2.a. Philolows.
Brown, History, pp. 224-234
Bassey, Essays, pp. 18-30
4.a. 1828-1900, in Great Britain particularly
Thomps, 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 beside 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, 1931.
The Life of Robert Hare, an American chemist, 1781-1853, 1917.
James Watt, a pioneer in chemistry, 1779-1825, 1918.
Pesticides in America, 1794-1894, 1921.

A number of works have appeared recently, but it is too soon for the complete history of chemistry in the war during 1914-18 to be written, and the section of new developments in medicine will be nearly equal to that describing chemical research.

LECTURE 9.

ORGANIC CHEMISTRY: BOOKS AND WORKS OF REFERENCE

The distinction between the chemistry of living and non-living matter was first made by Nicolas Lemery in his Comte de Olympe, 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 therefore recent in some ways, 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. General works
3. Laboratory manuals

B. Special works
1. Methods
2. Preparations
3. Analysis

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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, 1916, Ed. 3, 1921; this is rather a discussion of selected topics than a complete course. The organic part of Roe and Schroder's in English has not been revised for about thirty years. So far, only the first volume of the eleventh edition of Victor von Houter's Chonie der Kohlenstoffverbindungen, oder organishe Chemie, 1939, 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 Mayer and Paul Jacobson; the publication of the second edition, started in 1937 is not completed. Hiddeh in his Textbook of 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 Landmann; Spirit of organic chemistry, 1929, Hiddeh, Theories of the organic chemistry, 1912, combine history and theory; a translation of Hiddeh's into English is now in press; Hiddeh, Geschichte der organischen Chemie, 1916, puts history first, but gives much theory.

A. 2. Briefer works

There are available here in English and in French. The most recent is Chau- beklin's Textbook of organic chemistry, 1921, nearly a thousand pages, with much detail, and special attention to industrial problems. E. 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. Notes fonctionnelles de chimie organique, by Charles Moreau, 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 Perkins and Kipping, new edition printed in 1917, unlike the Heilmeier contains some directions for laboratory work in addition to the theoretical and descriptive matter. Chau beklin's Orga- nic agricultural chemistry, 1917, is for students in a special field; the books of Hiddeh, Ed. 2, and McQuilbon, 1921, giving briefly organic chemistry for students of medicine and biology, are smaller, while Moore's book is frankly elementary. McQuilbon has no laboratory work in his text.

A. 3. Laboratory manuals

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

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very little more than a laboratory manual. The revised Berthelot is very in the Southworth 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: Lassaw-Keil, Arbeitsmethoden der organisch-chemischen Laboratorien, Vol. 2, 1907, has a general and special section, the latter sometimes bound in two pieces. Hans Meyer, Analyse and Konstruktionsermitzung organischer Verbindungen, 1903, has some good material, as has been translated into English. Th. Wees’ 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 above general methods.

B. 2. Preparations

The German work by Bechler and Erdmann, (1890) has been replaced by the work of Vauth, Handbuch der preparativen Chemie, 2 vol., 1914; K. Miedess’s Die synthetische Verbindungen der Kohlenstoff-verbindungen: in 2 vol. in 1, 1884-91, is much less. A smaller but more recent work is Power, Lehrbuch der synthetischen Methoden der organischen Chemie, 1903; smaller yet are Levy, 1902; Ullmann, 1898; Hoke, 1909; and the Ed. 3 of W. Fischer’s, 1906, which can be had in English too.

In English the first volume of Molesworth, Chemical synthesis of vital products, was published in 1894; the nearest considerable work here is Brunetti, Preparations of organic compounds, Vol. 2 appearing in 1929. Fisher’s small work has been translated. Several numbers have been published of Organic Chemical Reagents by R. Adams, O. Kamau 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. R. Conn and O. Kamau, 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) hand books, and (c), those upon industrial analysis. Under (a), the most elaborate and identification of pure organic compounds, by Mihaly, three volumes are now published with a fourth in preparation. Sherratt, 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 Herstein, new editions of Novy and Mihaly, Novy, and Weston. We have Kiracofe and Knight, an English text on quantitative organic analysis.

In Germany, Rosenhauer, Der Nachweis organischer Verbindung, 1914, 1899 pp., published as vol. 19-20 of Marcksches Die Chemische Analyse, is the largest and states that it gives selected reactions and processes; H. Meyer, Analyse, noted under B. 1, Methods, is meant in size, but older, and an English version exists. O. 42
The encyclopedia of organic chemistry at present is the Handbook, published by Behr's. 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 on a substitute in English. Friedreich's 'System der organischen Chemie,' has never been translated into English. This, or a similar work, would be necessary. Leuch will make a valuable contribution to the literature of organic chemistry through the first volume of his 'Handbueh der organischen Chemie,' which will be published in 1881. The second 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 1900.

For each substance there is a name or names, the formula (chemical), 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, 1455 (741), that is, information found in the original volume II on page 1455 is supplemented by newer material in Ellepseumsband (suppl.) vol. II, p. 741.

The fourth edition is particularly the same 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 Haiden of the organic textbook) published in 1894, a small volume to serve prescriptively as a formula index to Behr's Handbook; 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, 1908. Of the supplement, Literary Register, edited by Steinrueger, two sections covering 1910-11, 1912-13, using the same general plan as the original, have been received.

The Preface to Richter's Lexicon, 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 num-
er of atoms of carbon, then by the number of other elements besides carbon, if
C H precedes all other, because in the first compound there is one element in
addition to the C, while in the second there are two. The formulas are worked
with the elements in a fixed order: C first, then these H, O, N, CI, Br, J (I), F, S in
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 names
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 refer-
ence to Ed. 3 of Berlinstein. This is never called by name, but a heavy dash is
followed by the volume and page, a star being placed if the reference is to
the Ergänzungsbuch (supplements); all references in Richter, Ed. 3 and Richter/
Lehrbuch-Literatur-Register, v. 1-2 are to Ed. 3 of Berlinstein, thus: —lI, 428; —Il, 157.

Tables of abbreviations used are given in volume I of Richter; the three mos
t used are perhaps, A., Analyse, B., Bestandt, C. Chemisches Zentralblatt. If you
know only the name of a compound, look in the Berlinstein collective index, 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
Berlinstein, and find there a quantity of material, with references to the origin-
papers in most cases.

C. 3. Tables of Data

These are, aside from the Locutions, the principal general tables of chemical
and physical data; the larger ones are the Recueil from the Société française
pour la physique, 1913; the fourth edition of Lammel-Bergmann, Physikalisch-chemische
Tabellen; the Annual Tables, vol. 4 and 5 published in 1821; and the older table
with English descriptive matter by Castell Evans. The smaller works like Y.
Nostrand's Annual, Chemists' Yearbook, give data on the more common com-
ounds.

Solubilities are given in Schreibe for organic substances; Scudder in his Elec-
trical conductivity and ionization constants of organic compounds, 1914, give
data with references; R. Kempf, Tabelle der wichtigsten organischen Verbindun-
genhalten beim Schmelzpunkt, 1913, presents data on color, boiling points
name and reference to original paper and to Berlinstein, Ed. 3, for 2500 common
compounds.

Lecture 10

Organic Chemistry: Sources and Patent Literature

The sources are:

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

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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 been papers, since organic researches are not even in inorganic works. The principal ones may be noted briefly; they include the two journals of the American and English societies: Annalen, Berichte, Monatsberichte, Journal für praktische Chemie, in Germany; Annals, Bulletin, France: Recueil, and Bulletin, Belgium. In French, Helvetica chimica acta, Gazette 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 dyestuffs, tinner industry, manufacture of chemicals, drugs, and biochemicals, 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, postulatively, review new books, but of the general ones, only the Journal of the Chemical Society (English) and the Bulletin de la Société Chimie 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, the Journal of the Chemical Society, for which 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 1908-12, by the abstractal index of Chemical Abstracts for 1907-15, 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 Jahresbericht der Chemie, founded by Richard Meyer (who is yet the editor-in-chief) in 1881; it is how through vol. 28, i. e., the work of 1910; there is a collective index for the first six volumes. It is rather a review serial, since no one is responsible for the literature of a field for the year, and his work is partly critical as well. The younger one in English, is the Annual Reports of the Progress of Chemistry, 1901-date, published by the Chemical Society, in London; this has only the annual bulletins at present; while this is largely pure chemistry, the topics of Agriculture, Chemistry, Foods, and Analysis are dealt with here. Meyer's Jahresberich frankly cites to be broken. See, "Fortschritte der reinsten und angewandten Chemie", while the applied chemistry, in English, there is the separate publication, 1876 to date, Reports et Progrès de l'Analyse, published by the Society of Chemical Industry. But 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, and Abstracts 1850, for the first, and to about 1875 for the latter two. The Berichte had few abstracts, 1857-96, the French Bulletin has abstracts, one always long, 1856-date the abstracts of the Journal of the Society of Chemical Industry, 1883-date; these acquire an index 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
The annual formula indexes for their own original papers in Arabian, Anatolische, Berichte, Journal für praktische Chemie, Journal of the Chemical Society, Montanzeitschrift, etc., furnish additional material for the years a Literary Register, at present for 1914 on. The formula indexes of the Jahresbericht (Liebig and Kopp), here, are older than the Literatur-Register and therefore must not be used often. In general, the organic chemist, for any comprehensive work, finds first in Reinherz and the Literatur-Register volumes, then in the serials since 1914; the fourth edition of Boeßlein should also be used if the volumes yet published contain the groups; otherwise, take the reference given in Reinherz'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, Forschritte der Tiefenreifenthaufration und verwandter Volumentooken, 1861-1914 (and probably to date); the volumes give patents, and for Germany and patent applications, contain subject indexes, indexes by number for English, American and French patents, some general discussion of important groups and indices by name of the patents. Cumulative indexes are in vol. 4 and following 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 Willy, Zusammentstellung der Patente und dem Gebiete der organischen Chemie, 1871-1905, published 1906-1910; the third volume has the index to the others, an index of foreign, e.g., non-German patents; patents here and elsewhere under the old German government, 1871 on, are indicated by the letters D, R, F, Deutsch, 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, these chief technical serials, have indexes to patents abstracted, by number as well as by subject and patente; similar number indexes are in the reference serials for general chemistry, i.e., Chemical Zeitschrift, Liebig and Kopp’s Jahresbericht, and the Chemical Abstracts, but these of course include much outside organic patents. Patents too are abstracted in the French serials, but these occur less than an index to patents, with abstracted and thereby noting in given is the Chemiker-Zeitung and in Die chemische Industrie, both for 1877 to date; the Jahresberichte of the latter has, beginning with January, 1919, been published separately, on one side of the paper only, for Butler; both these serials observe chiefly to the German chemical industries and their publications, so they include all the patents dealing with coal tar derivations.