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ANNIVERSARIES AND DATES

N. D. ZELINSKY INSTITUTE OF ORGANIC CHEMISTRY, RUSSIAN ACADEMY OF SCIENCES: 70 YEARS

The N. D. Zelinsky Institute of Organic Chemistry (Russian Academy of Sciences), or IOC as it is of course called for short by the hundreds of people who are working or have worked at the Institute and their thousands of colleagues, was 70 years old on February 23, 2004. Far beyond Russia's borders, the IOC is known as the N. D. Zelinsky Institute (where the field of science it covers is obvious to all). The very widespread fame of the IOC is quite understandable: it is one of the largest scientific centers in the world in the field of organic chemistry, organic catalysis, and the chemistry of natural and biologically active compounds.

When and how the Institute was organized decided its destiny. The IOC was created during the period when the Academy of Sciences was moving from Leningrad to Moscow, by bringing together representatives of the leading scientific schools active in those cities: the cream of Russian organic chemistry. The framework of the Institute included laboratories directed by A. E. Favorsky, N. D. Zelinsky and his students: A. A. Balandin, B. A. Kazanskii, and A. N. Nesmeyanov, and also representatives of the V. N. Ipatiev and A. E. Chichibabin schools. In addition to these groups, back at its very beginning the Institute combined the laboratories of N. Ya. Demjanov and M. A. Ilinsky, N. M. Kishner's group, and a number of students of P. P. Schorigin. Outstanding chemists of the younger generation included Academicians I. N. Nazarov, I. L. Knunyants, A. E. Porai-Koshits, V. V. Korshak, L. F. Vereshchagin, M. M. Shemyakin, M. I. Kabachnik, and Kh. M. Minachev; Corresponding Members A. D. Petrov, N. I. Shuikin, S. S. Novikov, B. M. Mikhailov, V. A. Ponomarenko, A. M. Moiseenkov; Professors Ya. L. Gol'dfarb, A. M. Rubinshtein, and many others. The constellation of these names promised not only success for the "newborn" but also a special role for the Institute in training highly qualified chemists for all the republics of the USSR (now sovereign states) and other countries, and also in creating new scientific approaches and groups.

In 1954, several laboratories of the IOC became the basis for creation of the Institute of Organoelement Compounds and the Institute of High Pressure Physics; in 1959, likewise for the Institute of the Chemistry of Natural Compounds (now the Institute of Bioorganic Chemistry). A number of academic institutes were organized with direct participation of leading IOC scientists: the Irkutsk Institute of Organic Chemistry (now the A. E. Favorsky Irkutsk Institute of Chemistry, Siberian Branch, Russian Academy of Sciences), the Institute of Bioorganic Chemistry in Minsk, the Institutes of Organic Chemistry in Bishkek and Dushanbe, and the Institute of Chemistry in Ashkhabad.

The Institute has a concentration of highly qualified scientists on its staff, who in many cases shaped the countenance of domestic and international chemistry. Nearly 550 scientific staff actively work at the Institute, including 5 Academicians and 5 Corresponding Members of the Russian Academy of Sciences, 95 Doctors and 280 Candidates in the sciences; their productive activity has been celebrated by high-level awards and honorary titles. Among those now working at the IOC, there are about 30 laureates of the Lenin and State prize, named prizes of the Academy of Sciences, the Demidov prize and others; 8 individuals have been awarded the title of

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"Honored Scientist of the Russian Federation." Leading IOC scientists are members of a number of foreign academies, domestic and international scientific societies, science councils of the Russian Academy of Sciences, ministries, and departments, and actively work on editorial boards of domestic and international journals. From within the walls of the Institute have issued thousands of scientific papers and reports, about 200 monographs and collected works, and more than 10 textbooks and laboratory manuals, many of which have gone through several editions and have been translated into foreign languages. IOC staff members have been the inventors on hundreds of patents.

A huge contribution to the formation and development of the IOC has come from the remarkable scientists who have headed it over the course of 70 years: Academicians A. E. Favorsky, internationally known for his classic papers on molecular rearrangements and the chemistry of unsaturated compounds (1934-1939); A. N. Nesmeyanov, who initiated new directions in chemistry: heteroorganic chemistry and the chemistry of synthetic food products (1939-1959); B. A. Kazansky, the author of basic papers on various aspects of petrochemistry and heterogeneous catalysis (1954-1955); N. K. Kochetkov, founder and leader of the domestic scientific school of the chemistry and biochemistry of carbohydrates and nucleotides (1966-1988); V. A. Tartakovsky, an outstanding scientist conducting basic research on the chemistry of nitro and heterocyclic compounds and also in the area of industrial synthesis, which is of tremendous theoretical and practical importance (1988-2002). Since 2003, the Institute has been headed by M. P. Egorov (Corresponding Member, Russian Academy of Sciences), who is a well known scientist in the field of physical organic and heteroorganic chemistry.

Institute staff have achieved a number of major scientific results. P. P. Shorygin discovered a new physical phenomenon: resonance Raman light scattering, which is currently being used successfully in studying organic compounds. They have designed and successfully applied methods for studying the structure and reactivity of organic compounds under normal and extreme conditions, including reactions at ultrahigh pressures (M. G. Gonikberg, V. M. Zhulin, B. S. Él'yanov, A. A. Zharov), low-temperature stabilization and study of unstable particles (carbenes, free radicals) in inert matrices (O. M. Nefedov, A. K. Mal'tsev, M. P. Egorov), phase transfer catalysis (L. A. Yanovskaya, S. S. Yufit), electrochemical processes (S. G. Mairanovskii, V. A. Petrosyan, V. P. Gul'tyai, G. I. Nikishin).

The achievements of the Institute have been universally recognized in the field of the chemistry of unsaturated compounds (the A. E. Favorsky—I. N. Nazarov school), indeed demonstrating the unlimited possibilities for synthesis of diverse aliphatic, alicyclic, and heterocyclic systems, including natural compounds.

Research on the chemistry of carbenes and their analogs, the chemistry of small rings, and diazo compounds at the Institute is widely known. A significant contribution has been made to the study of problems of double bonds involving silicon and germanium (O. M. Nefedov and colleagues).

One of the most important directions taken in the activity of the IOC has been studies in heterocyclic chemistry. In the early years of the Institute, research in this area was mainly conducted by students of A. E. Chichibabin. We should mention the synthesis of pilocarpine (N. A. Preobrazhensky and colleagues), broad studies in the chemistry of amino-substituted pyridines, nicotine, anabasine (O. A. Zeide, Ya. L. Gol'dfarb, M. M. Katsnel'son), synthesis of acrichine (I. L. Kunyants and colleagues), synthesis of vitamin B1 (G. V. Chelintsev, Z. V. Benevolenskaya), hydrogenation/hydration of sylvan, leading to acetopropyl alcohol (K. S. Topchiev, L. N. Pavlov), cleavage of saturated oxygen-containing heterocycles (Ya. L. Gol'dfarb, L. M. Smorgonskii).

In the 1950s, Ya. L. Gol'dfarb and colleagues carried out internationally recognized research in the field of thiophene chemistry, including study of diverse reactions of both substitution and conversion of thiophenes to form compounds in other series. During the same years, heterocycles became the objects of study for many IOC laboratories that seemed at first glance to be working rather far away from this field. G. Ya. Kondrat'eva discovered conversion of oxazoles according to a diene type synthesis, which now is the basis for industrial methods for obtaining vitamin B6. Studies of homolytic reactions (G. I. Nikishin and colleagues) conducted at the Institute in recent decades have discovered new options for preparative synthesis of thiacrown ethers and

lactones, including macrocyclic lactones. Regioselective and stereoselective syntheses have been carried out for polyfunctional pyridines, their hydrogenated and condensed analogs, including those using the cascade heterocyclization method (V. P. Litvinov, A.M. Shestopalov). We also note catalytic syntheses of thiophenes on rhenium-containing catalysts (M. A. Ryashentseva, Kh. M. Minachev), and syntheses of pyrazines and imidazoles on oxide catalysts (K. M. Gitis, G. V. Isagulyants).

Excellent successes have been achieved in the chemistry of organoboranes; research in this area includes study of problems in both synthesis and properties of these compounds, and their diverse application in organic synthesis. In recent years, Yu. N. Bubnov and colleagues discovered very interesting reactions of reductive allylation of nitrogen-containing heterocycles (pyridine, quinoline, isoquinoline, pyrrole, indole) when treated with triallylboron and related reagents, opening up possibilities for further conversions to form compounds similar to alkaloids. V. A. Dorokhov developed efficient syntheses for nitrogen-containing heterocycles with participation of chelates of boron and transition metals.

Especially significant successes in heterocyclic synthesis and conversions have been achieved by the internationally very prominent school (founded by S. S. Novikov) of the chemistry of nitro compounds (including high-energy compounds), which has been active in the Institute for half a century. V. A. Tartakovsky and colleagues observed and made broad studies of the ability of nitrone esters to act as dipoles in reactions of 1,3-dipolar cycloaddition. L. I. Khmel'nitskii and colleagues conducted comprehensive studies in the chemistry of furoxan and furazan, and also bicyclic bisureas, one representative of which: 2,4,6,8-tetramethyl-2,4,6,8-tetraazabicyclo[3.3.0]octane-3,7-dione (mebicar), has been adopted in medical practice as an effective daytime tranquilizer. Broad studies have been conducted at the Institute on chemical conversion of explosives. In particular, a number of fundamental problems have been solved in the chemistry of the very high-tonnage explosive trinitrotoluene (TNT), which makes it possible to convert it to polyfunctional benzannelated O-, S-, and N-heterocycles, including such civilian products as polymer materials, new dyes, and biologically active compounds (S. A. Shevelev and colleagues). Multitargeted studies, discovering new ways to use aliphatic and aromatic nitro compounds in organic synthesis, in particular for obtaining heterocycles (V. A. Tartakovsky and colleagues), have been conducted at the Institute. New options have been discovered for synthesis of polysulfur/nitrogen-containing heterocycles based on the reaction of a complex of sulfur monochloride and a nitrogen-containing base (O. A. Rakitin and colleagues).

In the area of the chemistry of natural compounds, IOC scientists have made a substantial contribution to development of the chemistry, biochemistry, and immunochemistry of carbohydrates and carbohydrate-containing biopolymers, and also the chemistry of physiologically active steroids. Research on carbohydrate chemistry (N. K. Kochetkov and his school) has created a scientific basis for understanding the biological functions of carbohydrate-containing biopolymers, which has opened up routes to obtaining new diagnostic and medicinal drugs. Research on steroid synthesis (A. A. Akhrem, A. V. Kamernitskii) has led to the creation of previously unknown hormonal drugs with separate biological functions.

At the Institute, basic research has been conducted in the theory of organic catalysis (A. A. Balandin); the elementary events of a number of catalytic reactions have been studied (G. V. Isagulyants) as well as the structure and physics of the surface of a number of catalysts, including the use of quantum chemistry methods and a combination of modern instrumental methods (A. M. Rubinshtein, A. A. Slinkin, E. S. Shpiro, V. I. Yakerson, G. M. Zhidomirov, V. B. Kazansky, and N. D. Chuvylkin); priority studies have been conducted in the field of catalytic conversions of hydrocarbons (B. A. Kazansky, A. F. Platé, A. L. Liberman, O. V. Bragin), synthesis based on carbon monoxide and other monocarbon molecules (Ya. T. Éidus, A. L. Lapidus), asymmetric catalysis (E. I. Klabunovskii); the scientific principles have been developed for preparation of new catalysts based on domestic zeolites (Kh. M. Minachev); kinetic, physical, and mathematical models have been created for designing industrial processes and reactors (S. L. Kiperman).

Many developments by the Institute have been brought to realization in the basic organic synthesis industry and the petroleum refining industry. The Institute has developed new high-efficiency, environmentally friendly catalytic processes for obtaining isopentane, high-octane gasolines, alkylaromatic hydrocarbons;

designed catalysts for obtaining styrene, allylacetate, acetopropyl acetate, conversion of hydrocarbons to motor fuel components etc. Industry has successfully used catalysts developed at IOC together with industrial organizations for hydrogenation of fats, purification of syngas in ammonia production, purification of inert and waste gases, synthesis of liquid hydrocarbons and ceresine from carbon monoxide and hydrogen, obtaining acetic acid by carbonylation of methanol, etc.

Basic research at the Institute has been the foundation for designing many industrial processes for obtaining vitamins, medicinal drugs, and pesticides, in particular vitamins A, B1, B6, □-ionone (a key intermediate for synthesis of vitamins A and E), acrichine, Hemodez (a blood substitute with detoxifying action), Vinylin (Shostakovskii balsam), Octitsil, potassium orotate, promedol, tsigerol, metaprogerol, mebicar, tribenol, lysocym, and other medicinal drugs and intermediates for their manufacture. An efficient method for isolation and purification of the antibiotic streptomycin has also been developed and put into operation. Considerable attention has been focused on synthesis of plant protectants, including insect pheromones and juvenile hormone analogs. A novel technology has been developed for obtaining insecticides with a broad spectrum of action from a group of synthetic pyrethroids (permethrin and its analogs).

A major role in development of domestic scientific instrumentation has been played by joint work during 35 years of scientists at the Institute and IOC Special Design Bureau in design and industrial application of various instruments, especially chromatographs,In recent years, at the Institute mathematical chemistry and computer-assisted synthesis have been successfully developed and the use of modern information technology has expanded. The Russian international nodes of the FREEnet computer networks and the National Joint Network Coordination Center, the Moscow Information Center of the Russian Academy of Sciences/STN International, the NMR Research Center of the Russian Academy of Sciences all are successfully operating within IOC.

Considerable attention has been focused on the education of new scientists and students at all levels. Post-grad and doctoral programs have existed at the Institute since its inception. Many of those who completed their graduate work at the IOC (about 1000 individuals) became major scientists, have had and continue to have key positions in science, are heads of institutes and departments, and are members of the Russian Academy of Sciences and the national academies of other countries. Today, more than half of the laboratory heads at IOC are former Institute graduate students. Institute graduates also work at prestigious scientific centers in many countries of the world. At the present time, 60 graduate students are being trained at the IOC: this is the largest group of graduate students in any chemical institute of the Russian Academy of Sciences.

With the aim of training highly qualified research chemists and attracting the most talented among them to work within the Academy of Sciences system, the Institute provided the initiative for creating a Chemical Lyceum in Moscow: a new type of educational institution for training high school students (the Lyceum was founded in 1990). A Scientific Education Center was set up in 1991 within IOC for special training of the Lyceum students in the field of organic chemistry. IOC staff participate in training young research chemists, working as lecturers or laboratory instructors in the Higher Chemical College of the Academy of Sciences, which was created in 1991 within D. I. Mendeleev Moscow Chemical Engineering University. Thus, a continuous system of education operates within the Institute: Chemical Lyceum to Higher Chemical College to graduate program to doctoral program.

The editorial boards of a number of leading chemical journals operate at the Institute with active participation of its staff: Izvestiya Akademii Nauk, Seriya Khimicheskaya [Russian Chemical Bulletin]; Uspekhi Khimii [Russian Chemical Reviews]; Kinetika i Kataliz [Kinetics and Catalysis]; and also Mendeleev Communications, published jointly with the Royal Chemical Society (UK).

L. I. Belen'kii

Our journal has very close ties with the IOC. Almost forty years ago, Professor Yakov Lazarevich Gol'dfarb became one of the initiators creating the journal Khimiya Geterotsiklicheskikh Soedinenii [Chemistry of Heterocyclic Compounds]; he was a very active member of the Editorial Board from the first issue to the last day of his life. For many years his student, Professor Leonid Isaakovich Belen'kii, has been a regional editor of the journal and has devoted considerable labor, effort, knowledge and skill, and good will to working with authors and editors, including not a few IOC staff members. Academician Nikolai Konstantinovich Kochetkov is a member of the Editorial Board. We can confidently say that in every issue of this journal, there is not a single paper that has not been either written or edited by "IOC'ers". We have found more than once that we can always obtain detailed and highly professional advice and support from members of the Institute and editors related to it (and to us). Our thanks to all.

Our wishes for the brilliant IOC group are for new accomplishments and new achievements to benefit our favorite science: organic chemistry.

Editor-in-chief of the Journal
Academician E. Lukevics
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