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Preserving scientific archives: the work of the
National Cataloguing Unit for the Archives of Contemporary Scientists

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1. Preservação de Arquivos Científicos
I. Título.

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When I return to the UK on a long haul British Airways flight from this side of the Atlantic, they like to show, as we approach Heathrow, a welcome-to-Britain film, a totally predictable assemblage of familiar images such as the Houses of Parliament, Oxford colleges, the city of Bath, a well worn tourist route but also, as it happens, the route of my personal career in archives. This began 25 years ago in the Parliamentary Archive in London (1979), continued a couple of years later in Oxford where I was introduced to scientific archives and then transferred a few years later (1987) to Bath where I and the scientific archives centre moved together and where we have remained ever since.

Bath is of course a world heritage site, famous for the Roman Baths and the classically inspired architecture of the eighteenth-century when the spa town was at the height of its success as a centre of health and recreation for a social elite. Now you might reasonably assume that this is not obviously a centre for science or indeed science archives but in fact the city of Bath has serious claims to fame in the history of science and its university founded in the 1960s has its primary focus in science and engineering. Since we are here in a museum of astronomy I must mention one of Bath's claims to fame in the history of science. This is the story of William Herschel who came to England from Germany as a young man and set up residence in Bath in 1766 where he earned his living as a musician. He was however passionate about astronomy and set up a telescope in the garden at the back of his house, and it was here on the 13th March 1781 that Herschel discovered an object that earned him world-wide fame, the planet we now call Uranus.

My intention this morning is to tell you something of my own organisation and its work in preserving scientific archives. Since we have recently (last year) celebrated our thirtieth anniversary we have inevitably been thinking a great deal about our own history and I am going to share some of that thinking with you. I have even done some research in the archives so that I can tell you with some authority about our origins and history, as well as our achievement, ways of working, funding etc, etc. This morning's presentation, therefore, has something of the retrospective about it. This afternoon I want to broaden the discussion to look at a number of contemporary issues and problems in scientific archives, reflecting, for example, on some of the questions thrown up by electronic archives and the adoption of the latest information and communications technology by archivists. Important though these developments are for science archives they obviously have a much wider relevance and my discussion will inevitably touch on a number of significant concerns of the archival community in Britain at the present time and I am sure elsewhere. As I have said this morning will have something of the retrospective about it; this afternoon will engage more with the

future. Although this is not necessarily how others see us engaging with the future is one of the essential characteristics of the archival community.

First, let me begin with a few words of general introduction about the NCUACS: National Cataloguing Unit for the Archives of Contemporary Scientists.

We have a mission: to preserve and make accessible the archives of distinguished contemporary British scientists and engineers. We do this by locating and cataloguing the archives and finding permanent places of deposit for them in established archive repositories – these repositories may be national or institutional archives but are predominantly university libraries and archives – the place of deposit is usually suggested by the scientist's career. Let me emphasise at the outset the unique feature of our archives project – we are not ourselves an archive repository but a processing centre. As experts in scientific archives we serve as intermediaries between the scientist or the scientist's family who owns the archive and hands it over to us for cataloguing, and the archive repository which will look after the archive permanently and provide access to those who wish to consult it.

It may be worth mentioning now that in a British context the archives of academic scientists are private archives. In some countries the situation is very different. They are public records covered by archival legislation and that can make it harder for colleagues in those countries to understand how we work at Bath. I might also say here that for almost all my career archival legislation has had no bearing on my work in scientific archives.

Some basic figures: over 250 archives of British scientists have passed through our hands and every conceivable scientific discipline is represented in that number. The scientists are predominantly Fellows [elected members] of the Royal Society, the UK national science academy, though not exclusively so, and include 22 Nobel Laureates. These archives have been catalogued for 49 different archive repositories located throughout the UK, including university and college libraries in Oxford, Cambridge and Edinburgh and a number of scientific institutions in London including the Royal Society and the Science and Natural History Museums.

[We currently have archives of 17 scientists in progress in our offices at Bath including two Nobel Laureates, representing astronomy, biochemistry, biochemical engineering, chemical engineering, geology, mathematics, physics, physiology and virology].

Having celebrated a thirtieth anniversary last year it seems appropriate to spend some time considering our own history, the thinking and planning that led to our particular solution to the problem of scientific archives. Perhaps of especial interest is the way in which archivists, historians and scientists had to come together and learn from each other to devise a workable programme.

If we go back forty or fifty years then we must talk about neglect and a lack of interest in scientific archives – generally speaking. One can always find exceptions. Scientists had more important things to concern themselves than archives, archivists knew nothing of science or scientists – the typical archivist of the period probably had a degree in mediaeval history; and the history of science community, which of course has a natural interest in the preservation of scientific archives, was very small and its members were far more likely to be researching Galileo and Newton than the science of their own century.

Nevertheless there were detectable stirrings of interest in scientific archives and the process of concern developing into programmes of action really begins with the Royal Commission on Historical Manuscripts – we usually use the shortened form Historical Manuscripts Commission – the HMC. I should perhaps say here that everything I am going to say about the HMC applies until April 2003 when the Public Record Office and the Historical Manuscripts Commission joined forces to form the National Archives.

The HMC was established in 1869 under royal warrant as a private archives commission. It has responsibilities for enquiring about private archives, for advising owners of private archives, for publishing information for researchers – from calendars of papers to summary guides – and since the end of the Second World War it has maintained the National Register of Archives now available online. We may note here that the one thing that the HMC does not do in respect of private archives is act as an archive repository for them though it may often act as an intermediary between owners and repositories, so that we can perhaps see here at the outset that its remit for the totality of private archives bears some relation to the NCUACS's mission in the area of scientific archives. I might also note here that the HMC's original terms of reference in 1869 did mention specifically science as coming within the sphere of its responsibilities though nothing seems to have been done about this for first 90 years.

To understand how scientific archives at last became a field of activity at the HMC it is necessary to understand a little of the HMC's structure. The HMC has a professional staff headed by the Secretary (the title Secretary betrays the HMC's nineteenth-century origins, today no doubt it would be something like Chief Executive) and, in an overseeing and advisory role, a body of commissioners appointed by the Queen on the advice of her Prime Minister. The Commissioners are leading public figures – amateurs in respect of archival science – but with some competence or expertise in areas of interest to the HMC. Commissioners might be leading figures in the law, politics, they might be owners of private archives, they might be historians and so on. Only in the last couple of decades were one or two professional archivists appointed as commissioners.

We have therefore a private archives commission with science in its remit but which had not been active in the scientific field for the first 90 years of its existence.

However, in 1957 a new Secretary Roger Ellis was appointed to head the Commission's professional staff. In his early years in post he set out to examine how effective the HMC was in carrying out its responsibilities. He concluded that it was weak in its survey work, the whole range of activity that went with making enquiries and locating private archives which, in its original terms of reference, was its primary task. He further concluded that should the HMC renew its activity in the field of locating private archives then the archives of science and technology were calling for attention.

The first problem is giving any sort of priority to science and technology was that no one on the professional staff or amongst the commissioners had any relevant expertise. The solution was to seek the appointment of a new commissioner with appropriate specialist knowledge, and Roger Quirke was appointed to fulfil this role. He was a Cambridge educated scientist who, at the time of his appointment as Commissioner, was a senior civil servant in the government department responsible for science. He immediately undertook to talk to leading scientists to gauge their attitude to the preservation of the archives of science and technology.

It is interesting to note that there was a key divergence of opinion amongst those involved in this early initiative. Roger Ellis later wrote to his successor as Secretary of the HMC that Quirk discounted personal papers (saying biographers would look after them) and wished to concentrate on laboratory records. Ellis visited the Clarendon Laboratory in Oxford and the Cavendish Laboratory in Cambridge with Quirk which tended to confirm the professional archivist's view that the more interesting documentary record was likely to be found in personal papers. It is also difficult to believe that any professional archivist could accept the doctrine that personal papers were not at risk because biographers would look after them.

Nevertheless with only very limited resources at its disposal the HMC decided on an institutional approach, leaving out of the scheme for the time being scientists' personal papers. In consequence the HMC started by approaching universities on the grounds that this was where much scientific and technological work was carried out and where the actual working papers of laboratories and the teams working in them might be expected to accumulate. In 1963-1964 the Chairman of the HMC, Lord Denning, one of the great figures in English Law last century, wrote to the Vice Chancellors of all British universities describing the kinds of records in which the HMC was interested, analysed their historical importance, suggested measures of preservation and registration of archives, and asked the Vice-Chancellors what they thought of it.

The replies from the Vice-Chancellors came in over a period of months and the HMC assessed the response. There was only one actively unsympathetic reply from a Vice-Chancellor, though we should note that it was from a scientist and a Fellow of the Royal Society who wrote that under modern conditions it was inconceivable that anything of real value would remain unpublished. [Manuscripts of Galileo and Newton

were obviously important but for twentieth century scientists it was all in the published papers]. However this reply was untypical and the HMC declared its initiative to have been a success. The HMC in its own report on the initiative expressed the hope that the heads of university science departments would now know at least of the potential value for historical research of archives originating in laboratories and that University Librarians and Archivists would be ready to preserve such papers when transferred to them as worthy of preservation and make them accessible to researchers should staff be available to permit this. Nothing is said in the HMC report about how or by whom the archives were to be assessed as worthy of preservation, and University Librarians and Archivists were not slow to spot this omission.

These modest initiatives taken by the HMC suffered a serious setback with the untimely death of the specially appointed commissioner Roger Quirke in November 1964. The Secretary Roger Ellis wished to pursue the question of scientific and technological archives but was uncertain as to which direction to take or to whom he should turn for advice.

These initiatives of the late 1950s/early 1960s can be seen as something of a dead end and may indeed seem remote in time from the work of my own organisation today but certain key points had been raised of great importance for the preservation of scientific archives. First, if you are going to do scientific archives you have to talk to scientists. Secondly, we have been alerted to a potential response from the scientists: it is all in the published literature. Thirdly, if we do not accept that it is all in the published literature we have to address the question what are the important archives that should be preserved and how and who decides what is worthy of preservation. Fourthly, the key role of universities has been identified both as places where science is done and scientific archives created but also as places where they might be preserved and made accessible.

The time has come to introduce another key player in these still uncertain strivings towards a scientific archives programme – Margaret Gowing, historian and archivist of the United Kingdom Atomic Energy Authority (UKAEA) whose monograph on Britain and Atomic Energy 1939-1945 was published in 1965. In connexion with her research in atomic energy history she was responsible for establishing major institutional archives, for example at the UKAEA Harwell establishment (in the decades after World War II a principal centre of government sponsored atomic research). However, Margaret Gowing's contacts with the very many distinguished scientists and engineers involved in wartime atomic energy work had aroused her concerns about the fate of their personal archives. She has herself written that her concern dated from a visit to the home of Sir James Chadwick, the 1935 Physics Nobel Laureate for the discovery of the neutron. He had retired to North Wales and when Margaret Gowing visited him there he showed her his attic lined with filing cabinets full of papers. When she asked him what he was going to do with the papers he gloomily replied 'burn them'. They were in fact preserved.

Amongst Margaret Gowing's scientific contacts was Nicholas Kurti, an Oxford physicist who specialised in low temperatures and had been involved in wartime atomic energy work. It was Nicholas Kurti who wrote to the Executive Secretary of the Royal Society to give expression to her concerns: Mrs Gowing, Nicholas Kurti wrote, was wondering whether the Royal Society could help in ensuring the personal papers of distinguished scientists, especially those pre-eminent in their field or who have been involved in public affairs, are preserved and made accessible.

While Roger Ellis, the Secretary of the Historical Manuscripts Commission, was still considering what direction to take in respect of scientific archives he was telephoned by Margaret Gowing. She conveyed to him the message that there were Fellows of the Royal Society (most notably Nicholas Kurti) who were anxious about the preservation of Fellows' personal papers and were looking for support from the archival community. Roger Ellis, Margaret Gowing and Nicholas Kurti – Archivist, Historian and Scientist – were natural allies. Although there was some difference of opinion on how a scientific archives programme might be developed they shared the conviction that personal papers of scientists must be the priority.

The Historical Manuscripts Commission now formally approached the Royal Society to discuss the preservation of scientific and technological records, suggesting concerted action in what was obviously a common field of interest. The outcome was positive - a joint Committee of the Historical Manuscripts Commission and the Royal Society to review the position regarding scientific manuscripts of historical importance, with a view to making recommendations about them. Roger Ellis, as Secretary of the HMC was a member, Nicholas Kurti was a member from the outset and subsequently became Chairman, and although Margaret Gowing was not a member at the beginning she subsequently became one. The Committee met for the first time in July 1967 and by the time it was dissolved some eight years later it had two major achievements to its credit:

First, the compilation and publication of a locations guide to the manuscript papers of British scientists. The provision of such a guide was seen as an objective for the Joint Committee which would be an important contribution to scholarship and thus it initiated an enquiry into the locations of scientists' papers. This proved, it must be acknowledged, a long drawn out affair, the surveying took much longer than was initially expected and there were many re-definitions of scope (number of scientists to be included, cut-off date etc). However, the results of the enquiry was published in 1982 by the Historical Manuscripts Commission as *The Manuscript Papers of British Scientists 1640-1940* in the HMC's Guides to Sources for British History series.

And secondly: (which concerns me much more directly) the establishment in Oxford of a contemporary scientific archives centre in 1973, a more original undertaking interestingly accomplished more quickly.

From the outset of the Committee's work, the professional archivist Roger Ellis insisted that surveying and providing a locations guide, though a valuable activity, was not enough. There had to be a means of safeguarding papers. The scientist Nicholas Kurti, ably supported by the historian Margaret Gowing, insisted that the safeguarding of the papers of contemporary scientists, including living scientists, must have priority. Their proposal for how this might be done was set out in a paper prepared for the Committee by Margaret Gowing in 1968.

Its principal features were as follows:

First, aim to create an archive of the personal papers of Fellows of the Royal Society. By electing as Fellows the country's most distinguished scientists the Royal Society already separated the cream of British scientists and was thus by far the best starting point for an archive of scientists' personal papers. The programme could always be extended to scientists who were not Fellows of the Royal Society later.

Secondly, there was a strong case for a central main archive

(a) for the convenience of historians – they would not have to move from Oxford to Cambridge to London to see the papers of scientists whose work was interrelated

(b) for economies in archival management: the treatment of scientific archives required specialist (though not necessarily scientific) skills and the same questions about keeping document types such as laboratory notebooks or the manuscript drafts of publications would recur again and again and should be answered according to coherent and uniform principles.

Thirdly, if there was to be a central main archive of the personal papers of Fellows of the Royal Society that central main archive should be based at the Royal Society in London. The Royal Society attracted great loyalty from scientists and it seemed very likely that Fellows and their families would be very pleased to hand over papers to it. In a letter to the Executive Secretary of the Royal Society in October 1965 Nicholas Kurti made a related point that contemporary papers were often of a confidential and sensitive nature and that scientists and their families would trust the Royal Society to look after them in a responsible manner. The mechanics of an operation at the Royal Society would be very easy since those working on the project would be well able to make appropriate contact with scientists and their families at the right time. The Royal Society is informed when Fellows die, has the contact information for next of kin and appoints a scientific colleague to write a biographical memoir which the Society publishes in a series of annual volumes of biographical memoirs. Furthermore, a Royal Society contemporary archive would also complement its great historical archives dating from its foundation over 300 years earlier in 1660.

To strengthen the case for a contemporary scientific archives programme a pilot project was proposed and carried out based on the personal papers of three recently deceased Fellows of the Royal Society: [Sir John Gaddum, pharmacologist and physiologist; Sir Francis Simon, physicist; and Lawrence Wager, geologist]. The papers were collected from the scientists' widows who enthusiastically supported the project. Duplicated papers and insignificant material were rejected and the papers chosen for permanent preservation were arranged and listed in outline. The bulk of the material was measured before and after processing and an exact account was kept of staff and services required. The work was carried out by a staff member of the United Kingdom Atomic Energy Authority who had taken over some of Margaret Gowing's archival responsibilities within the organisation, and the Atomic Energy Authority allowed her the time away from her other duties to carry out the pilot project. The whole pilot project process and its conclusion was shown at a meeting of scientists, librarians and archivists at the Royal Society in June 1969. The pilot project was declared to have been a great success and the Royal Society agreed to accept for permanent preservation the personal papers of the three scientists that formed the basis of the pilot project – but only the papers of the three scientists of the pilot project. The hope that the Royal Society might serve as a central main archive for the personal papers of contemporary scientists in general was not realised.

Roger Ellis, the Secretary of the Historical Manuscripts Commission, had from the outset opposed the idea of a specialised repository for scientific archives and suggested an alternative that was very much in keeping with the HMC's traditional way of working: the use of existing archive repositories, especially at universities. However, the scientists on the joint Royal Society/Historical Manuscripts Committee were sceptical – not without reason – of the willingness and ability of university libraries and non-specialised repositories to cope with scientists' papers. In fact the solution to this problem was suggested by the Cambridge historian of science, Michael Hoskin, at the June 1969 meeting at the Royal Society held to publicise the pilot project. He suggested that instead of a central main archive for scientists' personal papers there should be a central office, staffed by archivists with experience in handling scientific materials. From this central office the archivists – for a time they were referred to in the Committee papers as visiting or itinerant archivists – would locate scientists' papers, bring them back to their office for processing and, suitably processed deposit them in existing repositories – usually at universities – where the papers would be available for scholarly research.

Here we have a very simple idea – though simple ideas still need someone to think of them and give expression to them – was seized upon with great enthusiasm by the Joint Royal Society/Historical Manuscripts Commission. By using existing archive repositories it avoided the expense associated with establishing from scratch a specialised archive repository to deal with scientists' papers. By having staff who were able to develop experience in handling scientific materials it answered the scientists' concerns about the ability of existing repositories to deal with such materials.

Efficiencies in archive management came from having the archivists processing papers in a central office. Historians would still have to wander from Oxford to Cambridge to London to see the papers of scientists whose work was interrelated. Whether this is a real hardship for them is for others to say.

There remained one fundamental consideration before operations could begin: how was this contemporary scientific archives centre to be funded. Although a processing centre was clearly very significantly less expensive to establish than a dedicated scientific archives repository, funding was still required for office and staff costs. Matters would be more complicated today because of the need for personal computers and network connexions. Thirty years ago pencils and manual typewriters were more important. As it happened the Royal Society did not feel at that time that it could fund a scientific archives centre and the delay in over three years in establishing the centre after the pilot project meeting at the Royal Society in 1969 was explained by the need for fundraising. In the end sufficient funding was raised from a number of British foundations to provide support for a three year trial period and the scientific archives centre opened for business in Oxford with just two archives staff in April 1973. One reason for an Oxford location was that office accommodation could be arranged less expensively (from the university) than in London and another was that at the beginning of 1973 Margaret Gowing took up her appointment as the University of Oxford's first Professor of the History of Science and thus would be at hand to exercise direction over the activities of the new scientific archives centre. It was on her retirement from her Oxford chair that the centre moved to the University of Bath (and adopted its present title) in 1987.

It was almost goes without saying that this three year trial period, 1973-1976, was a great success. I should not be here if it had not been. A significant number of major archives were processed across a range of disciplines: 36 in total including those of three Nobel Laureates; and these were accepted for deposit in 23 different archive repositories, principally at universities. This demonstrated conclusively that the centre provided a valuable service both for scientists and their families and for the archive repositories. At the end of the three year trial period, in recognition of its success, the Royal Society became a financial supporter and has remained so to this day. Although the Royal Society has never fully funded the work, its long term support has provided an essential element of stability to our finances. With this major commitment to its continued success from the Royal Society we can consider the scientific archives project well and truly launched.

I now intend to consider how we actually work, our continuing relationship with the Royal Society and other funding bodies, and what exactly we have achieved in the preservation of historically important scientific archives. In approaching this topic I should like to remind you of the mission statement which I gave you at the beginning of this presentation: to preserve and make accessible the archives of distinguished

contemporary British scientists and engineers; and consider that mission statement in some detail.

First, the focus is on the individual scientist or engineer not scientific organisations, laboratories, etc. As we have seen, it was clearly felt by those who created the scientific archives centre that the personal papers of scientists should be given priority as being of most interest and I would add most at risk. We take the view that institutions should be responsible for looking after their own archives, and are prepared to offer general advice and encouragement in this area if asked.

The individuals we focus on may work in a wide range of scientific and engineering disciplines but we are not interested in those working in the social sciences or the humanities. In the early years of the centre it tried to encompass a wide range of people working in medicine. However in 1979 the Wellcome Trust established at the Wellcome Library for the History of Medicine in London a Contemporary Medical Archives Centre. As a result we withdrew from large areas of medicine but retain an interest in biomedical scientists.

Our mission statement says it is British scientists we are interested in. By that we mean those whose natural or adopted nationality was British and/or made their main contribution whilst working in Britain. The political upheavals in Europe in the 1930s and 1940s brought many important scientists to Britain as refugees and safeguarding their archives has been a significant part of our work. To give just one example, Nicholas Kurti, so important in the establishing the scientific archives centre, was Hungarian by birth, made his early scientific career in Germany and came to Oxford in 1933 as a Jewish refugee. One area of difficulty is where distinguished British scientists late in their careers move to the USA to work in institutions which do not have a formal retirement age. Are we are able to repatriate their archives when they die?

Our mission statement says that we are interested in contemporary scientists. This emphasis on the contemporary has always been an essential characteristic of our work. This was defined when the centre was first established in 1973 as scientists dying from the end of the Second World War, and thus during that three year trial period, 1973-1976, great efforts were made to locate the personal archives of such scientists [i.e. those dying 1945-1973]. Unfortunately, a very great deal had been lost or destroyed and in most cases where archives had survived they were rather small. That does help to explain, however, why a small office of just two people could process as many as 36 archives in three years. Today we say simply that we focus our work on scientists and engineers, still living or, more commonly, recently deceased, and I begin my working day by looking at the obituary pages of such newspapers as *The Times*. The Royal Society also informs me when it learns of the deaths of any of its Fellows.

Our mission statement says that we are interested in distinguished scientists. The use of a word like distinguished simply conveys that there has to be a selection process. We cannot do everything. As we have seen those establishing the archives centre placed great weight on the success of scientists in the election process by which the Royal Society chooses its Fellows as an indication that their archives might be worthy of preservation. Election as a Fellow of the Royal Society is usually on the basis of distinction in research but it was also recognised that scientists, even non-Fellows, who were very much involved in public affairs might have interesting archives worthy of preservation. Since we do not have the resources to preserve the archives of all Fellows of the Royal Society and since, as archivists, we are not ourselves competent to make judgements in matters related to scientific research, we place great reliance on an advisory committee to make recommendations as to which scientists we should prioritise in the preservation of their archives. This advisory committee meets twice a year at the Royal Society in the winter and at Bath in the summer and its membership includes senior Fellows of the Society covering a wide range of disciplines. At each meeting I present to them the obituaries of leading scientists who have died in the previous six months for their consideration.

We are to preserve the archives of these distinguished contemporary British scientists. How do we go about it? First, of course, we must locate the archives and this is a very significant part of my own job. Publicity is important. We prepare twice yearly reports of our activities which we send to leading scientists as well as historians of science and our colleagues in libraries and archives. I also make frequent visits to talk to scientists and their families on an individual basis. For example, on recent visits to Cambridge I went to the Molecular Biology Laboratory to talk to the Director, I visited in her home the widow of the 1984 Medicine Nobel Laureate Cesar Milstein who came from Argentina to work in the Cambridge Molecular Biology Laboratory, I visited in her home the widow of a mathematician, a refugee from Nazi Germany who came to Britain by way of Palestine, and I met at Trinity College Sir Andrew Huxley, the 1963 Medicine Nobel Laureate and former President of the Royal Society. When I visit places like Cambridge I will call on colleagues in the University Library and in College libraries and archives. Sometimes it is they who will alert me to the existence of scientific archives that they feel we should be interested in. And of course in all this work the Royal Society is itself a great help. When I write letters to scientists I do so on headed notepaper that includes the line printed directly under the name of our organisation ‘in association with the Royal Society’. In this way the Royal Society lends us a little of its own prestige every time I write a letter. Of more practical importance perhaps is the commissioning by the Society of biographical memoirs of all its deceased Fellows. The person asked to write the memoir is usually a close colleague who probably already knows the family and, if not, will certainly need to contact them. Therefore I very often write to the memorialist to ask for help in locating archives of the deceased scientist.

With the agreement of the scientist, if living, or of the family, if not, archives are brought to our offices in Bath for cataloguing. This involves the traditional archival

tasks of sorting, arranging, listing and indexing. For many years this work remained unchanged until in the 1990s we adopted first word processing and then dedicated archival software in the preparation of our catalogues. We are by the way very much committed to supporting national and international standards in such matters as the construction of personal names and archival description. In considering the catalogues we are moving from preservation to the final stage of the process: making the archives accessible to all those who wish to consult them. It is our aim that when archives are handed over to the archive repository they are indeed ready for immediate access. So that the greater part of any archive of recent papers can be safely made available we are careful in our work to identify any sensitive or confidential papers which may need to be closed for predetermined periods, and advise the repository accordingly. I should perhaps also say that since we never act as a repository ourselves we cannot bring any archive to Bath until a permanent home for the archive has been agreed. This is rarely a problem since the repository is usually determined by the principal base of the scientist's career.

How much work we can do, how many scientific archives we can preserve and make accessible depends ultimately on funding. Part of the funding as I have explained comes from the Royal Society, and this support is essential to the continued viability of operations. Over the years, additional funding has come from discipline-based scientific societies and engineering institutions; the research councils which allocate government money to support research in the universities; British charitable trusts and foundations; the National Heritage Lottery Fund which, as its title suggests, receives its funding from the proceeds of a national lottery; and individuals and institutions that directly benefit from our work. We do not as a general rule charge archive repositories for our cataloguing services but we always expect them to meet some of our costs, for example, in respect of archival supplies such as boxes and folders and in respect of the transport of the archives. There is no doubt that fund-raising success remains vital to the effectiveness of operations and one of the ways we marked our thirtieth anniversary was by launching an appeal.

I have discussed the scientists (and engineers) that we are interested in: British, contemporary, distinguished. I have talked about how we preserve and make accessible their archives. But I have not yet considered in any detail what we mean by archives in respect of scientists and their work. And it is important. Not least because we have to tell the scientists what we mean by their archives. You may recall earlier in my talk I referred to the comment of one scientist and Fellow of the Royal Society that under modern conditions it was inconceivable that anything of real value would remain unpublished: for twentieth century scientists it was all in the published papers. To counter this type of argument we have to say what exactly are the archives of scientists that are and should be preserved. This was done in a little guide on preserving scientific source materials that we prepared in 1980 at the request of the Royal Society and which was subsequently distributed by the Society to Fellows, especially those commissioned to write biographical memoirs of their deceased colleagues. Copies of a

revised version are available directly from the NCUACS at Bath and on our website. The guide suggested that it was useful to think in terms of three broad categories of material documenting the personal, professional and public life of the scientist, and we can illustrate these categories with examples from the archives of the scientists we have catalogued over 30 years.

In starting with personal life it is important to note that for major figures we are interested in the whole man or woman and thus we may be interested in documenting life outside the laboratory or scientific community altogether. Family background and early history may be indicative of why a particular individual became a scientist and may have especial interest in the case of pioneering women scientists such as Kathleen Lonsdale, the first woman to be elected to the Fellowship of the Royal Society and Dorothy Hodgkin, Britain's only woman science Nobel Laureate. There may be special features of personal biography, for example many leading figures have overcome handicaps such as deafness, stammering, war wounds, and family difficulties. The pioneering metallurgist William Hume-Rothery accomplished his higher education and all his subsequent scientific career under the handicap of total deafness. This required his colleagues to communicate with him in writing, and some of these conversation notes are preserved in his archives. Scientists may have special skills and interests that are documented in their archives. These have included in our experience chess, music, poetry and fiction. The geologist Lawrence Wager took up mountaineering as a student at Cambridge in the 1920s and was a member of the 1933 Mount Everest expedition, chosen to lead the final assault on the summit. The Oxford physical chemist Harold Thompson gave devoted service to football throughout his life from amateur player in his youth to Chairman of the Football Association, the body that runs the game in England, 1976-1981. [Papers relating to the appointment of the England team coach have passed through our hands]. Beliefs such as religion, politics and pacifism may also be important. Indeed, judging from their archives, religion holds a perennial fascination for scientists. For some this represented a lifetime of experience and underpinned a great deal of their thought and action while others more sceptically inclined felt nevertheless obliged to engage with questions of science and religious belief. A number of scientists have found time for political activity and we have catalogued the archives of scientists who acted as advisers to political parties of the Left and Right. Kathleen Lonsdale's religious beliefs led her to pacifism and during the Second World War she was imprisoned for a short period for refusing to register for civil defence duties. All this of course documented in the archives we have catalogued.

Family and personal correspondence may be of great interest in its own right. An exceptionally important example is the correspondence of J.J. Thomson, the 1906 Physics Nobel Laureate and discoverer of the electron. This documents extended family and social connexions from the 1870s to the 1940s. Family and personal correspondence may also be crucial in filling gaps in the absence of surviving records of professional career. In the case of Nevill Mott, the 1977 Physics Nobel Laureate, the

first half of his career up to his becoming Cavendish Professor of Physics at Cambridge is documented entirely by his correspondence with his parents. This correspondence survives from his last years at school and continues for more than thirty years and includes his student years in Cambridge, periods of research in Copenhagen and Göttingen and early academic career at the Universities of Manchester and Bristol.

Turning to professional life we come to the heart of the matter: the contribution to science and the scientific community whether as learner, teacher, researcher, director of an institute or department, writer, editor, lecturer, conference organiser or speaker, member of a learned society or international scientific organisation. These activities may be documented by a great range of material including correspondence of all kinds and can only be dealt with very selectively here.

Beginnings always have interest, and personal education and training in science may be documented by notes of lectures by other scientists, perhaps university courses by distinguished scientists or those who were particularly influential on professional formation and career development. Records here may have a range of potential interests: for example, the development of the scientist whose records they are, the influence through teaching and supervision of distinguished predecessors, and the state of a particular discipline or science in general at the time. Many archives of scientists contain material of this kind and certain disciplines such as physics and major institutions such as the Cavendish Laboratory in Cambridge are particularly well represented in the archives we have processed. However, the most complete record of personal formation is to be found in the archives of John Kendrew, the 1962 Chemistry Nobel Laureate, where there are extensive and systematic records of his wide-ranging science education at Clifton College school, Bristol and Cambridge University. These records amount to some 9000 manuscript pages of notes, not counting notebooks and essays. The topics are scrupulously indexed, there are very full notes of lecture courses and the lecturers are carefully identified and include most of the leading figures in Cambridge science immediately before and after the Second World War and some visiting lecturers. Apart from presenting important insights into Kendrew's character and scientific education the total sequence provides an exceptionally comprehensive picture of the education at a well-run school science department and a major 'science' university.

Research interests may be documented by research notes, laboratory notebooks, diaries, expedition journals, field notebooks, technical drawings and photographs. For many experimentalists the laboratory notebook has been the key recordkeeping tool, and there are many good examples in the archives we have processed. The archives of the Cambridge biochemist and historian of Chinese science Joseph Needham contain a complete sequence of his research notebooks, 1921-1943 which are particularly striking for the high quality of information they present. The notebooks usually identify the nature of the experiment and its date and often have annotations on

why results of particular experiments were not as expected, what might have gone wrong and how this might be remedied. The research notebooks of Rodney Porter, the 1972 Medicine Nobel Laureate, cover almost half a century, 1936-1985 and continue to within a couple of days of his death. They provide not only a record of experiments and observations but a direct insight into Porter's methods of work and especially his tenacity over long periods of trial and disappointment. The way a scientist keeps records of research may change over time. For the biochemist Hans Krebs, the 1953 Medicine Nobel Laureate, there is a full record of his contribution to metabolic research over an exceptionally long period, 1926-1981. This record takes various forms. Traditional laboratory notebooks were used for crucial early work on the citric acid cycle for which he was awarded the Nobel Prize. For later research there are binders of dated and indexed notes and loose pages. These may include data and experimental results, records of discussions and information, reflections on work in hand or projected, drafts for publications, correspondence, extensive bibliographical references and background material usually annotated. As is often the case in the archive of a principal scientist there is a strong presence of long-term collaborators in the form of notes and results.

Research records can present considerable challenges for archivists without a scientific background and only very rarely is the creator of the records available to advise. One of the most challenging cases was the research records of Robert Robinson, the 1947 Chemistry Nobel Laureate. This was because of the haphazard nature of the surviving documentation and the difficulty of interpreting it. There was a mass of loose jottings of ideas and chemical structures without dates or references. Nevertheless, despite the difficulty, such was Robert Robinson's eminence as a chemist, that every effort had to be made to assign this unpromising material to some identified field of study or period of time. This illustrates the importance on occasions of having the right scientific advice, and in the case of Robert Robinson we were fortunate in being able to call on John Cornforth, himself a Nobel Laureate (Chemistry 1975), who was able to bring his own expertise and long association with Robert Robinson to bear on even the most unpromising scraps of paper. One of the most interesting items was a sequence of ideas on the possible structure of strychnine, tentatively dated to 1945-1947 by John Cornforth who described it 'as the nearest you will get to Robert [Robinson] thinking'.

British scientists have made many important contributions to international scientific organisations and this is well documented. In the archives we have processed there are records relating to the formation of the International Union of Biochemistry and records of the activities of the International Union of Crystallography over many decades. The commitment of some scientists to international activity is exceptional and the Oxford physical chemist Harold Thompson who I have already mentioned in connexion with football is a very good example. He was Foreign Secretary of the Royal Society, 1965-1971 and there is extensive documentation of the

great services he performed in expanding the Society's international activities during his period of office. Other international activities documented include: the inception and organisation of the European chemical (EUCHEM) conferences which Thompson first proposed in 1963 during his period of office as Chairman of the British National Committee for Chemistry; his association with the International Union of Pure and Applied Chemistry (IUPAC through the 1950s and 1960s in respect of spectroscopy commissions and, subsequently, as member of the Executive Committee, Vice-President and President; and his association with the International Council on Scientific Unions (ICSU), serving as President, 1963-1966.

A focus on the scientist's public life reminds us that scientific research cannot be isolated from the wider community, a factor that is of particular importance in the history of twentieth-century science. Examples of the scientist's public role might be service on government advisory boards, research councils and university committees; service to international organisations and developing countries; advice to industrial or commercial concerns; and the whole gamut of activities associated with the public understanding of science, which might entail anything from an appearance at a major national event such as the annual conference of the British Association for the Advancement of Science to a talk to pupils at a local school. It is often very interesting to see from their archives just how much time leading scientists, including Nobel Laureates, are prepared to devote to such activities. A characteristic and well-documented British example might be the chemist Frederick Dainton whose public role developed in the 1960s. He advised government on a number of important science policy issues preparing reports on the planning and organisation of government-funded science and what was colloquially called the 'Swing away from science', the preference of increasing numbers of school pupils in the 1960s for university study and careers in the arts and social sciences. Perhaps less obviously for a scientist Frederick Dainton was asked by government to chair the National Libraries Committee. The recommendations of this committee led to the creation of the British Library whose governing body he chaired, 1978-1985. Furthermore in 1986 he was appointed to the House of Lords as Lord Dainton and made major contributions to the work of the House of Lords Science and Technology Committee, chairing three influential subcommittees on academic research careers, systematic biology research and forensic science and speaking in debates on higher education, medical research and the National Health Service. All of this is extensively documented in his personal archives.

As I suggested earlier I really want to leave matters relating to the electronic environment of the present day to this afternoon. However, I should conclude by saying that there is an enormous amount of information about our work available on the internet on our own website and elsewhere; and this includes six monthly reports on current activities, the guide we prepared to explain to scientists and their families what

are the scientific archives that should be preserved and the full texts of very many of our catalogues.

It is clear that looking back over 30 years we have more than fulfilled the expectations of those who had the foresight to realise the importance of preserving and making accessible the archives of contemporary science. The processing centre model has earned the respect of scientists and their families and the archival colleagues who administer the processed archives for posterity. A great archival treasure trove has been made available for historians and others to explore for many years to come. But their challenges for the future which will be another of my topics for this afternoon.