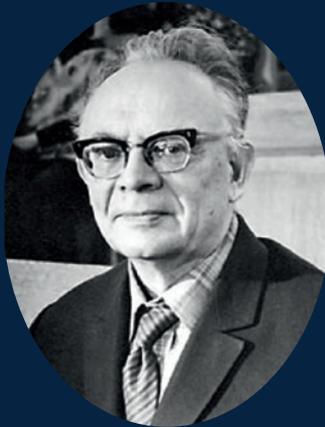




International
Arbuzovs Prize
in Organophosphorus Chemistry



Alexander E. Arbuzov



Boris A. Arbuzov

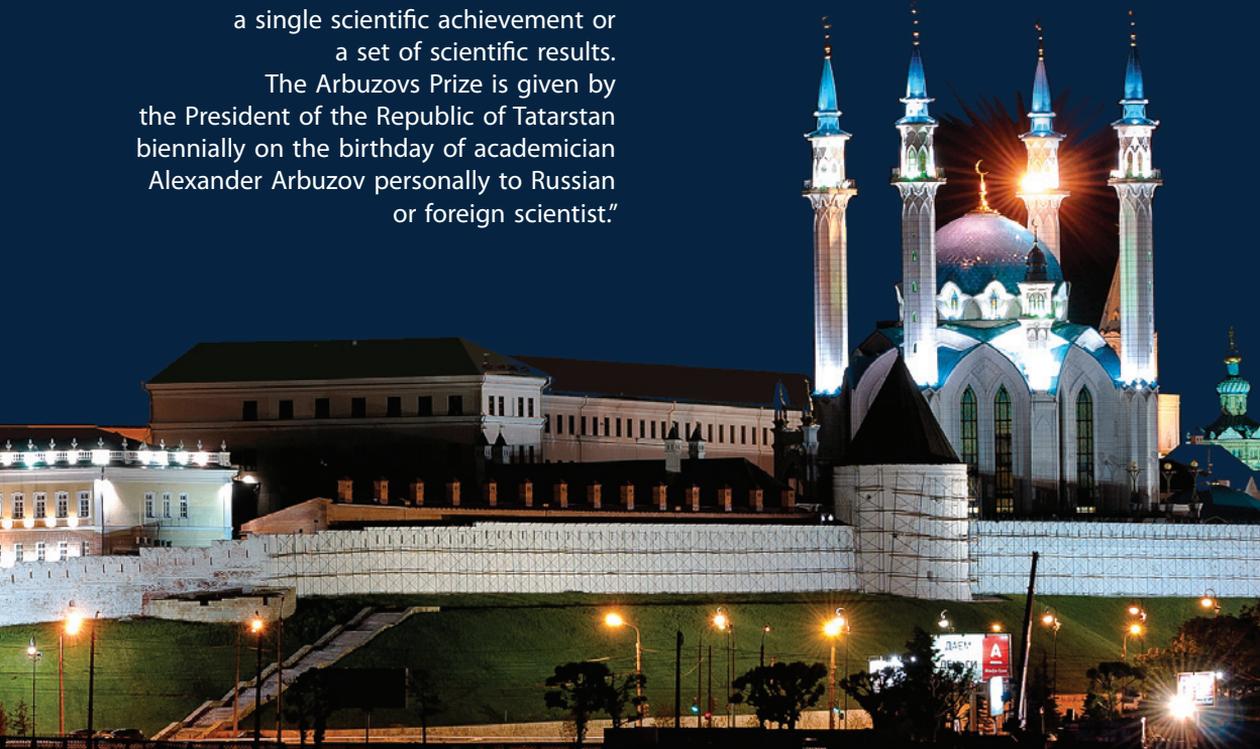
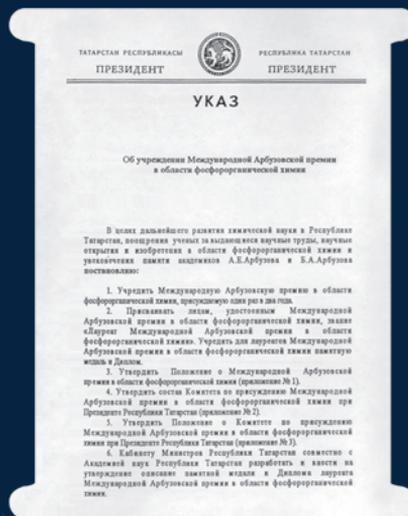


On July 11, 1997, at the threshold of the 120th anniversary of academician Alexander Arbuzov, an outstanding Russian chemist and originator of a new chemical branch – chemistry of organophosphorus compounds, President of the Republic of Tatarstan Mintimer Shaimiev signed the Decree establishing the International Arbuzovs Prize in the field of organophosphorus chemistry.

According to the Regulations “About the International Arbuzovs Prize in the field of organophosphorus chemistry”:

“...The Arbuzovs Prize, established in memory of the outstanding Russian chemists Alexander and Boris Arbuzovs, is awarded to an honored chemist for a single scientific achievement or a set of scientific results.

The Arbuzovs Prize is given by the President of the Republic of Tatarstan biennially on the birthday of academician Alexander Arbuzov personally to Russian or foreign scientist.”





Kazan and Kazan Chemical School have played a significant role in the history of science. Here, on the bank of the Volga river, in the city, where “the East meets the West”, in the middle of the XIX century the scientific school was developed, that gave the world a group of researchers whose works are now a part of the “gold fund” of the world chemical science.

Here K. Klaus discovered a new element Ruthenium (Russain), N. Zinin performed the reduction of nitrobenzene into aniline, A. Butlerov laid the foundation of modern organic chemistry.

In the XX century Alexander and Boris Arbuzovs became their successors.



The name of Alexander Arbuzov (1877–1968) is connected with the creation of a new chemical field: the chemistry of organophosphorus compounds. This field laid the foundation of the so-called “third chemistry”, the chemistry of organoelement compounds. The reaction, discovered by Alexander Arbuzov and named after him, became the “main road” for the synthesis of organophosphorus compounds.

Boris Arbuzov (1903–1991), his farther’s successor, was also a world-famous scientist. The scope of B. Arbuzov’s scientific interests was extremely wide. The major fields of his research work were the chemistry of organophosphorus compounds, the chemistry of terpenes, the chemistry of unsaturated compounds, and the stereochemistry of organic substances. His greatest discoveries were made in the field of physiologically active compounds and tightly connected with studies of his predecessors: A. Butlerov, V. Markovnikov, A. Zaitzev, F. Flavitzki, and A. Arbuzov.

A. Arbuzov and B. Arbuzov were both the prominent chemists and the important public figures. Their role as the organizers of science in Kazan can not be overestimated. They headed Kazan Chemistry School for about a century, and almost all achievements in organic chemistry which were made in Kazan at that time are connected with their names.

1997



ARKADY PUDOVIK
(Russia) (1916–2006)

Corresponding Member of the Russian Academy of Sciences, Honorary Academician of the Academy of Sciences of Tatarstan, Lenin prize winner, Director of the A. E. Arbuzov Institute, Freeman of Kazan

Arkady Pudovik is one of the most remarkable representatives of Kazan Chemistry School, the disciple of academicians Alexander and Boris Arbuzovs. He discovered a new addition reaction of hydrophosphoryl compounds and their thioanalogues to unsaturated reagents with homo- and heterodouble bonds. "Pudovik's Reaction" is the unique way for obtaining organophosphorus compounds with P-C bonds.

Arkady Pudovik made considerable contribution into the investigation of the reaction of trivalent phosphorus derivatives with electrophilic reagents – a "nonclassical" version of the Arbuzov's reaction. This reaction allowed the synthesis of a wide range of different linear and cyclic organophosphorus compounds.

He revealed that vinylphosphonic acid ethers add various nucleophilic reagents against the Rule of Markovnikov. This method of synthesis of β -functionalized alkylphosphonates was named "phosphonethylation reaction".

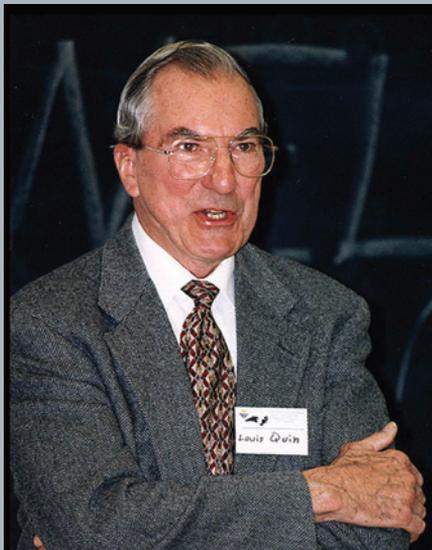
Arkady Pudovik successfully developed the chemistry of heterocyclic phosphorus derivatives. Original methods for synthesis of saturated and unsaturated phosphacyclanes were found.

For 55 years of his scientific activity he published about 1400 papers, 3 monographs and 20 surveys. Under his supervision more than 70 Ph.D. theses were defended and 20 his followers got Doctor's degrees.

1997

Louis QUIN
(U.S.A.) (1928)

*Professor Emeritus of the University of
Massachusetts at Amherst, and Duke
University of North Carolina at Durham,
President of the International Union on Main
Group Chemistry*

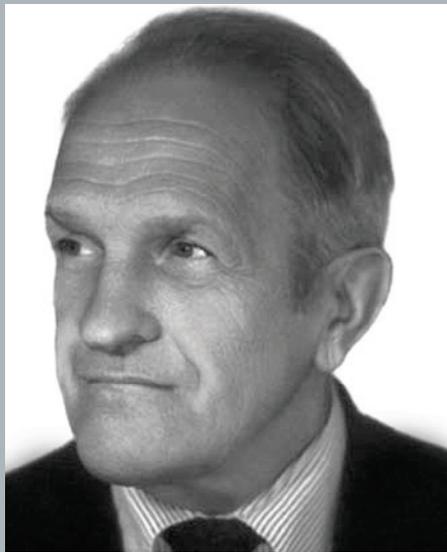


Louis Quin is well known by his works in the field of the conformational analysis of phosphorus heterocycles, the synthesis and reactivity of low coordination phosphorus compounds, and the application of ^{31}P NMR spectroscopy for studying the dynamic stereochemistry of phosphorus compounds.

Prof. Quin laid the foundation for a new field of the phosphorus chemistry – the chemistry of heterocyclic phosphorus compounds. He has synthesized phospholenes, investigated their reactivity and stereochemistry and developed the methods of synthesis of polycyclic compounds. He has made considerable contribution into phosphole chemistry. He was the first discovered cis-trans isomerism in cyclic phosphines with a single chiral center – the atom of phosphorus, and then a new line of research was developed, including the investigation of isomerism and conformation analysis of 6-membered heterocycles.

He revealed that the introduction of oxygen into P-C bond results in the formation of thermally unstable products, which are converted into highly reactive phosphoryl compounds of low coordination easily. He explained such effects as descreening by β -atoms of carbon and screening by γ -atoms of carbon.

1999



*JAN MICHALSKI
(Poland) (1920–2016)*

*Professor, Director of the Center
of Molecular and Macromolecular Studies,
Polish Academy of Sciences at Lodz*

Jan Michalski is the founder of the organophosphorus chemistry school in Poland and one of undisputed leaders in organophosphorus chemistry for more than 40 years. He is the author of over 350 papers and co-author of 4 monographs on the organophosphorus compounds chemistry.

Prof. Michalski is recognized for his pioneering work in the field of trivalent phosphorus stereochemistry as well as the chemistry of thio- and seleno-phosphoryl compounds. He was one of the first to use ^{31}P NMR spectroscopy together with stereochemical studies to elucidate the mechanisms of important reactions in phosphorus chemistry. Michalski developed also methods for chemo- and stereoselective phosphorylation of natural products. His development of the concept of organophosphorus pseudohalogens, which became an important tool in the synthesis of sulfur- and selenium-organic compounds as well as in general organic synthesis, is of particular importance.

Prof. Michalski is the member of Polish, France, and Berlin Academies of Sciences. He was awarded different international prizes including the Medals for scientific achievements of Paris, Polish Chemical Society, and Japan.

2001

FRANCOIS MATHEY
(France) (1941–2020)

*President of the French Chemical Society,
Member of the Academy of Sciences
of Paris, Professor of Chemistry in the
Ecological Polytechnic Institute and the
National Center on Scientific Investigations
in Paris*



Francois Mathey is well known authority in organophosphorus chemistry. F. Mathey has authored about 500 papers and 32 patents; mainly he has contributed to the development of phosphorus-carbon heterocyclic chemistry.

He has performed for the first time the synthesis of phosphirene ring, developed the chemistry of 2H-phospholes, 1-phosphanorbornadienes, phosphinines, polyphosphorus macrocycles with planar phosphorus atoms. He has synthesized numerous η^5 -phospha-cyclopentadienyl complexes with group III to IX transition metals. He has started to develop the chemistry of electrophilic terminal phosphinidene complexes, behaving as singlet carbenes. Another significant contribution is the synthesis of compounds with P=C double bonds from carbonyl derivatives via the phospho-Wittig reaction. The use of phosphoferrocenes in asymmetric catalysis and phosphazirconocenes in polymerization catalysis is currently under his active investigation.

Francois Mathey is the member of a few of international scientific societies including the Royal Society of Chemistry (UK) and the European Academy of Sciences. He has received the Alexander von Humboldt award, the Silver Medal of CNRS, the Main Group Chemistry award and many others. Francois Mathey is the editor-in-chief of the Journal "Heteroatom Chemistry" for many years.

The awarding ceremony
of the International
Arbuzovs Prize in the Field
of Organophosphorus
Chemistry-2005.



Masaaki Yoshifuji, winner of the International
Arbuzovs Prize-2005.



Laureate of the International Arbuzovs Prize-2007 Irina Beletskaya and
the First President of the Republic of Tatarstan Mintimer Shaimiev.



Laureate of the International Arbuzovs Prize-2017
Manfred Scheer.

Laureate of the International Arbuzovs Prize-2015
Yu-Fen Zhao and the President of the Republic of
Tatarstan Rustam Minnikhanov.

2003



*EDGAR NIECKE
(Germany) (1939)*

*Professor of Chemistry,
Director of the Department
of Inorganic Chemistry,
University of Bonn*

Edgar Niecke is one of the most well-known chemists of the XX century and founders of the modern organophosphorus chemistry school in Germany.

His primary research concerns the development of molecular compounds having phosphorus-element-(π - π)-bonds and, thus, phosphorus in low coordination. Experimental and theoretical structure and reactivity studies were carried out on a broad variety of systems such as iminophosphanes (behaving as singlet carbenes), phosphalkenes, bis(ylene) phosphoranes, phosphallylic and phosphacabenoid systems, monomeric metaphosphate analogues, as well as other unconventional compounds such as iminophosphenium and methylenediylphosphenium cations. The discovery of stable E- and Z-diphosphenes and the characterization of umbrella-shaped species are worthy of special attention.

His current activities are focused on two research fields:

1. Design of tridental hybrid ligands with low-coordinated phosphorus centers for the synthesis of novel macrocycles containing ligands with discriminative functionalities and redox activities and
2. Chemistry of unique stable diradical phosphorus heterocyclic systems, 1,3-diphosphetane-2,4-diyls, which are enabled to react as crypto-carbenes and/or can undergo mesolytic fragmentations. A long term perspective of the latter research is to develop the chemistry of phosphorus-containing polyradicals as non-metallic magnets.

2005

*MASAAKI YOSHIFUJI
(Japan) (1941)*

*Professor at Tohoku University
in Sendai*



Masaaki Yoshifuji has gained a worldwide recognition when he described the first genuine phosphorus-phosphorus double bond in a famous paper published in the *J. Am. Chem. Soc.* in 1981.

The stabilization of this first diphosphene $RP=PR$ was achieved by using very bulky substituents providing the double bond with a sufficient kinetic stability. This finding led to a complete reevaluation of the so-called double-bond rule forbidding the existence of stable double bonds between heavy elements. Following this breakthrough, Prof. Yoshifuji investigated the stabilization of a bunch of low-coordinated phosphorus species including phosphalkenes, phosphadienes, phosphacumulenes, phosphalkynes, etc. using bulky substituents and developed their chemistry. Recently, he started to investigate the possible uses of these new species as ligands in homogeneous catalysis.

Professor Yoshifuji has authored or co-authored about 250 papers in Japanese and international journals, has received the Alexander von Humboldt award, and has organized the 15th International Conference on Phosphorus Chemistry in 2001 in Sendai. He is clearly one of the prominent organophosphorus chemists in activity.

2007



IRINA BELETSKAYA
(Russia) (1933)

Full Member of the Russian Academy of Science, Professor of Moscow State University, Head of the Laboratory of Organoelement Compounds

Irina Beletskaya is recognized authority in the field of organic and organophosphorous compounds chemistry, chemistry of metalloorganic compounds, and homogeneous metallocomplex catalysis in organic synthesis. She is the author of about 1000 papers and 6 monographs, and the head of world-famous scientific school.

The area of her scientific research – use of the metallocomplex catalysis in organic and metalloorganic synthesis, new methods for generation of essential chemical compounds including biologically active analogues of natural substances and medical products.

Academician Irina Beletskaya has made considerable contribution into development of the chemistry of organophosphorous compounds. For the first time the P-H and P-P bonds addition reactions catalyzed by Pd and Ni complexes to alkynes and alkenes were performed. These reactions can be accomplished with high regio- and stereoselectivity. Also first an enantioselective addition of dialkylphosphites to an asymmetrical double bond in the chiral rhodium complexes catalysis was achieved. P-analogues of medical products used extensively were obtained.

Irina Beletskaya is the laureate of different Russian and international prizes. She has received the State Prize of the Russian Federation, the Lomonosov and Mendeleev awards, Sweden Prize “Women in engineering sciences” and many others. She is the editor-in-chief of the Russian Journal of Organic Chemistry, the member of INTAS Scientific Council, and the President of Organic Chemistry Department of International Union of Pure and Applied Chemistry (IUPAC).

2009

*MARIAN MIKOŁAJCZYK
(Poland) (1937)*

*Professor of Organic Chemistry,
Full Member of the Polish Academy
of Sciences, Director of the Centre
of Molecular and Macromolecular Studies,
Polish Academy of Sciences, Lodz*



Marian Mikołajczyk is widely recognized as one of the leading organophosphorus chemists.

He has provided many contributions to: synthetic organophosphorus chemistry, stereochemistry and physical chemistry of organophosphorus compounds, chemistry and stereochemistry of organosulfur compounds, synthetic chemistry. He has directed his skill and experience in heteroorganic chemistry towards the solution of problems on: nucleophilic substitution at the chiral phosphorus and sulfur atom, mechanism of the reaction between carbodiimides and thio- and selenoacids, synthesis of chiral trivalent phosphorus compounds; anomeric effect phosphorus substituted in cyclic sulfur and selenium compounds. Starting from 1985 attention was also paid to the synthesis of 1,4-dicarbonyl systems, cyclopentanoid antibiotics, prostaglandins and carbocyclic nucleosides using new organosulfur and organophosphorus reagents. During the last decade he contributed greatly to the development of enzymatic heteroatom chemistry.

The scientific achievements of Professor Marian Mikołajczyk are numerous; most of them are of fundamental importance and were widely cited in the chemical literature.

Marian Mikołajczyk is the winner of many prizes including: Award of the Polish Chemical Society, State award of Poland, and Alexander von Humboldt Research Award. He is Doctor Honoris Causa of the Paul Sabatier University, Toulouse (France) and of the Technical University, Lodz. Professor M. Mikołajczyk has worked as the Visiting Professor at the universities of Germany, France, Israel, USA, and Brazil. He is a member of some international scientific associations: Polish Chemical Society, International Union for Pure and Applied Chemistry (IUPAC), International Council on Main Group Chemistry, German Chemical Society.

2011



*GEORGE MICHAEL BLACKBURN
(United Kingdom) (1935)*

*Professor of Chemical Biology, Department
of Molecular Biology & Biotechnology,
the University of Sheffield*

Michael Blackburn has graduated University of Cambridge as Rockefeller Research Fellow in 1956. He performed his investigations under the supervision of Professor Lord Todd, Nobel Laureate. He was a Visiting Professor in Biochemistry in some universities of USA, Australia, Japan, PR China and other countries. However the biggest part of his scientific career is connected with University of Sheffield.

Considerable contribution into bioorganic chemistry, phosphorus chemistry, physical-organic chemistry, and basic enzymology made by Michael Blackburn cannot be overestimated. His most important achievements are closely connected with investigations of mechanism of enzyme-catalysed phosphoryl transfer, especially phosphatases and kinases. He designed non-hydrolysable nucleotide analogues incorporating various substituted bisphosphonates and trisphosphonates for studies on DNA repair enzymes and AdoMet processes including histone methylation. His investigations in the field of catalytic antibodies – from mechanism to cancer chemotherapy, are pioneer works. Professor Blackburn initiated research of phosphatase using selection technology as well studies with synthetic analogues of rare adenosine nucleotides - especially for cell-signalling. Now he is actively working in the area of enzyme inhibitors chemistry, especially for carbonic anhydrase and glaucoma therapy.

Prof. Blackburn is author of over 270 research papers in learned journals and three books as well the author and co-author of some 12 patents on bisphosphonates, on drug development for histone methylase inhibitors, on topical treatment of glaucoma, and on drug developments for avian influenza neuraminidase.

He is the member of many prestigious international scientific organizations as well the member of editorial boards of some scientific journals.

2013

VALERY KUKHAR
(Ukraine) (1942–2017)

*Academician of the National Academy of
Sciences of Ukraine (NASU),
Director of the Institute of Bioorganic
Chemistry and Petrochemistry, NASU.*



Professor Valery Kukhar is a world-known scientist. The main field of his scientific interest is bioorganic chemistry and fine organic synthesis of fluorine and phosphorus analogs of natural compounds, phosphorus containing amino acids as well chemical and technological aspects of environment protection, asymmetric synthesis. Since the beginning of his career, he is successfully continuing the way of fathers in phosphorus chemistry like Arbuzovs, Kirsanov, Kabachnik or Michalski and his impact on the development of phosphorus chemistry is enormous: phosphorus derivatives of α -chloroalkylamines, chlorophosphazopolychloroalkanes, phosphoruscontaining halogenoylides, aminophosphorous acids, asymmetric synthesis, bio-active compounds.

Valery Kukhar is being a leader in phosphorus chemistry for many years and has a distinguished publication record. He is the author of more 600 papers and about 20 review articles in refereed journals as well co-author of 6 monographs. His major achievement in phosphorus chemistry is a fundamental book "Aminophosphonic and Aminophosphinic Acids. Chemistry and Biological Activity" (in English) published in co-authorship with Harry Hudson.

Valerii Kukhar is the laureate of different prizes including A. Kiprianov Award of NASU, State Award in Science & Technology (Ukraine), San-Valentino Award, World Federation of Scientists, Memorable Medal "In Memory of Academician N. M. Emanuel", and others.

XXI International Conference on Phosphorus Chemistry



Patron of the 21 ICPC Rustam Minnikhanov with Arbuzovs Prize laureates of different years. At his left: Marian Mikolajczyk (Poland), Masaaki Yoshifuji (Japan). At his right: Yu-Fen Zhao (China), Michael Blackburn (UK), Francois Matey (France).



Chairmen of the 21 ICPC, Head of the Kazan Scientific Center of RAS, Professor Oleg Sinyashin introduces Arbuzovs Prize winners of different years to Rustam Minnikhanov – the President of the Republic of Tatarstan.

For more than 60-year history, for the first time the International Conference on Phosphorus Chemistry was held in Russia (Kazan, 5–10 June 2016). This fact became a certain indicator of international recognition of the contribution of Russian scientists, including representatives of several generations of the world-famous Kazan chemical school, in the world science.

The conference was held under the patronage of the President of the Republic of Tatarstan and under the auspices of IUPAC – International Union of Theoretical and Applied Chemistry.

At the Conference opening the President of the Republic of Tatarstan held the ceremony of awarding the International Arbuzovs Prize in Organophosphorus Chemistry for 2015 to Professor Yu-Fen Zhao as well met with Arbuzovs Prize laureates – participants of this largest international forum.

2015

YU-FEN ZHAO
(China) (1948)

*Academician of the Chinese Academy
of Sciences, Professor of Chemistry
at the Xiamen University*



Yu-Fen Zhao is well known authority and specialist in the organophosphorus chemistry field as well in the adjoining fields. A set of scientific achievements were made by Professor Yu-Fen Zhao in the following important directions: Phosphorus Chemistry and Origin of Life; Penta-Coordinate Phosphorus Chemistry; P-C Bond Formation; Medicinal Chemistry; Mass Spectrometry Analysis; ^{31}P NMR and Theoretical Computation.

She is author and co-author of more than 800 publications in top-level international chemical and biochemical journals. Especially important contribution was made by Professor Zhao into the field of the origin of the Earth life and the medicinal chemistry.

For the first time it was demonstrated the high-energy P-N bond might have participated in the evolution of prebiotic chemistry. N-phosphoryl amino acids (PAAs) can serve as interesting small molecular models for the P-N bond in prebiotic chemical evolution. PAAs are capable of simultaneously producing several important biomolecules such as polypeptides and oligonucleotides under mild reaction conditions. The remarkable reaction of N-phosphoryl amino acids with nucleoside mixtures, forming peptides and oligonucleotides simultaneously, suggests a pathway of 'co-evolution of proteins and nucleic acids'.

Professor Zhao presented an evolution model of modern protease and nuclease. The dipeptide Ser-His is the shortest peptide ever reported to show cleavage activity with multiple categories of natural substrates, such as DNA, protein, the ester p-NPA and RNA.

2017



*MANFRED SCHEER
(Germany) (1955)*

*Full Professor of Chemistry at the Institute
of Inorganic Chemistry,
University of Regensburg*

Manfred Scheer is a world-known specialist in the field of phosphorus chemistry, an author of over 500 publications on this scientific direction. Prof. Scheer is interested in the chemistry of arsenic and silicon-organometallic compounds as well.

Extremely interesting results were obtained by Prof. Scheer in the field of hybrid organo-inorganic materials with group V elements, first of all phosphorus and arsenic, as well in the chemistry of coordination compounds with low-coordinated phosphorus ligands.

Manfred Scheer laid the foundation of supramolecular chemistry of organometallic skeleton structures with cyclopentaphosphadienid ligands and other multiple-deck compositions with ferrocene-like structures.

Scheer's indisputable achievement is the synthesis of two- and three-dimensional coordination polymer structures with phosphorus ligands.

The most interesting are phospho-carbo-containing frame super-structures with geometry of a spheroidal fullerene type, where pentaphosphaferrocen blocks are associated around carborane playing a role of "guest" molecule. Structure of one of these "super-molecules" corresponds to icosahedral fullerene consisting of 80 carbon atoms.

2019

*OLEG SINYASHIN
(Russian federation) (1956)*

*Full Member of Russian Academy of Sciences
(Academician of RAS), Professor of Chemistry
Director of the Federal Research Center
"Kazan Scientific Center of the Russian
Academy of Sciences"*



Oleg Sinyashin is an outstanding scientist in the field of organic and elementorganic chemistry, author and co-author of more than 800 scientific publications.

His most important achievements in the field of organophosphorus chemistry are following:

1. Fundamental results in the synthesis, structure and reactivity of trivalent phosphorus compounds and their application in coordination, organometallic, and medical chemistry have been obtained, including their use in the creation of the most important types of catalysts, sensors, fluorescent materials and molecular magnets.

2. The scientific basis of highly efficient and environmentally safe (chlorine-free) technology of electrosynthesis of the most important classes of phosphorus compounds were created: organic phosphites, phosphates, pyrophosphates, tertiary phosphines and hypophosphoric acid, based on elemental phosphorus.

3. A significant contribution was made to the development of organic chemistry of fullerenes, including the synthesis of fullerenes with phosphorus – containing functional substituents – promising elements of compositions for organic nanoelectronics.

For many years Professor Oleg Sinyashin heads the Kazan Organophosphorus School. Oleg Sinyashin is the winner of many scientific awards, including the prizes of the Russian Academy of Sciences: named after A. N. Nesmeyanov (2015) and L. A. Chugaev (2018). He was elected the Honorary Professor of St. Petersburg State University and the Mendeleev Reader in 2017. He is Laureate of the State Prize of the Republic of Tatarstan in the field of science and technology.

2021



*KOOP LAMMERTSMA
(The Netherlands) (1949)*

*Emeritus Professor at the Vrije Universiteit
Amsterdam (The Netherlands),
Distinguished Visiting Professor
at the University of Johannesburg
(South Africa)*

Koop Lammertsma is a well-known organophosphorus chemist, founder of a powerful scientific school in the Netherlands.

He contributed to the advancement of the synthetic diversity of organophosphorus chemistry by embedding physical-organic concepts and using quantum mechanical calculations as a guiding tool. He focused on unraveling the chemical properties of reactive intermediates and controlling their chemical reactivities. Most of his work concerned the carbene-like chemistry of low-valent phosphinidene complexes and their applications toward novel, strained, as well as dynamic organophosphorus compounds. For his research he used a uniquely integrated synthetic-computational approach. He also contributed to the synthesis of novel organophosphorus ligands for transition metal complexes, the synthesis of P-based frustrated Lewis pairs, revitalized the research on white phosphorus by direct functionalization to organophosphorus products, and advocated efforts in phosphorus sustainability.

As well he engaged very much in the problematic of using and exploiting phosphorus resources. Due to his activity many politicians became aware of the problem that the natural resources (phosphonate rock) are on the edge of depletion and there is a need to regulate situation which may have catastrophic consequences.

Nowadays, the rich scientific works of Koop Lammertsma intimately known to every scientist, working in the area of phosphorus chemistry and beyond, and his talented students and followers successfully develop cooperation with chemists from around the world.

Professor Lammertsma is a Member of the Steering Committee of the International Conferences on Phosphorus Chemistry (ICPC), an excellent organizer of scientific forums on phosphorus chemistry including organization of 19 ICPC in Rotterdam and Amsterdam in 2012.

Koop Lammertsma has (co-)authored over 250 scientific publications.



АКАДЕМИК
АЛЕКСАНДР
ЕРМИНИНГЕЛЬДОВИЧ
АРБУЗОВ

1877-1968

*"The twentieth century is the Arbuzovs age
in the history of Kazan Chemistry School"*

Academician Alexander Konovalov

*"For all chemists over the world this award
will be associated with Kazan and
Kazan Chemical School"*

Professor Louis Quin

*"Needless to say, I shall keep
as a fantastic souvenir the warm
hospitality of your city"*

Professor Francois Mathey