

LECTURE 15

BIOCHEMISTRY : BOOKS AND SERIALS

For this special application of the science, the chemistry of living matter, there are various designations; the older term, physiological chemistry, was given when it was considered as a subdivision of physiology; now the word biochemistry is used rather more often, and the tendency is to regard it as an application of chemistry. The classification of the books and serials is affected by this double relationship, so that while most of the books are classified in 612.01, and the older serials in 612.05, the newer books are scattered among 547, organic, 615, pharmaceutical, 616, pathological with a few in 543, and some in the decimal subdivisions of these; the serials started more recently are in 540.5 in part, with some in special places as, Endocrinology, in 612.405.

The literature may be divided as follows:

A. Books

1. General works
2. Laboratory manuals
3. Monographs on special topics
4. Encyclopedic works, including methods

B. Serials

1. "Original paper" serials
2. Reference serials

A.1. *General works*

The most recent one here is T. B. Robertson's Principles of bio-chemistry, for students of medicine, agriculture and related sciences, 1920: this is particularly valuable for its discussion of the general chemistry of the cell, without special medical application; there is much descriptive material, with some tests; lists of references are given at the close of the chapters, including both books and serial articles. Of same year is Mathews' Physiological chemistry, Ed. 3, 1920, with even more descriptive material and longer lists of references; Ed. 2, 1916, is here.

Differing slightly in that it contains experiments and work for the laboratory is Plimmer, Practical organic and biochemistry, New ed. 1918; this is really the third edition of his Practical and physiological chemistry; being originally designed for use in the laboratory, it has less discussion of theories than the Robertson and Mathews, and much space is given to directions for laboratory work. A similar volume by an American author is Hawk's Practical physiological chemistry; this is revised often, Ed. 6, 1918, Ed. 7, 1921; the latest revision should always be used. In the work by McLeod and Pearce, Physiology and biochemistry in modern medicine, 1918, the attempt is "to present biochemical knowledge in terms rather from the physiologist's standpoint as an integral part of his subject," and there is naturally more physiology than biochemistry. Even the latest edition of Long is rather old; Ed. 7 of Hammarsten, in English here, is 1914; this is more like Mathews than Hawk. Bottazzi, 1902, is here in German; Lambing, French, 1911, is not very comprehensive.

Of the German texts the newest is the fourth edition of Abderhalden's *Lehrbuch*, (originally thirty lectures) now in two volumes, 1920; this gives many references, and some tests. Hoppe-Seyler's *Handbuch der physiologisch-und pathologisch-chemischen Analyse*, edited by Thierfelder, Ed. 8, 1909, is more of a reference book, than a general text, being almost a miniature encyclopedia for biochemistry. Older works, on the order of Abderhalden's *Lehrbuch* are in German, Bunge, second English from the fourth German edition being 1902, Thudichum, 1872, Lehmann, Ed. 2, 1899; also Wurtz, *Traité de chimie biologique*, 1885; Ed. 7, of Halliburton, *Essentials*, is 1909.

A, 2. *Laboratory manuals*

Hawk and Plimmer of the works just mentioned are intended for use in the laboratory; Cole, *Practical physiological chemistry*, Ed. 4, 1914, is about as large; Cramer, *Directions*, Ed. 3, 1917, for the medical students is about 100 very small pages; Jackson, *Directions*, Ed. 2, 1903, is a trifle less than Cole. Salkowski's laboratory manual, is here in the edition of 1904 in English; Schulz's *Praktikum*, Ed. 3, is of 1908; Abderhalden's *Physiologisches Praktikum* is here in the edition of 1912, but this has probably been revised.

A, 3. *Monographs on special topics*

Here perhaps the first in importance is the English series, *Monographs on biochemistry*, published by Longmans, Green & Co.; the plan of the series was to provide small works, moderate in price, revised thoroughly at frequent intervals, giving the newest information; these were to contain lists of the most recent literature, and this plan has been followed very closely, but the price has ceased to be small. Some notable numbers are, Leathes, *The fats*, Harden, *Alcoholic fermentation*, Bayliss, *Nature of enzyme action*, MacLean on *lecithin*, Osborne, *Vegetable proteins*, Plimmer on *proteins*, and Armstrong on *carbohydrates*.

There are a host of other works published as individuals, upon the subdivisions of biochemistry, as metabolism, dynamics, amino acids, enzymes, effect of drugs, special problems of nutrition, the processes of normal and diseased plant and animal matter. Some of these special works are Van Noorden on *metabolism and medicine* translated from the German; von Fürth, *Probleme der physiologischen and pathologischen Chemie*, 2 vol., 1912; Graham Lusk, *Science of nutrition*, Ed. 3, 1917; Carter, Howe, and Mason, *Nutrition and clinical dietetics*, Ed. 2, 1921.

Some upon a different phase are Fränkel, *Dynamische Biochemie*, 1911, Höber on *physical chemistry of cells*, Ed. 3, 1911, in German; Arrhenius, *Quantitative laws in biological chemistry*, 1915, McClendon, *Physical chemistry of vital phenomena*, 1917, Robertson, *Physical chemistry of the proteins*, Ed. 2, 1918.

Plimmer on *proteins* is in the *Monographs on biochemistry* series; others are Mann, *Chemistry of the proteids*, 1906; E. Fischer, *Untersuchungen über Aminosäuren, Nucleotide und Proteine*, 1906; the works of Schryver; two by Abderhalden, *Neuere Ergebnisse auf dem Gebiete der speziellen Eiweisschemie*, 1909, and *Synthese der Zellbausteine in Pflanze und Tier*, 1912; Underhill's *Physiology of the amino acids* in 1915.

The older work of Cohnheim on *enzymes* may be profitably supplemented by

Hans Euler (-Chelplin), General chemistry of the enzymes, 1912, with Javillier's thesis on proteolytic ferments, in French, 1909; there are also the fourth edition of Oppenheimer, *Die Fermente*, 2 vol., 1913, the English version of Effront on biochemical catalysts, 1917; and the latest edition of Bayliss on enzyme action in the Monographs of biochemistry; Falk's new work in the series of the American Chemical Society is of 1921.

Spiegel, Chemical constitution and physiological action, 1915, and Pittenger, Biochemical drug assay methods, 1914, discuss the action of organic compounds. Czapek, Chemical phenomena in life, 1911, and Tashiro, A chemical sign of life, 1917, are small but important. One of the topics not yet thoroughly understood is taken up by Schäfer, The endocrine organs, 1916, and in Falta, The ductless glandular diseases, translated by Meyers, Ed. 2, 1916. Other examples of very special works are Herter, *Infantilism*, 1908, Funk, *Die Vitamine*, 1914, Abderhalden, *Die Abwehrfermente des tierischen Organismus*, Ed. 3, 1913 and Verworn, *Irritability*, 1913.

Some of the more useful works on the chemistry of plants and their products are these: Practical plant biochemistry, M. Wheldale Onslow, 1920, a small book having references after each chapter; her *The anthocyanin pigments of plants*, 1916, is a study of the origin, distribution and chemistry of these coloring matters; Thatcher, *Chemistry of plant life*, 1921, is an American publication. Two that have been the foundation for much other work, are Czapek, *Biochemie der Pflanzen*, 2 vol., first published in 1905, and Euler, *Grundlagen und Ergebnisse der Pflanzenchemie*, 3 vol. in 2, 1908, translated into German from the original Swedish; Haas and Hill, *Introduction to the chemistry of plant products*, Ed. 1, 1913, has now Ed. 2, 1917, and vol. 1 of Ed. 3 appeared early in 1921; two by Kraemers, *Scientific and applied pharmacognosy*, 1915, Ed. 2, 1920, and *Applied and economic botany*, Ed. 2, 1916, are not wholly chemical, but have importance here; with these may be used Mansfield, *Histology of medicinal plants*, 1916.

Perkin and Everest, *Natural organic colouring matters*, 1918, is an attempt to present the present knowledge of this field in English, since Rupe's *Die Chemie der natürlichen Farbstoffe*, 2 vol., 1900-1909, is now old and available only in German. Some chemistry of plant products is found also in the works on perfumes and flavoring essences, such as these: Gildemeister and Hoffmann, *The volatile oils*, Ed. 2, in 3 vol., 1913-21 (?), Askinson, *Perfumes and cosmetics*, Ed. 4, 1915; both these are translated from the German; Walter, *Manual for the essence industry*, Ed. 1, 1916, is newer and seems to have been written originally in English. Pictet on plant alkaloids has been almost superseded by Henry, *Plant alkaloids*, 1913. The work of Cross with Bevan and others on cellulose belongs rather to industrial chemistry.

Perhaps the largest of the German works is Wehmer, *Die Pflanzenstoffe botanisch-systematisch bearbeitet*, 1911; in this are discussed the chemical constituents of plants and their products, including however only the phanerogams. This work, as a lexicon of the composition of plants, is the first to be consulted in determining the probable physiological action of the plant.

A. 4. Encyclopedic works, including methods

The oldest and the smallest is the Hoppe-Seyler's *Handbuch*, Ed. 8, noted under

A, 1; next in point of time is Oppenheimer, Handbuch der Biochemie, 1908-10, 4 vol. in 7, with *Ergänzungsband*, 1 vol., 1913; this is actually a set of monographs by various authors; the form of publication makes it less easy of revision than the English series. The Handbuch der biochemischen Arbeitsmethoden, edited by Abderhalden, 9 vol. in 11, 1910-19, has a more limited field in accordance with its title, but gives considerable descriptive matter; it is a working encyclopedia for all procedures in biochemistry. There is at present being published a new edition of this under the title, Handbuch der biologischen Arbeitsmethoden, also edited by Abderhalden, to be in 13 parts.

The newest up to 1920 and in some ways most useful is the Biochemisches Handlexikon, 6 vol. in 7, and two supplementary volumes, 1911-15, edited by Abderhalden; this is modelled after Beilstein in part, but it gives material in more detail and is more recent than the third edition of Beilstein; it has no collective index, but the volume indexes are good; it usually gives structural formulas for organic compounds, and has many references to the literature of the topics considered.

B. 1. *Serials containing original papers, chiefly*

Before 1877, there was no special serial, and the literature is scattered through the serials upon chemistry, medicine, and physiology. In that year Hoppe-Seyler's *Zeitschrift für physiologische Chemie* was started; there were some brief abstracts in the first ten volumes, but none since. The volumes may be one to four a year, and there are two collective indexes, including the first 60 volumes. Hofmeister's *Beiträge für physiologische und pathologische Chemie*, (original papers only) appeared 1902-08, eleven volumes with a collective index for the first ten. It was then merged in the *Biochemische Zeitschrift*, 1906-date, original papers only; this has had up to eleven volumes in the calendar year, and has three collective indexes, including the first ninety volumes. Two very recent ones in German are the *Internationale Zeitschrift für physikalisch-chemische Biologie*, edited by Traube and others; and *Fermentforschung*, the latter under the direction of Abderhalden, both started in 1914; none of the first since the number of April, 1917, has been received; the second seems to be continuing, and makes a special feature of the work done by Abderhalden and his students on his own topic, protective ferments.

Much work upon physiological chemistry, particularly on the side dealing with animal life has been published in the following:

Archiv für die gesamte Physiologie (Pflüger)

Archiv für experimentelle Pathologie und Pharmakologie

Archiv für pathologische Anatomie und Physiologie (Virchow)

Archiv für Physiologie. (Du Bois-Reymond)

Ergebnisse der Physiologie

Zeitschrift für klinische Medizin;

also in:

Archives italiennes de biologie

Journal de physiologie et de pathologie générale

also in:

American Journal of Physiology

Journal of Physiology

Physiological Reviews

The oldest serial for this field in English is the Journal of Biological Chemistry, founded by C. A. Herter and J. J. Abel in 1905; it has original papers only, publishes usually three or four volumes a year, and has a collective index for the first twenty-five volumes. It generally contains the proceedings of the American Society of Biological Chemists, **paged separately with Roman numerals.**

The Biochemical Journal, 1906-date, from the University of Liverpool, no abstracts, has always paid much attention to plant chemistry; it appears at irregular intervals, and has a collective index for the first ten volumes. The Biochemical Bulletin, 1911-16 (?), from Columbia University seems to have ceased with vol. 5, in May, 1916; it had abstracts that were little more than a subject index to current literature and gave news items, personals chiefly.

Two recent fairly general serials are these:

Journal of Laboratory and Clinical Medicine, 1915-, with original papers, laboratory notes on methods, and signed editorials; and, Journal of General Physiology, 1918-, bimonthly, original papers only; the articles are often upon topics in physiological chemistry.

Three very specialized ones are:

The Journal of Pharmacology and Experimental Therapeutics, 1909-, The Journal of Urology, 1917-, and Endocrinology, 1917-; the first and second have original papers, and the second contains the Transactions of the American Urological Association and its branches; the third has abstracts and book reviews also; both the second and third are bimonthly.

B.2. Reference serials

The principal index serial to be considered here is the Index Medicus, 1879-date; it includes many papers on medical topics that are also biochemical, giving the reference in full but no abstract. The Index catalogue of the U. S. Surgeon-General's Library is also of use for special topics, giving references to both serials and books. The section on biochemistry in the International Catalogue of Scientific Literature: Chemistry, 1901-, is very complete for the years included.

Before 1870, the abstract serials were not specific; thus one has to use the various general abstract serials, as, Berzelius' Jahresbericht for the early period, Chemisches Zentralblatt, Journal of the Chemical Society, Jahresbericht (Liebig and Kopp).

The oldest special one is Jahresbericht über die Fortschritte der Tier-Chemie, edited by Dr. Richard Maly, 1870-1918; the later volumes include bacteriology, pharmacology and other related topics as well; there are collective indexes for the volumes 1-30, i. e., annual ten-year indexes through 1900, only annual indexes since then. This serial is sometimes referred to as Maly's Jahresbericht, from its founder; it is a very complete record for the year, including books, theses, and papers in serials; the articles of importance are abstracted, often at some length, while papers considered of less value are dismissed with a few lines or even the reference alone. Maly's Jahresbericht ceased publication in 1918, being merged

in the new one, *Berichte über die gesamte Physiologie und experimentelle Pharmakologie*, noted below.

The second in importance of the abstract serials upon biochemistry began in 1902 as *Biochemisches Centralblatt*; it kept this title till 1909, then became *Zentralblatt für Biochemie und Biophysik*, and in 1919, absorbed the *Maly's Jahresbericht* and the *Jahresbericht über die Fortschritte der Physiologie*, and is now *Berichte über die gesamte Physiologie und experimentelle Pharmakologie*. The first few volumes had some original papers in the nature of reviews summarizing the progress in some field of biochemistry, but soon dropped these; the first four volumes had also, companion volumes, *Biophysikalisches Centralblatt*, and for these there is a collective index; then this set ceased. The volumes of the *Berichte* under any name have never coincided with the calendar year; and it seems now to have several each year. There are volume indexes, a collective index for the first nine volumes, i. e. the *Biochemisches Centralblatt*; the special feature is that the titles of articles are given in the language of the original, not in that of the abstract serial.

The serial now called (or at least in 1914; none received since) *Zentralblatt der experimentelle Medizin*, started in 1900 as the *Centralblatt für Stoffwechsel- und Verdauungskrankheiten*, has good abstracts, always with emphasis on nutrition and metabolism; it has annual and later semianual indexes, but no collective one. In French, good abstracts are found in the *Journal de physiologie et de pathologie générale*, 1899-, and in the *Archives italiennes de biologie* 1882-; both these are here in the Natural History library. In English, use the *Journal of the Chemical Society*, the *Chemical Abstracts*, and other general abstract serials, including the *Experiment Station Record*. The new one is *Physiological Abstracts*, 1916-, a cooperative affair by the English and American *Physiological Societies*, with some other organizations; the abstracts are of fair length, and so far cover the literature very well, with indexes for each volume. *Physiological Reviews*, 1921-, new and excellent so far, is to be rather a place for the publication of reports of progress, somewhat similar to those making up the old *Ergebnisse der Physiologie*, 1902-14.

LECTURE 16

SUGGESTIONS UPON LOOKING UP ALL THE LITERATURE FOR A TOPIC IN ORGANIC, APPLIED, PHYSICAL CHEMISTRY, OR BIOCHEMISTRY

This material may be found in a large number of places so that it is difficult to say when the search has covered all possible sources. Books and serial articles must both be investigated, but the method varies a little for each of these divisions of chemistry.

In general, if the topic seems large enough or of sufficient importance try the specific subject heading in the card catalogue; next, consult the indexes in the more comprehensive works in that field. When this has been done, turn to the

reference serials, or similar works where material from many sources is collected. The plan of attack will vary somewhat.

I. *Organic chemistry*

Here, if you know the name, in German, begin with the collective index of Beilstein, *Handbuch*, Ed. 3; if the English name only is known, look in Richter's textbook, *Chemistry of the carbon compounds*, the most recent edition in English and here if it is given, you will find the formula, and this will make possible the use of Richter's *Lexikon*, that in turn, gives a reference to Beilstein. Thus, finding the substance in Beilstein, you have there a fair summary of the information available at the date of publication of that volume; later work, through 1913, may be found in the *Literatur-Register*, by looking under the formula.

If the formula only be known, go to Richter's *Lexikon* first, then look up the reference given to the volumes, original and supplementary, of Beilstein's *Handbuch*. Articles since 1913 will at present require the use of annual indexes, or the decennial index of *Chemical Abstracts*; here too, it is advisable to employ the formula indexes for their own original papers in these; *Annalen*, *Annales*, *Berichte*, *Journal für praktische Chemie*, *Journal of the Chemical Society Monatshefte*, and *Recueil*; if the name is known, look under that also in the newest annual index, and going backward in time to the most recent collective index, in each case.

If for any reason a thorough search of the literature is to be made, the process is much like that for general chemistry.

A. Before 1840.

1789-, *Annales de chimie*

1822-, *Jahresbericht* (Berzelius')

1832-, *Annalen der Chemie*

1832-, *Chemisches Zentralblatt* (then *Pharmazeutisches Centralblatt*)

1834-, *Journal für praktische Chemie*

All these except the fourth have collective indexes.

B. 1840 to 1870.

Add to the ones above the following:

1840-58 *The Chemist*

1841-, *Journal of the Chemical Society* (1841-45 called *Memoirs*)

1842-59 *Chemical Gazette*; continued by *Chemical News*, 1859 on.

1847-, *Jahresbericht* (Liebig and Kopp)

1858-, *Bulletin de la Société chimique de Paris* (now de France)

1867-, *Berichte der deutschen chemischen Gesellschaft*

Note that Berzelius' *Jahresbericht* ceases with 1849; *Chemist* and *Chemical Gazette* have only annual indexes. The abstracts in *Annalen* ceased before 1870, and those in *Annales* and the *Journal für praktische Chemie* by 1873; for this period no collective index for *Chemisches Zentralblatt* has been published.

C. 1870 to 1906.

For this period, there are several good collective indexes, and their use facilitates the work; the order might be:

- a, Jahresbericht (Liebig and Kopp); slow to appear but very complete
- b, Journal of the Chemical Society
- c, Bulletin de la Société chimique de France
- d, Chemisches Zentralblatt; collective indexes for 1870-81, 1896-1906
- e, Jahrbuch der Chemie (Meyer) 1891-, collective index, vol. 1-10
- f, Journal of the Society of Chemical Industry, indexes 1882-1905
- g, Zeitschrift für angewandte Chemie, index of 1887-1907
- h, Jahresbericht (Wagner) collective indexes 1855-94

Use f, g, and h, only for topics in applied (industrial) chemistry; annual indexes of other serials having abstracts or reviews may be used, with the Chemistry section of the International Catalogue of Scientific Literature from 1901 on. Wagner's Jahresbericht might also be used for the preceding period for topics not in pure chemistry or theory.

D. 1907 to 1921.

Here, the order for covering the literature rapidly, might be:

- a, Chemical Abstracts, decennial, then annual indexes
- b, Journal of the Chemical Society, collective index and annual ones
- c, Bulletin de la Société chimique de France, annual indexes
- d, Chemisches Zentralblatt, index 1907-11, and semiannual ones since

Begin usually with the most recent annual or volume index, and work back to the newest collective one; the Jahresbericht has, here, only 1907-10 completely, but part at least of 1911 has been published, and this should be used before b, and c, if it is available. Consult also the annual indexes of Jahrbuch der Chemie and the Chemical Society's Annual Report of Progress of Chemistry. The annual indexes of the serials in c, f, g, h, may be used if the topic is one not of pure chemistry or the like. Check the final list by the volumes of the Chemistry section of the International Catalogue of Scientific Literature also, to make sure no item is overlooked.

Patents in the organic literature may be looked up in the reference serials under the subject; or, if the number only is known, the indexes by patent number in:

- Chemical Abstracts
- Chemisches Zentralblatt
- Jahresbericht (Liebig and Kopp), through 1910
- Zeitschrift für angewandte Chemie, through 1918
- Jahresbericht (Wagner), here only through 1914

For any product of coal tar, consult Friedländer, Fortschritte der Teerfarbenfabrikation, beginning with the newest volume, since these have collective indexes including material in the earlier volumes; if the substance has been known for some time, see also Winther, Zusammenstellung der Patente auf dem Gebiete der organischen Chemie, 1877-1905, 3 vol. published 1908-10. From 1918 on the volume indexes of Chimie et industrie will be of use.

II. *Applied chemistry*

A. Before 1840

Use the same reference serials as for organic chemistry.

B. 1840 to 1870.

Add to the organic list, *Jahresbericht* (Wagner), 1855-on.

C. 1870 to 1906.

For this period, collective indexes are available for only part of the time in the serials of applied chemistry; the best plan would be this:

a, *Journal of the Society of Chemical Industry*, index, 1882-1905

b, *Jahresbericht* (Wagner) index, v. 11-40, 1865-94

c, *Jahresbericht* (Liebig and Kopp), index 1867-1908

d, *Zeitschrift für angewandte Chemie*, index, 1887-1907

e, *Chemisches Zentralblatt*, index, 1896-1906

f, *Jahrbuch der Chemie* (Meyer), 1891 on; index, 1891-1900

Indexes for individual years for Wagner's *Jahresbericht* may be used for years after 1894, to check the other serials and make certain that nothing has been overlooked.

D. 1907 to 1921.

Here, start with the decennial index of *Chemical Abstracts*, 1907-1916, and use annual indexes of it for later years; the order would be as follows:

a, *Chemical Abstracts*, index, 1907-16

b, *Chemisches Zentralblatt*, index, 1907-11

c, *Jahresbericht* (Liebig and Kopp), 1905-10, inclusive, 3 indexes

d, *Journal of the Society of Chemical Industry*, annual indexes

e, *Zeitschrift für angewandte Chemie*, 1908-18, annual indexes

f, *Jahrbuch der Chemie*, annual indexes

Both d and e will probably have collective indexes for all or part of this period; the annual indexes of the *Chemiker-Zeitung: Repertorium*, 1914 on, and the indexes of the volumes of *Chimie et industrie*, for 1918 on should be used to check up for safety, as the foreign serials were sometimes difficult for American and English abstractors to obtain during those years. Use also the *Reports of Progress in Applied Chemistry*, 1916 to date.

III. *Physical chemistry*

Here for all periods the serials advised in Lecture 7 for general chemistry should be used; it might be well to add, as a further check for completeness, the collective index of *Zeitschrift für physikalische Chemie*, v. 1-50, 1887-1905, and that of the *Physikalisch-chemisches Centralblatt*, 1904-09, and that of *Journal de chimie physique* v. 1-10, 1903-12. If the topic is electrochemical use also the index of *Zeitschrift für Elektrochemie*, v. 1-10, 1894-1904, and the individual volumes of the *Jahrbuch der Elektrochemie und angewandten physikalischen Chemie*, 1894 on, 1907 being the latest here.

IV. *Biochemistry*

For the years before 1840, and 1840 to 1870, use the serials advised under those years for general chemistry, in Lecture 7.

C. 1870 to 1906.

At present, for rapid work and completeness, this is best :

- a, *Jahresbericht (Maly)*, collective indexes, through 1900
- b, *Biochemisches Centralblatt*, collective index, v. 1-9, 1902-09
- c, *Journal of the Chemical Society*, collective indexes
- d, *Centralblatt für Stoffwechsel- und Verdauungskrankheiten*
- e, *Archives italiennes de biologie*, 1882 on; collective indexes for v. 1-40, 1881-1903; index for 41-60, 1894-1913 is in press
- f, *Journal de physiologie et de pathologie générale*, annual indexes of volumes, 1899 on

D. 1907 to 1921.

- a, *Chemical Abstracts*, decennial index, and annual indexes since
- b, *Jahresbericht (Maly)*, annual volumes
- c, *Zentralblatt für Biochemie und Biophysik*, continued by *Berichte über die gesamte Physiologie und experimentelle Pathologie*; volume indexes only ones now
- d, *Physiological Abstracts*, 1916 on, volume indexes only.

The volume indexes of c and f in C may also be used, as a check particularly in the case of European work.

The resources of other libraries may be made use of by means of the system of interlibrary loans mentioned at the close of Lecture 7. New serials are often started and these are to be watched as new sources of abstracts or reviews of progress; such a one is the new *Physiological Reviews*, (that seems to take the place of the *Ergebnisse der Physiologie*, 1902-14), giving summaries of progress with bibliographies.

*Knowing books exist is not enough—they must be used. * * * **