Patterns of Journal Publication in Scientific Natural History from 1800 to 1939

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Introduction

In the nineteenth century, journal publication had already established itself as the most convenient way in which the results of original research were communicated to the scientific community at large. A study of journal publication may thus shed light, not only on the development of a science, but also on the organization of that science and the ways in which it was funded. In this paper, I have concentrated upon some of the leading journals devoted to various aspects of 'scientific natural history', that is zoology, botany and geology, published in France, Germany and Britain from the beginning of the nineteenth century to the outbreak of the Second World War. One of the difficulties of covering a relatively large time span is that a journal which was influential during the nineteenth century may decline in importance, or even fail altogether, in the changing conditions of the twentieth century. The journals described here are for the most part 'survivors' amidst changing conditions. They were selected using the list of journals covered by Biological Abstracts (1947), Genera1is (1969) and Edentula (1965).

To print a journal costs a considerable sum of money. So to survive, a journal must either attract a significant number of subscribers, or rely on a subsidy from some institution or organization, or, occasionally, on the generosity of individuals.

The nineteenth century and the first half of the twentieth century saw great changes not only in the biological and Earth sciences, themselves, but also in the development of a professional career in science and in the gradual exclusion of the amateur. Natural history is of particular interest in that, whilst the overall trend to professionalism can be clearly demonstrated, its specialisms have developed at different times and at different rates. Some specialisms have been, and a few still are, rooted in observation: descriptive science, not requiring well-equipped laboratories or expensive apparatus. In these specialisms, the amateur can still flourish and a scientific journal can draw on their support. In others the amateur/layman has long since disappeared and the journal is aimed solely at the professional market. For this latter type of journal, the crucial factor is the size of that
market, whereas, in the former, considerations of balance between amateur and professional interests may take precedence.

There are a number of ways in which a new journal can be launched, and all of them can be found in the various specialties of natural history. I shall briefly outline the main ways in which a scientific journal may be supported, but a more detailed examination of individual journals will show that there are many variations.

Individual scientists and enthusiasts have frequently been involved in the launching of a new journal, often in collaboration with a publishing house already connected with publishing in that branch of science (MacLeod, 1969a; Allen, 1972). Some of the original prospectuses are preserved in the first volume of the journal, itself, or at least referred to in the founder/editor's preface, etc. The steps leading to the foundation of the Palaeontologische Zeitschrift (Jacket, 1913-1914) provide a good example of individual initiative. Though most of the individuals who launched the journals covered here were professional scientists, this was not always the case. The Geologist founded in 1858 was begun by an amateur, S.J. Mackie. (His journal was, however, taken over some six years later, and incorporated in the Geological Magazine edited by professionals - Professor T.R. Jones and H. Woodward.) Again, Edouard A. Martel, a lawyer, founded Spelunca, a journal devoted to the science of speleology.

Institutions may be involved in supporting a journal either directly, or indirectly, by allowing the individual professional to draw on the advantages and contacts of the institution, when founding a new journal. The 'in-house' journal is a result of direct support from the institution concerned, and a few biological journals have started this way. Universities, research institutes, field stations, museums and botanic or zoological gardens have all been connected with journal publication in biology and geology. Some important institutional publications, such as those of the British Museum and the Geological Survey of Great Britain, are not described here, since their chief mode of production was as a series of monographs, rather than a journal.

Lastly, a journal may be founded, or supported, by a society; but this term covers a wide range of organizations, whose commitment to a journal may vary. In particular, the older societies were founded to forward the progress of their specialism by means of meetings, the formation of a library and sometimes a museum. Publication was only one of a number of ways in which the society sought to pursue its aims. In other so-called societies, publication is the main function of the society, and any other function is subsidiary to it, or may even be non-existent.

For instance, if the word for 'subscriber' had been substituted for the word 'member' in the editorials of Entomologische Zeitschrift (1867), it would have been a better, if less friendly, description of the readers' relationship to the journal.

Still other societies which publish journals are effectively pressure groups. Most societies concerned with the progress of science act as pressure groups on occasion, but this is not their primary function, whereas the Society for the Preservation of the Fauna of the Empire, for example, founded its Journal to promote action, rather than science. The two are not incompatibile, and the Society continues to publish, though the title of its journal has been changed to the less informative Oryx (1950).

Particularly in America, the term 'society' has been used to cover organizations such as the Society of Economic Geologists, founded in 1921, in which professional qualifications of a certain standard were made a statutory condition for membership from the beginning. This type of professional association is not found as early in the biological and geological societies in Europe: a similar organization for British geologists was started only in the 1970s. Nevertheless, there was some differentiation of a similar kind even in the nineteenth century. The founding of the Geologists' Association in 1858 ('... a mutual help society for beginners ... the Geological Society was too stiff and formal, and was above them' (George Potter: quoted in Kennard, 1947)) is evidence that the less scientifically minded amateur geologist might find the Geological Society of London unrewarding.

The nineteenth century also saw the development of many specialized scientific journals. If we compare the methods of founding journals in France, Germany and Great Britain, there are clearly certain differences, even though these have been masked to some extent by common trends in the twentieth century. In each of these countries, journals have been launched both by institutions and by individuals. The most common method in nineteenth-century Germany was through the collaboration of individual scientists and a commercial publisher, whereas in British scientific publication was largely in the hands of the societies. In France, no one method appears to have dominated, though by far the most prestigious journals emanated from the Muséum National d'Histoire Naturelle; sometimes the product of one of its laboratories, and occasionally of individual professors.

It would thus appear that scientific publication in natural history was controlled by the professional scientist in France from about the mid-nineteenth century onwards. The journals produced were aimed at the professional market from the start, and, apart from a few fringe areas, such as entomology, what might be termed 'amateur science' and 'amateur journals' were soon separated from the mainstream of scientific literature. By contrast, the amateur tradition remained strong in Britain, especially in the nineteenth century (Alen, 1976), but also during the twentieth century in certain branches of natural history. Scientific publication in Britain was supported by societies. Thus, though the content was generally controlled by the professional, it was often financially supported by the amateur (O'Connor and Meadows, 1976). The reasons for this contrast seem to be connected with the amount of government support for science. In both France and Germany a career in science became possible quite early on in the last century. In France, the foundations of a professional career for scientists, with a number of salaried posts and a recognised training (Crossland, 1975), were
laid down in the post-revolutionary period. The École Polytechnique, founded in 1794, the Muséum National d’Histoire Naturelle and the foundation of several science faculties in Paris provided teaching posts at a relatively high level and opportunities for research, to a limited extent, for those who wished to pursue it. In the 1830s and 1840s, French science was overtaken by research emanating from the German universities (Fox, 1973). In Germany (Ben-David and Zloczewer, 1972), we find a number of scientific centres based on the universities and supported by individual states; a situation quite unlike that in France, where the cultural and scientific life of the nation was very much centred on Paris. The provincial French faculties were isolated and short of finance (Fox, 1973) in comparison. Some attempt was made to strengthen them during the Second Empire (Paul, 1971a): in 1875 Catholic Institutes were founded at Lille, Lyons and Toulouse as well as in Paris (Paul, 1971b).

The German universities also became centres for research at a much earlier stage than in France or Britain (Ben-David and Zloczewer, 1972). Well-equipped research institutes under the direction of a professor provided opportunities for research, though the career structure was, for much of the nineteenth century, closely tied to the university system. In France, the universities and the Grandes Écoles were more involved in teaching, though a doctorate did require a thesis containing original work. Research thus tended to take place in separate institutions, such as the Muséum d’Histoire Naturelle (Croland, 1975).

Nineteenth-century Britain reveals a very different picture (Cardwell, 1973). State support for science was limited. The prevailing ideology of 'self help' and Governmental policies of non-interference (Morrell, 1971) meant that societies in nineteenth-century Britain were, by default, the patrons of science. It was they who built up libraries and museums. Many of them had an overtly educational function (Stephens and Gordon, 1971), and, most importantly, it was they who funded the journals. The small number of professional scientists made it inevitable that the amateur had to play an important role in these societies. Indeed, the pursuit of science was regarded as a leisure activity and specialized education and professionalization were regarded as inferior to a 'liberal' education (Berman, 1975). Joining a society was not only a means of furthering intellectual interests, but sometimes regarded as a way of increasing one’s social standing (Zuckerman, 1959). Societies in Germany, on the other hand, tended to be formed later and were, for most of the national societies considered here, gatherings of professionals—the amateur element being very much smaller.

Britain and Germany seem to represent two extremes as regards amateur involvement in scientific natural history, with France in between. In France, the societies formed were very similar to their British counterparts, and there is some evidence to suggest that the amateur remained an active force in science through these societies, though not on the same scale as in Britain.

General Biological Journals

If we turn our attention to the journals, themselves, we find that the oldest ones are, not unnaturally, less specialized. In Britain, the journal Biological Reviews can be taken as an example. This had its origins in the Cambridge Philosophical Society (Hall, 1899), established on 5 November, 1819 by, and for, fellows and graduates of the University who were interested in ‘promoting scientific enquiries, and of facilitating the communication of facts connected with the advancement of Philosophy and Natural History’ (Cambridge Philosophical Society, 1824). The first issue of their Transactions appeared in 1821, shortly after the Society’s foundation. Increasing specialization eventually led to the foundation of the Proceedings—biological sciences, but only in 1823, though the Proceedings—mathematical and physical sciences had been running since 1823. Similarly, the Philosophical Transactions of the Royal Society was divided into two, ‘Series A’ (physical sciences) and ‘Series B’ (biological sciences), in 1887; and even the relatively specialized Transactions of the Linnaean Society split into two, zoology and botany, in 1875.

In France, the Muséum National d’Histoire Naturelle was the main focus for biological research. The post-revolutionary phase of its history saw the foundation of the Annales in 1809, to which the eminent scientists then employed at the Museum contributed—Hauy, Bronnienart, Lamarck and Cuvier. In 1814 the Annales came to an end, but publication was continued by the Mémoires, which quickly became one of the most prestigious journals covering many aspects of scientific natural history. This only split into three sections (zoology, botany and geology) in 1960. A tendency towards the foundation of more specialized journals, and the modification of older ones to accommodate this trend, is generally apparent throughout the nineteenth and twentieth centuries. There were, however, men who felt that there was a need to preserve the unity of science, and journals such as Nature, founded in 1869 by the astronomer, Norman Lockyer, and the Biologisches Zentralblatt, founded in 1881, were begun with this aim in view.

Though by no means all museums and other institutions concerned with natural history produced their own journals, a great many of them did. The botanic gardens in Paris were associated with the Muséum National d’Histoire Naturelle and the botanic gardens in Brussels were also a focus for botanical research (Wildeman, 1971). Though zoological gardens were often less of a scientific centre than a place of public amusement, the Regent’s Park Zoo, founded by the Zoological Society of London endeavoured to combine the two (Zuckerman, 1976). One field station, the Biologische Station zu Plön, started to publish its own journal in 1893. Although, not surprisingly, this Forschungsberichte was an 'in-house' journal initially, contributions were increasingly received from scientists working outside the station and, in 1905, the title was changed to Archiv für Hydrobiologie. In France two field stations were set up by Henri de Lacaze-Duthiers (Petit and Théordorides, 1972), whilst he was Professor of Zoology at Lille. Both
were marine stations, one at Roscoff and the other at Banyuls-sur-Mer. Although they themselves were not directly connected with journal publication, Dutheirs their founder also founded the *Archives de Zoologie Expérimentale et Générale* in 1872 when he was a professor at the Sorbonne. Dutheirs hoped by these means to encourage laboratory and experimental work in zoology, for he felt that the subject had been merely descriptive for too long. Emil Racovitza, a one-time student of Dutheirs, became co-director of the station at Banyuls-sur-Mer and a co-editor of the *Archives* in 1900. In 1907 he founded *Biotopographia*, a series within the *Archives*, for the publication of the systematic research which he had initiated in the caves of the central Pyrenees (Serban et al., 1961).

In Britain, the development of the laboratory-based field station came much later, though occasionally aquaria intended for public entertainment had laboratories attached to them. The first regular station was set up in 1884 in an old quarry outside Edinburgh by the Scottish Meteorological Society; and, a few months later, a meeting was held in the Royal Society's rooms in order to found a well-equipped laboratory on the coast (Anon., 1887). The International Zoological Station founded by Dr. Dohrn in Naples was the model for this new venture, and it was decided to create a new journal, *Journal of the Marine Biological Association*, to be associated with the British laboratory. From the outset it was intended that the journal should be open to a wide range of workers, though reports from the laboratory were to be included. In the preface to the first volume there is an appeal for observations from fishermen and naturalists, anyone whose work or leisure might bring them into close contact with marine life (Lankester, 1887).

Most new journals have some sort of preface, or editorial, stating what area of science the new journal proposes to cover, and very often going on to say why the journal is needed. The reasons given have stayed remarkably constant throughout the period under discussion, and, probably, remain roughly the same today. New journals are said to be required to prevent the scatter of the literature. The journal is thus intended to provide a focus for publication in the specialism and so aid its progress, not only through the convenience provided by having a central publication, but also by drawing attention to the specialism's existence.

The older specialisms, those that emerged in the nineteenth century, supported and founded journals in a number of typical ways. The pattern, thus created, has persisted (with modifications), and may be contrasted with the pattern of publication in newer disciplines. As an example, I shall take the application of the microscope to biology, something that had a profound effect on the science. In Britain, the use of the microscope was widespread both amongst amateurs and professionals (mostly medical men). The *Microscopical Society of London* was founded in 1839 with Professor R. Owen, the anatomist and vertebrate palaeontologist, elected president. The aims of the original promoters were to 'consider the propriety of forming a Society for the promotion of microscopic investigation and the introduction and improvement of the Microscope as a scientific instrument' (Michael, 1895). The Society was not initially concerned with the publication of their own journal. In fact, the Council was most anxious to point out that the new Society would not trespass on the preserves of the older societies, and that their members would continue to publish their investigations in the journals of those societies (Microscopical Society of London, 1841). In 1841, however, a prospectus for the *Microscopical Journal* was shown to Council, and it was decided to publish the transactions of the Society in this journal (Michael, 1895). This arrangement only lasted for two years, and, in 1844, the Society began to produce the *Transactions of the Microscopical Society of London*. Publication of the Transactions lagg'd, and, in 1853, they were included as a section of the *Quarterly Journal of Microscopical Science* (Turner, 1974). The founders and editors of the *Quarterly Journal* were medically qualified and Fellows of the Royal Society. One, George Busk, who had also been associated with the previous *Microscopical Journal*, was a member of an elite group of scientists known as the 'X Club' (MacLeod, 1969b).

The *Quarterly Journal* was a joint venture with papers selected on behalf of the Society by its Council and published under the heading of its transactions, but the whole was under the guidance of its two editors, Edwin Lankaster and George Busk (Quarterly Journal of Microscopical Science, 1853), and supported by the commercial publishing house belonging to John van Voorst, himself a Fellow of the Linnean Society. This association lasted until 1868, when an agreement was made between the Society and another commercial journal, published by Robert Hardwicke, and founded by Henry Lawson, a member of the Microscopical Society and Assistant Physician and Lecturer in St. Mary's Hospital (Michael, 1895). In 1871, when the publisher requested a greater financial contribution from the Society as the journal was running at a loss, it was decided that the Society should publish its own journal, so gaining prestige in the scientific community and complete editorial control (Royal Microscopical Society of London, 1878). The first volume of the resulting *Journal of the Royal Microscopical Society* appeared in 1878.

In France, the foremost journal in microbiology *Annales de l'Institut Pasteur* was founded in 1887, whilst, in Germany, several journals founded during the nineteenth century were designed to further various aspects of microbiology. Thus, the *Zentralblatt für Bakteriologie und Parasitenkunde* was founded in 1887, like its French equivalent, and had a distinct medical bias. Other German publications in this field were the result of the efforts of individual scientists. *Arkiv für Mikroskopische Anatomie* was founded in 1865 by Max Schultz, Professor of Anatomy and Director of the Institute of Anatomy in Bonn. Some years later, in 1894, the Professor of Anatomy at Innsbruck, Wilhelm Roux founded the journal *Arkiv für Entwicklungsmechanik der Organismen*. There was evidently some rivalry between the two journals, perhaps indicating that the field by this time was becoming overpopulated with journals. Thus, an editorial in Schultz's journal was devoted to
pointing out that developmental anatomy was already served in its own pages (Archiv für Mikroskopische Anatomie, 1894–1895). In 1925, the two journals were, indeed, merged under the second title, and published as a joint venture by Springer.

We can contrast this nineteenth-century specialization with more recent ones. Ecology and related aspects of biology are specialisms which developed as separate entities in terms of journal publication during the twentieth century. The means whereby they founded journals are somewhat different from those of microscopy and microbiology. Whilst, in England, microscopy came to be published by a traditional society, or by individuals who could rely, in part, on the large number of amateur microscopists or the medical profession for support, the Journal of Ecology [1913] was published by a society, whose main reason for existing was to publish the journal. The British Ecological Society, founded in April 1913, replaced the British Vegetation Committee. The founders were a group of biologists who sought to further the science of ecology (Anon., 1913). Similarly, the Annals of Applied Biology first appeared in 1914 as ‘the official organ of the Association of Economic Biologists’. This Association, whose aims were described in an introductory editorial (Annals of Applied Biology, 1914) bore little resemblance to the traditional society so common in nineteenth-century Britain.

The purpose of the group was to unite those concerned with ‘research and teaching and in official positions throughout the Empire’ to press the claims of applied biology. The publication of the Annals was regarded as a means to this end. The British Journal of Experimental Biology, founded in 1925, is another example of a ‘publishing society’. On the back of the title page to the first volume, it is stated to be the journal of the ‘Society for Experimental Biology’: but there seems to have been some confusion about the name, for, on the wrappers, it announces itself as the ‘British Association of Experimental Biologists’. The Association’s objectives were to ‘promote intercourse between experimental biologists within the U.K. [and] to encourage facilities for the publication of experimental work’ (British Association of Experimental Biologists, 1923). The Association, in effect, existed solely to publish a journal. In later years, the Association became a limited company, the ‘Company of Biologists Ltd’. During the 1940s, this Company took on the Quarterly Journal of Microscopy, which shortly afterwards changed its title to Journal of Cell Science, being more descriptive and modern. Changes of title along these lines have been fairly common as publishers (including some societies) have become aware of the international professional market for their journals. The trend is particularly well demonstrated by some of the British regional geological society publications to be described later.

In nineteenth-century Germany, many biological journals were launched by the enthusiasm and hard work of individual scientists holding university positions. They were generally known by their founders’ names, though the name is not given on the title page as part of the title. The journal commonly known as Wilhelm Roux’s Archiv für Entwicklungsmechanik der Organismen is an example already described. Then, as now, certain publishers were prominent in this field: Gebrüder Borntraeger for instance in the nineteenth century, and in the early twentieth-century, the firms of Gustav Fischer and Springer. But there has been a trend away from the individual taking the initiative in founding a journal. In this century German publishers have taken more of the initiative and the editors—generally at least two, often from different parts of Germany, or even from different countries—have played a more subordinate role. No longer are the journals known by their founders’ names, nor are there lengthy editorial prefaces on how, and why, the founder thought it desirable to start a journal. Thus, though the Springer journal Zeitschrift für Vergleichende Physiologie [1904] states on the title page of later volumes that it was founded by K. von Frisch and A. Kuhn, the Archiv für Mikrobiologie [1909], Zeitschrift für Parasitikunde [1919], Zeitschrift für Morphologie und Ökologie der Tiere [1914] and Fortschritte der Botanik [1911], all Springer journals, have editors, but in no way are they designated as the founders. The same trend is found in the Gustav Fischer journals. Those which came into being in the nineteenth-century have founders, but the Archiv für Protistenkunde [1902] and Zoologische Jahrbücher [1932] have only editors. In the latter journal, the editorship has an international look, being based in Uppsala, Berlin and Oslo. This international approach has been more fully exploited by a number of publishers since the Second World War with the adoption of editorial boards and numerous advisory editors.

Natural history and general science societies have also played a part in the publication of biological research. Many of them sprang up in the nineteenth-century, and were then ‘important, but few have continued to be regarded as producers of scientific research in the twentieth-century. Their importance often depends on the extent to which amateurs are involved. Certain aspects of natural history had, and still have, a great appeal for the amateur, and a few amateurs have made considerable contributions to their pet specialisms, whilst many others have made more modest contributions. In some areas, science and the publication of science merge with lay activity—in ornithology and bird watching, entomology or entomology. In the nineteenth century, there was a good deal of overlap and mutual dependence between the two aspects.

Entomological Journals

Entomology is a specialism in which a particularly strong element of amateur participation has influenced the pattern of publication. In its applied aspects, it is of great medical and agricultural importance, so this, too, has had an effect. The Annales de la Société Entomologique de France began publication in 1892 (two years earlier than the Transactions of the Entomological Society of London). It was a national society based in Paris. The founder members are clearly mostly amateur
entomologists, largely drawn from the professional classes, but the honorary members included Cuvier, St. Hilaire and other eminent scientists. From the outset it was agreed that the Société, whose aim was to aid the progress of entomology, should be concerned with the publication of scientific papers (Société Entomologique de France, 1832). The Entomological Society of London was formed chiefly to provide a forum for the reading and discussion of papers. Edward Newman, a leading member of the Society and a well-known entomologist, wanted to publish the papers read to the Society in a journal called the Entomological Magazine, which had been founded by him and a few others in 1834. In the first editorial to this magazine the need for a journal devoted to entomology was stressed. It was alleged that there was too little room for entomology in other comparable journals, such as the Zoological Journal and the Magazine of Natural History, with the result that some entomological papers occurred in literary journals, or were lost in 'unreadable and cumbrous tomes of learned societies' (The Entomological Magazine, 1832–1833). (The Linnean Society is given as an example.) Since the Entomological Society of London was predominantly a society for amateurs - a meeting of 'gentlemen, friends of the science of entomology' (Neave and Griffin, 1933) - this proposal might well have been acceptable, but after much deliberation the Society decided to publish its own journal. The dignity of a scientific body is best consulted by publishing its memoirs in a separate volume devoted solely to the Transactions of the Society ...' (Entomological Society of London, 1834–1835). This decision was not universally welcomed: Edward Newman, in particular, resigned from the Council, and used the Entomological Magazine as a vehicle for making bitter remarks about the Society (Entomological Society of London, 1834–1836).

Both the French and English societies were started largely by amateurs, but gradually became more professional, both in terms of the relative numbers of members, and in the type of papers published in their journals. The centenary history of the (by then) Royal Entomological Society of London noted a change at about the 'turn of the century' (Neave and Griffin, 1933), and the Société Entomologique de France has similarly come to be dominated by professionals in the twentieth-century. The Revue Française d'Entomologie was established in 1934 to help amateurs by means of reviews and articles of general interest, but also to provide a place for short publications for specialists (presumably particularly those employed in the Laboratoire d'Entomologie, from whence it was published). The 'advertisement' states, however, that major papers should be sent to the Annales de la Société Entomologique de France (Revue Française d'Entomologie, 1934). This not only reveals the relative status of the Annales and the Revue, but also indicates that there was reason to believe amateur support for a scientific journal might still be forthcoming at that time.

In Germany, too, there was a journal catering for amateurs and collectors; the Entomologische Zeitschrift: Central-Organ des Internationalen Entomologischen Vereins, which began publication in 1887 and was directly aimed at the popular market. As in other specialisms of natural history, the relevant national German society was founded much later than those in France and Britain. The Deutsche Entomologische Gesellschaft, published by the Deutsche Gesellschaft für Angewandte Entomologie began publishing the Zeitschrift für Angewandte Entomologie in 1914. The latter is a German example of a small group forming a society essentially to exert pressure within science to get their subject recognised as a valid scientific discipline. Founded by Karl Escherich and other well known entomologists, the list of members present at the meeting in October 1915 in Würzburg shows that professional scientists were well represented among their number. The guests, on the other hand, were drawn from a much wider selection of local and influential people whose interest lay in agriculture, forestry, etc., and who might therefore be expected to have more than a passing interest in the benefits of entomological research. By 1927, the Society and the journal had developed a more international outlook, partly as a result of a visit to the U.S.A. made by Escherich, himself. In that year the Society had 479 members scattered over a variety of countries and continents (Becker, 1964). In 1925 the Society also produced Anzeiger für Schädlingkunde. This was announced on the title page as a journal for zoologists, agriculturalists, foresters and horticulturalists (i.e. those professions whose primary interests were unlikely to be in the scientific aspects of applied entomology, but for whom the practical side was of great importance).

In Britain, applied entomology came primarily under the wing of the Colonial Office. The Bulletin of Entomological Research was issued in 1910 by the Entomological Research Committee of the Colonial Office - several committee members were Fellows of the Royal Society. The need for entomological research in Britain's tropical possessions had by that time become of obvious importance. An epidemic of sleeping sickness was then sweeping through a large part of Uganda and East Africa, and the role of insects in the spread of disease was clearly significant. It is interesting to note that, whilst the Government was prepared, in this instance, to support publication and employ two entomologists in Africa, the amateur was still expected to play a part, 'they [the Entomologists] must necessarily be travelling about, and it is to the resident that we must look in the main for working out life histories' (Entomological Research Committee, 1910/11).

Many amateurs in Britain did, in fact, contribute to entomological research. The British Entomological and Natural History Society began as the South London Entomological Society, founded in 1872, with only 11 members (James, 1973). The South London Society was the lone survivor of a number of working-class entomological clubs, which met around London mostly in public houses. It was more middle class than the others, but owed much to Edward Newman's soirées, at which comparative beginners could meet and examine his collections.
By 1885, the Society had grown, and wished to publish its own transactions. Such a step might enhance the Society's prestige and scientific standing, but the expense was a heavy burden on their finances. Nevertheless, they went ahead with the project and publication continued, though it frequently had to rely on the generosity of anonymous donors.

In 1924, the Hampshire Entomology Society began to publish its Transactions. Although most of the members at the time were amateur, a few professional biologists and entomologists also became members. The membership list shows that W.R. Sheriffs and K.H. Vickery were honorary members; both of them were on the staff at the University College of Southampton and this link with the University was retained through subsequent years. In 1952, after the Society had expanded to become the Entomological Society of the South of England, there were some 20 members with science degrees out of a total membership of 119, and, in 1934, the Society moved on to the national stage, changing its title yet again to the Society for British Entomology. In 1932, another publication - the Journal - was founded, for those papers worthy of record, but 'not of sufficient completeness' to be included in the Transactions.

Ornithological Journals

Ornithology, too, has long had a wide public following. Many natural history societies have an 'Ornithological Section', and a list of the leading journals compiled in 1968 shows that over half the journals devoted to ornithology were published by societies (Karr, 1968). Like the collector in entomology, the bird-watcher in ornithology has been on the fringes of the science. The pattern of publication has some similarities in the two areas, though the applied aspects of entomology, which are of such economic importance, have no counterpart in ornithology. Of the more scientific journals, Journal für Ornithologie was founded in 1853 by Jean Cabanis, then custodian in the K. Zoologische Museum des Friedrich-Wilhelms University in Berlin. In his preface to the first volume, he notes that both entomology and conchology had their own journals, and intends that ornithology should be similarly served (Cabanis, 1853). With the cooperation of other ornithologists in Germany and elsewhere in Europe the journal was published by Theodor Fischer. By the turn of the century, it had become connected with the Deutsche Ornithologische Gesellschaft.

This development is paralleled by the appearance of the Ciris, published in Britain. A professional scientist, P.L. Sclater, then a Fellow of Corpus Christi College in Oxford and one of a group of keen ornithologists, felt that a number of naturalists would be grateful for a magazine devoted solely to ornithology, and that 'the number of people involved in this branch of zoology [was] sufficiently great to justify an experiment' - another such venture having succeeded in another country (Sclater, 1859). The journal was published in London by Trübner with various agents in Paris, Leipzig and New York. The informal meeting from which this idea had emerged resulted in the formation of a Union, which later became the British Ornithological Union, and, in later volumes, the Ciris is designated as the official organ of the British Ornithological Union.

In both Germany and Britain, new magazines were founded by individuals who took advantage of the amateur market. The Ornithologische Monatsberichte, founded in 1893 by Dr. A. Reichenow who was at that time in charge of the Ornithological Section of the K. Zoologischen Sammlung in Berlin, concentrated on short contributions, many from professional scientists. Correspondingly, British Birds was founded and published by H.F. Witherby, a notable authority on the subject (Hartt et al., 1912). Witherby used amateurs for making systematic investigations on a country-wide basis (Witherby and Pycraft, 1907[8]). The results of these projects were collated and published along with other short contributions and reports from local natural history societies. Ornithology remained undifferentiated as a subject: only in Germany do we find a very specialized journal devoted to one aspect of ornithology - reproductive biology and ology - the Beiträge zur Fortpflanzungsbioologie der Vögel mit Berücksichtigung der Osteologie. This began publication in 1924, but does not seem to have survived the Second World War.

Both entomology and ornithology are examples of popular branches of natural history open to a very wide range of people. Speleology attracts fewer enthusiasts, since it has necessarily rested in the hands of those who are active enough to pursue the sport. Articles on scientific speleology have appeared in natural history journals, such as the Transactions of the Torquay Natural History Society, but much work was originally published by the offspring of mountaineering clubs, such as the Società degli Alpini di Triestini (Commissione Grotte) and the Yorkshire Ramblers' Club, whose journal, started in 1899, was mostly devoted to climbing. The first journal devoted solely to speleology was published in Germany by the Verein für Höhlenkunde, in 1880 (Shaw, 1975). The twentieth-century was to see a much greater differentiation between the sporting and scientific aspects of the subject, matched by the foundation of a number of speleological journals. Their varied origins reflects the heterogeneous nature of the science and, correspondingly, the different groups involved in it. Edouard Martel, a well known speleologist and populariser of the science, founded the Société de Spéléologie in Paris in 1895. The Society produced a journal, Spéléo, but the first series was brought to an end by the outbreak of the First World War. Publication was restarted in 1935 and has been supported by a national French speleological society in one form or another to the present day (Geze, 1961). Biologapologie, as has been mentioned, was established in 1907, by E. Ravaoiviza, as a part of the Archives de Zoologie Expérimentale et Générale. In Britain, the leading journal until shortly before the Second World War was the product of a University Society, the Proceedings of the University of Bristol Speleological Society.
the karst is of great economic importance, scientific speleology began with a group within the Hungarian Geological Society. In 1910, this group formed a Commission on Speleology, later renamed the Hungarian Speleological Society, and publication of a journal, *Barlangutatás*, in Hungarian but with German summaries, was started in 1913.

Although speleology is a particularly good example of a science which must rely on the physically active for its data, there is a similar link with the field aspects in the other branches of science treated here. France, Great Britain and Germany were all colonial powers for at least a part of the period under discussion, and the exploration of their territories was more often undertaken by the non-scientist, or the amateur scientist. Natural history societies were able to flourish in the British colonies and dominions – as the histories of the Bombay Natural History Society (Anon., 1933) and the Australian and Tasmanian societies show (Hoare, 1966; 1969).

*Natural History Journals*

Scientific societies of one kind or another flourished in Europe, too. In France, for instance, there was usually at least one general scientific society in each department and in each major city (Delaunay, 1902). Such societies also occurred in Germany (British Museum (Natural History), 1968). In Britain, the provinces were served by Literary & Philosophical Societies, but there was, in addition, a great number of societies devoted to one or several branches of natural history. The publications of two of these provincial societies were still considered to be of sufficient importance to be included in the *Biological Abstract* list of journals for 1947. Of these, the Cardiff Naturalists’ Society was first to be founded, in 1867. The members’ primary aim at that time was to establish and furnish a museum in Cardiff, but they also published their *Report and Transactions* [1867]. Whilst this concentrated on the local fauna and flora, it nevertheless contained original data. The publication continues to the present day, but no longer presents original scientific work. It is now devoted to matters of conservation and to popular articles on natural history.

In contrast, the *Transactions of the Norfolk and Norwich Naturalists’ Society* [1865] continues to publish original scientific work, especially that relevant to the Norfolk countryside. In close association with the University at Norwich, and the contributions made by the staff of that institution, no doubt help to account for this. It is not the only example of this symbiosis, though association with a university is not an infallible guarantee of success. The Liverpool Biological Society, for instance, was founded in 1866. Staff and students of the University College joined with the citizens of Liverpool, including the Mayor, in order to found a society devoted to biology. The first President was W. Mitchell Banks MD, Professor of Anatomy at the University College. His inaugural address contains statements which are typical of many a professional’s attitude towards the amateur at that time: ‘In every great city there are a number of men, who for their own pleasure and recreation, have dug deep into nooks and corners ... [of] Natural History and Botany’ (Banks, 1866). He hoped that such people would be encouraged to bring their communications before the Society, where they were consigned to the ‘erudite of criticism and discussion’, and thus contribute to the advancement of biological science. Despite this encouraging link with a university institution, the volumes of the Society’s *Proceedings and Transactions* became much thinner after the First World War, and it ceased publication altogether in 1953.

If we turn our attention to the major divisions of natural history – zoology, botany and geology – we find a greater degree of professional involvement in journal publication from the nineteenth century into the twentieth century.

*Zoological Journals*

In zoology, the earliest journal of importance was the *Proceedings of the Zoological Society of London*. Much has been written about the setting up of this Society which was founded for the general advancement of zoological science (Mitchell, 1929; Matthews, 1953; Zuckerman, 1976; Bastin, 1970). The immediate object was to found a zoological garden for the study of living animals, and the Society did not begin publishing its *Proceedings* until some four years after its foundation in 1829. But the Zoological Society had a clear scientific orientation: almost all the members of the Zoological Club in the Royal Society joined it (Bastin, 1970). The Société Zoologique de France (Fox, 1977), on the other hand, was virtually ignored by the leading French zoologists of the day. It was founded in 1876 by Aimé Bouvier, a merchant and naturalist. Most of the founder members were amateurs, but a few of the aide-naturalists and preparateurs from the Museum and various laboratories in Paris joined it. Nevertheless, it remained isolated from the mainstream of scientific activity for some time. Its *Bulletin* made little impact on the scientific community until, in the 1880s, the Society came under the control of Raphael Blanchard, a professional zoologist. In 1889, the Society organised the first International Zoological Conference, and from that time onwards took on the role of representing French interests in the international scientific community. In Britain, the Zoological Society of London fulfilled a much wider role: promoting research and acting in an advisory capacity to the Government when required.

The German national society, the Deutsche Zoologische Gesellschaft, was founded in 1890. It did not found a journal of its own, but adopted an existing journal, the *Zoologischer Anzeiger* [1876], which had been launched by one of the Society’s founder members, Dr. Victor Carus, at that time Professor of Anatomy at Leipzig. The Society appears to have been founded as a national organisation to promote meetings and to represent the views of German zoologists, and the
adoption of an existing journal was evidently regarded as sufficient for their publication needs. The later Deutsche Gesellschaft für Säugetierkunde, on the other hand, placed immediate importance on founding a new journal – the Zeitschrift für Säugetierkunde [1926]. Its objectives read like those of the ‘publishing societies’ we have talked about before (Deutsche Gesellschaft für Säugetierkunde, 1926). It is interesting to note, however, that the Society was not to be exclusively for ‘skilled scientists’ (Pohle, 1926). Mammalogy was at that time a small specialty, and it is tempting to speculate that this led to the founding of a society open to non-professionals as being the only viable way to support a journal.

Malaconology and conchology are among the older specialties in zoology, and both have long had a considerable amateur following: shells are both attractive and collectable. The Proceedings of the Malacological Society of London first appeared in 1899. The Society, founded in February of that year, sought ‘to facilitate the study of mollusca and brachiopoda both recent and fossil’ (Malacological Society of London, 1899). It owed much to its first Secretary, E.A. Smith, who was in charge of the molluscan collections at the British Museum. The Society is, indeed, an excellent example of museum involvement in research and in its communication, for Dr. Henry Woodward, at that time Keeper of Geology, was made its first President (Hudleston, 1943). This orientation probably also explains the fact that it differed from British contemporaries in having a cosmopolitan composition: the number of foreign members exceeding that of the ordinary members from 1908 to 1930 (Kennard, 1943).

In France, conchology also appears to have been a popular specialty. The Journal de Conchylologie was founded and published by S. Petit de la Saussaye in 1850. He states in the ‘avant propos’ to the first volume that there was a need for a specialized journal of this kind to unite all those involved in the subject from ‘maîtres’ to students, travellers and enlightened observers (Petit de la Saussaye, 1850). Having raised about 150 subscriptions, some from eminent scientists, he began publication of the journal (Fischer, 1950). In 1856, he resigned from the directorship, and from then on it was run by members of the Fischer family in Paris. Henri Fischer and his son, Paul, were both active malacologists, and under their direction the scientific quality of the journal improved. On Paul’s death, his widow continued to manage the affairs of the journal with assistance from her sons and the aid of a scientific director.

In Germany, surprisingly enough, there was no comparable scientific journal for malacology or conchology, though German journals pioneered other specialties in zoology (see Table 1).

Both the Journal of Animal Ecology and Parasitology were offshoots from well-established journals, which found themselves unable to cope with the growing volume of papers in a sub-discipline. The Journal of Animal Ecology was published by the British Ecological Society when the Journal of Ecology no longer had room for all the papers submitted to it, whilst Parasitology was originally launched as a supplement to the Journal of Hygiene, a medical journal, at that time published by Cambridge University Press.

In both France and Germany a number of the leading zoology journals were founded by individuals. The Archives de Zoologie Expérimentale et Générale and Zoologischer Anzeiger have already been mentioned, but there were several others; such were the Zeitschrift für Wissenschaftliche Zoologie [1848] founded by Professor C.T. von Siebold (University of Freiburg im Breisgau) and Professor A. Kolliker (University of Würzburg) and the Zoologische Jahrbücher [1880] founded by J.W. Spengel (University of Gießen). In Britain, correspondingly, Neotropical Zoologica [1894] was founded by the Hon. Walter Rothschild (the journal and his museum at Tring were continued by the British Museum after his death).

As might be expected, the founders were typically associated with institutions connected with research. In zoology, however, museums played an important part. Thus, the various laboratories of the Muséum National d’Histoire Naturelle have been closely associated with publications. Mammalia, started in 1926, is an example, and there are several others besides the Mémoires and Bulletin. In Germany, the Senckenberg Museum has been associated with journal publication – Senckenbergiana [1918] – and, so, too, has the Zoologisches Museum in Berlin. The latter originally published research under the title Mitteilungen aus dem Zoologischen Sammlung des Museums für Naturkunde in Berlin (1898), but changed the name in 1900 to Mitteilungen aus dem Zoologischen Museum in Berlin.

### Table 1

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<thead>
<tr>
<th>Germany</th>
<th>France</th>
<th>Great Britain</th>
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<tr>
<td>Mammals</td>
<td>Z. Säugetierk. [1929]</td>
<td>-</td>
</tr>
<tr>
<td>Invertebrate groups</td>
<td>Arch. Protistenk. [1909]</td>
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### Botanical Journals

The pattern of publication in botanical sciences has been rather similar to that in zoology. The leading journals in Britain have been those of the Linnean Society and Annals of Botany. This latter was first published in 1887 as the result of an approach by a number of university botanists to the Clarenco Press. The Press was sympathetic, but stipulated a guarantee against loss if the venture should be
unsuccessful (Farmer, 1937). The only specialist botanical journal of note during this period was the Transactions of the British Mycological Society [1866]. There seems to have been a particularly strong amateur tradition in mycology in Britain. The Society itself (Ramsbottom, 1948a; 1948b) grew out of the excursions run by the Woolhope Naturalists’ Field Club, which were conducted by H.G. Bull, a medical practitioner. After his death, these forays were continued by the Yorkshire Naturalists’ Union; but, in 1896, an enthusiastic and largely amateur band of mycologists decided to found their own Society. This both enabled them to hold excursions in different parts of the country, and helped support the publication of a new journal; for Grevillea [1872–1894], which they had previously used, ceased to appear.

In Germany, mycology was covered by Annales Mycologique [1903]. Founded by H. Sydow, an amateur mycologist whose profession lay in banking rather than science, it changed its name in 1945 to Sydowia in his honour. Sydow’s preface (Sydow, 1903) reveals that he intended the journal to be international in character with original work published in either French, English or German. A list of his collaborators in this enterprise is given, mostly German academics, but with one or two non-Germans, including the French botanist, P.A. Dangeard.

Mycology in France, itself, was also served by a society. The Société Mycologique de France was formed to forward the progress and diffusion of knowledge about mycology. Publication of a Bulletin [1885] was an important part of the Society’s functions. The first list of members shows that a number of professors and professional men of various persuasions had joined, and that the membership was drawn from all over the country.

Only in France do we find journals devoted to other plant groups, and these are again museum publications, associated with the Muséum National d’Histoire Naturelle. One was the Annales de Cryptogamie Exotique [1928], published from the Cryptogam Laboratory (continued as Revue de Mycologie from 1936 onwards). The other was the Revue Bryologique [1874]; founded by T. Husnot, and later taken over and published from the Cryptogam Laboratory under the directorship of P. Alorge.

In France and Germany, there was an important group of general botanical journals, which, like the Annales de Botany, were founded by the efforts of individual scientists, and were very often known by the founder’s name (see Table 3). The personal initiative involved is indicated by the history of the Revue Générale de Botanique. Professor Bonnier founded the botanical research laboratory at the Sorbonne, and subsequently started the journal as a personal venture. On his death, it was taken over by another French botanist. When he decided to relinquish the task, Bonnier’s widow arranged that Guillermmond, who then had Bonnier’s Chair at the Sorbonne, should take it over (Guillermmond, 1939). Perhaps the ultimate in personalized journals, however, was the Botaniste, founded by P.A. Dangeard, whilst employed as a preparateur at Caen. The whole of the first two volumes were written by him. In a preface, Dangeard explains that he wanted to publish his work in this form so that it would not be scattered in different publications, and he would have complete control over the theoretical stance which he wished to adopt (Dangeard, 1889). By the third volume, a few other contributors – his students – were included.

Along with individuals, societies were the other main group involved in founding botanical publications. The Linnean Society has already been mentioned, and national societies were also formed in both France and Germany. The Société Botanique de France was founded in 1854, and the Deutsche Botanische Gesellschaft considerably later in 1889. Both published journals from the beginning. There was a general similarity with the Linnean Society. The Société Botanique de France was evidently intended to include both amateurs and professionals. Thus, Adolphe Brouniart, a leading scientist at the Muséum National d’Histoire Naturelle, presided at a preliminary meeting to draw up a circular describing the new Society, and this was sent to both professors and ‘amateurs des sciences naturelles habitant les départements’ (Société Botanique de France, 1854). The Society was modelled on the successful Société Géologique de France, which was, in turn, modelled on the Geological Society of London.

Not all the societies were national in scope. Flora [1818] was first published by the Botanische Gesellschaft in Regensburg in 1802 (as Allgemeine Botanische Bibliothek). In 1818 the title Flora oder Botanische Zeitung was adopted, and in 1831 the Society, itself, was renamed the K. Bayerische Botanische Gesellschaft.

The Botanical Society of Edinburgh was another relatively early regional foundation in 1836. Its first President was the Regius Professor of Medicine and Botany at Edinburgh, Robert Graham, and it is clear that he and his students provided much of the impetus for its foundation (Botanical Society of Edinburgh,
1837). Its objects were to forward the science of botany, something which they clearly felt was not being actively pursued by the natural history societies already in existence in both the University and City. Though based in Edinburgh, the Society tried to forge and maintain links with the other Scottish Universities. The Transactions were an integral part of the overall scheme for improvement, and were first published in the same year as the Society was founded.

**Geological Journals**

The science of geology was very popular with nineteenth-century natural history societies. In the early part of the century, the conceptual basis of geology developed rapidly, and controversy abounded, often conveyed in pamphlet form, or in general literary journals such as the Edinburgh Review. The Transactions of the Geological Society of London [1811], perhaps partly as a consequence, deliberately eschewed theoretical work, preferring to concentrate on the reporting of observations (Geological Society of London, 1811). On the continent, geology was taught as part of the curriculum in several famous mining schools, and Annales des Mines (founded under the title of Journal des Mines in 1795) contained much of relevance to the science of geology. Unlike some other topics we have examined, the major geological periodicals in France and Britain were largely launched and supported by societies, rather than individuals, during the nineteenth century.

Of all the national societies, the Geological Society of London, founded in 1807, is the oldest. Its Transactions, later to be superseded by the Quarterly Journal [1845], were first published in 1811. The reasons for this delay between founding the Society and the journal is probably to be sought in the rather strained relationship between it and the Royal Society (Rudwick, 1963), rather than in any reluctance to publish a journal. The Société Géologique de France was founded in 1839 and was closely modelled on the Geological Society of London. Publication of its Bulletin was viewed as an important part of the Society’s communication functions from the start, and the decision to hold one meeting each year outside Paris apparently gave much impetus to geological exploration in the provinces (Lapparent, 1879–1880). The Deutsche Geologische Gesellschaft was founded eighteen years later, in 1848, one of the earliest national societies founded in what was later to become the German state. Its object was to unite the scattered workers in geology in a common union. Berlin was the centre chosen, not only because it was already a scientific centre of some eminence, but because it had a good railway system connecting it with other German cities (Deutsche Geologische Gesellschaft, 1849). Although meetings, a library and various collections were to be a part of the Society’s function the emphasis was placed on the importance of written communications: its Zeitschrift der Deutschen Geologischen Gesellschaft held the central place in the Society’s activities.

Of the major specialisms within geology, mineralogy seems to have separated itself from the parent societies and journals first. The Bulletin de la Société Française de Mineralogie appeared in 1878, the same year that the Society was founded. The Mineralogical Society of Great Britain and Ireland was founded two years earlier, when it started publishing the Mineralogical Magazine (Watts, 1926–1928). Thus, though first merely envisaged as a news sheet, it was soon to become a recognised scientific journal.

Palaeontology seems to have remained tied to the parent body for much longer: perhaps because it was such an integral part of stratigraphy, that it was not considered a subject in its own right. This was certainly the assessment of Professor Dr. Otto Jaekel (Jaekel, 1913–1914). In order to redress the balance, he campaigned for the establishment of separate Chairs for Palaeontology in Prussia. In 1912 it became clear to him that he was not going to be successful in this, and so he set about raising the standing of his subject by founding an international assembly, the Palaeontologische Gesellschaft. This immediately gave priority to raising the standard of publication in palaeontology by the creation and administration of a journal devoted solely to that subject – the Palaeontologische Zeitschrift [1913]. The inaugural meeting certainly demonstrated international interest in this project; of those present, 130 were from various parts of Germany and a further 80 from other countries.

The establishment of a journal devoted to palaeontology in France was also largely due to the efforts of one man, Marcellin Boule, Professor of Palaeontology at the Museum. Boule, in collaboration with the publishing house of Maison et Cie, started the Annales de Paléontologie in 1906. Both this and its German counterpart were established considerably earlier than Palaeontologia, the British journal, which was first published in 1957 by the Palaeontological Association.

Like palaeontology, though less markedly, geophysics emerged as a separate discipline, from the journal point of view later in Britain than in Germany. Gerland’s Beiträge zur Geophysik was first published in Stuttgart in 1887, and its subtitle – Abhandlungen aus dem Geophysikalischen Seminar der Universität Strassburg – indicates that much of its initial support must have come from the university seminars: the first editor and founder was Georg Gerland, then Professor of Geography and Ethnology at the University of Strasbourg. In Britain, it was again a society which initiated publication in this field. The Geophysical Journal was first published as a geophysical supplement to the Monthly Notices of the Royal Astronomical Society in 1922. This is an interesting example of an interdisciplinary subject emerging as a specialization in its own right. In Britain, it was the Astronomical Society rather than the Geological Society which sponsored the new subject, whilst in Germany the influence of a geography department was important in its initial organization.

Along with the national journals, a number of regional journals also published geological research in the nineteenth century. The British Association for the Advancement of Science and the Société Géologique de France undoubtedly
stimulated enthusiasm for geology in the provinces of their respective countries, and regional geological societies also functioned in the various states of Germany.

Of these regional journals, only those published in Britain have been studied in any detail (O'Connor, 1972). They were founded by local geological societies with the aim of publishing research on their region. In the nineteenth century, a great many of these societies flourished, and towards the end of that century their contribution to the science of geology was considerable. In the twentieth century, many of these societies have ceased publication, mainly due to financial difficulties, but those listed in Table 3 have continued to publish scientific work. Both the finance and scope of the journals have been modified down the years: for instance, the emphasis on local geology has gone, so that the journal will appeal to the wider professional market. In some cases, the title has been changed to meet this requirement. Financial constraints have sometimes been eased by the amalgamation of two journals. This has had a double effect: increasing the number of subscriptions, and decreasing the total number of journals competing for the professional market.

In France, two societies, similar to those founded in Britain have played a significant role in geological publication. Of these, the more famous is the Société Géologique du Nord (Defrein, 1979). Conceived by Jules Gosselet in 1870, and begun with eleven members, each of whom had a particular section to study, its start resembles that of the Liverpool Geological Society (Hewitt, 1910). This, too, began with a small number of members intent on studying and recording local geology. Both Societies expanded rapidly, and decided to start publishing their researches. The Annales de la Société Géologique du Nord was first published in 1870. The scientific value of this publication is attested by the fact that, through exchanges of this journal, the Society's library became one of the best specialized geological libraries in France. The other society, the Société Géologique de la Normandie, like many of its counterparts in Britain, was supported by a number of active amateurs. The Society was formed with the intention of filling out the theories, expounded by the 'maîtres', with data and observations from their own region (Société Géologique de la Normandie, 1879). The Bulletin was first published in 1879. Though originally the Society had sought to concentrate on geology, its scope was widened in 1927 to include other branches of natural history, and the Society added 'ami du Muséum' to its title. This move probably implies that the Society required a larger membership to keep up its activities.

In Germany, the exact nature of the local associations involved with geological publication is not always easy to ascertain. The Oberheinisch Geologisch Verein, which began independent publication in 1883, described itself in 1923 as a 'Society for geologists and friends of geology' (Oberheinisch Geologisch Verein, 1923). It would thus seem that the amateur element was included, and this is not contradicted by its aims, which laid emphasis on the geology of the district. A somewhat similar society was the Niedersachsisch Geologische Verein, which was also involved in publishing, Geologische Jahrbücher [1883], and has continued to be associated with regional state geological and mining organisations (Schriftenleitung, 1949).

**Conclusion**

The consequences of the amount of state support for science in Germany, France and Great Britain are clearly to be seen in the publication of scientific journals. Where state support was forthcoming, professional scientists could rely on the professional market to support their journals. Thus, in Germany, from about the mid-nineteenth century onwards, specialized journals could be launched by professional scientists for their professional colleagues. The national societies in Germany tended either to be meeting grounds for professional scientists to represent the national interest, or they were international in character—'publishing societies' for that particular specialism. In France, though state support for science led to the creation of a career structure and training for scientists early in the nineteenth century, there was less emphasis on research. Although the Museum National d'Histoire Naturelle supported scientific publication from the start, several journals were launched by individual prestigious scientists. Alongside this, however, were the societies; most of them having an amateur element during the nineteenth century. However, there appears to have been nothing in France on the scale of the amateur involvement that we find in Britain.

The society network in Britain, through which many amateurs made their contributions, was closely interwoven. The Cotteswold Naturalists Club (Lucy, 1888), for instance, had connections with the Royal Society and other learned societies through its various members, and a professional scientist, the Professor

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**Table 3**

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<thead>
<tr>
<th>Regional geological journals in the United Kingdom</th>
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<tr>
<td>Transactions of the Edinburgh Geological Society [1857] [original Society founded in 1834]</td>
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<tr>
<td>Transactions of the Geological Society of Glasgow [1866] [Society founded in 1858]</td>
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<tr>
<td>Proceedings of the Liverpool Geological Society [1861] [Society founded in 1859]</td>
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<tr>
<td>Journal of the Manchester Geological Association [1946] [Association founded in 1925]</td>
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<tr>
<td>Proceedings of the Yorkshire Geological Society [1839] [Society founded in 1837]</td>
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<td>* Scottish Journal of Geology [1965]</td>
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<td>* Geological Journal [1951]</td>
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* Founded under a slightly different title.
of Natural History at the Agricultural College in Cirencester, was amongst its founder members. By the end of the century, organizations had been set up specifically to increase cooperation and contact between the various local natural history societies. The Midland Union of Scientific and Literary Societies is an example of one such organization, to which delegates from the societies were sent to discuss matters of common interest (Midland Union of Scientific and Literary Societies, 1877). At the top of this tier system was the British Association for the Advancement of Science, which did much to promote science in the country as a whole, and in the provinces in particular (MacLeod et al., 1975). That the British Association recognised the value of local societies is implied in its constitution (Harcourt, 1831) that 'members of Philosophical Societies in the British Empire shall be entitled to become members of the Association'. This is unlike the equivalent German organisation, which made a distinction between writers and readers. However, the Association did make this kind of distinction as regards the membership of the General Committee: members were to be drawn from those who had had their publications published by a Philosophical Society.

Amateur support for publication of research remained important, even during the twentieth century, when the numbers of professional scientists in Britain remained small compared with the numbers on the continent. This meant that societies, which published the results of scientific research, brought the amateur and professional together. A study of their collaboration in the promotion of ecology is to be found in Lowe (1976), and it is clear that this type of close relationship both encouraged the acceptance of professional norms by the amateur, and made the professional aware of what could be achieved by the amateur. Thus, the relationship between professional and amateur, though not without friction, tended to remain fairly harmonious. This situation may be contrasted with that in America during the first half of the nineteenth century (Holmfield, 1970; Daniels, 1967). From the 1820s onwards, there was a rapid growth in the number of posts for scientists in Government agencies and colleges. As the numbers of professionals increased there was a general move to form associations of their own, such as the Geological Society of America (founded in 1840). The American scientist was anxious to show his European counterpart that science in America was of a comparable standard. The controversy over the standards of publication, which began with papers submitted to the seventh meeting of the American Association for the Advancement of Science, illustrates this; it was particularly bitter, and evidence of a growing rift between the two groups (Holmfield, 1970; Daniels, 1967).

Particularly during the nineteenth century, the amateur naturalist has had some influence on publication patterns. Certain specialisms seem to have been especially amenable to amateur research, and, consequently, the publisher, whoever that might be, has been able to count on a much wider audience for the journal than just the relevant professional peer group. In addition, there have been differences in the general speed of professionalization of natural history in different countries. Germany and America effectively separated mainstream science from the amateur by about mid-nineteenth century. In France, the amateur remained an effective force, but was not nearly as important as in Britain. In this country, the amateur played a vitally important role, not only as an active participant, but also in giving financial support to research publication, both in the nineteenth century and for a significant part of the twentieth-century.

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The Changing Appearance of Research Journals in Science and Technology: An Analysis and a Case Study

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Introduction

The primary journal has been called the ‘keystone’ of the formal communication system in science and technology (King, 1977). It is the main vehicle for making public the results of original research in these fields. Although journals play an important part in information transfer in all disciplines, they are of particular significance in scientific communication:

In science there is a continual replacement of the old by the new, of the previous by the present ... and the errors and defects and obscurities of old times are superseded actually and replaced by further and more accurate knowledge. (Ferguson, 1932, quoted by Kronick, 1976)

The journal provides the ideal means for the rapid dissemination of recent research, and is therefore well suited to serve the communication needs of science and technology. The modern scientific journal displays in highly developed form those bibliographical and stylistic characteristics which are associated with scholarly journals in general, such as the presence of an abstract separated from the main text of an article, and a clear, logical, standardised method of presenting research findings.

The origins of the modern research journal can be traced back to the second half of the seventeenth century, when modern science itself was developing. The growth of scientific journal publishing since then has kept pace with the growth of the scientific community and the development of new specialisms (King et al., 1976). The primary journal is a by-product of the modern scientific revolution. But, equally, the journal, whose form and functions lie somewhere between the book and the newspaper, has been an important instrument in the development of science. The journal has proved to be peculiarly well suited to provide for the particular combination of information requirements demanded by formal scientific communication. These include recency, originality, objectivity, verifiability and variety (Ziman, 1978). Such qualities, of course, relate to the content of the infor-