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ALEXANDR DANILOVICH ALEXANDROV

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ABSTRACT. This is a tribute to Alexandr D. Alexandrov on the occasion of the centenary of his birth.

Presented here are excerpts of my memories about Alexandrov. My experience shows that if I decide to do anything completely, I will never do it at all.

Everyone who knew Alexandrov was well familiar with his hospitality. His Leningrad home at the Field of Mars was a permanent meeting place for our entire seminar. The tradition continued in Akademgorodok, although our get-togethers in Alexandrov's house included fewer people.

Alexandrov was for me what sociologists call a "reference group": thinking about my possible behavior, I always considered how Alexandr Danilovich would look at it. At his seminars, participants discussed not only a variety of mathematical problems, but also physics, philosophy and moral issues. I do not know whether my ideas about physics have evolved as a result of those seminars, or if they initially had been similar to the ones of Alexandrov. Nevertheless, the fact that I am as much an expert in the *general theory of relativity* as professionals working in that field, is the result of Alexandrov's seminars. As for his lectures in *differential geometry*, his concept of *infinitesimally close points* was extremely important, because these points are used in various fields of mathematics since the time of Isaac Newton. Scientists employ them in mathematical analysis, differential geometry, algebra, and algebraic geometry in both classical and modern versions (Grothendieck's schemes). The same is true about nonstandard analysis, with its idea of approximation of

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arbitrary objects with those finite (which is the underlying idea of Alexandrov's work about approximation of surfaces).

Alexandrov was the only person in my life with whom I could discuss everything. He knew a lot and had his own view of any subject. This is true for diverse subjects as history of mathematics, physics and biology. It was from Alexandrov that I learned about works on time circuits.

Unlike many scientists, Alexandrov never "stole" other people's work; rather the contrary. If a joint article included his name, it meant that the main idea and results had been his. But even in that case his name might not be mentioned among the authors.

Now, I'd like to describe an episode. A year after the death of Nikolai Vladimirovich Efimov (1910–1982), the Moscow Mathematical Society held a seminar in his honor. Most of the leading Soviet mathematicians and many of their foreign colleagues were present. One of the presentations was the joint work by A. D. Alexandrov, V. N. Berestovsky and I. G. Nikolaev "Generalized Riemannian spaces."<sup>1</sup> Alexandrov walked up to the podium, and began his speech with the words: "Alexandrov is a history here; the authors of the main results are Nikolaev and Berestovsky. That's why the presentation will be done by Nikolaev." The core of the joint work was *manifolds of bounded curvature*, the branch of geometry which was originated by Alexandrov in the 1930s. He received Stalin's State Award for that discovery.<sup>2</sup> The joint work under discussion at the seminar was based on the results of that theory. The findings of Igor Georgievich Nikolaev (who, by the way, had worked under Alexandrov's advice) were significant, but not nearly as important as those by Alexandrov. Later I asked Alexandrov why he had suggested that Nikolaev make the presentation. His answer was as follows: "Nikolaev is not appreciated enough in the Institute of Mathematics; I wanted to support him."

On my third or fourth year at the university, I participated in the seminar of Dmitriï Konstantinovich Faddeev (1907–1989) which was devoted to representation of Fëdorov groups. In connection with that seminar, I read the book by A. D. Alexandrov, B. N. Delone and N. N. Padurov "Mathematical Foundations of the Structural Analysis of Crystals and Determination of the Basic Repetition Parallelepiped by means of Röntgen Rays." There was one section in the book that I could not understand. So I approached Alexandrov after his lecture on differential geometry and asked about it. Alexandrov looked like a person who had never heard of that problem. "Where did you get that?" he asked me. "From your own book." "From which book?" I named the title. "Ah, I have forgotten about that already," he replied. The book was published in 1934.

Although I graduated from Leningrad University as a straight A student, one of the best in mathematics and the best in social and political disciplines, I was not admitted to the postgraduate program. I knew that it was at least partially due to a slander told about me by a Komsomol activist, Pavilainen by name, the man whom I had never met in person. A year later, when I was vacationing in a sanatorium in Komarovo (a suburb of Leningrad), Alexandrov walked into the cafeteria during lunch. Busy with his duties of Rector of Leningrad State University, he had made a special trip to Komarovo to invite me to join the doctoral program under his supervision.

<sup>1</sup>Later this talk was published in *Russian Math. Surveys*, Vol. 41 (1986) No. 3, pp. 3–44.

<sup>2</sup>Editor's note: In 1941.

There was a predicament concerning my first (i. e. Kandidat) thesis. It contained a small lemma which was so easy for me that later I completely forgot about it, and never referred to it. What I did not understand then, was that without that lemma, my entire thesis looked as if it had a false ground. One of my opponents was Olga Alexandrovna Ladyzhenskaya (1922–2004), whom everyone justly considered a genius. She could determine the value of the results as well how justified they were, by just glancing at a thesis, and so she did not need to read the thesis thoroughly. Naturally, Ladyzhenskaya decided that my thesis had a false ground, and she did not conceal her opinion. Ladyzhenskaya was famous not only for her outstanding research in mathematics, but also for grasping the issue immediately and never making mistakes, and Alexandrov respected her greatly for that. On the other hand, he appreciated me as a mathematician. He convened a seminar, and invited Ladyzhenskaya. I made a long and detailed presentation of my thesis. Ladyzhenskaya listened silently, until I reached that unfortunate place. “And why is that?” she asked. That is the exact moment when I finally remembered that I had a lemma on that subject, so I opened my thesis and read it. That was enough for Ladyzhenskaya to change her opinion of me to the opposite, and she always expressed that opinion to other people. Thanks to her references, Sergeĭ L’vovich Sobolev (1908–1989) offered me a job in his Institute of Mathematics in Novosibirsk.

I have always respected Ladyzhenskaya, so I’d like to tell another story about her. Alexei Mikhaĭlovich Vinogradov was proving his second (Doctor) thesis. He was a topologist and a student of Sergeĭ Petrovich Novikov, and his thesis was based on the most sophisticated tools and methods of algebraic topology—which in my opinion is the most difficult field of mathematics after algebraic geometry. Ladyzhenskaya was the only opponent who was not a topologist, and she was the only one who did not show up in person, but had mailed her review of the thesis: she always refused to travel by air. After all opponents made their presentations and Ladyzhenskaya’s one was read aloud, Vinogradov approached me and said: “Ladyzhenskaya understood my thesis better than anyone else.”

Alexandrov often visited our home in Akademgorodok. Once he dropped in when my wife was out of town, and I offered him a piece of salted ham that I served wrapped in paper, just the way it had been kept in the refrigerator. Alexandrov reacted to such a catering with the following phrase: “The fact that you have dared to serve me, an academician, pig’s fat on a dirty paper, shows that you do not consider me a rascal to whom one needs to cringe.”

Alexandrov wrote articles against the death penalty. During one of his birthday celebrations, many people from different Soviet republics (I had never met about half of them before) gathered in his one-family house in Akademgorodok. One of the topics at the party was the death penalty. I expressed an opinion that the death penalty should not be abolished. Alexandrov got angry: “You are a rascal, aren’t you? They execute people for currency violations!” He then named other articles of the Criminal Code which are punishable by death. I replied that, in my opinion, people should not be executed for currency violations, but only for common crimes. “What do you mean by *common crimes*?” asked Alexandrov calmly. “Capital crimes against a person,” I responded. Alexandrov said nothing to that.

When the VAK (the Supreme Attestation Committee of the USSR) had procrastinated approval of my Doctor thesis for three years, Alexandrov and

Sobolev wrote to the VAK, requesting it to expedite the decision. After this letter, I was summoned to the VAK, and six weeks later my thesis approved finally.

Alexandrov had the prestigious sports title “Master of Sports of the USSR” in mountaineering which was not just a sign of honor but awarded by the government only for some recoded high achievements in sports. If he hadn’t gotten sick with encephalitis and lost some of his mobility due to a food injury, he would have lived much longer. Here is one of the episodes he told me. Once while climbing a mountain, he decided to rope down simply holding a rope without other means of protection, since the descent looked easy. Before rappelling, he touched the hook that was holding the rope—and the hook fell out of the rock! That’s how Alexandrov escaped certain death.

Alexandrov defended Igor’ Andreevich Poletaev (1915–1983) against persecution, and eventually took him with his entire laboratory into his department. It was partly due to his efforts that Ladyzhenskaya elected as a full member of the Academy of Sciences of the USSR. He was the man who persuaded Jean Leray (1906–1998) to write a reference about Ladyzhenskaya’s works that played a critical role in her election. He told me how he had been helping geneticists at the time when genetics was not recognized in the Soviet Union and the scientists working in the field were persecuted. When Vadim Delone (1947–1983), a grandson of B. N. Delone (1890–1980), fell out of favor with the authorities, he lived at Alexandrov’s. It was the time when nobody else wanted to have anything to do with Vadim, since people feared repressions for mere acquaintance with him. Alexandrov helped Revol’t Ivanovich Pimenov (1931–1990) as well as other scientists who were persecuted by the authorities.

He tried very hard to help my son-in-law when he got in trouble. After Alexandrov’s death, my daughter told her daughter: “Alexandrov was the only person who tried to help your father.”

During one of my final trips to Leningrad, I visited Alexandrov in a hospital. I told him about a problem I have been working on since then (both the claim and my idea of how to prove it). He was the only specialist with whom I ever discussed that unfinished work. I wanted very much for Alexandrov to see my work published—but it was too late.

Юрий Евелиевич Боровский