

Russian Chemistry in the 1850s: A Failed Attempt at Institutionalization

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Summary

This paper examines the efforts of two young Russian chemists during the late 1850s and early 1860s to establish a professional chemistry journal and a public laboratory for chemistry research in Russia. These two, N. N. Sokolov and A. N. Engel'gardt, were important participants in the early efforts to institutionalize and professionalize chemistry in Russia. However, both the chemistry laboratory and the chemistry journal ended after only a few years. The chemistry journal was curtailed not because of Government interference, as is sometimes asserted, but because of a conflict over editorial policy and independence. The chemistry laboratory was closed and the equipment donated to St Petersburg University when Sokolov was appointed to the position of adjunct there.

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1. Introduction

During the mid-nineteenth century, Russian chemists began the dual processes of professionalization and the formation of a distinct national community of chemists. These processes eventually led to the formation of the Russian Chemical Society in 1868. One important aspect of the transformation of chemistry in Russia during these years was the increasing importance of original scientific research. This new emphasis on original research led to the founding in 1857 of one of the first public chemistry laboratories there, and the first specialized Russian chemistry journal two years later. These efforts were undertaken by two young St Petersburg chemists, N. N. Sokolov and A. N. Engel'gardt. Unfortunately, both enterprises failed within a few years, even though they evidently fulfilled the needs of a large number of chemists in the capital. Traditionally, Soviet historiography has attributed these failures to state interference or opposition. However, these enterprises failed not through of any lack of interest on the part of Russian chemists in St Petersburg, or because of Government opposition, but because of the personal needs of their founders. Only later, in the 1860s, would conditions change sufficiently to support the formation of an institution that would serve the needs of the research-oriented chemists in St Petersburg and elsewhere in Russia.

The experience of Sokolov's and Engel'gardt's private chemistry laboratory, and chemistry journal, during the 1850s can help us identify issues that were important to Russian chemists, and can provide us with clues concerning the professionalization of Russian chemistry and the development of a nationwide community of chemists.

2. Chemistry in Russia up to the 1850s

During the eighteenth century and the first half of the nineteenth, chemistry in Russia was more or less limited to the Academy of Sciences in St Petersburg and the various higher educational institutions in the country. Chemists earned their living primarily by teaching chemistry. There were very few amateur chemists, or chemists who were employed outside of educational institutions. This was in distinct contrast with the situation in other European countries, where chemists could seek employment in industry or in various other occupations not connected with education.¹ Until the middle of the 1850s, most Russian chemists had only limited contact with colleagues in other cities in their own country, and sometimes they had few dealings even with those in their own cities. Most held a 'local' orientation, that is, they focused their attention on matters of interest to their universities and local communities, and did not participate in a national or international community. Furthermore, often they performed little or no original research.

During the 1850s the first steps toward the creation of a professional community of chemists began in St Petersburg. At this time, an increasing number of chemists, including D. I. Mendeleev and A. P. Borodin, was beginning to emerge in St Petersburg. These were graduates of the university and the various technical institutes in the city, and they had a broader outlook than had previous generations, and began to view other chemists as their peer group. Many of them spent time abroad during the 1850s and 1860s, conducting original research, and they returned to Russia with a distinctly different intellectual outlook, and with professional desires other than those of the older generation, such as A. A. Voskresenskii, K. J. Fritsche, and N. N. Zinin.

On their return to Russia after studying abroad, many members of this new generation wanted to maintain the close ties they had established with each other while abroad. Thus, by the mid-1850s many of the chemists living in St Petersburg were gathering in informal discussion groups in order to talk about recent developments in chemistry.² While the older generation of chemists did participate in these informal groups, the catalysts and driving force for their establishment and continuation was the young generation. These scientific discussion groups of the 1850s were similar to the literary circles, the *kruzhki*, of the 1840s, and had social as well as scientific functions. These scientific *kruzhki* were not limited to St Petersburg: chemistry professors in both Kazan and Moscow, for example, participated in different groupings in the 1840s and 1850s.³ Other scientific *kruzhki* existed from time to time in these and other university, and larger cities in Russia. In St Petersburg, however, the *kruzhki* that attracted chemists quickly developed serious intellectual goals, since those who

¹ For examples of the variety of careers pursued by chemists in England during the mid-nineteenth century, see R. Bud and G. R. Roberts, *Science Versus Practise* (Manchester, 1983).

² V. V. Kozlov, *Ocherki istorii khimicheskikh obshchestv SSSR* (Moscow, 1958), 11–12. Kozlov does not cite any source for his information, and I have not been able to identify a primary source for this statement. Kozlov repeats this statement in *Vsesoiuznoe khimicheskoe obshchestvo imeni D. I. Mendeleeva. 1868–1968* (Moscow, 1971), 9.

³ Nathan M. Brooks, *The Formation of a Community of Chemists in Russia, 1700–1870*. PhD dissertation, Columbia University, 1989, chapter 4 for Kazan and chapter 5 for Moscow.

participated were ambitious, and were devoted to research as the core feature of chemistry.⁴

3. N. N. Sokolov and A. N. Engel'gardt

Perhaps as a result of these meetings, two young chemists decided to move beyond these informal *kruzhki*. N. N. Sokolov and A. N. Engel'gardt set up a private chemistry laboratory in St Petersburg in 1857 that was available for use by any chemist. At this time there were only a very few chemistry laboratories at the higher educational institutions in the city, all of which were poorly equipped. As Alexander Borodin was to recall:

The condition of chemistry [at the Medical–Surgical Academy] was pitiful at that time. Chemistry was assigned only 30 rubles per year.... The [chemistry] laboratory of the Academy occupied two dirty, gloomy rooms with stone floors, a few tables and empty shelves. For want of a fume hood, distillations and other activities had to be undertaken out-of-doors, even in the winter. Ordinary practical work was out of the question.⁵

With their emphasis on the pursuit of original research as the hallmark of a chemist, the new generation naturally desired a modern laboratory in which to perform this type of research themselves. Zinin's laboratory at the Medical–Surgical Academy was clearly inadequate for more than basic work, and was not always available to the young chemists, since Zinin performed most of his research in his private laboratory in his home. Many young chemists had only temporary positions, and often were not allowed to use the limited laboratory facilities that did exist in the city. They believed that original research would improve their chances of obtaining a permanent position, and therefore they felt pressure to conduct research and publish the results. As the laboratory facilities at educational institutions were so poor, Sokolov and Engel'gardt decided to purchase sufficient equipment and chemicals to set up their own laboratory. This laboratory, as noted, was not for their exclusive use, but was open even to students only just beginning to pursue laboratory work in chemistry.

The idea for a laboratory of this kind may have originated with Nikolai Nikolaevich Sokolov (1826–77).⁶ Sokolov was born into the merchant class, the *kupechestvo*, and began his studies at St Petersburg University in the public administration section (*kameral'nyi otdel*) of the legal faculty, the most popular section for those planning a business career. Later, however, he switched his attention to the natural sciences section of the physics–mathematics faculty. After graduation in 1848, Sokolov was appointed curator of the mineralogy museum at the Academy of Sciences. Poorly paid positions such as this (Sokolov received only 286 rubles per year) were often given to young

⁴ Ibid., ch. 6.

⁵ A. P. Borodin and A. M. Butlerov, 'Nikolai Nikolaevich Zinin. Vospominaniia o nem i biograficheskii ocherk', *Zhurnal Russkogo Fiziko–Khimicheskogo Obshchestva*, 12 (1880), 245.

⁶ For biographical information about Sokolov, see Iu. S. Musabekov, 'N. N. Sokolov', *Zhurnal prikladnoi khimii*, 22 (1949), 1133–42. Soviet historians only briefly discuss Sokolov in the course of various works on the history of chemistry in Russia, while the only individual treatment (by Musabekov) of his life and career does not cover more than the bare facts that are available in other works. However, additional information about Sokolov is located in various Russian archives. These include the Russian State Historical Archive in St Petersburg (RGIA f. 381, op. 13, d. 7852, ll. 3–16); the St Petersburg State Historical Archive (f. 14, op. 1, d. 5982, ll. 1–105); and the Manuscript Section of the Saltykov–Shchedrin Library in St Petersburg (GPB RO f. 708, No. 921, ll. 1–4 ob). The latter gives Sokolov's patronymic as Pavlovich, although the rest of the biographical information is the same as the official service record held in RGIA.

graduates while they studied for advanced degrees. On occasion the graduates would combine several such positions, or else teach at the same time, in order to obtain enough money to support themselves. In 1855 Sokolov was also made a laboratory assistant in the chemistry laboratory of the Department of Mining and Salt Affairs, and at the same time began to teach chemistry at the Mining Institute. He also continued his chemistry research, receiving a master's degree in 1857 and a doctorate in 1859 from St Petersburg University. In 1860 he was appointed adjunct in the chemistry *kafedra* at St Petersburg University, following which he was elected extra-ordinary professor in 1865. However, later in 1865, Sokolov decided to move to the newly opened Novorossisk University in Odessa, though he returned to St Petersburg in 1871 as professor of chemistry at the Agricultural Academy.

While Sokolov probably had the initial idea of starting a private chemistry laboratory, the money for purchasing its materials may have come from Aleksandr Nikolaevich Engel'gardt (1832–93). Having been born into a moderately well-off family of the aristocratic landowning class, Engel'gardt could rely on an income from his patrimonial estate in addition to his own salary as a military officer in order to finance the laboratory. His background was, in fact, very different from that of most Russian chemists.⁷ He received his early education at home from tutors, and at the age of fifteen was sent to St Petersburg to receive the standard military education deemed appropriate for sons of the aristocracy. In 1853 he graduated from the Mikhail Artillery School (*Uchilishche*), where he had developed an interest in natural history, but apparently was not yet committed to chemistry.⁸ On graduation, he was assigned to military service at the St Petersburg Arsenal, where he remained until 1866. Perhaps his service at the Arsenal sparked an interest in chemistry. Whatever the case, Engel'gardt soon joined the informal chemistry *kruzhki* and eagerly began learning experimental techniques in Zinin's laboratory at the Medical–Surgical Academy.⁹ Between 1855 and 1859 Engel'gardt wrote a series of articles with Zinin that was published in the journals sponsored by the Academy of Sciences. The subjects of Engel'gardt's research indicate that he was influenced more by Zinin, who was researching the organic chemistry of aromatic compounds, than by Shishkov, his teacher at the Artillery Academy, whose research interests lay in explosives. In 1866 Engel'gardt received permission to resign his position at the Arsenal and accept an appointment as ordinary professor of chemistry at the Agriculture Academy in St Petersburg. A few years previously he had shifted his scientific research interests sharply toward topics related to agriculture, and had lectured at the Agriculture Academy for several years before his permanent appointment. In 1863 he visited his patrimonial estate for the first time in more than fifteen years. Perhaps this visit stimulated his subsequent interest in scientific agriculture.

4. The Chemistry Laboratory and the *Chemistry Journal*

The private laboratory founded by Sokolov and Engel'gardt lasted for three years, from 1857 to 1860. During this period nearly every young chemist in St Petersburg

⁷ N. S. Kozlov, 'Nauchnaia i obshchestvennaia deiatel'nost' A. N. Engel'gardt', *Trudy Instituta istorii estestvoznaniia i tekhniki*, 30 (1960), 111–34; A. G. Shestakov, 'Aleksandr Nikolaevich Engel'gardt i agronomicheskaiia khimiia', in A. N. Engel'gardt, *Izbrannye sochineniia* (Moscow, 1959), 7–20. RGIA f. 398, op. 30, d. 11252, ll. 1–46. The best treatment of Engel'gardt in English is contained in Richard Wortman, *The Crisis of Russian Populism* (Cambridge, 1967), ch. 2.

⁸ This can be inferred from selections quoted from his diaries for 1852–54 in Shestakov (note 7), 7.

⁹ Borodin identified Engel'gardt as a participant in these *kruzhki* and in Zinin's laboratory: Borodin and Butlerov (note 5), 234.

worked in the laboratory at one time or another, including P. P. Alekseev, V. V. Bek, A. A. Verigo, A. P. Borodin, F. Korovaev, N. I. Lavrov, G. V. Struve, I. A. Tiutchev, and N. K. Iatsukovich.¹⁰ Sokolov and Engel'gardt asserted that laboratory experience was essential to the process of learning chemistry, 'because only with the help of practical exercise can learning from books be totally assimilated...'. Moreover, the 'rational application of the acquired knowledge [i.e. chemistry] is not possible by any different path'.¹¹

This chemistry laboratory had a distinct pedagogical function, and its organization was explicitly modelled on Liebig's famous teaching laboratory at Giessen University. Sokolov had spent some time at Giessen, beginning in 1850.¹² Of all of the Russian chemists who studied under Liebig, Sokolov was the one most influenced by the educational goals of his German teacher. Numerous Russian chemists spent time in Liebig's laboratory at Giessen, but they were not converted to his view of chemistry, or even to the opinion that original research was an important activity for a chemistry professor. Sokolov, however, eagerly embraced these ideals. While he might not have shared Liebig's specific theories, the young Russian became a convert to the approach taken by Liebig in the organization of laboratory work. The laboratory at Giessen was organized in a hierarchical pattern: new students were guided in their initial experiments by more advanced students, and the director of the laboratory personally oversaw only the research efforts of the most advanced ones. This pattern of supervision permitted a large number of chemistry students to learn basic experimental techniques in a short time. One of Liebig's innovations was his method for organic analysis that allowed even beginners to achieve accurate results and thus make a contribution to serious research. The director of the laboratory was thereby able to concentrate his energies on his own research and that of the most advanced students.¹³

Sokolov was also influenced by Liebig's interest in theoretical chemistry, but not by his concern for agricultural, animal, and food chemistry.¹⁴ Sokolov was one of the first Russian chemists to attempt to base his chemistry conceptions on explicit philosophical beliefs. This can be linked to the research orientation of Sokolov and other young chemists, who rejected the earlier 'consultant', 'practical' orientation exhibited by many Russian chemists. In the first issue of their *Chemistry Journal* (*Khimicheskii zhurnal*), published in 1859, Sokolov and Engel'gardt set out the goals not only of the *Journal* but of their private chemistry laboratory as well. They felt constrained to defend the need for such a laboratory:

One sometimes hears criticism of chemistry laboratories which function in too abstract a direction. [This is] because in these laboratories students primarily turn their attention to finding a solution by means of experiments to questions of pure scholarly value, which do not have direct application to industry. Such criticism

¹⁰ This list is given in Kozlov (1958) (note 2), 13.

¹¹ *Khimicheskii zhurnal*, 1, no. 1 (1859), ii.

¹² Joseph S. Fruton, *Contrasts in Scientific Style: Research Groups in the Chemical and Biochemical Sciences* (Philadelphia, 1990), 290. The official Russian service records for Sokolov do not list this time spent at Giessen, most likely because it was illegal for Sokolov to be abroad in 1850.

¹³ J. B. Morrell, 'The Chemist Breeders: The Research Schools of Liebig and Thomas Thomson', *Ambix*, 19 (1972), 1–46.

¹⁴ For information about Liebig and agricultural chemistry, see Pat Munday, 'Liebig's Metamorphosis: From Organic Chemistry to the Chemistry of Agriculture', *Ambix*, 38 (1991), 135–54; and Uschi Schling-Brodersen, 'Liebig's Role in the Establishment of Agricultural Chemistry', *Ambix*, 39 (1992), 21–31.

is easier to bear in less developed societies, where a true understanding of the essence of the matter is encountered more rarely than in developed societies. [In less developed societies] ... easy and superficial solutions to questions ... are preferred because of their ease.¹⁵

The authors go on to quote from Liebig's famous polemical article 'Der Zustand der Chemie in Preussen' (1840). They argue, following Liebig, that a good, solid fundamental education in chemistry can give experience that then allows one to handle other tasks in chemistry and the chemical industry. That is, a basic chemistry education is required for all who want to understand any subject touching on chemistry. Moreover, they argue that chemistry is the most fundamental science, and every scientist needs to study it.¹⁶

Later in this same introduction, Sokolov and Engel'gardt explicitly state that their laboratory was consciously modelled on that of Liebig at Giessen:

In our advice to the new students concerning their research work, we constantly follow the principles which Liebig espoused. Utilizing these principles over the course of many years, Liebig achieved such brilliant success in his laboratory that it became famous throughout the world. Many scholars in all fields of chemistry and from all countries went to Giessen University to study with Liebig. Without a doubt, for each of these scholars their stay in that small insignificant town in western Germany constitutes one of the most valued remembrances of their golden youth. They were completely committed to their great teacher, to his methods of study, to his straightforwardness, and to his strict logical path which led to many various goals. Liebig was capable of extracting a fresh spirit even from 'dead stones'—even from those people who had been infected from youth with narrow utilitarian education. In time, he made them well-rounded scholars by unswervingly proceeding toward his selected goal with a quiet, but strict and correct, philosophical manner.

We fully recognize that it is impossible in all respects for us to attain the high level reached by the Giessen teacher. Nevertheless, we are striving—as far as our means—to follow strictly his stated path. We are happy that the sole method of learning chemistry—which Liebig demonstrated and developed—has found sympathy in our public. This has been expressed by the number of visitors to our laboratory, which has exceeded all of our expectations.¹⁷

The logical complement to this public chemistry laboratory was a chemistry journal that could publish the results of the experiments conducted there. Russia did not then have its own specialized chemistry journal, although several such journals were being produced in other countries by this time. A specialized chemistry periodical could satisfy two requirements by Russian chemists: a forum from their own writings, and an information source about work being done in chemistry elsewhere. Engel'gardt and Sokolov began planning their new journal soon after they had opened their private

¹⁵ *Khimicheskii zhurnal*, 1, no. 1 (1859), iv.

¹⁶ For discussions of Liebig's article, see R. Steven Turner, 'Justus Liebig versus Prussian Chemistry: Reflections on Early Institute-Building in Germany', *Historical Studies in the Physical Sciences*, 13 (1982), 129–62; and Regine Zott, 'The Development of Science and Scientific Communication: Justus Liebig's Two Famous Publications of 1840', *Ambix*, 40 (1993), 1–10.

¹⁷ *Khimicheskii zhurnal*, 1, no. 1 (1859), vii–viii.

laboratory,¹⁸ although the first issue did not appear until 1859. As the editors of the *Chemistry Journal*, they acknowledged the need for a vehicle to disseminate information about chemistry. They stated that Russia had to have a ‘specialized chemistry journal that regularly communicates the latest discoveries in the science ... to those members of society who are specially involved with chemistry’.¹⁹ Of course, the editors would control what kind of information was presented in the journal, for they were especially concerned that only ‘the most worthy’ and up-to-date views be presented: their *Chemistry Journal*:

will give the possibility above all for our public to discard from the many varied works on chemistry all of the trash and everything not needed, often even harmful, which unfortunately has been published in great quantity ... and select only that which has undoubted worthiness.²⁰

The editors warned against the dangers of ‘false popularization’, and stated that popularizers as well as specialists should try to disseminate

a strict understanding of the truth [of the subject] and its conclusions... We must not forget that false, or not fully developed, views given in textbooks [and other more popular] paths lead to the dissemination in society of an untrue understanding and too easily produced imaginary knowledge, which is incontrovertibly worse than complete ignorance.²¹

The editors intended that their *Chemistry Journal* should be the chief organ for chemistry for all of Russia, one that would bring together chemists everywhere. The main goal was that it should publish original work by Russians, but the editors had many other ambitions for it too. One was that it would serve as a conduit to provide Russian chemists with, for example, ~~abstracts of foreign articles on chemistry~~ (published in Russian, if possible), ~~‘translations of the best chemistry work published in Europe’~~, together with ‘descriptions of these works ... if needed for full understanding and evaluation of the work’. Other news of interest to chemists would likewise be included, such as reports about defences of higher degrees and news on ‘the prices and quality of chemistry apparatus and materials obtained from both domestic and foreign sources’.²²

Consistent with their view that ~~‘abstract’ ‘pure’ chemistry~~ was the basis for a true understanding of the science, the editors restricted the scope of the areas covered in the *Journal*:

The *Chemistry Journal* includes, without exception, all chemistry studies in inorganic, organic, and analytical chemistry In scholarly literature there are many studies which are not concerned with pure chemistry and which in their chemical relations do not present anything new, but consist of information obtained by the chemical path and having more or less importance at the present

¹⁸ See the letter from Engel’gardt to Shishkov quoted in *Zhurnal Russkogo Fiziko-Khimicheskogo Obshchestva*, 42 (1910), 1343.

¹⁹ *Khimicheskii zhurnal*, 1, no. 1 (1859), ii.

²⁰ *Ibid.*, ix.

²¹ *Ibid.*, ii–iii.

²² *Ibid.*, ix–x.

or in future application to technology in general. The *Chemistry Journal* does not have as its goal to provide a place for such studies.²³

5. The end of the *Chemistry Journal* and the closing of the Chemistry Laboratory

Sokolov's and Engel'gardt's *Chemistry Journal* and their private laboratory both ceased to exist in 1860, although for different reasons. Several Soviet historians of chemistry claim that the demise of the *Journal* and the laboratory were due to financial costs and to Sokolov's declining health. One author has suggested that Sokolov initially intended to give up his editorship only for a short time, until his health recovered. Another hints that Government opposition to these private ventures forced them to close.²⁴ However, these interpretations obscure the actual motives for their closure. The fortunes of these two enterprises were directly linked to events in the lives of Sokolov and Engel'gardt, as well as to their beliefs about chemistry. The pair actually decided to stop publishing the *Chemistry Journal* because of a dispute over the content of a related journal, while Sokolov himself elected to close the laboratory in order to donate the equipment to St Petersburg University.

While the closure of the *Chemistry Journal* was perhaps tangentially related to the financial costs of its publication, it was more importantly indicative of the dependent position of Sokolov and his view of chemistry. That is, the *Chemistry Journal* essentially was not an independent, private venture at all, but was simply the separate publication of all the articles, translations of foreign chemistry articles, and reviews on chemistry published in the *Mining Journal* (*Gornyi zhurnal*). Sokolov was teaching chemistry at the Mining Institute at this time, and probably for that reason he was selected to be the editor of the chemistry section of the *Mining Journal* in 1859:

The Education Committee of the Mining Engineering Corps, finding that it would be useful for the *Mining Journal* to have chemistry articles which would acquaint employees with [knowledge] fundamental to factory production, and because the chemistry section is one of the most important sections of the journal, ... the editorship for the chemistry section of the *Mining Journal* has been assigned to master of chemistry N. Sokolov from January 1859.²⁵

The upgrading of the scientific quality of the *Mining Journal* was most likely connected to the general improvement of the scholarly and teaching institutions of the military that took place after the disaster that was the Crimean War.²⁶

Sokolov and Engel'gardt had set out to disseminate the *Chemistry Journal* to a wider audience of chemists and others interested in chemistry than did the publishers of the *Mining Journal*. Whereas the *Mining Journal* was sold only at the main editor's office and by subscription, the *Chemistry Journal* could be purchased at several bookstores

²³ Ibid., x.

²⁴ Ju. S. Musabekov, 'Pervyi russkii khimicheskii zhurnal i ego osnovateli', *Materialy po istorii otechestvennoi khimii* (Moscow, 1953), 288–302; for the idea of Government pressure, 289. N. S. Kozlov, 'Pervyi russkii khimicheskii zhurnal', *Uchenye zapiski [Permskago] pedagogicheskogo instituta*, vyp. 13 (1954), 155–92, 'There is reason to believe that the basic cause of the journal's closing was due to questions of material character and the serious illness of N. N. Sokolov' (159); Musabekov (note 6); Kolov (note 7). Also see Kozlov (1958) (note 2), 504–10.

²⁵ *Gornyi zhurnal*, no. 1 (1859), 59.

²⁶ See the discussion of this point in Brooks (note 3).

in St Petersburg. Subscriptions to the *Chemistry Journal* were to be sent to Sokolov directly at the private chemistry laboratory.²⁷

It did not take long before the views of the main editors (the board) of the *Mining Journal* came into conflict with those of Sokolov and Engel'gardt. The excerpts from the editors' 'programme' for the *Chemistry Journal* show that the editors perceived it as a general vehicle for research-oriented chemists that would draw this group of scientists together through the publication of original articles, abstracts, and translations of foreign publications, as well as various other types of news relating to chemistry in Russia. The statement about the appointment of Sokolov as editor of the chemistry section of the *Mining Journal* indicates that the editorial board of this periodical had a very different purpose in mind for the chemistry section. The board wanted to publish material that would be of practical use to chemists working in factories or to those involved in other aspects of mining, such as analytical techniques for assayers. Many of these individuals would not have been included in Sokolov's and Engel'gardt's definition of a chemist. In addition to this difference about the type of professional activity acceptable for chemists, Sokolov and Engel'gardt also differed from the authorities at the Mining Institute regarding the most important areas of chemical research and investigation. To Sokolov and Engel'gardt, the most exciting area of chemistry was organic chemistry, and they gave it a prominent amount of space in the journal—50% of the total original chemistry articles published. Indeed, Sokolov and Engel'gardt even went so far as to snub the work of G. Struve, who was working in the chemistry laboratory of the Ministry of Finance's Department of salt and Mining Affairs under the direction of N. A. Ivanov. At this time, Ivanov was a full professor of chemistry at the Mining Institute, while Sokolov was only an adjunct. For issues numbered 1 to 6 for 1859, there are only two differences between the chemistry section of the *Mining Journal* and the *Chemistry Journal* itself. The typography is identical, although the pagination is not. One of the two differences is the absence in the *Mining Journal* of an editorial reply by Engel'gardt that takes issue with an article by Mendeleev. The more significant feature is the omission from the *Chemistry Journal* of an article by G. Struve concerning the chemical analysis of ores and products from the Perm copper-smelting region. While this article was directly related to the objectives of the *Mining Journal*, Sokolov evidently did not believe it worthy enough to merit publication in the *Chemistry Journal*. That is, the article was too 'practical', and was not of great interest to professional chemists as defined by Sokolov and Engel'gardt.

Table 1 shows the number of original articles in chemistry divided by subject area for the *Mining Journal* for 1849–69 and for the *Chemistry Journal* for 1859–60. Except for the years 1859–60, the *Mining Journal* published on average only about two original chemistry articles per year. Most of these articles were in the area of analytical chemistry, with a much smaller number in inorganic chemistry. Only three articles on organic chemistry were published during these years (i.e. excluding 1859–60), and these were published in 1857–58, and included works by Sokolov. After Sokolov's editorship, 1861–69, most of the articles in the chemistry section of the *Mining Journal* were written by only two individuals: N. A. Ivanov and K. I. Lisenko. Both of them had connections with mining affairs. Lisenko was appointed chemistry professor at the Mining Institute in 1867 and was the overall editor of the *Mining Journal* from 1869 to 1873. As mentioned above, N. A. Ivanov was director of the chemistry laboratory

²⁷ *Khimicheskii zhurnal*, 1, no. 12 (1859), back cover.

Table 1. Original articles by Russian authors.

	I	II	III	IV	V	Papers	Authors
<i>Mining Journal</i>							
1849	0	0	0	0	0	0	0
1850	0	0	3	0	1	4	4
1851	1	0	1	0	0	2	1
1852	1	0	0	1	0	2	2
1853	0	0	2	0	0	2	2
1854	0	0	0	0	0	0	0
1855	0	0	1	0	1	2	2
1856	0	0	0	0	1	1	1
1857	0	1	4	0	0	5	5
1858	0	2	3	0	1	6	4
1859	5	11	6	3	3	28	17
1860	2	11	2	0	1	16	12
1861	0	0	1	0	1	2	2
1862	1	0	3	0	1	5	2
1863	2	0	0	0	0	2	2
1864	0	0	1	0	0	1	1
1865	1	0	2	1	1	5	2
1866	0	0	1	0	1	2	2
1867	0	0	0	0	0	0	0
1868	0	0	0	0	1	1	1
1869	3	0	4	1	3	11	4
<i>Chemistry Journal</i>							
1859	1	10	6	0	3	24	16
1860	0	9	0	0	3	12	10

I, inorganic chemistry; II, organic chemistry; III, analytical chemistry; IV, technical and applied chemistry; and V, other chemistry.

Papers is total number of papers in chemistry; and Authors is number of different authors of chemistry papers.

of the Department of Salt and Mining Affairs (Ministry of Finance) during these years and taught at the Mining Institute.

Thus, it is clear that in 1859–60 Sokolov took the chemistry section of the *Mining Journal* in the direction of organic chemistry and greatly increased the number of chemistry articles published in this journal. It might be expected that the board of the *Mining Journal* would not be pleased with Sokolov's editorial practice, considering the statement of purpose published when Sokolov was appointed to head the chemistry section. This supposition is strengthened by the contents of a letter (22 December 1860) from N. P. Il'in to Mendeleev, which includes the following statement:

The *Chemistry Journal* has died. The members of the Committee of the Mining Administration found that the chemistry section of their journal [*Mining Journal*] was filled with only articles on organic chemistry, and therefore they told the editors to send the articles for approval before printing to the Committee. Of course, Sokolov did not agree to this, as a consequence of which the editorship of this section has been transferred to the general editor of the [*Mining*] Journal—Poletik.²⁸

Without the support and resources of the *Mining Journal*, Sokolov and Engel'gardt were either unable or unwilling to continue publishing the *Chemistry Journal*. This was not an unusual occurrence in Russia. It was, legally, difficult to undertake private ventures of every kind, and often individuals were hesitant to take on the obvious political and financial risks involved in publishing a private periodical. Moreover, it is possible that Engel'gardt had only limited funds to devote to his chemistry interests at this time. A scholar has shown that, by the mid-1860s, Engel'gardt had amassed extensive debts.²⁹ Sokolov had no sources of income other than his small salary as laboratory assistant. However, the financial aspect of publishing such a journal was not a serious problem if a sufficient number of subscribers could be found. When the *Journal of the Russian Chemical Society* began publishing in 1868, it did not require subsidies, meeting its expenses entirely through subscription fees. Therefore, we can conclude that in 1860 there was either an insufficient number of subscribers to the *Chemistry Journal* to persuade Sokolov and Engel'gardt to continue it as a private periodical, or that Sokolov and Engel'gardt personally did not want to continue publishing the journal as a purely private venture for some other reason.³⁰

The difficulty of organizing and financing a private chemistry journal may also have been compounded by the fact that many of the Russian chemists who formed the audience for the *Chemistry Journal* were quite young, i.e. not yet established, at this time. At the beginning of the 1860s, many were still university students, or had not yet obtained stable employment, or were abroad conducting research. By the end of the decade, when the Russian Chemical Society was formed and began to publish its journal, these chemists had not only gained experience and prestige as scientists, but had also won academic positions. They were then able to devote more attention to founding a chemical society and publishing a specialized journal. As I have shown elsewhere, the main organizers of the Russian Chemical Society in 1868 were men who had gained their first research experience in Sokolov and Engel'gardt's private chemistry laboratory, and who had published their first research articles in the *Chemistry Journal*.³¹

Sokolov and Engel'gardt's private chemistry laboratory also ceased operations in 1860, although not because of Government pressure or financial costs. Rather, the closure of the laboratory was connected with Sokolov's appointment as *dotsent* and adjunct in the chemistry *kafedra* at St Petersburg University. Sokolov donated this laboratory to St Petersburg University shortly after his formal appointment as *dotsent* in January 1860.³² (He had already been teaching chemistry at the University for several years.) Later in 1860 he overwhelmingly won election as an adjunct in the chemistry *kafedra*. How much his prior gift of the laboratory equipment influenced this vote is not clear, but Mendeleev (one of the contenders for this position) and his friends sarcastically attacked Sokolov and belittled his knowledge of chemistry.³³ It was even

²⁸ Quoted in M. N. Mladentsev and V. E. Tishchenko, *Dmitrii Ivanovich Mendeleev, ego zhizn' i deiatel'nost'*, 1 (Moscow and Leningrad, 1938), 227–8.

²⁹ Wortman (note 7), 38, citing an archival source for his information.

³⁰ The number and names of the subscribers to the *Chemistry Journal* were not published in the periodical, as was the case for the *Journal of the Russian Chemical Society* beginning in 1869.

³¹ Brooks (note 3), ch. 8.

³² RGIA f. 381, op. 13, d. 7852, 11. 5 ob, 6 ob, 7 ob.

³³ See the letters from Il'in and Skinder to Mendeleev, quoted in Mladentsev and Tishchenko (note 28), 210–12.

implied by these chemists that Sokolov had donated the chemistry equipment as a means of getting support for his appointment as adjunct.

Whatever the case, Sokolov evidently preferred to have the laboratory at the University as the central location for his scientific research. This indicates a shift in attitude toward laboratory facilities. The few older professors at higher educational institutions who pursued original research in chemistry usually conducted their research in private laboratories located in their homes. For example, N. N. Zinin conducted his research in a small laboratory located in a room in his apartment. Only student researchers used the facilities at the Medical–Surgical Academy, where Zinin taught, even after these facilities were significantly improved in the early 1860s. Sokolov, on the other hand, chose to conduct his research in the St Petersburg University chemistry laboratory, alongside the students he was supervising. This trend became institutionalized at the universities in the 1860s and 1870s.

The failure of Sokolov's and Engel'gardt's *Chemistry Journal* and their private chemistry laboratory left St Petersburg chemists without a local organ in which to publish the results of their research, and deprived them of a meeting-place. When the laboratory was transferred to the auspices of St Petersburg University, the freedom of access for non-St Petersburg University students was significantly curtailed. Since the university provided the funds for the day-to-day expenses of the laboratory, the university administrators were not happy about allowing non-students to use these facilities. More crucially, in an era of extreme distrust of 'outside agitators' who might incite students to protest against the Government, access to university facilities by non-students was strictly limited. Thus, only students formally enrolled in the university were permitted to use the university laboratory facilities.

6. Conclusion

In this article I have examined the context of the formation and closing of the private chemistry laboratory and the specialized chemistry journal edited by N. N. Sokolov and A. N. Engel'gardt in St Petersburg at the end of the 1850s. The laboratory and journal reflected a growing professionalization of chemistry in Russia, especially among younger chemists. These men stressed the importance of original research in chemistry and wanted to participate in chemistry's European-wide intellectual trends. Because the laboratory facilities at the higher education institutions in Russia were inadequate for research, or else were closed to them, these young Russian chemists desired a private chemistry laboratory in which to conduct their research. In addition, they wanted a journal that would publish the result of their research, as well providing them with information about events in chemistry in other countries.

I have shown that the *Chemistry Journal* ended because it depended on support from the *Mining Journal*. Sokolov was editor of the chemistry section of the *Mining Journal*. Sokolov was editor of the chemistry section of the *Mining Journal*, and drew the materials for the *Chemistry Journal* from this source. Sokolov and Engel'gardt emphasized organic chemistry, which angered the main editors of the *Mining Journal*, who forced Sokolov to curtail the publishing of organic chemistry articles.

The conditions for chemistry changed dramatically in St Petersburg during the decade after the end of the *Chemistry Journal* and the private chemistry laboratory. More posts were created, thus giving opportunities for employment to many younger Russian chemists. Additionally, new laboratories were established at higher educational institutions in Russia, and existing laboratories were significantly upgraded. Many of the young Russian chemists of the late 1850s and early 1860s were vital participants

in the formation of the Russian Chemical Society in 1868. Any many of them had received their first laboratory experience in Sokolov's and Engel'gardt's private chemistry laboratory, and, too, had published their first research reports in the *Chemistry Journal*.

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