

- 2,a. Phlogiston  
       Brown, History, pp. 224-274  
       Ramsay, Essays, pp. 18-30
- 4,a. 1820-1900, in **Great Britain** particularly  
       Thorpe, **Essays**, Ed. 2, chap. 17, pp. 554-582

Tilden in his **Chemical discovery and invention in the twentieth century** 1916, considers most of the important developments up to the entrance of chemistry into the war.

- 4,b. Jones, **New era in chemistry**, pp. 1-75; this is descriptive of the newer research.

For American chemical history and biography in particular there are besides a number of papers by various authors, usually found in the **Journal of the American Chemical Society**, the following books, all by **Edgar F. Smith**:

**Chemistry in America**; chapters from the **history of the science in the United States**. 1914.

**The life of Robert Hare, an American chemist, 1781-1858**. 1917.

**James Woodhouse, a pioneer in chemistry, 1770-1809**. 1918.

**Chemistry in old Philadelphia**. 1919.

**Priestley in America, 1794-1804**. 1921.

A number of works have appeared recently, but it is too soon for the complete **history of chemistry in the war during 1914-19** to be written, and the section of **new developments in medicine** will be nearly equal to that describing **chemical as weapons**.

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## LECTURE 9.

### ORGANIC CHEMISTRY: BOOKS AND WORKS OF REFERENCE

The distinction between the chemistry of living and non-living matter was first made by **Nicholas Lemery** in his **Cours de Chymie**, in 1675. The term 'organic chemistry' was not in use till nearly or quite 1800; the authors discussed the chemistry of animal and vegetable matter. This division of chemistry is thus more recent in some ways than the inorganic, but the literature is voluminous and well arranged for use.

The books and reference works may be grouped as follows:

- A. **Books in general**
1. **Comprehensive descriptive**
  2. **Briefer works**
  3. **Laboratory manuals**
- B. **Special works**
1. **Methods**
  2. **Preparations**
  3. **Analysis**

## C. Works of Reference

1. Cyclopedia
2. Dictionary
3. Tables of data

### A. 1. *Comprehensive works*

The general works in English now (1921) are not very satisfactory; the best one, written in English, is Cohen's *Organic chemistry*, 3 volumes, Ed. 2, 1919, Ed. 3, 1921; this is rather a discussion of selected topics than a complete treatise. The organic part of Roscoe and Schorlemmer in English has not been revised for about thirty years. So far, only the first volume of the eleventh edition of Victor von Richter's *Chemie der Kohlenstoffverbindungen, oder organische Chemie*, 1909, has been translated into English; this too is more a discussion of compounds than anything else. The most elaborate one, having theoretical discussion as well as mere description, is the *Lehrbuch der organischen Chemie*, begun under the editorship of Victor Meyer and Paul Jacobson; the publication of the second edition, started in 1907 is not completed. Hilditch in his *Third Year course organic chemistry*, 1914, gives advanced work upon complex compounds. Pope, *Modern researches in organic chemistry*, 1912, Ed. 2, 1921, Stewart, *Recent advances*, Ed. 4, 1921, and Lachmann, *Spirit of organic chemistry*, 1899, Henrich, *Theorien der organischen Chemie*, 1912, combine history and theory; a translation of Henrich into English is now in press; Hjelt, *Geschichte der organischen Chemie*, 1916, puts history first, but gives much theory.

### A. 2. *Briefer works*

These are available here in English and in French. The most recent is Chamberlain's *Textbook of organic chemistry*, 1921, nearly a thousand pages, with much detail, and special attention to industrial problems. H. T. Clarke's *Introduction to organic chemistry*, 1914, is less extensive, but easy to read. Cohen's *Theoretical organic chemistry* is an older work, printed in small type; W. A. Noyes' *Textbook* is slightly smaller than Clarke's but very condensed; a new edition is being prepared. *Notions fondamentales de chimie organique*, by Charles Moureu, 1913, now available in English, is very similar to these just mentioned, though it is perhaps more like J. F. Norris' *Principles of organic chemistry*, 1912. The one by Perkin and Kipping, new edition printed in 1917, unlike the Holleman contains some directions for laboratory work in addition to the theoretical and descriptive matter. Chamberlain's *Organic agricultural chemistry*, 1917, is for students in a special field; the books of Haskins, Ed. 2, and McCollum, 1921, giving briefly *organic chemistry for students of medicine and biology*, are smaller, while Moore's book is frankly elementary. McCollum has no laboratory work in his text.

### A. 3. *Laboratory manuals*

These are numerous, since most authors prefer their own idea of what a manual should be; Cohen, Noyes, Norris, Hollemann, Moore, each has one, usually revised often. Others are by Jones, Sudborough and James (with photographs of apparatus); and perhaps the best, the newest revision of Gattermann, in English; Price and Twiss, *Course of practical organic chemistry*, Ed. 2, 1914, is

very little more than a laboratory manual. The revised Bernthsen is very like the Sudborough and James. H. L. Fisher's manual, 1920, American, is said to be good.

### B. 1. *Special works on methods*

Here the most useful books are German; Lassar-Cohn, *Arbeitsmethoden für organisch-chemische Laboratorien*, Ed. 2, 1907, has a general and special section, the latter sometimes bound in two pieces. Hans Meyer, *Analyse und Konstitutionsermittlung organischer Verbindungen*, 1903, has some good material, and has been translated into English. Th. Weyl's *Die Methoden der organischen Chemie*, 2 vol. in 3, 1909, has been translated into French; the new German edition, of 1921, is to be in four much larger volumes under the editorship of Houben. The laboratory manuals all give some account of the more general methods.

### B. 2. *Preparations*

The German work by Bender and Erdmann, (1893) has been replaced by the work of Vanino, *Handbuch der präparativen Chemie*, 2 vol., 1914; K. Elbs, *Die synthetische Darstellungsmethoden der Kohlenstoffverbindungen*, 2 vol. in 1, 1889-91, is much less. A smaller but more recent work is Posner, *Lehrbuch der synthetischen Methoden der organischen Chemie*, 1903; smaller yet are Levy, 1902, Ullmann, 1908, Henle, 1909, and the Ed. 8 of E. Fischer's, 1908, which can be had in English too.

In English the first volume of Meldola, *Chemical synthesis of vital products*, was published in 1904; the newest considerable work here is Barnett, *Preparation of organic compounds*, Ed. 2 appearing in 1920. Fischer's small work has been translated. Several numbers have been published of *Organic Chemical Reagents* by R. Adams, O. Kamm and C. S. Marvel, 1919-date, as bulletins of the University of Illinois, and others are in preparation. The first volume appears in September, 1921, of *Organic Synthesis*, an annual publication of satisfactory methods for the preparation of organic chemicals; the editorial board, is R. Adams, H. T. Clarke, J. B. Conant and O. Kamm, and the intention is to give methods that have been tested and proved to work well.

### B. 3. *Works on organic analysis*

These include (a), general comprehensive, (b), brief works, and (c), those upon industrial analysis. Under (a), the most elaborate is *Identification of pure organic compounds*, by Mulliken, three volumes are now published with a fourth in preparation. Sherman, *Organic analysis*, in the new edition is very good; with Clarke's *Handbook of organic analysis*, most substances may be identified; there are smaller works by Rakshit, new editions of Noyes and Mulliken, Neave, and Weston. We have Kingscott and Knight, an English text on quantitative organic analysis.

In German, Rosenthaler, *Der Nachweis organischer Verbindungen*, 1914, 1070 pp., published as vol. 19-20 of Margosches, *Die Chemische Analyse*, is the largest and states that it gives selected reactions and processes; H. Meyer, *Analyse*, noted under B, 1, *Methods*, is next in size, but older, and an English version exists. G.

Cohn has two huge volumes, *Die organische Geschmackstoffe*, 1914, and *Die organische Riechstoffe*, in which he groups organic compounds and tests for them by odor and flavor. Vaubel, *Quantitative Bestimmung organischer Verbindungen*, 2 vol. 1902, is now old. A new laboratory manual for qualitative organic analysis is now in preparation by Dr. O. Kamm, to be published early in 1922.

The industrial works are numerous, mostly large; Allen, *Commercial organic analysis*, Ed. 4 has 9 volumes, with some new data and a collective index to the set in the ninth volume. Lunge, *Technical analysis*, six large volumes in the English version, is largely but not wholly organic. Villavecchia, 1918, 2 volumes in English gives very new methods. There is some material upon analysis in the industrial organic volumes of Molinari, Martin, Sadtler, Herzog (in German) using the latest edition in all cases; Leach, Ed. 4 is invaluable for food analysis, while other special organic industries have each their own special works.

#### *Works used for reference*

C. 1. The encyclopedia of organic chemistry at present is the *Handbuch*, founded by Beilstein; Ed. 3 is the one in use, but several volumes of the fifteen that will make up the fourth edition are here. There has been some discussion upon a substitute in English. Friedrich Konrad Beilstein, 1839-1906, Russian by birth, began while a student under Wöhler at Göttingen, to keep a systematic record of the literature upon organic substances. The first edition of these notes was published in 1881; the third edition, in four volumes each containing an index, and four supplementary ones, with a ninth volume having a collective index for all, makes available in one place the literature of organic chemistry through July 1903; the fourth edition will cover all the literature to January 1, 1910.

For each substance there is given the name or names; the formula (empirical); then follow a brief history, occurrence, formation, methods of preparation, physical and chemical properties and reactions, salts (of acids and bases), some other compounds and derivatives. Reference is made in the collective index for Ed. 3 thus: II, 1457 (743), that is, information found in the original volume II on page 1457 is supplemented by newer material in *Ergänzungsband* (supp.) vol. II, p. 743. The fourth edition is practically the same in arrangement as the third. The Deutsche chemische Gesellschaft assumed editorial responsibility, with the first volume of the supplement to Ed. 3, while the financing is done by German firms interested in the chemical and related industries.

#### C. 2. *Dictionary*

Here again we have only one work, and that is in German, for which an English substitute has been suggested. Max Moritz Richter (*not* Victor von Richter of the organic textbook) published in 1884, a small volume to serve primarily as a formula index to Beilstein's *Handbuch*; the 16,000 compounds of this first edition seem few by comparison with the 250,000 of the third edition, which includes the literature through November, 1909. Of the supplement, *Literatur-Register*, edited by Stelzner, two sections covering 1910-11, 1912-13, using the same general plan as the original, have been received.

The preface to Richter's *Lexikon*, in German, French, English, and Italian explains the method of arrangement clearly; substances are entered under the

formula, the compounds being placed in groups according to, first, the number of atoms of carbon, then by the *number* of other elements besides carbon, then C H precedes all C H O, because in the first compound there is one element in addition to the C, while in the second there are two. The formulas are written with the elements in a fixed order, C first, then these H, O, N, Cl, Br, J (I), F, S and after these (which are sometimes termed the "chemical alphabet") are the other elements entering into the compound in alphabetical order (according to the chemical symbol). The arrangement then requires that we know, first the number of carbon atoms, the number of *other* elements present, and the number of atoms of each of these elements.

Note that at the top of each page the number of C atoms, and the *number* of other elements is given, thus: 5 IV, 7 III, 19 VI. Brief data are given, name, boiling or melting points, one or two references, and—most important—the reference to Ed. 3 of Beilstein. This is never called by name, but a heavy dash is followed by the volume and page, a star being prefixed if the reference is to the *Ergänzungsband* (supplement); all references in Richter, Ed. 3 and Stelzner, *Literatur-Register*, v. 1-2 are to Ed. 3 of Beilstein, thus: —II, 429; —\*II, 157. Tables of abbreviations used are given in volume I of Richter; the three most used are perhaps, A., *Annalen*, B., *Berichte*, C., *Chemisches Zentralblatt*. If you know only the name of a compound, look in the Beilstein collective index, and find the formula; then it can be looked up in Richter to see if there are any more recent data. If you know the formula only, look in Richter, get the reference to Beilstein, and find there a quantity of material, with references to the original papers in most cases.

### C. 3. *Tables of data*

These are, aside from the *Lexikon*, the principal general tables of chemical and physical data; the larger ones are the *Recueil* from the *Société française de physique*, 1913; the fourth edition of *Landolt-Börnstein, Physikalisch-chemische Tabellen*; the *Annual Tables*, vol. 4 and 5 published in 1921; and the older table with English descriptive matter by *Castell Evans*. The smaller works like *Van Nostrand's Annual*, *Chemists' Yearbook*, give data on the more common compounds.

Solubilities are given in *Seidell* for organic substances; *Seudder* in his *Electrical conductivity and ionization constants of organic compounds*, 1914, give data with references; *R. Kempf, Tabelle der wichtigsten organischen Verbindungen geordnet nach Schmelzpunkten*, 1913, presents data on color, boiling point name and reference to original paper and to *Beilstein*, Ed. 3, for 2500 common compounds.

## LECTURE 10

### ORGANIC CHEMISTRY: SERIALS AND PATENT LITERATURE

The serials are:

- A. Those containing original papers chiefly
- B. Reference serials
- C. Patent literature: being chiefly serials of the reference type

#### A. "Original paper" serials

These serials include practically all those published, except a few upon special phases, inorganic and metallurgical; and any serial on chemistry is apt to have organic papers, since organic reagents are used even in inorganic work. The principal ones may be noted briefly; they include now the Journals of the American and English societies; *Annalen, Berichte, Monatshefte, Journal für praktische Chemie*, in German; *Annales, Bulletin*, (France) *Recueil*, and *Bulletin* (Belgium) in French; *Helvetica chimica acta, Gazzetta chimica italiana*. The technical serials as *Chimie et industrie, Journal of the Society of Chemical Industry, Zeitschrift für angewandte Chemie*, the serials on special topics as dye-stuffs, leather industry, manufacture of chemicals, drugs, and biochemistry, all contain much upon organic chemistry. The American Chemical Journal, merged in the Journal of the American Chemical Society with January 1914, was largely organic. All these, practically, review new books, but of the general ones, only the Journal of the Chemical Society (English) and the Bulletin de la Société chimique de France now have abstracts.

#### B. Reference serials

The most comprehensive one for organic chemistry is probably the *Chemisches Zentralblatt*; second is the *Jahresbericht* (Liebig and Kopp); and third, *Journal of the Chemical Society*; for quick service the last is best, since it is in English, and has collective indexes for the longest period, 1841-date; this is well supplemented, the last collective index being 1903-12, by the decennial index of *Chemical Abstracts* for 1907-16, inclusive.

Two serials that do not attempt to include all papers, are of great value for the organic chemist in particular, since they give excellent abstracts of the more important papers, omitting the less valuable ones. The older is the *Jahrbuch der Chemie*, founded by Richard Meyer (who is yet the editor-in-chief) in 1891; it is here through vol. 28, i. e., the work of 1918; there is a collective index for the first ten volumes. It is rather a review serial, since one man is responsible for the literature of a field for the year, and his work is partly critical as well. The similar one in English, is the *Annual Reports of the Progress of Chemistry*, 1904 to date, published by the *Chemical Society, in London*; this has only the annual indexes at present; while this is largely pure chemistry, the topics of Agricultural Chemistry, Foods, and Analysis are dealt with here. Meyer's *Jahrbuch* frankly tries to include both, "*Fortschritte der reinen und angewandten Chemie*", while for applied chemistry in English there is the separate publication, 1916 to date, *Reports of Progress of Applied Chemistry*, published by the *Society of Chemical Industry*. Both the English ones are of the review type, giving some critical discussion of the papers considered sufficiently important to be included.

The *Annalen, Annales, Journal für praktische Chemie*, had abstracts till 1860, for the first, and to about 1873 for the other two. The *Berichte* had fair abstracts, 1867-96; the *French Bulletin* has abstracts, not always very long, 1858-date; the abstracts of the *Journal of the Society of Chemical Industry*, 1882-date, cover organic industrial very well; *Chemical Abstracts*, 1907-date, includes organic, and its 1920 index has a formula index of organic compounds. The *Zeitschrift für angewandte Chemie* has good abstracts, for industrial organic, from

1887-1918; after that they are part of the *Chemisches Zentralblatt*. The organic section of Wagner's *Jahresbericht* may also be used for industrial topics; this is best found in the *Journal of the Chemical Society*.

The annual formula indexes for their own original papers in *Annales*, *Annales*, *Berichte*, *Journal für praktische Chemie*, *Journal of the Chemical Society*, *Monatshefte*, and *Recueil*, furnish additional material for the years after 1913. *Literatur-Register*, at present for 1914 on. The formula indexes of the *Jahresbericht* (Liebig and Kopp), here, are older than the *Literatur-Register* and therefore need not be used often. In general, the organic chemist, for any compound, looks first in *Richter* and the *Literatur-Register* volumes, then in the serials since that; the fourth edition of *Beilstein* should also be used if the volumes yet published contain the group; otherwise, take the reference given in *Richter's Lexikon*, to the third edition of *Beilstein*.

### C. PATENT LITERATURE, FOR ORGANIC CHEMISTRY

Here the most comprehensive work is the serial edited by Dr. P. Friedländer, *Fortschritte der Teerfarbenfabrikation und verwandter Industriezweige*, 1877-1916 (and probably to date); the volumes give patents, and for Germany some patent applications, contain subject indexes, indexes by number for English, American and French patents, some general discussion of important groups and indexes by name of the patentees. Cumulative indexes are in vol. 4 and the succeeding ones, for, in each case, volume 1 through the one containing the index. Next in order of size on patents is the book, three volumes, edited by Adolf Wither, *Zusammenstellung der Patente auf dem Gebiete der organischen Chemie, 1877-1905*, published 1908-10; the third volume has the index to the others, and a list of foreign, i. e., non-German patents; patents here and elsewhere under the old German government, 1871 on, are indicated by the letters D. R. P., Deutsches Reichs-Patent.

In addition to these two sources, the *Journal of the Society of Chemical Industry*, Wagner's *Jahresbericht*, and the *Zeitschrift für angewandte Chemie* the three chief technical serials, have indexes to patents abstracted, by number as well as by subject and patentee; similar number indexes are in the reference serials for general chemistry, i. e., *Chemisches Zentralblatt*, Liebig and Kopp's *Jahresbericht*, and the *Chemical Abstracts*, but these of course include much besides organic patents. Patents too are abstracted in the French serials, but these cover less time; an index to patents both abstracted and merely noted is given in the *Chemiker-Zeitung* and in *Die chemische Industrie*, both for 1877 to date; the *Patentberichte* of the latter has, beginning with January, 1919, been published also separately, on one side of the paper only, for filing; both these serials are devoted chiefly to the German chemical industries and their upbuilding, so they include all the patents dealing with coal tar derivatives.