

Original communications

The life and death of Professor Alexander P. Borodin: Surgeon, chemist, and great musician

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Music is one of the most effective and most beautiful means of communication between peoples. However characteristically national the music may be, it will penetrate to the hearts of all receptive listeners regardless of outlook, provided that it has real beauty.¹

SEVERAL EMINENT COMPOSERS HAVE flirted with the art of medicine. Hector Berlioz studied medicine in Paris.^{2,3} Franz von Suppe attended medical school for 1 year before settling down to the more serious work of composing frothy operettas.² On the other hand, many physicians became more or less proficient in music.⁴ Perhaps the most prominent of them was Theodor Billroth, who became a pianist of high standing.⁵⁻⁷ His lifelong friendship with the famous composer Johannes Brahms, who dedicated his String Quartet, opus 51, to Billroth, is well known.^{6,7} The two Opus 51 quartets in C minor and A minor have come to be known by musically inclined surgeons as the Billroth I and II.⁶ However, life is such that very often one thing must be sacrificed in favor of another. For instance, Billroth once invited Brahms to listen to an amateur orchestra of physicians. After a few minutes, Brahms stood up and rushed away saying, "No, no, no! I would rather give the Vienna Philharmonic Orchestra to operate on me!" Professor Alexander Borodin combined the roles of medical doctor, chemist, and composer of major rank.⁸⁻¹⁷

It was my good fortune to study at the Military Medical Academy in St. Petersburg. As first-year students we spent a lot of time studying chemistry at the same laboratory where Professor Borodin was



Fig. 1. Alexander P. Borodin, MD, 1834-1887. (From the archives of the Military Medical Academy, St. Petersburg, Russia.)

working a century ago. We were told many stories and anecdotes about Borodin himself, his medical career, and the various opinions he had on different topics. Since that time I have maintained an interest in Borodin's life, which resulted in this article.

Accepted for publication Oct. 16, 1997.

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Surgery 1998;123:606-16.

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0039-6060/98/\$5.00 + 0 11/56/86923

LIFE

Alexander P. Borodin (Fig. 1) was born on Oct. 31, 1834, as the illegitimate son of Prince Gedianov, who registered Alexander as the legal son of one of his servants. In this way Borodin was the serf of his own father. Alexander was a very curious boy. Once when he was about 2 years old he stuck his head in the parapet of the balcony; the scar on his forehead remained with him for the rest of his life.^{1,18} Borodin's father died in 1843 and granted freedom to his son shortly before his death. He also provided Borodin and his mother with a four-story house and money.

Borodin's mother was an intelligent woman and did her best to provide her only son with a thorough education. Alexander was taught French and German privately. Soon he made a great friend, Mikhail Shchiglev, the son of a famous mathematics teacher. All tutors were employed at Shchiglev's father's recommendation, and both boys were taught by "teachers who were specialists in their particular subjects."^{1,18}

Early on, Borodin developed an equally strong passion for chemistry and music. By the time he was 13 years of age, Alexander had built a laboratory at home in various corners of his flat and was able to make his own watercolors.

In 1850 Borodin entered the Medico-Surgical Academy. During the first 2 years at the Academy, Borodin developed a deep interest in chemistry while attending the brilliant lectures given by Professor Nikolai N. Zinin (1812-1880). Zinin conducted a large-scale research study on nitroglycerin, which was first synthesized in 1846 by Italian chemist Ascanio Sobrero.¹⁹ Zinin's special interest was aniline, an organic base, which is used today to make dyes, drugs, explosives, and plastics. Aniline was first obtained in 1826 by destructive distillation of indigo, and Zinin was the first to synthesize it. His pioneer work in aniline derivatives led mankind to the entire world of synthetic dyes, and Zinin became known as the "magician of nitrates."^{20,21} Alfred Nobel lived in St. Petersburg from 1842 to 1863, from 9 years of age to age 30 years. Nobel studied privately in Zinin's laboratory, which was located within 15 minutes' walking distance from Nobel's apartment and, by the age of 17 years, became a rather skilled chemist.²¹ It is in Zinin's laboratory that Nobel first learned about nitroglycerin. Nobel left Russia in 1850 and, after 5 years of studying and working abroad, returned to St. Petersburg. He continued to work in Zinin's laboratory and his father's factory until the latter went bankrupt in 1859. At about the same time,

Borodin, a third-year student, began work of an advanced nature in Zinin's laboratory.

Borodin, who was exceptionally shy and sensitive, could not bring himself to approach Zinin for some considerable time, but now that he was in his third year, he at last went to see him, and explained that he would very much like to work in his laboratory under his supervision. Zinin was a little suspicious at first, but soon saw that he had not only a sound knowledge of chemistry, but also some acquaintance with experimental techniques. From that moment onwards, he never ceased to be Borodin's teacher, friend, and guide.²²

Whether Nobel and Borodin met each other while working in Zinin's laboratory is unknown. During the Crimean War (1853 to 1856), Zinin made a powerful explosive based on nitroglycerin. Zinin's ideas on physiologic and medical chemistry determined Borodin's priorities.^{23,24}

SURGEON

On April 6, 1856, Borodin was graduated from the Medico-Surgical Academy cum examia laude and was appointed house surgeon to the Second Military Hospital. Those first 3 years, until 1859, were very difficult for him as a young surgeon. Once, for instance, the coachman of some high-ranking official was brought into the hospital, and Borodin had to remove a bone that was choking him. While he was operating, the rusty instrument he was using broke while in the patient's throat. However, the young surgeon kept his presence of mind and, after a few unsuccessful attempts, removed the broken fragments of metal and the bone at the same time. Borodin said that, "the coachman went down on his knees before me, and it was as much as I could do to restrain myself from doing likewise. Just think what might have happened if the broken piece of forceps had stuck in his throat! You can bet that I would have been courtmartialled and ended up in Siberia."^{1,18}

Alexandrov gave the following account for another unpleasant incident: "In his first year as house surgeon at the hospital, my brother happened to be on duty one day when they brought in six serfs belonging to Colonel V... who had flogged them for locking him in the stables because of the cruel way he treated them. Borodin had the job of pulling out the splinters from their backs. He fainted three times at the sight of the skin hanging in tatters from their backs. In the case of two of them, their bones were visible."^{1,18}

It was during this time that Borodin first met Modest Musorgsky, an officer of the Preobrazhensky



Fig. 2. Military Medical Academy: Second Military Hospital and Department of Chemistry with Zinin's laboratory (author's photograph of 1994).

Guards, one of Russia's most aristocratic regiments. Borodin left a vivid picture of how they met:

I was a raw recruit in the army medical service and house surgeon at the Second Military Hospital. Musorgsky... looked very new to the job; he could not have been more than 17 at the time. We first met in the hospital, in the hospital orderly room. I was duty doctor and he duty officer. The room was like any other of its type, and neither of us liked being on duty. Neither of us was reserved and we naturally started up a conversation, and very quickly became friends. That night we had both received an invitation to a party the next evening by Popov, the Head Doctor at the Hospital. He had a grown-up daughter, and it was for her sake that he frequently threw parties, and of course the duty officers and doctors had to be invited.

There was something absolutely boyish about Musorgsky; he looked like a real second-lieutenant of the picture books... a touch of foppery, unmistakable but kept well within bounds. He was wearing a brand-new and tight-fitting uniform, he stood well, and his hair was well-groomed. He had the manners of a gentleman, and spoke through his teeth; he interlarded his speech with French turns of phrase, and rather flowery ones at that. His courtesy and good breeding were exemplary. All the women fell in love with him... He sat down at the piano and played... very gently and graciously, with occasional affected movements of the hands, while his listeners murmured, 'charmant, délicieux!' and so on.^{1,18}

Although the surgical duties left Borodin little time for music, the hospital was conveniently located, adjacent to the Department of Chemistry (Fig. 2). This made it easier for Borodin to continue his work in chemistry. All of his spare time was taken up with laboratory work.

CHEMIST

On May 15, 1858, Borodin received a doctorate for his dissertation, "On the Analogy of Arsenic and Phosphoric Acids." In October 1859 Borodin went abroad as a delegate of the Medico-Surgical Academy, together with Mendeleev, Sechenov, and Botkin. Zinin insisted that Borodin should spend some time abroad to gain the necessary experience for the post of Adjunct-Professor of Chemistry, which he would take up on his return. Thus it came about that Borodin was able to abandon his surgical career, which had seemed to him in any case the wrong choice.

In accordance with Zinin's instructions, Borodin was to work in Heidelberg in Bunsen's laboratory. However, when he got to know the conditions there, Borodin decided that it was unsuitable and spent most of his time in Heidelberg working with his friends, Mendeleev, Sechenov, and Botkin, in the laboratory of young Privatdozent E. Erlenmeyer.²⁵

The periodic table of elements of Dmitry I. Mendeleev (1834-1907) is well known today to everyone from secondary school. The final version of the periodic table was introduced in 1871. Although Mendeleev's textbooks ran to many editions in many languages, the periodic theory remains his chief monument. Ivan M. Sechenov (1829-1905) was one of the founders of the Russian school of physiology. Both Sechenov and Sergei P. Botkin (1832-1889) created their own scientific schools; their contributions to Russian medicine cannot be overstated. Among their students were Nobel Prize winner Ivan P. Pavlov, Vladimir M. Bekhterev, and many other prominent physicians. What about Borodin? His musical activities were viewed with disfavor by those who saw in him the makings of a brilliant chemist. Once, for instance,

Zinin said, "Dr. Borodin, it would be better if you gave less thought to writing your songs. I have placed all my hopes in you, and want you to be my successor one day. You waste too much time thinking about music. A man cannot serve two masters."^{1,18}

At the end of 1860, Borodin went to Paris and remained there until the spring of 1861, carrying out the studies he had planned in accordance with Zinin's instructions. On returning to Heidelberg in May 1861, Borodin met his wife-to-be, a 29-year-old Russian woman, Katerina S. Protopopova, who came to Heidelberg to be treated for tuberculosis. She was a brilliant pianist and a well-educated woman.

In September 1861, Borodin left Heidelberg to take part in a congress of German chemists and naturalists. It was at this congress that his friend Butlerov gave his famous report on aspects of the structure of chemical combinations, which was the beginning of structural chemistry. On returning to Heidelberg, Borodin learned that his fiancée was seriously ill. She wrote, "I again became ill after a respite of the summer. I developed a heavy cough, and blood came from my throat. It seemed as though my chest was bursting; I grew paler and thinner, as pale as death."¹ Borodin took her to see Professor Friedreich, a well-known Heidelberg physician, whose conclusion was: "She will not see the month out, if she does not go to a warm climate. Pisa is warm at this time of the year; let her go there."¹

They left for Pisa with no delay. Borodin continued his work with two well-known chemists in Pisa, Lucca and Tassinari. Borodin and his fiancée arrived in St. Petersburg at the end of September 1862. Borodin was appointed to the post of Adjunct-Professor in December 1862 and began lecturing to the students of the Academy. Borodin's lectures and his brilliant, fascinating personality produced a deep impression on the students.^{1,18,22,26} On April 17, 1863, Borodin was married to Katerina. Despite her chronic ill health and the fact that they had no children, their marriage was happy. Borodin became full professor in April 1864.

Borodin's enthusiasm for teaching students at the Academy was related by one of his students, who wrote:

He spent whole days there in the midst of his students. Possessed of a very even temper, he was always ready to break off his work to answer the questions of his pupils, who all felt quite at home with him. We could always approach him, display our ideas and give free rein to our thoughts without fear of being repulsed or of receiving an evasive answer. The only signs of impatience which he

showed were provoked by our negligence or want of care. "My dear old chap," he would then say, "if you continue to work in that style, you will not be long in destroying our fine collection of instruments," or "How can you make such bad smells in such a beautiful laboratory?" And he would send the careless pupil to work in another room.²⁶

Borodin played an active role in the administration of the Medico-Surgical Academy and, together with Botkin, Sechenov, and other professors of the Academy, helped to found the first medical course for women in Russia in 1872. This started out as a course in obstetrics based in the Academy and developed into a course of higher medical education for women. Borodin devoted a considerable amount of his time to this course.

COMPOSER

In autumn 1859, Borodin again met Musorgsky, this time at the home of Professor Ivanovsky. Borodin wrote about this:

He was just as smartly dressed, and still the perfect gentlemen, but there was no trace of foppishness. We were introduced to one another, but of course we immediately recognized each other, and went on to reminisce about the times when we first met at Popov's. The conversation automatically turned to the subject of music. I was still mad keen on Mendelssohn, and at that time hardly knew anything about Schumann at all. Musorgsky was already acquainted with Balakirev, and had an eye for all the new things that were going on in the musical world, of which I had not even slightest idea. He played me extracts from the E flat major Symphony of Schumann. When he came to the middle section he broke off with the words: "That is where the musical mathematics begins." It was all new to me and I liked it. Seeing that I was interested, he played something else that was new to me. I also learnt that he was writing music himself. Naturally I was fascinated, and he began playing me a scherzo of his. When he came to the trio, he muttered: "Look, this is oriental," and I was astonished by this strange kind of music, which was like nothing I had ever heard before.^{1,18}

In the late autumn of 1862, Musorgsky introduced Borodin to Balakirev at Professor S. P. Botkin's house. Balakirev, a mathematician and an almost exclusively self-taught musician, became the head of young composers, which at that time consisted of Musorgsky, a former military officer, Nikolai Rimsky-Korsakov, a former naval cadet, and Cesar Cui, an officer of the corps of engineers and, subsequently, a professor of fortifications in the Engineer's Academy. Together with Borodin, they formed the group known as the "The Mighty



Fig. 3. Borodin (*fifth from right, back row*) and Mendeleev (*second from left, back row*) during founding meeting of Russian Chemical Society on Jan. 5, 1868. (From the archives of the Military Medical Academy, St. Petersburg, Russia.)

Handful," dubbed "Five." The group drew its inspiration from the wealth of Russian folk music and an example from Glinka, the father of Russian music.

Balakirev wrote about the acquaintance with Borodin: "Our acquaintance has had a special significance in that he had regarded himself before only as a dilettante, and had not taken seriously his own efforts at composition. It appears that I was the first to point out to him that his real vocation was composition."^{1,18} This had an important effect on Borodin, who was occasionally overly self-critical, and whose powerful intellect and deep critical sense at times got in the way of his creative work.

Borodin himself always regarded his clinical, laboratory, and teaching activities as far more important than composing. He wrote, "I must point out that I am a composer, looking for the unknown. I am almost ashamed to confess to my composing activity. Others have the composition of music as the goal of their lives. For me, it is only rest, fun which takes time from my serious business as a professor. I am absorbed in my affairs, my science, my academy and students. Men and women students are dear to me."²⁷ Borodin composed music in his spare time: "When I am so ill I must sit at home and can do nothing important, my head splitting, my eyes filled with tears so that every moment I must take out my handkerchief, then I compose music."^{1,18}

A famous Russian composer, Rimsky-Korsakov, was similar to Professor Zinin in his belief that

Borodin "wasted his time." In his book, *My Musical Life*, Rimsky-Korsakov wrote about Borodin:

During my visits to him, I frequently found him in his laboratory, which was connected with the apartment, sitting silently before his tubes, retorts and other queer looking chemical implements. When he had finished his experiments, he returned to the apartment and again began to work on music. But the trouble with Borodin was that he was never at one place; either he jumped up and went to see whether something had not boiled over and spoiled in the laboratory or somebody wanted to see him. Borodin was forever attending meetings, making reports or speeches and giving most of his free time to the movement in behalf of women. Besides all this, he was conscientiousness itself regarding his lectures and clinical work. Then there were his students whom he could never refuse. Lastly there were his country relatives and friends. His apartment looked like a hospital and often he could not even find time to eat his meals. Besides this, his wife suffered from asthma. My heart ached to see how a great genius wasted his time on such matters and could not accomplish his real work.²⁸

Balakirev had been invited in the autumn of 1867 to take up the post as conductor of the Russian Musical Society. In 1868 he arranged for a private performance of Borodin's First Symphony, along with other new works by Russian composers. The symphony was a failure because the parts, which had been copied in a hurry, contained numerous mistakes.

In early December 1868, Borodin took part in

the founding meeting of the Chemical Society (Fig. 3). After the event he wrote, "This was a very nice and happy occasion for me. The second session has been fixed for January 9." Borodin was occupied by his research at the time; however, he had to correct the First Symphony in preparation for its first public performance at the concert of the Russian Musical Society. This work required great accuracy and precision and provoked exasperation from the composer. He wrote to Balakirev:

What a devil of a lot of mistakes! It is a general rule that you never know where you are with a symphony until it is performed. We all had our works played at the Free School concerts, and only mine was a flop. They got their performances through in good time, but I had to wait 3 years for mine. Haman did the copies for the others, but some real son of a bitch has done mine. It would not surprise me if they bombard the composer with rotten apples.²²

After correcting the mistakes, Borodin sent the symphony to Balakirev and wrote, "You have never seen such a bungled job in all your born days... Apart from the intentional harmonic peculiarities, I came across most extraordinary sequences of minor seconds, diminished fifths, clashes of major and minor, and the devil only knows what... Well, old chap, I never realized correcting parts could be such a hellish business."²²

The First Symphony "of a composer seeking oblivion," as Borodin put it, was conducted by Balakirev on Jan. 4, 1869. On Jan. 9, Borodin made several scientific reports for the Chemical Society. Both events were a great success.

In 1869 Borodin adopted a 7-year-old girl, Liza Balaneva, and later another girl, Elena Guseva. That same year he began to work on a three-act opera, *Prince Igor*, based on the twelfth century prose-poetic saga *Slovo o polku Igoreve (the Story of Igor's Army)*. The progress with the opera was slow because his musical work was constantly subordinated to his professional activities. After autumn 1881, *Prince Igor* appears to have been neglected altogether for about 5 years.

The international fame of Borodin's music came after 1877, when he met Franz Liszt while on a trip to Jena.² Liszt was sympathetic toward the "new Russian music"; he was very much impressed by the Second Symphony in particular and, subsequently, became active in promoting performances of Borodin's works in Germany. Borodin corresponded with Liszt frequently and managed to spend a month with him in Magdeburg and Weimar in 1881 and an additional few days in 1885. The symphonic sketch, "In the Steppes of Central Asia,"

composed in 1880, achieved great popularity in not only Russia but also Europe generally.² Liszt was so taken with it that Borodin dedicated it to him and, while in Weimar, Borodin and Liszt arranged it as a piano duet and performed it together at a private party given by Princess Wittgenstein.^{1,26} "But I am only a Sunday composer, Herr Liszt!" Borodin once said. "aber Sonntag ist immer ein Feiertag, Herr Borodin!" was the response. Sunday is always a feast day, so Franz Liszt summed up the contribution of medicine's greatest composer.

The interest in the new Russian music was particularly marked in France and Belgium. Borodin traveled to Belgium in 1885 and 1886. He was pleased to discover that his works were accorded great ovations and to find that he was feted as a celebrity.²

DEATH

On March 19, 1887, the following note appeared in the *Lancet*:

Dr. Alexander Porphyryevich Borodin died suddenly, probably from highly diseased coronary arteries. His published works were tolerably numerous and included a number of important articles on the estimation of nitrogen. By means of Professor Borodin's process, combined with that of Kjeldahl's, the physician has a means whereby this estimation may be made with a very moderate amount of difficulty and trouble... In spite of his arduous professional and laboratory work, Professor Borodin found time for cultivation of the art and science of music, in which he was quite adept. He is, indeed, said to have rendered valuable service to the cause of Russian music.²⁹

The last decade of Borodin's life was full of emotional tension and heavy work, but also this was a time when his music gained widespread international acceptance.

On Feb. 9, 1880, Borodin's beloved teacher and friend, Nikolai N. Zinin, died. Borodin helped with the funeral arrangements for "the father of Russian chemistry" and made a heartfelt and impassioned speech at the graveside to the crowd of students gathered there. Borodin headed a commission set up for raising the necessary money for a monument to his teacher to be erected at the Medico-Surgical Academy and personally supervised its construction. As a student at the Academy, I admired this monument, which reflected the truly scientific spirit of a great man.

In the summer of 1880, Borodin wrote, "I cannot remember a time when I had so much urgent and priority work on my hands. It happens very often



Fig. 4. Modest P. Musorgsky (portrait by Ilya E. Repin, 1881, Tretiakovskaya Gallery, Moscow).

nowadays that I do not get to bed before 2 or 3 in the morning, and have to be up again at 4 or 5."²²

On Feb. 24, 1881, Musorgsky became seriously ill. That day he was "in a state of great nervous excitement," saying that "there was nothing left for him, but to go and beg in the streets." In the evening he had three fits of seizures. As a result of his alcoholic liver cirrhosis, Musorgsky had portal hypertension with fever, ascites, jaundice, and renal insufficiency.

When Borodin examined him, Musorgsky had already had fetor hepaticus, a unique musty odor of the breath and urine, and a peculiar "flopping tremor" or asterixis, which are often seen in precoma and in advanced hepatic encephalopathy. Borodin managed to get him to the Nikolaevsky Military Hospital. Musorgsky was at the hospital for about 1 month. Borodin visited him daily and, together with Dr. Bertenson, provided Musorgsky with the best possible treatment.³⁰ With Borodin's urometer described in 1876, they were able to estimate uric acid in the blood and urea. The temporary improvement was achieved from March 15 to March 17, during which time Ilya E. Repin, one of the leading Russian artists of the day, painted his portrait (Fig. 4). Today this portrait is in the Tretiakovskaya Gallery in Moscow and could represent a classic picture of a patient with last-stage alcoholic liver cirrhosis who had encephalopathy, jaun-

dice, and facial edema. Borodin saw Musorgsky for the last time the day before his death. The next day, March 28, the nurse told Borodin that she heard Musorgsky cry out, "All is over!... How unfortunate I am!" His final agony lasted less than 15 minutes. So his old friend, who was "so talented, original, full of so much that was new and vital," died at the age of 42 years. Borodin was very affected by his death and after that moment began to have frequent episodes of angina pectoris.

Although Thomas Lauder Brunton (1844-1916) had already published his observations on the value of amyl nitrite in angina in the *Lancet* in 1867, and William Murrell (1853-1912) advocated nitroglycerin for the treatment of angina pectoris in 1879, the treatment for ischemic heart disease was not well established at that time.³¹⁻³³ Even in 1895, when Alfred Nobel was prescribed nitroglycerin for angina pectoris, he was certainly taken aback. Thus Borodin had to live with it.

Borodin had many talented students. One of them was Nikolai I. Kibalchich (1853-1881), who, as a third-year medical student and also a revolutionary minded member of the terrorist organization People's Will, made nitrogelatin, a powerful explosive for self-made bombs. The aim of People's Will was to force Alexander II to implement constitutional law in Russia. This constitution, if implemented, might possibly have become the germ of constitutional development in Russia. During unsuccessful attempts to shoot him, to derail his train, and finally to blow up the Winter Palace in St. Petersburg, Alexander II had shown unflinching courage based on a fatalist philosophy. However, ironically, on March 1, 1881, when, after much hesitation, the Tsar finally signed the proclamation announcing his intentions, he was mortally wounded by the bombs of Kibalchich. Kibalchich was arrested, tried, and executed. His last will was to write a letter to the Academy of Sciences in which he outlined his design of a rocket-propelled aircraft capable of rising beyond earth's atmosphere. This was the world's first recorded proposal of its kind. Although simple, his ideas are basic to space technology. A crater on the far side of the moon has been named after him.

The advent of Alexander III to the throne was marked by violent reactionary change in Russian political life. To restore order, the Medico-Surgical Academy was renamed the Military Medical Academy and subordinated to the Ministry of War. There were mass arrests of students, and Borodin, who was always closely linked with student life, shared the burden of their misfortune and did all he could to help those who had been arrested. One



Fig. 5. Borodin's sketch of Yaroslavna's scene with chorus from *Prince Igor*, composed 1869 to 1870. (From the archives of the Military Medical Academy, St. Petersburg, Russia)

night in February 1882, he came to his friend's flat "covered in snow and frozen to the marrow; it transpired that he had been going about in a cab, since 8 o'clock that morning, and had been from one institution to another, inquiring after someone who had been arrested... Borodin did not restrict himself to inquiries and investigations, but even went to the length of destroying any material that might have compromised his students."²² One of the casualties of Alexander III's reactionary reign was that the Minister of War refused the use of the military hospital as an academic base for the Women's Medical Course. Borodin and some other professors from the Academy were able to rearrange the course under the aegis of the Ministry of Education. This arrangement lasted for 3 years, from 1882 to 1885, when the course was finally closed by authorities. Borodin was very affected by the closure and was reported to have burst into tears when the chemistry equipment was transferred back to the Academy.

In 1883 Borodin wrote, "Yesterday I started work on 'Igor' very early in the morning; it was just like the old days. And then at 10 o'clock drove to the Nikolaevsky Hospital for a committee meeting... which dragged on till 3 in the afternoon... I sleep disgracefully little, 5 hours a night... Today I got up at 6, and got down to 'Igor' without even bothering to wash."^{1,18}

In 1883 Borodin founded the student orchestra. On Feb. 9, 1885, the fifth anniversary of Zinin's death, a memorial to Zinin was unveiled in the Military Medical Academy. This was largely thanks to Borodin, who had gathered the necessary funds. In fact, his nationwide appeal for funds had raised such a sizable sum that the surplus went toward endowing a Zinin Scholarship for needy students.

In December 1886 Borodin wrote, "I am dashing off this note in a great hurry, as I am up to my neck in stacks over all kinds of reports, notifications, memoranda, recommendations, decisions—a heap of utter rubbish. Lord! When will it end..."^{1,18}

Despite the lack of time, Borodin was always looking for an opportunity to help someone. He made notations on scraps of paper of the things he wanted to do. On one of these papers he wrote, "Go to B and ask him to admit A into a hospital. Write a prescription for K. Talk to B concerning D. Could not something be done for V?" If he succeeded in helping someone, he was very happy.²²

During 1886, Borodin worked on the Third Symphony, which remained unfinished because the year of 1886 was "a very hard one." First his mother-in-law was ill, and then his wife's tuberculosis grew worse and she was twice "literally on the point of death and saved only by a miracle." At the beginning of 1887, Borodin returned to *Prince Igor* and composed some parts, which he played to his friends but never wrote down except in fragmentary sketches (Fig. 5). *Prince Igor* was finished posthumously by his friends who were composers.

All this made no small demand on his time and was a great strain on his nerves. This period was apparently reflected in his opera *Prince Igor* by the words *Ni sna, ni ótdikha izmúchennoi dushé* (my tortured soul knows neither sleep nor rest). These words became almost idiomatic in modern Russian language and are often quoted jokingly.

On Feb. 10, 1887, Borodin did not feel well and apparently had a foreboding of impending death. His colleague, A. P. Dianin, found Borodin one day in the "room with open fire" throwing bundles of letters into the grate. When he was asked what on earth he was doing, Borodin declared, "Well, you see, my dear fellow, I am making quite sure that all this does not fall into the hands of some journalist after I die. I am afraid someone might have the bright idea of publishing all this." Because a large number of these letters survived, Borodin probably was diverted from the task of burning letters by some urgent piece of business.

On Feb. 14, 1887, "he thundered away for quite a long time playing the tremendous music... A few minutes later he came into the laboratory in a state of excitement and joy; there were tears in his eyes." "Well..., he said, 'I know that some of the things I have written are not bad. But this finale!... What a finale!'"²² Not a single bar of this finale has survived; he never got as far as writing it down. Borodin was very busy making arrangements for a fancy dress ball to be held next day.

Borodin wrote in his last letter that the ball was to be in grand style. Borodin asked his colleagues to dress up and wanted them to be as gay and informal as possible. Borodin begged professors to come and bring their wives to the party; he assured them that they would have an interesting time and

see things they would never see the likes of again.^{1,18}

In the evening of that day, Borodin wrote a letter to his wife, who was living in the drier climate of Moscow on account of her tuberculosis: "Tomorrow we shall have a dance. It is going to be a grand affair—a costume ball in the auditorium. I do not care to write to you about it since others will tell you about it later."

On the morning of Feb. 15, 1887, Borodin improvised at the piano some new material for the Third Symphony; in the evening of the same day he attended the ball organized by the professors of the Military Medical Academy for their families and friends at the lecture hall of the Academy.

He appeared at the ball dressed in Russian folk style with a dark red woolen shirt and dark blue baggy trousers and apparently enjoyed himself immensely. One of the witnesses gave the following description of the ball:

They were all there at the appointed time. There were not many people, but the place was packed. Everyone was in high spirits. Not long after the dancing began, Borodin had a waltz with someone, and then came over to me. We were standing there talking when Professor Pashutin arrived and came across to greet us. He had come from a dinner and was in evening dress. Borodin asked him why he was looking so smart. I remarked that of all male attire I liked evening dress the most; it seemed to suit everyone and always looked elegant. Borodin declared with his usual mock gallantry that if I was really so fond of evening dress, he would in future always wear his frock-coat whenever he came to me, so that I should never have any cause for displeasure.

These were his last words. He spoke them indistinctly as though his tongue had grown numb, and it seemed to me that he was swaying. I stared at him, and I shall never forget the look on his face: a helpless, pitiful, and frightened look. I hardly managed to cry 'What's the matter?' before he fell full length on the floor. Pashutin was standing right next to us but failed to break his fall...

My God! How terrible this was! And the cry that went up from everyone! They all rushed towards him and, without lifting him up from the floor, tried to bring him round. Every doctor and professor in the Academy was soon there. For almost a whole hour they tried everything possible to revive him, but it was no use. I shall never forget the despair of one of the doctors, who was sitting with his head in his hands saying again and again that he would never forgive himself for not applying bleeding treatment at the start.

And there he was, lying on the floor before us, and we all standing round him in our fool's costumes, afraid to admit to each other that this was the end.

I remember that the last to come was Professor Manassein, but all hope had been abandoned by that time. He leant over him and listened to his heart; with a wave of his hand he said, 'Lift him up.' And they lifted him up and carried him out. It was all over.^{1,18}

The autopsy was performed in the very same hall where his last dance had been held. It showed that the cause of death was rupture of a coronary artery aneurysm, with hemopericardium and cardiac tamponade. In falling, Borodin had struck his temple against the corner of the stove; this caused a minor brain hemorrhage.

An exceptionally large crowd of people of all professions and walks of life attended his funeral. Students from the Academy bore his coffin all the way from his home in the laboratory to the cemetery. Mikhail Shchiglev, his close friend with whom Borodin took his first piano lessons, was in tears as he conducted a student choir at the funeral. Borodin was buried in the cemetery of the Alexander Nevsky Monastery, next to the grave of Musorgsky.

Borodin's wife died a few months later of "dropsy," possibly right-side heart failure caused by progressive pulmonary fibrosis, and pulmonary hypertension, which may have been the result of amyloidosis caused by long-standing tuberculosis.⁷

In 1906 Sir Henry Hadow stated of Borodin that, "No musician has ever claimed immortality with so slender an offering. Yet, if there be, indeed, immortalities in music his claim is incontestable."³⁴

In 1936 Sarton wrote the following: "The chemical fame of Borodin is not comparable with that of Zinin—who was one of the most distinguished leaders of Russian science and who obtained international recognition. Borodin's fame is humbler, but none the less important... while the musician Borodin is a dear and old friend to thousands of people all over the world."³⁵

EPILOGUE

Ten years after Borodin's death, the income from *Prince Igor* alone amounted to 50,000 rubles. The essential sum was arranged soon to be donated to the St. Petersburg Conservatoire in the form of a Borodin Scholarship for young composers.

Borodin was the greatest musician and chemist of all surgeons. Although he did not make a great surgeon, he expressed himself equally well in his medical work and music of immortal beauty. More

than 100 years after his death, his music continues to capture and inspire audiences all over the world.

This article is dedicated to the 200th anniversary of the Military Medical Academy. I thank Professor V. O. Samoilov and Dr. Timothy Pansegrau for their valuable advice regarding the manuscript.

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