DISCOVERY OF ELECTROKINETIC PHENOMENA IN MOSCOW UNIVERSITY

A.V. Pertsov, E.A. Zaitseva (Baum)

Chemical Faculty, Lomonosov Moscow State University, Moscow, Russia
avpertsov@mail.ru

After the invention by Italian physicist A. Volta in 1800 of first chemical current supply that got the name of the "Voltaic pile", there began an active research of influence of electric current on various media and objects and one of the first researchers were scientists working in Russia. Already in 1801 the Voltaic pile and its action was demonstrated before the Conference of the Academy of science by an academician A.A. Musin-Pushkin. In 1802 Russian physicist V.V. Petrov, professor of Medical-Surgical academy in Petersburg conducted experiments of electrical melting of metals and burning of various substances using a Voltaic pile produced by him from 4200 copper and zinc discs. No doubt, his battery was the most powerful for that time. Several years later, a young, energetic scientist from Germany Ferdinand Friedrich (Fedor Fedorорvich) Reuss also began to investigate the influence of direct current on water solutions—he was invited in 1803 by curator of Moscow university M.N. Muraviev to hold the chair of chemistry at the Physical-Mathematical Faculty. Earlier chemistry was taught only at medical faculty.

The aim of Reuss' research was study of influence of conditions of electrolysis conduction on speed of gas emission: he correlated the progress of electrolysis in a beaker and in natural reservoir ("at the bank of Moscow river and at a site of one garden", according to Reuss), in view of existence of "barriers" in form of sand and clay between the poles of battery [1]. In course of this research conducted with the help of the Voltaic pile "consisting of 92 Silver rubles and the same amount of zinc discs" he discovered the phenomena of electro-osmosis and electrophoresis. F.F. Reuss informed of this discovery for the first time in 1807 at the meeting of the "Society of Competition of Medical (Iatric) and Physical Sciences", established in 1804 with Moscow University (later renamed into Physical-Medical Society), one of founders of which was Reuss. Corresponding articles in Latin and French were published by the scientist in 1809 in « Mémoires de la Société Impériale des naturalistes de Moscou » (the society attached to Moscow University), and Commentationes Societatis Physico-Medicae, apud Universitatem Literarum Caesaream Mosquensem Institutae (Commentaries of Physical-Medical Society affiliated with Moscow University), which has been published since 1808 (in volumes 1 and 2, in years 1808 and 1821, repectively)[2].

Ferdinand Friedrich von Reuss (also Reuß) (1778–1852) was born in Tübingen. His father was professor of Tübingen University. In 1800 F.F. Reuss, having finished university course in Tübingen, received the title of licentiate of medicine. Afterwards he leaved for Göttingen, where his uncle lived – professor and chief librarian of Götttingen university. Already in 1801 Reuss got the degree of doctor of medicine and surgery and at the same time the degree of privat-docent of general medical chemistry. Upon arrival to Moscow the young scientist was immediately honored the degree of extraordinary professor (1804) of Moscow University. One year later he was elected as a correspondent member of St. Petersburg Academy of Sciences. Since 1808 he was an ordinary professor of Moscow University. Besides, the scientist was in 1817–39 the professor of chair of chemistry and formulae in Moscow Department of Emperor Medical-Surgical Academy, there he also headed the chair of history, methodology and encyclopedia of medicine. In 1828 Reuss was elected as an academician of Medical-Surgical Academy [2].

Activity of Reuss was notable for exceptional versatility and in many spheres he was a pioneer; he actively participated in life of the city, outliving together with other its inhabitants all hardships of complicated period that he happened to live in.

Reuss engaged in issues of Russian chemical terminology, having published in 1808 the "Essay on Benefit of Newest Chemical Terminology (Vocabulary), with Attempts to Translate Chemical Terms into Russian" (Moscow, 1808).

An important direction of the scientist's activity was research of medical action of various drugs. He made a substantial contribution to study of action of chinchona, salts of cuprum and potassium for treatment of croup etc. [3]

As Reuss attached much importance to the driving force of electro-osmosis in nature, calling it water-pushing and to the action of which he ascribed appearance of various springs, motion of juices in plants and even of blood in humans and animals, the part of his research was dedicated to study of physiological processes, taking place in living organisms [3].

On 1 of September 1912 together with other professors and students on university carts, on a wagon Reuss leaves Moscow. In Nizhniy Novgorod he was taken ill with "nervous fever", was in quite a grave condition and the doctors have nearly relinquished hope to save him [4]. After coming back Reuss takes an active part in reconstruction of the university. Due to his efforts in winter of 1823 the new building of University Pharmacy was opened, with which there were equipped Chemical laboratory and Chemical cabinet [2].

From 1822 to 1832 F.F. Reuss was director of university library and at this position he approved himself as reformer of library theory and practice: he put forward an idea of creating a joint catalogue of scientific libraries of Moscow and Petersburg. For 11 years of work F.F. Reuss managed to make a model library (among European ones) and scheme of classification of funds, system of book card catalogues, technology of replication of printed book cards that were developed by him gained ground afterwards in Russian library practice [5, 6]. The old part of library until recent time bore the name "Cabinet of Reuss". At present time it is moved to the edifice of Fundamental library, where the present conference is held—the III International Conference of Colloid Chemistry and Physicochemical Mechanics, dedicated to 200th anniversary of discovery of electroosmosis and electrophoresis by Reuss.

Reuss has also researched the chemical composition of natural mineral waters of Caucasus, Tverskoy and Moscow regions. In 1820s he engaged in composing artificial mineral waters, corresponding to certain medical requirements [7].

In 1839 the scientist returned to his motherland.

Unfortunately, the rarity of editions with published works of Reuss connected with research of electrokinetic phenomena (besides, most part of them was destroyed by fire of 1812) explains the fact that his works in this sphere remained nearly unknown to wide scientific community. In particular, the name of Reuss is not even mentioned in works on history of physical chemistry of W. Ostwald. 50 years later G.H.Wiedemann and G.Quincke investigated the principles of electro-osmosis in detail. Other 20 years later on basis of this research Hermann von Helmholtz created the theory of these phenomena and introduced the concept of double chemical layer which underlies, in particular, contemporary theoretic electrochemistry. That is one can say that Reuss discovery gave birth to a large number of scientific directions (theory of double chemical layer, electrochemistry, theory of disperse system stability etc.) and practical application of electrophoresis and electro-osmosis in technique, geologic exploration, medicine. No doubt, that discovery of Reuss is one of most substantial achievements of scientists of Moscow university.

Moscow University, to which Reuss dedicated 30 years of his creative activity, highly appreciates the contribution of the scientist to the development of science. Though he did not acquire Russian citizenship, he is inscribed to the list of outstanding writers and scientists of Russia [8].

LITERATURE

1. F.F.Reiss. *Zametka o novom deistvii gal'vanicheskogo elektrichestva (1808)* — v knige: *Izbrannye trudy po elektrichestvu*. [F.F.Reuss. *A Note on the New Action of Galvanic Electricity (1808)* — in the book: *Selected Works on Electricity*]. M: Gos. Izd-vo tekhniko-teor.liter., 1956, p.159–168.
2. E.A. Zaitseva. Deutsche an der Moskauer Universität im 19 .Jahrhundert: Ferdinand Friedrich v.Reuss (1778–1852) —In: *Deutsch-russische Beziehungen in Medizin und Naturwissenschaften* / D.v.Engelhardt u. I.Kästner (Hgg), Bd.4. Aachen: Shaker Verlag, 2001, S.209–226.
3. E.A. Zaitseva. Deutsche an der Moskauer Universität in der ersten Hälfte des 19. Jahrhunderts: Lehre und Forschung zur Chemie der Arzneimittel und der Lebensvorgänge — In: *Deutsch-russische Beziehungen in Medizin und Naturwissenschaften* / D.v.Engelhardt u. I.Kästner (Hgg), Bd.6. Aachen: Shaker Verlag, 2002, S.149–158.

4. A. Iu. Andreev. *1812 god v istorii moskovskogo universiteta.* [*Year 1812 in the History of Moscow University*.] M.: 1998.
5. Iu.V.Grigoriev *F.F.Reuss. Ocherk zhizni i deyatel'nosti* [*F.F.Reuss. Essay on Life and Activity*]. M.:Izd-vo MGU, 1963, 106 p.
6. V.V.Sorokin. *Istoriya biblioteki Moskovskogo universiteta (1800-1917)* [*History of Library of Moscow University (1800-1917)*]. M.: Izd-vo MGU, 1980. 136 p.
7. E.A. Zaitseva-Baum. Ferdinand Friedrich v. Reuss und die Mineralwässeruntersuchungen — In: *Deutsch-russische Beziehungen in Medizin und Naturwissenschaften* / Hgg. D.v.Engelhardt u. I.Kästner, Bd. 12. Aachen: Shaker Verlag, 2005, S. 137–150.
8. G.N.Gennadii. *Spravochnyi slovar' o russkikh pisatelyakh i uchenykh, umershikh v XVIII i XIX stoletiyakh, i spisok russkikh knig s 1725 po 1825 god. T.3* [*Reference Dictionary of Russian Writers and Scientists, who Died in XVIII and XIX Centuries, and the List of Russian Books from 1725 to 1825. Vol. 3*]. M.:Tipografiya shtaba Moskovskogo voennogo okruga, 1908, p. 245–246.