In December, 2010, the community will be celebrating the 150th anniversary of the birthday of an outstanding Russian chemical scientist Nikolai Semenovich Kurnakov. N.S. Kurnakov, a junior contemporary and follower of D.I. Mendeleev, as D.I. Mendeleev vividly noted, belongs to the “Russian chemical brigade” that held high the banner of the Russian chemical science.

For many years, Kurnakov was at the head of the inorganic chemistry in Russia. He brought up a large (perhaps, the largest) school of inorganic chemists who continue and develop his ideas.

Being a scientist with a broad scope of interests, Nikolai Semenovich was also an engineer engaged in applied problems to bring the results of fundamental research to practical implementation. He was also an outstanding teacher and a science organizer, who founded a number of scientific institutions and industrial plants, and headed numerous expeditions.

Nikolai Semenovich Kurnakov was born on December 6 (November 24, O.S.), 1860, in the town of Nolinsk, Vyatka province. His father, sous-lieutenant of the Bryansk chasseur regiment, participated in the heroic defense of Sevastopol’ in 1854—1855. At the beginning of the warfare, he was at the Malakhov Mound, where he was severely blast-injured, dismissed from the army, and in 1868, he died in Nolinsk. Interestingly, a famous Russian organic chemist, V.V. Markovnikov, was a close relative of Nikolai Semenovich’s mother, Varvara Alekseevna Mezentseva. The Nikolai Semenovich’s great-grandfather, major general Semen Ivanovich Kurnakov (1758—1817), was a fellow-fighter of A.V. Suvorov and M.I. Kutuzov.

Nikolai Semenovich Kurnakov was brought up in the Zhedrin village of the Nizhni Novgorod district by his mother, and in 1871, he entered the Nizhni Novgorod military gymnasium, from which he graduated in 1877. In the gymnasium, he got his initial knowledge in chemistry. Nikolai Semenovich noted in his autobiography that as early as being 14 years old, he carried out by himself experiments in preparative and analytical chemistry in the attic of his house, using the chemistry handbook by Yu.A. Shtekgardt. As he said, it was the home experiments that determined his future.

After having graduated from the gymnasium in 1877, Kurnakov moved to Petersburg and enrolled the Mining Institute, where chemistry was taught at that time at a high level. Professor K.I. Lisenko (1837—1903), who had extensive knowledge in salt production, steel, cast iron, copper and ores, crude oil and oil-based industry, and coal-mining industry was the first chemistry teacher of Nikolai Semenovich at the Mining Institute. Probably, he passed this broad area of scientific research to his student, Kurnakov. Note that Professor Lisenko also delivered lectures in analytical chemistry at the Mining Institute. The courses of general and inorganic chemistry were delivered by Professor D.K. Sushin whose dissertation was devoted to elucidation of chemical interaction in a homogeneous medium by spectral method and, as noted by a Kurnakov’s follower, Corresponding Member of the USSR Academy of Sciences N.I. Stepanov, this was one of the first examples of the powerful investigation technique that is now developed extensively and fruitfully in the laboratory of the Mining Institute and far beyond it under the name physicochemical analysis. [1].

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The Institute had an excellent library, good mineral collections, well equipped laboratories, physical
rooms, and so on. All this demonstrates that Kurnakov started his education at a higher institution that had high-level scientific tradition and scientific staff and, it is natural, that the gifted and hard-working young man got fairly profound knowledge in natural science and technology. Among his teachers, Kurnakov named also outstanding mineralogists Academicians N.I. Koksharov (Director of the Mining Institute and Mineralogical Society) and A.P. Karpinsky, the first elected President of the Russian Academy of Sciences (1917–1925) and President of the USSR Academy of Sciences (from 1925 by the end of his life).

In June 1882, Kurnakov graduated from the plant division of the Mining Institute with a mining engineer degree. According to the order for Mining department of January 21, 1883, he remained at the Mining Institute for practical work in the chemical laboratory.

As a matter of fact, Kurnakov showed interest in many branches of science; however, professors K.I. Lisenko and N.A. Iossa had long noticed Kurnakov’s particular interest in chemistry, and it was them who applied that Kurnakov be left at the Institute. Note that the crucial changes that took place in the chemical science at the beginning of the 20th as regards both the theoretical science and investigation methods and the type of the problems being solved were associated to a large extent with the names of Kurnakov and his trainees.

Kurnakov was an equally outstanding scientist, educator, and science organizer, and also a talented engineer. In his public speeches and articles, he considered only his scientific works and their practical applications and only briefly mentioned his educational and science organization activities.

On the occasion of the anniversary of Kurnakov’s birthday, it would be pertinent to consider (although briefly) all aspects of the many-sided activity of this great scientist, educator, and a patriot of his country.

I. KURNAKOV’S CONTRIBUTION TO THE RUSSIAN AND WORLD SCIENCE AND INDUSTRY

Kurnakov’s scientific activity covers a broad range of important problems that can be classified into six areas:

(i) Kurnakov is the founder of a new field of general chemistry, in particular, physicochemical analysis.

(ii) Physical chemistry and industrial processing of metallic alloys.

(iii) Physicochemical investigations of water–salt equilibria and salt deposits of the country.

(iv) Physicochemical investigations of organic systems.

(v) The chemistry of coordination (complex) compounds.

(vi) Participation in the initiation and development of the Russian chemical and metallurgical industry.

It is noteworthy that even before Kurnakov, outstanding chemists repeatedly noted the significance of investigations of the dependence of compound properties on their composition. Back in 1752, M.V. Lomonosov, while pointing to the relationship between chemical or mechanical properties and the chemical composition of a substance, advised “to observe how, to what extent, and in what manner a given feature changes following the change in a known constituent with the goal to derive the true cause of the feature after elucidating the nature of this feature from the compatibility of one and the other” [2].

A century later, in 1864, the outstanding physical chemist I.I. Beketov wrote: “Study of the so-called general physical properties of various bodies is rationalized only in relation to their chemical composition” [3]. D.I. Mendeleev was immediate Kurnakov’s forerunner in the development of physicochemical analysis. In his classical works About Compounds of Alcohol with Water (1865) and Study of Solutions by Specific Gravity (1887) where he carried out the first systematic investigation of properties depending on the composition, Mendeleev demonstrated that the formation of particular compounds is characterized by specific (singular) points in the composition–property diagram. The change in the specific gravity upon continuous variation of the composition showed the existence of some specific points in the variation of the properties that corresponded to particular molecular compounds. Mendeleev’s works were important for the theory of solutions but at the same time, they served as the starting point for Kurnakov to develop the main statements of physicochemical analysis [4].

Kurnakov himself noted: “Mendeleev’s specific points were the first examples of the singular breaks that belong to particular chemical compounds in binary systems. Mendeleev’s theory of specific (singular) points gradually develops to a potent physicochemical discipline, which is significant both for practical applications and for general aspects of the cognitive theory” [5].

An important role was also played by studies of J.W. Gibbs dealing with equilibria of heterogeneous systems. Kurnakov pointed out this fact: “The modern period in the development of physicochemical analysis started from 1873–1878 where the Connecticut Academy of Science (North America) published the classical Gibbs’ memoirs concerning the equilibria of heterogeneous systems. There he introduced for the first time the new notions of phases and components (constituents), which later had enormous value for the study of chemical equilibria. The phase doctrine became a constituent part of physicochemical analysis; this underlay the notion of chemical individual” [6]. Kurnakov indicated that “the concept of phase is more general than the chemical individual used at that time, as the latter corresponded only to compounds