A Century of Science Publishing
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Chapter 2
Academic Publications before 1940

Alan Cook
Selwyn College, Cambridge, UK

Summary

The overall scope of this book is scientific publishing from 1900, but 1900 is a somewhat arbitrary date in the history of academic publishing which, for the most part from 1900 to 1940 was a continuation of that in earlier times. There were substantial changes from about 1850 and then after 1950, so that it is natural to consider the hundred years between those dates as a whole. There were considerable advances in physics in 1900, which also influenced chemistry, and they had consequences in publishing, but the journals founded before 1900 continued into the new century and relatively few new ones appeared after 1900. The procedures and economics of academic publishing up to 1950 also remained much as they had been for almost two centuries. Thus something must be said about the development of academic publishing in science from the end of the seventeenth century onwards in order to understand its nature in the first half of the twentieth. That is the plan of this chapter.

The physical sciences underwent greater developments and were generally more advanced by 1900 than were the biological sciences, and that is reflected in the greater prominence given to the physical journals in this essay. Most attention is also given to publishing in English, not because that in other languages was negligble but because it was on the whole parallel, and the account of English language publishing covers most of the issues that arose in other languages.

Early academic publishing in natural philosophy

The natural philosophers who started the so-called scientific revolution about the middle of the seventeenth century differed from the hermetic scholars of the Renaissance who preceeded them by making their thoughts and discoveries public and by open correspondence with others at home and abroad. In so doing they not only disseminated natural knowledge, but by developing peer review they authenticated it, and so steadily augmented the stock of confirmed understanding of the natural world. Thus in the first half of the seventeenth century students of mag-

netism published some notable books. In 1581 Robert Norman described in the *The Newe Attractive* the dip needle that he had just constructed. William Gilbert in his *De Magnete* of 1600 studied the Earth as a great magnet, and Guillaume de Nautonier in the *Mecometrie de Leymand* of 1602–1604 put forward somewhat similar ideas. Athanasius Kircher, the Jesuit polymath of Rome, wrote a small book, *Ars Magnesia* in 1631, with a substantial list of magnetic observations at ports and other places round the world, and a suggestion of how a balance might be used to measure forces between magnets. He followed it in 1641 with the far longer *Magnes*, in which he again had a list of observations, and also described the idea of a chart showing lines of equal magnetic declination. Lastly in 1644 René Descartes gave an extensive account of his ideas about magnetism as part of his comprehensive *Principia Philosophiae*. All those books were written before there were any serial journal publications, and before there were permanent academies in England or France. They were however contemporaneous with the Accademia dei Lincei, founded in Rome by Prince Federico Cesi, Duke of Aquasparta, of which Galileo was a fellow. Fellows of the Lincei certainly published privately, but the Lincei itself brought out two works of Galileo, the *Letter on Sunspots* of 1613 and *Il Saggiatore* of 1623. They were the first works published by an academy, although not as journals. Slightly later the Accademia del Cimento, founded and actively supported by the Medici princes, Ferdinando II and Leopoldo (later cardinal), enjoyed a brief life in Florence during which it published the *Saggi di naturali esperienze* of 1667, a cooperative account of the researches conducted by its fellows as part of its corporate life.

At the same time a few individuals maintained a lively correspondence in which they gave news of what their colleagues were doing and sought similar information from their correspondents. Henri Justell in France, Henry Oldenburg in England, and P. Eschinardi in Rome were three such letter writers. Justell was associated with Montmort's informal academy in Paris, Oldenburg became secretary of the new-born Royal Society in London, and Eschinardi was a member of the Roman Accademia Fisica-Mathematica in which Queen Christina of Sweden, then living in Rome, was interested. People who had no official connection with an academy might also maintain a substantial correspondence, as did, for example, the astronomer Johann Hevelius of Danzig. Scientific journals seem to have arisen from that extensive letter writing. Henry Oldenburg began the first with the *Philosophical Transactions* of the Royal Society of London in 1665. Others soon appeared, notably the *Journal des Sçavans* in Paris (1665) and the *Acta Eruditorium*, but they were private not corporate endeavours. The Académie Royale, founded in Paris shortly after the Royal Society, began to publish its *Histoire* (later *Memoires*) *de l'Académie royale des Sciences* in 1699, more than thirty years after those of

Inscriptions and Belles Lettres. At first the Royal Society also published books by fellows, no doubt because by its charter it had licence to do so independently of the powerful Stationers' Company of London. Its experiences were not happy. The *Historia Piscium* (1686) by Francis Willughby, completed after his death by John Ray, was a financial disaster for the Society, and on that account, and because many of the most active fellows were engaged in helping to bring it out, the Society could not itself undertake Newton's *Philosophiae naturalis principia mathematica* (1687), but had to rely on Edmond Halley to finance it and see it through the press. From then onwards, the Society left book publishing alone and concentrated on the regular publication of Philosophical Transactions that effectively set the pattern for scientific publishing in Europe for the next century.

There had been natural philosophers in the English colonies in North America from at least the time of the foundation of the Royal Society, which included among its early fellows a Mather and a Winthrop. There was much interest in natural history and astronomy in Jamaica as well as the northern colonies, and that is reflected in contributions to *Philosophical Transactions*. Then in the middle of the eighteenth century publishing by academies extended to North American when the American Philosophical Society was founded in Philadelphia in 1769; it also had members from Jamaica.

In the first academic journals like *Philosophical Transactions*, all life was there, from mathematics to mycology, and much else besides that we would not now count as natural knowledge. The *Histoire de l'Académie royale des Sciences* in Paris, the journal of the American Philosophical Society, and the *Transactions* (1832) of the Royal Society of Edinburgh, were all devoted to natural knowledge of the most comprehensive sort.

The second half of the nineteenth century

Towards the end of the eighteenth century so many people were engaged in certain fields of science that they needed more and more specialised journals than those of the older comprehensive academies. Thus in Britain the Astronomical Society was founded in 1820 (the Royal Astronomical Society from 1850). It and the Geological Society of London (1826) both published learned journals, the *Memoirs* and the *Monthly Notices of the Royal Astronomical Society* from 1827, and the *Quarterly Journal* and *Memoirs of the Geological Society* in the previous year. The Linnaen Society (1874) and the London Mathematical Society (1865) similarly served biologists and mathematicians. Those societies were primarily devoted to original science, although that does not mean that all their fellows were professionals who earned their living by doing science. Far from it: the Royal

Astronomical Society always had many amateur astronomers among its fellows, and there were many amateurs in the Geological Society and in the Linnaen Society. That is not surprising, for those subjects depended strongly on observation in their early days, and amateurs, especially country clergymen, could make valuable contributions. There was, and to some extent still is, great scope for the amateur observer in ecology.

The year 1850 seems to mark the beginning of a considerable increase in professional science throughout Europe. In that year the British Government first made a grant to the Royal Society for the support of work by scientific men, and it seems very likely, if not certain, that the ideas associated with the Great Exhibition of the following year led the government to agree to do so. The foundation of the Kensington colleges of science and engineering was the most important outcome of the Exhibition. The government grant supported significant investigations in the physical sciences in the late nineteenth century, as well as geological and biological expeditions, while the Kensington colleges were new centres of research in universities. Scientific work increased greatly in Britain, and became more specialised and professional as the numbers of university staff and the resources available to them increased.

In consequence of those developments, the volume of papers in *Philosophical Transactions* increased considerably, and in 1867 the Royal Society divided it into two series, A and B, physical and biological. In the early years of scientific academies, many fellows could attend meetings in person and did not need to be told what had gone on at them, but later people wanted to have published reports of meetings as distinct from the papers presented to them. Already in 1800 the Royal Society started its *Proceedings*. At first it contained reports of meetings and brief sunmmaries of papers that would be published in full in *Philosophical Transactions*. In the same way the Académie des Sciences had its *Comptes Rendus* (1835) and other academies likewise had such subordinate journals. They themselves came in time to take shorter original papers while the older journals took longer ones. In 1905 *Proceedings* also was divided into two series, A and B. A similar pattern was followed by the *Accademia dei Lincei* which was refounded in Rome in 1870 after the reunification of Italy and began to publish its Atti in 1873. It subsequently published Rendiconti with short papers and Memorie and other occasional publications with more substantial contributions. Each of the early issues of the *Proceedings* of the Royal Society contained lists of presents among which were copies of journals received from other academies: those lists show how numerous academic publications were around 1870.

There were three major developments in academic publishing in the nine-

teenth century that to a large extent set the pattern for the early twentieth century. Regional comprehensive academies were formed in Europe, especially in those lands, particularly Germany and Italy, that had no central government. There were academies all publishing journals in Turin, Milan, Venice, Bologna, Naples and Palermo, and in Göttingen, Hamburg, Berlin, Munich and Vienna. Britain had the Royal Society of Edinburgh (1832) and the Royal Irish Academy.

In the second development new specialist societies were founded. They included in Britain the Physical Society, the Chemical Society, the Linnean Society, the Royal Meteorological Society, the Royal Microscopical Society, and the Zoological Society, all with one or more serial publications.

The third development was the appearance of comprehensive academies outside Europe. Scientific research was developing in the British dominions, and Royal Societies were formed in Canada, Australia and New Zealand, and published their own journals. However, many scientists from those countries, and even more from India, continued to send their important papers to the Royal Society in London.

Comprehensive academies such as the American Philosophical Society were relatively less important in the United States where academic publishing became dominated by the major societies, among them the American Physical Society, the American Geophysical Union and the American Astronomical Society, all three of which and others published the most important work in their fields, whereas in Europe, and especially Britain, the work published by the established national academies continued to include important investigations in most fields.

The first scientific institutions supported by public funds were a few physic gardens and the royal observatories in Greenwich and Paris. In the course of the nineteenth century other public institutions came into being, the geological surveys of Britain and the USA, for example, and meteorological and magnetic observatories. They were institutions with responsibilities to the public generally, and they saw it as their duty to publish their work in their own journals in a quasi academic manner, for the dissemination of knowledge and not for commercial profit. Their publications complemented those of academies and other societies. They were for the most part the means of preserving and putting on record the work of institutions that were supported by public money. Although like the publications of academies they did not in general depend on outside sales, some publications were sold widely to the public, in particular The *Nautical Almanac* from the Royal Observatory in England and the *Connaissance des Temps* from the Bureau de Longitude in Paris, two annual publications essential for seamen.

In the nineteenth century, medical men in hospitals did more research in the life sciences related to medicine. Early maps of the brain, for instance, were made

in mental hospitals. A few hospitals, including mental asylums, were under the control of local or central government, but most were institutions of charitable foundations, and some were associated with universities. Journals such as *Philosophical Transactions* published work done in them, but scientific medicine, like other burgeoning fields, produced its own journals, in particular the *London Journal of Medicine* which became the *British Medical Journal*.

Engineering Institutions are not considered here, for they have functions that include representing the professional interests of their members and certifying that they are qualified to practise as engineers. They do however also publish academic journals, and like the purely scientific societies they grew in numbers and functions throughout the latter part of the nineteenth century

The amateur composition of many scientific societies in the late eighteenth and early nineteenth centuries had a considerable influence on the economics of their publications. For the most part a member of a society received its publications free in return for his subscription. Additional sales were few. Many copies were given free to individuals or institutions that in return presented the academy with copies of their own works. Societies and institutions such as observatories, commonly developed their library collections of learned journals in that way. When members, especially amateurs, were reasonably well to do, when the cost of the manual labour of printing was by comparison low, when the sizes and volumes of journals were small, and editorial work was done voluntarily by a few members, the subscriptions of the members could cover the costs of production. Academic publishing was not a commercial business, it was undertaken to promote and disseminate knowledge, and in the circumstances of the times it did not have to be run on commercial lines.

At the same time as the specialist societies were coming into being, other societies were formed to develop an interest in science and the understanding of it, but not to pursue it as such. The British Association for the Advancement of Science was formed in 1835, and in addition to its annual metings, published a journal to promote wider support for science. The Royal Society of Arts had somewhat similar aims, though more technological, while the Royal Institution, although not an academy, also published a similar general journal. The American Association for the Advancement of Science was likewise founded in the USA.

The first half of the twentieth century

The patterns that had been set in the latter part of the nineteenth century continued in the first half of the twentieth. The established general journals continued, with some modifications, as did the publications of the more specialist societies that had been formed in the nineteenth century, as well as the obligatory pub-

lications of public scientific and technical institutions. At the same time changes were taking place foreshadowing the major rearrangements of scientific publishing that occurred after 1950. Most may be traced to the great increase of scientific activity and to the change from a partly amateur to a more wholly professional pursuit. Active scholars and teachers found it increasingly difficult to read for themselves all the relevant papers in their field, and so journals came into being that published reviews for whole topics. Two early ones were *Reviews of Modern Physics* (1929) from the American Physical Society and *Reports on Progress in Physics* (1934) from the Physical Society in Britain.

While it is true that calendar dates are in general arbitrary milestones in human history, it so happens that two developments around 1900 had a significant influence on academic publishing. National laboratories for standards and other physical research were founded in Germany (the Physikalische-Technische Reichsanstalt in Berlin), in the United States (the National Bureau of Standards in Washington DC) and in Britain (the National Physical Laboratory in Teddington, 1900); they had been preceeded by the Bureau international des Poids et Mesures at Sèvres. All had a responsibility for making their work publicly known, and like the Bureau international the German and American laboratories published their own series of reports, the National Bureau of Standards through the US Government Printing Office. The National Physical Laboratory, however, was initially guided by a committee under the Royal Society and so published important work in the journals of the Society, although it also issued annual reports. In addition, it collaborated with the Institute of Physics to publish the *Journal of Scientific Instruments* (1923) which, in responding to the growing importance of instrumentation in science, was like the *Review of Scientific Instruments* of the American Physical Society.

The turn of the century was notable for the evolution of quantum mechanics and relativity, both of which led to a great increase in experimental as well as theoretical investigations in the new subjects and consequently to larger and more numerous journals of physics and chemistry.

New sciences emerged early in the twentieth century. Geomagnetism had been studied on traditional lines since the work of Edmond Halley in 1700, but when the Smithsonian Institute in Washington began to publish its studies in geomagnetism it did so in its own *Journal of Terrestrial Magnetism and Electricity*. Papers on geophysical topics, mostly theoretical, had been published in the journals of the Royal Society and of the Royal Astronomical Society, and then in 1922, the Royal Astronomical Society began a small journal, the *Geophysical Supplement to the Monthly Notices of the Royal Astronomical Society*, in which at first most papers were on seismology, then just developing as a major observational study. Similarly

the American Geophysical Union published its *Transactions* (1920) that became the *Journal of Geophysical Research*.

In summary, the important developments that occurred in the early years of the twentieth century were the foundation of journals for new subjects such as geophysics, for scientific instruments, and for reviews as distinct from original contributions.

The economics and methods of academic publishing differed little after 1900 from those before. An honorary officer of a society would decide on the publication of a paper after receiving one or more reports from referees, and would probably assemble the articles to make up an issue. He (almost never she) would be assisted by a small paid staff in the office of the society where a few members, perhaps no more than one, would deal with the correspondence (receiving papers, sending them to referees), undertake the copy editing, send copy to the printers, check and distribute proofs, and maintain a mailing list.

Many journals were produced by small printing firms among whom Taylor and Francis in London were prominent. Type was still set by hand until early in the century the larger printers adopted the monotype machine in which individual characters were cast at the touch of a key. Small mechanical presses would print small numbers of journals. Journal printing for many smaller societies was still a sort of cottage industry.

As in the late nineteenth century, so at first in the early twentieth century, a large proportion of the print run of many academic journals would be distributed free, either to members of the society in part return for their subscriptions, or by exchange with other societies. Sales for profit were few.

So long as journals could be produced in that way without a net loss to a society, there was no need to market the journal agressively to libraries and individuals, nor to give the journal a superficially attractive format. Societies did find in these years that their journals were increasingly sought by university libraries. In 1850 there were few universities with scientific laboratories and libraries, by 1950 there were very many, especially in the English-speaking countries. That was the time in which great universities in London and the English industrial cities grew up, in Bristol and Birmingham and Manchester and Newcastle and elsewhere. Even more, in North America the original universities of the East coast were supplemented by state universities — every state of the Union wanted its own college. Many were like the University of Colorado, founded with the state in the Centennial year of the Union. It was at first a very small college, but it gradually accumulated a substantial library and supported research. The University of California at Berkeley, founded in the nineteenth century, acquired a substantial

library and active research departments; in the 1930's an additional campus was started in Los Angeles. Those two parts of the University of California, together with the California Institute of Technology in Pasadena, supported important early work in astronomy and in geophysics, especially seismology. All those developments generated demands for the existing academic publications, especially in English, and also led to the establishment of newer academies, such as the Astronomical Society of the Pacific, and associated journals. In the first half of the twentieth century American science came to exceed European science, especially in physics, chemistry and the earth sciences, and journal publishing and sales followed suit. The expansion of science was however, not confined to Europe and America, and the early twentieth century saw the foundation of academies elsewhere, for instance, the Imperial Academy of Tokyo in 1912.

Aftermath

The second world war brought about very great changes in academic publishing. Developments already seen before the war speeded up, but in addition, new subjects came to the fore, in the physical sciences, for example, microwave radio engineering, nuclear physics, geophysics and space research, and in biology, molecular biology. At the same time the cost of producing journals increased drastically, so that academies have had to behave more as commercial publishers, and seek to obtain a profit from their publications, but now in severe competition with the real commercial publishers. Another development, again begun in the previous years, has been a great increase in the number of univerities and industrial and public research institutions, all wanting to acquire runs of journals, not only in the USA and Europe, but even more outside, in India, Russia, China, South America and the older British dominions. At first most of those institutions had ample funds to buy journals for libraries, but not now, so that commercial pressures on academies have increased as sales have fallen. The costs of printing were reduced by replacing traditional means of composing and printing by electronic systems, but they have not entiely solved the problems, and now academies face the need to introduce electronic publication. How, in these circumstances to maintain a public duty to publish and authenticate reliable natural knowledge, as they have done for three hundred and fifty years, is a serious issue for academies.

Academic publishing before 1940

List of Journals

This list is far from complete, and does not adequately represent academic publishing in Europe, but does give an idea of how academic publishing expand-

ed up to 1940. The greatest number of new journals appeared in the nineteenth century.

1665	Philosophical Transactions (A/B, 1887)
	Journal des Sçavans
1699	Histoire de l'Académie royale des Sciences
1769	American Philosophical Soc.
1780	Mem. Acad. Roy. de Belge
	Naples, Acad. royale
1783	American Academy of Arts and Sciences
1786	Acad. roy. de Turin
1799	Annalen der Physik
1800	Proceedings, Royal Society (A/B, 1905)
1826	Proc. Geol. Soc. London
1827	Mon. Notices, R Astronom. Soc.
1830	Proc. Zool. Soc. London
1832	Proc. Roy. Soc. Edinburgh
1835	Inst. de France, Comptes Rendus
	Mem. Ist. Nat. Genève
1841	Mem. Chem. Soc., London
1843	Cambridge Philosophical Society
	Istituto Veneto
1849	Astronom. J.
1861	Trans. Roy. Microscop. Soc.
1861	Proc. Roy. Met. Soc.
1865	London Math Soc.
1873	Atti. Acad. naz. Lincei
1874	Proc. Linnaen Soc.
1880	Astrophys. J.
1883	R. Soc. Canada
	Edinburgh Math. Soc.
1889	J. Inst Elec. Eng.
1893	Physical Rev.
1896	Aeronautical J.
	Geol. Soc. France
1897	Proc. Inst. Chem. G.B. & Ireland
1898	R. Acad. Sci., Amsterdam
	Physics Abstracts
1899	Proc. Washington. Acad. Sci.
1900	American. Math. Soc.
1904	Proc. Amer. Chem. Soc.
1905	Faraday Soc.
1912	Imperial Academy of Tokyo
1915	Proc. Nat. Acad. Sci., Washington, DC
1920	American Geophys. Un.
	J. and Proc. Inst. of Chem.
	Zeits. f. Physik
	Phys. Berichte
1922	Geophysical Supplement
1923	J. Sci. Instrum.
1929	Rev. Modern Physics
1934	Rep. Progress Phys.