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# TWO-HUNDRED-AND-SEVENTY-FIVE YEARS OF THE RUSSIAN ACADEMY OF SCIENCES†

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The establishment and development of Russian science and its outstanding world achievements have always been closely associated with the activities of the Academy of Sciences. It was the first learned society and higher educational institution in Russia which promoted scientific progress and the subsequent extensive development of higher education in the country.

Exactly 300 years ago, in 1699, Peter the First issued the edict, that was to become symbolic, on changing to the Western European way of numbering the years from the birth of Christ. In 1700, the Northern war began, which came to an end after 21 years in absolute victory for Russia with the conclusion of the Nystad peace treaty and with the conferring on Peter of the titles "the Great", "Father of the Fatherland" and "the Emperor of All Russia". Actually, in these historic years, the czar-reformer "was fated to hew a window into Europe".

Although Peter himself had not received any formal education, he felt profoundly the need to introduce culture and science into Russia. It may also be symbolic that he was elected an honorary member of the Paris Academy of Sciences, while his completely illiterate native field marshal A. D. Men'shikov was made a Fellow of the Royal Society of London, at the time when its president was Isaac Newton.

Travelling throughout Western Europe, Peter arrived at the idea of setting up an academy in his own northern capital. At that time, as now, this was a dual concept: it stood for both a learned society and a higher educational institution. In turn, Peter gave priority to each of these academic functions. The sporadic talks on the founding of the Academy, which had lasted for many years, were concluded with the consideration of a prospectus drawn up by the future first President of the Academy, the physician-in-ordinary L. Blumentrost. On 22 January (on the Julian calendar; 2 February according to the Gregorian calendar) in the year 1724, Peter, with his own hand, made certain corrections to the prospectus and stipulated, with foresight, the appropriation of money for the upkeep of the future Academy. This extremely progressive bill on the statutes of the Academy which would combine scientific and educational functions and have a high degree of independence remained incomplete and was abandoned. However, six days later, a decision "to create the Academy, in which languages would be taught as well as the other sciences and leading arts, and books would be translated" was announced in the form of an edict from the Senate.

It is interesting that, according to the draft approved by the czar, the President of the Academy was to be appointed by election and, also, the academicians themselves were to enrol new members by election. In accordance with this plan, the Academy was divided into three departments: mathematical, physical and historical-philological (with the inclusion of jurisprudence) with four academicians in each of the first two departments and three academicians in the third one. The mathematical department included one mathematician, one astronomer (geographer) and two scientists in the field of mechanics.

Correspondence concerning the invitation of foreign scientists to the Academy began in 1725. However, Peter did not live to see his own creation as he died on 28 January (8 February) 1725. Six months later, the members of this Academy, which still existed only on paper, began to arrive in St Petersburg, and the first audience with Peter's successor, Ekaterina I, took place in August. Semi-official scientific sittings of the members of the Academy then commenced. The edict of the Senate "concerning the founding of the Academy of Sciences and the nomination of the physician-in-ordinary Blumentrost as President" was published on 7 (18) December 1725, and the first ceremonial public meeting of the Academy took place on 27 December 1725 (7 January 1726).

During the first 20 years, the Academy had neither statutes nor an official title. In its publications, which were printed predominantly in Latin and German, it was called the Imperial Petersburg Academy of Sciences. In the first Regulations of 1747, which had been confirmed by Her Imperial Majesty, although they were still very incomplete, it is called the Imperial Academy of Sciences and Arts in St Petersburg

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and stated in a declaratory manner that "it is subdivided into the Academy itself and the University". In the subsequent Regulations of 1803, it is simply the Imperial Academy of Sciences and, in the Statutes of 1836, the title of St Petersburg is again added to it. After the fall of the monarchy in 1917, the Academy was renamed the Russian Academy of Sciences and, in 1925, it was given the title of the USSR Academy of Sciences, which it kept up to the dissolution of the Soviet Union, and now, and it is to be hoped for a long time to come, it is again called the Russian Academy of Sciences.

The original membership of the Academy was predominantly drawn from countries of Germanic culture. At the beginning of 1726, the Petersburg Academy had 12 academicians (professors) and four adjuncts with an average age of 30 years (with the passage of time, the average age of the academicians increased steadily: in 1741, it was 35 years, in 1825 it was 50, in 1908 it was 56 and, in 1991, 70 years). The first to enrol and the oldest was the 47-year-old scholar in the field of mathematics and rational mechanics, Jacob Hermann, a well-known disciple of Jacob Bernoulli. Among the first academicians were G. B. Bülfinger (physics), J. N. Delisle (astronomy), Ch. Goldbach and the brothers Nikolaus and Daniel Bernoulli (mathematics). In 1727, Leonhard Euler and G. W. Kraft were invited to be adjuncts.

Pure and applied mathematics was represented best of all in the Academy. At the first of the sittings known to us, on 2 (13) November 1725, a lecture on the shape of the Earth was given by J. Hermann in which he presented an analytical proof of its oblateness according to Newton. Later on, an academic Conference (General Meeting) usually sat twice a week with, as a rule, the presentation of a single scientific paper at each sitting. During 1725–1727, short minutes of the proceedings of the 113 sittings were kept. In 80 of these sittings, problems of the exact sciences were discussed including, in 42 of them, problems of mechanics (the measure of forces, the composition and resolution of forces, celestial mechanics, hydraulics and hydrostatics, capillary phenomena, mechanical engineering, etc.).

Despite the limited make-up of the academic Conference, the discussions following the scientific presentations were at times very heated. The dry records of the proceedings written in Latin which have survived mention discussions that developed into heated arguments (which became very personal) and required the intervention of the President of the Academy to restore order.

From the very outset of its activities, the Academy started to publish an annual "Commentaries of the Imperial Petersburg Academy of Sciences" (in Latin). The first volume of these "Commentaries" opened with papers by J. Hermann "On the measure of forces in bodies", G. B. Bülfinger "On the forces which are inherent in a moving body and their measure—a mechanical proof", N. Bernoulli "Discourse on the motion of bodies on impact", D. Bernoulli "Investigation of the principles of mechanics and geometrical proofs of the composition and resolution of forces", and J. Hermann "On the Kepler problem".

The first volumes of these academic "Commentaries" attracted the serious interest of scientific circles throughout Europe. "I cannot explain to you enough", wrote D. Bernoulli to Euler in 1734 after Bernoulli had returned to Switzerland, "with what avidity, they ask everywhere about the Petersburg memoirs . . . it would be desirable that they speed up the printing of them".

Originally, the responsibilities for higher education had been given to the Petersburg Academy. Accordingly, a gymnasium and a university were founded but their activities did not turn out to be very efficient, so that they naturally began to wither away over a period of time. In 1755, M. V. Lomonosov wrote, with the emotional feeling that was characteristic of him, that the academic university "not only does not function but also does not have a name". The first real Russian university was founded in the same year in Moscow by I. I. Shuvalov on the initiative and with the assistance of Lomonosov. The Petersburg Academy formed, together with the Paris Academy of Sciences and the Royal Society of London, the three most important academies in the world. In spite of its enormous role in the development of world science, the immediate influence of the Academy on the progress of science and technology in Russia in the eighteenth century was quite small as a whole. Of the large-scale activities of the Academy, which were undertaken in the eighteenth century and were of great significance in the study of history, geography and the productive resources of Russia, the grandiose Siberian expeditions which were organized at this time should be mentioned.

During the first half century of its existence, the Academy had 87 active members and adjuncts, of whom 15 were Russian. Among the Russian academicians were M. V. Lomonosov (1745), the man of letters V. K. Trediakovskii (1745), the naturalist S. P. Krasheninnikov (1750), the astronomer N. I. Popov, the mathematician S. K. Kotel'nikov (1760), the astronomer S. Ya. Rumovskii (1767), the anatomist A. P. Protasov (1771), the naturalist I. I. Lepekhin (1771), and the astronomer P. B. Inokhodtsev (1783). All of them left their mark in the history of Russian science and culture.

For the outside world, the scientific face of the Petersburg Academy in the eighteenth century was associated, above all, with its school of mathematics and physics but, for Russian life and culture, the Academy was subsequently personified by Mikhail Vasil'yevich Lomonosov. The son of a coastal

inhabitant of the Archangel province, Lomonosov, after ten years of training in Moscow and in Germany, was appointed to the position of junior scientific assistant in the physics department in January 1742 and, in 1745, after a long period of hardship, to the position of professor of chemistry, an academic position in which he served for 20 years.

Lomonosov did so much for the development of Russian culture and, at the same time, was such an outstanding scientist that it is impossible to describe his role in a brief article. We shall simply quote the words of S. I. Vavilov: "In all the fields of science and the arts with which the Petersburg Academy was occupied in the eighteenth century (with the exception of mathematics), Lomonosov was indisputably the most remarkable and original representative. For the Russian state, Lomonosov became the incarnate proof of the talents, abilities and skills of the Russian people in the affairs of science and culture and, at the same time, the hopes of Peter the Great regarding the educational role of the Academy were realized at a startling speed." Lomonosov himself was in many ways similar to Peter: both of them were naturally gifted, each of them in his own sphere completed a multitude of large and important reforms, neither of them had the time to consolidate their many accomplishments, by nature both men possessed remarkable strength and an unbalanced character, they both lived tempestuous lives and both died prematurely at the age of just over 50 years.

International recognition of the Petersburg Academy in the eighteenth century was inseparably linked with the activities of the supreme mathematician Leonhard Euler. A citizen of the Swiss city of Basel, Euler arrived in Petersburg, as a 20-year-old youth, and developed into a scientist there, where over a period of 56 years, he was the most active member of the Petersburg Academy. Working in Berlin from 1741 to 1766 and being an honorary member of the Academy during this time, Euler wrote: "I and everyone who has had the good fortune to be members of the Imperial Academy for some time must acknowledge that everything that we are is owed to the favourable circumstances in which we found ourselves there. As far as I am concerned, had there not been such supportive conditions, I would have been largely forced to turn to other occupations in which, by all accounts, only a narrow pedant could be engaged. When His Royal Majesty (Friedrich II) recently asked me where I had acquired my knowledge, I truthfully replied that it was all owed to my stay at the Petersburg Academy". And again (in 1760): "Hitherto, I have worked for the Imperial Academy not as an absent member but, in exactly the same way, as if I were personally present there, which all the volumes of the 'Commentaries' adequately demonstrate". From 1766, Euler was again, and for good, in Petersburg. He lived in Russia for a total of 31 years and was buried in Petersburg, leaving to his second homeland, along with his outstanding works, many descendants, representatives of whom in Petersburg and Moscow still to this day bear the famous family name of Euler.

Euler's papers were continuously published in academic annuals and journals over a whole century from 1729 to 1830(!). For the first 50 years of publishing by the Academy of Sciences, 60% of all publications in pure and applied mathematics were due to Euler and, over a period of 100 years, it was 40%. Even for a period of 200 years (1728–1927), the number of Euler's publications still constituted about a quarter of all the mathematical output of the academic press. As Vavilov justifiably said: "together with Peter the Great and Lomonsov, Euler became the good genius of our Academy, being responsible for its fame, its strength and its productivity".

The sphere of Euler's scientific interests was all embracing and his papers constitute an encyclopaedia of the exact sciences in the eighteenth century. The development of the calculus, the establishment of the analytical foundations of mechanics, the creation of the variational calculus, hydrodynamics, the theory of naval architecture and many other fields of science are associated with his activities. To him, of course, belongs the merit of having developed the scientific language of mathematical natural science which defined the style of exposition in the publications of successive generations of scientists over a period of at least one and a half centuries. The total volume of Euler's papers is enormous. More than 800 of his scientific publications constitute the 72 large volumes of the still unfinished "Complete Collected Works" published in Switzerland since 1911.

The highest Russian authorities clearly understood the importance of Euler for the Petersburg Academy of Sciences but he was not awarded any high rank, and his direct influence on the academic management was small. Nevertheless, the position of permanent secretary of the Academy stayed in the hands of the Euler family (his son J. A. Euler, the husband of his granddaughter N. I. Fuss, and his great grandson P. H. Fuss) over a period of 86 years (1769–1855).

Academician N. I. Fuss did much to raise the standard of the teaching of the mathematical sciences in Russia towards the beginning of the nineteenth century. He also actively participated in the work of the Chief Board of Education, the highest body of the Ministry of Public Education founded in 1802, which was responsible for the "education of young people and the spreading of the sciences". Immediately after the founding of this ministry in Russia, an extensive network of special higher and

intermediate educational institutions started to be formed in Russia, including universities and higher technical colleges. Academicians who had been obliged, according to the old academic regulations, to work solely in the capital were, however, associated with a higher school practically only in Petersburg. Among the academicians and professors of the middle of the nineteenth century, one can name the outstanding mathematician and teacher M. V. Ostrogradskii. The Vice-President of the Academy of Sciences, the mathematician V. Ya. Bunyakovskii paid a considerable amount of attention to the problems of teaching in higher schools. The founder of the Petersburg School of Mathematics, Professor of Petersburg University, Academician P. L. Chebyshev, played an outstanding role in the development of Russian science. The outstanding academics, university professors and, subsequently, academicians, A. M. Lyapunov and A. A. Markov, were his disciples.

Relations between the Russian authorities and the Academy of Sciences were, over the whole of its history from its foundation up to modern times, extremely complex, and were characterized by frequent conflicts arising from attempts to place the Academy under the control of the bureaucratic state apparatus.

Thus, the internally inconsistent politics of the Czarist government in the nineteenth century and, particularly, at the beginning of the twentieth century were naturally reflected in the life of the Academy of Sciences, leading to various clashes. The failure of D. I. Mendeleyev to be elected as a full member of the Academy in 1880 and the annulment of the election of Maxim Gorkii as an Honorary Academician in the "belles-lettres" category, which led to the demonstrative exit of V. G. Korolenko and A. P. Chekhov as members of the Academy, serve as clear, although not the most significant, illustrations of this.

In 1915, the 12th and last President of the Academy to be appointed by the Emperor, the Grand Prince Konstantin Konstantinovich, died (as a well-known poet, he was simultaneously an Honorary Academician in the "belles-lettres" category under the pseudonym of K. R.). After the February revolution in 1917, the Academy of Sciences elected its president independently for the first time and the then acting Vice-President A. P. Karpinskii now became the President. The October revolution which followed, placed the Academy of Sciences in an ambiguous position. The Soviet regime took rigorous measures to control higher education and the development of Russian science, proposing, in particular, that the Academy should concentrate its efforts on studying the natural productive resources of the country. An extremely critical evaluation of the Bolshevik reforms in Russian higher education undertaken in 1920/21 was given in an only recently published letter from 38 of the most prominent scholars in the country, academicians and professors, which was sent in 1921 to the Chief of the Council of People's Commissars, V. I. Lenin. At the beginning of the 1920s, several academicians were deported from the Soviet Union.

In the struggle against the independence of the Academy of Sciences, the authorities compelled the academicians to enlarge the composition of the Academy in 1929 and at the beginning of the 1930s with a number of their own trusted representatives and to exclude the most obstinate scholars from its members. Under these conditions, several academicians considered that it was better to go abroad and subsequently never returned to their homeland. Among these were the outstanding scholars, the physicist V. N. Ipat'yev and the chemist A. E. Chichibabin who, for doing this, were deprived of their academic titles by their own "loyal" colleagues and were subsequently deprived of their citizenship of the USSR by the government. In all, more than 50 members of the Academy were excluded at different times from membership of the Academy during the period of Soviet power (a significant number of these were rehabilitated in the records of the Academy, most posthumously, in the 1950s and 1960s).

However, the systematic struggle of the Communist party and the government against the independence of the Academy was simultaneously combined with concerns about the development of science in the country, which was directed towards building up the national economy and increasing the prestige of Soviet science. However, intervention by the Communist party in determining the routes for the development of science at times had serious consequences. The prohibition of genetics, which was accompanied by the imprisonment of Academician N. I. Vavilov and his death in jail was one of the most tragic pages in this intervention. It only became possible finally to get rid of the fruits of a quarter of a century of direct domination of "Lysenkoism" in the country during the presidency of M. V. Keldysh in 1964.

Over a period of 65 years, the statutes of the USSR Academy of Sciences have been repeatedly corrected and changed, reflecting both the instability of its position in Soviet society as well as the rapid development of science in the twentieth century.

At the beginning of the 1930s, the Academy of Sciences was placed directly under the command of the Council of People's Commissars and, during 1934–1935, it was relocated from Leningrad to Moscow. After a number of reforms, the Academy lost its independence but the highest governing bodies encouraged the creation of new research institutions throughout the country. Since membership of the

Academy had ceased to be associated with permanent residence in the capital, the members of the Academy could now collaborate more closely in higher education and science-intensive industry in other cities throughout the USSR. In November 1935, the new statutes of the Academy of Sciences were confirmed. According to these statutes, it was to be subdivided into three branches: the Division of Social Sciences, the Division of Mathematical and Natural Sciences and the Division of Engineering Sciences. The Group of Engineering Mechanics, headed by B. G. Galerkin, was created in 1935 within the new Division of Engineering Sciences. In this connection, it was acknowledged, in particular, that it was advisable to put the Leningrad non-periodic collection *Applied Mathematics and Mechanics* under the aegis of the Academy of Sciences, and the academic publishing house started the regular publication of this journal, which has become, over a period of many decades, the leading Russian journal in its field.

In November 1938, the USSR Academy of Sciences founded the Institute of Mechanics in Moscow and B. G. Galerkin was appointed as its first director. After him, the institute was headed by N. G. Chetayev, A. A. Il'yushin and A. A. Nikol'skii. In January 1965, a new Institute for Problems in Mechanics, headed until 1988 by A. Yu. Ishlinskii and subsequently by D. M. Klimov, was opened, based on the Institute of Mechanics of the USSR Academy of Sciences.

Particularly favourable conditions were created for the scholars and, in particular, for the Academy of Sciences after World War II when scholarly and educational activity was regarded as being extremely prestigious for a long time. Of course, this was associated to a significant extent with the fact that the development of both the basic as well as the engineering sciences was crucial for the reinforcement of the military might of the country, to which the leadership of the country attached great importance.

Certain changes in the position of the Academy of Sciences took place after 1953. In particular, steps were taken in the USSR to restore the international relations of Soviet science which had been lost during the preceding 20 years. In particular, in 1956, the USSR National Committee (subsequently renamed the Russian National Committee) on Theoretical and Applied Mechanics, which was called upon to renew contacts with foreign scientific organizations, was set up at the Academy of Sciences. One of the oldest scientists in the field of mathematics and rational mechanics in the country, N. I. Muskhelishvili, became the founder and first president of this committee. As one of its main tasks, the National Committee also set up a convocation of prestigious All-Union congresses on mechanics. From 1960 to 1991, seven such congresses were held, the first three and the last of which took place in Moscow. The Thirteenth International Congress of Theoretical and Applied Mechanics was also held in Moscow in 1972.

Starting in the 1950s and, particularly, in the 1960s, the introduction of powerful computing facilities, which greatly increased the possibilities of solving complex problems, began to have an active influence on the development of the exact sciences, including theoretical and applied mechanics. Within the framework of the Academy of Sciences, problems of computational mechanics were initially developed at the Institute of Applied Mathematics (this institute existed up to 1953 in the form of the independent and classified Division of Applied Mathematics of the Mathematical Institute) which was directed from the end of the 1940s by M. V. Keldysh and in the Computational Centre of the USSR Academy of Sciences, which has been headed since its foundation in 1955 by A. A. Dorodnitsyn.

Starting in the 1950s, the creation of new scientific centres to the East of the central regions became important for the development of science in Russia and, in particular, the foundation in 1957 of the Siberian Branch of the Academy of Sciences, which was directed by M. A. Lavrent'yev for many years. At the same time, a number of research institutes were formed in the Novosibirsk Akademgorodok, and the scope of scientific research carried out in these institutes also included problems in mechanics.

However, the conflicts between the Communist party leadership and the Academy of Sciences continued into the 1960s. During this period, the government attempted to remove the Academy of Sciences from direct subordination to the Council of Ministers by placing it under the command of specially created committees attached to the USSR Council of Ministers. Even one of the most brilliant presidents of the Academy, M. V. Keldysh, was once forced to leave the building of the Presidium of the Academy of Sciences for some time in a demonstrative manner in protest against the declaration by N. S. Khrushchev that the Academy was failing to meet the requirements of the Communist party. On the whole, however, the Academy of Sciences achieved outstanding scientific results in the post-war years, above all in the fields of physics and mathematics, firmly consolidating its position among the leaders of world science. Evidence of this was the award, after a break of half a century, of Nobel Prizes to the Russian scientists Academicians N. N. Semenov (1956), P. A. Cherenkov, I. M. Frank and I. E. Tamm, (1958), L. D. Landau (1962), N. G. Basov and A. M. Prokhorov (1964) and, later, to L. V. Kantorovich (1975) and P. L. Kapitsa (1978). The outstanding physicist and citizen, Academician

A. D. Sakharov, was awarded the Nobel Peace Prize in 1975. We must also mention the enormous contribution made by Academician I. V. Kurchatov in the development of nuclear technology.

The whole world applauded the historic achievements of our scientists and engineers in the conquest of space, which was accomplished under the guidance and with the direct participation of Academicians M. V. Keldysh, S. P. Korolev and V. P. Glushko. Unfortunately, the Communist party leadership would not authorize that the designers of the first Soviet artificial satellites, who had consolidated Russian priority in space science, be recommended for the Nobel Prize.

The contribution of Russian mathematicians to the development of world science is enormous. Here, above all, one has to mention the remarkable schools of Academicians N. N. Luzin and A. N. Kolmogorov.

Outstanding results have also been obtained in the twentieth century by Russian scientists in the field of mechanics, among whom, above all, the following Academicians should be mentioned in order of seniority: A. N. Krylov, S. A. Chaplygin, N. I. Muskhelishvili, M. A. Lavrent'yev, N. Ye. Kochin, L. I. Sedov, M. V. Keldysh, A .Yu. Ishlinskii as well as the corresponding member of the Academy of Sciences, N. G. Chetayev. The journal *Applied Mathematics and Mechanics* is proud of the fact that they have all been members of its editorial board.

The academies of the other Soviet republics, whose scientific activities were coordinated by a special council at the USSR Academy of Sciences in Moscow, functioned actively in the country side by side with the USSR Academy of Sciences. The most intensive research in the field of mechanics outside Russia was carried out in the Academies of Sciences of the Ukraine, Georgia, Armenia and Uzbekistan. With the break up of the USSR, close ties between scientists of the former Soviet republics have been almost completely blocked.

The Russian Academy of Sciences is now living through a serious crisis, due above all to the utterly inadequate financing of basic research and promising developments, and the exodus of talented young people from academic institutions which this has caused. However, the Academy continues its work, and there is evidence of this, in particular, in the continuing publication in academic journals, including *Applied Mathematics and Mechanics*, of outstanding new scientific results. The optimism of the best Russian scientists and their faith in a bright future for Russian science supports them in the difficult living conditions of the present time.

*Translated by* E.L.S.