# Building for the future

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*Synopsis*

This reflective article discusses the importance of the University's scientific instrument collection and some of the criteria for including objects in the collection. It ends with a recommendation for a development of University policy.

*Introduction*

A museum curator needs a sense of the future. Which objects will posterity value? What aspects of today's and yesterday's civilisation will be seen as the foundations upon which future knowledge, culture and society are based? In short, how did we get from there to here? It is immensely frustrating for humanity that we don't know in detail how we have got from arboreal ancestor to walking, talking, space-exploring, molecule manipulating mankind. Centuries of exploring the fossil record, interpreting chance archaeological survivals and, more recently, unravelling the genetic code have barely begun to provide the answers. From now on, though, it's all different. We can select what we think will illuminate the human story for our descendants.

*Science & Instruments*

No-one can doubt that science and technology will shape even more of our lives in future. Scientific knowledge not only influences daily lives, it influences what many people do with their lives and how we see ourselves in relation to our environment, on all scales up to the universe as a whole. There is no bigger story than mankind's progress from ignorance to insight. Scientific truth rests on the pillars of observation, experiment and interpretation. The story of how mankind has journeyed from ignorance to insight in relation to the natural world is in a large part told by the history of scientific instruments and their applications. A collection of scientific apparatus such as ours has fundamental relevance to us all. What makes it even more important is that such collections are quite rare: rare judged against art and archeological collections, rare judged in absolute numbers around the world. It is fitting that our own collection should be in an institution dedicated to discovering and disseminating knowledge and it is no co-incidence that we have been 'in the business' for over 500 years.

It is a mistake to underestimate the importance of our instrument collection. Preserving both the evidence and the story of the world's scientific heritage has in the past often relied on chance. The scope of science and the importance of science in changing the way the world works is too important to leave the process to chance. Institutions that are close to the top of the international tables in scientific research, such as the University of Cambridge and MIT, are rising to the challenge of deciding what modern instruments and evidence of science practice to preserve. No-one, though, will create a world scientific instrument museum. Preserving scientific heritage will in future become a co-ordinated international project. As one of Britain's ancient Universities it is fitting that we should be part of such a project with a distinctive collection that reflects local, national and international participation in science. If

we are to be a respected member of what I believe will be an elite collection of international universities, then we need to value the heritage we have.

Without wishing to talk down the importance of other subjects, it is worth emphasising that Physics and its precursor Natural Philosophy has a special place in science, if not in the arts too. Until the middle of the nineteenth century, every Arts graduate (there were no science degrees then) of this University whether destined for a career as lawyer, teacher, minister of the church or government administrator spent much of one year studying natural philosophy. When the science syllabus came along, until the 1990s Natural Philosophy (re-named Physics here in 1986) was one of the three core subjects in the science syllabus, one of which all science graduates from this University had to study. Today, there is hardly a science or medical speciality in which physical instrumentation isn't important. Indeed, physical instruments are far too important to be left as the preserve of physicists. The point is a serious one, for the audience that the collection is aiming to address is far wider than an audience of physicists. Few factors are more important in determining the nature of a collection than its intended audience.

The breadth of subjects under the umbrella of Natural Philosophy is huge. On reflection, 'umbrella' is a poor image: 'tent', 'marquee' or 'pavilion' is a better one. Traditional divisions include mechanics, dynamics, properties of matter, heat, light and optics, sound, hydrostatics and hydraulics, electricity and magnetism, and astronomy. Large but more specific areas include microscopy, navigation and surveying, meteorology, spectroscopy and thermodynamics, augmented by more 'modern' subjects such as, nuclear physics, medical physics, X-rays, lasers, communication, electrical measurements, electronics, computing, metrology and crystallography. Our collection includes instruments used in all these disciplines, along with some items from specialist fields that also have been a part of university research. Seismology and radio-astronomy come to mind as examples. Every one of these fields has impacted public life in one way or another. All three Colleges in our University, broadly covering Medicine, Science and Engineering, the Arts and Social Sciences, will have no difficulty in finding areas of relevance within the collection and, indeed, specific items of interest. This pan-University relevance needs to be spelt out because the traditional division of academic subjects associates physics with a highly specialized minority pursuit. Some cutting-edge physics may still be thought of in these terms but the instruments in the collection illustrate the basic principles of science that have spread right though western style society. When looking at the breadth of the collection I am reminded of the comparable breadth of the Scottish Enlightenment.

*Accession criteria*

If one is setting up a railway museum, one doesn't just collect locomotives. What shows people how the system works is a collection representing all aspects of the experience, from the framed picture in the panelled carriage, though the buffet car crockery to the signing and signalling systems that underpin the timetable of services. Indeed, it is often the small items that engage people more than technically important but hidden developments like vacuum operated brakes. Likewise with scientific instruments, in that their context needs to be retained to make the bigger picture clear.

This brings me to a key point of this short piece. What should be added to our collection in future? What will posterity expect to find? I used to say that like other collections and museums, we have preserved the chance survivals of the historic record. On reflection this is not really true. The survivals haven't really been the products of chance: the have been

significant items that past staff, both academic and technical, have thought worth keeping, though often past their 'use by' date. There have been enough to illuminate many aspects of past science for today's audience. We are not starting from scratch and it is these objects that have largely defined the shape and remit of our collection. One central guiding principle is '*continuity*'. It is almost trite to say it but science has continued from past to future with no breaks and few sideways steps; the business of our university has likewise evolved continuously. Our collection is intended to represent the evolution of physical science as seen through the filter of activity at the University of Aberdeen, activity covering the research and teaching of staff and the learning of students. Because the University has a profile that is local, national and international, the story of its physical scientific instruments is a story with relevance to the development and practice of science on all these stages.

Continuity has another implication. More recent equipment is given meaning by being part of a continuing story. If our University didn't have a collection that spanned two centuries prior to the mid 20$^{th}$ century, it would not be a sensible policy to suddenly start keeping equipment of the 1950s and 1960s in a store (unless there were some alternative powerful motivation). However, such equipment forms part of the continuing story and in that context it is not sensible to dispose of historically relevant equipment that is given added value by prior holdings and also, in return, makes the connection between recent science and older activity. In short, continuity adds significant value to modern items.

In deciding what to accept into the collection, two of the most important issues are *context* and potential *information content*. Objects that are put on display are primarily assessed by their appearance. Yet if appearance was everything, the world's art galleries could replace their expensive masterpieces with copies that the general public could not tell apart, at a fraction of the cost. Collectors and the public want to see original artefacts, objects that were created by the masters and designers of the past, used for the historic purposes that make them significant by the people who made our history. That is one aspect of *context*. Objects in the instrument collection should have context in the evolution of science and its impact on society and in the activities of the University. On reflection, although the collection is full of objects that are fascinating to look at, for most objects context is of greater significance than appearance. The problem with context is that it is supplied by evidence brought to the table from sources other than any one particular object under scrutiny.

'Context' also works the other way around. What added value does an object bring to existing documentation and reference material found elsewhere in the University? There is no doubt that the co-location within the University of relevant objects, contextual documentation and wide academic knowledge facilitates interdisciplinary studies. Add to that internal research facilities with the capability of physical and chemical investigation and the University provides a better package for the holding of instruments of science than almost any other organisation. Indeed the preservation of scientific heritage can scarcely be done better than in a University museum, which is within an institution that contributes directly to that heritage or to teaching its practitioners and spreading its results.

Information content is clearly a function of both the condition of an object and its rarity. More importantly, however, objects contain a large amount of untapped information: examination of how the objects work and how accurately they work can provide insight into the science of the day well beyond that conveyed in written texts; physical and chemical analysis of the materials they are made of can reveal details of the trade and technology of the times, providing evidence of regional economic activity for example; methods of construction illuminate the technology of the era and how artisans worked their trades, even sometimes telling us who made

individual pieces; analysis of wear can illuminate usage of objects or weaknesses or defects in design; biological residue may even yield DNA of owners or makers. Almost none of this information can be gleaned simply from the appearance of items or from a well-made copy. Original items have an information content that is much greater than meets the eye. The problem with information content is that one's perception of it depends on known techniques for recovering the information. In the past few decades, physical and chemical techniques like isotopic analysis, X-ray fluorescence and related spectral analysis, and DNA profiling to cite just a few developments, have become available that have hugely increased our ability to extract information from artefacts, turning objects previously thought to have little value into interesting historical evidence.

Original objects, then, have a value in many senses of the word that copies do not have. High on the list of accession criteria is also the question of "*whose attention is the object likely to gain*?" The potential audience covers a very wide range of interests. For example, within academia there are general historians of science, specific instrument historians, a wide range of interdisciplinary academics and students from medicine through the arts to the physical sciences; there are those interested in education and its history, including both secondary and primary level teachers and their pupils, there are university visitors, members of the public both general and those associated with special interest groups, both technical and cultural. Each of these categories itself includes many different interests. Several years ago I might have assessed the interest of an object only in terms of the science it represented yet it is clear from people's response to displays that the object as art or the object as cultural history engages many people, often providing a way into a science that they had previously felt excluded from. I'll add that academics are often motivated by the 'big picture' – the overarching ideas in their subject and long-term trends in concepts and their relationships. The public tend have more of an eye for detail. This is an important point. In a University it is usually academics who decide what to keep. They need to remember that their perspective is but a modest part of the story.

In no special order, as the phrase goes: *continuity, context, content* and *appeal* seem to me the basis of accession decisions on items that make it to the front door of the collecting house.

*Impact*

This is perhaps the best place to note that the potential impact of the collection is substantial, wide and readily tapped. I've put into an appendix a list of some areas where the collection can contribute. I seem to recall that in the University's submission for national recognition the collection was badged as a cultural history asset, well capable of attracting interest and support for both public and academic engagement. To my knowledge, we have not yet explored any aspect of this with the AHRC or more widely with EU partners. For better or for worse the concept of 'economic and social impact' has risen to the top of research agendas. Widening people's interest in or acceptance of science through an appreciation of its cultural history would seem to me to have a clear social impact and, perhaps indirectly, an economic impact. With the advent of the digital information age, I have always considered that the collection forms the master copies of artefacts with enormous digital prospects, whether showing 3D form, interior construction, mode of operation, cooperative use of related apparatus, links to manuscript and textual information, or as sources of the kind of hidden information alluded to earlier. Google may effectively put the contents of much of the University library holdings on the web in due course but they won't be able to do the same with the contents of our instrument collection, for most of the items we have are more individual than copies of a book.

*Beyond a conventional accessions policy*

There is an archival tradition, or there certainly used to be, that archivists don't tout for business. The archivist decided what to acquire based upon what was offered or what appeared on the market. Given that one can't keep everything then a policy of random selection is a valid procedure, allowing external influences to make the choice, or most of it, for one. Most museums traditionally worked on the same principle. It's not, however, a procedure that people employ when running their own lives. One doesn't furnish one's house with a random selection of items from a furniture warehouse, or eat a random selection of food from the supermarket shelves. People make a much better job of their lives than that. Collections representing the heritage of science should be aiming to do much better too.

In the scientific instrument context, the most obvious missing participants in deciding what should be kept for the future are the scientists themselves, researchers and teachers (who often have a longer perspective on the subject), who have used the equipment or at least are knowledgeable about it. There is no cradle-to-grave policy in science for the instruments that science uses to make its discoveries. In my experience the issue of heritage scarcely enters most researchers' thoughts and is not addressed by Research Councils and other funding bodies. By default the ownership of sponsored equipment purchased by University research groups usually passes to the University, who notionally inherit the responsibility for what to do with it. In practice they inherit no plan, no accompanying resource, no assessment of its significance and no advice. If we are to build a better scientific heritage, we need to do better.

Changing people's ideas and practices will take years. Since the University inherits both the problem and the opportunities, then Universities have to take some initiative to include the scientific community as important participants in its heritage plan. With planned acquisition for heritage purposes, a range of new possibilities arise using modern technology. For example, a short video can be made of equipment in use (before it is passed to the collection!), interviews given describing the associated research work and what it is intended to achieve, a few photos taken of the equipment *in situ*, copies of selected pages from lab notebooks can be saved along with the equipment, and accompanying manuals saved that at the moment are often separated from equipment at delivery and never re-united. An elaborate production is not needed. An hour or two thoughtfully spent, less for small objects, would add very considerable value to the context and operation of equipment worth keeping. All the ancillary material could be kept digitally, involving no increase in equipment storage space, and referenced through the object database information retrieval system.

Some equipment may be used for a decade after its initial purchase so the issue is more complicated than simply deciding what to do with apparatus when the grant expires. Moreover, researchers who have little interest in heritage may not wish to engage, particularly when first offered the opportunity. Many researchers, though, have taken onboard during the past decade the necessity to promote public engagement with their work. Considering whether one's equipment should make a significant contribution to our scientific heritage is an extension of this activity.

Finally, the suggestion above is not intended to imply that the collection should address only research equipment in future. It already has a strong teaching and learning profile and experience has shown that the teaching and learning artefacts attract more attention than research equipment. What is certainly true, though, is that with the substantial reduction in teaching by demonstration, new science and new applications are more likely to be seen in the

University in a research context in future, possibly filtering into undergraduate laboratories in due course. Bringing the research community on board is a timely development.

One example of co-operation between the museum sector and modern science is provided by the rolling agreement between the Royal Observatory Edinburgh and the National Museums of Scotland. The ROE's remit is modern research, the Museum's is conservation, display, storage and the provision of historic context. Objects seen to be of historic interest, as assessed by either ROE staff or curatorial staff, are offered to the National Museum at the end of their working life. At least they are on paper, but there are a number of past examples, where historic equipment has been 'lost' or dismantled for parts, that illustrate very well that an agreement on paper is only part of the framework required to preserve heritage. The research partners need to 'buy into' the arrangement at a personnel level and recognise that their actions are an integral part of the process. Everyone gains when the system works properly.

*Conclusion*

This piece began as a statement of issues that the curator felt it was appropriate to pause and reflect on. It has ended with a recommendation that the University put in place a policy that does not exist at present, a policy that should be part of a coherent plan for the science collections as a whole. Strategic decisions must come first. Implementation will involve considerable discussion.

*JSR*
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**Appendix**

*What can the collections do for us*?

This topic is in many ways a different slant on the question of whose attention is an object likely to get, adding some more detail to this issue. The University prides itself on the broad learning environment it develops, not only across undergraduate courses but covering its expanding rôle in encouraging children to take an interest in subjects promoted by the University and in being part of society's drive to increase life-long learning opportunities.

We are accustomed to the traditional learning media of books and manuscripts and, nowadays, of material presented on computer screens. Museum objects represent a powerful third way that comparatively few Universities have the resources to exploit over the range of areas we can at Aberdeen. They are a way that blends with presentation through published material and computer screen but adds a third dimensional experience. Objects themselves provide a reality worth a thousand pictures.

The instrument collection is not only a historical record in the physical sciences but is a collection of reference material that forms the basis for substantial future research projects in conjunction with related collections world-wide.

The potential function and rôle of objects in our collections include:

- *helping the University*
    - project its purpose, ethos and values

  - engage the implicit interest of visitors in artefacts that are unusual and significant
  - publicise its history and its cultural and scientific connections
  - broaden its knowledge base and resources to enhance our international collaborative research
  - add value to the university's world-wide standing and to its appeals for charitable support

- *helping students and the public*
  - engage with the work of the University
  - engage with the scientific and medical process
  - see objects not only from the viewpoint of their defining purpose but also as works of creation and art
  - unravel the layers of interest implicit in real objects
  - appreciate through succinct evidence the effects of the passage of time and evolution in society
- *illuminating*
  - the history of science and the evolution of scientific ideas and concepts
  - the development of technologically based techniques and artefacts (e.g. telegraphy, radio, electronics, X-rays, etc.)
  - the changing impact of science in society and of society on science
  - issues relating to manufacture, trade and the industry of scientific instrument production
  - the changing use of materials and design in science
  - the evolution of particular devices (e.g. microscopes, calculating and computing machines, electrical measuring instruments)
  - the exploitation of natural phenomena for the benefit of mankind
  - the history of sub-disciplines (e.g. geology, meteorology, astronomy, crystallography, etc.)
- *acting as*
  - the reference material for virtual images and other educational developments that are based directly on our objects
  - the source of new course-work related material both undergraduate and post-graduate
  - reference material for academic research in all the disciplines touched on by the collection
  - ambassadorial material representing the University in special exhibitions and events.

This list is long enough but it isn't intended to be exhaustive.