ANNIVERSARY DATES

To the 90th birth anniversary of Dmitry Konstantinovich Lvov, Academician of Russian Academy of Sciences

M.P. Chumakov: «We should make the impossible possible» (1961);
«Where DK had been, others have nothing to work on...» (1965)

Dmitry Konstantinovich Lvov (also known as DK among his associates) is a world-renowned scientist whose name is associated with establishing and developing new direction in the field of virology – molecular ecology of viruses and population genetics of arboviruses as well as studies addressing the formation of population gene pools of viruses. He applied an evolutionary approach and mathematical tools of the multiple factor analysis to creating a concept about regular patterns of virus circulation in various geographical and climatic zones of the world. Over 70 years, his scientific and organizational work has been intrinsically connected with the problem of emerging and reemerging viral infections posing a threat to biosafety.

Dmitry Lvov is the author of the unique method of ecological sensing of North Eurasia and forecasting of epidemic outbreaks in different landscape belts of Russia. He organized and took part in multiple expeditions around North Eurasia.

Dmitry Konstantinovich was born in Moscow on June 26, 1931. His father was a psychologist, educator, corresponding member of the Academy of Pedagogical Sciences of the Russian Soviet Federative Socialist Republic; his mother taught Russian and literature. Parents and elder brother (was killed in a battle near Rzhev in January 1942) had a great impact on the civil and scientific development of the future researcher and patriot. This was further fortified by the years-long friendship with the families of academicians A.V. Chayanov, V.A. Engelgardt, I.P. Razenkov, Ye.M. Tareev, and other residents of Nikolina Gora, a unique community of science and art workers (the first house was built by K.I. Lvov, Dmitry's father). In 1949, D.K. Lvov entered the Sechenov First Moscow Medical Institute, and two years later he was transferred to the Kirov Military Medical Academy (Leningrad) as a third-year student. He graduated with honors from the Academy in 1955. During his education, he received fundamental training in biology and parasitology, doing research on transmitters of Japanese and other encephalitis viruses. Almost fifty years later, in 2004, D.K. Lvov was elected Doctor Honoris Causa of the Academy.

Dmitry Lvov's research advisers were well-known scientists, Ye.N. Pavlovsky, Sh.D. Moshkovsky, and M.P. Chumakov. Till 1957, Dmitry Lvov worked as a junior researcher at the Sanitation Institute of the USSR Ministry of Defense. After demobilization, he was admitted by the competitive examination to the position of a junior researcher at the Institute of Medical Parasitology and Tropical Medicine of the USSR Ministry of Health, where he worked up to December 1960, studying the problem of tick-borne encephalitis. Then, he was transferred to the Institute of Poliomyelitis and Viral Encephalitis of the USSR Academy of Medical Sciences, where he successively passed all the stages of the academic career path – from a junior researcher to the head of the laboratory. He conducted large-scale studies in inactivated vaccine against tick-borne encephalitis and immunoprevention strategies to combat this infection. The manufacturing technology and application of the vaccine served as a prototype for a number of other vaccines, including the present-day CoviVac vaccine against COVID-19.

Since October 1967, Dmitry Konstantinovich Lvov has been working at the Ivanovsky Institute of Virology of the Russian Academy of Medical Sciences (RAMS). He started as the head of the Arbovirus Genetics Laboratory and from 1969 to 1987 he held several positions at the same time, being the head of the laboratory, the head of the Virus Ecology Department (to present) and the Deputy Director of Research. From 1987 to 2014, he was the Director of the Institute of Virology.

In 1960, the young scientist defended a candidate's (Ph.D.) thesis on the Immunological Structure of the Population in Tick-Borne Encephalitis Clusters; five years later he became a doctor of medical sciences, having defended a doctoral (D.Sci.) thesis on the Immunoprophylaxis in Tick-borne Encephalitis and majoring in virology and epidemiology.

In 1975, Dmitry Konstantinovich Lvov was elected a corresponding member of the USSR Academy of Medical Sciences, and in 1984, he became an academician of the Academy in the virology field. Since 2013, he has been an academician of the Russian Academy of Sciences (Division of Medical Sciences).

The name of Dmitry Lvov is associated with the proof of the trans-taxonomic transmission of zoonotic viruses through the respiratory route in the human population. Under his supervision, researchers completed large-scale field and experimental studies to identify multiple zoonotic viruses belonging to different families, many of which were entered into the International Catalog of Arboviruses as new, previously unknown to science. The role of the identified viruses in human pathology was studied, and diagnostic products were developed. The previously unknown zoonotic infections were described, including infections transmitted by mosquitoes from birds (Karelian fever), bats – the aerogenous and alimentary route (Issyk-Kul fever), ticks from birds and animals (Tamdy fever, Syr-Darya Valley fever, etc.). The method of molecular ecology was used to identify the genetic makeup of the Crimean-Congo hemorrhagic fever virus and West Nile virus (WNV), which caused massive epidemic outbreaks with high mortality rates in 1999–2002 in the South of Russia. It was found that genomes of WNV strains isolated in Russia and the United States during the above period were identical.

The ecology approach was used by D.K. Lvov to study mechanisms of origination of new pandemic viruses of influenza A. An active circulation of 15 out of 17 known influenza A viruses was discovered in natural biocenoses of Northern Eurasia, including genetic variations seen as possible predecessors of new pandemic viruses. The studies also addressed the causes and consequences of the avian influenza H5N1 imported to Northern Eurasia as well as global consequences of this process and the pathogen evolution. The spread of the new pandemic influenza A/H1N1pdm2009 in Russia and the molecular mechanisms of lethal pneumonia development were studied.

The monitoring of the spread of various genotypes of hepatitis C virus in Russia made it possible to identify the universal prevalence of the most pathogenic genotype 1b. The studies helped understand what causes high hepatitis A, B, and E incidence rates in the population of Central Asia.

Dmitry Konstantinovich conducts research, which is significant both for science and public health; he is consistently committed to exploration and successful resolution of the problem of emerging and reemerging infections posing a threat to biological safety of the country.

The scientist of great knowledge in many fields: biology, virology, molecular ecology, epidemiology, infectious disease pathology, Dmitry Lvov has made a significant contribution to successful development, completion, and implementation of scientific programs. He has created a school of virologists, specialists in arbovirology and virus ecology.

He has authored and co-authored more than 400 fundamental research papers, including 11 monographs and manuals of general and special virology, the unique Atlas showing the spread of pathogens causing highly dangerous and poorly studied viral infections in Russia. Dmitry Konstantinovich has been a scientific adviser of more than 50 candidates and doctors of sciences. His h-index in the RSCI database is 41, in Scopus 22, and in Web of Science 21.

D.K. Lvov is the Chairman of the Special Board for Theses in Virology and Molecular Biology (medical and biological sciences) and the Chairman of the Interdepartmental Academic Board for Virology.

For many years, Dmitry Konstantinovich has been participating and coordinating an extensive range of scientific programs in virology. As the Head of the Center for the Ecology of Viral Pathogens of Infectious Diseases, he organized and took an active part in annual expeditions, regional meetings, scientific conferences and seminars of virologists, epidemiologists, and infectologists representing the healthcare sector of Russia and CIS countries, and addressing the problem of arboviruses and arboviral infections. He was an organizer and the Chairman of the Presidium of the Arboviruses, Viral Hepatitis, and 100th Anniversary of Virology international academic conferences.

The multifarious scientific activities of Dmitry Konstantinovich gained national and world-wide recognition. D.K. Lvov has a high reputation in the global scientific community. This is proved by the fact that he was elected an International Adviser to the American National Committee for Arboviruses (1976), a member of the International Committee for Study of Viruses in High Latitudes and participated in the work of taxonomy groups specializing in bunyaviruses and togaviruses. He is a member of the International Committee for Virus Taxonomy, the supervisor (representing Russia) of research on influenza, which is conducted as part of the Russian-American cooperation program on the influenza problem; he is an expert of WHO for influenza (since 1989), Chairman of the Committee for Medical Sciences and Public Health of the Pacific Science Association (1974–1982), and a member of the editorial board of two international journals. Since 1996, academician Lvov has been the editor-in-chief of Virology Issues Journal ranked in Q4 Journal Citation Reports, JCR (impact factor RSCI 0.646).

The years-long scientific and organizational work of Dmitry Konstantinovich Lvov, his contribution to the foundation and development of virological science in our country were highly appreciated by the RAMS Presidium, the Government, and the President of the Russian Federation. D.K. Lvov has been awarded the Ivanovsky Prize three times; he is a winner of the Academician Gamaleya Prize. In 1976, he was awarded the Order of the Badge of Honor; in 1991, he was awarded the Order of Lenin (for the foundation of a new scientific school – virus ecology – and for the development of theoretical prospects in this field); in 2012, he was awarded the Order of Honor. In 1999, Dmitry Konstantinovich became the laureate of the State Prize of the Russian Federation in Science (for the countrywide research in emerging and reemerging infections and for the Atlas of Spread of Pathogens Causing Zoonotic Viral Infections in Russia).

Over the years the scientific, theoretical and practical, administrative, organizational and social activity of Dmitry Konstantinovich is having been as an example of honest and selfless service to the country. His warm heartedness and spiritual generosity earned him respect and deep appreciation of all those who have worked with him.

We wholeheartedly congratulate Academician Dmitry Konstantinovich Lvov on his memorable jubilee and sincerely wish him optimism, health, fulfillment of all his plans and initiatives for the benefit of national and global science.

It seems appropriate to introduce the main stages in D.K. Lvov's research (**Table**).

D.K. Lvov's main research blocks

№	Research direction	Where and when	Main results	Main publications
1.	Taxonomy of transmitters of arboviral infections, finding the main patterns of their relationships with viruses	Military Medical Academy named after S.M. Kirov (Leningrad – St. Petersburg), FSBI «48 Central Research Institute» of the Ministry of Defense of the Russian Federation (formerly the Institute of Sanitation of the USSR Ministry of Defense) (Moscow region, Sergiev Posad) 1952–1956	The taxonomy of the mosquito *Aedes esoensis* Jam., the transmitter of Japanese encephalitis, was specified. Virological research. 2 articles	1. L'vov D.K. On the species independence of the Japanese encephalitis vector *Aedes esoensis* Jam. (*Diptera*, *Culicidae*). *Entomologicheskoe obozrenie AN SSSR.* 1956; 35(4): 929–34. (in Russian) 2. L'vov D.K. Reference No. 2334 of December 8, 1956, Moscow: Institute of Sanitation of the USSR Ministry of Defense; 1956. (in Russian)
2.	Assessment of herd immunity to the virus of tick-borne encephalitis (TBE) in various landscape belts, among different age groups of Western Siberia	E.I. Martsinovsky Institute of Medical Parasitology and Tropical Medicine (Ministry of Health of the Russian Federation), D.I. Ivanovsky Institute of Virology, RAMS (Moscow), N.F. Gamaleya Research Institute of Epidemiology and Microbiology, RAMS (Moscow) Western Siberia 1957–1960	The risk of TBE infection among the population of various landscape belts in Western Siberia was identified. The highest risk area was the south taiga region (the sum of effective temperatures 1200–1600 °C). 9 articles Ph.D. (Medicine) thesis (epidemiology, virology)	3. L'vov D.K. Immunological structure of the population of two types of Southern taiga foci of tick-borne encephalitis. *Meditsinskaya parazitologiya i parazitarnye bolezni.* 1962; (4): 387–92. (in Russian) 4. L'vov D.K., Nikiforov L.P., Beklemishev V.V., Fastovskaya E.I. Quantitative indicators in epizootology and epidemiology of tick-borne encephalitis. *Zhurnal gigieny, epidemiologii, mikrobiologii i immunologii (Praga).* 1963; 7(3): 267–72. (in Russian) 5. L'vov D.K., Chumakov M.P., Gol'dfarb L.G. The nature of the immunological structure of the population in relation to tick-borne encephalitis in various landscape zones of Western Siberia. In: *Endemic Virus Infections [Endemicheskie virusnye infektsii]*. Moscow; 1968: 195–201. (in Russian)
3.	The study of the new (cell-culture) vaccine against tick-borne encephalitis during the controlled trial (~2 mln. people) in the hyperendemic region of Western Siberia (Kemerovo Region)	Institute of Poliomyelitis and Viral Encephalitides, RAMS (Moscow Region), Western Siberia, D.I. Ivanovsky Institute of Virology, RAMS, (Moscow), Steklov Mathematical Institute, RAS (Moscow) 1961–1967	The safe and highly effective vaccine was manufactured for broad use; the strategy for TBE immunoprevention was developed in the USSR. 14 articles D.Sci. (Medicine) thesis (epidemiology, virology)	6. L'vov D.K., Chumakov M.P., Zaklinskaya V.A. The rate of accumulation of antibodies in humans in the early stages after vaccination and revaccination against tick-borne encephalitis. *Voprosy virusologii.* 1964; 9(5): 601–4. (in Russian) 7. Chumakov M.P., L'vov D.K., Gagarina A.V., Vil'ner L.M., Rodin I.M., Zaklinskaya V.A. Conditions influencing the effectiveness of tick-borne encephalitis vaccination. *Voprosy virusologii.* 1965; 10(2): 168–72. (in Russian) 8. L'vov D.K., Chumakov M.P., Gol'dfarb L.G. Epidemiological effectiveness of inactivated culture vaccine against tick-borne encephalitis according to the controlled epidemiological experience of 1961–1964. In: *Endemic Virus Infections [Endemicheskie virusnye infektsii]*. Moscow; 1968: 207–13. (in Russian)
4.	Studies in the clusters of yellow fever and other 60 tropical viral infections in the equatorial Amazon River basin	Institute of Poliomyelitis and Viral Encephalitides, RAMS (Moscow Region), Laboratory of the Rockefeller Foundation (Belem, Brazil) 1967	The high correlation was found between the level of circulation of some arboviruses and the abiotic factors of the habitat (temperature, precipitation). 3 articles	9. L'vov D.K., Moshkin A.V., Puzachenko Yu.G. Information analysis of arbovirus areas. *Vestnik MGU. Geograficheskaya sektsiya.* 1967; (3): 78–86. (in Russian) 10. L'vov D.K. Features of the distribution of some arboviruses in the Brazilian Amazon. *Voprosy virusologii.* 1968; 13(2): 187–92. (in Russian) 11. L'vov D.K., Ottis R., Kozi K. Features of the distribution of arboviruses in the equatorial climate (on the model of arboviruses of the Amazon basin). In: *Proceedings of the XIII Session of the Institute of Poliomyelitis and Viral Encephalitis of the USSR Academy of Medical Sciences [Materialy XIII sessii Instituta poliomielita i virusnykh entsefalitov AMN SSSR].* Moscow; 1967: 228–30. (in Russian)

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№	Research direction	Where and when	Main results	Main publications
5.	The problem of viral hepatitis Monitoring the distribution of hepatitis C virus genotypes in the Russian Federation («affectionate killer»)	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), Uzbekistan, the territory of the Russian Federation and adjacent territories 1979–1997	The causes of high incidence of hepatitis C virus infection in Central Asian republics were analyzed and the program aimed at its reduction was prepared. The division of the D.I. Ivanovsky Institute of Virology was opened in Tashkent; it was further transformed into an independent institute studying viral hepatitis in Uzbekistan. The monitoring of the circulation of different genotypes of hepatitis C virus started in Russia. The widespread dominance of the most pathogenic genotype 1b was found. Recommendations were given for examination and treatment of patients. 17 articles	12. L'vov D.K. Viral Hepatitis. In: *Man against Viruses*. Venice: UNESCO; 1994: 159–205. (in Russian) 13. L'vov D.K., Mishiro S., Selivanov N.A. Distribution of genotypes of the hepatitis C virus circulating in the territory of the North-Western and Central parts of Russia. *Voprosy virusologii.* 1995; 40(6): 251–3. (in Russian) 14. L'vov D.K. Viral hepatitis C – «affectionate killer». *Rossiyskiy gastroenterologicheskiy zhurnal.* 1995; (1): 4–6. (in Russian) 15. L'vov D.K., Samokhvalov E.I., Tsuda F., Selivanov N.A., Okamoto H., Stakhanova V.M., et al. Prevalence of hepatitis C virus and distribution of its genotypes in Northern Eurasia. *Arch Virol.* 1996; 141(9): 1613–22. 16. L'vov D.K. Viral hepatitis. *Vestnik Akademii meditsinskikh nauk.* 1996; (6): 25–31. (in Russian) 17. L'vov D.K., Samokhvalov E.I., Mishiro S., Tsuda F., Selivanov N.A., Okamoto Kh. Patterns of the spread of the hepatitis C virus and its genotypes in Russia and the CIS countries. *Voprosy virusologii.* 1997; 42(4): 157–62. (in Russian)
6.	Development of a theoretical framework for monitoring of viruses posing a threat to the national biological safety in various geographic and climatic belts; Implementation of the program in the Soviet Union and in a number of bordering countries.	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), 20 support bases in the key locations of the USSR Within the USSR and in bordering countries All-USSR Center for the Ecology of Viruses (based on D.I. Ivanovsky Institute of Virology) 1970–1990	A new scientific field had formed – ecology (molecular) of viruses. The research base was prepared. The ecological-virological school was created. The ecological approach served as foundation for development of the system of circulation of arboviruses in different geographic and climatic regions; the territories from the Arctic Region to the subtropical zone of North Eurasia were examined. More than 60 viruses were isolated; out of them 27 were entered into the International Catalog of Arboviruses as new, previously unknown to science. Their role in pathology was studied, diagnostic methods and techniques were developed; the previously unknown infections were described: Karelian fever, Issyk-Kul fever, Tamdy fever, Syr-Darya Valley fever, etc. The widespread prevalence of California encephalitis viruses was found. The forecast for epidemic outbreaks was developed for different geographic and climatic zones; the Atlas of virus spread in North Eurasia was prepared. ≥ 120 articles Order of Lenin (1990) RF State Prize (2000) 6 monographs	18. L'vov D.K., Lebedev A.D. *Ecology of Arboviruses [Ekologiya arbovirusov]*. Moscow: Meditsina; 1974. (in Russian) 19. Tsilinskiy Ya.Ya., L'vov D.K. *Population Genetics of Viruses of Vertebrates [Populyatsionnaya genetika virusov pozvonochnykh]*. Moscow: Meditsina; 1977. (in Russian) 20. Zhdanov V.M., L'vov D.K. *Ecology of Pathogens [Ekologiya vozbuditeley infektsiy]*. Moscow: Meditsina; 1984. (in Russian) 21. L'vov D.K., Klimenko S.M., Gaydamovich S.Ya. *Arboviruses and Arbovirus Infections [Arbovirusy i arbovirusnye infektsii]*. Moscow: Meditsina; 1989. (in Russian) 22. Mahy B.W., L'vov D.K. *Concepts in Virology: From Ivanovsky to the Present.* Victoria–Paris–Berlin–Berkshire: Harwood Academic Publishers; 1993. 23. L'vov D.K., ed. Organization of ecological and epidemiological monitoring of the territories of the Russian Federation for the purpose of anti-epidemic protection of the population and troops (Methodological recommendations). Moscow: MZ RF; 1993. (in Russian) 24. L'vov D.K. Ecological sounding of the USSR territory for natural foci of arboviruses. *Sov. Med. Rev. Ser. E: Virology Reviews.* 1993; (5): 1–47. 25. L'vov D.K. Arboviral zoonoses of Northern Eurasia (Eastern Europe and the commonwealth of independent states). In: Beran G.W., ed. *Handbook of Zoonoses*. *Section B: Viral.* London–Tokyo: CRC Press; Boca Raton: AMArbar; 1994: 237–60. 26. L'vov D.K., Deryabin P.G., Aristova V.A., Butenko A.M., Galkina I.V., Gromashevskiy V.L., et al. *Atlas of the Spread of Pathogens of Natural-Focal Viral Infections in the Territory of the Russian Federation [Atlas rasprostraneniya vozbuditeley prirodno-ochagovykh virusnykh infektsiy na territorii Rossiyskoy Federatsii]*. Moscow; 2001. (in Russian)

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№	Research direction	Where and when	Main results	Main publications
7.	Assessment of significance of birds in virus circulation and their role in transcontinental transmission of viruses and critical epidemic situations.	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), A.N. Severtsov Institute of Ecology and Evolution Academy of Sciences of the USSR, everywhere in North Eurasia 1970–1990	Opening of the All-Union Ornithological Committee at the D.I. Ivanovsky Institute of Virology. The active role of birds was proved regarding the circulation of viruses belonging to families *Togaviridae* (Sindbis, Karelian fever viruses), *Flaviviridae* (tick-borne encephalitis viruses, West Nile viruses, Omsk hemorrhagic fever viruses, Sokuluk viruses, Tyuleni viruses, Japanese encephalitis viruses), *Reoviridae* (Kemerovo, Baku, Okhotsk viruses), *Bunyaviridae* (Crimean-Congo hemorrhagic fever viruses, Sakhalin, Paramushir, Zaliv Terpeniya, Ukuniemi viruses), *Orthomyxoviridae* (influenza H1N1 viruses and other viruses of the genus *Alphainfluenzavirus*, Tyulek (genus *Qaranjavirus*), Batken, Dhori viruses (genus *Thogotovirus*) in natural biomes of North Eurasia. The participation of birds in transcontinental transmission of viruses was found. 18 articles, monograph	27. L'vov D.K. Il'ichev V.D. *Migration of Birds and Transfer of Infectious Agents [Migratsiya ptits i perenos vozbuditeley infektsii]*. Moscow: Nauka; 1979. (in Russian) 28. L'vov D.K. Ecology of viruses. *Vestnik Akademii meditsinskikh nauk SSSR.* 1983; (12): 71–82. (in Russian) 29. L'vov D.K. The importance of new and returning infections for biosafety. *Voprosy virusologii.* 2002; 47(5): 4–7. (in Russian) 30. L'vov D.K., Timopheeva A.A., Chervonski V.I. New types of arbovirus foci in the northern part of the Soviet Far East and their relationships with other regions of the pacific. In: *12th Pacific Science Congress.* Australia, Canberra; 1971. 31. L'vov D.K. *The State and Prospects of the Work of the National Committee for the Study of Viruses that are Environmentally Related to Birds. Results of the 6th Symposium on the Study of Viruses, Ecologically Related to Birds [Sostoyanie i perspektivy raboty Natsional'nogo Komiteta po izucheniyu virusov, ekologicheski svyazannykh s ptitsami. Itogi 6-go simpoziuma po izucheniyu virusov, ekologicheski svyazannykh s ptitsami]*. Moscow; 1972: 3–11. (in Russian) 32. L'vov D.K., Gromashevskiy V.L., Sidorova G.A. Complex natural focus of arboviruses on Glinjanji Island, Baku archipelago, Azerbaidzhan S.S.R. *Acta Virologica.* 1973; (17): 155–8.
8.	Study of the virus circulation in high latitudes (the Arctic and Subarctic Regions)	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), with broad international collaboration with researchers from the USA, Canada, Norway, Australia, New Zealand 1970–1990	The natural clusters, unique by intensity, were found for 20 viruses from families *Flaviviridae*, *Bunyaviridae*, *Reoviridae*, ecologically connected with the *Ixodes uriae* tick and nesting sites of colonial seabirds. Viruses are characterized by circumpolar spread both in the Northern and Southern Hemispheres. 22 articles	33. L'vov D.K., Timofeeva A.A., Lebedev A.D. Foci of arboviruses in the north of the Far East. From hypothesis to experimental verification. *Vestnik Akademii meditsinskikh nauk SSSR.* 1971; (2): 52–64. (in Russian) 34. L'vov D.K., Gromashevski V.L., Skvortsova T.M., Berezina L.K., Gofman Y.P., Zhdanov V.M. Arboviruses of high latitudes in the USSR. In: Kurstak E., ed. *Arctic and Tropical Arboviruses.* New York–San Francisco–London: Harcourt Brace Jovanovich Publ. Academic Press; 1979: 21–38. 35. L'vov D.K., Timopheeva A.A., Chervonsky V.I., Tsyrkin Yu.M., Sazonov A.A., Pogrebenko A.G., et al. The ecology of Sakhalin virus in north of Far East of the USSR. *J. Hyg. Epidem. Microbiol. Immunol.* 1974; 18(1): 87–95. (in Russian)
9.	Ecology of influenza viruses. Analysis of the circulation of influenza A viruses in natural biomes and their role in emergence of endemic (pandemic) strains	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), territory of Northern Eurasia Engelhardt Institute of Molecular Biology, RAS (Moscow) 1976–2003	In North Eurasia, there were natural clusters identified; they were clusters of 15 out of 17 known viruses (*Orthomyxoviridae*, *Alphainfluenzavirus*) ecologically connected with semiaquatic birds as well as viruses of *Thogotovirus* and *Quaranjavirus* genera, which are transmitted by ixodid and argasid ticks. 56 articles	36. L'vov D.K. Circulation of influenza virus in natural biocenosis. In: Kurstak E., Maramorosh K., eds. *Viruses and Environment.* New York–San Francisco–London: Academic Press; 1978: 351–80. (in Russian) 37. L'vov D.K. Evolution of pathogens of new and returning infections in Northern Eurasia-global consequences. In: L'vov D.K., Uryvaev L.V., eds. *Studying the Evolution of Viruses within the Framework of the Problem of Biosafety and Socially significant infections [Izuchenie evolyutsii virusov v ramkakh problemy biobezopasnosti i sotsial'no-znachimykh infektsiy]*. Moscow; 2001: 5–16. (in Russian) 38. L'vov D.K., Yamnikova S.S., Fedyakina I.T. Ecology and evolution of influenza viruses in Russia (1979–2002). *Voprosy virusologii.* 2004; 49(3): 17–24. (in Russian) 39. L'vov D.K. Influenza A virus – a sum of populations with a common protected gene pool. *Sov. Med. Rev. Ser. E: Virology Reviews.* 1987; (2): 15–37.
10.	Panzootic highly virulent influenza A/H5N1 virus (mortality in poultry >90%, in humans >50%)	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), territory of Northern Eurasia, Research and Production Association «NARVAK» (Moscow) Veterinary institutions in the European part of Russia, the Urals, Siberia and the Far East 2003–2014	The routes of importation of different genetic clades of viruses were identified regarding the country and the further virus spread to Moscow. The molecular and genetic profile was prepared for the isolated strains; recommendations for protection were prepared; the vaccine was developed for immunization of agricultural birds. 19 articles	40. L'vov D.K. Population interactions in the biological system: influenza A virus-domestic animals-humans; causes and consequences of the penetration of the highly virulent influenza A/H5N1 virus into the territory of Russia. *Zhurnal mikrobiologii, epidemiologii i immunobiologii.* 2006; 83(3): 96–100. (in Russian) 41. L'vov D.K., Kaverin N.V. Avian influenza in Northern Eurasia. In: Klenk H.-D., Matrosovich M.N., eds. *Avian Influenza.* Basel: Karger; 2008: 41–58. 42. L'vov D.K., Aliper T.I., Deryabin P.G., Zaberezhnyy A.D., Grebennikova T.V., Sergeev V.A. Avian influenza vaccine inactivated emulsified FLU PROTECT H5 and a method for preventing avian influenza. Patent RF № 23503350; 2009. (in Russian)

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№	Research direction	Where and when	Main results	Main publications
11.	Comprehensive study of the epidemic outbreak of West Nile fever in the south of Russia; the study was performed with participation of clinicians, entomologists, zoologists, virologists, medical workers, sanitary and epidemiological workers, veterinary workers and game husbandry workers	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), Astrakhan region, Volgograd region, Republic of Kalmykia, Central Research Institute of Epidemiology, Rospotrebnadzor, Moscow; State Research Center of Virology and Biotechnology «VECTOR», Novosibirsk 2000–2006	The routes of virus circulation in different ecosystems were identified; the risk factors were identified regarding infection among the population in the upper, middle and lower belts of the Volga Delta. The role of different species of mosquitoes-transmitters and species of birds – reservoirs of infection was identified for different biomes. The role of *Hyalomma marginatum* ticks in preservation of the virus during winter was identified, including their role in mechanisms of existence of stable natural clusters. Genotypes of circulating viruses were identified. Recommendations were prepared for protection of the population, tourists, and border patrol staff. 21 articles	43. L'vov D.K., Butenko A.M., Gromashevsky V.L., Kovtunov A.I., Prilipov A.G., Kinney R., et al. West Nile virus and other zoonotic viruses in Russia: examples of emerging-reemerging situations. *Arch. Virol. Suppl.* 2004; (18): 85–96. 44. L'vov D.K. West Nile fever. *Voprosy virusologii.* 2000; 47(2): 4–9. (in Russian) 45. L'vov D.K., Kovtunov A.I., Yashkulov K.B., Gromashevskiy V.L., Dzharkenov, A.F., Shchelkanov M.Yu., et al. Features of the circulation of the West Nile virus (*Flaviviridae*, *Flavivirus*) and some other arboviruses in the ecosystems of the Volga Delta, the Volga-Akhtuba floodplain and adjacent arid landscapes (2000–2002). *Voprosy virusologii.* 2004; 49(3): 45–51. (in Russian) 46. L'vov D.K., Pisarev V.B., Petrov V.A., Grigor'eva N.V. *West Nile Fever Based on the Materials of Outbreaks in the Volgograd Region in 1999–2002 [Likhoradka Zapadnogo Nila po materialam vspyshek v Volgogradskoy oblasti v 1999–2002 gg]*. Volgograd; 2004. (in Russian)
12.	Study of the new pandemic influenza A H1N1/pdm 09 virus (clinical presentation, molecular and genetic characteristics, epidemiology, receptor characteristics)	D.I. Ivanovsky Institute of Virology, RAMS (Moscow), 10 support bases in the European part of Russia, in the Urals, Siberia and the Far East Shemyakin–Ovchinnikov Institute of Bioorganic Chemistry, RAS (Moscow) 2009 – present	Identification of the routes, through which the virus is imported to the country; patterns of spread, the mechanism of development of primary viral infection through mutations at the receptor-binding site 222 of HA1 hemagglutinin with replacement of aspartic acid (D) for glycine (G) or asparagine (N), thus inducing the replacement of receptor specificity of epithelial cells of the respiratory tract from α2-6 linked to α2-3 linked acids and causing penetration of the virus into alveoli and bronchioles. 22 articles	47. L'vov D.K. Influenza and other new and returning infections of Northern Eurasia: global consequences. In: *Federal reference book «Healthcare of Russia». Volume 11 [Federal'nyy spravochnik «Zdravookhranenie Rossii». Tom 11]*. Moscow; 2010: 209–19. (in Russian) 48. L'vov D.K., Shchelkanov M.Yu., Bovin N.V., Malyshev N.A., Chuchalin A.G., Kolobukhina L.V. Correlation between the receptor specificity of pandemic influenza A(H1N1)pdm09 virus strains isolated in 2009–2011, the structure of the receptor-binding site, and the probability of developing lethal primary viral pneumonia. *Voprosy virusologii.* 2012; 57(1): 14–20. (in Russian) 49. L'vov D.K., Burtseva E.I., Kolobukhina L.V., Fedyakina I.T., Bovin N.V., Ignat'eva A.V., et al. Peculiarities of the influenza and ARVI viruses circulation during epidemic season 2019–2020 in some regions of Russia. *Voprosy virusologii.* 2020; 65(6): 335–49. (in Russian)
13.	Using the metagenomics next generation sequencing to study molecular and genetic characteristics of viruses isolated in North Eurasia; identification of their taxonomic status	D.I. Ivanovsky Institute of Virology, RAMS (Moscow) «48 Central Research Institute» of the Ministry of Defense of the Russian Federation, Sergiev Posad, Moscow region North Eurasia 2012–2020	The performed studies included genetic characteristics, molecular evolution and taxonomy of more than 80 zoonotic viruses isolated during the years-long monitoring in different ecosystems of North Eurasia. The circulation of viruses from minimum 17 genera, 8 families was studied. The data were entered into the last international issue on virus taxonomy. 18 articles	50. L'vov D.K., Borisevich S.V., Al'khovskiy S.V., Burtseva E.I. Actual approaches to the analysis of viral genomes in the interests of biosafety. *Infektsionnye bolezni: novosti, mneniya, obuchenie.* 2019; 8(2): 96–101. https://doi.org/10.24411/2305-3496-2019-12012 (in Russian) 51. L'vov D.K., Shchelkanov M.Y., Alkhovsky S.V., Deryabin P.G. *Zoonotic Viruses of Northern Eurasia: Taxonomy and Ecology.* London: Academic Press, Elsevier; 2015. 1–440. 52. L'vov D.K., Al'khovskiy S.V. *Bunyavirales* order. *Problemy osobo opasnykh infektsiy.* 2018; (4): 15–9. https://doi.org/10.21055/0370-1069-2018-4-15-19 (in Russian)
14.	Compilation and analysis of present-day data on virology and viral infections of humans and animals in Russia and worldwide in the virology manuals	D.I. Ivanovsky Institute of Virology, MoH RF (Moscow) 2007–2013	The books are the most complete present-day manual of general and specific virology. The analysis includes the place of viruses in the biosphere, ecology of viruses, their structural components, genome strategies, interaction with cells. The description is given to families of viruses, which are pathogenic to humans and animals. Antiviral immunity, chemotherapy of viral infections, laboratory diagnostics and immunoprevention, virological methods. The information is given about viral infections of humans (over 150) and animals (more than 150)	Publishing of two guidelines to virology: 53. L'vov D.K., ed. *Medical Virology [Meditsinskaya virusologiya]*. Moscow: MIA; 2008. (in Russian) 54. L'vov D.K., ed. *Guide to Virology. Viruses and Viral Infections of Humans and Animals [Rukovodstvo po virusologii. Virusy i virusnye infektsii cheloveka i zhivotnykh]*. Moscow: MIA; 2013. (in Russian)

See p. 179 for a continuation of the table.

№	Research direction	Where and when	Main results	Main publications
15.	The problem of emerging and reemerging infections in the context of national and global biosafety. Theoretical analysis of formation of the population gene pool of viruses transmitted through respiratory transmission and being a potential threat to biosafety	D.I. Ivanovsky Institute of Virology, RAMS, National Center for Epidemiology and Microbiology named after Honorary Academician N.F. Gamaley, Ministry of Health of the Russian Federation 1951 – present (Military Medical Academy named after S.M. Kirov, Institute of Sanitation of the USSR Ministry of Defense, Institute of Medical Parasitology and Tropical Medicine, Institute of Poliomyelitis and Viral Encephalitides, RAMS, D.I. Ivanovsky Institute of Virology, RAMS, etc.)	Emerging and reemerging infections have always posed and will pose a continuous threat to safety. All human viral infections were zoonotic in the past. The population virus genepool formation was analyzed, focusing on viruses transmitted through the respiratory route and capable of starting pandemics; the gene pool was analyzed at different stages of the evolution of the biosphere. The formation of the gene pool of viruses *Poxviridae* is closely connected with the evolution of rodents living during the Paleocene (75–70 million years ago). Smallpox can reemerge. Viruses *Orthomyxoviridae* are ecologically connected with birds from the Chalk Period (135–110 million years ago). There is likelihood of catastrophic pandemics caused by influenza A viruses. Coronaviruses (*Coronaviridae*) interacted mainly with chiropterans from the Tertiary Subperiod (110–85 million years ago). COVID-19 may become a seasonal infection. Apparently, critical epidemic (and epizootic) situations, which can be much more serious than COVID-19, can take place in the foreseeable future. This calls for consolidation of efforts, preferably at the international level, to minimize consequences of emerging catastrophes. This requires continuous monitoring of population gene pools of potentially dangerous viruses capable of being transmitted through the respiratory route. 60 articles.	55. L'vov D.K. Ecology of viruses. *Vestnik Akademii meditsinskikh nauk SSSR.* 1983; (12): 71–82. (in Russian) 56. L'vov D.K., Zverev V.V., Gintsburg A.L., Pal'tsev A.M. Natural smallpox – a dormant volcano. *Voprosy virusologii.* 2008; 53(4): 4–8. (in Russian) 57. L'vov D.K. Birth and development of virology – the history of emerging-reemerging viral infection investigation. *Voprosy virusologii.* 2012; (S1): 5–20. (in Russian) 58. L'vov D.K. Century of virology. In: Mahy B.W., L'vov D.K., eds. *Concepts in Virology: From Ivanovsky to the Present.* Victoria–Paris–Berlin–Berkshire: Harwood Academic Publishers; 1993. 59. L'vov D.K. New and recurring viral infections. *Voprosy virusologii.* 2000; 45(1): 4–7. (in Russian) 60. L'vov D.K., Shchelkanov M.Y., Prilipov A.G., et al. Evolution of highly pathogenic avian influenza H5N1 virus in natural ecosystems of northern Eurasia (2005–08). *Avian Dis.* 2010; 54(1 Suppl.): 483–95. https://doi.org/10.1637/8893-042509-review.1 61. L'vov D.K., Al'khovskiy S.V., Kolobukhina L.V., Burtseva E.I. Etiology of the COVID-19 epidemic outbreak in Wuhan (Hubei Province, People's Republic of China) associated with the 2019-nCoV virus (*Nidovirales, Coronaviridae, Coronavirinae, Betacoronavirus,* subgenus *Sarbecovirus*): lessons from the SARS-CoV epidemic. *Voprosy virusologii.* 2020; 65(1): 6–16. https://doi.org/10.36233/0507-4088-2020-65-1-6-15 (in Russian) 62. L'vov D.K., Al'khovskiy S.V. The origins of the COVID-19 pandemic: ecology and genetics of coronaviruses (*Betacoronavirus: Coronaviridae*) SARS-CoV, SARS-CoV-2 (subgenus *Sarbecovirus*), MERS-CoV (subgenus *Merbecovirus*). *Voprosy virusologii.* 2020; 65(2): 62–70. https://doi.org/10.36233/0507-4088-2020-65-2-62-70 (in Russian) 63. L'vov D.K., Gulyukin M.I., Zaberezhnyy A.D., Gulyukin A.M. Formation of population gene pools of zoonotic viruses, potentially threatening biosafety. *Voprosy virusologii.* 2020; 65(5): 243–58. https://doi.org/10.36233/0507-4088-2020-65-5-1 (in Russian)

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From the Jubilee Celebrant

I would like to express my sincere gratitude to all those who undersigned the jubilee presentation material. This support will help me move further along the thorny path from the bright past to, as I hope, even brighter future. I want to add the following.

I am grateful to my parents and my elder brother who was killed in the Rzhev battle; I appreciate that they taught me to be proud of my country, to respect the traditions of people living in it, to be committed to made decisions.

I am deeply thankful to my scientific advisers, academicians Ye.N. Pavlovsky, Sh.D. Moshkovsky, and M.P. Chumakov who provided fundamental training in biology, quantitative epidemiology, virology and taught how to make the impossible possible.

I express my gratitude to the unique teachers of the Kirov Military Medical Academy that gave me a start in life.

I am grateful to hundreds of my associates around the Soviet Union; shoulder to shoulder in expeditions and laboratories, sometimes at the risk of our life and health, we «hunted» new pathogens to place them for further study.

I am grateful to the government authorities that provided the possibility of conducting extensive studies in biological safety and minimization of the consequences of catastrophes resulting from emerging and reemerging infections.

It should be kept in mind that the birth of virology as a science is inextricably connected with our fellow countryman, Dmitry Iosifovich Ivanovsky. 130 years ago, he demonstrated the ability of the tobacco mosaic virus penetrate through bacterial filters, while producing infection. The symposium that we organized in St. Petersburg (1992) was dedicated to the 100th anniversary of this event, during which the commemorative medals that were punched out at the State Mint were presented to more than 60 leading virologists representing world virology. The Institute of Virology, which was founded in 1944, was named after D.I. Ivanovsky in 1950. This institute was a talent-factory for virologists from Russia and other countries. It hosted studies which made a fundamental contribution to the development of world virology. Its director, academician Viktor Mikhailovich Zhdanov spearheaded the Global Smallpox Eradication Program, which was adopted at the 11th World Health Assembly in 1958. He pioneered the foundation of the International Union of Microbiologists (bacteriologists, virologists, mycologists) and was rightfully elected its first chairperson.

The fledging period of virology comes to an end in the late 19th – early 20th century with German researcher F.A. Loeffler*'* description of the first filter-passing infectious agent causing foot-and-mouth disease in animals and with the discovery that yellow fever had viral etiology, as it was found by W. Reed and his team of American military medical workers. Further on and to date, the development of virology has been connected with emerging and reemerging infections.

The evolution of viruses has been inextricably entwined with the evolution of the biosphere for 3.5 billion years on our planet and, possibly, in the Universe. All human viral infections have the zoonotic origin. The population gene pools of viruses capable of causing epidemics and pandemics through the respiratory route of infection have been formed for hundreds of millions of years during the interaction with population gene pools of their main hosts – birds, rodents, bats. It was only during the last 2–5 (hominids) – 5 (hominins) million years when the population gene pools of these (and other) viruses had first possibilities of interaction with the population gene pool of human ancestors. The range of these possibilities was dramatically expanded 300–40 thousand years ago due to the first civilizations and active domestication of animals, which opened the way for trans-taxonomic transmission of pathogens of zoonotic diseases as well as for zooanthroponoses and anthroponoses. Since that period, there existed conditions for development of epidemics (epizootics) and pandemics (panzootics). This process continues, and we became witnesses of these transformations: the human immunodeficiency virus, influenza A/H1N1/pdm2009 virus, SARS-CoV-2 (COVID-19) virus. The population genepool of the SARS-CoV-2 virus is still being formed. Most likely that in a few years, the virus will increase its contagiousness and decrease its virulence. The description of the virus diversity in natural biomes and study of the evolutionary processes leading to trans-taxonomic transmission of viruses and emergence of new viral infections are significant and fundamental tasks that should employ modern molecular and genetic methods. These studies have great applied significance for the monitoring of emerging and reemerging infections as well as for minimization of their consequences. Apparently, critical epidemic (and epizootic) situations, which can be much more serious than COVID-19, can take place in the foreseeable future.

Today it is important, preferably at an international to start, start preparation (scientific, organizational, social) for such catastrophes, taking in account tremendous positive and negative experience of different countries in their combat against COVID-19 and other pandemics. I would like to hope that in future the efforts in this area will not lose their strength because of another «optimization».

Respectfully yours,
ДК.