Preserving the memory of chemistry

Ever since I left Oxford University with a DPhil in physical chemistry under my belt, my career has, in some way or other, been involved in preserving the history of chemistry. In terms of printed books and archives in libraries, these have been reasonably well cared-for. For example, the IUPAC archive itself is carefully preserved in the institution of which I am now President, the Science History Institute in Philadelphia. But in terms of objects, the scene looks much thinner and patchy.

The material culture of chemistry is a difficult subject to deal with for two main reasons. Earlier objects themselves do not excite visually in the same way that instruments and apparatus from other disciplines do, and do not tend to be preserved to the same extent [1]. Microscopes, telescopes, orreries and astrolabes are innately photogenic: the brass shines and the carved ivory is intriguing. Test tubes, flasks and distillation apparatus are less visually attractive. It is likely that for this reason that the survival rate of chemical objects is much poorer than in the optical and mechanical categories which I have just mentioned. Glass test tubes are expendable because they are cheap and readily replaceable, and the historical evidence that can be extracted from them is usually much less. Secondly, there is the issue of understanding. Many members of the public are well aware of what a microscope or telescope does. Chemical objects are more arcane and difficult to fathom. It is true that the division between chemistry and other physical sciences converges as one approaches the present day when the black box syndrome hides the working parts of all types of instrument and makes them a challenge to display. As an example, one of the most important instrumental developments for chemistry of the post-Second World War years was the Beckman DU series of spectrophotometers, which made a major impact on the study of chemical and biological substances. Approximately 30,000 of these instruments were made between 1941 and 1976 and there is no denying their significance in research (*figure 1*). Yet the inner workings are surrounded by the archetypical metal black box which conceals how they function. Persuading the lay-public of their mode of operation and importance is extraordinarily difficult, and very few science museums even attempt it.

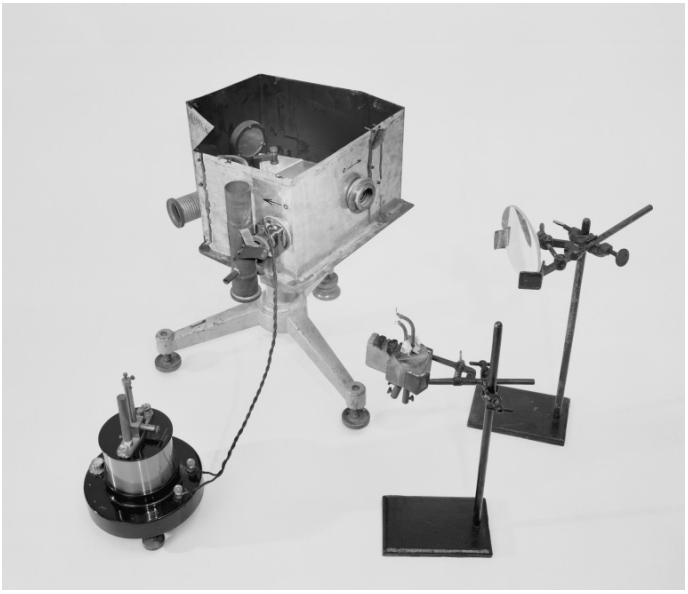

Figure 1 - Infra-red spectrometer created by Sir Harold Thompson in the 1930s at the University of Oxford. Collection of the Science Museum, London.

However, there can be no doubt of the importance of preserving the material culture of chemistry, which impinges on so many aspects of contemporary life. In their day-to-day work, chemists draw constantly on the findings of their predecessors, while museum specialists need to seek out collections in the major science museums to tell stories. Even if their displays are attenuated, the significance of chemical artefacts has been accepted by the Conservatoire National des Arts et Métiers in Paris (whose most-prized chemical objects must surely be the 18th century instruments of Antoine Laurent Lavoisier), the Deutsches Museum in Munich, and the Science Museum in London. These three are highlighted because they contain largely historical material, antiquities of the nature of which might be found in other types of history museums. There are plenty of science centres around the world which demonstrate scientific principles, but the devices which they contain are largely made to order and have not been used by practicing scientists in the normal sense of the word.

Apart from the large national science museums which have been mentioned and which contain chemical material, there are a number of what might be called "boutique" science museums which make no claims to be comprehensive but which contain associational instruments (including chemical ones) and apparatus. Examples which might be mentioned are the Teyler Museum and the Boerhaave Museum in Haarlem and Leiden in the Netherlands, the Royal Institution in London (with rich collections pertaining to Humphry Davy and Michael Faraday), the National Museum of Scotland (for Joseph Black's teaching apparatus) and the Collection of Historical Instruments at Harvard University in the USA.

But these institutions contain few instruments dating from the latter part of the 20th century onwards, a period when instruments proliferate and can become very large and anonymous. That area has been best dealt with by the Science History Institute, which has made special efforts to preserve chemical instruments, either prototypes or examples which are widespread, and which have made a major impact on chemical practices. To fulfil this purpose, a committee was established of scientists who had personal experience of working in fields such mass spectroscopy, X-ray diffraction or chromatography. Fifty key objects (an arbitrary number) were identified and searched for. The collection now contains nearly all of these, and several are displayed at 315 Chestnut Street, Philadelphia.

When I was working at the Science Museum in the mid-1970s, I was anxious to acquire objects which I knew were in danger of being discarded. One of the desirable acquisitions

Figure 2 - Spectrophotometer in the DU range designed and manufactured by Beckman Instruments, 1940s. An early example of the "black box". Collection of the National Museum of American History, Smithsonian Institution, Washington DC.

I identified was the first infra-red spectrometer constructed pre-Second World War by the man who was my tutor at St John's College (Oxford), Sir Harold Warris Thompson (who, incidentally, became President of IUPAC). It was a very difficult task to wrest it from him: scientists can become quite sentimental about the instruments they work with. Eventually he called me on the telephone and agreed to part with it, but only if I came immediately to the headquarters of the Football Association (of which he was President) in Bayswater, and I walked across Kensington Gardens with the precious instrument in a cardboard box back to the Science Museum (*figure 2*).

Printed books on chemical subjects would seem to be safely preserved by many libraries, but there is no cause for complacency. Many libraries are freely disposing of printed monographs and journals, assuming that present and future generations will prefer to work with electronic images. If this is done without care, historical evidence might well be lost. Many chemistry books are annotated in some way or other. Early annotations may be prized by historians, and association copies, including those with bookplates can be of very great interest. Just because the notes or doodles of users of such books are of recent origin doesn't mean to say that in future years these may be recognized as forming vital evidence, especially when annotations are by the authors of the books themselves. An area which is often ignored is printed, non-book material. Such might include instrument manuals, commercial promotional leaflets and advertisements, conference programmes, lecture syllabuses, examination papers, scientific dealers' catalogues and so on, which when taken into account, provide a more rounded picture of the total chemical enterprise. These materials are not much-loved by librarians as they are difficult to catalogue and to store. In the case of dealers' catalogues, I did a survey of those surviving in major libraries [2]. They were not very common; about half of them were available only as a single copy. These kinds of publications are often difficult to collect, as they are considered ephemeral, and they are so easily disposed of as they are not often registered in the way books are because they lack ISBNs.

Another vitally important area for preservation are photographs. These can be individual portraits (useful for publications, though images of youthful chemists in their creative prime are difficult to find), group photographs (early 20th century ones of major conferences frequently seem to include the easily recognizable Albert Einstein) and laboratories (rarer than one might think). It is important when receiving photographs to annotate them quickly whilst the donor is still able to identify and date them. There are rather few paintings of chemical interest as few were commissioned and artists would be unlikely to be confident of future speculative sales. However, there is a significant genre of paintings which depict early chemists and alchemists in their places of operation, often by 17th and 18th century Netherlandish artists. The Science History Institute has a collection of about ninety of these. There are often very attractive woodcuts of chemical processes in textbooks of the 16th to 18th centuries but they have to be treated with caution as they may be symbolic rather than representative of real life.

Which brings us to archives and manuscripts. It is this category which is probably of greatest value to the historian, as the development of ideas can often be traced in handwritten or typed pages.in a way not possible in polished, final accounts in periodicals and books. The choice of what to collect is a fine art in itself. It must always be remembered that historical collections are not being compiled by libraries and museums simply for the present. One has to ask, what is going to be of interest in, say, twenty or fifty years? There has been a tendency to collect the works, unsurprisingly, of men and women currently recognized as being great. It must be remembered that reputations can change, and that the great scientist, as an individual, is only part of the process of conducting science. I have long argued for the papers of a few key laboratory technicians to be collected. One of the most significant of the laboratory support services is supplied by glassblowers, but where would one find evidence of how they think? Some nations have attempted to collect scientific archives systematically: The United Kingdom is one such place which developed a scheme of straightforward, simple indexing of papers for scientists who had just retired or died, these papers then being offered to appropriate libraries.

It must not be thought that the history of chemistry touches only historians: one does not have to be an historian to be an historian of science. I would claim that all scientists are necessarily historians in so far as they refer constantly to what has been written about in the past. It was Isaac Newton himself who captured that thought when he wrote in a letter of 1676 to Robert Hooke: "*If I have seen a little further it is by standing on the shoulders of Giants*" [3]. These words, I believe, are quite as pertinent today as they were in the 17th century.

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[1] Anderson R.G.W., Where has all the chemistry gone?, *Mitteilungen der Gesellschaft Deutscher Chemiker*, **2017**, *25*, p. 329.
[2] Anderson R.G.W., Burnett J., Gee B., *Handlist of Scientific Instrument Makers' Trade-Catalogues 1600-1914*, National Museums of Scotland, **1990**.
[3] Merton R.K., *On the Shoulders of Giants: A Shandian Postscript*, Free Press, New York, **1965**.

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