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| CLINICAL METHODS AND TESTS. | <i>U. S. Naval Medical Bull.</i> , 30 (1932), 214 |
| Patton, H. W. | Schoorl, N. |
| Simple colorimetric method for the determination of potassium iodide in blood and urine | Sugar titration with De Jong's reagent
<i>Pharm. Weekbl.</i> , 69 (1932), 253 |

PHYTOCHEMICAL LITERATURE.*

BY EDWARD KREMERS.

With the classification of all natural objects as belonging to one of the three natural kingdoms, mineral, vegetable and animal by Emanuel Koenig in 1682, it became the practice of authors of chemical texts to arrange the *materia chemica* in like manner. A text of far-reaching influence is Lemery's *Cours de Chimie* which first appeared in 1675 and which served as a standard text in many countries for a century and a half. The division on Plant Chemistry in this treatise resembles a text on vegetable *materia medica* during the second half of the 19th century, rather than a text on phytochemistry. But very few chemical individuals are enumerated by Lemery. Even Berzelius *Lehrbuch*, as late as 1837, still suggests this resemblance though, by that time, many chemical individuals had been isolated from plants and receive due consideration in the text. Still later, in Liebig's *Handbuch der Chemie* of 1843 a goodly share of the section devoted to "Organic Chemistry" is replete with phytochemical material.

With the second half of the 19th century the tendency toward synthetic compounds gained the ascendancy. Witness Berthelot's *Chimie organique fondée sur la synthese* of 1860. After that Kekulé's structural theories prepared the way for a veritable orgy of synthetic organic chemistry. During the fourth quarter of the 19th century, organic chemistry began to share its primacy with physical chemistry and since the beginning of the 20th century, not only inorganic chemists, but organic chemists as well, have been trained largely in physico-chemical methods and have applied the new viewpoint to their researches.

If the chemical developments of the past half century have revealed a strong tendency away from the study of the products of plant life, the latest development has drifted, nevertheless, into an application of both synthetic organic chemistry and physical chemistry to the study of life problems. Thus Emil Fischer is quoted as having stated that "The great and stimulating problems of organic chemistry have their roots in their application to biology." His ambition, it has been said, was to synthesize a sugar, an alkaloid and a protein. He accomplished this and much more for phytochemistry though he seldom worked with plants as such. If Emil Fischer has done much for what may be regarded as phytochemical statics, so-called biochemists of to-day are utilizing their physico-chemical training in the study of phytochemical as well as zoöchemical kinetics. Both points of attack of the chemistry of plants are equally important. One danger in the latter point of view lies in the fact that its methods are not infrequently based on an insufficient knowledge of the chemical individuals involved in the investigation, hence, the interpretation of results may go astray. The present biochemical situation is comparable in a measure to the one existing in

* Section on Historical Pharmacy, A. PH. A., Miami meeting, 1931.

agricultural chemistry a generation ago when the nitrogen content of fodders was interpreted in terms of protein.

From what has been said it will be seen that no hard and fast line can be drawn, on the one hand, between general chemical literature and phytochemical literature; also, on the other hand, between phytochemical literature and biochemical literature. As will be shown later, it is equally impossible to draw a sharp line between general treatises on phytochemistry and somewhat specialized treatises. Thus treatises on the chemical analysis, so-called of plants, do not belong in the same class with such special treatises as those on carbohydrates, oils, alkaloids, etc. (Going a step farther neither can treatises on microchemistry be grouped with those special classes of phytochemical literature.) The compiler of this literature will, therefore, be guided largely by the titles of the books under consideration as reflecting the author's point of view. Hence, only those books are to receive consideration at this time the titles of which specifically class them as phytochemistry.

Omitting Uslar's¹ (1795), de Saussure's² (1804) and Nees von Esenbeck's³ treatises, which are phytophysiological rather than phytochemical in character, the book literature comprises the following titles arranged chronologically. For editions, translations and comments on the several treatises, see under authors' names.

- 1821. Runge, *Neuste phytochemische Entdeckungen zur Begründung einer wissenschaftlichen Phytochemie*.
- 1834. C. Koch, *De phytochemia*.
- 1847. Fr. Rochleder, *Beitrag zur Phytochemie*.
- 1854. Fr. Rochleder, *Phytochemie*.
- 1858. Fr. Rochleder, *Chemie und Physiologie der Pflanzen*.
- 1871. Husemann, Hilger und Husemann, *Die Pflanzenstoffe*.
- 1882. E. Ebermayer, *Physiologische Chemie der Pflanzen*.
- 1905. Fr. Czapek, *Biochemie der Pflanzen*.
- 1908. H. Euler, *Grundlagen und Ergebnisse der Pflanzenchemie*.
- 1911. C. Wehmer, *Die Pflanzenstoffe*.
- 1913. Haas and Hill, *An Introduction to the Chemistry of Plant Products*.
- 1913. H. Snyder, *The Chemistry of Plant and Animal Life* (2nd ed.).
- 1920. M. W. Onslow, *Practical Plant Biochemistry*.
- 1920. R. W. Thatcher, *The Chemistry of Plant Life*.
- 1924. Georg Trier, *Chemie der Pflanzenstoffe*.

¹ An English translation "with additions by G. Schmeisser," was published in Edinburgh in 1795, under the title *Chemicophysiological observations on plants*.

² *Les recherches dont je m'occupe dans cet Ouvrage, ont pour objet l'influence de l'eau, de l'air et du terreau, sur la végétation*. Though the method is chemical rather than that of plant mechanics and plant physics, the point of view is that of the agricultural plant physiologist. The *Recherches chimiques sur la végétation*, par Théod. de Saussure, Paris, 1804, were translated by F. S. Voigt as *Theodor von Saussure's chemische Untersuchungen ueber die Vegetation (mit einem Anhang und Zusätzen versehen)* and have been made generally available by A. Wieler, as Nos. 15 and 16 of Ostwald's *Klassiker der Exakten Wissenschaften*. Leipzig. Verlag von Wm. Engelmann, 1890.

³ *Die Entwicklung der Pflanzensubstanz...* Von C. G. Nees von Esenbeck, C. G. Bischof und H. A. Rothe. Erlangen, 1819. According to H. C. Bolton's *Select Chemical Bibliography* (*Smithsonian Miscellaneous Collections* No. 850, Wash. 1893), page 695, the complete title reads... *physiologisch, chemisch und mathematisch dargestellt mit combinatorischen Tafeln der moeglichen Pflanzenstoffe, und den Gesetzen ihrer stoechiometrischen Zusammensetzung*.

The treatises that appeared during the nineteenth century may be regarded as possessing historical interest only. The collected papers of phytochemical investigators can scarcely be regarded as general treatises. For essays and addresses of a general nature such as Ciamician, "*The photochemistry of the future*" see *Phytochemistry* (Addresses, etc.).

Though in a certain sense not general treatises, yet more out of place under the caption Special Literature, are the treatises on phytochemical analysis. These also are arranged chronologically. For special information the reader is referred to the author's name.

- 1795. Hermbstaedt, *Anleitung zur chemischen Zergliederung der Vegetabilien*.
- 1808. ———, *Chemische Tabellen der Pflanzenanalysen*.
- 1858. Fr. Rochleder, *Anleitung zur Analyse von Pflanzen und Pflanzentheilen*.
- 1868. Wittstein, *Anleitung zur chemischen Analyse von Pflanzen und Pflanzentheilen*.
- 1869. Arata, *Guja parael Analisis immediato de dos Vegetales*.
- 1880. Parson, *A Method of Proximate Analysis of Plants*.
- 1882. G. Dragendorff, *Die qualitative und quantitative Analyse von Pflanzen und Pflanzentheilen*.
- 1923. L. Rosenthaler, *Grundzuge der chemischen Pflanzenuntersuchung*. Zweite Auflage.

As may be assumed from the dates, all of these treatises but the last are out of date. In addition to Rosenthaler, the recent special literature will have to be consulted. In this connection, however, mention should possibly be made of two treatises on the microchemical examination of plants, viz.:

- 1913. O. Tunmann, *Pflanzenmikrochemie*.
- 1913. H. Molisch, *Mikrochemie der Pflanze*.

Attention should also be directed to recent book literature that covers biochemistry rather than phyto- or zoöchemistry. Of the *Monographs on Biochemistry* edited by Plimmer and Hopkins, only one, *The Development and Present Position of Biological Chemistry* by F. G. Hopkins, is of general interest; (see monographs), the others will be included in the special bibliographies. Abderhalden's *Handbuch der biochemischen Arbeitsmethoden* (1910), also his *Biochemisches Handlexikon* (1911), the former in 8 parts (10 vols.), the latter in 9 parts (10 vols.), both compiled with the aid of specialists, have become the modern handbooks of the physiological and organic chemist as well as the phytochemist.

Finally, there should be mentioned Ritsema and Sack's *Index phytochemicus* published in 1905, which, however, was not continued and which has since been replaced by Wehmer, the phytochemist's "Beilstein." Quite different, but of sufficient importance to be mentioned in this connection is *Price List 44 (6th Edition)* of *United States public documents relating to plant life* for sale by the Superintendent of Documents, Washington, D. C., U. S. A. (February 1914), a pamphlet of 63 pages. Last, but not least, mention should be made of the *Acta Phytochemica*, a Japanese periodical devoted exclusively to plant chemical research. (Vol. I, No. I appeared in 1922) and to *Plant Chemistry* ephemeral monographs published by The Ievata Institute of Plant Biochemistry. (No. I, Tokyo, 1924.)

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Runge, F. F.—Friedlieb Ferdinand Runge was born Feb. 8, 1795 near Hamburg as son of pastor J. G. Runge. Originally pharmacist, he turned first to

medicine (M.D., Jena, 1819: *De nova methodo . . .*), and then to chemistry (Ph.D., Berlin, 1822: *Diss. de pigmento . . .*). His pharmaceutical-phytochemical foundation found expression in both dissertations, also in his *Neueste phytochemische Entdeckungen zur Begründung einer wissenschaftlichen Phytochemie*, published in the interval, viz., 1820-1821. Shortly after his second graduation he lectured at Berlin on Phyto- and Zoöchemistry.

After his "Wanderjahre" in Germany, Holland, France, England and Switzerland, he was appointed Professor of Technology at the University of Breslau. At the beginning of the thirties he was appointed director of a chemical factory in Oranienburg on the Havel. Pensioned in 1854, he died March 25, 1867 in strained circumstances. However, before his death the London Industrial Exposition of 1862 honored him with a medal for his researches on coal tar published in 1834 in which he had made discoveries of the most fundamental importance. However, these had not been exploited by his own factory because of the beurocratic stupidity of its officers. Because of his factory connections, most of his later contributions to science were of a technological character.

His phytochemical dissertations and book publications are:

De nova methodo veneficium belladonnae, daturae, nec non hyosciami explorandi. Jenae, 1819.

Neueste phytochemische Entdeckungen zur Begründung einer wissenschaftlichen Phytochemie, 2 Haeft 8°, Berlin, 1820-1821.

Diss. de pigmento indico ejusque connubiis cum metallorum nonnullorum oxidis. Berlin, 1822.

Of his phytochemical journal articles the following may be listed:

Ueber d. Bestandtheile d. Krapps u. ueber Krappsaerberei. Erdmann's Journ. IV, 1829.

Ueber d. Atropin. Schweigg. Journ., Vol. 43 (1825).

Chemisch-technische Monographie des Krapps oder vergleichende Untersuchungen der Krappfarbstoffe und der verschiedenen Krappsorten. Berlin, 1845.

Runge's fondness for pigments, more particularly dyestuffs, found expression in his *Grundriss der Chemie* which was published in 1846. Each and every one of the inorganic substances described is represented, so far as its color is concerned, by a square of colored paper which accompanies the description in the text. The American student may be interested to know that Wm. Simon adopted this practice in his *Manual of Chemistry with Plates*.

A biography, written by Anschuetz, may be found in Hoefler, *Allgemeine Deutsche Biographie*. A list of his publications, supplemented by Anschuetz, can be consulted in Poggenдорff, *Biogr.-litter. Handwoerterbuch*.

Other biographical material of interest:

Von dem Entdecker der Anilinfarben. Pharm. Ztg., 1885, No. 23.

Friedrich Ferdinand Runge. Ein Gedenkblatt zu seinem, 61. Todestage. N. Y. Apoth.-Ztg., 1928, pages 35 and 49; from *Heimat und Welt*.

As to the erection of a monument over Runge's grave by the *Deutsche chemische Gesellschaft*, see *Berichte*, 2 (1869), page 325; also 5 (1872), pages 839 and 1119.

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Runge, F.—*Neueste Phytochemische Entdeckungen zur Begründung einer wissenschaftlichen Phytochemie*.

While published in book form, this was, after all, an attempt on part of the author to establish an ephemeral, quasi journal or "phytochemische Lieferungen" (see page X) of which the first appeared in 1820 and the second in 1821. Enthused with the idea to change phytochemistry from a name to a science, the author conceived daring plans which did not materialize (page VIII). From the purely scientific aspect he was soon switched over to the practical (see Biography). So far as we know, his Phytochemical Society never got beyond the stage of good intentions; and his elaborate scheme of classification of the science did not outlive the printed suggestion. Even his suggestions as to a rational nomenclature of the *materia phytochemica* failed because they were based on a strict analogy of organic chemistry to the inorganic chemistry of acids, bases and salts, an analogy that was hailed as a great achievement on part of the theoretical chemist after Sertuerner's discovery of 1817, but which failed even in the modified form given to it by Liebig.

Viewing the publication as an ephemeris, its table of contents will readily tell its story. For the sake of bibliographic completeness, its main title—not commonly used—should be given, namely, *Materialien zur Phytologie*. The first "Lieferung" also bears the subtitle: *Anleitung zur einer besseren Zerlegungsweise der Vegetabilien durch Theorie und Versuche erlaeutert von.*

Inasmuch as the books have become very rare, the table of contents, arranged in chapters, may here be given:

Erste Lieferung, 1820

1. *Phytochemische Prinzipien.*
2. *Reagentien.*
3. *Zerlegungsweise der Pflanzen.*
4. *Critische Bemerkungen ueber die jetzt herrschende Namenmacherey in der Phytochemie.*
5. *Versuch einer Zerlegung der drey sogenannten Narkotica: Hyoscyamus niger, Atropa Belladonna, und Datura Stramonium.*
6. *Kaffe.*
7. *China.*
8. *A. Crocus sativus, Safran.*
B. Aloe.
9. *Der narkotische Stoff der Bilse, der Belladonna und der Datura im Conflict mit dem lebenden pflanzlichen und thierischen Organismus.*
10. *Quantitative Bestimmungen ohne direkte Anwendung von Mass, Wage und Gewicht.*
11. *Ueber die Extraktbereitung aus Narkoticis.*

Zweite Lieferung, 1821

1. *Die Phytologie und das Verhaeltniss der Botanik und der Phytologie zu ihr.*
2. *Die Metamorphose der Pflanzen.*
3. *Die Pflanzenstoffwelt.*
4. *Zur Zerlegungsweise der Pflanzen.*
5. *Reagentien.*
Anhang. Ueber Extraktivstoff und die Darstellung der Pflanzenbasen und Pflanzensaehren.

Thus far no book reviews have been found in the pharmaceutical journals of the early twenties of the nineteenth century, viz., in the *Almanach*, the *Archiv* and the *Berlinisches Jahrbuch*. Hence, we are not advised as to the reception of the *Materialien zur Phytologie* by the contemporaries of their author and editor.

Karl Heinrich Emil Koch, born on the Ettersberg near Weimar, June 6, 1809, died in Berlin, May 25, 1879, as Extraordinary Professor of Botany. As a student of medicine he inclined to botany. Having attained the doctor's degree in Medicine in 1833 in Wuerzburg, he acquired the degree of Doctor of Philosophy in Jena in 1834, offering as dissertation¹ his *De phytochemia*. Here he became "Privatdozent" in Botany. He explored Asia Minor. His publications were almost exclusively botanical, with decided leanings towards dendrology.

Allg. Deutsche Biographie 16, page 395, based on "Biogr. Skizze Karl Koch's, den Freunden gewidmet von Frau Koch." Poggendorff, *Biogr. Lit. Handwoerterbuch*, Bd. III, page 732.

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Koch, K. H. E.—De phytochemia. Dissertatio inauguralis . . . pro venia legendi.

This inaugural lecture, delivered before the Philosophical Faculty of the University of Jena, April 28, 1834, is dedicated to Professor J. W. Doebereiner who, in 1810, had been appointed Professor of Chemistry, Pharmacy and Technology, the appointment having been brought about by none less than Goethe, the advisor of the Archduke of Sachse-Weimar. (Hugo Doebeling, *Die Chemie in Jena zur Goethezeit*, Jena, 1928, however, does not mention Koch.) The author signs himself as "Dr. Phil. Med. Chir. et Art. Obst."

The lecture, in Latin, has little interest other than historical. It is devoted in large part to an historical account of the author's knowledge of organic substances obtained from plants. Its special significance, if any, lies in the apparent fact that he was influenced by Runge and the latter's attempt to make phytochemistry a science; also in his recognition of Sertuerner's discovery of the alkaloids from which event he dates a new period in phytochemistry.

The lecture concludes with a brief account of the preparation of "Caryophyllatinum" and "Sylvaticinum," and an elementary analysis of the former.

(To be continued)

¹ E. Wimschumann, in his biography in the *Allg. Deutsche Biogr.*, states that Koch received his degree of Doctor of Philosophy on the strength of this dissertation, whereas the title page specifically states the publication is a *dissertatio inauguralis . . . pro venia legendi*. Possibly it may have served both purposes.

"No one appreciates the value of a highly qualified pharmacist more than does the doctor. A great share of the physician's success is due to the care and precision with which his prescriptions are filled. A highly trained, properly qualified pharmacist is more careful of his stock and prescriptions than one not so qualified. The more highly trained the pharmacists are, the better is the service the physicians can give, since the utmost in pharmaceutical service is needed to make the utmost in medical service possible. The physician can encourage the qualified pharmacist by patronizing him and can in this way help the laudable effort of the pharmaceutical profession to advance its educational and practical standards."

"Medicine and pharmacy are specialized fields of professional service within the larger and inclusive field of health work. Their separation began at a time in the development of civilization so long ago that it cannot be stated in chronological terms, but it must have begun at a time when what we now call medical and pharmaceutical knowledge had accumulated to a point where one person could no longer encompass and utilize it all, and the separation completed itself gradually."—ARTHUR W. ERSKINE, M.D.