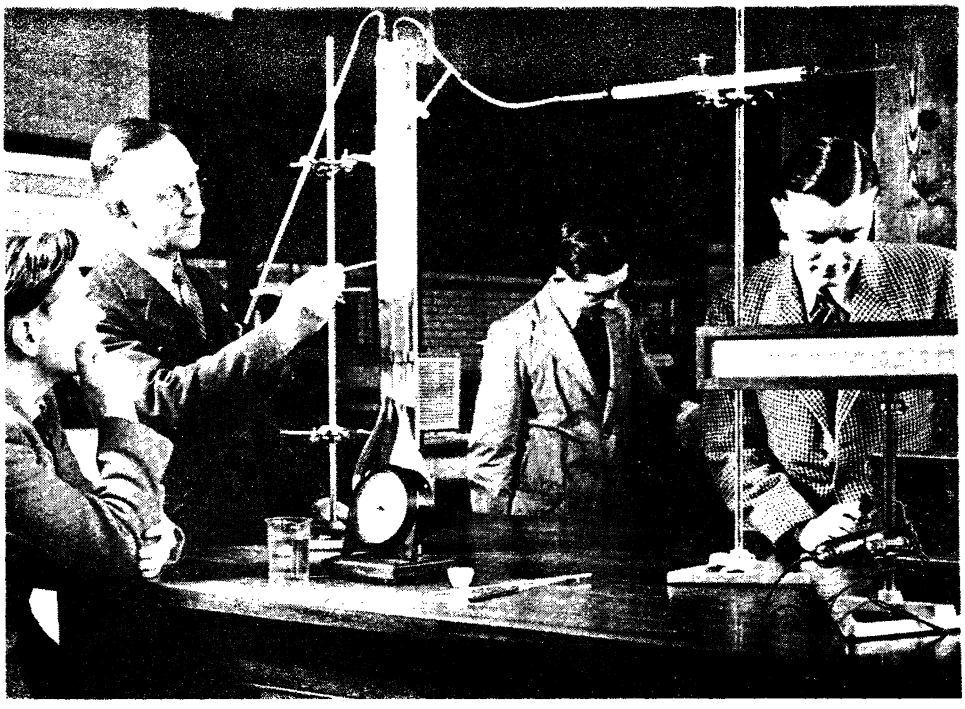


Lecturer demonstrating a viscometer to a group of students in the Herschel Laboratory of the physics department of Durham University.

quite old enough to have a firmly established tradition of science teaching. This is being much strengthened by the building of a new science block, to be completed in 1958, to house the departments of civil engineering, chemistry, botany, and zoology. At Hillsborough the university maintains an agricultural research institute.

Conclusion

This necessarily brief survey of the scientific facilities of the provincial universities in the United Kingdom cannot even mention many of their special features. But enough has been said, it is hoped, to indicate that they deserve the most careful attention of the intending student, whose requirements must be exacting indeed if he cannot find among them a course to suit his needs.

It is worth remarking, too, that the provincial universities can offer a great deal more than good technical facilities and competent teachers. For the student who stays long enough to complete a full course of study, they offer the opportunity of seeing sides of life in the United Kingdom which the visitor all too seldom appreciates. Like every other country, the United Kingdom is not homogeneous, and every region has its own characteristic features. Although the advent of rapid transport, and of media of mass entertainment, such as the radio, television, and films, is rapidly ironing out the local differences in the population which were so marked only 50 years ago, they still exist in sufficient degree to be very noticeable and interesting.

Some parts in which are situated such universities as those of Manchester, Sheffield, Leeds, Liverpool, and Glasgow are heavily industrialized and thus have innumerable features of interest for the student of applied science. At the same time, all have fairly close at hand attractive country whose exploration can provide pleasant occupation for leisure hours.

Fellowship of the Royal Society

D. C. Martin

"Gentlemen, . . . I trust that in all our researches we shall be guided by that spirit of philosophy, awakened by our great masters, Bacon and Newton; that sober and cautious method of inductive reasoning which is the germ of truth and of permanency in all the sciences. I trust that those amongst us who are so fortunate as to kindle the light of new discoveries will use them not for the purpose of dazzling the organs of our intellectual vision but rather to enlighten us, by showing objects in their true form and colors; that our philosophers will attach no importance to hypotheses except as leading to the research after facts so as to be able to discard or adopt them at pleasure treating them rather as parts of the scaffolding of the building of science, than as belonging either to its foundations, materials, or ornaments; that they will look, where it be possible, to practical applications in science, not however, forgetting the dignity of their pursuit, the noblest end of which is, to exalt the powers of the human mind, and to increase the sphere of intellectual enjoyment, by enlarging our views of nature and of the power, wisdom, and goodness of the Author of nature."

These words were addressed to fellows of the Royal Society in 1820 by Humphry Davy. The society was in the

Dr. Martin has been assistant secretary of the Royal Society since 1947.

160th year of its existence, and the distinguished chemist Humphry Davy was its 22nd president. He was restating the objects of the founder fellows of the Royal Society. These objects remain the objects of the Royal Society at the present time.

Founding

In the early part of the 17th century, the philosophic writings of Francis Bacon (1561–1626) greatly affected the minds of intellectual leaders in Europe. Bacon was an advocate of the experimental method of research, and he protested strongly against the deductive method which had been accepted until that time. He described his thoughts in a book called *New Atlantis,* and he believed that the fruits of the experimental method could best be achieved by the corporate action of men devoting their whole time to experimental investigations. This book had a great impact, and there can be little doubt that it opened up the way for the formation of the Royal Society and other academies of science throughout Europe. There was a campaigning enthusiasm among certain groups of men of quality in London to try out this new philosophy, and in the year 1645 these men began to have meetings to discuss the new philosophy and how they might set up a college of the type described by Bacon. This group of people, who were philosophers without a college building, came to be known as the invisible or philosophical college. Men whose names are now part of the fabric of science were in this group—for example, Robert Boyle and Christopher Wren. Some of their meetings were held in Gresham College in the City of London.

However, there was civil war in England at that time, and the holding of meetings became very difficult. Some of the philosophers went to Oxford and met there. Others remained in London, but the uncertainty of the times hindered the furtherance of any proposal to create a college of the type dreamed of by Francis Bacon, and it was not until the restoration of the monarchy in 1660 that the philosophers were again able to meet weekly. On 28 November 1660 they decided to give themselves a more formal constitution. In their memorandum of foundation, they agreed to continue their weekly meeting "on Wednesday, at 3 of the clock in the tearme time at Mr Rooke's chamber at Gresham College; in the vacation, at Mr Bull's Chamber in the Temple." There was an entrance fee of 10 shillings and a weekly subscription of 1 shilling. It is further recorded in this memorandum, which is still treasured in the society's archives as page 1, volume 1 of the Journal Books of the Royal Society, as follows.

Isaac Newton.

"And to the end that they might the better be enabled to make a conjecture of how many the elected number of this Society should consist, therefore it was desired that a list might be taken of the names of such persons as were known to those present, whom they judged willing and fit to joyne with them in their designe, who if they should desire it, might be admitted before any other."

Here then was the formation of this private society of natural philosophers. On that November day nearly 300 years ago, a dozen or so far-seeing men formally founded a society whose influence on the course of history has been considerable. The historian, H. A. L. Fisher, has written of this event as follows.

"The seventeenth century, which opens with the glowing dreams of Francis Bacon, closes with Isaac Newton's precise demonstration that the whole universe is one vast mechanism. Between these two names lies a long and splendid chapter of English scientific work, beginning with Harvey's discovery of the circulation of the blood in 1624 (reached only because he tested all his theories by experiment), carried on by Robert Boyle's epoch-making work in chemical science, illustrated by the foundation of the Royal Society and giving to England a place in the intellectual life of Europe, which the insular reputation of a Shakespeare or a Milton could not have secured."

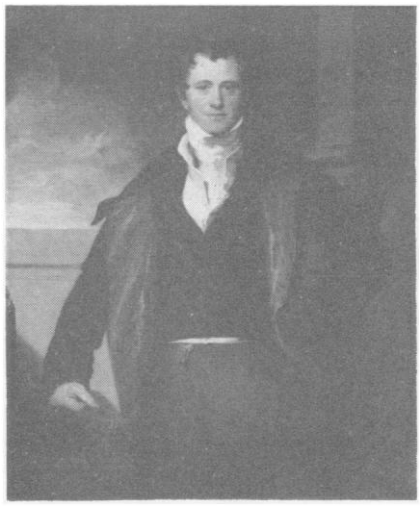
One of the leaders in the formal foundation of the society was Robert Moray, a courtier of King Charles II. He had accompanied Charles into exile, and a week after the memorandum of foundation was drawn up, Robert Moray is on record as having acquainted His Majesty with the "designe of this Meeting" (on 28 November). "And he did well approve of it and would be ready to give encouragement to it." Charles II, who himself was greatly interested in natural philosophy, kept his word and encouraged the newly born society, which soon began to be known as The Royal Society. He granted his royal charter on 15 July 1662, and in it the society was named "The Royal Society of London for Improving Natural Knowledge." A second charter was granted on 22 April 1663, and this one has largely governed the growth and development of the society. A third charter was granted in 1669, but this was relatively unimportant compared with the second charter. It is a striking tribute to the foresight of the founders that the second charter laid down principles and rules which remain unchanged today in governing the society's affairs. For instance, that charter lays down the composition of the council, insuring a constant flow of new fellows into the government of the society, and it has proved to be a system so admirably suited to improving natural knowledge that no attempt has been made to alter it.

Charles II gave further encouragement to the society by two fine gifts. On 23 May 1663, he gave the society a mace "of the same portion and bigness as those carried before His Majesty to be borne before our President on meeting days." A few months later, in January, he presented to the society a folio volume prepared in leaves of finest vellum and bound in crimson velvet; in it were inscribed the charter and statutes of the society. He signed this, describing himself "founder." It is my proud duty to carry this self-same mace before the president at each of our weekly meetings today, and likewise to assist at the inscription of this self-same Charter Book by each new fellow admitted to the society. Through these two cherished possessions, we have a tangible link with the worthy founders of this Royal Society. The monarch continues to be its patron, and the Charter Book contains, alongside those of the scientists, the signatures of all the royal patrons since Charles II. The signature of Queen Elizabeth graces the latest, specially illumined, royal page.

Members

I wish to draw attention particularly to the phrase "the names of such persons . . . whom they [the founder fellows] judged willing and fit to joyne with them in their designe, who . . . might be admitted [to the society] before any other." Like almost all the laws that govern the society today, the principles of election laid down in 1660 are still prescribed by the founder fellows.

That the founders judged well of those "fit to joyne them" is evident by the achievements of the early fellows. They were true amateurs or lovers of the new experimental method. Robert Hooke was



Humphry Davy.

one such, and he became the society's first curator. It was his duty each week to arrange the experiments which were to be discussed. This remarkable man, who gave his name to Hooke's law, did much to establish the society's early reputation. Likewise Henry Oldenburg, one of the first secretaries, who founded the *Philosophical Transactions* in 1665 and corresponded with men of science in other countries, made the society well known both in England and elsewhere. It was in 1671 that a young man of 29, destined to ornament natural philosophy in a manner unexcelled by anyone since, was admitted to the society. His name was Isaac Newton. He was president from 1703 to 1727, and by his illustrious works he brought the society the greatest renown. The society published Newton's *Principia*, and the society's clerk (or assistant secretary) of that day, Edmond Halley, did much to bring about the issue of this work, which was described by Laplace as "preeminent above any other production of human genius." Halley, himself a great astronomer, meteorologist, and geophysicist, was born in 1656, and in this tercentenary year of his birth the society was pleased to commemorate the event by naming the location of the society's International Geophysical Year base in the antarctic as Halley Bay.

It is not possible even to list the names of the great men of science who, since Newton's day, have brought distinction to the Royal Society. Benjamin Franklin was elected in 1756, and special mention must be made of Joseph Banks, who occupied the presidential chair for 42 years, from 1778 until 1820. He was a keen and distinguished botanist who had been on one of the voyages of exploration of James Cook. He was a great figure of his day and a personal friend of King George III, who took a benevolent interest in the society's affairs. During Bank's long presidency, Henry Cavendish and James Watt were making their important studies on the composition of water, Herschel discovered Uranus, and Volta was sending accounts of his electrical studies to the society. The society was taking an increasingly important part in public affairs. Humphry Davy succeeded Banks, and to mention briefly Michael Faraday, Charles Darwin, John Dalton, Clerk Maxwell, in addition to presidents such as Thomas Henry Huxley, William Thomson (Lord Kelvin), Joseph Lister, John Strutt (Lord Rayleigh), Joseph J. Thomson, and Ernest Rutherford is to give sufficient indication that there has been no lack of distinguished successors to the society's founders.

The number of fellows during the period from 1660 until Newton's death never exceeded 200, but from then until 1847 the fellowship grew steadily to a maximum of 764 fellows.

The year 1847 marked a very important change in the society's policy, inasmuch as very strict rules were introduced regarding the qualifications for election. Only 15 persons could be elected each year after 1847, and numbers fell steadily, being reduced to 469 in 1888. The 1847 rules had the result of changing the society within a generation from a body of well-educated and cultivated men of whom only about one-third could be classed as men of science to a scientific institution of the highest rank. In 1930 the number who may be elected was increased to 17, and in 1937 it was again increased to 20. In 1946 it was decided to increase it to 25, and the present fellowship is as given in Table 1.

There are three principal categories of fellowship under the patronage of Queen Elizabeth: (i) royal fellows, (ii) foreign members, and (iii) fellows. Category (i) consists of three royal dukes at present, including the Duke of Edinburgh, whose personal interest in scientific matters is an inspiration to so many British scientists. Foreign members (category ii), who may be elected at a rate of not more than four each year, include distinguished men of science from many lands, as Table 2 shows.

Category (iii) constitutes the main element of the society. To be eligible for fellowship, a scientist must be a British subject or a citizen of Eire, and he must be proposed and recommended by a certificate in writing signed by at least six fellows, of whom three at least must certify their recommendation from personal knowledge. About 250 certificates are examined each year by an elaborate machinery based on sectional committees, each dealing with a basic division of scientific activity—mathematics, physics, chemistry, engineering sciences, geology, botany, zoology, and physiology and medical sciences. The nomination procedure takes care of scientists working in borderline fields. Several months each year are spent in this very important matter of introducing new fellows judged "fit to joyne" the society. In 10 years, 250 fellows are elected, so that in a decade just under half of the category (iii) fellowship changes. If the choice of new fellows were not very carefully undertaken, the society's character could change very rapidly. Outstanding work of an original nature is a necessary achievement for election, and it is possible for a person influential in scientific affairs and well respected for his contribution in this regard never to attain fellowship of the Royal Society. The society does, however, have authority to elect at a rate of not more than one person per year a person who has either rendered conspicuous service to the cause of science or who is so distinguished that his election would be of signal benefit to the society. This authority is very sparingly used, and only twelve of the present fellowship were elected in this way.

A recent examination of the age of election of fellows shows that about 375 of the total were elected before they had reached the age of 50 years—all but 45 or so of these between ages 35 and 49. A. V. Hill, a former secretary of the society, recently calculated the median age of election for the different subject sections as follows for the years 1939–1953: mathematics, 42 years; physics, 44 years;

Table 1. Present fellowship of the Royal Society.

Date	Patron and royal (No.)	Foreign Fellows (No.)	(No.)
At 31 Dec. 1955	4	60	566
Elected 1956	0	4	25
Deceased to June 1956	0	2	11
At 27 June 1956	4	62	580

Table 2. Foreign membership of the Royal Society.

Country	Fellows (No.)
Argentine Republic	1
Austria	1
Belgium	1
Denmark	3
France	8
Germany	6
Netherlands	2
Norway	1
Soviet Union	1
Sweden	8
Switzerland	5
United States	23

chemistry, 45 years; engineering, 54 years; geology, 51 years; botany, 52 years; zoology, 50 years; physiology (including biochemistry and all medical sciences except anatomy, which comes under zoology), 49 years.

Geographical Distribution

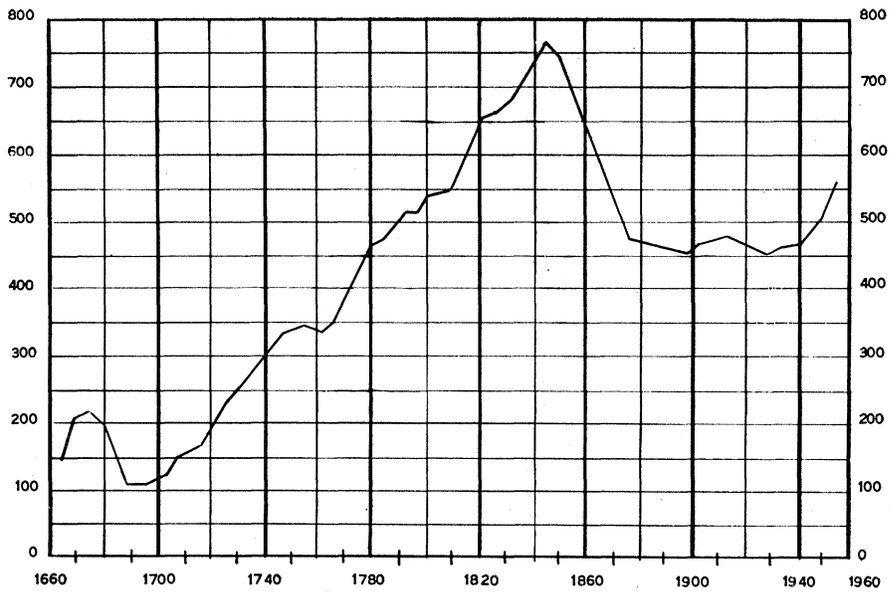
The distribution of fellows resident in member countries of the British Commonwealth is as follows: Australia, 14; Canada, 23; India, 5; New Zealand, 3; Union of South Africa, 2; Colonial territories, 3. In addition, it is of some interest that 11 fellows of category (iii) are resident in the United States. Several other fellows reside in other parts of the world.

Within the United Kingdom, 40 fellows reside in Scotland, seven in Wales, one in Northern Ireland, and three in Eire, and the others are mainly to be found in university centers throughout England. Table 3 shows the current distribution of fellows at universities in the British Isles. Several fellows occupy leading positions in industrial organizations and in government departments, and from this distribution it will be clear that the society can and does exercise a decisive influence on scientific research in the United Kingdom.

Although the present president, the distinguished chemist Cyril Hinshelwood, is at Oxford and his immediate predecessor, Edgar D. Adrian, is from Cambridge,

Table 3. Distribution of fellows at the universities in the British Isles on 27 June 1956.

University	Fellows (No.)
England	
Birmingham	11
Bristol	11
Cambridge	70
Durham	4
Exeter	2
Leeds	6
Liverpool	9
London	51
Manchester	10
Nottingham	1
Oxford	39
Reading	2
Sheffield	3
Southampton	1
Wales	
University Colleges	5
Ireland	
Belfast	1
Dublin	2
Scotland	
Aberdeen	2
Dundee	1
Edinburgh	14
Glasgow	7
St. Andrews	2



Number of fellows of the Royal Society, 1660–1955.

and at these two ancient universities are some 20 percent of the fellows of the Royal Society, it will be evident that the society's fellowship derives from a wide range of scientific centers both inside and outside the United Kingdom. It might be of some interest to mention eminent scientists who have worked or are working at some of these centers.

Scotland, Northern Ireland, and Wales

The great physicist Kelvin, president of the society 1890–95, was born in Northern Ireland and spent most of his life in Glasgow, bringing great renown to the department of natural philosophy of the University of Glasgow, where P. I. Dee continues the tradition with an active nuclear physics school equipped with an electron synchrotron. Three fellows lead active research groups in chemistry in Glasgow; J. M. Robertson, who delivered the George Fisher Baker lectures at Cornell University in 1953, is an acknowledged expert in the x-ray diffraction studies of organic crystals and molecules. D. H. R. Barton, who, like Robertson, has spent some time in the United States, has recently become a professor in the University of Glasgow, and his outstanding work in organic chemical synthesis attracts many research students. He was visiting professor at Harvard University in 1949–50. The third fellow is F. S. Spring, the Freeland professor of chemistry at the Royal Technical College, Glasgow, who has also carried out important work in organic chemistry. In marine zoology, C. M. Yonge's contributions to the study of Mollusca are well known, and Guido Pontecorvo is making significant contributions to the genetics of microorganisms.

In Scotland's capital city, Nobel prizeman, Edward Appleton, is vice chancellor of the University of Edinburgh. In spite of heavy administrative duties, he continues some studies in the nature and behavior of the ionosphere, where his pioneering work was so significant. Edinburgh University has had several fellows as vice chancellor in the past, notably Thomas Holland, the geologist, and Alfred Ewing, the engineer, and the scientific tradition is maintained by several active groups. N. Feather, a pupil of Rutherford, is continuing fundamental work on the study of the atomic nucleus. A. C. Aitken is head of the mathematics department, where previously the doyen of British mathematics, the late Edmund Whittaker, presided. Joseph Lister, president of the Royal Society from 1895 to 1900 and founder of the principles and practice of antiseptic surgery, was, at one time, a member of the medical faculty of Edinburgh University, which still enjoys a high reputation. Today there are five fellows in this faculty, J. H. Gaddum and Marthe Vogt (pharmacologists), G. F. Marrian and E. Stedman (biochemists) and D. Whitteridge (physiologist). C. H. Waddington is professor of animal genetics. E. L. Hirst, president of the Chemical Society, who has done very distinguished work in the field of carbohydrate chemistry, directs a large school in the chemistry department. The head of the chemistry department is J. P. Kendall, who recently retired from being president of the Royal Society of Edinburgh, which does much to encourage scientific research in Scotland.

Joseph Banks.

In the attractive town of St. Andrews, two fellows of the society conduct researches, John Read in organic chemistry and J. F. Allen in low-temperature physical phenomena. There are also two fellows in Aberdeen: biochemist W. O. Kermack and statistician D. J. Finney.

In Northern Ireland at the Queen's University in Belfast, there is research work in various disciplines being carried out; that directed by D. R. Bates on the fundamental constitution of the upper atmosphere is notable.

There are active centers of research in the constituent colleges of the University of Wales in Bangor, Aberystwyth, Cardiff, and Swansea. At Bangor, S. Peat has made important discoveries in carbohydrate chemistry and continues this work, and F. W. Rogers Brambell is making first-class contributions in embryological studies. At Aberystwyth is T. A. Stephenson, who is an artist as well as being a leading marine biologist.

England

In England there are several university centers where progressive research schools attract workers from overseas; for instance, Manchester University has a great reputation in physics and chemistry as well as in many other scientific fields. The chair of physics, now held by S. Devons, has been occupied by three Nobel laureates, Ernest Rutherford, Lawrence Bragg, and P. M. S. Blackett, and a stream of highly important original work has flowed and continues to flow from there. Associated with this department is A. C. B. Lovell's pioneering work on radio astronomy, soon to be further extended by the completion of the largest radio telescope in the world. The chair of organic chemistry, now held by A. J. Birch, has been distinguished by many British leaders of organic chemistry. Nobel prizeman Robert Robinson, president of the Royal Society from 1945 to 1950, held the chair from 1922 until 1928. Others who have held the chair since are Arthur Lapworth, Ian Heilbron, Alexander Todd, E. L. Hirst, and E. R. H. Jones. The chair of physical chemistry is now held by G. Gee, who is continuing his study of polymers, and he succeeded in this chair M. Polyani and M. G. Evans. The school of mathematics has also gained renown. In pure mathematics, M. H. A. Newman's work is well known, and in the mathematics department Kurt Mahler is professor of mathematical analysis. Newman has been associated with F. C. Williams in the design of a new computing machine and its application to mathematical research. M. J. Lighthill leads a very vigorous department of applied mathematics. In the biological sciences, S. C. Harland is professor of botany, and H. Graham Cannon is professor of zoology. Other fellows in the area are associated with engineering developments and medical sciences.

In Liverpool there are several chairs of chemistry occupied by fellows of the Royal Society: A. Robertson in the field of organic chemistry, C. E. H. Bawn in physical chemistry, and R. A. Morton in biochemistry. H. W. B. Skinner is the professor of physics and is a leader in neutron diffraction studies. R. J. Pumphrey occupies the chair of zoology. In the field of mathematics, L. Rosenhead is in charge of applied mathematics, and A. G. Walker in pure mathematics.

Liverpool, being one of Britain's principal ports, has had many leading figures in the field of oceanography. J. Proudman has just retired from the chair of oceanography, and A. T. Doodson is director of the Liverpool Observatory and Tidal Institute.

Birmingham, in the heart of the Midlands, has for long been a leading center of research, and it is the city with which are associated the names of Erasmus Darwin, Joseph Priestley, James Watt, and Matthew Boulton. Today the university has many chairs related to industrial developments, but in the field of pure science it also stands high. In physics, P. B. Moon has an active group working in the field of nuclear physics, and R .E. Peierls is in charge of mathematical physics. In chemistry, a large and active department is shortly to come under the leadership of M. Stacey with a wide range of interests in carbohydrate chemistry, fluorine compounds, polymerization, and so forth. F. W. Shotton is professor of geology. In biology there are many fellows of the Royal Society: D. G. Catcheside in microbiology, Lancelot Hogben in medical statistics, O. E. Lowenstein in zoology and comparative physiology, E. J. Maskell in botany, K. Mather in genetics, and Solly Zuckerman in anatomy.

In Yorkshire there are three universities—one quite new, at Hull. At the other two, at Sheffield and Leeds, there are many fellows of the society leading active schools in the field of physical and biological sciences. Mention might be made of the work in x-ray crystallography of W. T. Astbury and E. G. Cox at Leeds. R. D. Haworth at Sheffield is in charge of an active chemical research school there. Physics at Sheffield is in the charge of W. Sucksmith, while at Leeds the physics department is headed by E. C. Stoner. Sheffield is, of course, at the heart of Britain's metallurgical industry and has many active research workers in this field. It is also the center of glass-making.

The University of Reading has gained a reputation for leadership in the field of agricultural science; especially well known is the closely associated National Institute for Research in Dairying, ably led by H. D. Kay.

The University Colleges of Nottingham and Exeter have recently acquired university status, and J. W. Cook, a distinguished organic chemist, is the first vice chancellor of Exeter University.

In Northumberland, the University of Durham, with colleges in the cities of Durham and Newcastle, also has a strong contingent of fellows of the Royal Society on the university staff. In geology, for instance, there are K. C. Dunham of Durham and T. S. Westoll of Newcastle. W. W. Rogosinski is head of the pure mathematics department, and M. Thomas is professor of botany.

Bristol University also has many fellows of the Royal Society on the staff. The school of physics has done a great deal of distinguished work and is now in the charge of M. H. L. Pryce. One of his principal colleagues is C. F. Powell, Nobel laureate, whose work in cosmic rays has been so outstanding. Another is C. R. Burch, who numbers among his many inventions that of the reflecting microscope. Yet another is F. C. Frank in the field of metal physics, and also J. W. Mitchell, reader in experimental physics, who was elected into the fellowship only this year. Wilson Baker is the principal professor in an active school of chemistry. In mathematics, H. A. Heilbronn and L. Howarth cover the fields of pure and applied mathematics, respectively. Alfred Pugsley is professor of civil engineering, and in biology J. E. Harris is in charge of the zoological department.

Bristol was a city where Humphry Davy began some of his work in chemistry, and so we return to the man whose words began this article. During the 136 years since he addressed the fellows of the society, there has been no lack of

effort to follow his dictum. I have purposely left out of this description of the fellowship any detailed mention of the very active departments of research at the Universities of Oxford, Cambridge, and London, because these are usually better known; the fact that there are other very active scientific research centers in the United Kingdom is perhaps not as well appreciated in other countries as it might be.

The Royal Society seeks to recognize and encourage scientific research wherever it is carried out. Through its award of medals, the invitations it issues to scientists to lecture or to read papers before it, and by its maintenance of the highest standard in its publications, it will continue to exert a not inconsiderable influence on the course of research in the natural sciences.

Graduate Students in Britain

H. N. V. Temperley

Graduate students in Britain vary enormously. They range from the strictly "dedicated" person to the man who merely regards the Ph.D. as an additional qualification for getting a good job. In personality, they range from the carefree, sometimes almost childish, individual to the serious and earnest seeker after truth. Sometimes they seem to be working under continuous strain; the worried face and the tic that goes with it (often coupled with brilliant work) is probably represented in any research group of any size. As in the United States, it has been found that a research director cannot look after more than about six students with any efficiency, so that the head of a group of any size has to delegate a great deal of this work to others.

The success or failure of a student depends very much on the stimulus he gets from his director of research, who is a far more important influence than is the graduate student adviser in the United States, for reasons that will be explained in a subsequent paragraph. There can be no question that the student who has a really good research director at the beginning of his career has an immense advantage, and such an experience is quite unforgettable, as many of the former students of Rutherford and R. H. Fowler will testify.

The problems facing a director, such as that of guiding a student into profitable channels and yet avoiding bullying, of telling him tactfully that his cherished idea is unsound or not new, of striking the happy mean between "spoon-feeding" and unduly neglecting his students, of advising them about their personal problems and future plans, and of seeing that they all get proper credit for their work, have probably always existed, but a further complication is becoming evident today on account of the trend of research itself, the tendency being more and more toward work in large teams on big projects. The attempt to expand a flourishing team can lead to disaster. It by no means follows that a first-rate individual researcher can lead a team of six with any success: the relationship between a student and his director is always rather delicate, and it is almost impossible to repair the damage once a real "blow-up" has occurred. Still less does it follow that such a man can successfully run a department of 30 or more; he may resent the inevitable load of administration, which he considers to be "waste of time," he may find that its problems fascinate him as much as his now neglected research and students once did, or he may make a heroic effort to do both parts of the job at high pressure and end up with an ulcer. Thus, the personality of the director influences the students enormously. It is possible to inspire better work in others than one can do oneself, as Barrow inspired Newton.

Beginning Graduate Work

The main differences between a British graduate student and his American cousin arise from their different educational backgrounds. In the first place, a British boy has to be fairly bright to get into a university at all, the percentage of population being far smaller than in the United States. No one has any prescriptive *right* to a place in a college, each of which has its own special system of selecting candidates. Secondly, he will already have done at school most of the work that is usually done during the freshman year in the United States, and, at the end of his 3 undergraduate years, he will be in about the same position as is a second-year graduate student in the United States. His chance of becoming a graduate student depends mainly on his undergraduate degree.

Nearly everyone at college *passes* his final examinations, but he would not usually be considered to be graduate student material unless he finished up with a "First Class." The type of man who would be elected to Phi Beta Kappa in the United States would probably get a good "First Class" in England. Quite a few of the research grants also go to those who are fairly high in the "Second Class." (This probably corresponds to a minimum grade average of about 6.5 out of 9.)

Having attained this standard, he will probably be awarded some research grant or scholarship. The system for handing these out is complicated, and is administered partly by the Government and partly by the universities themselves, the money coming partly from taxes and partly from private endowments of many kinds. In practice, a man without private means gets enough to pay his fees as a graduate student and to enable him to live in a fairly simple style. Unlike his American cousin, he is not specifically required to do any work outside his research program in return for this money; indeed, the outside work he may do is usually limited to a little teaching or laboratory demonstration during termtime. Some students earn a little extra money during the summer vacation, but control on the type and length of job is often exercised here too. Most of our graduate students are unmarried, our convention being that a man lines up a safe job before considering marriage.

The third main difference is that the British graduate student is given a great deal more freedom to organize his own program than his American cousin is

The author, who resides at Riversdale, Grantchester, Cambridge, England, has had about 10 years' experience in directing the research of others at the British Admiralty and at Cambridge University. He has spent a total of about 2 years in the United States, where he has held various visiting appointments at Yale University, the University of Nebraska, and the National Bureau of Standards. In addition, he has made short visits to about 15 other universities. His experience has been with mathematics and the physical sciences, but he feels that the situation of students in the other subjects is not very different.