IN MEMORY OF EUGENE DYNKIN (1924–2014)

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Eugene Dynkin (Yevgeni Borisovich Dynkin), who was a preeminence in Lie groups and probability theory in the XX century, died on November 14, 2014, at the age of 90.

Eugene Dynkin was born in Leningrad on May 11, 1924. His father was a lawyer, his mother a dentist. Until the age of nine Eugene did not go school, he studied at home, read a lot, in particular popular science literature and especially books by Perelman. He went to school in 1933 jumping ahead to the third grade. Soon after the assassination of Kirov (December 1934) the family was exiled to Kazakhstan. The family managed to leave Eugene with his mother's sister in Moscow until the end of the school year. After the parents had settled in Aktyubinsk they brought Eugene there and he went to a privileged school for children of railroad workers. Dynkin later praised that school; according to him the Leningrad and Moscow schools (that he went to) were in many ways inferior. In November 1937 the father was arrested again and this time he disappeared in the GULAG forever.

In 1940 Eugene graduated from high school with highest marks and was accepted by the department of mechanics and mathematics (mehmat) of the Moscow State University (MSU). Moreover, his name was mentioned in an article about the new MSU students in the main newspaper "Pravda." Dynkin remarked that he was lucky that he entered the MSU in 1940 and had studied a year before the war started, otherwise he would have lost four years at best: Among his teachers were the outstanding mathematicians I. M. Gelfand and A. N. Kolmogorov. He was also greatly influenced by A. S. Kronrod. After the war broke out, Eugene and his mother evacuated to Perm. He became a student at Perm State University and studied there until the end of 1943. S. A. Yanovskaya, who at that time was the only math professor from the MSU in Perm, became an important person in his life. By that time Dynkin was already actively interested in algebra. He himself stated and then solved the problem of classification of all closed subgroups of a finite-dimensional vector space. As it turned out later, this problem had already been solved in the XIX century. Still, Yanovskaya sent that work to Gelfand, and upon returning to Moscow Gelfand invited Eugene to his (later famous) seminar. Dynkin was not drafted because of child bone tuberculosis and nearsightedness.

While still an undergraduate student Dynkin submitted two papers for publication. After graduation from the university he became a graduate student with Kolmogorov as his advisor. Dynkin defended his PhD thesis ahead of time and became a senior lecturer in the probability division of the mechanics and mathematics department (mehmat) of the MSU. In a year he became an associate professor, and in 1951 he defended his second thesis and soon became a professor. Both theses were devoted to Lie groups and algebras. His works in that area became classical. The fundamental nature of these works is perpetuated in the term "Dynkin diagrams", one of the central notions of the theory of Lie groups and its generalizations. Beginning in 1955 Dynkin moved from the theory of Lie groups to probability theory and foremost to Markov processes. His works in this area are immense: works on the strong Markov property, criteria of continuity, a large collection of papers on the boundary theory of Markov processes. His fundamental monograph "Markov processes" published in 1963 served as a

standard source of information in this field and continues to be a classical exposition of the theory. The last collection of papers devoted to superprocesses—Markov processes related to nonlinear partial differential equations—deserves special mention. Less known to a wide circle of mathematicians but no less remarkable are Dynkin's works of the 1960s and 1970s on game theory and mathematical economics. Their importance became clearer only in recent years especially because of newly discovered applications of "Dynkin games" in financial mathematics.

Dynkin was one of the brightest stars in the mathematical constellation of the MSU's mehmat in the 1950s–1960s. His influence as a mentor of the highest level was huge. The Lie groups seminar, which he started, still functions under the leadership of his students E. B. Vinberg and A. L. Onishchik who created their own mathematical schools. Many leaders of the next generation are among Dynkin's students. We will name only those who, in their turn, had many students, omitting other equally outstanding mathematicians who could not (for logistical reasons) work with graduate students: N. V. Krylov, M. B. Malyutov, S. A. Molchanov, A. V. Skorohod, M. I. Freidlin, R. Z. Khasminsky. Quite a number of mathematicians, including a few who became later famous, attribute their first papers to work with Dynkin even if he was not their formal advisor. Altogether 30 theses were defended under his guidance. If one, as it is common now, counts not only Dynkin's students but also students of students, etc., then he has over 500 such "scientific descendants."

Beginning even in the war (WWII) years, Dynkin got involved with mathematical circles. When he remembered the time spent at Perm State University in his interviews Dynkin said that "following the Moscow tradition" he started "something like a mathematical circle" for three other students from the MSU who happened to be in Perm. Upon returning to Moscow he became the leader of one of the sections of the mathematical circle for school children. Dynkin and a participant of that section, V. A. Uspensky, later used the 1945–1947 materials of the section to write a book "Mathematical conversations" (1952) which became a classic of popular education literature.

Due to a secondary education reform in the USSR, special magnet mathematical high schools were opened in the 1960s. In addition to outstanding high school teachers, mathematicians of different levels from upper division undergraduates to professors and academicians volunteered to teach in mathematical schools. Dynkin played an exceptional role in the early development of mathematical schools. In 1963 he founded the Evening Mathematical School (EMS) as an addition to the Moscow school #2; and next year, with help of the school principal V. F. Ovchinnikov, he organized a section (three groups, around 100 students total) for mathematically gifted children in grades 9–10 (1964–1966).

Dynkin was not the first well known mathematician who worked within the structure of mathematical schools, which was drastically different from the established and famous tradition of mathematical circles and olympiads. However, his approach had some unique features. Working in school #2 Dynkin showed himself as a talented organizer which is not typical for actively working mathematicians. Dynkin's section in school #2 was well thought through and organized. Twice a week he lectured for the whole section. Each of his six immediate assistants was responsible for a group of 15–20 students. Each assistant had two upper division undergraduate students who helped them. The lessons in the groups were not similar to university studies. They were closer in style to a more intense version of a mathematical circle. This combination of a well organized lecture system and spontaneous but intense atmosphere of group studies was quite unique.

In spite of his preference for system and organization Dynkin encouraged a more spontaneous and "chaotic" approach for his assistants. It was an unusual but remarkable harmony. The first author of this article was one of the six senior Dynkin assistants. The second author was a student in Dynkin's section who later became Dynkin's graduate student and worked closely with him for a long time.

To characterize the atmosphere of Dynkin's section in school #2 let us quote an unpublished memoir of I. D. Novikov, who also was one of Dynkin's senior assistants: "It was difficult to study, especially difficult because Dynkin encouraged competition in every way. There was no penalty, but the system of selective encouragement was more effective than penalty. Not to receive praise or not to receive enough praise was worse than punishment, for example when the parents were called in. There were different competitions for which special problems were presented. Their solution was paid for in "tugriks." Those were not Mongolian coins but pieces of paper with a number and Dynkin's signature. This money could be used to buy something in the school department store organized by Dynkin. This happened several times a year in the evening. Dynkin, as many other mathematicians, was a music lover, and he had a large collection of vinyl records. He brought some of his records for sale in the store, maybe duplicate copies. Besides, there were books of popular math lectures, nominally very cheap. But Dynkin asked his friends-mathematicians, authors of the books, to sign them. So, these tugriks could be used to buy real rarities with the author's signatures. More importantly, the results of these competitions were announced. I don't remember how it was done but the students always knew who solved how many problems, and this was a huge incentive. The children did their best."

Dynkin's organizational talent and his exceptional ability to systematize and classify can be seen in his other activities, including his mathematical papers and his unique collection of interviews with mathematicians conducted by him over several decades.

The powers that be did not like Dynkin's independent thinking, and he had to leave the MSU in the spring of 1968. After a jobless period he at last got a position of senior researcher in the department of mathematics of CEMI (Central Economics-Mathematics Institute) of the Soviet Academy of Sciences. Even then he had a seminar at home for a small group of students. In 1976, after his daughter's family left for Israel, Dynkin decided to emigrate. He accepted an offer from Cornell University (Ithaca, NY) and became the A. R. Bullis Professor there. Dynkin spent 33 years at Cornell and retired after he turned 86. His achievements were recognized appropriately in the USA. In 1978 he became a fellow of the American Academy of Arts and Sciences, in 1985 he was elected a member of the National Academy of Sciences of the USA, in 1993 he received the most prestigious award of the American Mathematical Society—the Leroy P. Steele Prize for Lifetime Achievement. He was recognized around the world: Doctor Honoris Causa of the Pierre and Marie Curie University (Paris 6) in 1997, and Doctor of Science honoris causa) of the University of Warwick in 2003. His recognition in Russia came somewhat late. In 1995 he was elected an honorary member of the Moscow Mathematical Society where he was vice president in 1964–1971. In 2003 he became a Doctor Honoris Causa of the Independent Moscow University (Russia). His wife Irina gave him constant support and invaluable help. She always organized their life so that he could concentrate on his work.

E. B. Dynkin authored more than 200 scientific papers, eight scientific monographs, and three popular mathematics books. He was active scientifically until the very end. His last paper was published in 2013.

His students, friends and colleagues will always fondly remember Eugene Dynkin.