

On Moscow Mathematics — Then and Now

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Once, when giving a talk at the Moscow Mathematical Society (MMS), I compared the Mathematics Department of Moscow University (Mekh-Mat) with the Pushkin Lyceum¹ and the Leningrad Fiz-tekh.² In the history of education in our country, only the Pushkin Lyceum, the Leningrad Fiz-tekh of the 1920's, the Physical-mathematical Department in Moscow of the 1920's–1930's and Mekh-Mat of the 1950's–1960's can be placed on the same level according to the number of outstanding individuals who graduated from these institutions. This is the result of the particular spiritual atmosphere that was characteristic for the history of each of these educational establishments. Such an atmosphere was and still is considered by the majority of those who witnessed it as a miracle, as a particular gift of Fate. And that, in and of itself, deserves posterity's grateful remembrance.

But if Pushkin's incomparable light illuminates the whole historical space of his lifetime, things are much more complicated in the other two cases. In particular, Mekh-Mat's history can sink into oblivion if one does not take the trouble to write a truthful chronicle of 20th-century Moscow mathematics. Therefore, the publication and re-publication of *Golden Years of Moscow Mathematics* is priceless. In this article I want to describe briefly the landmarks of the development of the Moscow mathematical school against the background of the historical events of the 20th century in Russia.

First of all, a few words about this 20th century. A factor contributing to the birth of the Moscow mathematical school, which was formed within Moscow University, was the MMS. One of the organizers of the Society was Nikolai Dmitrievich Brashman (1796–1866), who came from Austro-Hungary to Russia, and remained there for the rest of his life. Brashman was one of the initiators for creating a publication of the MMS, the journal “*Matematicheskii Sbornik*”.

The successive presidents of the MMS were mathematicians who played a major role in the history of mathematics in Russia: N. D. Brashman (1864–1866), A. Yu. Davydov (1866–1882), V. Ya. Tsinger (1889–1898), N. A. Bugaev (1898–1903), P. A. Nekrasov (1903–1905), N. E. Zhukovskii (1905–1921), and D. F. Egorov (1921–1931). Then P. S. Aleksandrov was president for many years, followed by A. N. Kolmogorov, I. M. Gelfand, I. R. Shafarevich, S. P. Novikov and V. I. Arnold, who is the current president.

¹The name given nowadays to the 19th-century privileged school establishment known for its political liberalism and for several remarkable graduates, including the iconic poet Pushkin.

²Physical-technical Institute, headed by A. F. Ioffe, who raised a whole Pleiad of outstanding physicists, starting with the Nobel Prize winners P. L. Kapitsa and N. N. Semenov.

At the beginning of the 20th century, a rather narrow mathematical direction in differential geometry, surface deformations, was being developed in Moscow, cultivated by Karl Mikhailovich Peterson, a graduate of Derpt University and a student of F. F. Minding. At Moscow University, V. Ya. Tsinger, B. K. Mlodzievskii and others worked on this circle of problems. The greatest Moscow mathematician of this period—Dmitrii Fedorovich Egorov (1869–1931)—was also interested in differential geometry. Another active area in Moscow was classical mechanics. Brashman started its development, whereas Nikolai Egorovich Zhukovskii played a major role in its coming into being at Moscow University and the country in general.

At the beginning of the 1910's, there was only one scientific seminar at Moscow University, the Egorov seminar.

And it is against this background that the new mathematical school was born in the middle of the second decade of the 20th century. The phenomenon is striking.

The Moscow scientific community sharply changes its interests, and follows the road outlined by the French mathematicians E. Borel, R. Baire and H. Lebesgue. In the course of some seven years, a whole Pleiad of prominent researchers arises: P. S. Aleksandrov, N. K. Bari, A. N. Kolmogorov, M. A. Lavrentev, L. A. Lyusternik, D. E. Menshov, L. V. Keldysh, P. S. Novikov, I. G. Petrovskii, M. Ya. Suslin, P. S. Uryson, A. Ya. Khinchin, and L. G. Shnirelman. Some mathematicians from the older generation are also active: V. V. Golubev, I. I. Privalov, V. V. Stepanov, S. P. Finnikov, and others. Thus began the first phase of the golden period of Moscow mathematics. In the 1930's, the number of seminars rose to dozens (while in the 1950's they numbered more than one hundred!).

All of the above-mentioned young mathematicians later chose their own path, and began acquiring their own students: suffice it to name I. M. Gelfand, A. I. Maltsev and S. M. Nikolskii—students of Kolmogorov; L. S. Pontryagin and A. N. Tikhonov—students of P. S. Aleksandrov; and in the 1930's, the mathematical school of Moscow University (a school formed within the confines of a single university!) became comparable with the greatest mathematical schools in the *world*. It would not be a great exaggeration to say that it assumed a leading position in the whole mathematical world. Such a flowering of outstanding mathematicians was unique; the German mathematical school was devastated by fascism, the French was experiencing a change of generations, and the American was at the stage of initial development.

How can one explain such an unprecedented phenomenon? There were global reasons, as well as reasons connected with the activities of particular individuals. Both are worthy of particular analysis.

The revolution of February 1917 was embraced by many representatives of the Russian intelligentsia. The nobility's privileges were abolished immediately, as well as the laws and regulations affirming national (ethnic) and religious inequalities. A huge mass of people were called to active work, people who had hitherto been cut off from it. In the hope that the ideals of freedom, equality and fairness had been achieved, people were inspired and propelled toward creativity, in particular scientific creativity. This enthusiasm, this creativity, this passion remained for a while even after the October revolution.

Altogether other realities turned out to be connected with the October revolution. A totalitarian regime ensued, which was not conducive to the development of the humanities and to a series of branches of the natural sciences. Many creative

young people started to choose physics, mathematics and technical professions. The Soviet regime of the 1930's contributed to the development of these fields. To be a scientist-mathematician was prestigious.

The social conditions in the Soviet Union outside of the main centers were difficult, and this contributed to the unprecedented concentration of the creative intelligentsia in several cities, and particularly in Moscow. Such were the social peculiarities in our country, peculiarities that promoted the development of the Moscow mathematical school.

A second reason for the take-off of Moscow mathematics is connected with two outstanding personalities: Egorov and his student Nikolai Nikolaevich Luzin.

Egorov was born in 1869 in Moscow. He graduated from Moscow University in 1891 and began teaching in 1893 at the University, becoming a Professor in 1903. As mentioned before, he was the president of the MMS from 1921 until 1931 (in 1930, he was arrested, but remained president of the Society). Egorov was a deeply religious man and one of exceptionally high moral principles. There is no evidence of his ever acting against his conscience; he always stood firmly by his opinions. I will present a few stories I heard personally.

In these years, rooms were scarce, and several institutions of higher learning held classes in vacant churches. Egorov, who also taught outside of Moscow University, refused to teach in God's temples. And, as strange as it may seem, the authorities did not insist.

Egorov realized full well the tragic consequences of a totalitarian ideology, and tried with all his might to resist. At the end of the 1920's, he was fiercely criticized for not submitting to the new regime. At one public meeting he was reproached for being a reactionary and a freedom suppressor. Egorov courageously countered to his accusers: "You are the suppressors of freedom, the freedom of speech, that is!"

Once he was called, among some others, to a meeting for re-educating the old professors by the revolutionary youth. All "re-educatees" swore allegiance to the new authority. Finally, it was Egorov's turn. He was asked, "What are your political views?" He answered, "I am not sure this audience will understand me, but I deem it unworthy of myself to conceal my thoughts. I am a proponent of constitutional monarchy." One can only imagine the reaction of the audience, triumphant from the abolition of Tsarism and ready for the World Revolution. The behaviour of Egorov was completely unprecedented, and the tragic ending was predetermined. In 1930, he was arrested and shortly thereafter exiled to Kazan', where he died on September 10, 1931.

Egorov was the traditional professor type. He was very restrained, exact in everything, serious and reserved. His lectures were always well thought out, delivered in a strict manner.

Luzin, a student of Egorov, was of a completely different mould. As a personality, he was a romantic and a prophet. He often improvised during his lectures, giving his fascinated audience the opportunity to witness his free-flying thoughts.

Luzin was born in 1883 in Tomsk. In high school, he did not like mathematics, so his parents had to hire a tutor. The tutor turned out to be a university student who had a passion for mathematics. This student accomplished a conversion in the soul of his pupil. Subsequently, Luzin wrote, "He opened in front of me the door of mathematics not as a system of mechanical theories, to be learned by heart, but as a science firing the imagination." Luzin was accepted at Moscow

University. He later would say, “The brilliant pure math lectures made a huge impression on me.” Mathematics presented itself to him as a science full of tempting secrets. He became a student of Egorov, who introduced him to the rudiments of the theory of functions of a real variable. Luzin later deduced from Egorov’s theorem the fundamental Property S of measurable functions. After graduating from the University, Luzin was retained “to be prepared for the title of Professor”, and then Egorov sent him on a study trip abroad, first to France, and then to Germany. In 1905–06 and 1912–14, Luzin was in Paris, and in 1910–12 he was in Göttingen. In Paris, Luzin attended lectures by remarkable mathematicians: H. Poincaré, J. Hadamard, E. Picard, G. Darboux and many others. He had fruitful scientific and personal contacts with Borel and especially with Lebesgue, toward whom he cultivated feelings of reverential admiration. Upon his return to Moscow, Luzin sharply changed the style of Moscow mathematical life. How indeed did this new era of Moscow mathematics start?

Luzin introduced completely new methods of working with youth. Egorov would distribute literature at his seminar on series, the students would read it and then talk about what they had read. By contrast, Luzin would start from the outset by posing to his students, who were barely out of high school, problems of the highest level, problems that stymied the most eminent scholars.

This is how P. S. Aleksandrov described the first meeting with his teacher: “I first met him when I was a second-year student. The impression from this meeting was, simply put, staggering, and I have remembered it for life. After one of his lectures, when I asked his advice on how I was to work in mathematics, I was first of all struck by his attention and—I cannot think of another word—his respect vis-à-vis his interlocutor, as strange as this might sound when one thinks that it concerns a conversation between a renowned—even if young—scientist and an 18-year old student. When he heard me out, Luzin quickly managed, by asking skillful questions, to discern the character of my mathematical inclinations, and immediately sketched—in a form accessible to me—some directions that he could propose for me to work on; he very carefully steered me toward a choice of one of these directions, and as far as I can tell now, correctly so.” Luzin then gave Aleksandrov the Continuum problem for Borel sets—a problem that interested Lebesgue himself and that had been attacked in vain by such great mathematicians as Young and Hausdorff.

Another great accomplishment is connected with Luzin’s name. He united all his students in a remarkable, unique community, *Luzitania*. This is what Aleksandrov wrote in 1977: “Formed already in 1914–16, the group of older Luzin students consisted of D. E. Menshov, A. Ya. Khinchin, M. Ya. Suslin and myself. In 1919–1920, a series of young mathematicians joined: P. S. Uryson, L. A. Lyusternik, M. A. Lavrentev, N. K. Bari, and a few other Luzin students. A very friendly collective was thus formed, which was later joined by two remarkable mathematicians, Kolmogorov and Shnirel’man. From the mathematicians of the older generation, V. V. Stepanov also joined, as did later on P. S. Novikov and L. V. Keldysh. Thus arose the famous Luzitania, a collective of young mathematicians, united not just by ties of close friendship, but also by a passionate love of, and selfless interest in, mathematics. Luzitania immediately considered itself as a whole, and declared itself an ‘order’, with Luzin as ‘Commander’ and Egorov as ‘Grandmaster’. Luzitania was a collective with great creative, working and emotional élan, reflecting

in a ‘microcosm’ the huge and all-embracing élan of the Mathematics Department of Moscow University of the day. An essential element of Luzin’s interaction with students was at the meetings and discussions that he had with very small groups (1–3 people) working on one subject. There was also the weekly general meeting day for all of his students. These weekly meetings of Luzin’s students at his home were often also attended by Stepanov and I. I. Privalov. These evenings consisted of two parts: first there was the math part in Luzin’s study... I’ll never forget the conversations we used to have, full of the liveliest mathematics. These conversations went on past midnight, but whenever they ended, they were followed by a tea with the invariable walnut cake. During this tea—held not in the study, but in the dining room of the Luzins, the conversation had a different, nonmathematical character, and touched upon the most varied cultural topics.” Kolmogorov once wrote that a “common heartbeat” was characteristic of Luzitania.

Let us stop to recapitulate.

In the 1910’s, an unusually bright star appeared at Moscow University: N. N. Luzin. Exhibiting unusual, new methods of interaction with the young generation, Luzin laid out already before the revolution the fundamentals of the Moscow mathematical school of the theory of functions. The living conditions in Russia in the 1920’s were conducive to the development of mathematics on the one hand, and to the concentration of intellectual forces in Moscow on the other. And shortly thereafter, many outstanding students of Luzin’s began working at Moscow University. Luzin’s example served as a model to be imitated for many of them, and from this school began to gemmate the topological school of Aleksandrov and Uryson, the schools of Kolmogorov and Khinchin on probability, of Stepanov and Petrovskii on differential equations, of Lavrent’ev on complex analysis, and of Lyusternik and Shnirel’man on nonlinear analysis. These were joined by the schools on number theory of A. O. Gelfond, on differential geometry of S. P. Finnikov and V. F. Kagan (which moved from Moscow to Odessa), on algebra of B. N. Delaunay and O. Yu. Schmidt (from which D. A. Grave was an alumnus), and I. M. Gelfand’s school as well.

The above-mentioned mathematicians obtained many outstanding results in the 1920’s and 1930’s, so that this period can naturally be called the first golden period of Moscow mathematics.

This brilliant period for Moscow mathematics was marked in the history of our country by many tragic events. Our country went through collectivization at the end of the 1920’s, through a horrible famine in the Ukraine at the beginning of the 1930’s, and through a period of most cruel repression in the mid-1930’s. Then war started. The country suffered frightful, irreplaceable losses. Those who lived and worked in the 1940’s had to endure the war on cosmopolitanism,³ the decrees concerning questions of art, the flowering of Lysenkovshchina and much, much more. Thinking people lived in fear and expectation of the worst. But in the 1950’s a clearing-up occurred, and it brought forth a new take-off in mathematics.

The second golden period of Moscow mathematics has clear temporal limits: from 1953 until 1968. A new generation, which I shall call mine, entered science. In order to understand the reasons for this unusual take-off in mathematics in Moscow, one needs to describe not only the political atmosphere of these years, but also the

³Code word for “being Jewish”.

new generation entering science, and the people who were most responsible for the development of science in this period.

The year 1953 is forever engraved in world history; this year is as important as 1914 and 1939—the years when the two world wars started—and 1917, the year of the two Russian revolutions. On March 5, 1953, Stalin's rule over an enormous territory of the world ended, and with it his tyranny. A period began of some respite from the looming freeze, the period referred to as the period of thaw. Warm winds of hope began blowing, and the iron curtain was slightly lifted. It became possible for some chosen, deserving individuals to see the world, to attend congresses and conferences. Through the narrow cracks under the iron curtain, we acquired access to many cultural and scientific activities. The Mekh-Mat entrance exams loosened their questionnaire restrictions.⁴ Such were the social upheavals connected with the development of mathematics in our country.

Now about the generation. In order to more easily talk about my generation, I shall give the list of those who studied with me and with whom I have collaborated later on, with whom I was connected by ties of friendship and/or scientific work. This list contains the names⁵ of those who were born between 1929 and 1938 and entered Mekh-Mat between 1946 and 1955; the year of their entering Mekh-Mat is given in parentheses.

S. K. Godunov, I. Y. Piatetski-Shapiro (1946), R. L. Dobrushin, V. A. Uspensky, N. N. Chentsov (1947), F. A. Berezin (1948), A. G. Vitushkin, A. A. Gonchar, M. L. Lidov, R. A. Minlos (1949), V. M. Alekseev, N. S. Bakhvalov, O. B. Lupanov (1950), Yu. K. Belyaev, L. D. Meshalkin, A. L. Onishchik (1951), I. V. Girsanov, Yu. A. Rozanov, Ya. G. Sinai, A. N. Shiryaev (1952), D. V. Anosov, A. D. Wentzell, Yu. I. Manin, B. S. Mityagin (1953), V. I. Arnold, E. B. Vinberg, Yu. V. Egorov, A. A. Kirillov, S. A. Kruzhkov, M. I. Freidlin (1954), A. M. Vinogradov, V. A. Zorich, V. P. Palamodov, S. P. Novikov, A. B. Sossinsky, D. B. Fuchs (1956). All of them were leaders of their classes (sometimes that became clear after they finished the University), and all of them studied (some not from the start, I shall talk about that later) at Moscow University.

The lot of those whose destiny it was to be born in our country in the 1920's and 1930's was harsh; they had to endure many hardships at the beginning of their lives. The tragic fate of their fathers was typical: some were victims of the repressions, and an uncountable number of them did not return from the war. It was not rare for the mothers to be separated from their children, who were then raised by their grandmothers or nannies. Those who were born between 1920 and 1926 went to war, and "few returned from the fields". The ones I will be talking about did not go to war, but almost all had to suffer hunger and cold, the burdens of the evacuation, poverty, and unsettled existence in communal apartments. Such was life for almost everybody.

I shall give only one example from my list. Vladimir Mikhailovich Alekseev was born in 1932. His father was a very sick man and died when his son was nine years old. His mother remarried, and Volodya was raised by his grandmother in the village of Bykovo near Moscow. They lived in a village house on the grandmother's minimal scanty pension. Clearly, they had no means to buy books, or go to the

⁴The implicit way of ensuring restrictions on admissions, based on ethnicity.

⁵The transliterations of the names here and below are chosen so as to agree with those that the authors have been publishing under recently.

theater, concerts or exhibitions. But I have never met a person with such a breadth of knowledge, cultural interests and spiritual needs. He combined spiritual wealth and outstanding accomplishments in science with an unusual tranquility. Where did that come from? The answer is, of course, that it came first of all from a fundamental inner strength, but for many, it also came from Mekh-Mat and from the personal contact with unusual personalities, such as A. N. Kolmogorov and I. G. Petrovskii.

Those who were lucky enough to attend Mekh-Mat in those years have forever kept in their hearts the memory of the remarkable reigning atmosphere of daring and camaraderie.

Our generation had amazing teachers. Mekh-Mat managed to retain remarkable creative potential at the beginning of the 1950's. P. S. Aleksandrov, A. O. Gelfond, V. F. Kagan, A. N. Kolmogorov, A. G. Kurosh, D. E. Menshov, I. G. Petrovskii and A. Ya. Khinchin were heads of sections (so-called cathedras).

During the period 1946–1960 the compulsory courses at the university were taught by direct students and collaborators of Luzin's, by mathematicians who belonged to the first generation of their students, and also by eminent scientists who came to Moscow and by their students. Such were P. S. Aleksandrov, N. K. Bari, I. M. Gelfand, A. O. Gelfond, B. N. Delaunay, E. B. Dynkin, V. F. Kagan, M. V. Keldysh, A. N. Kolmogorov, M. A. Kreines, A. G. Kurosh, M. A. Lavrentev, A. A. Lyapunov, A. A. Markov, A. I. Markushevich, D. E. Menshov, S. N. Mergelyan, P. S. Novikov, O. A. Oleinik, I. G. Petrovskii, L. S. Pontryagin, Yu. V. Prokhorov, P. K. Rashevskii, S. L. Sobolev, V. V. Stepanov, L. A. Tumarkin, S. P. Finnikov, I. R. Shafarevich, B. V. Shabat, G. E. Shilov, S. A. Yanovskaya and others.

“A Pleiad of great mathematicians, gathered in one department, was a completely exceptional event, and I have never encountered such a thing anywhere else”, wrote V. I. Arnold, describing the atmosphere at Mekh-Mat during his years as a student.

The knowledge acquired in the compulsory courses was reinforced by the practical seminars, led by experienced lecturers with long tenure. Such were N. D. Aizenshtat, B. P. Demidovich, S. A. Galpern, Z. M. Kishkina, A. S. Parkhomenko and I. V. Proskuryakov.

The famous physicist and alumnus of Moscow University, M. L. Levin, wrote the following lines on the role of our “seminarists”⁶:

Когда прямой была дорога,
И нам Вселенной был мехмат,
Мы все учились понемногу
У Кишкиной и Айзенштат.
Тем, у кого мечта сломалась,
И тем, которых вознесло,
Нам всем от этих двух досталось
Святое наше ремесло.

(When our road was straight and narrow,
And Universe was just Mekh-Mat,
Our knowledge came, slipshod or thorough,
From Kishkina and Aizenshtat.

⁶The translator is grateful for D. Burns' and A. Sossinsky's help with these lines in particular.

Both those, whose dreams were shattered,
 And those who saw them made,
 It was from these two icons
 We learned our sacred trade.)

One of the incomparable qualities of the Mekh-Mat of these days was the wealth of special courses and seminars. Their number was around one hundred. Among the seminars that played a role in the history of mathematics in our country, one should mention the topological seminar of P. S. Aleksandrov, which started with the friendship of Aleksandrov and Uryson, the seminar of Bari and Menshov, which was the continuation of the Luzin seminar, Kolmogorov and Khinchin's seminar on probability, Lavrentev and Markushevich' seminar on complex analysis, the seminar of Petrovskii, Sobolev and Tikhonov on PDE's, and Gelfand's seminar on all of mathematics.

After the 1960's, the basic courses began to be taught by mathematicians of my generation: V. M. Alekseev, V. I. Arnold, V. A. Zorich, A. A. Kirillov, Yu. I. Manin, Ya. G. Sinai and others. They also authored textbooks for revamped courses on mathematical analysis, algebra and geometry.

And finally, one must give credit to those who played a crucial role in the life of Mekh-Mat. I shall only mention four of them, though one could add many more: Ivan Georgievich Petrovskii, Andrei Nikolaevich Kolmogorov, Israel Moiseevich Gelfand and Nikolai Vladimirovich Efimov.

Petrovskii became Rector (=President) of Moscow University in 1951. His tenure in this position turned out to be a selfless service to Science and to those who had devoted themselves to Science. He had an uncanny vision in picking people he could ask advice from and rely upon. V. M. Alekseev and V. I. Arnold belonged to the few mathematicians of our generation who enjoyed Petrovskii's confidence, as did Yu. I. Manin and V. A. Uspenskii. Petrovskii made it an absolute principle of his life to take particular care of the best graduates of Moscow University. At the beginning of his tenure as Rector, hard and fast restrictions based on social and ethnic origins were still in place. For example, after graduating from Moscow University, Ilya Yosifovich Piatetski-Shapiro was assigned to teach in a secondary school in Orekhovo-Zuevo, and Feliks Aleksandrovich Berezin was assigned to teach in a vocational school in Moscow for working-class youngsters. Petrovskii took Piatetski-Shapiro on the staff of Mekh-Mat despite strong objections from those who insisted on keeping the old ways.

Kolmogorov and Efimov enjoyed particular patronage from Petrovskii. They were both Deans of Mekh-Mat, Kolmogorov from 1954–1968, and Efimov from 1962–1969. These were years when Mekh-Mat flourished, all of which was possible because Petrovskii was Rector of the University. In these years, I. M. Gelfand, Kolmogorov and Petrovskii's scientific influence, either direct or indirect via their former students E. B. Dynkin and O. A. Oleinik, on practically all of the above-mentioned students who entered Mekh-Mat in 1946–1954 was decisive. One should, of course, note that others shaped the mathematical school of that period. Suffice it to mention the names of L. S. Pontryagin and I. R. Shafarevich, who laid the foundations of schools on optimization theory and algebraic geometry, respectively.

The students who began their studies after 1955 belonged to a new, "post-Kolmogorov" wave. Here, Sergei Petrovich Novikov played a crucial role; he laid the

foundations for the development of modern geometry and topology within Mekh-Mat. This “wave” was backed in a most active way by Efimov, a most noble man and a remarkable mathematician, pedagogue and organizer. I deem it a duty for his students, colleagues and those who simply studied during his tenure as a Dean to publish a book of reminiscences about this fine man.

The Golden Age came to an abrupt end in 1969–1970, following the publication in the West in 1968 of the “letter by 99 mathematicians” protesting the harsh conditions of detention in a psychiatric hospital of Aleksandr Sergeevich Esenin-Volpin, a Mekh-Mat graduate whose specialty was mathematical logic and who was the son of the famous poet Esenin. New procedures were established more or less immediately. In the 25 years between 1970 and 1995, Mekh-Mat suffered irreplaceable losses. All of our teachers, the founders of Mekh-Mat, were gone: Petrovskii passed away in 1973, Efimov’s death was accelerated by the grave worries connected with the fate of his beloved Mekh-Mat, Kolmogorov had to endure much grief, many remarkable mathematicians of my generation passed away in their prime (V. M. Alekseev, F. A. Berezin, R. L. Dobrushin and others), and many Mekh-Mat professors started emigrating. From the sixty or so above-mentioned mathematicians of my generation, only a few remained by the 1990’s. Here are the names of some who left: Yu. K. Belaev, B. R. Vainberg, A. D. Wentzell, I. M. Gelfand, S. I. Gelfand, S. G. Gindikin, E. B. Dynkin, B. A. Dubrovin, Yu. V. Egorov, A. A. Kirillov, N. V. Krylov, Yu. I. Manin, M. Melnikov, B. S. Mityagin, S. A. Molchanov, V. P. Palamodov, I. I. Piatetski-Shapiro, A. Panchishkin, A. N. Rudakov, Ya. G. Sinai, M. I. Freidlin, D. B. Fuchs, M. A. Shubin, and A. M. Yaglom—these are all close friends of mine. And the above is not a complete list by far of those who had taught or led an active scientific life at Mekh-Mat. V. I. Arnold, S. N. Artemov, E. A. Gorin, R. L. Dobrushin, R. A. Minlos, A. L. Onishchik, and A. B. Sossinsky were forced to leave the University, as were many others.

Many Mekh-Mat graduates, who later obtained outstanding results, were not hired by their alma-mater, e.g. G. Margulis, V. Drinfeld and M. Kontsevich, to name but three. Often, when meeting former students who had been my friends (for example Fedya Bogomolov, Vitya Lomonosov or Asik Khovanskii, all students of a graduating class I was particularly attached to), I find it hard to conceal my bitterness over the fact that they are no longer part of our department.

But I do not want to end on a sad note. In the 15 years since the collapse of the USSR, much has changed to the point of being unrecognizable. And as a result, a new Golden Age does not seem to be imminent. But note that world history has not seen golden ages like the one during which, within a single city, nay, within a single university, one saw a concentration of many dozens of world-renowned scientists. And if one does not abandon hope that a peaceful and prosperous existence for all humanity is achievable, then one should not even dream about golden periods such as the one in the history of Moscow mathematics. People should be free in their choice of where to live, but they should also have the freedom of contact with everyone on Earth.

About 15 years ago many of my friends and colleagues obtained the possibility to move from Moscow. I do not know of anyone who has regretted their choice. Not all had a warm hearth in the old country—some emigrants have never returned to even visit Moscow. But they are in the minority. And of course, with the passing

of time, few are those who do not pay tribute to the blessings of their youth, their teachers and their university.

And what did happen during these last years here in Russia? Of course, much that was abominable and unimaginable. But the University has remained. With heavy losses, it has remained nevertheless and even grown. And the MMS has been working very productively.

Mekh-Mat has a hard time keeping up with the developments of the new, modern mathematics. And the difficult events of Russian history in the past 15 years are not the only reason. It is a law of nature that all living things are doomed to age. And maybe one should not make Utopian plans for the re-animation of the department; it can still serve a purpose by providing a decent general education. I would hope that a special department of “contemporary mathematics” be created either within the University or under its Aegis. It can be small, but it should have the possibility to invite scientists from various countries.

A prototype of such a department has been formed in Moscow—the Mathematical College of the Independent University of Moscow. It functions within the framework of the Moscow Center for Continuous Mathematical Education, in the creation of which N. N. Konstantinov played a fundamental role. This Center, headed by a mathematician who started working during the Petrovskii years, I. V. Yashchenko, carries out most varied and fruitful activities. It publishes a large number of books, booklets, the Almanac *Matematicheskoe Prosveshchenie* (“Mathematical Education”), a series of booklets *Biblioteka Matematicheskoe Prosveshchenie*, and the scientific journal *Moscow Mathematical Journal* with Yu. Ilyashenko and M. Tsfasman as editors and an Editorial Board consisting of D. Anosov, V. Arnold, S. Artemov, A. Belavin, V. Buchstaber, P. Cartier, B. Feigin, V. Ginzburg, J. Guckenheimer, S. Gusein-Zade, A. Katok, A. Khovanski, A. Kirillov, I. Krichever, R. MacPherson, G. Margulis, N. Nadirashvili, Yu. Neretin, S. Novikov, J. Palis, S. Shlossman, S. Smale, A. Sossinsky, V. Vassiliev, and S. Vleduts. This is a remarkable combination of Mekh-Mat graduates and respected scientists who have never studied at Mekh-Mat.

Within the Independent University, there is a seminar, called “Globus” on all of mathematics “as a single organic whole”. Two books have already been published based on this seminar. In the preface, Tsfasman (quoted above) gives a full list of the speakers for the past three years. The list is very impressive. No explanation is needed about who is who on this list for those who have spent some time at Mekh-Mat around the middle of the 20th century, whereas for the uninitiated it would take too long to explain (and many of the names have already been mentioned in my story). So I give the list without comment: S. Alesker, V. I. Arnold, S. N. Artemov, V. V. Batyrev, A. A. Beilinson, A. A. Belavin, O. I. Bogoyavlenskii, A. A. Bolibruch, A. M. Borodin, V. M. Buchstaber (twice), V. A. Vassiliev, A. M. Vershik, A. M. Vinogradov, S. G. Vleduts, S. I. Gelfand, S. G. Gindikin, R. I. Grigorchuk, S. M. Gusein-Zade, V. I. Danilov, P. Deligne (three times), S. Yu. Dobrokhotov, E. B. Dynkin, Yu. G. Zarhin, A. V. Zelevinsky, V. Ya. Ivrii, Yu. S. Ilyashenko, M. E. Kazaryan, V. A. Kaloshin, S. B. Katok, B. Keller, M. L. Kontsevich, S. K. Lando, L. Lafforgue (three times), G. Lachaud, L. A. Levin, D. A. Leites, G. L. Litvinov, A. S. Losev, Yu. I. Manin (three times), V. P. Maslov, S. K. Nechaev, V. V. Nikulin, S. P. Novikov, G. A. Olshanski, S. Yu. Orevkov, A. N. Parshin, A. N. Rybko, V. Serganova, A. G. Sergeev, Ya. G. Sinai, A. B. Sossinsky, J. Stienstra,

B. L. Feigin, M. V. Finkelberg, J.-M. Fontaine, D. B. Fuchs, A. Ya. Helemskii, A. G. Khovanskii, B. V. Shekhtman, V. V. Schechtman, M. Schlichenmaier, S. B. Shlosman, and M. A. Shubin. If one looks at the titles of the reports, one sees that the former Mekh-Mat graduates continue to be fruitful in the development of modern mathematics.

Science does not belong to one city, one nation, or one country—it is the property of all of humankind, and one can only dream of a Golden Age of mathematics of all of humanity. But personally, I would like it if, among the important world centers of mathematics, along with Paris, Princeton and some others that have already appeared or that will at some point show their worth, there were a city with a most rich mathematical tradition, whose name is Moscow.

Translated by Smilka Zdravkovska ⁷

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