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LIEBIG'S POLISH PREDECESSORS AND SUCCESSORS

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The ideas of every scientist are based on his observations and experiments, but also on those of his predecessors. Liebig developed many new ideas that were continued by his scientific sons, grandsons, etc. He had, of course, also some predecessors, although only few of them are mentioned in Liebig's papers. In XIX c. it was rather not popular to refer to one's predecessors. However, comparing the texts of different naturalists some traces can be found. One of such physicians, naturalists and chemists, nonmentioned by Liebig, is a Pole, Jędrzej Śniadecki. Śniadecki was born in 1768 in Żnin (Poznań District), studied medicine at University of Cracow, then worked with A. Volta in Italy and J. Black in Scotland. In 1797 after returning home, he has been appointed professor of chemistry at the medicine faculty of the Vilna University: He occupied this chair till 1822, being at the same time one of the most known Polish physicians. At that time Poland was occupied by three neighbourhood states and Vilna was a part of Russian Empire. At the beginning of XIX c. in the old Polish University in Vilna it was lectured mainly in Latin but most of lecturers and students were Poles. The Śniadecki's predecessor at the chair in Vilna, Sartorius, lectured the chemistry based on the old phlogiston theory in Latin. Śniadecki began the Lavoisier's chemistry course in Polish. In 1800 he published the first Polish handbook of chemistry *The Principles of Chemistry* reedited in 1806 and 1816 [1]. Thus Śniadecki is one of principal founders of the actual Polish chemical terminology. His terminology influenced also the Czech terminology formed by J. S. Presla [2] in 1827. In 1825 he has been appointed the head of the Therapeutical Clinic of the Vilna University. Śniadecki died in Vilna 1838.

The other important Śniadecki's publication was a handbook of physiology *The Theory of Organic Beings* [3]. The first volume was published in

1804, the second in 1811 in Polish, (the planned third volume was not written). This work was translated into German, published twice (1810 and 1821) and used as a handbook in some German universities. It was also published in 1825 in French. Many Liebig's theses are compatible with those of Śniadecki. I will give only some examples:

In § 41 and 42 of his *Theory,* Śniadecki relates that all organic beings contain several inorganic elements: hydrogen, oxygen and carbon in the first line, but also nitrogen, sulphur and phosphorus [4]. Similar theses can be also found in Liebig's writings published some years later. More significant are the conceptions concerning the natural forces acting in living organisms. In § 154 of his physiology handbook Śniadecki writes: " We have shown that all organic processes depend on exerting of organising forces and their preponderance over antiorganising ones, so as on preponderance of the disorganising processes on the prevalence of affinities. It follows that in the first part of life the organising forces are predominant and give a direction to all the life, so in the other part of life, they decline step-by-step and in this way they let to play a greater role to the affinities, and at the end retreating completely to affinities they give an end to all organic processes and to the life itself." [5]. So, in accordance with Śniadecki's views, the organising, it is the vitalic force and the chemical force, it is the affinity, they are both acting in the organic beings from their birth to their death, but with the lapse of time the role of the first one decreases and the role of the other — increases. This is a very interesting approach, as we know today that at the beginning the organic beings were very far from thermodynamic equilibrium. The chemical reactions are much nearer to this equilibrium, but the equilibrium itself means the lack of any reactions, that is the death of organic beings.

What are the Liebig's views of these problems? We can find them in his *Letters on Chemistry* published 1851 in London [6] and compare with the Śniadecki's view. The problem which elements are present in organic compounds is at that time out of discussion. About the role of vital and chemical forces we read in the letter XIV [7]: "Neither heat, electricity, nor the vital force are capable of connecting the particles of two dissimilar elements into a group— of uniting them into a compound; — this, the chemical force alone is able to accomplish.

"...The substance of brain, of muscle, the constituents of blood, of milk, of bile &c., are compound atoms, the formation and duration of which depend upon the affinity which acts between their ultimate particles, — their component elements. It is affinity, and no other power, which causes their aggregation. Separated from the living body, withdrawn from the influence of vital force, it is chemical force alone which determine the condition of their ulterior existence."

But according to the XXV letter [8]: "Universal experience teaches us that all organised beings gradually vanish from the surface of the earth... The animal matters lose their cohesion; they are dissipated into air, leaving only the mineral elements which they had derived from the soil.

"This grand natural process of dissolution of all compounds formed in living organisms, begins immediately after death, when manifold causes no longer act, under influence of which they were produced. The compounds formed in the bodies of animals and of plants undergo, in the air, and with the aid of moisture, a series of changes, the last of which are the conversions of their carbon to carbonic acid, of their hydrogen into water, of their nitrogen into ammonia, of their sulphur into sulphuric acid. Thus, their elements resume the form in which they can again serve as food to a new generation of plants and animals."

The Liebig's formulation is, of course more modern than that of Śniadecki but some coincidence can be found. The problem of influence of Śniadecki's ideas on Liebig still waits analysis.

What concerns the Polish Liebig's successors. In 1845 Mikołaj (Nicholas) Laskowski (born in 1816) worked in Liebig's laboratory in Giessen and in 1846 he published an article on the protein theory [9]. Laskowski studied also in Giessen the acids of cheese with P. Iljenko [10]. Laskowski later worked in Russia. No other Pole, as we know, worked in the Liebig's laboratory, but many Polish chemists visited laboratories of Liebig's scientific sons and grandsons.

Bronisław Radziszewski (1838–1914), graduated from the Moscow University, after the fall of the Polish uprising against Russia in 1863, when he was a member of the Polish government, was obliged to leave Russian territory and went to Gent, where in the August Kekule's laboratory he performed in 1867 his Ph.D. thesis. In 1872 he was appointed the chief of the chemistry chair at the Lwów Polish University, at that time under Austrian occupation. There he founded the Polish organic chemistry school [11]. He observed as first one, the luminescence originated by chemical reactions and considered (before other naturalists) the organic origins of the crude oil. In 1867 he worked in Gent with a young Pole, Stanisław Szuch (1849–1910) [12], with whom Kekulé published an article [13].

Later in Kekule's laboratory in Bonn worked Poles Wiktor Richter (1841–1892) in 1874 and in 1875 Ernest Tytus Bandrowski (1853–1920), since 1879 a professor at the Technical Academy of Kraków and since 1896 chemistry professor at the Jagiellonian University of Kraków. And also Jan Siemieński (1855–?) who began in Bonn in 1880 his Ph.D. thesis that was finished in Erlangen with an other Liebig's student, Jacob Volhardt [14].

Wilhelm Ostwald studied in Riga by Carl Schmidt, Liebig's pupil. With Ostwald collaborated 5 Polish chemists: Mieczysław Centnerszwer (1874–1944) fulfilled in 1898 his Ph. D. thesis on the catalytic influence of gases in the oxidation of phosphorus. Centnerszwer was after 1898 the founder of the Baltic school of chemistry and since 1929 a professor of physical chemistry of Warsaw University. Another Ostwald's collaborator, Jan Zawidzki (1866–1928) fulfilled in 1900 in Leipzig his Ph.D. thesis *"Ueber die Dampfdrucke binären Flussigkeitgemischen* ,cited in many handbooks. In 1918-1928 Jan Zawidzki was a professor of inorganic chemistry at the Technical University of Warszawa. Tadeusz Miłobędzki (1873–1959) after 1915 professor of the Technical University of Warszawa worked in 1905 some months in the Ostwald's laboratory. Two future professors of physical chemistry at the Jagiellonian University of Kraków, Ludwik Bruner (1871–1913) and Bohdan Szyszkowski worked for some months in the Ostwald's laboratory.

In 1896 Stanisław Tołłoczko (1868–1935) graduated from the Russian Warsaw University commenced his Ph.D by Ostwald's pupil, Walther Nernst. In 1905–1935 he was the head of the department of Inorganic and Physical Chemistry at the University of Lwów. He played an important role in the development of Polish chemistry and educated some Polish eminent chemists. In 1904 Tołłoczko worked also with Fritz Haber.

Fritz Haber was a student of Carl Liebermann, a pupil of Adolf v. Baeyer who in turn studied by August v. Kekule. With Haber worked 2 Polish scientists. The first one was in 1909 Zygmunt Klemensiewicz (1886–1963) who invented in the Haber's Laboratory in Karlsruhe the glass-electrode. Klemensiewicz took in 1920–1940 the chair of physics at the Technical University of Lwów, in 1947–1951 at the Polish Technical University of London, and since 1956 at the Silesian Technical University of Gliwice.

Another Polish chemist, Józef Zawadzki (1886–1951), graduated from the Jagiellonian University of Kraków spend two years (1911–1913) in the Haber's laboratory in Karlsruhe. In 1923 he was appointed the head of the department of Chemical Technology at the Technical University of Warszawa. During the Nazi occupation he was the dean of the clandestine Chemical Department of Warsaw Universities.

Thus, Liebig influenced to some extend the development of some branches of Polish chemistry by means of his pupils and pupils of his pupils.

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