CHEMISTRY JOURNAL OF MOLDOVA. General, Industrial and Ecological Chemistry. 2019, 14(1), 8-31
ISSN (p) 1857-1727 ISSN (e) 2345-1688
http://cjm.asm.md
http://dx.doi.org/10.19261/cjm.2019.349

THE INSTITUTE OF CHEMISTRY AT 60 YEARS ANNIVERSARY. BRIEF HISTORY, ACHIEVEMENTS AND PERSPECTIVES

At the beginning of the 60's the chemistry in the Republic of Moldova exceeded the perimeter of higher education and registered a rise to a new level - the academic level. The first research group, formed in 1951, was the analytic group connected to the Department of Pedology of the Moldovan Branch of the former USSR Academy of Sciences with the research in the field of analytical chemistry and chemistry of coordination compounds. Later, in 1953, the analytical group became a laboratory and in 1956 the Department of Chemistry was formed. Along with coordination chemistry, the chemistry of natural compounds and organic synthesis developed. Investigations in the field of chemistry significantly developed after the formation of the Departments of Inorganic Chemistry and Organic Chemistry of the Moldovan Branch of the of the former USSR Academy of Sciences in 1956, and even more due to the setting up of the Institute of Chemistry, which became and still remains, the main centre of chemical research in the republic [1,2].

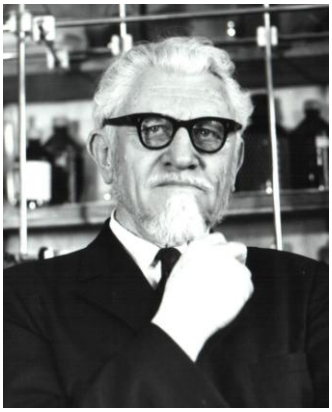
The Institute of Chemistry of the ASM was founded in 1959 (April 15th) on the basis of the Department of Organic Chemistry, and that of Inorganic Chemistry and the Laboratory of Analytical Chemistry of the Moldovan Branch of the Academy of Sciences of the USSR.

The Institute of Chemistry has witnessed a continuous growth: new laboratories emerged, from existing ones, the Laboratory of Chemistry of Mineral Resources (1962), Laboratory of Quantum Chemistry (1964) and Laboratory of Bioinorganic Chemistry (1975), and the Laboratory of Organic Chemistry (known as the Laboratory of Chemistry of Natural Compounds during the foundation of the institute) leads to the formation of the Laboratory of Organic Synthesis (1962) [3].

The cornerstones of scientific directions of the institute were laid down by famous researchers, members of the Academy of Sciences, founders of scientific schools in Republic of Moldova: acad. Antonie Ablov (1905-1978) – *school of coordination compounds chemistry* [1-3,4]; acad. Gheorghe Lazurievski (1906-1987) – *school of organic and bioorganic chemistry* [1-3,5], acad. Iurie Lealicov (1909-1976), organizer and leader of research related to physical-chemical methods of analysis – *school of polarography* [1-3,6].

Later, new scientific schools were created, those of *quantum chemistry* – headed by acad. Isaak Bersuker [1,3,7,8]; *organic, bioorganic chemistry and chemistry of natural and physiologically active compounds* – headed by acad. Pavel Vlad (1936-2017) [1,3,9,10]; *chemistry of coordination, macrocyclic and supramolecular compounds* – headed by acad. Nicolae Garbalau (1931-2006) [1,3]; *ecological chemistry* – headed by acad. Gheorghe Duca [1,3,11,12]; *bioinorganic chemistry* – headed by acad. Constantin Turta (1940-2015) [1,3,13,14]; and the scientific school in the field of *chemistry of adsorbents* was created by acad. Tudor Lupascu [1,3,15].

Acad. Antonie Ablov (1905-1978)

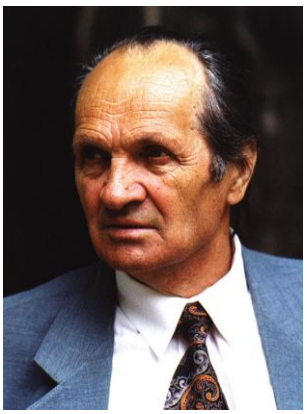


Acad. Gheorghe Lazurievski (1906-1987)

Acad. Iurie Lealicov (1909-1976)

Acad. Isaak Bersuker

Acad. Pavel Vlad (1936-2017)



Acad. Nicolae Garbalau (1931-2006)

Acad. Constantin Turta (1940-2015)

Acad. Gheorghe Duca

Acad. Tudor Lupascu

During the 60 years the scientific activity of this prestigious academic institution has been led up by directors: acad. Antonie Ablov (1959-1961 and 1965-1975); acad. Gheorghe Lazurievski (1961-1965); acad. Pavel Vlad (1975-1995); Nicolae Garbalau (1995-2001); acad. Tudor Lupascu (2001-2018) and doctor habilitate Aculina Aricu (from 2019); deputy (scientific) directors: acad. Isaak Bersuker; dr. Lev Curtev; dr. habilitate Dumitru Batir; acad. Pavel Vlad, dr. habilitate Grigore Junghietu; acad. Nicolae Garbalau; dr. habilitate Anatol Dimoglo; dr. habilitate Vladimir Arion; dr. Vasile Lozan; acad. Tudor Lupascu and dr. habilitate Aculina Aricu; scientific secretaries: dr. Alexandr Shamshurin; dr. habilitate Dumitru Batir; dr. Dumitru Palade; dr. Valeriu Ropot; dr. Larisa Madan; dr. Raisa Cater and dr. Maria Cocu [3].

At present, the scientific potential of the Institute of Chemistry is represented by 123 scientific researchers, including - three full members of the Academy of Sciences of Moldova, one corresponding member of the Academy of Sciences of Moldova, 10 doctors habilitate and 40 doctors of chemistry.

During the years, the Institute of Chemistry of the Academy of Sciences of Moldova passed through several structural and research-related reforms. Now the institute includes three scientific centres: the Centre of Physical and Inorganic Chemistry, the Centre of Ecological Chemistry and Environmental Protection and the Centre of Organic and Biological Chemistry.

The ***Centre of Physical and Inorganic Chemistry*** furnished with modern equipment, was created in 2006 (first named Centre of Physical Chemistry and Nanocomposites) by academician Gheorghe Duca, and includes four laboratories:

- The Laboratory of Quantum Chemistry, Catalysis and Physical Methods;
- The Laboratory of Coordination Chemistry;
- The Laboratory of Physico-Chemical Methods of Research and Analysis;
- The Laboratory of Bioinorganic Chemistry and Nanocomposites.

The ***Laboratory of Quantum Chemistry, Catalysis and Physical Methods*** was founded in 1964 (under the name of Laboratory of Quantum Chemistry) by academician Isaac Bersuker who led the laboratory for 29 years (1964-1993) [1-3,8].

Professor Ivan Ogurtsov, dr habilitate of physics and mathematics, was the head of the laboratory during 1993-2010. Since 2010 the head of the Laboratory is Natalia Gorinchoy, doctor of chemistry.

In 2006, the laboratory was renamed in the Laboratory of Quantum Chemistry and Chemical Kinetics and later, in 2013, the laboratory enlarged by the integration of the Laboratory of Magnetic Resonance and Laser Spectroscopy headed by corresponding member Ion Geru, hence the name of the laboratory was replaced by the Laboratory of Quantum Chemistry, Chemical Kinetics and Magnetic Resonance, which currently includes four groups. In 2016 the name of the laboratory becomes Quantum Chemistry, Catalysis and Physical Methods.

Dr. habilitate Ivan Ogurtsov (1941-2009)

Dr. Natalia Gorinchoy

Corr. member Ion Geru

Research in the field of quantum chemistry was quite significant from the very beginning, being highly appreciated at the international level. The study of the influence of the electronic structure on nuclear configurations of polyatomic systems and their dynamics led to the elaboration of a new concept in the theory of structure and particularities of polyatomic systems – the concept of vibronic interaction, which resulted in a scientific discovery, this achievement (after official support by ten research institutions of the USSR) was qualified as a "Scientific Discovery" registered in the USSR in 1978 under no. 202: *„Явление туннельных расщеплений уровней энергии многоатомных систем в состоянии электронного вырождения" (I. Bersuker „The Phenomenon of Tunneling Splitting of Energy Levels of Polyatomic Systems in Electronic Degenerate States"*) [8,16].

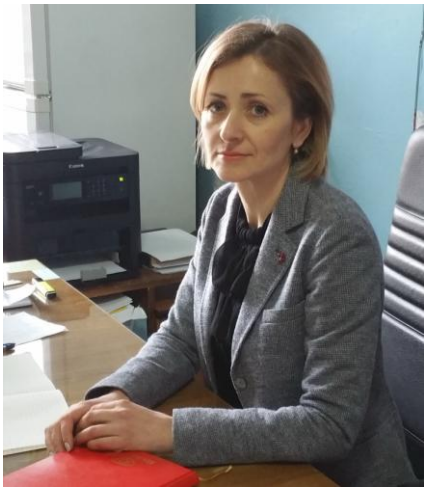
The research interests of the Laboratory of Quantum Chemistry, Catalysis and Physical Methods are:

- Geometry and electronic structure calculations of molecular systems by *ab initio* and semiempirical methods;
- Activation of small molecules through the interaction with coordination compounds of transition metals;
- Theory of vibronic interactions;
- Study of the "structure-activity" correlation;
- Theoretical and experimental studies of reaction mechanisms of redox processes;
- Magnetic properties of bi- and tri-homonuclear coordination compounds;
- ESR in carbon nanotubes and coordination compounds;
- NMR in liquids and solids, including the determination of nuclear relaxation times;
- Spectroscopic studies and molecular dynamics simulations of the interaction of biological macromolecules with metal cations.

The ***Laboratory of Coordination Chemistry*** is one of the oldest and most representative entities of the institute. The investigations in the field of chemistry of coordination compounds expanded substantially after the formation (in 1956) of the Department of Inorganic Chemistry of the Moldovan Branch of the Academy of Sciences of the USSR. In 1975, the laboratory was called the Laboratory of Chemistry of Coordination Compounds, headed by academician Antonie Ablov (during the years 1959-1978) [1-4]. From 1978 till 2006 the head of the laboratory was academician Nicolae Garbalau, for a short period (in 2006) the laboratory was guided by corr. member Mihail Revenco [17]. In the same year, 2006, the laboratory was renamed in Laboratory of Coordination Chemistry and was headed by dr. habilitate Ion Bulhac (during years 2006-2016 and 2018- present), and dr. Diana Dragancea (2015-2018).

Corr. member Mihail Revenco (1947-2014)

Dr. habilitate Ion Bulhac



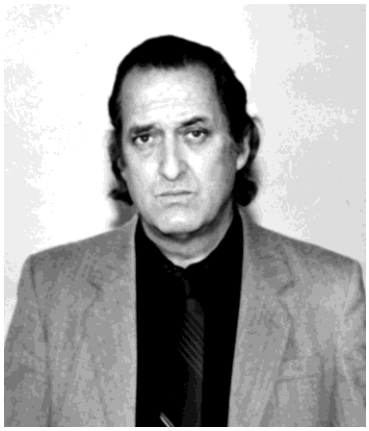
Dr. Diana Dragancea

The research interests of the laboratory of Coordination Chemistry are:

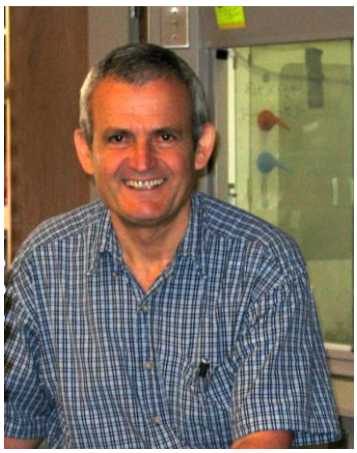
- Synthesis methods, especially template synthesis of the mono-, polynuclear and supramolecular compounds of the transition metals with organic polyfunctional ligands based on Schiff bases;
- basic research in elucidating physical, chemical, magnetic, catalytic and structural properties of the synthesized compounds;
- applied research of coordination compounds as stimulants of the vital activity of some microorganisms in the biosynthesis of enzymes, as well as stimulants to increase the productivity and drought resistance of cultivated plants;
- Synthesis of different metal carboxylates both of small clusters (mono-, bi-, trinuclear) and larger cages (from M_4 to M_{16}), as well as coordination polymers with the metals such as vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc.

The ***Laboratory of Physico-Chemical Methods of Research and Analysis*** has descended from the Laboratory of Analytical Chemistry, which was founded by academician Iurie Lealicov in 1957 [1-3,6]. Under the guidance of professor Lealicov, methods for the analysis of metals in industrial facilities, semiconductors, foodstuffs and environment were developed. In 1973, dr. Ion Vatamanu was appointed head of the Laboratory of Analytical Chemistry (called the Laboratory of Electrochemical Methods of Investigation for a short period), and in 1991 dr. Ludmila Chiriac was elected head of laboratory. Later, the laboratory was headed by corresponding member Mihail Revenco during 1997-2006 [17] and dr. Ion Dranca in the period 2006-2008. In 2006, with the foundation of the Center of Physical Chemistry and Nanocomposites (now Centre of Physical and Inorganic Chemistry), the laboratory was reorganized and transformed into the Laboratory of Physico-Chemical Methods of Research and Analysis, which at present is headed by dr. habilitate Igor Povar.

Dr. Ludmila Chiriac
(1937-2014)



Dr. Ion Vatamanu
(1937-1993)



Dr. Ion Dranca
(1945-2012)

Dr. habilitate Igor Povar

The research interests of the Laboratory of Physico-Chemical Methods of Research and Analysis are:

- Chemical thermodynamics of complex chemical equilibria in multicomponent heterogeneous systems;
- Developing the theory of buffering capacity in multicomponent heterogeneous systems for assessing the effects of pollutants remediation in contaminated waters;
- Analysis of new organic reagents for the voltamperometric adsorptive accumulation with cathodic or anodic stripping of metals; development of voltamperometric methods for the analysis of traces of harmful species;
- Testing of certain new organic chelating polyfunctional agents that are used for the adsorptive accumulation of heavy metals on the mercury electrode;
- Development of methods of electrochemical accumulation on the carbon fiber electrode with the surface modified by a monolayer of mercury so as to increase the scanning speed, which would significantly shorten the accumulation time and bring closer the nanomolar detection limit;
- The use of spectral methods of structural analysis of organic and inorganic materials.

The ***Laboratory of Bioinorganic Chemistry and Nanocomposites*** was established in 1975 (under the name Laboratory of Bioinorganic Chemistry) by dr. habilitate, professor Dumitru Batir [1-3,18]. The laboratory was designed to study coordination compounds with biological activity [1,3]. At the end of 1988, academician Constantin Turta was elected as head of the laboratory, giving a new breath to the laboratory by implementing progressive methods (at that time) Nuclear Gamma Resonance Spectroscopy (Mössbauer spectroscopy) and magnetochemistry [1,3,14,19,20]. After passing away of academician Turta, dr. Vasile Lozan (2015 - present) was elected as head of laboratory. In 2006, with the creation of the Center of Physical Chemistry and Nanocomposites the laboratory was renamed in Laboratory of Bioinorganic Chemistry and Nanocomposites.

Additionally, in this laboratory, corresponding member Boris Tsukerblat and his team developed the scientific direction *Magnetochemistry and the spectroscopy of the polinuclear coordinative compounds* [2,3].

The research interests of the Laboratory of Bioinorganic Chemistry and Nanocomposites are:

- Synthesis of mono- and polynuclear coordination compounds of transition elements (*n*d, *4*f) with mono- (H_2O, R-Py, THF, DMAA, *etc*.) and polydentate ligands of Schiff Base type and carboxylic acids;
- Investigations of their molecular and crystalline structure (in collaboration with other research groups);
- Deciphering of IR, UV-Vis, Mössbauer, NMR, TG and EPR spectra of the synthesized substances;
- Testing of synthesized compounds as single-molecule-magnets (SMM), photosensitizers in solar cells with dye sensitizers (CSCs), magnetic nanomaterials and biologically active compounds.

The ***Centre of Ecological Chemistry and Environmental Protection***, created in 2016 and headed by academician Tudor Lupascu, includes three laboratories:

- The Laboratory of Ecological Chemistry;
- The Laboratory of Monitoring of Environmental Quality;
- The Laboratory of Water Chemistry.

Dr. Vasile Lozan

Dr. habilitate Dumitru Batir (1927-2014)

Corr. member Boris Tsukerblat

The ***Laboratory of Ecological Chemistry***, was established in 1962 by dr. in chemistry Nicolae Lobanov, under the name of Laboratory of Mineral Resources; and with the purpose to research the chemical composition, physicochemical properties of the clay minerals and their use in various fields of national economy [1-3]. The laboratory goes into a wider area of concern as the Laboratory of Mineral Resources and Water Chemistry Laboratory, in 1972, headed by dr. Valeriu Ropot. Later, in 1991, the laboratory has been modernized and coordinated by acad. Tudor Lupascu, who reinvigorated it; the laboratory was renamed in Laboratory of Ecological Chemistry, focusing on the quality of the environment [1,3,11].

In 2001 acad. Tudor Lupascu was elected as director of the Institute of Chemistry, thus, the Laboratory of Ecological Chemistry was led by dr. habilitate Vasile Rusu (during 2002-2006) and by dr. habilitate Mihail Ciobanu (during 2007-2014 years). In 2015 dr. Raisa Nastas has been elected as head of the *Laboratory of Ecological Chemistry*. Now the head of the laboratory is dr. Nina Timbaliuc.

The research interests of the Laboratory of Ecological Chemistry are:

- Optimization of the obtaining and modification technologies of carbonaceous and mineral adsorbents for practical purposes;
- Obtaining and studying of the structure parameters of carbonaceous and mineral supported catalysts for their use in the catalytic processes of pollutants removal from surface and underground waters;
- Synthesis and study of the new polyfunctional materials (including biologically active substances) by chemical and physicochemical methods, useful for economy, medicine, industry, agriculture and environment.

Dr. Nicolae Lobanov (1897-1972)

Dr. Valeriu Ropot (1934-2002)

Dr. habilitate Vasile Rusu

Dr. habilitate Mihail Ciobanu

Dr. Raisa Nastas

Dr. Nina Timbaliuc

The ***Laboratory of Monitoring of Environmental Quality*** was established in 1978 by dr. Burghelea Nicolae under the name of Laboratory of Land Geochemistry at the Institute of Geophysics and Geology of the Academy of Sciences of Moldova [21]. Subsequently, the laboratory was renamed to Laboratory of Hydrogeochemistry and Laboratory of Geochemistry. Due to the reorganization and optimization of the Academy of Sciences of Moldova, which started in 2015, the laboratory was transferred at the Institute of Chemistry. With the creation of the Center of Ecological Chemistry and Environmental Protection the laboratory was renamed to Laboratory of Monitoring of Environmental Quality. The head of laboratory is dr. Oleg Bogdevich.

Modern methodologies for studying the geochemistry of toxic substances in different environmental objects were implemented within the laboratory and now it is accredited according to ISO 17025 and can perform the following analyses of different environmental objects (natural and waste waters, soils, sediments, plants):

- determination of toxic organic substances POP, PAH, BTEX;
- identification of substances in different objects by gas chromatography with mass detection;
- determination of toxic chemical elements (As, Se, Hg, Pb, Cd, Cu, Zn, Ni, Cr, Al, Mn, Fe);
- analysis of water quality by standard methods.

The ***Laboratory of Water Chemistry*** was founded in 1979, under the name Laboratory of Atomic Spectroscopy, as part of the Automation and Metrology Center of the Academy of Sciences of Moldova [21]. In 2007, due to reorganization and optimization, the laboratory became a part of the Institute of Chemistry. Later, with the creation of the Center of Ecological Chemistry and Environmental Protection in 2016, the laboratory was renamed to Laboratory of Water Chemistry. The head of laboratory is Ms. Mitina Tatiana.

The laboratory was accredited by the National Center of Accreditation of the Republic of Moldova (MOLDAC) in 1994, 1997, 2000, 2007, 2011, 2015 and 2019. The laboratory organizes inter-laboratory tests at the national level; the object of the analysis is water.

The research interests of the Laboratory of Water Chemistry are:

- Elaboration of new procedures and improving the existing ones;
- Broadening the spectrum of analyzed objects and the number of determined parameters;
- Improving metrological characteristics of the procedures;
- Evaluation of chemical composition of water from different sources (ground, surface, bottled) and its classification according to drinking water quality standards.

The ***Centre of Organic and Biological Chemistry***, created in 2016 and headed by dr. habilitate Aculina Aricu, includes two laboratories:

- The Laboratory of Organic Synthesis and Biopharmaceutics;
- The Laboratory of Chemistry of Natural and Biological Active Compounds.

Dr. Oleg Bogdevich

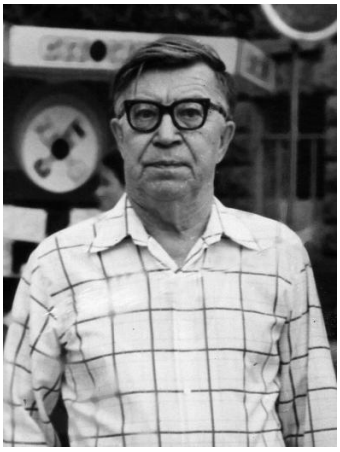
Tatiana Mitina

The ***Laboratory of Organic Synthesis and Biopharmaceutics*** was established in 1962 on the initiative of dr. Alexandr Shamshurin, with the first name Laboratory of Organic Synthesis. The first researches were oriented towards obtaining preparations for pests control and of several compounds with attractive properties [1-3].

During 1972-1982 the Laboratory of Organic Synthesis, named in 1976 as the Laboratory of Chemistry of Preservatives, was headed by dr. habilitate Grigore Junghietu [1,3,22]. In 1984 dr. Miron Krimer took the lead of the laboratory, which was then named the Laboratory of Pesticides Chemistry, and in 1991 named again the Laboratory of Organic Synthesis. After the decease of the dr. Miron Krimer, the Laboratory of Organic Synthesis has been headed by dr. habilitate Fliur Macaev [1,3,22]. In 2016, with the creation of the Center of Organic and Biological Chemistry the laboratory was renamed in Laboratory of Organic Synthesis and Biopharmaceutics.

The research interests of the Laboratory of Organic Synthesis and Biopharmaceutics are:

- Various aspects of organic and medicinal chemistry; discovery of new catalysts (metal-mediated and metal-free) for asymmetric synthesis, mechanistic investigations of reactions which proceed with high levels of regio- and stereoselectivity;
- Ionic liquids (including magnetic ones), which are used as green alternatives to solvents, catalysts, extractors. The laboratory provides a total synthesis of biologically active compounds, including natural ones using computer-aided molecular design and study of structure-activity relationships;
- Development of inexpensive methods for obtaining of specific co-polymers for selective detergent-free isolation of membrane proteins.



Dr. Alexandr Shamshurin (1909-2003)

Dr. Miron Krimer (1938-1999)

Dr. habilitate Grigore Junghietu

Dr. habilitate Fliur Macaev

The ***Laboratory of Chemistry of Natural and Biologically Active Compounds*** was established in 1959 by acad. Gheorghe Lazurievski, under the name of Laboratory of Chemistry of Natural Compounds [1-3,5].

In 1975 the laboratory was divided into two: Laboratory of Chemistry of Steroidal Compounds (headed by dr. in chemistry Petru Ceban and the Laboratory of Chemistry of Isoprenoids (headed by dr. Dumitru Popa). In 1976, both laboratories were reorganized; the first one became the Laboratory of Chemistry of Ethero-oleaginous Plants (headed by acad. Pavel Vlad), and the second one was reprofiled and further led by Dumitru Popa under the name of the Chemistry Laboratory of the Plant Growers and Development Regulators. In 1991 these two laboratories merged into a single research unit - the Laboratory of Chemistry of Terpenoids, headed by acad. Pavel Vlad [1,3,9,10,22,]. In 2010, dr. habilitate Nicon Ungur became the head of the laboratory. In 2016, with the creation of the Center of Organic and Biological Chemistry the laboratory was renamed in Laboratory of Chemistry of Natural and Biologically Active Compounds.

The research interests of the Laboratory of Chemistry of Natural and Biologically Active Compounds are:

- Targeted synthesis of polyfunctionalized bioactive terpenic compounds;
- Elaboration of methods for renewable resources valorisation;
- Elaboration of new green methods for the modification of natural products.

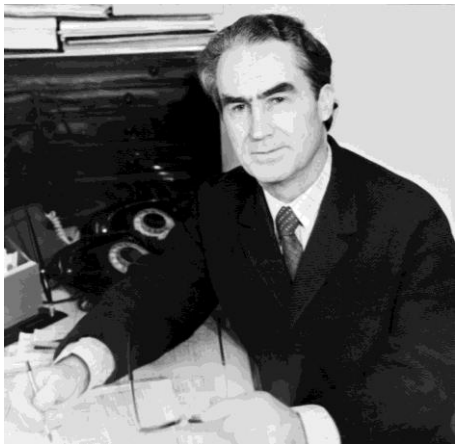
Most valuable achievements

The results of scientific investigations performed in the frames of the institute are presented in over 6500 scientific publications, including around 115 collective and individual monographs and thematic selections, over 300 author certificates and patents; over 120 technological elaborations have been implemented into the national economy.

Among the most important ones are the following:

- Investigations of the influence of electronic structure on the nuclei configuration and molecular dynamics, which were crowned with the "scientific discovery" title *„The Phenomenon of Tunneling Splitting of Energy Levels of Polyatomic Systems in Electronic Degenerate States"* (author acad. I. Bersuker, registered in the USSR in 1978 under no. 202: *„Явление туннельных расщеплений уровней энергии многоатомных систем в состоянии электронного вырождения"*).

Dr. Petru Ceban
(1940-2009)



Dr. Dumitru Popa
(1927-1997)

Dr. habilitate Nicon Ungur

- A new concept was postulated and developed in the frames of the theory of molecules and crystals – the theory of vibronic interactions. In the framework of this concept a new approach based on the Jahn-Teller and the Pseudo Jahn-Teller effects has been elaborated for the interpretation of instability and structural changes of molecular systems coordinated to the transition metal coordination compounds or adsorbed on solid surfaces. Applications to specific coordination compounds demonstrate the predictive power of the theory and its efficiency in rationalization of the experimental data on structural changes in molecular systems due to their interaction with another system.
- In addition, some progress was made in understanding the possibility to influence the planarity of two-dimensional (2D) or quasi 2D structures through targeted external influences (such as excitation, oxidation, reduction, chemical substitution, *etc*.), which means the possibility to manipulate their puckering or buckling.
- In terms of the four-colours groups of magnetic symmetry it has been shown that anomalous magnetic properties of trihomonuclear clusters with Kramers degeneracy of energy levels, containing ions of Fe(III), Cr(III), Cu(II), V(IV), or Co(II), are caused by structural distortions due to the existence of time-reversal symmetry.
- Pure CdSe, ZnS and ZnO quantum dots and doped with 3d-ions, which have a broad range of applications including water photolysis, solar cells, stable nanometric sources of light, photocatalysts, chemical sensors, and various biomedical applications (such as biosensors, bioimaging diagnosis, cancer diagnosis, *etc*.), were synthesized using methods of colloidal chemistry. It has been established that at relatively high concentrations of ZnO quantum dots in organic solvents, the excitonic absorption band 1S has a multiplet structure, caused by the self-organization of quantum points in clusters of different sizes.
- A new method was proposed of spin levels inversion in homonuclear magnetic dimmers with $S_1 = S_2 = 1/2$ spins by an isomorphic substitution of one of the ions by a "time-reversed" one relative to the initial ion. The method has been generalized for homonuclear magnetic dimmers $3d^n$ - $3d^n$ and $4f^m$ - $4f^m$ ($1 < n < 10$, $1 < m < 14$, $S_1 = S_2 > 1/2$). This method allows a controlled synthesis of binuclear coordinative compounds with magnetic properties, when the chemical synthesis result is known in advance: a compound with ferro- or antiferromagnetic exchange interactions.
- It was shown that instability of the spin levels population relative to small structural distorsions of a trihomonuclear cluster with a Kramers degeneracy of energy levels did not occur, unlike some affirmations made in the specialty literature on the existence of this effect. Instead, it was shown that such instability was only possible in the presence of a constant homogeneous electric field.
- A new method of a virtual time reversal was proposed for testing the time-reversal symmetry. This method has been confirmed experimentally for two types of EPR spectra (with and without a hyperfine structure) recorded by a specific procedure using the modernized EPR spectrometer SE/X-2544.
- Chemical-catalytic method of TiO_2 nanotubular particles covered with metal layer (Cu), including the internal surface of nanotubes, was elaborated, in order to improve the catalytic properties of the material produced.
- A new chemical-catalytic method was elaborated for powder particles TiO_2 doping with metals to promote an increase in their catalytic activity. The process involves three main stages: 1) combined sensibilization-activation; 2) application of polymetal layers with the help of reducing agent; 3) treatment of the metal layer with the weak acid solution.
- Based on the electron-conformational method the toxicophore identification (TPH) and quantitative prediction of the toxicity of a series of fragrance allergens have been performed.
- Within the framework of the research topic of "Spectroscopy and molecular dynamics simulations of the conformation of biological macromolecules" were studied the conformation transitions that human lactoferin underwent as a result of Fe(III)-binding or release. Using small-angle neutron scattering and molecular dynamics simulations it was shown that the binding of Fe(III) ions to human lactoferrin depended on simultaneous binding of the synergistic anion CO_3^{2-}, which ensured the formation of a stable complex compound of diferric human lactoferrin.
- The concepts and fundamental laws of template synthesis of macrocyclic and supramolecular systems, including highly polynuclear clusters were elaborated. Of great importance were the developments in the theory and practice of the template synthesis of coordination compounds of transition metals with organic ligands of chelating and macrocyclic type,

amongst which compounds of practical utility were marked out.

- Original methods of the synthesis of coordination compounds of 3d metals with *α*-dioximes, carboxylic acids and Schiff bases, aldehydes, ketones, organic amines and other were developed, which led to the formation of complexes with novel structures, macrocyclic, supramolecular, excellent biological, catalytic and of inhibitory activities.
- The dual nature of some ligands was revealed, namely: coordination-addition of pyridine aldehydes in iron(II) dioximates and coordination cyclization of *β*-diketones in compounds of cobalt(III). On the cobalt(II) matrix, the synthesis of a 20-dentate macrocyclic ligand was performed, that coordinated 3 or 4 atoms of cobalt(II) with a highly porous structure, which can be used as a storage for small molecules of gases such as hydrogen, nitrogen and others.
- Coordination compounds with various useful properties: polynuclear compounds of Cr(III) as molecular magnets, catalysts of technological and biotechnological processes, macrocyclic colorants for plastics and synthetic fibers; new compounds for obtaining extra-pure metals, compounds for ion selective electrodes; agents for anticorrosive coating and protection of metals have been obtained. Using the obtained compounds the following preparations were created: *Trifenamid*, *Coditiaz*, *Cobamid*, *Compozit*, *Conimid*, *Compozit-plus*, *Fludisec*, *Polyel*, *Virinil*, *Galmet*, *Gajazot* and others, which can be used to develop new advanced technologies or to improve the existing ones in agriculture and microbiology.
- Investigations related to coordination compounds of biometals (Fe, Co, Mn, Cu, Zn, Ni) with *α*-dioximes, Schiff bases and carboxylic acids, including amino acids were performed. The electronic structures of iron(II) and (III) dioximates, of homo- and heteronuclear clusters containing iron were determined, allowing a more adequate interpretation of spectra of such compounds.
- Carboxy dysprosium cluster {[Dy(*α*−C_4H_3OCOO)(*μ*−(*α*−C_4H_3O $COO))_2(H_2O)_3$]}n exhibits a slow magnetic relaxation at 10 K; two Dy ions with different surroundings behave as single-ion magnets (SIM) with a different activation energy, U_{eff}= 80.5 K and 32.4 K. Continuous cooling allows to reach the quantum tunneling regime.
- Nanoparticles (NPs, d= 11±3 nm) of the iron-chromium oxide prepared by thermal decomposition of μ_3-oxo{$FeCr_2O$}acetate, in the presence of dodecylamine and oleic acid, used as stabilizing agents, and trichloroacetic acid used as a solvent had an advanced ordering, namely, a smectite crystal.
- By using Mössbauer spectroscopy and magnetism the nanoparticles of iron oxide in the form of nanofire were obtained and investigated. It has been demonstrated that at room temperature the Mössbauer spectrum exhibits an intense doublet and a low intensity sextet, and temperature decrease reveals the dependence of the doublet area and sextet on the temperature value. It has been clearly established, that in the temperature range 110-115 K, the area of the doublet and the sextet becomes equal and the blocking temperature has been estimated in the region where the two lines intersect (111 K).
- It has been demonstrated that the electrocatalytic testing of Ni complexes with bis(4-(*p*-methoxyphenyl) thiosemicarbazone)-2,4-butane gave the Faradeic yield at 70% and it was determined that one mole of complex catalysed the production of 9 moles of hydrogen (TON= 9). It has been found that Ni complexes with bis (4-(*p*-methoxyphenyl) thiosemicarbazone)-2,4-butane and Cu with 2-(2H-benzotriazol-2-yl)-4,6-phenol, possessed electrocatalytic properties exhibiting a TON= 18 and 6.5, respectively.
- Synthesis and multilateral study of porous transition metal coordination compounds based on mixture ligands and biphenyls containing carboxyl groups, and/or donor nitrogen atoms as potentials sorbents for small molecules were performed.
- The quantitative basis for the theory of buffering properties for multicomponent heterogeneous buffer systems has been developed. Mathematical equations were derived for estimating the quantitative buffering capacity towards mineral phase components. It has been established that the buffer capacities of the components were reciprocally proportional.
- Determination of toxic metals in water, soil, *etc.*, catalytic currents and adsorption phenomena of voltammetry species, the stripping adsorption polarography, the chemical and electrochemical activation of carbon fibre microelectrodes were used. Methods of analysis of trace metals in electronic materials and semiconductors were developed. Also, the behaviour of some organic polydentate and polyfunctional reagents of oxoacids, metalocrome indicators, triazine dyes, thiosemicarbazones in complex forming reactions is under study. The impact of these interactions on the selectivity and

sensitivity of the methods of electrochemical analysis of heavy metals was specified. Effective methods were developed for the analysis of such metals as Pb, Cu, Cd, Fe, Ni, Zn and Mo, in foodstuffs and the environment.

- The quanto-chemical computation of the system catalyst – activator – oxidant, was performed for the first time, which allowed a deeper understanding of the catalytic process mechanism.
- The investigation of two classes of natural organic compounds: alkaloids and terpenoids constituted the main orientation of research at the initial stage in chemistry of natural compounds. This chemical study has been performed on a large number of spontaneous and cultivated plants, as well as on wastes remaining on the processing of vegetal raw material, both of theoretic and practical value. Over 750 species of local plants were tested for alkaloids presence.
- Research related to the chemistry of terpenoids started with the study of compounds isolated from vegetal wastes, generated during the distillation of essential oils from clary sage, lavender, mint, *etc*. A quite accessible compound has been found – sclareol, a diol isolated from the sage *Salvia sclarea* L. The method of their isolation has been elaborated, and their derivatives have been obtained.
- Special attention was paid to the study of stereochemistry of a series of labdanic diterpenoids. The absolute configuration at the chiralic C_{13} centre was established for various diterpenoids: sclareol, labdanolic acid, manoyl oxides and their derivatives.
- A large number of oxidic odorants with tetrahydrofuranic and tetrahydropyranic decalinic and hydrindanic structures belonging to the norlabdanic series were synthesized.
- A new logico-structural and electron-topological theory was proposed revealing the dependence of amber odour on the structure of compounds. Subsequently, the same approach was used to explain the dependence of musk odour on the structure of compounds with this odour.
- On the basis of norambreinolide, a series of derivatives with rearranged carbonic skeleton were synthesized, several of which with a strong amber fragrance.
- The cleavage products of a series of accessible labdane diterpenoids have been investigated. Original methods for the preparation of a large number of drimanic sesquiterpenoids and norlabdanic derivatives have been elaborated. A group of drimanic diols and tetraols were prepared. Presently, the syntheses of nitrogen containing drimanes are performed.
- Systematic studies were performed in the field of terpene cyclizations with superacids. It was established that on superacidic treatment labdanic compounds give tricyclic isoagatanic diterpenes in high yields. Natural compounds of spongian series were synthesized. The reaction of superacidic cyclization of alcohols, their acetates, of acids and their esters of C_{10}-C_{25} series was studied and it was found that the reaction was chemo- and structural-selective and stereospecific and gave cyclic compounds in high yields. The same regularities of the superacidic cyclization reaction were observed in the case of homo- and bishomo- terpenic derivatives.
- New efficient methods for the synthesis of drimenoic and homofarnesoic acids have been elaborated. They have been coupled with amines of pirimidine, pirazine, 1,2,4-triazole and carbazole structures.
- Guanidinic derivatives of homofarnesenoic acid, as well as of 14,15-dinorabd-8(9)-en-13-amine have been synthesized for the first time. Evaluation of antiproliferative and cytotoxic activities of these compounds demonstrated that the investigated guanidines show a very high activity against MRC5 human pulmonary fibroplasts and colon adenocarcinoma cells.
- The coupling-heterocyclization reaction involving the hydrazide of 8α-hidroxi-11-homodrimanic acid and tetramethyltiurame disulfide was studied. The formation of two bioactive compounds has been achieved: homodrimanic oxadiazole and tiadiazole. Antimicrobial testing revealed that the synthesized oxadiazoles possessed significant antifungal and antibacterial activities against five fungal strains, as well as against gramm-negative and gramm-positive bacteria.
- New efficient free radical methods for the synthesis of a series of *ent*-kauranic derivatives have been elaborated and their cytotoxic activity has been investigated.
- Efficient synthetic methods have been elaborated for the synthesis of natural tetracyclic diterpenoids with *ent*-kauranic skeleton with functional groups in cycles C and D, including oxygenated and halogenated moieties. Their high anti-HIV and antitumor activity has been demonstrated.
- A new synthetic pathway has been reported to access nor-scalarnic sesterterpenoids functionalized at C_{12}. This method opened a new perspective for the synthesis of a whole sub-class

of natural bioactive scalaranic sesterterpenoids which are currently hardly available.

- The synthesis of functionalized diterpenoids of *ent*-isocopalic structure which showed selective antitumor activity has been performed.
- Advanced studies have been conducted on the elaboration of synthetic pathways towards a whole series of perhidrindanic and *ent*-halimanic compounds.
- In the field of organic synthesis, at the beginning, the investigations were oriented towards the synthesis of bioactive compounds for use in winemaking and veterinary, with antibacterial, antiviral, antifungal, antihelminthic aproperties.
- The synthesis and application of pheromones for plant protection against pests was developed. The isolation, characterization and synthesis of the following attractants have been accomplished: disparliur (forest pests *Porthetria dispar*), propiliur (white American butterfly *Hyphantria cunea*), ghipliur (queen-bee *Apis mellifera* L.).
- The synthesis and investigation of nitrogen-containing heterocycles were started. Investigations related to the compounds with preserving properties for fruits, juices, beer, essential oils, and animal food were carried out. For these purposes, the hydroxamic acids were studied, as well as quinoline derivatives and mixed anhydrides of several acids. Preservatives for rose petals and fish spawn were proposed. An active preservative for refreshing drinks - *JUGLONE* was proposed. Studies in the field of indole derivatives, isatine and quinoline were carried out.
- A new synthetic method and technology for obtaining of the systemic fungicide Tilt (*PROPICONAZOL*) were developed, including synthesis of its structural components: 2,4-dichloroacetophenones, 1,2-pentandiol and 1,2,4-triazol, and alkylation reaction of 1,2,4-triazoles.
- New catalysts (metal-containing and metal-free) for asymmetric synthesis and mechanistic investigations of reactions that proceed with high levels of regio- and stereoselectivity were obtained.
- For the first time, it was demonstrated that using one-pot reaction it is possible to transform available chalcones to very stable pyrazolines with a high yield. It was shown that derivatives of acetophenones with pyrazoline and oxindole fragments possess antidepressant activity. Based on hydrazides of benzoic and salicylic acids, the synthesis of 5-aryl-2-thio-1,3,4-oxadiazoles was performed with several of the synthesized compounds showing high anti-tuberculosis activity.
- The syntheses of the natural antifeedant cryptomerlone and monoterpene carvone were elaborated for the first time. It has been found that an effective method for the preparation of common precursor of above compounds is the electrochemical anode oxidation of α-pinene. It was found that chiral chlorohydrins or quinolines may be selectively obtained from the pinonic acid.
- A number of heterocyclic derivatives of 2,2-dimethylcyclobutane, some of which possess the anti-HIV-1 activity were synthesized.
- General methods for stereoselective synthesis of optically active biologically active pyretroids and clerodane compounds and their precursors were developed from (+)-3-carene and of (-)- and (+)-carvones.
- A new method for the preparation of clerodane polyfunctional diterpenoids was developed. Stereoselective syntheses of natural biologically active diterpenoids – antifeedants Lupuline C and (-)-dihydroclerodine from (-)-R-carvone were performed. It was found that the nanosized catalytic system (~5-6 nm of γ-Fe_2O_3/CuO) works as an efficient organic phase catalyst (~0.02 mol%) in the one-pot three components Biginelli synthesis. Previously unknown *P**-mono, *P*,N*- and *P*,N**-bidentate phosphite ligands based on carenes and pinenes were found to be successful ligands for the Pd-catalysed allylation of 1,3-diphenylallyl acetate with $(Pr)_2NH$, $(CH_2)_4NH$, $PhCH_2NH_2$, $CH_2(CO_2Me)_2$ and 4-Me-$C_6H_4SO_2Na$. The enantioselectivity reached 99% *ee*, being the best result among all known optically active phosphites.
- In the framework of the investigation of the mineral resources of the Republic of Moldova mineral adsorbents (bentonites, illites, *etc*.) were applied in wastewater purification technology from the production of dairy and meat products, also to purify the mash obtained when producing cognac, to clarify (refining) sunflower oil. Extensive studies were performed in order to improve sorptional and catalytic properties of bentonites, resulting in the elucidation of changes in the crystal lattice of montmorillonite, changes in surface chemistry, and cation exchange capacity.
- The synthesis of a new class of adsorbents from clay minerals (pillared clays) has been performed. Pillared clays (PILCs) have larger pores compared with ordinary zeolites. Such

materials have been obtained by pillaring of clay minerals, particularly montmorillonite, with oligomeric species by hydrolysis of polyvalent cations, especially of aluminium ions. They are characterized by a high thermal stability and large surface area.

- The influence of surface chemistry of PILCs obtained from Ascangel montmorillonite (Georgia) and Larguta bentonite (R. Moldova) in catalytic processes was evaluated. The tests carried out show that intercalated adsorbents obtained from Larguta bentonite (R. Moldova) have real prospects for use in practice as solid acid catalysts for organic synthesis and for the production of biofuel from vegetable oils.
- The quality of water from the main water resources of the Republic of Moldova (Danube, Dniester, Prut, Raut, Bic Rivers, Dubasari, Costesti-Stanca, Cuciurgan, Ghidighici, Taraclia, Ialpug, Cahul reservoirs, *etc*.) was investigated. Research results allowed to elucidate the processes and mechanisms of interaction between chemical components in water systems, depending on various factors, such as temperature, reaction medium, dissolved oxygen concentration, anthropogenic pressing, turbidity, water flow velocity, ionic strength, *etc*. The processes and mechanisms of immobilization, migration and transformation of heavy metals, organic and inorganic nitrogen and phosphorus compounds in water - particulate materials - bottom sediments in the main water bodies of the R. Moldova were also studied.
- With the purpose to improve the wastewater treatment technologies, the composition of wastewaters from the main economic units of Republic of Moldova has been studied. The processes and mechanisms of coagulation, decanting, flotation, oxidation, adsorption of organic and inorganic pollutants detected in wastewater on carbonaceous and mineral adsorbents were investigated. The obtained results were used to develop technologies for purifying wastewater from the food industry and textile enterprises. The most relevant achievements in this area are represented by the technologies that are developed and implemented at Wine and Brandies Factory from the Balti city, which contribute to purifying the wastewater after wine distillation. Application of this technology allows to obtain tartaric acid and also to apply sediments formed by sedimentation of the mineral adsorbents for building materials.
- Wastes from the limestone mines near the municipality of Chisinau are a matter of concern to the scientists of the institute. Research that was carried out have resulted in the development and patenting of five compositions of building materials on the basis of limestone as the main component. The obtained building materials are cheaper and their quality is comparable to that of the imported products.
- Another technology that was developed and applied into practice is the treatment of wastewater from the dyeing processes in textile factories. The purified wastewater can be returned in the technological process being economically advantageous.
- The procedures to improve drinking water quality, *i.e.* replacement of the chlorination process by the ozonation and the process of adsorption of POPs traces, based on activated carbons obtained from fruit stones and nut shells were evaluated. Use of the activated carbons allowed obtaining high-quality drinking water.
- Technologies for the purification of groundwater containing hydrogen sulphide and sulphides have been developed. A broad spectrum of modified carbonaceous and mineral adsorbents (modified with Fe, Cu, Mn, *etc*.) has been tested for removal of sulphide ions from water. Comparative analysis of adsorbents highlights the performance of carbonaceous adsorbents obtained by impregnation with copper (II) ions and mineral adsorbents modified with manganese ions, being recommended for practical purposes to remove hydrogen sulphide from natural waters. Using the copper modified carbonaceous adsorbents allows oxidizing sulphide ions to thiosulphate ions, sulphite and sulphate, avoiding the formation of colloidal sulphur. Field tests of copper impregnated carbonaceous adsorbents for removal of hydrogen sulphide from underground waters have been performed in town Hincesti (R. Moldova). The results showed that the recommended process ensures 100% efficiency for the removal of hydrogen sulphide from underground water.
- Technological processes for removing of iron, manganese, strontium ions, ammonia, *etc*. (having concentrations often exceeding the permissible limits) have been developed and patented. Field tests of the technological processes for their removal have been performed in village Sculeni, district Ungheni, R. Moldova. Ecological and health expertise confirms that the proposed technology is efficient and the treated water meets the ecological and sanitary norms regarding the quality of drinking water.
- In the framework of the development of the technologies for obtaining the activated carbons from fruit stones, grape seeds and nut

shells, investigations have resulted in the development and patenting of procedures to obtain the activated carbons by physicochemical, chemical and mixed activation methods. Analyses have shown that quality indices of autochthonous activated carbons are comparable with those of commercial ones. Testing of autochthonous activated carbons for treatment of water and wastewater, and for detoxification of the human organism demonstrated that local activated carbons are appropriate for solving current problems, namely for protection of the environment and human health.

- Microbiological, pharmacological, and toxicological research, have shown that the Enoxil preparation is not toxic and exhibit pronounced antifungal and antibacterial properties. On the basis of Enoxil, new pharmaceutical preparations *Enoxil-M* and *Enoxil-A* were developed and tested under clinical and field conditions. Field testing showed that *Enoxil-A* preparation enhanced agricultural crops resistance. Clinical testing of the pharmaceutical preparation *Enoxil-M*, produced by the local company "Farmaco" LTD, has shown its beneficial activity in the treatment of diseases caused by fungi and bacteria, in particular, in healing of wounds caused by thermal and surgical injury.
- Experimental batches of compositions (creams, ointments, gels) based on usage of the Enoxil were prepared and tested under clinical conditions.
- Laboratory analysis of industrial waste stocks and obsolete chemicals, accumulated historically at industrial enterprises has been done. Agricultural soil and groundwater were studied with the purpose of toxic substances determination and risk assessment. The methodology for environmental and population health risk assessment has been proposed, including the impact of human activities and hazardous geological processes (erosion and landslides).
- The geological conditions of the storage of radioactive substances in the Chisinau municipality were evaluated. The conceptual model of risk estimation for the given lot was developed with the slope stability calculation and taking into account various scenarios of climate change. Migration of toxic substances into the environment has been investigated on the basis of specific pollution sources.
- Groundwater characterization and quality assessment has been performed within the management of aquatic resources in accordance with the requirements of the EU Water Framework Directive.
- The analysis of the results of the chemical composition of natural waters (from Republic of Moldova) reveal that in 70% of the cases, the studied water collected from different wells did not meet the requirements for drinking water quality on one or more parameters. The groundwater had an increased content of ammonia and ammonium ions, hydrogen sulphide and sulphide ions, sodium ions, iron, manganese, increased oxidation values, as well as increased calcium and magnesium levels.
- Advanced methods have been developed for the determination of chlorine, sulphate and nitrate ions in coloured waters to solve problems related to the monitoring of the quality of the waters.

All scientific results with potential application are protected by patents and appreciated with medals at national and international exhibitions of inventions: VDNKh in MSSR and USSR; State Agency on Intellectual property, INFO INVENT (AGEPI, R. Moldova); "EUREKA" (Brussels, Belgium); INVENTIONS (Geneva, Switzerland); INVENTICA, PRO INVENT EUROINVENT INVENT INVEST (Bucharest, Iasi, Cluj Napoca, Timisoara Romania); International Invention Show „40 INOVA", „TESLA Fest" (Osijek, Karlovac, Novi Cad, Croatia); „IVIS 2016" (Warsaw, Poland); 10th International Exhibition of Inventions & 3rd World Invention and Innovation Forum (China) *etc*.

Among the most recent innovations that have been implemented into the national economy or are proposed for implementation we can mention (http://chem.asm.md/):

- ***Aromatizers (flavour compositions) and sauces for the tobacco industry*** which allow the production of high quality tobacco products with an intense aroma of high-quality tobacco, fine and pleasant taste. Their composition is almost identical to the composition of the compounds extracted from tobacco. The process of production of aromatizers utilizes local raw material – wastes obtained after treatment of ethero-oileaginous plants and other natural local products. Flavours compositions have been implemented at the Tobacco Plant (SA Tutun-CTC, Chisinau, R. Moldova).
- ***New materials for buildings surfaces plastering***, on the basis of local raw material (gypsum, lime, limestone flour and other three micro-constituents) were implemented at SA Monolit (R. Moldova).

- ***The technology for the production of activated carbons*** from local raw material (wood, nut shells, peaches, plums and apricots stones) is implemented at LTD Ecosorbent (Stefan Voda, R. Moldova).
- ***The ecological technology for the recycling of plastic wastes*** (integral processing of plastic wastes by mechanochemical processes, with the obtaining of new products) was implemented at LTD UISPAC (Chisinau, R. Moldova).
- ***The technology of using waste in the glass processing industry*** consists in the use of the sediment formed after the neutralization of glass glazing waste and was implemented at LTD Luxochim (R. Moldova).
- ***The technological process for glaucine isolation*** from the medicinal plant *Glaucium Flavium Grantz* was implemented at LTD Labormed (R. Moldova).
- ***The technology for the production of pressed bricks*** based on Portland cement and local mineral materials has been implemented at LTD Odgon (Basarabeasca, R. Moldova).
- ***The technology of organic sludge processing*** in an ecological product for agriculture has been implemented at SA Apa Canal (Chisinau, R. Moldova).
- ***The technology for the treatment/potabilization of groundwater*** has been implemented at Bakery Factory (Tiraspol, R. Moldova).
- ***Underground water treatment technologies*** for the removal of iron ions, bivalent manganese, humic substances, hydrogen sulphide and sulphides were tested in field conditions at Sculeni (Ungheni, R. Moldova) and Hincesti (R. Moldova).
- ***Catalysts for the solidification of epoxydic resins***, on the basis of polynuclear compounds of chromium, which allow obtaining dielectric materials with optimal parameters for the microelectronics, have been implemented at Moldavizolit Factory (Tiraspol, R. Moldova).
- ***Catalysts for the coloring of cotton fabrics by the bathing method***; catalysts based on coordinate compounds allow to save energy and to obtain the materials with more intense, stable colors. Catalysts were implemented at Tiraspol Textile Factory – LTD Tira-Tex (Tiraspol, R. Moldova), as well as at Textile Factories abroad: Moscow, Ivanovo, Kalinin (now Tver) and Yartsevo (Russian Federation), Ternopol (now Ternopil, Ukraine).
- ***The selective catalyst for obtaining Juglone***, has allowed the development of a simplified, non-polluting and less costly technology. The method was implemented at the Biochemical Plant (Ungheni, R. Moldova), and can be applied for the preparation of antiseptic drugs (*Nucina* and others).

- ***Juglone*** has been proposed as an active preservative for soft drinks and has been introduced into the production cycle at Ostankino Brewery (Moscow, Russian Federation).
- ***Catalysts - stabilizers for polyurethane compositions***. The proposed substances *KDMF-1* and *KDFF-9* in the polyurethane compositions simultaneously perform the function of catalyst and stabilizer, do not carry a pronounced selective character while at the same time improve the qualities of the polyurethanic composition, the viability of the composition, its physical-mechanical and adhesion characteristics, raise the resistance of the composition against thermooxidative destruction. The preparation is of interest to the chemical industry of the Russian Federation, Romania, Ukraine, *etc*.
- ***The preparation Enoxil-A*** can be used to increase plants resistance against root rot and gray rot, was tested in field conditions on experimental grounds at Research Institute for Field Cultures "Selection" and of the National Institute for Viticulture and Wine-making.
- ***The preparation Enoxil-M*** for the treatment against bacteria and fungi in the process of regeneration of thermal, physical and chemical wounds, in the treatment of postoperative wounds. On the basis of the preparation *Enoxil-M* were obtained medicinal products produced at SA Farmaco and were tested in four Republican clinics in Chisinau (the Dermato-venerological Dispensary, the Oncological Institute, the Republican Children's Hospital E. Cotaga, the Republican Thermal Damage Center) (R. Moldova).
- ***Dental preparations Fenglicol and Fencarin***, obtained from fennel with ingredients such as eucalyptus oil, glycerin *etc*. The preparations are useful in treating gingivitis, periodontitis, and other inflammation affections of the oral cavity. *Fenglicol and Fencarin* have passed the preclinical tests at the Laboratory of Preclinical and Clinical Evaluation of Medicines of the Medical Center and Faculty of Stomatology of the SUMF "Nicolae Testemitanu" (Republic of Moldova).
- ***The preparation Salvit-1*** - can be used for treatment of affections related to the locomotor system and to the peripheral bone system (radiculitis, osteochondrosis etc.). Salvit-1 represents a vegetal mass of *Salvia*, processed according to a certain technology, and can be attributed to ecologically pure medicinal preparations. *Salvit-1* has passed the preclinical tests at the Laboratory of Preclinical and Clinical Evaluation of Medicines of the Medical Center, of the SUMF "Nicolae Testemitanu" and Tiraspol Clinical Hospital (Republic of Moldova).
- ***The preparation Mobipan*** – antihypertensive agent developed for treatment of cardiovascular diseases that has passed the preclinical tests at the Laboratory of Preclinical and Clinical Evaluation of Medicines of the Medical Center of the SUMF "Nicolae Testemitanu" (Republic of Moldova).
- ***New compounds of natural and synthetic origin with antituberculosis properties,*** derivatives of chalcone, triazole, oxodiazole and *β*-carbolines have passed the preclinical tests at the Laboratory of Preclinical and Clinical Evaluation of Medicines of the Medical Center of the SUMF "Nicolae Testemitanu" and the Laboratory of Microbiology and Morphology of the Institute of Phthisiopneumology (Republic of Moldova), Department of Pharmaceutical Chemistry, Aristotle University of Thessaloniki (Greece), Liverpool John Moores University, (Liverpool, UK), Institute of Biomedical Chemistry, Russian Academy of Medicinal Science (Moscow, Russia), Institute of Pharmacology, Russian Academy of Medicinal Science, (Moscow, Russia), Southern Research Institute (Birmingham, AL, USA), "Carol Davila" University of Medicine and Pharmacy, Pharmacology and Clinical Pharmacy Department (Bucharest, Romania). Pharmaceutical forms for these compounds have been developed; the acute and chronic toxicity and bioavailability were tested.
- ***The preparation Gajazot*** with antichlorosis properties for vines. The 0.3% solution of this compound exhibits antichlorosis properties in vines and fruit-trees. Treatment of vineyards, affected by chlorosis, with this preparation completely restores their production potential.
- ***The preparation Virinil*** – growth stimulator for vine grafting, roses and strawberries rooting. *Virinil* significantly increases the outcome of the grafted slips. The preparation *Virinil* has been implemented at SA Codru Nord (Balti, R. Moldova).
- ***The preparations Coditiaz, Cobamid, Compozit, Conimid, Trifenamid*** with growth stimulator properties and growth of crop plants.
- ***The preparations Trifeden and Difecoden*** – stimulators and regulators of growth, development and productivity of corn.
- ***The preparation Propiconazol* (*Tilt*)** with antifungal properties, which can be used against various fungal affections of cereals. A new technology has been developed for its production,

including synthesis of its structural components: 2,4-dichloroacetophenones, 1,2-pentandiol and 1,2,4-triazol, and alkylation reaction of 1,2,4-triazoles.

- ***The preparation Decametrine*** with anti-insecticide properties, which can be used for the protection of agricultural plants and animals against insects.
- ***The preparation Codiclogu,*** new anti-coccidiosis preparation practically completely destroys coccidia in rabbits. It can be used for the prophylaxis and treatment of animals against intestinal intercellular parasites.
- ***The preparation Codimez,*** exhibits major therapeutic activity in pesticide-poisoned animals. This kind of preparations are not known.
- ***The preparation Chetizal*** - a psychotropic synthetic preparation from the group of antidepressants.
- ***The new preparation Setremed*** with anticancer properties is effective against cervical tumors (CCU-5, 80-90%), B-15 melanoma (80%), Luis lung tumor (70-80%) and others. The preparation *Setremed* has synergic effect on joint administration with sarcolicin, cisplatin (DDP) and local irradiation. The preparation has successfully passed the first phase of clinical testing in oncological centers in the Republic of Moldova and the Russian Federation and was proposed for the second phase of clinical testing in the Oncological Institute of the Republic of Moldova.

Scientific results were summarized in over 120 books, monographs and chapters, published by national and international publishers (*e.g.* Stiinta, Publishing house of ASM, Khimia, Springer Science-Business media B.V., John Wiley & Sons, Springer International Publishing, Palmarium Academic publishing, Publishing house of Romanian Academy, Springer Nature Switzerland, Atta-ur-Rahman, Elsevier, Wiley VCH, N.Y., Nova Science Publishers, INC, N.Y. *etc.*); the list for the 50 years is presented on the institute web page (http://chem.asm.md/) [1]; the list for the last 10 years is presented below.

Books, monographs, chapters

- Bersuker I. *Electronic Structure and Properties of Transition Metal Compounds. Introduction to the Theory.* John Wiley & Sons, 2009, 760 p.
- Duca Gh. *Contributions to knowledge society.* Chisinau, Publ. "Stiinta", 2009, 280 p.
- Aricu A. Ed. *Academician Pavel Vlad - an illustrious scientist and tenacious promoter of science.* Chisinau, Publishing house of ASM, 2009, 345 p. (in Romanian). *(Academicianul Pavel Vlad - savant ilustru şi promotor tenace al ştiinţei.* Chişinău, Tipografia AŞM, 2009, 345 p.)
- Purice I.; Cazac T.; Caşcaval I. *Chemistry of public foods products.* Chisinau, MOLDCOOP, 2009, 136 p. (Purice I., Cazac T.; Caşcaval I. *Chimia produselor alimentaţiei publice.* Chişinău, MOLDCOOP, 2009, 136 p.)
- Lupascu T.; Duca Gh.; Lupascu G. *Enoxil - ecological preparation for plant protection.* Chisinau, Publishing house of ASM, 2010, 144 p. ISBN 978-9975-62-274-5. (in Romanian). (Lupaşcu Tudor; Duca Gheorghe; Lupaşcu Galina. *Enoxil - preparat ecologic pentru protecţia plantelor.* Chişinău, Tipografia AŞM, 2010, 144 p. ISBN 978-9975-62-274-5)
- Aricu A. Ed. *Researcher and prestigious manager: Professor Tudor Lupascu at the 60 years.* Homage volume. Chisinau, Publishing house of AŞM, 2010, 296 p. (in Romanian). (Red. şt. dr. A. Arîcu. *Cercetător şi manager de prestigiu: profesorul Tudor Lupaşcu la 60 de ani.* Volum omagial. Chişinău,Tipografia AŞM, 2010, 296 p. ISBN 978-9975-9690-4-8)
- Lupascu T. Ed. *Professor Constantin Turta. The path of knowledge and scientific results.* Chisinau, Publishing house of ASM, 2010, 328 p. ISBN 978-9975-62-277-6. (in Romanian). (Coordonator: dr. hab., prof. Lupaşcu Tudor. *Profesorul Constantin Turtă. Drumul cunoştinţelor şi rezultatelor ştiinţifice.* Chişinău, Tipografia AŞM, 2010, 328 p. ISBN 978-9975-62-277-6.)
- Geru I. Ed. *Transactions on metrology and analytical methods of research.* Chisinau, Publishing house of AŞM, 2010, 283 p. ISBN 978-9975-62-276-9.
- Lupascu T.; Duca Gh.; Goncear V. *Enoxil – ecological preparation for human health.* Chisinau, Publishing house of ASM, 2011, 256 p. ISBN 978-9975-62-304-9. (in Romanian). (Lupaşcu Tudor; Duca Gheorghe; Goncear Veaceslav. *Enoxil – preparat ecologic pentru sănatatea omului.* Chişinău, Tipografia AŞM, 2011, 256 p. ISBN 978-9975-62-304-9)
- Shofransky Z.; Shofransky V. *Traditional Romanian chromatics. Technology, ways of acquiring and functionality of natural dyes in Carpatho-Danubian-Pontic space.* Bucuresti: Etnologic Publishing house, 2012, 454 p. ISBN 978-9738920-37-8. (in Romanian). (Şofransky Zinaida; Şofransky Valentin. *Cromatica tradiţională românească. Tehnologia, modalităţile de dobîndire şi funcţionalitate a coloranţilor naturali în spaţiul carpato-danubiano-pontic.* Red. şt.: dr. hab. în istorie

V. Dergaciov, dr. hab. în chimie T. Lupaşcu. Bucureşti, Editura Etnologică, 2012, 454 p.)

- Geru I.; Shter D. *Resonance Effects of Excitons and Electrons. Basics and Applications.* Eds. SPRINGER Science-Business media B.V. 2013, 283 p. DOI: 10.1007/978-3-642-35807-4
- Simeonov L.; Macaev F.; Simeonova, B. *Environmental Security Assessment and Management of Obsolete Pesticides in Southeast Europe.* Eds. SPRINGER Science-Business media B.V. 2013, 475 p. ISBN 978-94-007-6460-6. DOI: 10.1007/978-94-007-6461-3
- Geru I. *Highlights on time axis.* Chisinau, Publishing house of ASM, 2013, 276 p. ISBN 978-9975-62-335-3. (in Romanian). (Geru Ion. *Repere pe axa timpului.* Chişinău, Tipografia AŞM, 2013, 276 p. ISBN 978-9975-62-335-3)
- Duca Gh. *Management of Water Quality in Moldova.* Ed. Duca Gh. Springer International Publishing, Switzerland, 2014, Series: Water Science and Technology Library, 241 p. DOI: 10.1007/978-3-319-02708-1
- Povar I.; Spinu, O. *Thermodynamics of complex chemical equilibria in multicomponent heterogeneous systems.* Chisinau, Publishing house of AŞM, 2014, 452 p. (in Romanian). (Povar I.; Spînu, O. *Termodinamica echilibrelor chimice complexe în sisteme eterogene multicomponente.* Chişinău, Tipografia AŞM, 2014, 452 p. ISBN 978-9975-62-382-7)
- Povar I.; Lupascu T.; Leah T.; Andries S.; Filipciuc V. *Natural and anthropogenic factors influencing the quality of soils and water resources of the Republic of Moldova.* Chisinau, Publishing house of ASM, 2014, 268 p. (in Russian). (Повар И.; Лупашку Т.; Лях Т.; Андриеш С.; Филипчук В. *Природные и антропогенные факторы воздействия на качество почв и водных ресурсов Республики Молдова.* Кишинэу, Типография АН Молдовы, 2014, 268 с. ISBN 978-9975-62-383-4.)
- Batir D. *Message to light: Miniencyclopedia or the values of chemistry and humanity.* Chisinau, Publishing house of ASM, 2014, 356 p. (in Romanian). (Batîr D. *Solie către lumină: Minienciclopedie sau despre valorile chimiei şi ale omeniei.* Chişinău, Tipografia AŞM, 2014, 356 p. ISBN 978-9975-62-000-0)
- Vlad P.F.; Macaev F.Z. *Introductory course on the stereochemistry of organic compounds.* Chisinau, Publishing house of ASM, 2014, 200 p. (in Russian). (Влад П.Ф.; Макаев Ф.З. *Вводный курс по стереохимии органических соединений.* Кишинэу, Типография АН Молдовы, 2014, 200 с. ISBN 978-9975-62-360-5)
- Vlad P.F.; Macaev F.Z.; Arîcu A.N. *Introductory course on the stereochemistry of organic compounds.* Chisinau, Publishing house of ASM, 2014, 200 p. (in Romanian). (Vlad P.F.; Macaev F.Z.; Arîcu A.N. *Curs întroductiv al stereochimiei compuşilor organici.* Chişinău, Tipografia AŞM, 2014, 200 p. ISBN 978-9975-62-360-5)
- Macaev F.Z.; Junghietu G.I. *Chemistry of drugs.* Palmarium Academic publishing, Saarbrűcken, Deutscland. 2015, 585 p. (in Russian). (Макаев Ф.З.; Жунгиету Г.И. *Химия лекарственных средств.* Palmarium Academic publishing, Saarbrűcken, Deutscland. 2015, 585 с. ISBN 978-3-659-60059-3)
- Filip G.; Ciocarlan A. *Practical work on organic chemistry.* Part I. Chisinau, UST, 2015, 80 p. (in Romanian). (Filip G.; Ciocârlan A. *Lucrări practice la chimia organică.* Partea I. Chişinău, UnST, 2015, 80 p.)
- Filip G.; Ciocarlan A. *Practical work on organic chemistry.* Part II. Chisinau, UST, 2016, 80 p. (in Romanian). (Filip G.; Ciocârlan A. *Lucrări practice la chimia organică.* Partea II, Chisinau, UnST, 2016, 80 p.)
- Covaliov V.; Duca Gh.; Covaliova O. *Green energy: innovative ecobiotechnology and combined reactors. Anthology of inventions.* Chisinau, CEP USM, 2017, 504 p. (in Russian). (Ковалев В.; Дука Г.; Ковалева О. *Зеленая энергия: инновационные экобиотехнологии и комбинированные реакторы. Антология изобретений.* Кишинэу, CEP USM, 2017, 504 с. ISBN 978-9975-71-902-5.0)
- Dragancea D. *Supramolecular chemistry. Lesson course, master.* Chisinau, 2018, 75 p. (in Romanian). (Dragancea Diana. *Chimie supramoleculară. Curs de lecţii, masterat.* Chişinău, 2018, 75 p.)
- Duca Gh.; Macaev F. *Compounds and materials for drug development and biomedical applications.* Bucureşti, Publishing house of Romanian Academy, "Istros a Muzeului Brailei "Carol I", 2018, 307 p.
- Geru I.I. *Time-Reversal Symmetry. Seven Time-Reversal Operators for Spin Containing Systems. Tracts in Modern Physiscs.* Springer, Vol. 281, Springer, 2018, 362 p. DOI: 10.1007/978-3-030-01210-6
- Duca Gh.; Lupascu T.; Nicolau E.; Culighin E. *Ecological and environmental chemistry.* Chisinau, Publishing house "Biotehdesign", 2018, 250 p. (in Romanian). (Duca Gh.; Lupaşcu T.; Nicolau E.; Culighin E. *Chimia ecologică şi a mediului.* Chişinău, Tipografia "Biotehdesign", 2018, 250 p.)

- Duca Gh.; Nicolau E. *Ecological water chemistry. Standards and quality indicators.* Chisinau, Publishing house "Biotehdesign", 2018, 75 p. (in Romanian). (Duca Gh.; Nicolau E. *Chimia ecologică a apei. Standarde şi indicatori de calitate.* Chişinău, Tipografia "Biotehdesign", 2018, 75 p. ISBN 978-9975-108-58-4)
- Lupascu T.; Nastas R. *Synthesis, studying of porous structure, sorption properties and using of new active carbons obtained from vegetal raw.* In book: Adsorption, adsorbents and sorption processes of nano-porous materials. Moscow: Granita, 2011, p. 425-446. ISBN 978-5-94691-460-4. (in Russian) (Лупашку Т.Г., Настас Р.И. Синтез, исследование пористой структуры, адсорбционных свойств и применение новых косточковых активных углей. В книге: Адсорбция, адсорбенты и адсорбционные процессы в нанопористых материалах. Москва: Граница, 2011. с. 425-446. ISBN 978-5-94691-460-4)
- Lupascu T.; Duca Gh. *Obtaining of medicinal and agricultural preparations based on active bioligical active Enoxil synthesized from enotanins.* In: "Secondary winemaking products". Chisinau, Publishing house "Stiinta", 2011, pp.171-234. (in Romanian). (Lupaşcu T.; Duca Gh. *Obţinerea preparatelor medicamentoase şi agricole in baza substanţei bioligic active Enoxil sintetizat din enotaninuri.* În: "Produse vinicole secundare". Chişinău, ÎEP "Ştiinţa", 2011, pp. 171-234.)
- Cadocinicov O.; Petuhov O. *Possible Use of Certain Mineral Raw Materials of Moldova for DDTs and HCHs Adsorption from Aqueous Solutions.* In: "Environmental Security Assessment and Management of Obsolete Pesticides in Southeast Europe". Springer, 2013. pp. 311-321. DOI: https://doi.org/10.1007/978-94-007-6461-3_29
- Macaev F. *Bioactive natural products from enantiomeric carvones.* In: "Studies in Natural Products Chemistry". Ed. Atta-ur-Rahman, ELSEVIER, Amsterdam, 2013, vol. 39, pp. 233-269. DOI: https://doi.org/10.1016/B978-0-444-62615-8.00007-2
- Palii S.; Indricean C.; Revenco M. *Mass Spectrometry of Metal-Phenolate Moiety-Containing Complexes and their Derivatives.* In: The Chemistry of Metal Phenolates. Wiley VCH, N.Y., 2014, pp. 220-262. ISBN 978-0-470-97358-5.
- Lupaşcu T.; Nastas R.; Rusu V. *Treatment of Sulfurous Waters Using Activated Carbons.* In: "Management of Water Quality in Moldova". Editor Gheorghe Duca, Springer International Publishing, Switzerland, 2014. Series: Water Science and Technology Library, vol. 69, pp. 209-224. ISSN 0921-092X, ISBN 928-3-319-02707-4. DOI: https://doi.org/10.1007/978-3-319-02708-1_11
- Turta C.; Duca G.; Marin I.; Sirbu D. *Electrochemical Solar Cells Based on Pigments*. In: "Management of Water Quality in Moldova". Editor Gheorghe Duca, SPRINGER International Publishing, Switzerland, 2014. Series: Water Science and Technology Library, 2014, volume 69, pp. 35-60. ISBN 928-3-319-02707-4. DOI: https://doi.org/10.1007/978-3-319-02708-1_3
- Geru I.I. *Water Structure, Quantum Nature of Hydrogen Bonds and Diffusion of Water Molecules in Chloride Aqueous Solutions.* In: "Management of Water Quality in Moldova". Ed. by Gheorghe Duca, SPRINGER, Series: Water Science and Technology Library, 2014, volume 69, pp. 21-34. ISBN 928-3-319-02707-4. DOI: https://doi.org/10.1007/978-3-319-02708-1_2
- Lupascu T.; Mitina T.; Grigoras D. *Methods of determination of microelements in biological objects.* In: "Microelements in the biosphere objects of the Republic of Moldova and application in agriculture and medicine". Chisinau, 2016, p. 240-253. (in Romanian). (Lupaşcu T.; Mitina T.; Grigoraş D. *Metodele de determinare a microelementelor in obiectele biologice.* În: "Microelementele în obiectele biosferei Republicii Moldova şi aplicarea în agricultură şi medicină". Chişinău, 2016, pp. 240-253.)
- Ungur N.; Aricu A.; Grinco M. *Occurrence, Biological Activity and Synthesis of Diterpenoid Amides.* In: "Diterpenoids. Types, functions and research". Brandon Jones Ed., Nova Science Publishers, INC, New York, 2017, pp. 1-3. ISBN: 978-1-53610-671-8.
- Kozakevych R.; Bolbukh Y.; Lupascu L.; Lupascu T.; Tertykh V. *Polymeric Composite Films with Controlled Release of Natural Antioxidant Enoxil.* In: "Nanochemistry, Biotechnology, Nanomaterials, and Their Applications". Eds. Fesenko O.; Yatsenko L. Springer International Publishing AG, part of Springer Nature, 2018, Springer Proceedings in Physics 214, pp. 149-164. DOI: https://doi.org/10.1007/978-3-319-92567-7_9

The Institute of Chemistry organizes a series of international conferences. The most important are: the Ist (1962) to the XVIIIth International Conference on *"Physical Methods in Coordination and Supramolecular Chemistry"* that takes place every 3 years, the International

Conferences of the Chemical Society of the Republic of Moldova *„Achievements and perspectives of modern chemistry”* that are forums for researches to present and discuss recent results and innovations in chemical sciences (http://chem.asm.md/).

In 2006, at initiative of acad. Duca Gheorghe the Institute of Chemistry launched the publication of the peer-reviewed (open access) scientific journal ***CHEMISTRY JOURNAL OF MOLDOVA. General, Industrial and Ecological Chemistry*** (ChemJMold), that publishes articles in all fields of chemistry (http://www.cjm.asm.md/).

Over the course of several years the researchers of the Institute of Chemistry carried out scientific researches on the basis of collaboration agreements with various international scientific centres, which allowed for mutual visits with the purpose of participating in various scientific events, exhibitions, salons and conducting scientific researches in the fields of common interest, also, preparation of scientific projects and grants (INTAS, NATO, SCOPES, CRDF-MRDA, joint research projects: ASM-Russian Foundation for Fundamental Research; ASM-Belarusian Republican Foundation for Fundamental Research; ASM-Federal Ministry of Education of Germany; ASM-National Authority for Scientific Research and Innovation from Romania; STCU-ASM, FP-7, Horizon 2020) [1].

Over the years, the Institute of Chemistry performed joint research with numerous institutions, among which the following should be mentioned:

Romania: „Politehnica” University, Bucharest; National Institute of Materials Physics, Bucharest; Institute ECOIND, Bucharest; „C.D. Nenitescu” Institute of Organic Chemistry of the Romanian Academy, Bucharest; „G. Murgulescu” Institute of Physical Chemistry of the Romanian Academy, Bucharest; “P. Poni” Institute of Macromolecular Chemistry of the Romanian Academy, Iasi; „A.I. Cuza” University, Iasi; „Gh. Asachi” University, Iasi; National Institute for Marine Research and Development „Grigore Antipa” (NIMRD); *etc*.

United Kingdom: University of Brighton, Brighton; Newcastle University;

Greece: National Technical University of Athens; Aristotelio Panepistimio Thessalonikis;

Hungary: Budapesti Muszaki Es Gazdasagtudomanyi Egyetem, Budapest;

Russia: Institute of Physical Chemistry and Electrochemistry of the AS of Russian Federation; the Association of Science and Production „Neorganica”, Electrostali, Moscow region; Institute of Technical Physics, Kazani; Joint Institute for Nuclear Research, Dubna; *etc*.

USA: Department of Chemistry and Biochemistry, University of Texas at Austin; Centre for Marine Sciences (CMS), University of North Carolina at Wilmington;

France: Laboratory of synthesis and study of systems of biological interest and Laboratory of molecular and macromolecular photochemistry, University Blaise Pascal, Aubiere Cedex; University Aix-Marsellie, France; Institute Laue - Langevin;

Ukraine: Institute of Colloidal Chemistry and Water Chemistry of the NAS of Ukraine; O.O. Chuiko Institute of Surface Chemistry of NAS of Ukraine;

Poland: Chemistry Faculty of „A. Mickiewicz” University, Poznań; Institute of Physical Chemistry, the AS of Poland; “A. Pawin” Institute of Biochemistry and Biophysics, Polish Academy of Sciences, Warszawa; Maria Curie-Sklodowska University, Lublin, Poland;

Belarus: Institute of Bioorganic Chemistry of the National Academy of Sciences of Minsk; Institute of General and Inorganic Chemistry, National Academy of Sciences of Belarus, Minsk;

Holland: Agrarian University from Vageningen;

Spain: Department of Organic Chemistry, Faculty of Pharmacy, University of Valencia, Valencia; University of Zaragoza; University of Alicante;

Italy: Institute of Biomolecular Chemistry, CNR, Pozzuoli (Na); Laboratorio di Chimica Bioorgabica Universita degli Studi di Trento; Istituto di Geologia Ambientale e Geoingegneria – CNR, Italia Kavetsky Instytut;

Germany: University of Leipzig, Institute of Organic Chemistry, Leipzig;

Slovakia: Ustav Geotechniky Slovenskej Akademie Vied;

Kazahstan: Nazarbayev University; Institute of Combustion Problems;

Canada: Canada Fund for Local Initiatives.

With the launch of the Eastern Partnership (EaP) and the signing of the RM-EU Association Agreement, new collaborative opportunities (bilateral and multilateral cooperation) for the Institute of Chemistry and the research institutions abroad were opened. The positive dynamics of the participation of the scientific community from the Republic of Moldova in the EU FP7 Framework Program has created prerequisites for joining the new EU Framework Program for Research and Innovation, Horizon 2020 (2014-2020), aimed at ensuring the European and global ideas, technologies and human capital by gaining full access to the mechanisms of academic mobility,

integration into European and international business and innovation associations. This allowed Moldovan scientists, research institutes, universities and companies to collaborate with their counterparts across Europe in key research areas, while strengthening their own research expertise and capacity.

At present, joint scientific research is performed in the framework of several international projects: mobility program ASM-National Council for Research in Italy; STCU-ASM Joint Research and Development program; Horizon 2020 program, H2020-MSCA-RISE-2016 (Marie Skłodowska-Curie Research and Innovation Staff Exchange), INFRADEV-02-2016-2017, (European Research Infrastructures, Coordination and Support Actions).

Developments in technology, science and society have caused major changes to traditional systems, structures and ways of working and exciting new opportunities are emerging. These trends are changing the nature of chemistry as a discipline, the role of chemists and the landscape within which we work. It is essential for research institutions to look ahead, anticipate future developments and adapt to stay relevant. It is very likely that chemical sciences are increasingly needed to address the challenges of energy and climate change, food production and clean water. Chemistry could play an important role in biochemistry and pharmaceutical industry as well as in infrastructure maintenance and development.

Prospective proposals

- Performing scientific research in the field of: organic chemistry including chemistry of natural compounds, chemistry of coordinative compounds, ecological chemistry, quantum chemistry, analytical chemistry, for solving of the national economy problems.
- Development of new areas of research aligned with the modern themes of European and international research without leaving the main field. Thus, research will be continued towards the synthesis of inorganic, organic compounds, including natural and nanoparticles, as biologically active substances for medicine, industry and agriculture; supplying of the population of the republic with quality drinking water, valorisation of domestic and industrial waste, elaboration of methods of analytical control of pollutants in the environment, which will contribute to the solving of the important problems (of the R. Moldova) in the shortest time.
- Plenary capitalization of the opportunities associated with the country-specific status associated with H2020; Possibilities of international collaboration with research centres from other countries in order to access the funds through European programs financed by the EU.
- Application for participation in Knowledge and Innovation Communities (KICs) with financial support from the European Institute of Innovation and Technology.
- Exploiting the potential of using the research tools of the research infrastructures consortia in the region: CERIC-ERIC; ELI NP, DANUBIUS, etc.
- Creation of the "Interdisciplinary National Centre for the Testing of Medical-Biological Properties" of substances synthesized in the research centres of the Republic of Moldova.
- Creation of a National Specialized Enterprise for the production of biologically active substances, in order to select them for practical uses in medicine.

References

1. Lupascu, T.; Vlad, P.F. Aricu, A.; Cocu, M. Achievements of the Institute of Chemistry of the Academy of Sciences of Moldova at 50 years anniversary. Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry, 2009, 4(1), pp. 8-16. DOI: dx.doi.org/10.19261/cjm.2009.04(1).17
2. Vlad, P. Ed. The Institute of Chemistry of the AS MSSR (1959-1984 years). Stiinta: Chisinau, 1987, 145 p. (in Russian)
3. Batir, D. Restless of memory. The development of chemistry in Moldova and the avatar of the life. Synthesis. Portraits. Medallions. Reflections. ASM: Chisinau, 2007, 348 p. (in Romanian).
4. Batir, D. Ablov A. Biography and creativity review. Stiinta: Chisinau, 1986, 220 p. (in Russian).
5. Vlad, P.F.; Terentieva, I.V. Eds. Lazurievski Gh.V. (1906-1987). My life is chemistry of plants. Stiinta: Chisinau, 1995, 175 p. (in Russian).
6. Ablov, A.V.; Conunova, T.B. Eds. Lealicov Iu.S. Biography and creativity review. Stiinta: Chisinau, 1980, 132 p. (in Russian).
7. Boggs, J.E.; Polinger, V.Z. Eds. The Jahn-Teller Effect and Beyond. Selected Works of Isaac Bersuker with Commentaries. ASM & Univ. Texas Austin: Chisinau, 2008, 398 p.
8. Bersuker, I.B. Quantum chemistry in Moldova – 50 years. Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry, 2009, 4(1), pp. 36-43. DOI: dx.doi.org/10.19261/cjm.2009.04(1).14
9. Aricu, A. Ed. Academician Pavel Vlad - an illustrious scientist and tenacious promoter of science. Publishing house of ASM: Chisinau, 2009, 345 p. (in Romanian).
10. Duca, Gh.; Lupascu, T. Eulogy to a man of excellence: Academician Pavel Vlad. Chemistry Journal of Moldova. General, Industrial and

Ecological Chemistry, 2017, 12(1), pp. 119-120. DOI: http://dx.doi.org/10.19261/cjm.2017.428
11. Lupascu, T., Gonta, M.; Gladchi, V. The school of ecological chemistry founded by academician Gheorghe Duca, Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry. 2009, 4(1), pp. 44-55. DOI: dx.doi.org/10.19261/cjm.2009.04(1).13
12. Batir, D. The steps of an ascent. Stiinta: Chisinau, 2004, 176 p. (in Romanian).
13. Lupascu, T. Ed. Professor Constantin Turta. The path of knowledge and scientific results. ASM: Chisinau, 2010, 328 p.
14. Lupascu, T.; Aricu, A. In memory of academician of Academy of Sciences of Moldova professor Constantin Turta. Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry, 2015, 10(1), pp. 116-117. DOI: dx.doi.org/10.19261/cjm.2015.10(1).17
15. Aricu, A. Ed. Researcher and prestigious manager: Professor Tudor Lupascu at the 60 years. Homage volume. ASM: Chisinau, 2010, 296 p. (in Romanian).
16. Bersuker, I.B., Scientific Discovery: "The Phenomenon of Tunneling Splitting of Energy Levels of Polyatomic Systems in Electronic Degenerate States", State Registered, USSR, 1978, with the priority from September 12, 1960. [Diploma N 202 issued in 1979] Official Bulletin of the State Committee on Inventions and Discoveries, N 40, October 1978.
17. Duca, Gh.; Lupascu, T. In memory of corresponding member of Academy of Sciences of Moldova professor Mihail Revenco. Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry, 2014, 9(2), pp. 111-112. DOI: dx.doi.org/10.19261/cjm.2014.09(2).16
18. Duca, Gh. Dumitru Batir: The infinite road of the hourglass. Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry, 2007, 2(1), pp. 123-125. DOI: dx.doi.org/10.19261/cjm.2007.02(1).02
19. Turta, C. Physical methods in chemistry investigations of the Chemistry Institute of ASM. Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry, 2009, 4(1), pp. 56-65. DOI: dx.doi.org/10.19261/cjm.2009.04(1).12
20. Turta, C. Introduction in gamma rezonance spectroscopy. CEP USM: Chisinau, 2003, 171 p. (in Romanian).
21. Academy of Sciences of Moldova. Stiinta: Chisinau, 2001, 112 p.
22. Vlad, P.F. Macaev, F.Z. Advances in organic, bioorganic and natural products chemistry in the Institute of Chemistry of the Academy of Sciences of Moldova. Chemistry Journal of Moldova. General, Industrial and Ecological Chemistry, 2009, 4(1), pp. 30-35. DOI: dx.doi.org/10.19261/cjm.2009.04(1).15

Acknowledgements

The administration of the Institute of Chemistry wishes to express its gratitude to the Institute's researchers for their dedication and commitment to research, and research partners for joint results and successful stories together.

Special thanks to directors of the scientific centers, academician Gheorghe DUCA and academician Tudor LUPASCU for their continuous guidance and scientific support, as well as to laboratories leaders.

The Institute of Chemistry is always open to cooperation and initiation of new research relationships.

Address:
The Institute of Chemistry
3, Academiei str.
Chisinau, MD-2028
Republic of Moldova
e-mail: ichem@asm.md;
aculina.aricu@gmail.com
http://chem.asm.md/

Dr. habilitate Aculina ARICU
Director of the Institute of Chemistry

Dr. Raisa NASTAS
Deputy director of the Institute of Chemistry

Dr. Maria COCU
Scientific secretary of the Institute of Chemistry