caused by the application of the high-tension pulse will heat the solution a few degrees. Most chemical equilibria are slightly displaced when the temperature is changed, and the rapid establishment of the new equilibrium after heating can be recorded.

Eigen has also specified other methods for starting fast reactions in a solution formerly in equilibrium.

Whereas the study of electrolytic dissociation equilibria was already commenced in the 1880's by Svante Arrhenius, it is now possible to measure the reaction velocities at which these equilibria are established. A large number of extremely fast reactions can now be studied, involving all kinds of molecules ranging from the very simplest ones to the most complex that the biochemists work with.

Although Eigen starts his reactions in another way than that employed by Norrish and Porter, the instruments that record the fast reactions are largely identical for both research groups.

The chief importance to chemists of the methods worked out by Eigen, Norrish and Porter is their usefulness for the most widely diverse problems. A great many laboratories round the world are now obtaining hitherto undreamt-of results with these methods, which thereby fill what used to be a severely-felt gap in the means of advance available to Chemistry.

Professor Dr. Manfred Eigen. Although chemists had long been talking of instantaneous reactions, they

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had no way of determining the actual reaction rates. There were many very important reactions of this type, such as the neutralization of acids with alkalis. Thanks to you, chemists now have a whole range of methods that can be used to follow these rapid processes, so that this large gap in our chemical knowledge has now been filled.

May I convey to you the warmest congratulations of the Royal Swedish Academy of Sciences.

Professor Ronald George Wreyford Norrish, Professor George Porter. Photo-reactions have been studied by chemists for more than two hundred years, but the detailed knowledge of the behaviour of the activated molecules was meager and most unsatisfactory. By your flash photolysis method you

have provided us with a powerful tool for the study of the various states of molecules and the transfer of energy between them.

May I convey to you the warmest congratulations of the Royal Swedish Academy of Sciences. Professor Eigen. May I ask you to come forward to receive the Nobel Prize for Chemistry from His Majesty the King.

Professor Norrish, Professor Porter. May I request you to receive the Nobel Prize for Chemistry from the hands of His Majesty the King.

From Nobel Lectures, Chemistry 1963-1970, Elsevier Publishing Company, Amsterdam, 1972



Prof. Dr. The Lord Porter - Biography



Nobel Laureate (Chemistry) Prof. Dr. The Lord Porter OM kt BSc MA PhD ScD FRS HonFIC Hon. FRSE Hon.FRSC Dr. h.c.mult MAEur FANAS FAAAAAS FAAPS FA Pontifical Acad. Memb.Inst.mult.

Prof. Porter is Emeritus Professor of Chemistry and one of the most distinguished scientists of the modern age. Lord Porter has held and still holds an unprecedented number of positions at the highest level in science including assistant director of research, university of Cambridge; professor of physical chemistry, Firth professor and head of department of chemistry, university of Sheffield; professor of chemistry, The Royal Institution; director of The Royal Institution, Fullerian Professor of chemistry and emeritus professor of the Royal Institution; President of The Royal Society; Chancellor, university of Leicester; Gresham professor of astronomy; professor and chair, center for photomolecular sciences, Imperial college of Science, Technology and Medicine; President Comité Int. de Photobiologies, president of the Chemical Society; member Aeronautical Research Council; member of Council Open University; member Science Research council; president Research and Development Society; member RSA Council; director of Applied Photophysics Limited; president The Association for Science Education and president of the British Association for the Advancement of Science.

He has been honoured with numerous world awards including medal from UNESCO, the Nobel Prize for Chemistry, Davy Medal, Kalinga Prize, Robertson Prize, Rumford Medal, Communications Award of the European Physical Society, Faraday Medal, Longstaff Medal and the Michael Faraday Award. Lord Porter has given many eminent lectures which include, The Humphry Davy Lecture at The Royal Society and The Richard Dimbleby Lecture (BBC). He has been awarded many doctorates from universities throughout the world together with Hon. Memberships of some of the world's most prestigious institutions. Lord Porter's publications include, Chemistry for the Modern World and Progress in Research Kinetics and has numerous scientific papers to his name. His television series include Laws of Disorder, Young Scientist of the Year, Time Machine and the Natural History of a Sunbeam. Lord Porter is unique in having a science Medal named after him in his honour, and in his own lifetime. It is to such great men that all scientists should see the reasoning in what they are doing in that it is for the benefit and future of the whole of humanity.

In the years following World War II, Porter, together with the British chemist Ronald G.W. Norrish, developed the new technique of flash photolysis to initiate and record very fast chemical reactions. This method employed very brief, intense bursts of light to produce and study excited, transient, and “unstable” chemical states which had been inaccessible to earlier methods of observation. For this achievement Porter shared the 1967 Nobel Prize in chemistry with Norrish and the German chemist Manfred Eigen.

The original flash photolysis apparatus was built at Cambridge in 1947 for the detection and study of short-lived gaseous free radicals. The materials for the desired reaction were assembled in a cylindrical vessel of glass or quartz, which was flanked by one or more electronic flash tubes, the whole assembly being enclosed in a reflector. A pulse of visible or ultraviolet light from the flash tubes brought the reactants within milliseconds to a highly excited state (naturally, the substances in question had to be photoreactive).

The resulting transient absorption spectra were recorded by two methods. In the first methods, called flash spectroscopy, at some time after the initial pulse an additional flash tube is caused to discharge. The light from this source, passing through the reaction vessel, reaches the slit of a spectrograph, where it is photographed. In the second recording method, called kinetic spectrophotometer, the additional flash tube is replaced by a continuous light source, whose light, after traversing the reaction vessel, is passed through a monochromator and monitored continuously, providing a complete record of the reaction as observed at a single wavelength. These two methods proved complementary: the first yields more accurate single spectra, while the second is more valuable for kinetic studies.

The technique of flash photolysis was soon taken up enthusiastically, both by its originators and

others, and began at once to give important results. Its unique value lay in its ability to produce chemical situations which are not only very short-lived, but which do not exist at all except far from any equilibrium state. In this respect it differs from the technique developed by Eigen, in which the system under consideration is commonly rather close to some equilibrium point.

One of the most important applications of flash photolysis was in the investigation of unstable free radicals – the use for which it was originally devised. Since 1949 the technique has yielded to many investigators the detailed spectra of well over a hundred free radicals, in both gaseous state and solution, as well as much information about the kinetic behavior of these compounds.

In the study of short-lived, excited state absorption spectra – another important application of flash photolysis – Porter in 1953 was the first to obtain spectra of the upper triplet states of aromatic molecules in fluid solvents, with lifetimes on the order of 1 millisecond. The technique also proved valuable in studying longer-lived excited states of fluid solutions.

In 1952 Porter, Norrish, and others used flash photolysis to follow the recombination of iodine atoms – the first study of gas kinetics to employ this technique. From further work in this field it became clear that the flash spectroscopic method of recording could be used, at least in theory, to observe each successive rotational and vibration level of a reaction, a great improvement in detail over the statistical methods and results of conventional kinetic studies.

Finally, flash photolysis was of importance in the investigation of complex organic molecules and reactions. The approach elucidated, for example, transient stages in the hemoglobin-oxygen reaction; and, of course, it was extensively used to observe the behavior of chlorophyll.

Glossary on Kalinga Prize Laureates

Porter's later work involved, among other things, the development of microscopic flash photolysis techniques for in place investigation of complex molecules in the biological context of the cell. He also extended the applications of the technique by initiating the use of laser and spark sources and other improvements.

In 1941 Porter received his B.Sc. at the University of Leeds. After wartime service with the British navy, he returned to his studies at the University of Cambridge, obtaining a doctorate in chemistry in 1949. Porter then became assistant director of research in the department of physical chemistry

at Cambridge, spent a year (1954-55) as assistant director of the British Rayon Research Association, and next moved to the University of Sheffield as professor of physical chemistry (1955-63) and subsequently Firth Professor of Chemistry at the Royal Institution, London. In 1966 he was named director of the Royal Institution and Fullerian Professor of Chemistry there.

Porter wrote *Chemistry for the Modern World* (1962).

For background information see PHOTOCHEMISTRY; PHOTOLYSIS; SPECTROPHOTOMETRIC ANALYSIS; SPECTROSCOPY in the McGraw-Hill Encyclopedia of Science and Technology.



SIR GEORGE PORTER



Sir George Porter shared the 1967 Nobel Prize in chemistry with his mentor, RONALD G.W. NORRISH, with whom he had developed flash photolysis, and with MANFRED EIGEN, who developed a similar “relaxation” technique for analyzing very rapid chemical reactions. Whereas Eigen’s method chemically disrupted equilibrium in order to study the return to equilibrium, Porter and Norrish’s method did so with short bursts of light energy.

Porter was born on December 6, 1920, in Stainforth, in West Yorkshire, England. His parents were Alice Ann Roebuck and John Smith Porter. He attended Thorne Grammar School, and in 1938 he entered the University of Leeds as the Ackroyd Scholar. He studied chemistry under M.G. Evans, specializing in physical chemistry and chemical kinetics. After receiving his bachelor of science in 1941, he joined

the Royal Naval Volunteer Reserve Special Branch as an officer, applying the knowledge he had gained in a special course on radio physics and electronics at Leeds. As a radar specialist his training included pulse techniques, methods that he later returned to and advanced.

After World War II Porter pursued graduate studies at Emmanuel College of Cambridge University as a postgraduate research student of Ronald G.W. Norrish. His research topic concerned free radicals generated by gaseous photochemical reactions, which he studied by flow techniques. In the summer of 1947 he constructed an apparatus that elicited chemical reactions by disrupting chemical equilibrium with a very brief pulse of light energy, immediately followed by a weaker pulse of light to illuminate the reactive parts, namely, the free radicals, for study. This technique became known

as flash photolysis. In 1949 he married Stella Brooke, and together the couple had two sons, John Brooke and Christopher.

In 1949 Porter earned his doctorate from Cambridge University, which retained him as a demonstrator in chemistry. By 1952 Emmanuel College had inducted him as a fellow, and Cambridge appointed him as assistant director of research in its Department of Physical Chemistry. Throughout this time he and Norrish collaborated on flash photolysis studies of combustion and of gaseous free radicals. Their partnership ended in 1954, when Porter left for an assistant director of research position at the British Rayon Research Association. He applied flash photolysis methods, recording reactions as short as 1 millisecond, to investigate dye fading and phototendering of fabrics during his brief tenure in industry.

In 1955 Porter returned to academia as a professor of physical chemistry at Sheffield University in South Yorkshire. He continued to extend his flash photolysis technique into new applications, developing a new method of stabilizing free radicals called matrix isolation. He utilized his flash photolysis technique on both animal and plant, investigating reactions between oxygen and hemoglobin in the former, while examining chlorophyll properties and photosynthesis processes in the latter. In 1963 Sheffield named him Firth Professor and appointed him to head the chemistry department.

Porter moved to the Royal Institution in London, where he was named Fullerian Professor of Chemistry (succeeding Sir Lawrence Bragg) and director of the Davy Faraday Research Laboratory in 1966. The next year he shared the 1967 Nobel Prize in chemistry with Norrish and Eigen for their contributions to the study of very fast chemical reactions. Honors continued to grace Porter thereafter: He received the Royal Society's 1971 Davy Medal, in 1972 he was knighted, and in 1978 he won both the Robertson Prize of the American National Academy of Sciences and the Rumford Medal of the Royal Society (which had inducted him into its fellowship in 1960). He also held a visiting professorship at University College London from 1967 and an honorary professorship at the University of Kent at Canterbury.

In 1990 Porter took over the chair of the Center for Photomolecular Sciences at Imperial College of London, and he continued with active research throughout the 1990s, publishing a chapter in a 1994 collection on Femtosecond Chemistry, a lecture he delivered in Pune, India, in 1995; a journal article titled "Chlorine – An Introduction," which appeared in a 1996 issue of *Pure & Applied Chemistry*; and a book in 1997, *Chemistry in Microtime*. He also extended his influence into other fields, using television as a medium for advancing interest in and study of the sciences.



George Porter

His Relationship with Science and Society

by

Graham R. Fleming¹ and David Philips²

George Porter will never be forgotten for his impact on science, but, equally, he made major lasting contributions in raising public awareness of science and, through the media, in bringing science issues to the fore. His Nobel Prize ensured he was listened to by all, particularly the politicians with whom he sparred in his later years. George was a great champion of fundamental research, or as he put it, 'research which has not yet been applied'. He argued that without a sound scientific base from which applications would emerge, a nation's prosperity would inevitably decline. In his memorable Dimbleby lectures of 1988, he beguiled the audience by the following quotation:

(Since the war) in the rivalry of skills, England alone had hesitated to take part. Elevated by her war-time triumphs she seems to have looked with contempt on the less dazzling achievements of her philosophers. ...Her artisans have quitted her service, her machinery has been exported to distant markets, the inventions of her philosophers, slighted at home, have been eagerly introduced abroad, her scientific institutions have been discouraged and even abolished, the articles which she supplied to other states have been gradually manufactured by and transferred themselves to other nations. Enough, we trust, has been said to satisfy every lover of his country that the sciences and the arts of England are in a wretched state of depression, and their decline is mainly owing to the ignorance and supine-ness of the Government.

He then revealed that these words were spoken by Sir David Brewster just after the Napoleonic War, and used this as a theme to outline his views on present-day ills in science in the UK. There followed a passionate plea that 'curiosity-driven' research should be funded more generously, and particularly that young scientists in their most creative phases should be enabled with funding to develop their ideas without the necessity of demonstrating an end product or application. This was a continuing theme of his, and it really came to the fore during the five years of his Presidency of the Royal Society, when he spoke out often on public policy issues concerning science (the Dimbleby lectures were given during this period). In his Presidential Address to the Royal Society in 1987, he warned against the 'over-management' of research, citing as a prime example of a successful scientific center the Laboratory of Molecular Biology in Cambridge under Max Perutz FRS, who was on record as saying, 'My laboratory was often held up as a model of a center of excellence, but this is not because I ever managed it. I tried to attract talented people by giving them independence. ...had I tried to direct other people's work, the mediocrities would have stayed, and the talented ones would have left. The laboratory was never mission orientated.' This encapsulates the ongoing tensions in UK science, the methods by which the relatively small amount of research funding can be used to best effect without stifling talent through over-management. George clearly felt there was a grave danger of this, quoting again in

his 1987 Presidential Address the then President of the Mexican Academy of Scientific Research: "The most tangible evidence of Third World Science is the early preparation and export of outstanding scientists and the production of an avalanche of experts and documents in the politics of science rather than the production of scientific works.' George warned that this could be the fate of the UK, a thought widely reported in the UK press. In his farewell address to the Royal Society in 1990, George bemoaned the fact that the research councils held an effective monopoly over basic research funding, and advocated a new 'Science Foundation' operating at arm's length from The Royal Society but drawing on the judgment of its Fellows to distribute grants. This dream was never realized.

George Porter not only championed 'response mode' research, and particularly help for young researchers, but was strongly opposed to central facilities, such as the Rutherford Appleton Laboratories (RAL), and Interdisciplinary Research Centres which, he felt, soaked up too much of the available funding. In this he was perhaps a little blinkered, in that some research, for example the physics of plasmas using ultra-high-power lasers, could feasibly only be conducted in such large central groupings, and the High Power Laser Facility at RAL has been responsible for much world-class research. Porter's dislike of RAL also had a personal overtone because an application he had made to the Science and Engineering Research Council (SERC) for a copper vapour laser was peer-reviewed at a rating not high enough to secure funding. A referee had made the suggestion that the work could be performed at RAL, which incensed Porter, and was widely reported in the press in support of his case for the need for more funding and a

rebalancing of the way in which funds were used by the research councils. George made another plea, this time in support of chemistry, at the 150th Annual Chemical Congress in 1991, pointing out that SERC funding for chemistry research had dropped to half its level of just one year previously, and yet the UK was known to be extremely strong in chemistry.

As President of The Royal Society, George called for science to be taught throughout the National Curriculum in schools, and for broader A-levels to be taken to allow sixth-form students to take both arts and science subjects. This has now been achieved in the UK, although in some cases, universities would say, at a cost. The relationship between arts and science was a theme that George often addressed, notably in his Athenaeum Lecture in 1999 ('The two cultures 40 years on'). In a telling presentation in support of universal appreciation and knowledge of science, he quoted the literary critic Lionel Trilling: "The exclusion of most of us from the mode of thought which is habitually said to be the characteristic achievement of modern age is bound to be experienced as a wound to our self-esteem.'

His quotation, in that same lecture, of Vannevar Bush might have been a description of George's creed:

Science has a simple faith which transcends utility. Nearly all men of science, all men of learning for that matter, and men of simple ways too, have it in some form and in some degree. It is the faith that is the privilege of man keen to learn to understand that this is his mission. Why does the shepherd at night ponder the stars? Not so that he can better tend his sheep. Knowledge for the sake of understanding, not merely to prevail: that is the essence of our being. None can define its limits or set its ultimate boundries.

George Concluded:

There is, then, one great purpose for man, and for us today, and that is to try to discover man's purpose by every means in our power. That is the ultimate aspiration of science, and not only of science, but of every branch of learning that can improve our understanding.

In his maiden speech in the House of Lords in May 1991 and subsequently, George Porter returned to the theme of funding of 'blue-skies' research by the research councils, and the relationship between the councils and university scientists. He was active in the House of Lords until shortly before his death.

All of his life George had championed the public awareness of science, particularly among the young, and during his unique tenure as President of The Royal Society, Director of the Royal Institution, and President of the British Association in 1985, he was able to bring together these three institutions to attempt to coordinate their efforts, and to act as a focus for the many other efforts in this regard already existing in the UK. Thus COPUS (the Committee for the Public Understanding of Science) was born,

and chaired by George throughout his period as President of The Royal Society. This move was catalysed by the Royal Society's Bodmer report. Although the nature of the committee has now changed somewhat, the publicity and new projects brought by COPUS will act as a lasting legacy to George Porter's dedication to this vital area.

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 2. *Faculties of Life Sciences and Physical Sciences, Department of Chemistry, Imperial College London, South Kensington Campus, London SW7 2AZ, UK*
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Source :

Biographical Memoirs of Fellows of the Royal Society, London **50**, 257-283 (2004)



GEORGE AND HIS WIFE STELLA : An Elegant and Admirable Couple

by

Graham R. Fleming¹ and David Philips²



Aboard Annobelle. From left to right are Stella Porter, June Honeycombe and George Porter. (Taken by Sir Robert Honeycombe FRS, circa 1985.)

George Porter enjoyed unfailing support from wife, Stella, née Brooke, and we devote this final brief section to her contribution, and their life together. George met Stella at a dance at the London College of Dance which she and Mary Norrish attended in Holyport in 1946. Mary had asked her father to enlist some suitable research students as guests, and George, being very sociable and one of Norrish's PhD students, was happy to oblige. George and Stella married in 1949, the year in which he was appointed to a University Demonstratorship in Physical Chemistry. George's love of life was already well to the fore at that time. Contemporaries report his enthusiastic participation in life at Emmanuel College, citing his membership of the then active

Emmanuel Singers and notable performances of Gilbert and Sullivan, including a role as 'Patience'! Stella shared this exuberance, and together they made an exceptional couple. George and Stella always greatly enjoyed inviting guests both great and small to their home. When he was established as Professor of Physical Chemistry in Sheffield, they together transformed the local perception of senior academics, the so-called 'Herr Professor' world, by their unstinting hospitality and un-stuffiness. At their frequent 'at-homes' George delighted in showing off his ex-wardroom trick of balancing a half-pint tankard of beer on his forehead while standing, and drinking it without touching it with his hands or arms by various contortions involving lying down and using both feet.

Glossary on Kalinga Prize Laureates

When George and Stella Porter moved to the Royal Institution in 1967, the flat they occupied quickly became their home, though they used to spend weekends in their own beautiful house in Luddenham, Kent, where they also enjoyed sailing. This had been a pursuit of George's from Cambridge days (he was a member of the University Cruising Club) and was greatly enhanced by the purchase of a new boat, appropriately named *Annobelle* with some of the 1967 Nobel Prize money. In 1967, the Royal Institution was as ever underfunded, and somewhat austere. George and Stella set about livening it up, enlisting the aid of all staff in helping them in cleaning and painting the interior of the building. This initial informality with staff later became less prominent, but the feeling was always created of 'family' working together at the Royal Institution. Stella would often invite students and staff to lunch in the flat, and was always there on social occasions, both informal and formal. In time, the formal Friday Evening Discourses were to become glittering events, in which Stella played an enthusiastic role as hostess at the dinners which at that time preceded the 9p.m. lecture, and at the drinks party that followed in the flat, referred to by Stella as 'The George and Dragon'. Many a Discourse speaker, stressed by the ordeal of performing to a strict timetable in formal evening wear late on a Friday evening, found welcome relaxation in their company afterwards in the elegant surroundings of the flat, which had been occupied previously by Davy, Faraday, and all successive Directors of the Royal Institution. Both George and Stella delighted in regaling guests with historical anecdotes about their predecessors.

Stella Porter had been a dancer, and was the perfect consort to her elegant husband. George could be very serious on social occasions, and Stella did not hesitate to chide him if he was overdoing this. She was, however, fiercely loyal to George, and would not tolerate any criticism of him from others. She could be delightfully unconventional. There was a period where she affected the smoking of a clay pipe, to the astonishment of many uninitiated guests.

George travelled extensively throughout the world, and where possible Stella accompanied him. They were an elegant and admired couple who were exemplary ambassadors for Britain, for UK science, and indeed for science in general.

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1. *Department of Chemistry, 221 Hildebrand Hall, University of California, Berkeley, CA 94720, USA, and Physical Bioscience Division, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, MS: 11-221, Berkeley, CA 94720, USA*
 2. *Faculties of Life Sciences and Physical Sciences, Department of Chemistry, Imperial College London, South Kensington Campus, London SW7 2AZ, UK*
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Source :

Biographical Memoirs of Fellows of the Royal Society, London **50**, 257-283 (2004)



Honours and Awards Received By George Porter

Medals and Prizes		1989	Member of the Order of Merit
1955	Corday-Morgan Medal of the Chemical Society	1990	Created Baron Porter of Luddenham in Birthday Honours
1960	Fellow of the Royal Society	1991	<ul style="list-style-type: none"> ● Society Medal of the Society of Chemical Industry ● Michael Faraday Medal of The Royal Society ● Ellison – Cliffe Medal of the Royal Society of Medicine
1967	Nobel Prize for Chemistry	1992	Copley Medal of Royal Society
1968	Silvanus Thompson Medal of the British Institute of Radiology	1993-94	Master, Salter's Company
1971	Davy Medal of The Royal Society	Honorary Degrees	
1972	Knight Bachelor		
1974	Foreign Associate of the National Academy of Sciences, Washington	1968	Honorary DSc, University of Sheffield Honorary DSc, University of Utah, Salt Lake City, USA
1977	<ul style="list-style-type: none"> ● 1976 Kalinga Prize (UNESCO) for the Popularisation of Science ● Bose Medal of Bose Institute, Calcutta 	1970	Honorary DSc, University of East Anglia Honorary DUniv, University of Surrey Honorary DSc, University of Durham
1978	<ul style="list-style-type: none"> ● Robertson Memorial Lecture and Prize of the National Academy of Sciences ● Communications Award of the European Physical Society ● Rumford Medal of The Royal Society 	1971	Honorary DSc, University of Leicester Honorary DSc, University of Leeds Honorary DSc, Heriot-Watt University Honorary DSc, City University
1980	Faraday Medal of the Chemical Society	1972	Honorary DSc, University of Manchester Honorary DSc, University of St Andrews Honorary DSc, University of London
1981	<ul style="list-style-type: none"> ● Longstaff Medal of the Royal Society of Chemistry ● Freeman and liveryman, <i>honoris causa</i>, of the Salters' Company City of London 	1973	Honorary DSc, University of Kent at Canterbury
1987	Melchett Medal of the Institute of Energy	1974	Honorary DSc, University of Oxford
1988	Porter Medal for Photochemistry (first recipient)	1980	Honorary DSc, University of Hull

Glossary on Kalinga Prize Laureates

- 1981** Honorary DSc, Instituto Quimico de Sarria, Barcelona
- 1983** Honorary DSc, University of Pennsylvania
Honorary DSc, University of Coimbra, Portugal
Honorary DUniv, The Open University
- 1984** Honorary DSc, University of Lille
- 1985** Honorary DSc, University of the Philippines
- 1986** Honorary DSc, University of the Phillipines
Honorary DSc, University of Notre Dame
Honorary DSc, University of Bristol
Honorary DSc, University of Reading
- 1987** Honorary DSc, Loughborough University
- 1988** Honorary DSc, Brunel University
Laurea in Chimica *honoris causa*, University of Bologna
- 1990** Honorary DSc, University of Cordoba, Argentina
Honorary DSc, University of Liverpool
- 1993** Honorary LLD Cantab.
- 1995** Honorary DSc, Mangalore University
Honorary DSc, University of Buckingham
Honorary DSc, University of Bath

Fellowships and Honorary Positions

- 1966** Honorary Professor of Physical Chemistry, University of Kent
- 1967** Honorary Fellow of Emmanuel College, Cambridge
- 1968** Honorary Member of the New York Academy of Sciences
- 1970** ● Honorary Fellow of the Institute of Patentees and Inventors
● Honorary Member of the Leopoldina Academy

- 1974** ● Member of the Pontifical Academy of Sciences
● Corresponding Member of the Gottingen Academy of Sciences
- 1975** Honorary Fellow of the Royal Scottish Society of Arts
- 1976** Frew Fellow, Australian Academy of Science
- 1978** ● Honorary Member, Chemical Society, Spain
● Foreign Corresponding Member of La Real Academia de Ciencias, Madrid
- 1979** ● Honorary Member of the Société de Chimie Physique (now Société Française de Chimie)
● Foreign Honorary Member of the
● American Academy of Arts and Sciences
● Member of the Academic International de Lutece
- 1980** ● Member of the European Academy of Arts, Sciences and Humanities
● Honorary Research Professor, Dalian Institute of Chemical Physics of the Academy of Sciences of China
- 1982** Honorary Member of the Chemical Society of Japan
- 1983** ● Honorary Fellow of the Royal Society of Edinburgh
● Foreign Member, Academy of Sciences, Lisbon
- 1985** ● Foreign Member, Institute of Fundamental Studies, Sri Lanka
● Honorary Member, Association for Science Education
- 1986** ● Honorary Fellow of Queen Mary College, London
● Honorary Member, American Philosophical Society

Glossary on Kalinga Prize Laureates

- Foreign Fellow, Indian National Academy of Sciences (INSA, Delhi)
- Honorary Professor, Institute of Technology, Beijing, China
- Honorary Member of the Society for Free Radical Research
- 1987** ● Honorary Fellow, The Royal Medical Society, Edinburgh
- Honorary Fellow, Imperial College, London
- Honorary Member, Foundation de la Maison de la Chimie, Paris
- Foreign Member, European Academy of Arts, Sciences and Humanities, Paris
- Foreign Member of the Academia Nazionale Dei Lincei, Italy
- Honorary Member, Indian Academy, Maharashtra
- 1988** ● Honorary Member of the Royal Institution
- Professor *honoris causa*, Royal Institution
- Honorary Foreign Member, Hungarian Academy of Sciences
- Honorary Member, Japan Academy
- 1989** ● Honorary Member, Indian Science Academy, Bangalore
- Honorary Member, Royal Society of Medicine, Edinburgh
- Member, Academia Europaea
- Honorary Member, Soviet Academy of Sciences
- 1990** ● Honorary Member, Indian Academy of Sciences
- Honorary Member, Scientific Society of Argentina
- 1991** ● Honorary Fellow, Royal Society of Chemistry, London
- Honorary Fellow, Science Museum of London
- Distinguished Visiting Professor, University of Exeter (1991-92)
- Honorary Fellow, Society of Radiation Physics
- 1992** Honorary Fellow, University of North Lancashire
- 1995** ● Honorary Fellow, King's College, London
- Honorary Member of KAST (Korean Academy of Science and Technology)
- Honorary Fellow, Tata Institute, Bombay
- 1996** Honorary Member of KIAS (Korean Institute for Advanced Studies)

Presidencies and Appointments

- 1968-72** President, Comité International de Photobiologie
- 1970-72** President, The Chemical Society
- 1973-74** President, Faraday Division of the Chemical Society
- 1972-74** Trustee, British Museum
- 1975-80** First President, The National Association for Gifted Children
- 1977-82** President, The Research and Development Society
- 1985** President, Association for Science Education
- 1985-86** President, British Association for the Advancement of Science.
- 1985-90** President of the Royal Society of London
- 1986 -** Trustee, The Exploratory, Bristol
- 1986** Trustee, Glynn Research Institute
- 1986-95** Chancellor, University of Leicester
- 1987-89** President, London International Youth Science Fortnight
- 1987-89** President, Scitech

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- 1987 -** Vice-President of the British Video History Trust
- 1991 -** President, British Mathematics Olympiad
- 1987-91** Member of the Cabinet office Advisory Council on Science and Technology (ACOST)
- 1989-91** Trustee, National Energy Foundation
- 1991** President, National Energy Foundation
- 1990-94** Member of the House of Lords Select Committee on Science and Technology
- 1991-92** Second Warden, Upper Warden (1992-93) and Master (1993-94) Salters' Company
- 1994-** Almoner of Christ's Hospital

Principal named lectures

- 1958** Tilden Lecturer of the Chemical Society
- 1960** P.O'Reilly Lecture, University of Notre Dame
- 1968** The Silvanus Thompson Memorial Lecture
- 1969** ● Liversidge Lecturer of the Chemical Society
- Farkas Memorial Lecture, Hebrew University, Jerusalem
- Elsie O. and Philip D.Sang Exchange Lecturership at Illinois Institute, Chicago
- 1970** ● John Dalton Lecture, Manchester
- Liversidge Lecture, University of Essex and University College of South Wales and Monmouthshire.
- 1971** Irvine Memorial Lecture, The University of St Andrews
- 1972** ● Seaver Lecture, University of Southern California

Glossary on Kalinga Prize Laureates

- Leverhulme Lecture of the Society for Chemical Industry, Liverpool
 - Bruce-Peller Lecture, Royal Society of Edinburgh
 - A.M. Tyndall Memorial Lecture, University of Bristol
- 1973** ● The Selby Memorial Lecture, University College, Cardiff
- Brunel Lecture, Brunel University
 - Reginald Mitchell Memorial Lecture, Association of Engineers
 - Joseph Larmor Lecture, University of Belfast
- 1974** ● Phi Lambda Upsilon Priestley Lecturer, Pennsylvania State University
- Burton Memorial Lecture, Queen Elizabeth College Student Chemistry Society
 - Henry Tizard Lecture, Westminster School
 - Haden Memorial Lecture, Institution of Heating and Ventilation Engineers
 - Purves Lectures, McGill University, Canada
- 1975** ● Walker Memorial Lecture, Edinburgh University
- Farrington Daniels Memorial Lecture, ISES
- 1976** ● Robbins Lectures, Pomona College, California
- Godfrey Frew Lecture, The University of Adelaide, Australia
- 1977** ● Bakerian Lecture of the Royal Society
- Pahlavi Lectures, Pahlavi University, Iran
 - The Cecil H. and Ida Green Visiting Professorships, The Vancouver Institute, Canada
- 1978** ● Romanes Lecture, University of Oxford

Glossary on Kalinga Prize Laureates

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| <ul style="list-style-type: none"> ● Charles M. and Martha Hitchcock Lectures at the University of California, Berkeley ● Robertson Memorial Lecture, National Academy of Sciences, Washington | <ul style="list-style-type: none"> ● Melchett Lecture, Institute of Energy ● Redfearn Lecture, Leicester University |
| <p>1979</p> <ul style="list-style-type: none"> ● Ahron Katzir-Katchalasky Lectures, Weizmann Institute, Israel ● Goodman Lecture, Aitchison Memorial Trust, London | <p>1988</p> <ul style="list-style-type: none"> ● Dimpleby Lecture, 'Knowledge itself is power', BBC Television ● McGovern Lecture (Sigma Sci, Orlando) ● Fawley Lecture, Southampton University ● Koimura Shimbun Lecture, Nagoya, Japan. |
| <p>1980</p> <p>The Nuffield Lecture, The Nuffield Foundation, Chelsea College</p> | <p>1989</p> <ul style="list-style-type: none"> ● 9th Einstein Memorial Lecture, Israel ● Cecil and Ida Green Lectures, Galveston, Texas |
| <p>1981</p> <p>Swift Lecture, California Institute of Technology</p> | <p>1990</p> <ul style="list-style-type: none"> ● Ramon Alceras Memorial Lecture, Madrid ● Darwin Lecture, Darwin College, Cambridge |
| <p>1983</p> <ul style="list-style-type: none"> ● Edgar Fahs Smith Lecture, University of Pennsylvania ● George M. Batmen Lecture, Arizona State University ● F.J. Toole Lecturer, University of New Brunswick, Canada ● Quain Lecture, University College, London | <p>1991</p> <ul style="list-style-type: none"> ● Linus Pauling 90th Birthday Lecture, Caltech, Pasadena ● Maiden Speech, House of Lords (23 May) ● Gerald Walters Memorial Lecture, University of Bath ● RSC 150th Anniversary Address ● Faraday Bicentennial Address at Royal Institution, Leeds and Newcastle Universities ● SCI Medal Address, Liverpool University ● Science Centre Young People's Lecture (for IC series), Singapore |
| <p>1984</p> <ul style="list-style-type: none"> ● Dorab Tata Memorial Lectures, Bombay ● Reddy Lectures, Osmania University, Hyderabad | <p>1992</p> <ul style="list-style-type: none"> ● Michael Faraday Award Lecture of The Royal Society ● 5th Ellison – Cliffe Lecture and Gold Medal of RSM ● 3rd Rayleigh Lecture, Harrow School ● Centenary Lecture at the University of Chicago ● Bernal Lecture, Birkbeck College, London |
| <p>1985</p> <ul style="list-style-type: none"> ● The Julian H. Gibbs Lectures, Amherst College, Massachusetts ● The Hampton Robinson Lecture, Texas A & M University ● The Humphrey Davy Lecture, Académie des Sciences, Paris ● Vollmer Fries Lecture, Rensselaer Polytechnic Institute, Troy, USA ● Royal Institution of Great Britain Lecture, University of Arizona | <p>1993</p> <p>Birla Memorial Lecture, Science Centre, Hyderabad</p> |
| <p>1986</p> <ul style="list-style-type: none"> ● 9th J.T. Baker Nobel Laureate Lecture, Stanford University ● Neil Graham Lecture, Toronto University | <p>1994</p> <ul style="list-style-type: none"> ● Campaign for Resource Lecture to University Court, Bristol |
| <p>1987</p> <ul style="list-style-type: none"> ● Lee Kuan Yew Distinguished Visitor, National Universtiy of Singapore | |
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Glossary on Kalinga Prize Laureates

- 1995**
- Lee Kuan Yu Video Lecture, University of Singapore
 - Rajiv Gandhi Memorial Lecture, Puna
 - Sidney Chapman Memorial Lecture, Fairbanks, Alaska

TELEVISION AND RADIO PROGRAMMES

- 1960** Eye on Research. 'Quick as a Flash'. BBC Television.
- 1973** 'A Candle to Nature'. Pilot for 'Horizon' series. BBC Television.
- 1965-66** 'Laws of Disorder', 10 programmes. BBC Television (repeated four times).
- 1969-70** 'Time Machines', six Christmas Lectures from the Royal Institution. BBC (repeated twice).
- 1971-75** 'Controversy', series of debates, chairman. BBC.
- 1976-77** 'The Natural History of a Sunbeam', six Christmas Lectures from the Royal Institution. BBC Television.

- 1966-81** Judge, Young Scientists of the Year. BBC.
- 1982** Contributor, Open University course on 'Photochemistry: Light, chemical change and life', BBC Television.
- 1984** 'Man of Action,' Radio. BBC Radio 4.
- 1987** 'Conversation Piece,' Radio. BBC Radio4.
- 1988** Dimbleby Lecture. BBC Television.
- 1990** 'Desert Island Discs' (with Sue Lawley). BBC Radio 4.

FILMS AND VIDEOTAPES

- 1996** George Porter. Three autobiographical tapes for The Royal Society. 'The Laws of Disorder', a series of four ICI (Millbank) films for schools. 'Why Chemistry', videotape for Salters' Company and ICI.

Source :

Biographical Memoirs of Fellows of the Royal Society, London **50**, 257-283 (2004)



GEROGE PORTER QUOTES



Quote : I have no doubt that we will be successful in harnessing the sun's energy.....If sunbeams were weapons of war, we would have had solar energy centuries ago.

Originator : George Porter (1920-2002), British chemist, quoted in The Observer, 26 August 1973.

understanding. In the words of Tolstoy, "The highest wisdom has but one science, the science of the whole, the science explaining the Creation and man's place in it."

Originator : Sir George Porte (1920-2002), British chemist in The Times, June 21 1975.

Quote : There is, then, one great purpose for man and for us today, and that is to try to discover man's purpose by every means in our power. That is the ultimate relevance of science, and not only of sciences, but of every branch of learning which can improve our

Quote : Should we force science down the throats of those that have no taste for it? Is it our duty to drag them kicking and screaming into the twenty-first century? I am afraid that it is.

Originator : George Porter (1920-2002), British chemist.

Glossary on Kalinga Prize Laureates

- It is a joyous occasion for a scientist when the subject which interests him most is recognized by the highest honour that the world can bestow.
- It is not only my laboratory and my place of work but also my home, so that on the 30th October I was able to share my happiness immediately with my students and collaborators and, at the same time, with my wife and family.
- Science and Literature are splendid, and it is really to science and literature themselves that this distinguished company pay its homage.
- Tonight I should like to thank all those who have shared my work and to acknowledge the debt that I owe to my wife whose encouragement to put research before all other things has been a great strength to me
- We are rewarded for work the very essence of which is that we were so impatient that we spent only a millionth of a second over an experiment.
- We three chemists here are the most fortunate of Nobel Laureates, many of whom are rewarded after years of patient and painstaking work.
- When the honour is given to that scientist personally the happiness is sweet indeed. Science is, on the whole, an informal activity, a life of shirt sleeves and coffee serve in beakers.



Nature – Obituary

George Porter (1920-2002)



Innovator in Ultrafast Chemistry and Advocate for Pure Research

The time taken for molecules to dissociate or rearrange lies typically in the range 1-100 fs, a femtosecond being 10^{-15} s. When, in 1945, George Porter started out as a research student at the University of Cambridge, direct observation of these processes was impossible. But he lived to see the techniques that he developed reach the astonishing state today where such ultra fast events can be studied routinely in real time. Porter died on 31 August 2002, aged 81. He was scientifically active until the last two years of his life, a tribute to his devotion to his own and his colleagues' science, and to promoting science generally.

Porter, a Yorkshireman, displayed a passion for science as a schoolboy and obtained his BSc in chemistry at the University of Leeds. At Cambridge, with R.G.W. Norrish, he tackled the problem of how to detect short-lived chemical intermediates, so-called free radicals. These are molecules that have an unpaired electron, which makes them extremely

chemically reactive, so that they exist for what was thought then to be a very short duration – typically milliseconds or less. Porter knew that free radicals could be produced easily by absorption of light. From his wartime experience with signaling lamps using intense pulses, he reasoned that if a radical were created by a pulse of light that was short in comparison to the radical's lifetime, the species could be detected absorbing light from either a second continuous light source or a second pulse of light delayed in time with respect to the first. These experiments were spectacularly successful. They led ultimately to Porter and Norrish's award of a share in the 1967 Nobel Prize in Chemistry, for their development of 'flash photolysis'.

Radicals are common intermediates in chemistry and biology, and so of great interest, but there are even shorter-lived chemical entities, such as electronically excited states. Porter turned flash photolysis to the task of observing intermediates

such as 'triplet states' in the microsecond time-domain, and by 1960 this had become a standard approach. However, for conventional light sources, the shorter the pulse, the weaker the light. Nanosecond pulses can be made, but the intensity is too small – about as bright as a spark plug-to be useful.

In 1963, Porter had moved from Cambridge to the University of Sheffield, where he was Firth professor of chemistry (he joked that with more funds, they would have appointed a 'Thecond' professor). Three years later, he and his group transferred to the Royal Institution in London-the RI. There they took advantage of Theodore Maiman's invention of the visible ruby laser, which could produce both short pulses and high intensities. Porter and colleagues exploited the laser technique, first in the nanosecond region, then quickly to picoseconds and, after 1985, at Imperial College London, ultimately to the femtosecond regime. He relished pointing out that within his lifetime the time-domain accessible to the 'ultrafast scientist' had shortened by about the same number of orders of magnitude as the timescale from the beginning of the Universe to the present day.

Few chemical reactions initiated by light are as important as photosynthesis, by which sunlight, carbon dioxide and water produce the carbohydrate food source that underpins all animals life on the planet. Porter's group helped to lay the foundations in understanding this vital process by investigating the photo-induced transfer of electrons in the first few picoseconds of the reactions. Inspired by this application of light in nature, he became increasingly interested in the artificial use of sunlight to provide energy, either directly as electricity, or by splitting water to produce hydrogen as a clean fuel.

As director of the RI, George Porter was inspirational. No one could forget the Davy-Faraday Laboratory weekly discussions-George sitting in the front row, quietly puffing on his pipe under the no-smoking sign, and listening to young students or distinguished visitors with equal courtesy, and through politely expressed questions cutting straight to the heart of the matter (often to the discomfort of the speaker). The RI was founded in 1799, and by

1966 could easily have been regarded as an anachronism. But in the 19 years they were in residence, Porter and his wife Stella made it a living center for the exposition of science. They brought a memorable style and glamour to the public functions; Davy and Faraday would have approved of the preservation of top-class science and lucid scientific presentation.

Popularization of science was then widely sneered at, but Porter had the courage and vision to make it a major concern and changed the perception of such activities. He insisted that speakers at the RI discourses use demonstrations in the best traditions of the institution and exemplified the style by being the most polished of presenters. His early films on thermodynamics still look remarkable. At the RI, he also introduced the Christmas Lectures to BBC television audiences. Uniquely, he simultaneously held the positions of president of the Royal Society, president of the British Association for the Advancement of Science, and director of the Royal Institution, and he was instrumental in the founding of COPUS-the Committee for the Public Understanding of Science.

George Porter was a powerful advocate of preserving a strong scientific base in Britain, saying "pure research was merely that research which has not yet been applied". He had the ear of senior politicians, and after his creation as Lord Porter of Luddenham in 1990 he vigorously promoted the cause of pure research in the House of Lords.

He will be badly missed by his colleagues and collaborators, who number hundreds, and by his family – particularly Stella, who supported him with a passion equal to his own for science.

David Philips

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OBITUARY

Editorial : Special Issue in Commemoration of Lord George Porter FRSC FRS OM (6th December 1960 - 31st August 2002)

Photochem. Photobiol. Sci.,2003,2

George Porte was one of the most innovative and accomplished scientists of the 20th century. Readers will be aware of the fundamental contribution he made to photobiology and photochemistry resulting from his development of the technique of flash photolysis for which he was awarded the Nobel Prize for Chemistry in 1967, jointly with Norrish and Eigen. However, many readers may not be aware of the many important contributions he has made to the public understanding of science, a cause he made his own. He was a fluent, articulate speaker who made many converts, including myself, to his belief that the earch for knowledge is the highest aim of mankind. He used television to bring science into the home by, for example, persuading the BBC to broadcast the Royal Institution's Christmas Lectures annually, by being the main force behind the BBC's Young Scientists of the Year Awards and by his Richard Dimbleby Lecture entitled '*Knowledge Itself is Power*', in which he argued the case for strong financial support of basic science to enable young scientists to pursue science for its own sake. As he put it on that occasion "It is doubtful whether there is such a thing as useless knowledge. Ignorance, the only alternative to knowledge, can only be no more than temporary bliss."

In additions to being a gifted communicator and an inspiring teacher George Porter was a family man who was lovingly supported in all that he did by his wife Stella for their 53 years of married life together. Stella, alongside George, gave encouragement and affection to every person who joined his research group. The Porter scientific family, his students, post-doctoral researchers, colleagues and collaborators, have dedicated their articles in this Special Issue of *Photochemical & Photobiological Sciences* to honour a truly great man and in memory of a true friend. In 1986, members of his academic family instigated the Porter Medal in his honour, to be awarded biannually to the candidate who, in the opinion of the Presidents of the Inter American Photochemistry Society, the Asian Photochemistry Association and the European Photochemistry Association, has made the most prestigious contribution to the field of Photochemistry. There is no doubt that this has become the most coveted award there is for photochemical research. The medal has been awarded to an impressive array of superbly innovative international photochemists and it is particularly pleasing to note that all of the last six Porter Medal recipients, N.J. Turro, USA (1994), J.C.Scaiano, Canada (1995), N. Mataga, Japan (1996), F.C. de Schryver, Belgium (1998), V.Balzani,

Italy (2000), and J. Michl, USA (2002), have made contributions dedicated to Lord Porter in this Special Issue.

George Porter's research career started in Cambridge and the first two articles in this issue describe the fascinating photochemistry of the early 1950s. Porter left Cambridge in 1954 and, after a year in industry, he moved to Sheffield University and continued his outstanding research work for 11 years. He left Sheffield in 1966 to devote more of his time to fostering the public discussion of science by becoming director of the Royal Institution (RI) in London, where his consummate communication skills enabled him to popularize science, especially amongst children, and thus to follow successfully in the footsteps of other great chemists who preceded him at the RI, including Davy, Faraday, Dewar and Bragg. His research work during 20 years at the RI was of the highest international standard. He left the RI to become President of the Royal Society of London in 1985 and, in 1990, became Chairman of the Centre for Photomolecular Sciences at Imperial College, London. The articles in this special issue include contributions from members of Professor George Porter's research groups, who worked with him and were inspired by him in each of these various laboratories.

It is difficult to find appropriate words to pay adequate tribute to such a scientific genius as George Porter and, therefore, I have chosen to conclude this editorial with quotations from the Romanes Lecture presented to Oxford University in 1978 by the then Sir George Porter entitled '*Science and the Human Purpose*', which represents his view of science, a view which continues to inspire so many of us who were privileged to have worked with him. I would like to thank Lord Porter's sons, Professor John Porter and Dr Andrew Porter, who read extracts from this and from some of his other lectures at the Service of Thanksgiving for the Life and Work of the Right Honourable The Lord Porter of Luddenham OM FRS in St Margaret's Hall, Westminster Abbey, on

Tuesday 21st January 2003, thus demonstrating the appropriateness of such quotations.

Extracts from the 1978 Romanes Lecture by George Porter :

'Science and the Human Purpose'

"...When Michael Faraday was asked the question, so tiresome to a scientist, "What is the use of your work ?", he could reply in the words of Benjamin Franklin, "Madam, what use is a newborn baby ?" Or, when asked the same question by the Prime Minister, Robert Peel, about his magnetic induction, he could reply, "I know not, Sir, but I'll wager one day you'll tax it." And in the golden age of Victorian progress, the point was taken and later proved to be correct.

It is not so easy to satisfy the questioner today. The baby is grown up into a body of great achievement and power. It has almost won its battle against disease and the miseries of hard labour; Michael Faraday and James Watt released more men from slavery than did Abraham Lincoln. "Yes," says the layman, the concerned citizen, to the man of science, "I accept this, and I really am grateful, but now I have had enough; I need time to adjust to what I've got already. So will you please find a cure for cancer, solve the energy problem and then stop."

...The discoveries of Copernicus, Darwin and the molecular biologists have irrevocably changed our beliefs about our place in the world, but the new understanding has been negative in the sense of invalidating old conceptions and religious views without providing a new, positive philosophy and purpose.

If, then, we have changed our traditional faiths through increased knowledge of ourselves and of our universe, is it not possible that our way to a new faith, a new purpose for life, is through further knowledge and understanding of nature?

This is the ultimate purpose of science.

In the past, the hope of individual immortality removed much of the concern about the purpose of life on earth...one day all would be revealed in a happier place. It was taken for granted that the purpose of life would be one of those revelations. Now, our hopes for immortality have to rest in our children or through the works we leave behind us...our genes or our genius. And our hope for an understanding of the human purpose, through a continued search, must also rest mainly on our hopes for the species as a whole rather than ourselves. But, with this hope, life becomes more meaningful and death loses some of its sting.

It is, of course, quite possible that we can never understand, never discover a purpose, but we shall not succeed if we do not try. Time and time again in science some artificial barrier has been proposed beyond which science could not pass, and many of those barriers are now behind us. The synthesis of organic substances, for example, was said to require a vital force until Wöhler, in 1928, destroyed the idea in the only convincing way, by synthesizing one *without* a vital force. There is absolutely no evidence that the great intellectual power with which man is endowed has any limitations and, until evidence to the contrary is produced, we shall be wise not to give up the search.

...If our problems seem insuperable, and the route interminably long, we should remind ourselves that modern science started only 400 years ago and has already transformed our lives and understanding. In this endeavour, it is earlier than we think. What may we not achieve in the four billion years which remain before the earth becomes uninhabitable?

What is it that we want man to achieve? Is it merely the greatest happiness of the greatest number? How many people do we want on earth anyway and what sort of people should they be? Perhaps Linus Pauling's suggestion that we should strive only to *reduce unhappiness* is more realistic. Until we have more understanding, all our ambitions for the world

are, at best, short term and, at worst, may be quite wrongly conceived. Our ethics and morals must ultimately be decided in the light of this understanding. It is my thesis that the *search* for understanding provides in itself a human purpose and source of happiness.

Others have expressed the view more eloquently.

Horace wrote "Knowledge of that which underlines everything gives true happiness, unshakeable peace of mind, by eliminating the wonder at our personal fate."

Vanevar Bush has written "Science has a simple faith which transcends utility. Nearly all men of science, all men of learning for that matter, and all men of simple ways too, have it in some form and in some degree. It is the faith that it is the privilege of man to learn, to understand and that this is his mission. Why does the shepherd at night ponder the stars? Not so that he can better tend his sheep. Knowledge for the sake of understanding, not merely to prevail, that is the essence of our being. None can define its limits or set its ultimate boundaries."

And Tolstoy wrote "The highest wisdom has but one science, the science of the whole, the science explaining the Creation and man's place in it."

There is, then, one great purpose for man, and for us today, and that is to try to *discover* man's purpose by every means in our power. That is the ultimate odyssey of science, and not only of science but of every branch of learning which can improve our understanding..."

Porter's life in brief :

Professor Lord Porter of Luddenham FRSC FRS OM was born in Stainforth, Yorkshire, on the 6th of December 1920. He died on August 21st 2002, aged 81.

George Porter attended Thorne Grammar School and obtained his BSc from Leeds University in 1941. He served during the war in the Royal Navy. In 1945 he started his photochemical research in Cambridge

Glossary on Kalinga Prize Laureates

for his Ph.D. under the supervision of Professor R.G.W. Norrish.

George Porter was appointed Demonstrator in Physical Chemistry at Cambridge University from 1949-52, Assistant Director of Research in Physical Chemistry from 1952-54, made a Fellow of Emmanuel College, Cambridge, from 1952-54, and an Honorary Fellow in 1967. He was Assistant Director of Research at the British Rayon Association from 1954-55 and was appointed Professor of Physical Chemistry at Sheffield University from 1955-63 and Firth Professor of Chemistry from 1963-66. He was made a Fellow of the Royal Society in 1960, became Resident Professor and Director of the Royal Institution of Great Britain from 1966-85 and Emeritus Professor in 1988. George Porter was awarded the Nobel Prize for Chemistry (jointly with R.G. W. Norrish and Manfred Eigen) in 1967. He was President of the Chemical Society from 1970-72 and was knighted in 1972. George was President of the National Association for Gifted Children from 1975-80, **received the Kalinga Prize awarded by UNESCO in 1977** and was made President of the Royal Society from 1985-90, President of the British Association for the Advancement of Science from 1985-86, Chancellor of Leicester University from

1986-95, a Professor at Imperial College, London in 1987 and Chairman of the Centre for Photomolecular Sciences in 1990. Sir George received the Order of Merit (OM) in 1989 and was created Baron Porter of Luddenham in 1990. He was appointed Gresham Professor of Astronomy, Gresham College, from 1990-94, President of the National Energy Foundation from 1990-2000 and Master of the Salters' Company from 1993-94.

Lord Porter was an ordinary member of the European Photo-chemistry Association from its inception. He was awarded honorary degrees at over 50 universities worldwide.

The Royal Society of Chemistry awarded him the Corday-Morgan Medal in 1955, the Tilden Medal in 1958, the Liverside Medal in 1970, the Faraday Medal in 1980 and the Longstaff Medal in 1981. The Royal Society awarded him the Davey Medal in 1971, the Rumford Medal in 1978, the Michael Faraday Medal in 1991 and the Copley Medal in 1992.

George Porter married Stella Brooke in 1949. They had two sons-John and Andrew.

Professor Frank Wilkinson

Emeritus Professor of Physical Chemistry
Loughborough University , UK
Editor-in-chief



OBITUARY

THE LORD PORTER OF LUDDENHAM [6 December 1920 – 31 August 2002]

PROCEEDINGS OF THE AMERICAN PHILOSOPHICAL SOCIETY VOL.149, NO.1, MARCH 2005

George Porter, who died on 31 August 2002, not only was a Nobel Prize winning scientist, but had also earned international respect as a statesman, as a hugely engaging populariser of science, as a spokesman for science in the developing world, and as one who made great efforts to bridge the perceived gap between the “two cultures” of Arts and Science.

George Porter was brought up in Yorkshire, whose inhabitants are caricatured as being down-to-earth, gritty, determined, and perhaps less humourful than those from other parts of the United Kingdom. That he was dedicated to his science, and to his fellow-men, is not in doubt, and he was always incisive and not afraid to speak his mind, so he had some traits typical of his origins. However, in the second half of his life, when I knew him, he was a polished, witty, urbane individual equally at home in academe, in the corridors of power, or in the Institution that he loved, and that was his home for twenty years, the Royal Institution of Great Britain, in Mayfair, London. He could not thus be said to be a true Yorkshireman in every sense.

George Porter developed an early passion for science while at school in Thorne, Yorkshire, so much so that his artisan father bought for him an old bus in which the young George could carry out experiments, thus preserving the family home from

chemical disaster. He studied for his first, B.Sc., degree in chemistry at the University of Leeds, where he was Ackroyd Scholar. From 1941 to 1945 he served in the Royal Navy, largely on antisubmarine duty in the Western Approaches, an experience that was to stand him in great stead when he turned to research after the Second World War. That was carried out at Cambridge, under the supervision of R.G.W. Norrish, with whom George shared, with Manfred Eigen of Germany, the 1967 Nobel Prize for the study of fast reactions.

The scientific problem at the time is simply stated. Many chemical reactions take place on a time-scale so fast that following their course in real time was precluded by the slow response of available detectors, yet these fast reactions were those of very significant interest to the community. One approach to their study was to slow down the reaction rate by drastically cooling the chemical mixture, which George did succeed in doing, thus laying the foundations of what was to become the so-called “matrix isolation” technique. However, it is clearly desirable to study chemistry under ambient conditions; to achieve this goal, Porter and Norrish’s approach was to use a short pulse of light to initiate some chemistry, and then to study the chemical species produced, confined at this stage of progress to those lasting about a millisecond, on the basis of

absorption of light by a continuous monitoring beam. This worked well, but the huge leap forward, which led to the award of the Nobel, was to use for the monitoring process a second pulse of intense light, delayed with respect to the first, so that by carrying out repeated experiments with the interrogatory pulse at successive delay times, a complete picture of the evolution of the chemistry in real time could be constructed. This technique, inspired by Porter's naval experience with signaling lamps, is now universally applied to photochemical reactions, and termed "Flash Photolysis". The technique moved during George Porter's lifetime and under his leadership from the millisecond range in 1949, through microseconds in the 1950s, to nanoseconds in the 1960s after the invention of the laser in 1960 by Theodore Maiman, through picoseconds in the 1970s and 1980s, and to femtoseconds in the nineties, at Imperial College, where Porter moved in 1987. Now attoseconds are in prospect. George used to like to ruminate that in his lifetime, the time period that defined "fast" has been reduced by as many orders of magnitude as the time from the beginning of the universe to the present (not quite true, but only by a factor of ten or so!).

George Porter carried out this work first in Cambridge, then at the University of Sheffield, where he was Firth Professor of Chemistry (he used to pun that had they had more funds, there would have been a "Thecond" Professor of Chemistry), and from 1966 to 1985 at his beloved Royal Institution, the home of so many distinguished scientists, including Humphry Davy, Michael Faraday, John Tyndall, James Dewar, and William and Lawrence Bragg. The Royal Institution was founded in 1799 by subscription from individuals interested in bringing to the attention of the general population "mechanical inventions" of benefit to the "common purposes of life." A leading proponent of the RI was Benjamin Thompson, Count Rumford, an irascible American who had the dubious distinction of supporting the Loyalists in the War of Independence, and who escaped to Europe when independence was won.

The reputation of the Royal Institution when Porter became director in 1967 was that of a small institution carrying out internationally renowned science and, through public lectures, bringing the excitement and relevance of this science to the public. There could have been no better appointment to the Institution at that time than George Porter. His demonstration lectures were magical, exciting, and great fun, but firmly rooted in the principle of explaining often difficult science, leaving in the minds of the audiences some appreciation both of the progress of science, and the methods by which science advances.

George Porter brought the ethos of the Royal Institution into the twentieth century by arranging for the famed "Christmas Lectures for Juveniles," initiated by Michael Faraday in 1826, to appear on U.K. television screens for the first time in 1967, thus amplifying the audiences by a factor of two thousand or more. At the time in Britain, and elsewhere in the developed world, the idea that a serious scientist should devote time and effort to the "popularization" of science was repugnant to many fellow scientists. It is typical of George Porter's character that he denounced this conventional wisdom, and pioneered the notion that, far from being a distraction from their main purpose, it is the duty of scientists to communicate their findings, a belief that by the end of his life had itself become the conventional view. In 1985 he became president of the Royal Society, and during that year was simultaneously and uniquely also director of the Royal Institution and president of the British Association for the Advancement of Science. It is not a coincidence that these three bodies at that time formed an alliance (COPUS) whose purpose was to advance the public understanding of science.

George Porter's passionate commitment to science extended to the political arena also. He had been knighted in 1967, but in 1990 he was created a baron, which gave him a seat in the second chamber of Parliament, the House of Lords. There he used his position as Lord Porter of Luddenham to advocate

increased expenditure on basic science, often quoting one of his favourite aphorisms, that the distinction between “basic” science and “applied” science was false; there was only “science, that already applied, and that which had not yet been applied.” He had earlier crossed swords with Margaret Thatcher, then prime minister, over the issues of science funding, and was influential in improving the lot of academic science generally. His belief in the universality of science led him to devote much time to assisting its development in less advantaged countries, and he traveled the world expounding his own science, and the need for all nations to engage in and support scientific endeavour. His courage was tested when, on a visit to the then USSR, he publicly defended Sakharov, disgraced by the USSR for his outspoken opposition to the regime.

George Porter was a great lover of music, and had a fine voice, melodious in song, and in speaking. He was a cultured man, with a love of opera, and of ballet, influenced perhaps by the fact that his wife was a young ballerina when they met. He was a man of great charm, and not averse to letting his hair down. He had a reputation in his younger days for being able to stand on his head, and to consume a pint of bitter beer from a glass without using his hands. On a lecture trip with him in Tucson, Arizona, in 1985 to celebrate the hundredth anniversary of the University of Arizona, my colleagues and I were somewhat astonished to witness the then Sir George breaking into the bar of the hotel to find some tonic water to accompany the bottle of gin he had brought with him to the party. He was an accomplished yachtsman, sailing his boat (bought with some of the Nobel Prize money) in the English Channel and across to France.

Above all, he was a superb inspirational teacher, and never lost his incisive understanding of science. His avuncular appearance at research colloquia belied his very deep grasp of so many fundamentals of science. His questions could discomfit internationally renowned visitors as much as beginning research students, but they were delivered with the characteristic George Porter elegance of speech and gentlemanly demeanour.

He was supported from the time of their marriage, and throughout his life, by his wife, Stella. Together they made public gatherings at the Royal Institution into glittering social occasions; in private they were equally warm and welcoming to the young and old, famous and unsung guests. The hospitality at the “George and Dragon,” as Stella called their apartment, was legendary.

In 1999, in the Athenaeum Lecture, entitled “The Arts and Sciences; The Two Cultures 40 Years On,” George Porter wrote, “We need to tell of science as a great odyssey, a search for truth and understanding of ourselves and our universe.... There is then one great purpose for man, and for us today, and that is to try to discover man’s purpose by every means in our power. That is the ultimate aspiration of science, and not only of science, but of every branch of learning that can improve our understanding.” This was the creed by which he lived. He was an inspiration to all who knew him or saw him; he is missed.

Elected 1986

David Phillips

Hofmann Professor of Chemistry
Imperial College London



TELEGRAPH OBITUARY

Prof Lord Porter of Luddenham, OM **[6 December 1920 – 31 August 2002]**

Professor The Lord Porter of Luddenham, better known as Sir George Porter, who has died aged 81, was one of the most highly regarded and well known scientists in Britain; he won a Nobel Prize, became Director of the Royal Institution and President of the Royal Society, and had a gift for communicating his enthusiasm for science.

It was for his work on techniques for observing and studying extremely fast chemical reactions during the processes of combustion, explosion and chain reaction that, with fellow Cambridge scientist Ronald Norrish, and with Manfred Eigen, of Gottingen, he shared the Nobel Prize for Chemistry in 1967.

When Porter had joined Professor Norrish at Cambridge after the war, Norrish was trying to study the fragments of molecules made when certain chemicals are exposed to intense beams of light. He and his team had set up a huge arc lamp and were attempting, without much success, to capture the fleeting existence of these fragments-known as free radicals. But the free radicals produced existed too briefly to be detected, let alone studied.

Surmising that the problem lay in the light source, Norrish dispatched Porter to a company in Preston to see if he could find something better.

When Porter was shown a huge flash unit that had been used during the war for taking reconnaissance photographs, it suddenly dawned on him that the mistake had been to use a continuous beam of light

rather than very short pulses-flashes-which were of shorter duration than lifetime of the free radicals.

In the summer of 1947, porter began work on constructing a suitable apparatus; within six months, using short pulses of visible or ultraviolet light, Porter and Norrish were able to chart the free radicals brief lives – to examine, as Porter put it, “the spectroscopy of transient substances”.

While a first flash of light was used to create the free radical, successive flashes allowed its fleeting existence to be photographed and studied in detail.

Over the next few years, Porter and Norrish applied the technique- which became known as “flash photolysis” – to the study of free radicals in a wide variety of gaseous substances, and to combustion.

Porter would always remember the first appearance of the absorption spectra of new, transient substances in correct time sequence, as they gradually appeared under the safe light of a dark room, as one of the most rewarding experiences of his life.

By 1950, Porter was able to detect substances that survived for less than a millisecond (one thousandth of a second). A decade later, with the invention of the laser, much shorter flashes of light became available, and by 1967 Porter could photograph stages that lasted a nanosecond (a thousandth of a million of a second). By 1975, the time limit was a

thousand times shorter even than that – a picosecond.

It was during his time as Director of the Royal Institution of Great Britain, from 1966 to 1985, that Porter's talents as a fluent speaker, lecturer and broadcaster became widely known through radio and television. While the Royal Institution's Children's Christmas Lectures were regularly broadcast on BBC television, Porter himself invariably spoke with an infectious enthusiasm about his subject, and indeed about all science.

On his television debut in the 1960s, he even made thermodynamics, a subject feared by most science undergraduates, seem exciting; and he was the main force behind the BBC's long-running series *Young Scientist of the Year*.

As president of the Royal Society, from 1985 to 1990, Porter worked hard to improve the status of science, and employed his communication skills ably in the defense of British science under attack from inadequate government funding, of which he was fiercely critical.

George Porter was born on December 6 1920 at the village of Stainforth, near Doncaster, South Yorkshire, and went to Thorne Grammar School. Science was an early passion, and when George was a boy his father bought him an old bus in which to conduct his experiments away from the house. Sixty years later, Porter reflected that he was "still very fond of explosions".

From school he went on to read for a science degree at Leeds University, where he was Ackroyd Scholar. It was during his last year at Leeds that, inspired by the teaching of M G Evans, he became Interested in physical chemistry and chemical kinetics. Also at that stage, he took a special course in radio physics.

On graduating in 1941, he joined the Royal Naval Volunteer Reserve. With other young scientists he was put to work on perfecting radar, and for four years served as a radar operator in the RNVR in the Western Approaches and the Mediterranean.

In spare moments on board ship, he pondered his future. "I read a lot outside science," he recalled, "classics, poetry, philosophy and religion – which I'd more or less left, although my father was a lay preacher. Lying in my hammock, I convinced myself that science was the true philosophy and that the search for knowledge is the highest aim of mankind."

Porter was still in the Navy when he decided to try his luck at Cambridge; and here fate intervened when the scientist he had arranged to meet at Cambridge was unable to see Porter in time for him to return to his ship. So instead Porter saw the research chemist Professor Ronald Norrish, whose special interest was photochemistry – chemical reactions triggered by light.

As a result of this unexpected encounter, when Porter was released from the Navy in 1945 he went up to Cambridge to work under Norrish as a postgraduate research student at Emmanuel College. He went on to become Demonstrator in Physical Chemistry at Cambridge from 1949 to 1952, and Assistant Director of Research in Physical Chemistry from 1952 to 1954.

While Porter's early work with Norrish involved gases, he later developed methods to apply flash photolysis to liquids and solutions, enabling it to be used in organic chemistry, biochemistry and photobiology. Stimulating chemical reaction with light, photochemistry is now used to synthesise hydrocarbons for fuels and chemical feedstuffs.

Porter also studied how the photosynthesizing parts of plant cells collect the light, and what happens in the first nanosecond of the photosynthesis reaction.

In 1954 Porter left Cambridge to join the British Rayon Research Association, where he applied the methods he had developed to such practical problems as the dye-fading of fabrics.

The next year he took the Chair of Physical Chemistry at Sheffield University, where in 1963 he became Firth Professor of Chemistry and head of the Chemistry department. After a further three years

Glossary on Kalinga Prize Laureates

at Sheffield, he left to succeed Sir Lawrence Bragg as Director of the Royal Institution of Great Britain and Fullerian Professor of Chemistry.

In 1985 Porter became President of the Royal Society, taking over from Sir Andrew Huxley. In an address to the Society in 1987, he described scientific research as “the brightest jewel in our crown”, but said that if the government continued to downgrade it, Britain would join “the third world of science”.

In his Richard Dimbleby Lecture on BBC television the next year, he attacked the Thatcher Government’s “deliberate policy” of downgrading scientific research, and made a special plea for more money to support “first-class young scientists” whose talents were being squandered. He did, however, welcome the introduction of the national curriculum, which meant that science would be taught to all children.

On relinquishing the presidency of the Royal Society in 1990, Porter became chairman of the Centre for Photomolecular Sciences, Imperial College, London, where he had held a professorship since 1987.

Porter served on a myriad of bodies, mostly scientific but including the National Association for Gifted

Children (1975-80); the Council of the Open University (1969-75); and the Council of the Royal Society of Arts (1976-80). He was also a trustee of the British Museum (1972-74).

He gave the Romanes Lecture at Oxford University in 1978. He was Chancellor of Leicester University from 1986 to 1995, and was awarded honorary degrees, professorships and fellowships by more than 50 universities and academies worldwide. He was involved in overseas projects concerned with science education, and in **1977 was awarded the Kalinga Prize by Unesco.**

The Royal Society of Chemistry awarded him Corday-Morgan Medal (1955); the Tilden Medal (1958); the Liversidge Medal (1970); the Faraday Medal (1980), and the Longstaff Medal (1981). The Royal Society, of which he was elected a Fellow in 1960, awarded him the Davy Medal (1971); the Rumford Medal (1978); the Michael Faraday Award (1991); and the Copley Medal (1992).

He was knighted in 1972, and was appointed a member of the Order of Merit in 1989. He was created a life peer as Lord Porter of Luddenham in 1990. He died on Saturday. George Porter married, in 1949, Stella Brooke; they had two sons.



BBC NEWS | SCIENCE NATURE | OBITUARY LORD PORTER MONDAY, 2 SEPTEMBER, 2002



Lord Porter : Natural Communicator [6 December 1920 – 31 August 2002]

George Porter, Lord Porter of Luddenham, had been a professor of chemistry for 35 years and was president of the Royal Society from 1985 to 1990.

He was joint winner of the Nobel Prize for chemistry in 1967 for his work on photochemistry-chemical reactions triggered by light-and flash photolysis-photographing the behaviour of molecules during chemical reactions.

In later life, George Porter had regularly stressed the need for better teaching of science, and accused successive governments of deliberately downgrading scientific research.

He once said that Britain seemed well prepared to join the Third World of science.

George Porter was a natural communicator and a pioneer of scientific programmes on television. He was knighted in 1972, made a member of the exclusive Order of Merit in December 1989 and a life peer in June 1990.

George Porter was born in December 1920 at Stainforth in Yorkshire, where his father was a Methodist lay preacher, and after grammar school, went to Leeds University.

During World War Two he was a radar officer in the Royal Navy. He went up to Cambridge after the war, took a PhD, and then had several research jobs there.

Later he was Professor of Chemistry at the Royal Institution of Great Britain, where he was also director for 20 years. Since 1987 he had been

Professor of Photochemistry at Imperial College, London.

When he was elected President of the Royal Society in December 1985, Sir George Porter was seen as the right man to put science back on the map in Britain and to try to stop the brain drain.

In the next few years he showed himself to be a great champion of science and scientists.

Warning :

He criticised proposals to concentrate research in selected centres and universities, saying this might stifle the original mind and encourage the safe and mediocre.

He attacked the spread of an anti-science lobby, condemning what he saw as the skimping on long-term research and the concentration of scientific spending on short-term get-rich-quick projects.

Giving the 1988 Dimbleby lecture, he warned that Britain would fall still further behind its competitors because of the downgrading of research.

Sir George gave a warning of a different kind when he said that the revolution in biology could insidiously change the human race.

One of the most pressing and ominous questions, he said, was how far scientists should manipulate the process of evolution.

Popular lecturer :

Discussing threats to the ozone layer, he said that specially designed plants with a super efficient photosynthesis system and put in an area 400 miles square, could supply the world with energy and help to beat the greenhouse effect.

Sir George regretted the great educational divide between the sciences and the humanities after the age of 16.

He told one interviewer that the teaching of science was most important at the age of five and the teachers must be properly qualified.

His television series included *Laws of Disorder* about thermodynamics and *Time Machine*. He was the driving force behind the BBC's *Young Scientist of the Year Award* and presented the Royal Institution's children's Christmas lectures.

Sir George, who was Chancellor of Leicester University from 1986 to 1995, won many awards and held more than 50 honorary professorships, doctorates and fellowships.

He was a former member of the Open University Council and trustee of the British Museum. He was married with two sons.



E-BULLETIN : UNIVESITY OF LEICESTER OBITUARY



Lord Porter of Luddenham, OM, FRS **[6 December 1920 – 31 August 2002]**

Former Chancellor of the University of Leicester, Lord Porter of Luddenham, OM, FRS, died on Saturday, August 31, aged 81. The University's third Chancellor, he served between 1984 and 1995.

One of the most highly regarded and well-known scientists in Britain, and a Nobel prize-winner, he had a gift for communicating his enthusiasm for science.

It was for his work on techniques for observing and studying extremely fast chemical reactions during the processes of combustion, explosion and chain

reaction that, with his Cambridge colleague Professor Ronald Norrish, and with the German scholar Manfred Eigen, he shared the Nobel Prize for Chemistry in 1967. Porter and Norrish developed flash photolysis, using pulses of light even shorter than the reactions they sought to study, to open up a window onto a hitherto impenetrable world.

Underpinning Porter's science was a bedrock of everyday reality, and a profound concern for the future of mankind and the interlinked physical and biological systems of the planet. If the processes of photosynthesis could be unravelled, then mankind

might be able to solve its energy problems and look forward to a truly sustainable future.

Far from being remote these considerations were basic, and the questions posed were those that any child might ask. Thus Porter's great interest in encouraging young people to understand science followed naturally from his academic study. He used his skills in communication most successfully in a highly entertaining series of televised Christmas Lectures.

A fluent and infectious speaker, lecturer and broadcaster on radio and television, he became widely known and in great demand throughout the country. In later years he campaigned for the greater teaching of science in schools, to all children between the ages of five and 18.

He was outspoken too in his criticism of national science policies and inadequate funding, of the "pseudo-sciences" of psychologists, sociologists and economists, and spoke strongly of the need for industry to do its own research. His position as President of the Royal Society gave him a powerful platform from which to express his views, and his belief in the power of the media was revealed in a forceful Dingleby lecture in 1986, attacking the Thatcher government for deliberately 'downgrading scientific research'.

George Porter was born in the Yorkshire town of Stainforth, and went to Leeds University as an Ackroyd Scholar in 1938. During the Second World War he served in the Royal Navy on anti-U-boat patrol, working on radar. Taking up a research career at Cambridge, he became Fellow of Emmanuel College in 1952, going to the University of Sheffield as Professor of Physical Chemistry in 1960, where he became Head of Department in 1963.

George Porter was elected a Fellow of the Royal Society in 1960. He became Professor of Chemistry at the Royal Institution of Great Britain in 1963, serving as its Director from 1966 to 1985, and as president of the Royal Society from 1985 to 1990. Among his many honours were over 50 honorary degrees, professorships and fellowships. He was knighted in 1972, was awarded the Order of Merit in 1989, and made a Life Peer in 1990.

In honour of its former Chancellor the University of Leicester named the Chemistry teaching building the George Porter Building in 2001, when Lord Porter unveiled a commemorative plaque. This building, the first to be completed on the Science site in 1960, is currently being refurbished, and will next year accommodate the whole Chemistry Department – a fitting memorial to one of Chemistry's most innovative academics and one of science's greatest popularisers.