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INTRODUCTION

Librarians have long recognized the principle that their collections should be able to serve both immediate and future needs. Thus they collect scientific books, and scientists use these books for two main purposes: (1) to aid in the discovery of new scientific facts, principles and theories, and (2) to aid in the historiography of science. The first of these purposes tends to dominate the second, but in recent years the history of science, by definition an interdisciplinary field, has become a respected and full-fledged discipline itself. This paper has

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been written to provide other librarians with background information on the
development of this interesting and increasingly popular field, to mention
guides to its voluminous literature, to note some of the problems that it
presents for librarians, and to look at a few of the ways that librarians in
institutions offering courses in the history of science have organized their
collections.

Collingwood states that "natural science as a form of thought exists
and always has existed in the context of history and depends on historical
thought for its existence." Scientists and historians however tend to go
their separate ways, and the historian of science was often regarded as a hybrid.
George Sarton (1884-1956), by lecturing at Harvard, editing journals, and
writing constantly, was responsible more than any other individual for the
acceptance of the history of science in the academic world. It is now widely
regarded as an important part of the "New History," but this acceptance has
not come overnight. Much time and energy have been expended by Sarton and others
not in writing the history of science but in writing apologetae, books and essays
on the value of such history.

Some of the more common and oft-repeated arguments for its value may be
briefly summarized as follows:

1. The "secret history" of man (his religion, art, philosophy and science)
is more "essential" than mere political or economic history. A study of the
history of science deepens an appreciation of our heritage from the ancients.

2. The history of science can help bridge the gap between the sciences and
the humanities (Snow's "two cultures") and counteract some of the dangers of
extreme specialization.

3. East and West should understand each other better, and the history of
science affords a meeting place for such an understanding. According to Sarton
there have been four main periods in this history, two Eastern and two Western
periods: Ancient Science (Mesopotamian and Egyptian), Greek Science, Muslim
Science (8th to 11th centuries), and Modern Science. An understanding of these
periods helps us to appreciate the unity and continuity of man's intellectual
and spiritual pilgrimage.

4. The emulation of heroic deeds should be encouraged. The stories of the
struggles and triumphs of scientists afford many such examples.

5. The subject has practical value for members of various "parascientific
professions": writers, teachers, philosophers, historians, librarians, curators,
editors and publishers.

6. The history of science is interesting in itself and needs no apology.
Cohen, tired of the analogy of the bridge between disparate groups, is especially
outspoken on this point:
We need seek no "excuse" for our inquiries into the origins and development of any activity which for more than two millennia has attracted to itself some of the best minds the world has known.\textsuperscript{9}

Bare and oversimplified summaries such as these are wide open to criticism, but this is not the place for a debate on the validity of the arguments. The important point is that spokesmen for the history of science have, in one way or another, been successful in selling their product to the academic world.
Ancient and Medieval Writers. Although it is generally agreed that the study of the history of science is basically a modern movement, its beginnings lie somewhere in antiquity. The authorities do not agree at all, however, on who was the first historian of science. Sarton's *Introduction to the History of Science,* with its massive documentation of ancient science, shows quite clearly that such an assignment of priority would require a strict definition of terms. Thus according to Plessner, "The founder of this field of learning is Aristotle [384-322 B.C.] whose textbooks opened with historical reviews." One of Aristotle's disciples, Eudemos of Rhodes (flourished c. 320 B.C.), whose writings on the history of arithmetic, geometry and astronomy are available unfortunately only in fragments embedded in the strata of later writings, is sometimes spoken of as being the first historian of science. Earlier than either of these, however, was Hippocrates of Cos (born c. 460 B.C.), popularly known for centuries as the "Father of Medicine," who somewhere between 430 and 420 B.C. wrote a treatise on what was then considered ancient medicine.

Many centuries later the historiography of science was furthered by the contributions of a handful of Muslim scholars. Notable among these were Ibn Sa'id of Toledo (1029-1070) whose *Tabaqāt al-Umam* a universal history, included much on the progress of science, Ibn al-Qifti of Egypt (1172-1248) who wrote 414 biographies of ancient and Muslim scientists, philosophers and physicians, and Ibn abī Usaibī'a of Syria (1203-1270) whose *Uyūn al-Anbā* consists of over 400 bio-bibliographies of ancient and Muslim physicians (men who were often scholars in what we today would call one or more of the sciences).

The Scientific Revolution and Modern Writers. Although Sir Francis Bacon (1561-1626) is best known for his discussion in the *Novum Organum* (1620) of the inductive method of reasoning and for his optimism about the possibilities of experimental science, he should also be remembered for his urging in *The Advancement of Learning* (1605) that the study of civil and ecclesiastical history should be supplemented and enriched by the study of the history of learning.

As the progress of science in the seventeenth and eighteenth centuries reached revolutionary proportions, writers in many fields were seeking to popularize it. Mention can be made here only of Denis Diderot (1713-1784), whose famous *Encyclopédie* attempted to apply the new science to many phases of life, and Voltaire (François Marie Arouet, 1694-1778) who included the history of science and technology in his famous *Essai sur les Moeurs et l'Esprit des Nations* (1756), a work which put into actuality what Bacon had proposed earlier.
Meanwhile practitioners of the various sciences had begun to produce histories of their specific fields. These were solid technical studies, but were written from a very restricted point of view and thus altogether different from what Bacon and Voltaire had hoped for. During the closing years of the seventeenth century and through the eighteenth and nineteenth a great many of these appeared. For example (mentioning authors but not titles), Daniel Le Clerc (1652-1728), John Freind (1675-1728), and Charles Victor Daremberg (1817-1872) wrote histories of medicine. Histories of botany were written by Olaf Celsius (1670-1756), Christian Konrad Sprengel (1750-1816) and Julius von Sachs (1832-1897). Johann Christoph Heilbronner (1706-c. 1747), Abraham Gotthelf Kastner (1719-1800), Jean Étienne Montucla (1725-1799), Moritz Cantor (1829-1920), and V. Bobynin (1849-1919) produced histories of mathematics. Jean Sylvain Bailly (1736-1793) and Jean Baptiste Joseph Delambre (1749-1822) wrote on the history of astronomy, and Johann Beckman (1739-1811) on the history of inventions and discoveries. Joseph Priestley (1733-1804), Johann Karl Fischer (1760-1833), and Johann Christian Poggendorff (1796-1877) wrote histories of physics. And chemistry was covered by Johann Friedrich Gmelin (1748-1804), Thomas Thomson (1773-1852) and Hermann Franz Moritz Kopp (1817-1892).

According to Guerlac, "These contributions were notable, but the unity of science, to say nothing of the cultural environment in which it arose, was hardly suggested." Some of the later authors would perhaps not deserve such a criticism, but for most it would be a fair assessment. At any rate these were histories of the separate sciences and are not considered the true forerunners of the present movement.

The unifying concept of the "histoire générale des sciences," about which Sarton and others have said so much, was first clearly propounded by Auguste Comte (1798-1857) in his Cours de Philosophie Positive (1830-1842). Better known for positivism and as the founder of sociology, Comte urged the study of the history of science as an important aspect of the story of man's intellectual progress, and he was the first to suggest that academic chairs be established for it. Several decades were to pass however before the latter suggestion could be implemented.

Although it is sometimes referred to as the first modern history of science, the monumental three-volume History of the Inductive Sciences (1837) by William Whewell (1794-1866) failed, in spite of its broad scope, to achieve a unified presentation simply because it was a collection of separate histories of the various sciences. What unity Whewell was able to achieve is found instead in The Philosophy of the Inductive Sciences, Founded upon Their History (1840).

The first great historian of science in the modern sense--i.e. one devoted to the history of science rather than to the history of a science--was Paul Tannery (1843-1904), a French government official and a true scholar, who wrote voluminously on many aspects of the history of science, of medicine and of technology, always admitting his great indebtedness to Comte. To him this history was the key to all modern history. "Perhaps," says Hall, "more than any other single scholar he raised the history of science from the level of a chronicle to intellectual history."
6.

George Sarton (1884-1956) and Aldo Mieli (1879-1950) took up where Tannery had left off, with both of them devoting their careers to the study and promotion of this general history. Sarton, a native of Belgium with a doctorate in mathematics (University of Ghent), moved with his family to the United States in 1915. Associated for many years with both the Carnegie Institution of Washington and Harvard University, he was the most prolific writer and editor and most tireless and ardent propagandist of the history of science movement. One of the most erudite men of all time, it is ironic that he will probably be remembered more as a bibliographer than as a historian. Generations of historians will doubtless use and be thankful for his encyclopedic *Introduction to the History of Science,* with its thousands of biobibliographies, but his attempts at historical interpretation as in his *History of Science* were far less successful.

Mieli was likewise a productive historian and popularizer. Because of political danger he was compelled to leave his native Italy, spending his later years in France and Argentina. Writing in Italian, French, or Spanish, Mieli was truly cosmopolitan in both interests and abilities.

Lynn Thorndike (1882-1965), medieval historian at Columbia University, will be remembered partly for his scholarly work of editing and translating texts and especially for *A History of Magic and Experimental Science,* a work whose thesis that today's science is an outgrowth of primitive magic has not been above criticism, but whose emphasis on the continuity of past and present has been very influential.

With much of the groundwork of bibliography, chronology, editing and translating having been done for them, and with solid training themselves in historical methods and in one or more of the sciences, today's generation of historians of science is truly professional. More and more of them have full-time teaching or research positions. According to Multhauf, the articles in the 1952 volume of *Isis* were written by 39 percent professionals and 61 percent amateurs; by 1962 the ratio was 58 percent for professionals and 42 percent for amateurs.

The profession has "arrived" and this security is reflected in the non-apologetic tone of its literature, in its increasing emphasis on interpretation rather than the mere accumulation of facts, in its closer cooperation with the philosophy of science, and in recent appeals for specialization within this vast and complex discipline. Thus Cohen would distinguish between "pure history of science" and "applied history of science," meaning that the "pure" activities of collecting, editing, translating, and critically annotating are never finished and must be furthered continuously if the "applied" functions, such as humanizing engineering and scientific studies, adding perspective to the philosophy of science, and providing background for industrial history, are to have any foundation.

Koenig would distinguish between the "inner history of science" that "deals with the chronology of the development of science . . . and with the relation of this chronology to the logical order . . . of the body of scientific knowledge" and the "outer history of science" that "deals historically with the interrelations between science . . . and the main bulk of extrascientific matters." Lilley writes in a similar vein:
The history of science cannot be explained as a causally connected development unless two types of causes are taken into consideration: (1) those arising from the internal coherence of science itself, and (2) those arising from the action of society on science.\textsuperscript{27}

Passmore maintains that the unity of the history of science is a unity of spirit and of method, that any attempt to encompass the whole field and also deal adequately with the extrascientific cultural world in a single treatise is futile, and that therefore historians must specialize by concentrating on quite specific problems.\textsuperscript{28}

Specialization, however, should not de-emphasize the broad cultural history of man, and Crombie is thankful that the nineteenth-century stress on political history, perhaps inevitable in an age of nationalism and empire-building, has given way to this broader concept:

Historiography must perhaps always reflect the problems of its own time. The character of life in our own day gives a new relevance to the eighteenth-century historians whose view included the whole of civilization. The present interest in social, intellectual, and scientific history and in the comparative method are in a sense a return to the ideas with which modern historiography began in the age of Voltaire. Once more, historians in their analyses of human behaviour and human society are seeking enlightenment from all aspects of civilized life. Historiography is again becoming the study of civilization as a whole, with the potentiality of providing a bridge, instead of reflecting a division, between the scientific and humanistic sides of our education.\textsuperscript{29}

**ORGANIZATIONAL ASPECTS OF THE HISTORY OF SCIENCE**

The full stature of the history of science is reflected in at least four organizational aspects: (1) periodicals, (2) academies and societies, (3) international and national congresses, and (4) university and college curricula. The long and difficult but successful struggle in each of these areas is an interesting story in itself, but only a few highlights can be given here.\textsuperscript{30}

**Periodicals.** Periodicals have played an important part not only in the progress of science itself but also in its historiography. Three types have been important for this latter purpose: (1) the many general scientific and historical periodicals that contain occasional articles on the history of one or more sciences; (2) periodicals devoted to the history of a particular science; and (3) those covering the general history of science rather than the history of any specific science.
All three of these are given current bibliographical coverage by *Isis*, in which a recent "Critical Bibliography" lists 137 periodicals as being examined systematically, and by Section 22 of *Bulletin Signaletique* which covers over 2500 periodicals in many subject fields. A selective list of 28 titles, current and retrospective, may be found in Malcès, while a still more selective one of 15 titles, with annotations but somewhat outdated, may be found in Sarton's *Study of the History of Science*; full bibliographical details for several hundred titles may be found in Sarton's *Horus: a Guide to the History of Science*.

The *Mitteilungen zur Geschichte der Medizin, der Naturwissenschaften und der Technik* (1902-1942) had a distinguished history as a review type of journal. Also of great importance was the *Archiv für die Geschichte der Naturwissenschaften und der Technik*, featuring long monographic articles, founded in 1909 and continuing, with two title changes along the way, until 1942. *Rivista di Storia Critica delle Scienze Mediche e Naturali* was another early title; founded in 1910, it is still being published. *Isis*, founded in 1913 by George Sarton in Belgium, but interrupted in its publication from 1914 to 1919, has been the most influential of all. When Sarton came to the United States in 1915 he brought his publication with him and continued as its editor until 1952. In 1919 when it began to seem that *Isis* had become a war casualty, Aldo Mielì founded *Archivio di Storia della Scienza* which, under its later title *Archeion*, became a casualty itself in 1943. Resurrected in 1947 but under still another title, *Archives Internationales d'Histoire des Sciences*, it continues to be an influential journal. These are but a few of the periodicals of importance; many others have appeared since 1919. Their international aspect is reflected both in their titles and in their places of publication. The Malcès list, for example, includes periodicals that are (or were) published in London, Rome, Bologna, Brussels, Paris, Copenhagen, Stockholm, Leipzig, Berlin, Zurich, Berne, Madrid, Leningrad, Cambridge, Mass., and New York. Such a listing of places would be multiplied several times if the *Isis* or *Bulletin Signaletique* lists were used.

**Learned Societies, Academies and Congresses.** Much of the publication in the history of science, including both serial and monographic types, is the work of the large number of societies or academies that are devoted to the history of one of the sciences, of a group of sciences, or of science and/or technology in general. These are at regional, national and international levels.

The oldest of the national societies for the history of science is the Deutsche Gesellschaft für Geschichte der Medizin und der Naturwissenschaften. It was founded in Hamburg in 1901 by a group that included the great medical historian, Karl Sudhoff (1853-1938), and was reorganized in 1949 as the Deutsche Vereinigung der Medizin, Naturwissenschaft und Technik. It was followed in 1907 by the Società Italiana di Storia Critica delle Scienze Mediche e Naturali, one of the founders of which was Domenico Barduzzi (1847-1929).
Other national societies (with places and dates of founding) have been established as follows: Genootschap voor Geschiedenis der Geneeskunde Wiskunde en Natuurwetenschappen (Society for the History of Medicine, Mathematics and Natural Sciences), Leiden, 1913; Schweizerische Gesellschaft für Geschichte der Medizin und der Naturwissenschaften, Zurich, 1922—one of its publications is Gesnerus; History of Science Society, founded by David Eugene Smith (1860-1944) and others in Boston, 1924—it has sponsored Isis since that date; Groupe Français d'Histoire des Sciences, Paris, 1931—it publishes the Revue d'Histoire des Sciences; Comité Belge d'Histoire des Sciences, Brussels 1933; Lardomhistoriska Samfundet (Swedish Society for the History of Learning), Uppsala, 1934—it publishes Lychnos; Grupo Português da História das Ciências, Lisbon, 1937; Japanese Society for the History of Science, 1941; and British Society for the History of Science, London, 1947—it publishes the British Journal for the History of Science. These and other national societies have contributed to the development of the discipline not only by their publications but by their annual meetings and special events.

The most exclusive of all the history of science organizations is the International Academy of the History of Science. Founded in Oslo in 1928 by Aldo Mieli, George Sarton, Lynn Thorndike and others, it is limited to an elected membership of 150. Closely related to the International Union of the History of Science (established 1947) and cooperating with both UNESCO and the International Council of Scientific Unions, its official organ is Archives Internationales d'Histoire des Sciences. The Academy and the Union sponsor triennial International Congresses of the History of Science and Technology which have been held as follows: I-Paris, 1929; II-London, 1931; III-Coimbra, Portugal, 1934; IV-Prague, 1937; V-Lausanne, 1947 (planned for 1940 but postponed by the war); VI-Amsterdam, 1950; VII-Jerusalem, 1953: VIII-Florence - Milan, 1956; IX-Barcelona - Madrid, 1959, X - Ithaca, N.Y. - Philadelphia, 1962; and XI - Warsaw - Krakow, 1965. Official proceedings have been published in monographic form for Congresses III, V-IX, while summaries, discussions, and some individual papers of these and the other Congresses have appeared in various journals. Congress XII is to be held in Paris, August 25-31, 1968. 35

Prior to 1929 (as well as since) historians and philosophers of science have participated to some degree, sometimes by means of special sections, in the International Congresses of History (Historical Sciences) and the International Congresses of Philosophy. Both of these series began in 1900 and both have published proceedings. Historians also participate in congresses organized around many different scientific subject areas and publish accordingly.

Academic Chairs and Departments. Since the time of the French Revolution the history of medicine has been taught in various universities, and since the early nineteenth century many German professors of chemistry have regularly included some history in their courses of lectures. But according to Sarton the first chair in the general history of science was established at the Collège de France in 1892 with Pierre Laffitte (1823-1903), the leading positivist of the day, as the first professor.
By 1903 Paul Tannery had acquired his reputation as a science historian of the first rank and was the logical person to succeed Laffitte, but administrative bungling resulted in the appointment of an incompetent instead. The blow was probably responsible in part for Tannery's death the following year.3

Shortly before 1900 Ernst Mach (1838-1916) held a professorship at the University of Vienna in the History and Theory of the Natural Sciences, and soon after the turn of the century a similar chair was established at the University of Paris. Certainly the most famous professor of all has been Sarton who taught the History of Science at Harvard from 1916 to 1956.

From humble beginnings and widely scattered professorships, the history of science as an academic discipline has grown in recent years to such an extent that it is now a part of the curricula of many colleges and universities in various parts of the world. Dijksterhuis in 1949 listed 210 courses in 112 institutions in the following countries: South Africa, Germany, England, Argentina, Australia, Austria, Belgium, Canada, Denmark, Spain, United States, France, Greece, Hungary, Ireland, Israel, Italy, New Zealand, Netherlands, Poland, Portugal, Roumania, Sweden, Switzerland, Czechoslovakia, Turkey, Uruguay, and Yugoslavia.37

Strong undergraduate and graduate programs are offered in Great Britain at the University of London, Cambridge and Oxford, and at least some courses are offered in almost every other British university as well as in many of those in the Commonwealth.38 Incidentally, the Syllabus of Examinations of the Library Association includes an optional section on the history of science.39 At the University of Moscow, by way of contrast, there are no courses in the general history but there are courses in the histories of particular sciences.40

According to Roller there are at least 94 colleges and universities in the United States that now offer one or more courses.41 The picture is one of such variety, however, that it is almost futile to speak of a typical program. There are both graduate and undergraduate programs, ranging from single courses to full doctoral programs. Courses are offered within departments of history, departments of philosophy, one or more of the science departments (including medicine), or within separate departments of the history and/or philosophy of science.

There are doctoral programs in the History of Science at Harvard, Johns Hopkins, and Wisconsin; in the History of Medicine at Johns Hopkins; in the History of Mathematics at Brown; and in the History and Philosophy of Science at Indiana, Pennsylvania, and Princeton.42 The History of Science as an area of concentration for the Ph.D. in History is offered by California (Berkeley), California (Los Angeles), Chicago, Cornell, Illinois, Kansas, City University of New York, Oklahoma, Pittsburgh, and Washington, as well as those just mentioned. The Philosophy of Science as an area of concentration for the Ph.D. in Philosophy is offered by at least thirty-five universities.43 According to an earlier study by the present writer, at least nineteen American universities between 1955 and 1964 accepted doctoral dissertations that were clearly in the area
of the history (and philosophy) of science. A few of these universities have never had full-scale programs or have abandoned them, but the over-all picture is that of a steady increase rather than a decrease.

**DIFFICULTIES IN CollectING**

Problem areas for the librarian who is responsible for supporting an academic program in the history of science include these: (1) breadth of the field and shifting boundaries, (2) antiquarian bookmanship, (3) bibliographic organization, and (4) classification schemes.

Because of its tremendous scope the history of science demands good libraries for its foundation. Thus Sarton wrote:

The history of science is like any other discipline in the field of science or the humanities, in that the fundamental work is slow and difficult, and the results austere. It is also expensive, or at least seems to be. It requires the most expensive of all scientific instruments, far more expensive than the greatest telescopes or cyclotrons—a large library, the larger the better (try to evaluate the total cost of such libraries as the Library of Congress or the Harvard College Library).

Not all historians of science can be served by libraries of this calibre, nor would an undergraduate course or two require such facilities, but a graduate program demands books, periodicals, manuscripts, artifacts, and reports, in quantity, in various languages, and through a wide spectrum. It is to be hoped that new programs will be initiated only after there have been certain discussions with the librarian, an adjustment of his budget for materials, and a reasonable agreement on time goals.

In a fairly recent issue of *Isis*, Multhauf writes that "The subdivisions of science are after all to a degree synthetic, and journals in our field have a unique opportunity to show their interconnections." No doubt this is true, but for the practising librarian these frequently shifting and overlapping boundaries among the sciences present quite a challenge. Rigid pigeonholes for scientific materials will obviously be inadequate.

Some authorities include the applied sciences in the general history of science, while others do not. There was strong disagreement between Thorndike and Sarton on the place of error (magic and the pseudo-sciences) in this history. Sarton seems inconsistent, including in his *Introduction to the History of Science* much material on such topics as religion, philology and music, but excluding technology and giving scant attention to medicine. Meanwhile historians of medicine have been going their own way, with numerous journals and societies devoted to that field, but historians of technology have been slower in getting themselves established. Singer and his colleagues completed their monumental *History of Technology* in 1958. Forbes's *Studies in Ancient Technology* was completed in 1959.
Much of the material needed for research in the history of science is old and often rare. The competition among libraries in acquiring such scarce materials has become so keen that it probably would be foolish for a librarian to attempt to start a collection of rare books for the history of science. According to Peckham,

> It is virtually impossible today for a library to begin a rare book collection from scratch, from absolute zero. The cost of acquiring an initial corpus of books—a minimum number which could be called a collection and be worth the attention of a scholar—is almost prohibitive. Most rare book collections are built on an initial gift of several hundred or several thousand rarities from a private collector.\(^5\)

As will be seen below, practically all of the academic libraries with special collections for the history of science have been the recipients of private collections amassed either through great wealth or by position of influence.

Assuming that a library has substantial material to support the history of science—either in the form of old and well developed general collections or in the form of (perhaps recently acquired) special collections—how does the librarian build on such a foundation? Archer and his associates discuss many of the problems in acquiring rare books and offer helpful solutions, but they seem to imply that practical experience is by far the best teacher.\(^5\)

Fortunately there has been a great deal of bibliographical activity in this field, but unfortunately the work has been fragmented. The handbooks and treatises by Sarton and the great multivolume work by Thorndike contain a wealth of bibliographies and references, especially valuable for older and more exotic sources.\(^5\) Thornton and Tully's Scientific Books, Libraries and Collectors is a useful work that gives a wide-sweeping historical and bibliographical survey.\(^5\) Also of value is Thornton's Medical Books, Libraries and Collectors.\(^5\)

Besterman lists dozens of bibliographies for the history of science in general, for particular sciences and groups of sciences, for pseudo-sciences, for scientific work in various countries and regions, and for individual scientists.\(^5\) The catalogs of the great national libraries, catalogs of scientific and medical libraries, national and regional catalogs of imprints, auction and dealers' catalogs, catalogs of manuscripts and archives, censuses of incunabula, lists of serials, lists and indexes of dissertations, guides to reference books, catalogs of government publications, bibliographies and biobibliographies of scientists, literature guides and indexes and abstracts of scientific literature are all taken for granted and need not be listed here.

Both comprehensive catalogs of special collections and selective lists for exhibitions have become rather commonplace. Outstanding examples of the comprehensive catalog include those of the Waller Collection at the University of Uppsala\(^5\) and the Osler Collection at McGill University.\(^5\)
Several other examples are mentioned below, in connection with specific American universities. Examples of the selective catalog and exhibition handlist include the Pierpont Morgan Library's *2000 Years of Science, Hippocrates to Leonardo*, the Burnby Library's *Heralds of Science*, the Linda Hall Library's *Some Milestones in the History of Science*, and the Grolier Club's *One Hundred Books Famous in Science*.

The best bibliographical information for current work and for secondary source material is found in the "Critical Bibliography" section of *Isis* and in Section 22 of *Bulletin Signalétique*. A new publication that is of great interest because of its almost unique concern with modern science is the *Newsletter* of the Center for History and Philosophy of Physics at the American Institute of Physics in New York. McKie's three-part bibliographical survey covers the literature in English of the 1945-1960 period.

Several scholars have discussed research opportunities and priorities and have indicated desiderata. These should be helpful to both historian and librarian. Guerlac, in a paper delivered to the International Congress of Historical Sciences in 1950, provides a valuable survey of the historiography of science, discusses possible new approaches, and calls upon his profession to provide a greater number of general histories of an integrating and interpretative type. At the same time he calls for a greater supply of source materials in the form of modern critical editions, translations of Latin, Hebrew and Arabic scientific works, and facsimile editions of scientific classics. His paper gives an outline discussion of bibliographical and publishing needs for each period in the history of science. Forbes's paper before the same group ten years later calls attention to some of the same desiderata but with more emphasis on the history of technology. Bell's excellent bibliographical survey covers early American science only. McDermott covers many areas that either include or border upon American science.

Whitrow is editing a fifty-year index to the *Isis* bibliographies which when completed should prove to be a landmark reference work. Meanwhile Garfield and his associates have shown that citation indexes can be useful tools for the science historian and librarian.

Obviously a history-of-science librarian must be a student of bibliography, with his information coming from many sources. That he must also be a classification expert is debatable. It is true that there has been much discussion through the years about classification in the sciences. Vickery summarizes much of this, and Lorphevre lists schemes for the sciences from Gesner to the present time. Many of the special collections for the history of science, however, are in closed stacks where the classification scheme is relatively unimportant. As Baughman points out:

In rare book libraries with closed stacks, the objections to maintaining collections in separate units and in orders different from the library's primary classification system are difficult to support by logic. In reality it makes little difference how books are arranged on the shelves of a closed stack insofar as the efficiency of reader service is concerned, always providing that the arrangement is controlled by an effective location system.
Several of the librarians therefore who are mentioned below in connection with special collections use either a simple numbering device or an alphabetical arrangement, while others follow the classification used in the rest of the library.

There really is no altogether suitable classification scheme for a history-of-science collection. Whitrow, in discussing such schemes—including those used for the bibliographies in Isis, Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften, Index zur Geschichte der Medizin, Naturwissenschaft und Technik, Bulletin Signaletique, Scientiarum Historia, and Technology and Culture, and for the History of Science section of the University College Library in London—points out the difficulties. These include: (1) the chaotic tangle of historical, philosophical, scientific, and technological emphases within academic programs; (2) the difficulty in handling the relationship of historical and subject facets within a single area; (3) "the shift in the limits of the traditional disciplines through the centuries"; (4) the place of the pseudo-sciences. The Isis scheme has been revised several times and is under revision again because of the difficulty with period, subject and civilization facets. Because of these complexities there will inevitably be certain compromises in any classification for the history of science.

ACADEMIC LIBRARY COLLECTIONS

A form letter was sent in October 1965 to 92 librarians in American colleges and universities that were known to be offering courses in the history of science. The letter, a copy of which is attached as an appendix to this paper, inquired into the nature of special collections for the support of these academic programs. Out of the 65 replies that were received, 57 librarians (or 88 percent) indicated that no special provisions are made for materials in the history of science.

The 57 libraries without special collections for the history of science represent such a variety of institutions (as to level, support, purpose, and control) that tabulations are not meaningful. Hence only a few generalizations will be attempted. The form letter was much too general to allow for the whole complex of factors, such as the degree of centralization, geography (accessibility of other libraries), age of the collection, and tradition on the one hand, and the newness of the history of science in the curriculum, the strength of its faculty, and the degree level of its program on the other.

It must not be inferred from this report that these 57 libraries are failing to support their institutions' programs in the history of science. They are providing support, but not through special collections. Librarians in older institutions are naturally reluctant to pull out their old and expensive sets of scientific serials, for example, and transfer them to a comparatively new collection. A number of respondents mention special efforts that are being made to acquire important works for the history of science, but indicate that the disposition of these works in the library depends on subject classification and degree of rarity. In libraries with subject division arrangements the acquisitions for the history of
Many of these librarians are with institutions that simply offer too small a number of courses to justify a special collection. Others are opposed as a matter of principle to special collections of any kind, preferring a completely integrated collection instead. Quite a few of the university librarians either state or imply that the history of science is such a broad area that a special collection for its support would isolate materials and thus handicap the users in too many other subject areas. At Oklahoma State University a solution has been found in the form of a classified bibliography of over 3000 cards which has been developed instead of a special collection.77

The librarians who report the existence of one or more special collections for the history of science represent Cornell University, Harvard University, Princeton University, and the Universities of California (Berkely), Kansas, Pennsylvania, Texas, and Wisconsin. In the following discussion of these collections the information supplied by correspondence will, in several instances, be supplemented by pertinent references to the published literature.78

At Cornell University there is a special division of the library called History of Science Collections. It consists of old and rare books and manuscripts, and does not include current materials as a rule. The latter are kept in the general stacks. The Library of Congress Classification is used throughout the libraries.79

The History of Science Library at Harvard University is a noncirculating library for faculty and graduate students in the history of science and for upperclassmen majoring in either history or science.80 U. Sarton started the collection in 1912 and, as editor of Isis, was able to assemble through the years approximately 4,000 books, 15,000 pamphlets, 100,000 cards, and numerous portraits, prints, medals, letters, and other archival items, which he gave to Harvard in 1949. Housed in Rooms 185 and 189 of Widener Library, the collection is arranged according to that chronological-geographical-subject scheme that was developed by Sarton for the Isis bibliographies.81 With its policy of coordinated decentralization, Harvard has other libraries with rich resources for the historian of science and technology.82 One outstanding example is the Library of the Museum of Comparative Zoology which was built upon the 6000-volume library of Professor Louis Agassiz and which had reached the mark of a quarter of a million volumes by the early 1950's.83

Although the Princeton University Library provides no large, separate collection for the history of science as such, it does maintain a study room on C Floor of the main building (Firestone Library) for the use of graduate students in the history and philosophy of science. This room, which houses basic reference works in these subjects plus other works likely to be in some demand, is adjacent to the 8000's and 9000's (Science and
Technology in the Richardson Classification) and is near the 0800 collection (Public Documents).

On the Berkeley campus of the University of California the main library and several of the twenty-one branches maintain rare book units and special collections. These contain several sub-units for the history of science, most of which are kept in closed stacks where they are shelved either by physical form and serial number or by the arrangement followed by the original collector. Some of these collections have been provided with their own indexes or finding lists. All receive normal cataloging on cards, including subject headings but excluding subject classification. Published bibliographies are marked to show holdings.

At the University of Kansas the Science Library maintains a general reference collection for the history of science (arranged by Dewey), and the Chemistry Library has a 1500-volume collection on the history of chemistry (now being arranged by size). Even more important are the Ellis, Fitzpatrick, and Linnaeus collections within the Department of Special Collections. The Ralph N. Ellis Collection of some 25,000 volumes covers ornithology (about one-third), voyages and travels, including scientific expeditions (another one-third), and various other areas of natural history and bibliography. The arrangement is by size (for economies in space and binding), then alphabetically by main entry within the nine subdivisions of size. The Thomas Jefferson Fitzpatrick Collection, containing about 8,000 volumes of botany and early American science in general, has for the most part been incorporated into other collections within the department. The Linnaeus Collection consists of approximately 1,750 volumes written by or about Carolus Linnaeus, the great eighteenth century botanist, and was assembled from both the Ellis and Fitzpatrick collections. It is arranged by size and then by publication date. Manuscripts of interest to the historian of science, especially those from the Ellis and Fitzpatrick collections, are kept in the Manuscript Division of the department.

At the University of Pennsylvania most of the material for the history of science is kept as a part of the general collection, partly because of the interdepartmental interest in the subject and partly because of the other Philadelphia libraries with strong historical collections in one or more of the sciences. The university's only special collection for the history of science is the Edgar Fahs Smith Collection in the History of Chemistry. An endowed collection, it is separately housed and is classified, like the rest of the university libraries, by the Dewey Decimal Classification. A catalog was published in 1960.

The History of Science Collection at the University of Texas consists of rare books and manuscripts, with current and less valuable materials on the subject being located in the general stacks. This special collection is classified, along with most of the other libraries on the campus, by the Dewey Decimal Classification.

At the University of Wisconsin materials in the history of science are extensive, with most of them being kept in the general stacks and
arranged according to the Library of Congress Classification. In the Rare Book Department there are two separate collections for the history of science, both of which are arranged by a simple numbering system. One of these is the Denis I. Duveen Collection of over 3,000 items in early chemistry and alchemy, for which the original collector himself compiled and published a catalog in 1949. The university then acquired the collection two years later. The other special collection is the Chester H. Thordarson Collection of natural history and early English science. It was acquired in 1946 and has been discussed in papers by Bay and Hagedorn.

In addition to the special collections of the eight institutions just mentioned, a few remarks about such collections at three other universities will now be offered. At the University of Oklahoma the famous DeGolyer Collection in the History of Science and Technology now contains over 26,000 volumes. Everette Lee DeGolyer (1889-1956), a geologist and petroleum executive, collected intensively in the history of geology but also covered the entire history of science with considerable strength. Expansion of the collection during the last decade has been so rapid that the last checklist, published in 1954, indicates only a fraction of the present holdings. The materials, except for a small reference collection in the reading room, are alphabetically arranged and kept within a closed area on the third floor of the main library. In addition to the card catalog, a file of punched cards has been prepared which will permit a printout by either author, title, or date listing.

At Columbia University the number of courses in the history of science has been greatly reduced in recent years. Meanwhile the History of Science Library and the David E. Smith Library (for the history of mathematics) have been integrated into the library serving the Mathematics Department. The old card catalogs have been retained, but otherwise no special treatment is provided. Of course the rich and varied special collections at Columbia contain numerous treasures that are of great interest to the historian of science.

Joseph K. Lilly's vast collection of Americana and old and rare books on many subjects was estimated to be worth over five million dollars when he gave it to Indiana University in 1956. In 1960 when the collection was moved into its own new building, the Lilly Rare Book Library, it consisted of about 75,000 volumes, including 20,000 first editions, and 1,500,000 manuscript items. One part of this library is a collection for the history of science, but exact information on its size and arrangement was not available for this paper.

In conclusion, the great variety of academic programs for the history and/or philosophy of science and/or technology is reflected in the variety of library arrangements for their support. In most libraries there is no special provision for the history of science because the latter is just one of many subject areas depending on the library for its resources. Faculty and students working in the history of science depend on many areas of the university library, including both general and rare book collections. The relatively small number of collections specifically designated for the history of science usually represent
private libraries that were assembled by wealthy patrons. Some have been bequeathed and endowed, while others were given during the collectors' lifetime, and still others were purchased by the university. Some follow the primary classification scheme of the main library, but materials in closed stacks are often arranged by order of acquisition, by size, alphabetically by main entry, or by a combination of such arrangements.

An increasing emphasis on the history of science in colleges and universities is being matched by a greatly increased output by the publishers. Not only are new periodicals, textbooks, and reports of research appearing more frequently, but reprints of primary sources are also being offered. It is hoped that this trend will continue.
REFERENCES


6. Eric Temple Bell however, in The Development of Mathematics (New York, McGraw-Hill, 1940, p. viii), cautions that "Nothing is easier ... than to fit a deceptively smooth curve to the discontinuity of mathematical invention." According to him historians tend to stress the continuity but mathematicians the discontinuity.


39. Library Association (London). *Syllabus of Examinations 1963.* London, Library Association, 1963, pp. 11,22. In Part II of the Final Examination for qualifying as an Associate of the Library Association, the candidate writes six three-hour papers on topics chosen from a fairly long list. One of the topics that may be chosen is "Bibliography and Librarianship of History of Science, 1600-1900."


41. Roller, Duane H. D. "Institutions Offering One or More Courses in the History of Science." Unpublished checklist prepared in the History Department, University of Oklahoma.


52. Archer, *Rare Book Collections*, op. cit.

53. See references 10, 11, 21 and 23.


60. Burndy Library, Norwalk, Conn. Heralds of Science, as Represented by Two Hundred Epochal Books and Pamphlets Selected from the Burndy Library. With notes by Bern Dibner. Norwalk, Conn., Burndy Library, 1955.


63. See "Periodicals" section in Chapter III above.

64. Volume 1, whose first issue appeared in May 1964, was called the Newsletter of the Project on the History of Recent Physics in the United States.


74. Baughman, Roland O. "Organization of a Collection." In Archer, Rare Book Collections, op. cit., p. 36.

75. Whitrow, op. cit.

76. See reference 41. The letter was not sent to the University of Oklahoma because of the author's familiarity with the library of that institution. One college was omitted through a clerical error.


78. Rubinstein, Joseph. "The History of Science: Library Resources and Academic Programs of Teaching and Research in the Middle West," Library Resources & Technical Services, 2:3-15, Winter 1958. This excellent article discusses holdings in eighteen university libraries, including several whose librarians did not reply to the present author's letter of inquiry.


Holland

Collection of Ornithology in the University of Kansas Libraries.
Lawrence, University of Kansas Libraries, 1957; Williams, Terrence, comp. A Checklist of Linneana, 1735-1835, in the University of Kansas Libraries. Lawrence, University of Kansas Libraries, 1964. Mengel has been at work for a number of years on a multi-volume bibliographical catalog of the ornithological works in the Ellis Collection.


ADDITIONAL REFERENCES


Dear Sirs:

We are interested in finding out how college and university librarians organize their collections for the support of courses in the history of science. We understand that your institution includes such courses in the curriculum, and we should like very much to find out (1) whether or not you maintain one of more special collections in the history of science; (2) if there are such special collections, how they are classified, or otherwise organized for use.

Any library handbooks, reports, or reprints of articles on this subject would be greatly appreciated.

This letter is being sent to over ninety academic libraries. The findings will be summarized and incorporated in a paper being prepared on the subject of library resources for the history of science. Your cooperation is respectfully requested and will be greatly appreciated.

Sincerely yours,

Harold E. Holland

mpe
Harold E. Holland has recently been appointed an assistant professor at the School of Library and Information Science of the University of Missouri. Born in Nashville, Tennessee, in 1924, he is married and the father of four children.

He has attended David Lipscomb College, Harding College (B.A. in English, 1945; M.A. in Religion, 1955), Vanderbilt University, Columbia University (M.S. in Library Service, 1957; now a doctoral candidate), and the University of Southern California.

Mr. Holland has served as a minister of the Churches of Christ (often on a part-time basis) in Tennessee, Arkansas, New York, California, North Carolina, and Ibaraki Prefecture, Japan. Library positions have been as follows: Teacher-Librarian, Franklin Junior High School, Yonkers, New York, 1956-57; Assistant Technical Librarian, Linde Company, Tonowanda, New York, 1957-58; Librarian, Pepperdine College, Los Angeles, 1958-61; Cataloger and Supervisor of Technical Services, Aerospace Corporation, El Segundo, California, 1961-63. He has held the following teaching positions: Instructor in Physics, Lipscomb College, 1946-47; Assistant Professor of English and Bible, Ibaraki Christian College, 1950-54; Visiting Lecturer in Library Science, University of Southern California, summer 1961; Assistant Professor of Library Science, University of Oklahoma, 1963-64; Teaching Assistant, School of Library Service, Columbia University, 1964-65; Associate Professor and Chairman, Department of Library Science, Appalachian State Teachers College, 1965-67.

Mr. Holland is a member of various national and regional library associations, the History of Science Society, the Disciples of Christ Historical Society, and the Hymn Society of America. He has contributed articles to several library periodicals and religious journals. His proposed dissertation will be devoted to the development of Nashville as a religious publishing center.
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