

**The University of Aberdeen Natural Philosophy
Collection of Historical Scientific Instruments**

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18th century equatorial telescope for stellar mapping from the first semi-public observatory in Scotland erected in 1782 at Aberdeen. The telescope was originally made by Jonathan Sisson but the scales were re-divided by Jesse Ramsden for the observatory.

Until as recently as the mid 1980s, graduates in the old Scottish Universities would have obtained their degrees in ‘Natural Philosophy’ and not in ‘Physics’. I did. What we have in our collection is apparatus used in University teaching and research over some 250 years, from the mid-eighteenth century until almost the present day.

What have we got? The outsider might imagine that academics in a university that’s more than 500 years old have been carefully accumulating for centuries a historical archive of significant objects, the sacred relics of the learning trade. Not a bit of it! Frankly, it is only over the last 30 years that we have realised the value of what we have in a national and international context. The bulk of the collection is a result of North-East frugality, never throwing away what might be useful; of comparative penury, not being able to replace equipment at a whim; and a North-East eye for quality, making sure we bought the best that was affordable at the time so that it would last the longest. Only the modern items have been added to the collection in an organised and rational way. The rest is historical accident, survival of the good, the interesting and the lucky pieces. Not much different from any other museum collection then! That said, the realisation that we have a stunning collection of scientific equipment spanning two and a half centuries has come just in time. The

combination of good fortune and our history in the UK of being close to centre-stage in the world of science has meant we have a collection of international value.

When I first looked at what we had in our stores and laboratories I found items made in the 1850s still in use, not because we were behind the times but because they still worked well. Lecturers weren't aware of the pedigree of some of what they used (me included) and were unaware that some items had acquired a considerable historical value. These working pieces are now part of the collection. As honorary curator of over 2000 instruments and devices, I have tried to put the items we have in their historical context, finding the story behind many pieces. I've also tried to conserve items from the late 20th century as they become obsolete, so that our collection represents not simply science past but science continuing into the present. It is highly desirable when filling a display case to link historical artefacts with those that the audience might recognise, to show the relevance of the earlier pieces and perhaps some of the evolutionary path to today's technology.



Frictionless wheels, or the next best thing prior to air bearings, from the top of an Atwood's machine made in the later 18th century by Patrick Copland.

I'm probably preaching to the converted here in saying that apparatus that demonstrated clearly the principles of mechanics, electrostatics or optics two hundred years ago still demonstrates clearly those principles today. The old equipment with its polished brass, varnished wood and slightly irregular glass may look old but it actually works as well as today's version in die-cast metal and plastic. In some respects the old equipment is better. It can be elegant, artistic and it never tries to do two things at once. 'Multifunctionality' is a 20th century development – useful at times but how many owners can work all the functions on their video recorder or even their graphics calculator?

Collections of scientific instruments are pretty rare – anywhere in the world. At Aberdeen we have one of the best collections in Britain. The equipment has been used by the famous and the worthy, and the not so famous researchers, teachers and students who have been through the university for the past two-and-a-half centuries. The scientific instrument trade has been an international one, more or less from the beginning. Our collection shows not just what science was being done in the North-East over the past two centuries but what science was being done in the world.



Professor Patrick Copland (1748 – 1822) of Marischal College, one of the founders of the art of teaching physics by lecture demonstrations. From a painting in possession of his descendant, Patrick A Copland.

The ‘founder’ of our collection was a remarkable man, Professor Patrick Copland of Marischal College. He was a figure of the Scottish Enlightenment, that loose movement of intellectuals in 18th century Scotland whose ideas, methods and philosophy were very influential in shaping science, technology and other subjects into their modern form.

Copland was a professor who was not only fully conversant with his subject but also a skilled mechanic in wood, glass and metal, the materials of his day, capable of making apparatus to the best professional standards in his own workshop. He believed passionately in the application of science for the betterment of mankind and being a man of action as well as ideas he gave very extensive courses to tradesmen as well as to university students, all profusely illustrated with demonstrations. This was well before the efforts of Young, Birkbeck and many others in the 19th century. In fact Copland was one of the pioneers of teaching Natural Philosophy by demonstration.

Copland built up his collection until, in the words of contemporary historian Robert Wilson, “*the collection is generally considered as superior to any in Britain, and some deem it superior to any in Europe*”. He might have added ‘*the world*’ because there was nothing better than in Europe anywhere else in the world. That was said in 1822 and we have an inventory of Copland’s collection in that year with over 500 entries that backs up the claim. About 50 of Copland’s pieces, or parts of them, survive.

Copland didn't make all his equipment himself. Some he bought and in the 1780s he obtained a grant that enabled Marischal College to employ a technician, John King, to make equipment. King may well have been the first university science technician in Britain. In Glasgow, James Watt had earlier been given premises within the College to operate his instrument-making shop but he was never a college employee. John King specialised in making models of industrial machinery and models relevant to clocks. Only a few of King's models survive but pride of place among King's work in our collection goes to an astronomical clock made by King and Copland in the late 1780s. It's a complex piece that was designed by the famous 18th century North-East born educator and inventor, James Ferguson, FRS. After leaving Marischal College, King earned his living as a clockmaker and examples of his clocks, signed 'JNO KING', can occasionally be seen in the North East.



James Clerk Maxwell's dynamical top, as produced by Harvey and Peake in the 1890s.

Copland and King's astronomical clock to a design by James Ferguson FRS made in the 1780s

James Clerk Maxwell was the last Professor of Natural Philosophy at Marischal College before the universities at Marischal and King's in Aberdeen amalgamated in 1860. This year marks the 150th anniversary of Maxwell's appointment.* He inherited such an extensive collection of equipment that he had little need to make any further routine pieces. He did, though, innovate two historically memorable demonstration pieces associated with his research.

The workshop of Smith and Ramage in Regent Quay made them for him. One was a model to illustrate stability in Saturn's rings, a subject he spent years investigating; the other was Maxwell's 'dynamical top' that illustrated advanced concepts connected with rotating bodies. Unfortunately for us he took both pieces with him when he left Aberdeen but we have a rare commercial production of Maxwell's dynamical top that is on permanent display in the Marischal Museum. It is even more finely made than the Smith and Ramage version, which can still be seen at the Cavendish Laboratory in Cambridge, where Maxwell ended up.

David Thomson, a very able teacher and administrator, said by one source to be a relative of Faraday, was the first Professor of Natural Philosophy in the new University of Aberdeen. His teaching covered a wide range of topics but he was particularly known as an authority on acoustics. He was the author of the long article on that subject in the famous 9th edition of the Encyclopaedia Britannica. Maxwell was one of the science editors of that edition, regarded as the most sophisticated edition in the entire history of this encyclopaedia. Thomson expanded the University's apparatus in other fields too.

From 1880 – 1922, Charles Niven, FRS presided over Natural Philosophy. I was intrigued to find that in 1899 his assistant was a distant cousin of mine. Aberdeen has a habit of springing such surprises. Acoustics must have been one of Niven's interests too for he was seconded during World War 1 to work on the location of submarines by underwater acoustics. Niven lived in exciting times, with the discovery of radio waves and X-rays, radioactivity and, later, the birth of nuclear physics. He witnessed the invention of the gramophone and telephone, radio broadcasts, moving pictures and the cinema, bicycles and cars. These developments and more besides are the foundations that our lives are built on and we are lucky to have many examples in our collection that show the science that started them.



Almost a sculpture in brass and glass. This 19th century prism of variable angle is filled with water or other liquid to illustrate the relationship between the bending of light passing through a prism and prism angle. It is typical of a large number of 19th century demonstration pieces in the collection.

Niven was succeeded by G.P. Thomson, son of J. J. Thomson who had won the Nobel Prize for Physics in 1906. G.P. Thomson's own work in Aberdeen in the late 1920s on electron diffraction won him the Nobel Prize too, making him one of the select few University staff to obtain this honour.

Thomson was succeeded in 1930 by John Carroll, later Sir John Carroll, whose work in solar spectroscopy would be very topical in astronomy today. Carroll was followed after World War 2 by Professor R V Jones, who's absorbing involvement in designing precision instrumentation was significantly ahead of its time. His twin interests in apparatus and teaching by demonstration mirrored those of Patrick Copland 150 years earlier. In one way, Copland and Jones were the alpha and the omega of teaching by demonstration, the beginning and the end. Nowadays, computer simulation has replaced much of this technically intensive but very effective educational technique.



Helmholtz double siren from the 19th century acoustic demonstration equipment of David Thomson.

I've given a brief outline of the professoriate who, through their teaching and research, built up the equipment that now forms our 'natural philosophy collection of historical instruments of physics'. It is a treasure-trove, covering an enormous range of subjects. Where can you see this 'hidden historical treasure'? We have a modest display of items adjacent to the foyer of the Fraser Noble Building in the University at Old Aberdeen. It's open to the public during normal working hours. A few items are displayed in Marischal Museum's *Encyclopaedia of the North-East*. An increasing number of items are accessible on the web through the Lemur initiative www.abdn.ac.uk/diss/historic/museums/. More and more will appear on the web in the coming years, so patience is needed.

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