
НАЦІОНАЛЬНА
АКАДЕМІЯ
НАУК
УКРАЇНИ
1918

NATIONAL

The 100th Anniversary of its Foundation

NATIONAL
ACADEMY OF SCIENCES
OF UKRAINE

1918

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FOREWORD

Paging in mind through the centennial history of the National Academy of Sciences of Ukraine, one invariably is convinced that it has come a long and worthy path along all stages of the modern history of its Motherland, sharing all its upsurges and troubles, many times giving evidence of its dedication to the ideals of scientific objectivity, academic integrity and deep democracy, successfully combining the cherished scientific traditions with innovative approaches to the organization of research process and to the introduction of the results obtained into the practice of social life.

The determining feature of the Ukrainian Academy is that since the time of its foundation it has not confined itself to the status of, so to speak, a "scientific club", but, according to Academician V.I. Vernadsky's idea, united both individual scientists and, which is the most important thing, scientific research institutions. That has become a reliable foundation for the efficient development of existing scientific areas and for starting new ones — nonlinear mechanics, mechanics of composite materials, molecular spectroscopy, physics of excitons, quantum mechanics of dissipative systems, electron chemistry and electrochemistry of nonaqueous solutions etc.

It should be emphasized that the main task of the Academy has always been and still remains the comprehensive development of basic research. At various times its scientists proposed the theory of quasiconformal mappings, the theory of rock pressure, the theory of abiogenic deep origin of oil and gas, the electronic theory of catalysis, phytohormone theory of tropisms, were the first in the USSR to implement a man-made nuclear reaction (namely, the splitting of lithium atom nucleus), they produced "heavy water", constructed the first USSR radar, determined the feasibility of the direct thermal-emission conversion of heat into electrical energy, discovered the mechanism of nerve cell membrane functioning, constructed the first electronic computing machine in Continental Europe.

Yet, a no less important feature of the NAS activities has always been its focus on dealing with pressing practical problems, which was facilitated by the close integration of basic and applied research, as well as the development of appropriate infrastructure, first and

foremost, pilot production facilities. Such practices have repeatedly permitted the Academy to combine, when necessary, the efforts of many scientists in tackling complex problems of both basic and applied nature.

During World War II the Academy, even in distant evacuation, demonstrated its ability to respond to new challenges promptly and adequately. At that time a number of important products for defense and medicine were developed. They were applied in the maintenance, strengthening, improving the viability and maneuverability of military equipment, upgrading various types of weaponry, ammunition, artillery optical devices, air defense equipment and in developing new efficient medical agents for the treatment of injured servicemen and civilians, dealing with other pressing issues of public health care during the war (in particular, of epidemics prevention).

Another striking example of immensely efficient joint effort was the active participation of the researchers of 40 scientific institutions in the liquidation of Chornobyl accident consequences since the very first days after the meltdown. In particular, they were involved in determining the radiation levels near the wrecked reactor, in dealing with the problem of dust suppression in the zone territory, the necessary water treatment in the water-purification facilities. By the way, Academy research in the exclusion zone is going on.

After our country won independence, the Academy, responding to new needs, has undertaken the S&T support to basic industries and certain high tech production enterprises, which was of utmost importance in the situation when economic ties were broken and sectoral science completely ruined. It also carried out a radical re-orientation of its studies in socio-humanities. In a number of areas research was started or resumed, especially in sociology, demography, politology, ethnology and Ukrainian studies. Accordingly, new scholarly institutions necessary for building up the independent Ukrainian state were founded.

Today's Ukraine is taking a strength test under the economic crisis, with Crimea annexation, an armed conflict in Donbas, and the Academy traditionally does not stand aside from those challenges. In 2015, the NAS started a special targeted S&T program whose implementation would meet numerous needs of the national defense industry sector. Besides, potential problems and prospects of the expected reintegration of the occupied territories are being studied.

Now the Academy, like the whole science sphere of Ukraine, is in a rather difficult situation. But there are also favorable signs that are worth mentioning. The new Law of Ukraine 'On scientific and S&T activities' adopted late in 2015 laid the foundations of progressive changes in the national science, in forming and implementing the state scientific and S&T policies. Besides, of importance is the fact that this law not only confirms the status of the National Academy of Sciences as the top scientific self-governing organization of Ukraine but it also clearly defines the norms of Academy's self-governance and the freedom of its researchers' creative work. Also encouraging is the fact that, in view of the more intense European integration processes, Academy's ties with research and governmental stakeholders of the EU member states are promoted. At the same time, other areas of the international scientific and S&T collaboration also receive much attention. The National Academy of Sciences of Ukraine will not spare efforts towards further efficient integration of Ukrainian scientists into the European and global science area.

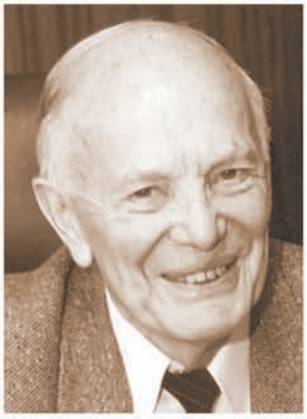
All in all, crossing the borderline of the first century of its existence, the Academy is looking into the near future with hope and optimism. I am sure that the best time of the Ukrainian science is yet to come. NAS scientists will continue their conscientious work in the name of science, nation's advancement and the progress of the entire civilization. This is our duty both to the generations of prominent predecessors and to the future.

Boris PATON, NAS Academician,
President of the National Academy
of Sciences of Ukraine







MILESTONES OF THE ESTABLISHMENT OF UKRAINE'S MAIN SCIENCE CENTER

CHAPTER 1

Academy is a generally recognized symbol of knowledge, scholarship, and science. Its origins date back to the classical antiquity. In 387 B.C., Plato — eminent Greek philosopher and writer — founded the famous "gymnasium" (school) in the suburbs of Athens in the garden of legendary Akademos. That gave rise to the name "academy" for the most renowned science schools. Plato's academy existed for nearly a thousand years, building up its fame. It attracted young talents of Europe, Asia and Africa, who were willing to master the skill of wisdom.

In 529 Emperor Justinian closed the Platonic Academy as a center of free thought. Since then, theological scholasticism dominated Europe for at least seven centuries. But in the epoch of Renaissance, when advanced circles became committed to rationalism, realism and scientific search, the idea of academy was resurrected and triumphed around the world. Emperors, royals, kings and other rulers either founded academies themselves or became their patrons and, not infrequently, headed them. In many cases, scholars themselves teamed up and formed academies. The presence or absence of an academy of sciences became the prestige criteria of states and nations.

The process of establishing new academies of sciences is still going on. According to G.M. Dobrov Institute for Scientific & Technological Potential and Science History Studies of the NAS of Ukraine, since 2000 18 national academies of sciences have been founded in the countries of Western Europe, 21 academies — in Eastern Europe, 16 academies — in Central and South America, 33 — in Asia, 22 — in Africa.

Now there are nearly 300 academies of sciences and a large number of research organizations of the academy type that specialize exclusively in generating new knowledge and developing novel technologies on its basis. Those are intellectual drivers of global progress.

The ideas to set up its own academy appeared in Ukraine late in the 19th century. There were attempts to organize it on the basis of T. Shevchenko Scientific Society in Lviv and of the Ukrainian Scientific Society in Kyiv. De facto and de jure, the Ukrainian Academy

of Sciences (UAS)[1] was founded during the existence of the Ukrainian State headed by Hetman P.P. Skoropadsky. The decisive role in that was played by V.I. Vernadsky and M.P. Vasilenko — eminent scholars and science administrators, outstanding personalities who shared the classical views of science as a beneficial force.

M.P. Vasilenko headed the Ministry of Education and Art in the Hetman Government. He drew up an extensive plan of advancing science and education in Ukraine. In particular, he envisaged the establishment of national institutions: the academy of sciences, a library, a museum, an archive, and higher education establishments. The ministry set up a special committee for elaborating the legislative draft on the foundation of the Ukrainian Academy of Sciences. V.I. Vernadsky, who was well informed about the academy matters, was appointed the Chairman of the Committee. V.I. Vernadsky was a Member of Petersburg Academy of Sciences and a Member of the State Council of the Russian Empire delegated by the Academy of Sciences and institutions of higher education, he took part in the foundation of the International Union of Academies, the "academy union" of Russia. After the February Revolution of 1917 in Russia he worked in the Provisional Government as the Deputy Minister of Public Education and was responsible for organizing scientific research. There he met M.P. Vasilenko, who also had the post of a deputy minister. "He was the first, — V.I. Vernadsky recollected later, — to think of the foundation of the Ukrainian Academy. When he died, he was its member"[2].

The first sitting of the Committee for the Draft Legislation on the Foundation of the Ukrainian Academy of Sciences in Kyiv was held on 9 July 1918 in the ministerial office of M.P. Vasilenko (now 14 T. Shevchenko Boulevard). He opened the meeting with a passionate appeal, speaking about the need for the state support to the establishment and functioning of the Academy and stressed its nation-wide importance. "The foundation of the Ukrainian Academy of Sciences, — M.P. Vasilenko said — is also of great national importance, as there still are people who are skeptical and sarcastic about the Ukrainian movement and revival, who do not believe in the vital force of the Ukrainian people, consider the development of the Ukrainian language and science as impossible. But for those who believe in the viability of the Ukrainian nation, for whom its revival is the "sanctum sanctorum" — for them the establishment of the Academy of Sciences is of tremendous significance, is a national necessity and a pressing issue"[3].

At that meeting, V.I. Vernadsky spoke after M.P. Vasilenko. He made the presentation "On the foundation of the Academy of Sciences in Kyiv", which, as a matter of fact, was the concept of the UAS structure and functions[4].

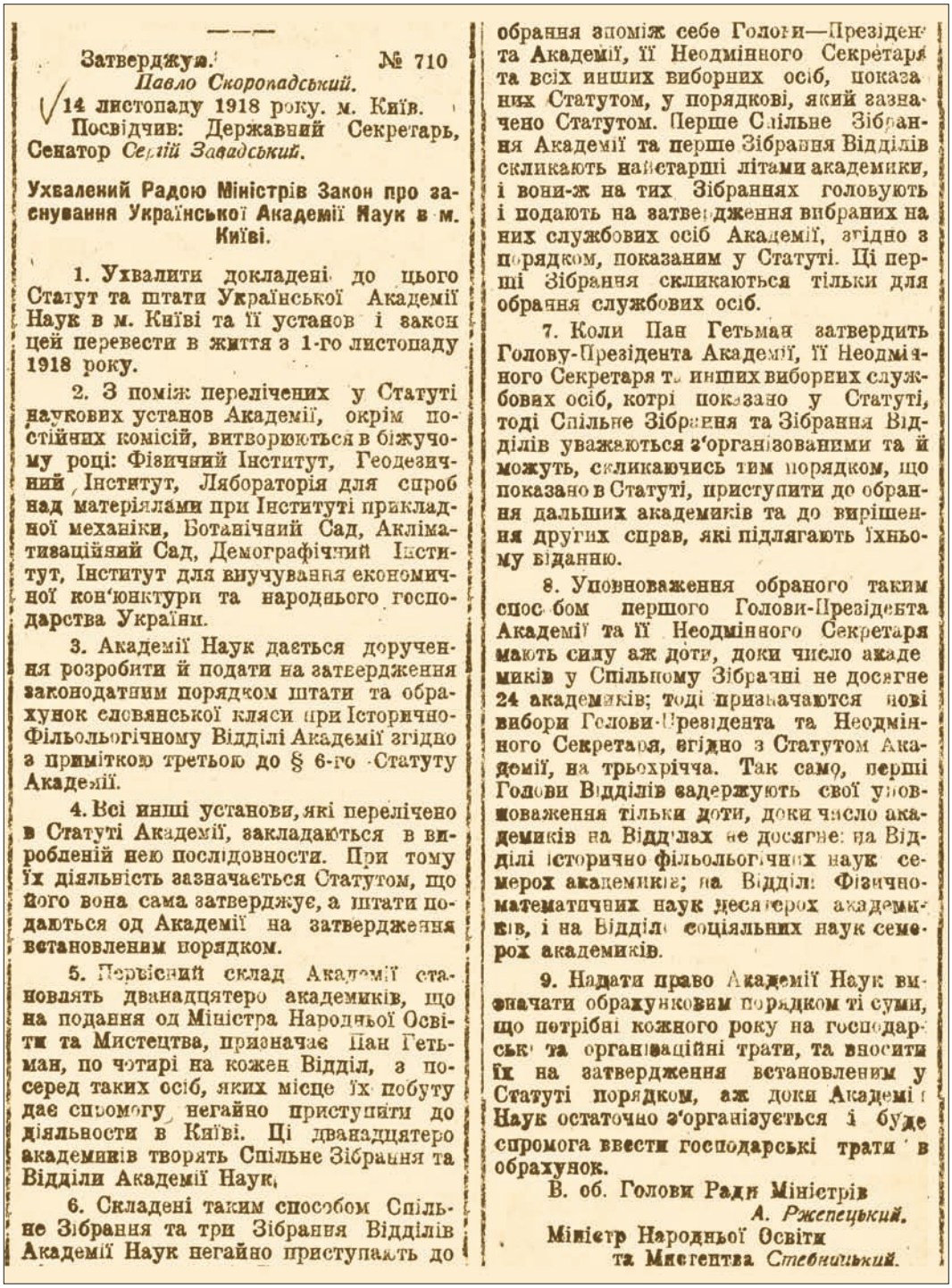
[1] Over the years of Academy's existence its name was changed seven times: from November 1918 till June 1921 it was the Ukrainian Academy of Sciences (UAS), from June 1921 till October 1935 — the All-Ukrainian Academy of Sciences (AUAS), from April 1935 till March 1936 — the Academy of Sciences of the Ukrainian Socialist Soviet Republic (AS UkSSR), from January 1937 till August 1991 — the Academy of Sciences of the Ukrainian Soviet Socialist Republic (AS UkSSR), from August 1991 till March 1994 — the Academy of Sciences of Ukraine (AS of Ukraine), and since 22 March 1994 — the National Academy of Sciences of Ukraine (NAS of Ukraine).

[2] Володимир Іванович Вернадський і Україна: у 2 кн. Кн. 1: Науково-організаційна діяльність (1918—1921). P. 552.

[3] Історія академії наук України. 1918—1923. Документи і матеріали. — Київ : Наук. Думка, 1993. — P. 72.

[4] Ibid. P. 72—76.

The Law on the foundation of the Ukrainian Academy of Sciences in Kyiv adopted by the Council of Ministers of the Ukrainian State and approved by Pavlo Skoropadsky, Hetman of Ukraine, on 14 November 1918



Затверджую. № 710
Павло Скоропадський.
14 листопаду 1918 року. м. Київ.
Посвідчив: Державний Секретарь, Сенатор *Сергій Завадський.*

Ухвалений Радою Міністрів Закон про заснування Української Академії Наук в м. Київі.

1. Ухвалити докладені до цього Статут та штати Української Академії Наук в м. Київі та її установ і закон цей перевести в життя з 1-го листопаду 1918 року.

2. З поміж перелічених у Статуті наукових установ Академії, окрім постійних комісій, витворюються в біжучому році: Фізичний Інститут, Геодезичний Інститут, Лябораторія для спроб над матеріялами при Інституті прикладної механіки, Ботанічний Сад, Акліматизаційний Сад, Демографічний Інститут, Інститут для вивчування економичної кон'юнктури та народнього господарства України.

3. Академії Наук дається доручення розробити й подати на затвердження законодатним порядком штати та обрахунок словянської кляси при Історично-Фільольогічному Відділі Академії згідно з приміткою третьою до § 6-го Статуту Академії.

4. Всі инші установи, які перелічено в Статуті Академії, закладаються в виробленій нею послідовности. При тому їх діяльність зазначається Статутом, що його вона сама затверджує, а штати подаються од Академії на затвердження встановленим порядком.

5. Первісний склад Академії становлять дванадцятеро академиків, що на подання од Міністра Народньої Освіти та Мистецтва, призначає Пан Гетьман, по чотирі на кожен Відділ, з посеред таких осіб, яких місце їх побуту дає спромогу негайно приступити до діяльности в Київі. Ці дванадцятеро академиків творять Спільне Зібрання та Відділи Академії Наук.

6. Складені таким способом Спільне Зібрання та три Зібрання Відділів Академії Наук негайно приступають до обрання зпоміж себе Голови—Президента Академії, її Неодмінного Секретаря та всіх инших виборних осіб, показаних Статутом, у порядкові, який зазначено Статутом. Перше Спільне Зібрання Академії та перше Зібрання Відділів скликають найстарші літами академики, і вони-ж на тих Зібраннях головують і подають на затвердження вибраних на них службових осіб Академії, згідно з порядком, показаним у Статуті. Ці перші Зібрання скликаються тільки для обрання службових осіб.

7. Коли Пан Гетьман затвердить Голову-Президента Академії, її Неодмінного Секретаря та инших виборних службових осіб, котрі показано у Статуті, тоді Спільне Зібрання та Зібрання Відділів уважаються з'організованими та й можуть, скликаючись тим порядком, що показано в Статуті, приступити до обрання дальших академиків та до вирішення других справ, які підлягають їхньому віданню.

8. Уповноваження обраного таким способом першого Голови-Президента Академії та її Неодмінного Секретаря мають силу аж доти, доки число академиків у Спільному Зібранні не досягне 24 академиків; тоді призначаються нові вибори Голови-Президента та Неодмінного Секретаря, згідно з Статутом Академії, на трьохрічча. Так само, перші Голови Відділів задержують свої уповноваження тільки доти, доки число академиків на Відділах не досягне: на Відділі історично фільольогічних наук семерох академиків; на Відділі Фізично-математичних наук десятерох академиків, і на Відділі соціяльних наук семерох академиків.

9. Надати право Академії Наук визначати обрахунковим порядком ті суми, що потрібні кожного року на господарські та організаційні трати, та вносити їх на затвердження встановленим у Статуті порядком, аж доки Академія Наук остаточно з'організується і буде спромога ввести господарські трати в обрахунок.

В. об. Голови Ради Міністрів
А. Ржепецький.
Міністр Народньої Освіти
та Мистецтва *Стебницький.*

On the whole, analyzing the idea of the UAS establishment, this presentation speech of V.I. Vernadsky should be considered in conjunction with the "Explanatory note of the Ministry of Public Education and Art to the Council of Ministers of the Ukrainian State on the draft legislation for the foundation of the Ukrainian Academy of Sciences in Kyiv", which was prepared by M.P. Vasilenko in the early October 1918. It demonstrated an obvious interlacing of the ideas of those two indefatiguable fighters for implementing the idea of the Academy. It is difficult to tell the difference between their concepts of the Academy. But, with a certain assumption, it can be said that, perhaps, the scientific image of the Academy is rather, Vernadsky's vision, while its public, state-supporting image was generated by Vasilenko. On the whole, the concept of the Ukrainian Academy of Sciences combined their views, as well as those of their creative milieu.

The core of the concept was that "the structure of the Ukrainian Academy of Sciences cannot resemble a common association of scholars. It cannot be built like those academies which retained the old structures of learned societies, say, the Prussian, Parisian or Bavarian ones. It should consist of the circles of educated people who are paid money by the state and devote themselves to science and research as the work of their lives recognized by the state as important for the nation. The Academy should incorporate numerous scientific research institutions" [5]. That implied the main principle which became the governing idea in the UAS organization — the Academy must be a state-supported scientific institution and bring together both people who dedicated their whole lives to science and scientific research institutions.

From the very beginning, V.I. Vernadsky set the highest goal for the newly founded Academy — to achieve the "world-wide importance", so that "the Ukrainian Academy of Sciences be recognized by the international union of academies" [6], and that the UAS meet the principles "of the world academic organization" "both in its membership and structure" [7]. As we see, the guidelines are aimed at the forefronts of the world science. Thus, according to V.I. Vernadsky, the Ukrainian Academy of Sciences was able to gain a respected place in the international academic community and simultaneously solve another major task: "That way, — V.I. Vernadsky said, — the worldwide recognition of the Ukrainian culture in one of the most important branches of human activities would be achieved" [8]. M.P. Vasilenko repeated this idea in more detail in the "Explanatory note of the Ministry of Public Education and Art to the Council of Ministers of the Ukrainian State on the draft legislation for the foundation of the Ukrainian Academy of Sciences in Kyiv". He wrote that the establishment of the Academy of Sciences in Kyiv and bringing together the Ukrainian scientific forces in it "would win the weightiness equal to other peoples of the Ukrainian cultural work in one of the highest manifestations of mankind's intellectual activities — in the scientific work" [9]. If dispersed, "those forces do not produce all that which they, if joined together, must and can produce in the global intellectual work of mankind. At the same time, the Ukrainian culture does not show itself in the global life according to its inner force and potential either. That damages both the Ukrain-

[5] Ibid. P. 75.

[6] Ibid. P. 73.
[7] Ibid.
[8] Ibid.
[9] Ibid. P. 150.

ian culture and the joint scientific work of mankind" [10].

No less lofty tasks were also set for the Academy in ensuring the development of the Ukrainian society. According to V.I. Vernadsky, it must "in addition to its worldwide weightiness, satisfy important: "1) national, 2) state, and 3) local vital interests" [11].

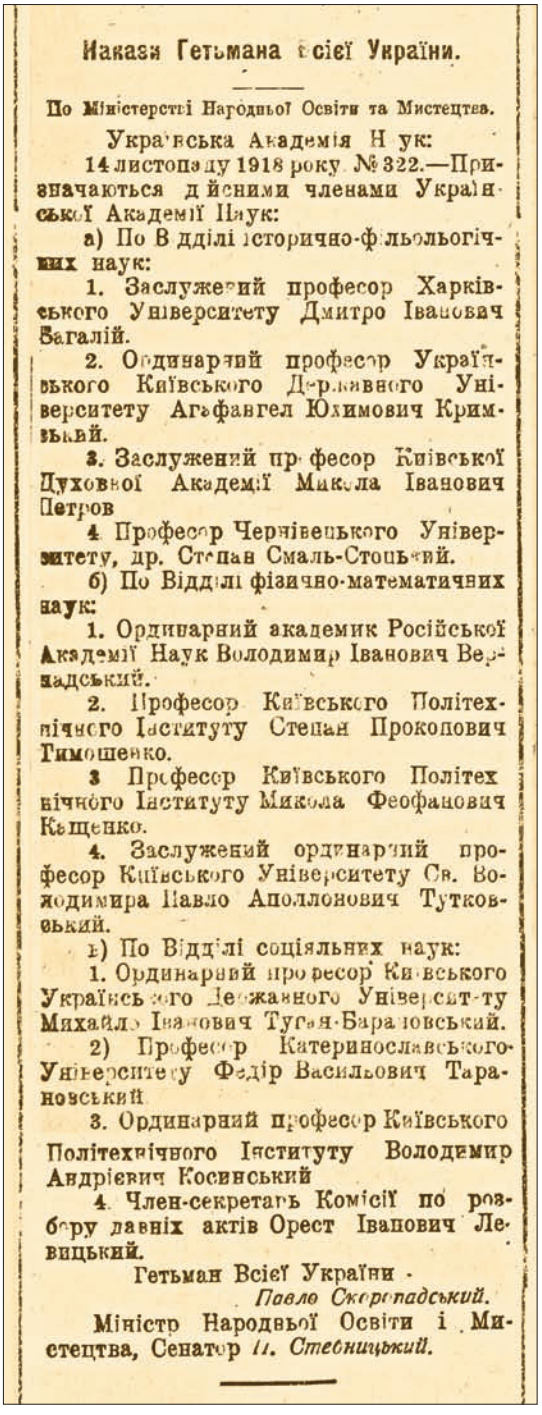
The nation-wide role of the Academy was that "it should promote the growth of the Ukrainian national self-awareness and the Ukrainian culture through extensive, deep, penetrating scholarly studies of the past and present of the Ukrainian people and its neighbors, the nature of the territory they inhabit, in all its infinite manifestations" [12]. That meant the course towards the intensified advancement of socio-humanities and increasing their role in the social life.

V.I. Vernadsky and M.P. Vasilenko were convinced that that the Ukrainian Academy of Sciences was objectively called into existence by "the forces of two flows" (by the way, they are still acting today) — "the national self-awareness of the Ukrainian nation" and "the inevitable measures to overcome the impacts of the global crisis" [13].

Each academy gets its tasks, first and foremost, from the national self-awareness of the people of its country and they consist in studying their existence. The Ukrainian Academy of Sciences was to become the center for studying the history, way of life, folklore, literature, language, art and music, economic life, the physical nature of the Ukrainian people [14]. M.P. Vasilenko stressed that there was a need for studying "absolutely all aspects of Ukrainian peo-

[10] Ibid.
[11] Ibid. P. 74.
[12] Ibid.
[13] Ibid. P. 150.
[14] Ibid. P. 150—151.

The Ordinance of Pavlo Skoropadsky, Hetman of Ukraine, of 14 November 1918 on the Appointment of Active Members of the Ukrainian Academy of Sciences



Наказ Гетьмана всієї України.

По Міністерстві Народньої Освіти та Мистецтва.

Українська Академія Наук:

14 листопаду 1918 року № 322.—Призначаються дійсними членами Української Академії Наук:

а) По Відділі історично-філольогічних наук:

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2. Ординарний професор Українського Київського Державного Університету Агафангел Юхимович Кримський.

3. Заслужений професор Київської Духовної Академії Микола Іванович Петров.

4. Професор Чернівецького Університету, др. Степан Смаль-Стоцький.

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3. Ординарний професор Київського Політехнічного Інституту Володимир Андрієвич Косинський.

4. Член-секретарь Комісії по розбору давніх актів Орест Іванович Левицький.

Гетьман Всієї України.
Павло Скоропадський.

Міністр Народньої Освіти і Мистецтва, Сенатор *І. Стешицький.*

ple's life" [15]. He wrote in the "Explanatory note…": "This work is important not only because it will produce the strongest and deepest foundations for the national self-awareness. It is also important because this work of any living nation must and can only be done by itself. When a nation does that, it also creates great things common to all mankind — because through studying itself it creates new branches of human knowledge. If done by someone other, such work can never achieve the same depth and entirety which it does achieve when the nation studies itself" [16]. This concerns the exploration of the nature of its homeland as well. "With all the limitless diversity of phenomena to be necessarily examined, it cannot be studied from somewhere outside, it should be learned scientifically by the very people who live there" [17]. Such work is held up if the workforce that does it is dispersed and casual" [18].

Thus, the establishment of the Academy of Sciences in Ukraine was considered as a necessary response to the essential national needs of the Ukrainian people. And those needs required "that there should be a big academy of sciences, whose potential for scientific research would exceed the forces available in those institutions of higher education, scientific societies and other centers of scientific work that exist in Ukraine" [19]. Only a big academy of sciences provided with all the equipment necessary for research in the 20th century will be able to do the work required by the times we live in" [20].

The state weightiness of the Academy, according to V.I. Vernadsky, was the influence it would have on the enhancement of productive forces of the country and the man in Ukraine. The Academy was to help find the way out of the greatest problems of life" [21]. For that purpose, new ways were to be found and new values created, productive forces of the country were to be enhanced, "be those the common forces of nature or forces of people; new forces of nature should be found and the old ones used in the right and a complete way" [22], relying on extensive scientific research to increase quickly the importance of its natural resources for Ukraine, which "are not used by its people yet or are even hidden from them" [23], and by economic and statistical studies "to find measures" [24] necessary for raising the productivity and improving the quality of labor. This was, actually, the idea of the continuous scientific support to the rise of production and economy in Ukraine, the indispensable role of the Academy in it.

Finally, the fourth role, "weightiness" of the Academy was in its close ties with life, its "deep insights into the everyday existence of people" [25]. It was to be "most frequently concerned with common issues of everyday life, its needs in the broadest sense of that word" [26]. Hence, the weightiness of the Academy would be felt by the whole people, the entire Ukraine. V.I. Vernadsky noted: "In my view, this aspect of Academy's life is of utmost importance. Its activities should respond to all the needs and necessities of people which require scientific aid and scientific interpretation. The pulse of its life should beat in harmony with spiritual and material needs of the people, as the scien-

[15] Ibid. P. 151.
[16] Ibid.
[17] Ibid.
[18] Ibid.
[19] Ibid.
[20] Ibid. P. 152.
[21] Ibid. P. 74.
[22] Ibid.
[23] Ibid.
[24] Ibid. P. 75.
[25] Ibid.
[26] Ibid.

tific weightiness and scientific thought can be instrumental in meeting those needs" [27].

And one more principle that also guaranteed its weightiness was laid to the foundations of the Academy — the principle of free creative scientific work. The founders of the UAS considered it absolutely necessary to adhere to the main features of all academies of sciences — "their strictly scientific nature free from any influence on the research work" [28]. No national, political or religious considerations can and must limit the freedom and completeness of scientific research. "The Academy of Sciences is, first of all, a scientific institution. The search for truth, the desire to go deep into it without any constraints — that is its main task" [29]. The freedom is necessary not merely for scientific creative work as such, but also for the Academy to perform its social functions. "Only the Academy that will reject any irrelevant considerations when the scientific truth is concerned will be able to fulfill completely and with greater efficiency all tasks, whether they are national or state economic ones" [30].

All that shows that the foundation of the Ukrainian Academy of Sciences was designed as a large-scale general scientific project and socially significant issue whose implementation would give rise to a powerful national intellectual center that would continuously increase its contribution to the development of the country, nation, and personality. Although the legislative formation of the Academy was very fast, its establishment was a deliberate decision. M.P. Vasilenko had every reason to say that the draft law on the UAS creation was prepared "in the full realization of the tremendous importance that a modern scientific institution in ancient Kyiv will have both for Ukraine and the whole mankind" [31]. The Academy "is not a matter of a fleeting day, but it determines the future fate of many generations" [32].

On 12 October 1918, M.P. Vasilenko, the Minister of Public Education and Art, addressed the Council of Ministers of the Hetman Government with a request to consider the draft legislation on the foundation of the Academy. The agenda of the following week was very busy and there was no place for the draft law on the Academy. The Ministers for Finance and for Food Provision, at the request of M.P. Vasilenko, gave him priority and the Academy issue was considered on October 19. Most items were approved without discussion. Only the issue of the number of first academicians was delayed due to the absence of draft's authors who could provide the necessary explanations.

"On the financial side, — M.P. Vasilenko wrote for the press, — the draft did not come up against any obstacles. A.K. Rzhepetsky, Finance Minister, G.M. Kurillo, Deputy Minister, Kh.M. Lebid-Yurchik, Director of the Credit Office, and the members of the Budget Committee, realizing the great importance of the prompt passing of the Academy draft law, took every measure to provide the prospective Academy with the necessary means… The Budget Committee considered the staff list and the budget of the Academy as a top priority" [33].

On the very same day, 19 November 1918, the Government resigned. But the new Government passed the Law on the Foundation of the Academy as one of its first acts, and on 13 November, even before Hetman ap-

[27] Ibid.
[28] Ibid. P. 152.
[29] Ibid. P. 153.
[30] Ibid.
[31] Ibid, P. 161.
[32] Ibid.
[33] Ibid. P. 162.

proved it, allocated money from the State Treasury for its support.

On 14 November 1918, Hetman Pavlo Skoropadsky approved the Law on the Foundation of the Ukrainian Academy of Sciences in Kyiv, which had been passed by the Council of Ministers, confirmed the Statute and the staff lists of the Academy and its institutions. The Law was to be enacted from 1 November 1918 — the decision of the Council of Ministers on the foundation of the Academy was confirmed after the event.

On the same day, Hetman issued the ordinance on the appointment of the first active members of the UAS. They were 12 eminent Ukrainian scholars:

D.I. Bagaliy, Honored Professor of Kharkiv University; A.Yu. Krymsky, Ordinary Professor of the Ukrainian State University of Kyiv; M.I. Petrov, Honored Professor of Kyiv Theological Academy; Doctor S.Yo. Smal-Stotsky, Professor of Chernivtsi University, — in the field of history and philology;

V.I. Vernadsky, Ordinary Academician of the Russian Academy of Sciences; S.P. Timoshenko and M.F. Kashchenko, Professors of Kyiv Polytechnic Institute; P.A. Tutkovsky, Honored Ordinary Professor of St. Volodymyr University of Kyiv, — in the field of physics and mathematics;

M.I. Tugan-Baranovsky, Ordinary Professor of Ukrainian State University of Kyiv; F.V. Taranovsky, Professor of Katerynoslav University; V.A. Kosynsky, Ordinary Professor of Kyiv Polytechnic Institute; and O.I. Levitsky, Secretary-Member of the Commission on Studying Old Documents, — in social sciences.

The first, constituent General Assembly of the UAS was held on 27 November 1918. According to minutes # 1, "under the chairmanship of Academician O.I. Levitsky, as the person most advanced in age, in the presence of Active Members-Academicians… the Assembly elected by secret ballot… Acad. V.I. Vernadsky the President-Chairman and Acad. A.Yu. Krymsky — the Permanent Secretary of the UAS". On 30 November 1918, by Hetman's Ordinance, V.I. Vernadsky was approved the Academy's President-Chairman. The foundation of the Ukrainian Academy of Sciences was completed.

In fact, all the legal procedures of Academy's foundation were implemented within two weeks' time. That was a praiseworthy exemplar of the situation when the mutual understanding of the scholarly community and state authorities allowed a fundamental public problem to be resolved in a fairly short time frame.

The Ukrainian Academy of Sciences received the legal right to exist. 12 academicians started their tireless work. They were and still are referred to as 12 apostles of science. The number "12" is an accidental coincidence with Jesus Christ's Apostles. Just for the beginning, it was decided to build the Academy around three divisions and, for the sake of equality, appoint four active academicians to each of them. Indeed, they performed the apostle mission — brought true knowledge to people. And none of them was a traitor like Judas, though the first months and years were impossibly difficult for the Academy.

In 1918—1919 Kyiv lived through 5 changes of the state power. For that reason, there was no question of the adequate funding and logistic support of the Academy. Each regime saw the Academy's place and role in its own way. The leadership of the Academy had to take great pains to keep it intact. The Academy withstood: its founders — V.I. Vernadsky, M.P. Vasilenko, O.I. Levitsky, A.Yu. Krymsky — defended it.

Here is an eloquent story from the review of the first five years of the Academy given by A.Yu. Krymsky, its Permanent Secretary: "It has survived for full five years, it has worked for five full years, "full" in the most precise sense of this word, since our work was not interrupted by any vacations, any rest. The Ukrainian Academy of Sciences is, perhaps, the only scientific institution in the soviet state that did not take even the shortest vacation. In summer, the work is even more intense than in winter, as we are not freezing in unheated premises.

Many things have happened in those five years — both good and bad. But, in the final analysis, there were more good things than bad. It's good that we have done an immense amount of work. The Ukrainian Academy of Sciences has evolved into a powerful extensive, truly all-Ukrainian organization, which has brilliantly proven its high viability and immeasurable self-sacrificing ability for work, and won broad respect both of Ukrainian people (even those beyond the borders of the Soviet Ukraine) and even of European nationals. Our Academy is deliberately avoiding anything that resembles self-advertisement and is working in silence" [34].

Over a hundred years, the Academy's activities have been built in accordance with its fundamental principles and strategic goals, both in favorable and difficult times, during social stability and under continuous social changes. Over the century, at least five generations of scientists step by step have been implementing the multidimensional model of the Academy elaborated by its founders and enriched by their followers, transforming it into the topmost research, coordinating, expert, scientific institution, a training center of highly qualified scientific personnel of the country.

In the beginning, chairs and commissions were the principal structural units of the Academy. At that time, chairs meant branches, areas of research. Academy's structure was under the influence of the traditions of scientific societies and the weak resource base. It is known that after extended discussions an agreement was reached that the structure of the Academy would consist of three divisions: those of History and Philology (the First), Physics and Mathematics (the Second) and of Socio-Economics (the Third). "All three divisions of the Academy form a single natural continuity and just supplement each other; while the Second Division has nature as its object, the Third — the socio-economic life of the nation, the First Division addresses its spiritual life and culture" [35]. That shows that since the very beginning of its existence the Academy has clearly outlined the model of the complex structure that inseparably links three all-embracing fields of scientific knowledge — natural, social and human sciences.

As is proper for the Academy that cares for the enhancement of nation's self-awareness, the priority was given to historical and philological studies, the Ukrainian studies being among them. Thus, for the first time the Ukrainian studies were given a reliable base for development. Besides, they were not treated narrowly and specifically, but, rather, as self-consciousness, the study of the national identity on the background of the general historical process and the lives of neighboring nations.

The First Division only consisted of commissions. There were six of those: 1) for compiling a dictionary of the living Ukrainian language; 2) for compiling a historical

[34] Ibid. P. 356—357.

[35] Ibid. P. 198.

dictionary of the Ukrainian language; 3) for compiling a historical and geographical dictionary of the Ukrainian land; 4) archeographic (for publishing the linguistic, literary and historical heritage); 5) for publishing the landmarks of modern literature; 6) orthographic and terminological[36]. Later they generated various Academy institutions studying history and philology.

One should note the initiative of the First Division that was later spread over the whole Academy — setting up prizes named after prominent scholars to reward researchers, in particular: M.A. Maksymovych Prize — in the field of the history of Ukraine, V.B. Antonovych Prize — in archeology, O.O. Potebnya Prize — in linguistics, I.Ya. Franko Prize — in the history of literature, M.P. Dragomanov Prize — in folklore studies, M.I. Kostomarov Prize — in the field of historical geography and ethnography, P. Mohyla Prize — in the history of Ukrainian church, and M.V. Lysenko Prize — in the history of Ukrainian art[37]. The O.O. Potebnya, I.Ya. Franko and M.I. Kostomarov prizes still exist today.

The Second — Physical and Mathematical Division had in the bud all those basic areas that afterwards gave rise to numerous institutions working in the fields of exact, natural and engineering sciences. It started the implementation of the most ambitious initiative of the Academy — "joining science and engineering", organizing the collaboration of "people of engineering and people of science"[38], uniting all S&T forces of Ukraine for fulfilling the common goal — to explore country's natural wealth and develop rational methods of its management[39].

In the long run, the successive implementation of that idea led the Second Division to the first place in the Academy, made it a well-known testing ground for the interaction of the "pure" and "applied" science, the embodiment of the creator of nation's S&T potential.

The Physical and Mathematical Division founded the first scientific research institute of the Academy — the Institute of Technical Mechanics, the laboratory of physical chemistry "as a part of prospective Physical Institute", started work towards organizing the Geodesic Institute, the Institute of Experimental Medicine, the Acclimatization and Botanical gardens. The Commission for the exploration of the natural resources of Ukraine, the Committee for studying the fauna of Ukraine, sections for exploring mineral resources, construction materials, fuel, hydro engineering were set up. Much attention was given to organizing the exploration of energy resources — the key problem of the S&T sphere. For that purpose the commissions established the departments: those of the geological exploration of Donbas coals and of the rational firing of coal, coke, peat[40]. The S&T breakthrough in Ukraine, which has been led by the Academy for a century, started back in 1918 in the Second Division.

The Third Division covered a smaller range of research topics than the First and the Second ones. It focused on the issues of economy and law. Its research was carried out in the areas of sociology, the national economy of Ukraine, the history of West Rus and Ukrainian Law and the common law of Ukraine.

Founders of the Academy also placed the systemic and adequate information support of scientific research, as well as continuous

[36] Ibid. P. 200.
[37] Ibid.
[38] Ibid. P. 203.
[39] Ibid. P. 206.
[40] Ibid. P. 204—206.

and broad communication with the society, among the fundamental principles of its functioning. The first years of its existence were the search for the ways to implement those tasks as well. The "institution of immense importance — the National (or People's) Library", whose goal was to provide everyone with the opportunity "of getting acquainted on the largest scope with the world literature in all branches of human knowledge written in every language"[41] worked in it. The "Ukrainica" department was envisaged in its structure, "which was to unite everything ever published in Ukrainian anywhere, and also the literature written in any language about the history of the Ukrainian people, its folklore, language, literature, art, the way of life, social and economic conditions etc."[42].

Each division of the Academy formed its specialized library. The Division of History and Philology had the largest one and it was headed by Acad. D.I. Bagaliy — the Division's Chairman himself. Practically every scientific subunit of the Academy gathered specialized literature, compiled bibliography indices, produced thematic information reviews of publications. A system of academy publishing was started: sectoral "bulletins", "proceedings", "materials" were issued; training workshops, courses, popular lectures were organized; ties with educational and popularizing institutions, public organizations, and production structures were established.

The start of Academy's activities was hindered by the unstable political situation in Ukraine, when numerous regimes treated the Academy in very different ways: from giving it full support (the Hetmanate) to denying it completely (Denikin's rule). The situation was also complicated by the fact that in the first decade of Academy's existence the stays of its presidents in their offices were short. In the autumn of 1919, V.I. Vernadsky left for Rostov-on-Don, where Denikin's headquarters was located, to persuade its security service that the UAS should not be liquidated. When he was coming back to Kyiv via Crimea, he fell ill with epidemic typhus, hardly survived at all, and stayed in Simferopol. O.I. Levytsky acted as UAS President. In February 1921, V.I. Vernadsky resigned from his post. M.P. Vasilenko was elected the President. But the People's Commissariat of Education did not approve of him and insisted on the reelection of the Academy Presidium. When M.P. Vasilenko was elected the President again, a very strong pressure was put on him and he had to resign. O.I. Levytsky was elected the President. After less than two month's stay in the office he died of cold. V.I. Lipsky became the President in June 1922. His "political inertness" did not satisfy the state authorities and he also had to resign. In May 1928 the Academy was headed by D.K. Zabolotny, who died in December 1929.

All those people were eminent scholars devoted to the Academy. Each of them made the greatest possible contribution to building up the Academy, selflessly worked towards the implementation of its concept. The Academy model developed by V.I. Vernadsky and his allies proved so strong and viable, truly necessary, that it survived unbelievable hardships in the very beginning of its existence, and after the stabilization of power in Ukraine it became the platform on which the Academy evolved into the country's topmost scientific institution, the backbone of the national science system, an internationally renowned scientific center which spawned numerous powerful science schools, raised world-famous scientists and

[41] Ibid. P. 212.
[42] Ibid.

provided support to the nationwide intellectual community.

That process was not fast and entirely even. Four noticeably different periods could be distinguished in it: formation (1918—1941), restructuring during World War II (1941—1945), post-war recovery (1945—1960), the advancement and rise on the waves of creative boom of the new generation of Ukrainian scientists and the requirements of the S&T progress (1960—1990). The fifth — present period started in 1991. It involves the restructuring of research areas in accordance with the needs of independent Ukraine and the self-reliant accession of Ukrainian science to the global science area. In each of those periods one can notice the fusion of tradition and innovation, the steady increase in basic knowledge, more diverse Academy's ties with practice, and the rise in its social prestige.

The general trend was the implementation of the model of the Academy as a body of specialized state-supported scientific institutions and the formation of new cohorts and generations of research scientists. Scientific research institutions — institutes, laboratories, centers, complexes with professional salaried teams — were becoming basic units of the Academy. Commissions, committees, councils, other informal associations of the representatives of various institutions and agencies only proved efficient (and not always!) as coordinating, systematizing structures. Certainly, if those structures were not the names of actual research institutions. The entire history of science has demonstrated that new scientific knowledge is generated by a researcher who acts (lives, works) in the scientific research environment. Hence, public or semi-public organizations have retreated into the subsidiary sphere of Academy's life.

Yet, till the late 1920s, commissions, committees, chairs, seminars, societies did prevail in the Academy. Just because it was easier to organize them irrespective of the staffing and funding, which were very scarce. There were 68 institutions in the Academy in 1928[43]. Of them, there were only tree institutes: those of Engineering Mechanics, Demography, and Biology, which functioned under the Chair of Experimental Zoology. Chairs were the majority of subunits in the Division of Physics and Mathematics. In terms of organization forms of their activities, they were the closest to future institutions, since they needed laboratories, while socio-humanities structures could have many part-time employees and only gather them occasionally to discuss scholarly presentations. Ii was difficult to plan the work of part-time employees, even more so to get timely accounts from them, as their main jobs and salaries were outside the Academy.

The requirements for the efficiency of scientific research, increasing its practical effect, scheduled accounting for the funding used brought the Academy increasingly closer to the necessity of setting up institutions with teams of full-time staff members and stable planned funding. The proper organization of Academy's work was found in the form of scientific research institutes and related structures (laboratories, experimental stations, engineering centers). 1934 was the watershed year. The Academy Council approved the decision that scientific institute was to become the principal structural unit. The step-by-step filling of the Academy with institutes was started: new institutes were set up on the basis of previous relevant institutions, the institutions that earlier had

[43] Національна академія наук України. 1918—2013. Хронологія. Київ: Фенікс, 2013. P. 90.

merely collaborated with the Academy but had not been its parts came under its jurisdiction.

This restructuring of the Academy was carried out in the difficult, ambiguous times both for it and for Ukraine at large. On the one hand, there was the Holodomor (homicide famine), search for and persecution of the "enemies of people", groundless trials against intellectuals and Academy's ranks decreased in number. And on the other, the state supported and encouraged the advancement of science, engineering and natural sciences in particular, for that was required by the course towards industrialization with its need for basic research and large-scale training of engineers. The governing bodies of the Academy led by O.O. Bogomoletz, who became its President in 1930, took great pains to protect scientists against repressions and develop the Academy as a multidisciplinary system of scientific institutions.

In 1940, which could be considered as the indicative year of the restructuring, the Academy consisted of 25 research institutions. A transformation of its general structure was carried out as well. The Division of History and Philology and the Socio-Economic Division were united into the Division of Social Sciences, while the Division of Physics and Mathematics was divided into three: those of Physico-Chemical and Mathematical Sciences, Biological Sciences, and Engineering Sciences. Besides the institutes of Economics, the History of Ukraine, Ukrainian Literature, Linguistics, Folklore and Archeology, the Division of Social Sciences also included the Office of Jewish Literature and the all-Academy library and publishing house. The Division of Physico-Chemical and Mathematical Sciences consisted of the institutes of Mathematics, Physics, Physical Chemistry, Chemical Technology, Geological Sciences and Poltava Gravimetric Observatory. The Division of Biological Sciences included the institutes of Zoology, Botany, Biochemistry, Clinical Physiology, Microbiology, Hydrobiology, and Karadag Biological Station. Engineering sciences for the first time consolidated into a specialized — Fourth — Division, which later was to play the key role in the Academy, to set the pace of all its life, and be the leader in shaping its course and image. At that time it only consisted of the institutes of Construction Mechanics, Electric Welding, Energy Engineering, Hydro Engineering, Ferrous Metallurgy and Silicates[44].

By the beginning of the tragic 1941, the Academy had been formed as a full-fledged, multi-purpose and world-renowned scientific institution. Analyzing its activities in the first half of 1941, Acad. O.O. Bogomoletz had all grounds to state: "One of the youngest academies of sciences, the Academy of Sciences of the URSR, has grown … into one of the largest scientific research institutions of the world"[45]. It united 29 institutions, 1200 research associates (495 of those had the degrees of doctors and candidates of science), 205 post-graduate students and 54 scientists working towards doctor's degree. In the previous 11 years, Academy's funding had increased nearly 50 fold and amounted to 36,097,000 karbovanets. Its library had become one of the richest in the world and contained over 6 million books[46].

Scientific research topics were aimed at producing new knowledge and assistance in solving "the most important problems of the national economy"[47]. Even inter-insti-

[44] Ibid. P. 144.
[45] Історія Національної академії наук України. 1938—1941. Київ, 2003. P. 351.
[46] Ibid. P. 351—352.
[47] Ibid. P. 352.

tute joint brigades were organized for that purpose. The Academy could already set the task of implementing large-scale interdisciplinary programs that would provide extensive economic, technological and industrial return.

All these facts prove that, as of early 1941, Ukraine had a powerful academy scientific system that was able to deal with difficult theoretical and practical tasks on a par with the advanced world science of that time, generate new knowledge and develop respective technologies. The Academy was recognized by the state authorities and the society as the leading state-supported scientific institution of Ukraine, though the repressions and purges of the 1930s and the ideological dictate of the political regime noticeably restrained the realization of its intellectual potential.

The aggression of Nazi Germany against the USSR turned the territory of Ukraine into a three-year continuous battlefield. The lives of Ukraine and its Academy were radically changed. The Academy had to adjust the topics and organization of its research to the needs of the war situation.

The main part of the Academy was evacuated to Ufa. The institutes moved to the Urals: the Institute of Electric Welding — to Nizhny Tagil and the Institute of Ferrous Metallurgy — to Sverdlovsk (now Ekaterinburg), while the Institute of Energy Engineering went to Kopeisk (Chelyabinsk Oblast). Kharkiv Institute of Physics and Technology moved to Alma-Ata (now Almaty, Kazakhstan), Poltava Gravimetric Observatory — to Irkutsk.

Academy's activities during the war of 1941—1945 is illustrative in its experience of mobilizing and consolidating its efforts in crisis time for the scientific support to dealing with pressing, vital and crucial tasks, upholding scientific traditions, schools and retaining its personnel. The structure of the Academy was compressed and simultaneously the procedure of its fast renewal in the post-crisis time was envisaged. The focus on the issues of the day was combined with the development of strategic plans of Academy's participation in the post-war reconstruction of the national economy of Ukraine.

In early 1942 the Academy had 15 "strong scientific research institutes"[48], of those: four in the Division of Physico-Chemical and Mathematical Sciences (the institutes of Physics and Mathematics, Chemistry, Physical Chemistry, Physics and Technology) and four in the Division of Biological Sciences (the institutes of Botany, Zoobiology, Biochemistry, Clinical Physiology). As we see, the institutes were merged and grouped to solve the problems of life support. All the institutes of socio-humanities formed a single research complex — the Institute of Social Sciences. It had eight departments. Among them were the departments of economics, history and archeology, linguistics, the history of the Ukrainian literature, folklore, which embodied the respective specialized institutes that had existed before the war. Besides, the departments of belles-lettres, musical and fine arts were added; they included representatives of the Ukrainian literature and arts: poets, prose authors, playwrights, composers, architects, painters[49].

The Academy gave top priority to studies necessary for "all possible assistance to the front"[50]. Ukrainian scientists proceeded from the concept that "modern war is the

[48] Сапєгін А.А., Гарцман Б.М. Академія наук УРСР в дні Великої вітчизняної війни. Вісті АН УРСР. — 1942. — № 1—2. P. 17.

[49] Славін Л.М. Інститут суспільних наук Академії наук УРСР. — Вісті АН УРСР. — 1942. — № 1—2. — P. 55—66.

[50] Сапєгін А,А., Гарцман Б.М. Академія наук УРСР в дні Великої вітчизняної війни. P. 18.

war of motors"[51]. Hence, the institutes of the divisions of Engineering and Physical and Mathematical Sciences set for themselves a complex of tasks stemming from the need to advance the manufacturing of engines, airplanes, tanks. The Electric Welding Institute worked hard on using the methods of electric welding in tank industry to intensify technological processes[52]. Under the guidance of Acad. E.O. Paton, its researchers in the shortest possible time developed and deployed a novel method of the automatic welding of tank armor, which became known as submerged-arc welding. It permitted a much faster manufacturing of tanks, was instrumental in a rapid increase in the production of the famous T-34 tank — an all-welded, fast, strong combat vehicle. To a great extent due to that development, as early as in 1943 the USSR manufactured much more tanks than Germany, which ensured a great combat advantage over the aggressor.

The improvement of the strength and wear resistance of engines and airplanes was one of the major research problems in the work of the institutes of Construction Mechanics, Physics and Mathematics, Energy Engineering[53]. The institutes of Geological Sciences, Physical Chemistry, Chemistry and Chemical Technology developed a number of express methods for the spectral analysis of ores, minerals, alloying additives in metals and their alloys, which was of great importance for metal-working and aviation industries.

In general, the Academy worked hard on the development and application of physico-chemical methods of production control. That improved the quality of new equipment, instruments, materials and mechanisms. Tremendous attention was given to the advancement of coal and oil industries, development of new deposits of coal and oil in the Urals and Bashkortostan. The Institute of Geological Sciences generalized the results of the geophysical surveys in the Volga—Ural oil- and gas-bearing area that was given the name "a second Baku". New oil-production enterprises and refineries were built there[54]. At the same time, a program of fast methods of reconstructing the coal industry of Donbas was worked out.

The institutes of Botany and Zoobiology focused on issues of increasing the yield of agricultural crops and stockbreeding productivity.

Important integrated research was carried out by the institutes of Clinical Physiology, Biochemistry and Zoobiology in the field of human health care[55]. They continued to study the effect of the anti-reticular cytotoxic serum on the human organism as a new method to stimulate the functions of the connective tissue physiological system. The Institute of Clinical Physiology developed a procedure of using this serum to accelerate the healing of wounds and bone fractures, which saved the lives of thousands of wounded soldiers. The Institute of Biochemistry discovered the possibility of using vitamin K to stop bleeding[56]. Microbiologists studied staphylophages for wound infection control and passed it to producing enterprises[57]. At that time the Institute of Social Sciences was a large and integrated single institution that developed nearly all branches of the Ukrainian culture, the issues of preserving the whole great legacy produced by the Ukrainian people over the centuries and of further progress

[51] Ibid. P. 19.
[52] Ibid.
[53] Ibid.
[54] Ibid. P. 26.
[55] Ibid. P. 33.
[56] Ibid. P. 34.
[57] Ibid.

of the Ukrainian culture[58]. In the field of literature, scholars studied its history, the issues of inter-Slavic literary ties, the theme of struggle against the German aggression and Nazism in literature, the role of people's volunteer corps and partisan warfare in the struggle against foreign invaders. The writers, who were Institute's members, devoted a number of publications to the theme of home land and patriotism in belles-lettres. A four-volume history of Ukraine for institutions of higher education was being prepared for publication[59].

The institutes worked on the abovementioned problems and themes during their evacuation, preparing to return to Ukraine.

It is worth mentioning that in January 1942, the Academy Presidium set up a special Commission for restoring the ruined Ukrainian economy, ruined cities, towns, villages, enterprises and industry (from January 1943 on it was referred to as the Commission for restoring the economy of the URSR)[60].

Those workers of the Academy who for some reason or other could not go to evacuation faced a cruel fate. In October 1941, the Kyiv City Council and the Ukrainian National Rada declared that the work of the UAS was resumed. However, no funding was provided for it. The occupation authorities did not intend to advance science. They only wanted to use Ukrainian scientists for supporting their rule and meeting the needs of the German army. So, in January 1942 the formally existing UAS structures specializing in engineering and natural sciences were subordinated to Kyiv General Commissar, while the majority of institutions specializing in humanities were closed. Academy's premises and equipment were transferred to German institutions. The remainder of the Academy was finally ruined. In February 1942, the Presidium of the restored UAS, which worked for less than half a year, ceased to exist.

In mid-August 1943, the re-evacuation of the Academy from Ufa was started — at first to Moscow, and late in October the Academy Presidium approved the decision on the return of its institutions to Kyiv. In the spring — early summer of 1944, the institutions of the URSR AS were re-evacuated. In September 1944, the work of all Academy institutions (including its Lviv-based affiliation) was resumed.

Despite severe war-time conditions, the staff of the Academy continued to increase. The elections of active members and corresponding members of the AS of the URSR were held in 1943 and 1945. Its membership was replenished by such prominent scientists as A.V. Dumansky and A.I. Kiprianov, chemists; V.O. Belitzer, biochemist; V.E. Lashkaryov, physicist; S.O. Lebedev, expert in electrical engineering, automation and computer engineering; K.K. Khrenov, scientist in the field of electric welding; V.Ya. Yuryev, plant breeder; B.V. Gnedenko, mathematician; R.E. Kavetsky, pathophysiologist; M.S. Polyakov and G.M. Savin, scientists in mechanics; M.T. Rylsky, poet, scholar in literature and linguistics, and others.

Simultaneously, amendments of current and long-term research plans were made. Without shifting the focus from defense problems (the Academy addressed them till the end of the war), it re-shaped its plans with a view to providing maximum support to the revival of the Ukrainian economy. And the main thing was that plans were developed and concrete measures taken to

[58] Ibid. P. 36.
[59] Ibid. P. 36—40.
[60] Палладін О.В. Робота Академії наук УРСР в 1943 р. і план науково-дослідних робіт Академії на 1944 р. Вісті АН УРСР. 1944. № 3—4. P. 10.

The first meeting of the URSR AS Presidium in Kyiv liberated from the Nazis. 1944

The administration and leading scientists of the URSR AS. In First Row Left to Right: Acads. I.I. Lukinov and V.M. Glushkov, URSR AS Vice-Presidents; Acad. B.E. Paton, URSR AS President; Acads. K.M. Sytnyk and F.S. Babichev, URSR AS Vice-Presidents. First Left in Second Row is Acad. I.K. Pokhodnia, Chief Scientific Secretary of the URSR AS Presidium. Kyiv, 1981

revive the Academy itself. Acad. O.V. Palladin, Vice-President of the Academy, in his report 'The work of the Academy of Sciences of the URSR in 1943 and the plan of Academy research for 1944' said: "This time we have already given a significant place to core theoretical problems in certain areas of science — not to the issues of today but, rather, to future issues, long-term tasks, issues that ensure fast progress and growth of relevant fields of knowledge here, in Ukraine, to problems whose solutions would guarantee the leading role of our science in the world science" [61].

The task was set "to resume work on the major pre-war problems that had been studied earlier at each institution. That was necessary for our science … not merely to keep pace with the world science, but, rather, for it to take the leading place in the science of the whole world after the war" [62]. The Academy headed to problems that "are of great general scientific and general theoretical importance" [63]. In the fields of physico-chemical and mathematical sciences those were the investigations of atomic nucleus, isotope chemistry, catalysis. Geologists focused their attention on exploring the Earth's crust, Donbas coal, soils as the basis for grain growing, underground waters and erosion processes. The institutes of the Division of Biological Sciences continued their studies towards increasing the yield capacity of agricultural crops, examinations of the flora and fauna of Ukraine, development of stock-breeding, and the issues of general biology as well. In the field of clinical physiology they studied nervous system physiology, the physiological system of connective tissue, wound sepsis; in the field of biochemistry — the issues of biochemistry of neural and muscle activity; in the sphere of hydrobiology they explored water areas. Those topics show that the institutes of biological sciences resumed their studies of the problems they had addressed before the war.

At the Division of Engineering Sciences, scientists also focused on basic research that was of immense practical importance. The Electric Welding Institute continued its work in the area of fast automated welding. The Institute of Ferrous Metallurgy studied the problems of improving new types of metallurgical processes, high-grade cast iron and heat-resistant alloys; the Institute of Energy Engineering addressed new types of energy management, the improvement of generation facilities and power networks, the creation of electronic computing machines; the Institute of Construction Mechanics studied the problems of strength in machine building and the problems of nonlinear mechanics; the Institute of Mining Mechanics investigated stability and elasticity in mining, mine winding systems. All those issues were concerned with the strategy of engineering and technological progress.

The Division of Social Sciences aimed its efforts towards further advancement of the Ukrainian economy and culture: studies of the literary Ukrainian language, preparation of dictionaries, scholarly courses in the history of Ukraine, Ukrainian literature, Ukrainian art, as well as issues of industrial and agricultural economy, economic geography, and statistics.

The reorganization of the Academy structure was started, so that, after their return to Kyiv, researchers could work at the institutes which had existed before the war [64]. The Institute of Zoobiology was again divided into tree — those of Biology, Microbi-

[61] Ibid. P. 16.
[62] Ibid.
[63] Ibid. P. 17.
[64] Ibid. P. 19.

ology and Zoology, the Institute of Physics and Mathematics — into two independent institutes of Physics and Mathematics. The Institute of History and Archeology was also divided into two independent institutions. The foundation of new institutes and renewal of post-graduate studies were discussed. Much attention was given to the advancement of economic science and culture in the western oblasts of Ukraine. Departments of the institutes of the History of Ukraine, Economics, the Ukrainian Literature, Linguistics were restored in Lviv, and they were united into an Academy branch. Afterwards, the departments of the Institute of Geological Sciences, Mathematics, Energy Engineering, Zoology and Botany were added to them.

In 1944—1945, the Astronomical Observatory in Kyiv, the Laboratory of High-Speed Machines and Mechanisms, the Kharkiv Branch of the Institute of Energy Engineering, the Laboratory of Metal Physics, the institutes of General and Inorganic Chemistry and of Organic Chemistry were founded[65]. Relying on the newly established institutions related to the agrarian sphere — the institutes of Genetics and Selection, Entomology and Phytopathology, Physiology of Agricultural Crops and Agrochemistry, Forestry and the laboratories of Machine Building and Problems of Agricultural Mechanics, Soil Science etc. — the Division of Agricultural Sciences was organized.

Various measures were taken to improve research logistics, libraries and publishing, the housing conditions of Academy's employees and the training of young researchers.

In general, 1945, the year when World War II ended, became the year of restoring the Academy in its pre-war format and even of its replenishing with new institutions. The time came for systemic research and research planning, as well as introducing research outcomes to practice. O.V. Palladin became the Academy President in 1946. In his summary report of 1945 he had grounds to declare that the Academy of Sciences and all its institutions, despite the reconstruction difficulties, "in many areas obtained results that are of great scientific and practical importance. Our institutes were able to resume the research of the key theoretical problems of each scientific field in order to advance science"[66].

The frame of the Academy structure and its status as Ukraine's topmost scientific research institution was restored. The switch of all areas of the academy system to their routine work was interrelated with the restructuring of the entire Ukrainian economy and overcoming the consequences of war in the social life. In 10 post-war years Ukraine entered the pathway of stable development. Its experience of intense activities in the years of war helped the Academy to go promptly through the restoration period. The basic research in fundamental areas was resumed, the material facilities for science were built up, and the social demand for science was increasing. A young generation was coming to science.

The Academy's period of flourishing falls on the 1960—1980s[67]. At the beginning of that period it already had a wide network of institutions that were grouped into three sections: those of Physics and Engineering,

[65] Палладін О.В. Академія наук УРСР в 1945 р. — Вісті АН УРСР. — 1946. — № 5—6. — P. 19.

[66] Ibid. P. 29.

[67] Національна академія наук України. 1918—2008: до 90-річчя від дня заснування / голов. ред. Б.Є. Патон. — Київ: Вид-во КММ. — 2008. — P. 103—194.

Chemical Technology and Biology, and Social Sciences. Actually, that was the first version of the present structure of the Academy. There was a boom of sciences that sped up the S&T revolution.

The Academy, which since 27 February 1962 has been headed by Boris Paton, aimed the research work of its institutions at promoting the engineering, technological and educational progress that would rely on the advancement of basic science, as it is this very basis that gives rise to breakthrough, socially significant scientific results and technologies. The Academy successfully implemented B.E. Paton's idea concerning the advancement of ***purposeful basic research***, which was new not only for science in the USSR but for global science as well. This paradigm of scientific research organization permitted a rather fast transformation of basic research results into applied results and R&D products. It was in the AS of the URSR, in contrast to the AS of the USSR, that the network of design offices and pilot production facilities grew quickly. This essentially accelerated the advancement of new knowledge towards practice, facilitated the development of innovative technologies and products on its basis.

The reformation of the Academy, improvement of its structure, setting up numerous new institutes in the major research areas, building up its human potential took place, proceeding from the principle that the main resource of academy science is basic research whose front has been essentially extended. Yet, applied research was not phased out and the Academy ensured that it did rely on the outcomes of basic research. Along with classical sciences, interdisciplinary research gave rise to new science areas and generated new knowledge.

In the 1960—1980s, the Academy of Sciences of Ukraine was the second center in the USSR (after the Union's Academy) whose research personnel generated science which made the Soviet Union (in spite of all the negative impacts of limited personal freedom and distorted social relations) one of the two superpowers alongside the USA. The Academy of Sciences of Ukraine has become a renowned leader in the strategic trends of science progress — cybernetics, energy engineering, materials science, electric welding, heavy engineering, space-rocket industry, and in biotechnologies.

At that time the Academy boasted infrastructure innovations that drew together science and industry, facilitated the deployment of basic research results. The focus was given to the fast transition of research outcomes to the stage of industrial production. R&D complexes were set up for that purpose. They consisted of institutes, design offices, pilot production facilities and plants. Inter-departmental R&D complexes became their extension and continuation. At first, they emerged at the Electric Welding Institute and the Institute of Materials Science Problems.

To make the way from an invention to its deployment as short as possible, engineering (research and engineering, research and technological, research and production) centers were organized both within Academy's R&D complexes and interdepartmental R&D complexes. A scientific idea took definite practical shape there.

Academy institutions of Lviv were among the first to work out and implement integrated targeted S&T programs aimed at improving the technological level of particular production enterprises. For that purpose, all participants of the program set up interdepartmental targeted research-and-production agglomerations on a contractual basis. They proved efficient integrators of the R&D efforts of Academy institutions and

industrial enterprises. Later the agreements on the R&D collaboration of scientific, industrial structures and authorities became a regular practice in every oblast of Ukraine.

In the 1960—1980s, the Academy initiated the development and adoption of major integrated S&T programs intended for entire branches of industry, transport, agriculture, energy sector, which enabled scientists to make a sizeable contribution to the solution of pressing problems in the Ukrainian economy.

The network of Academy institutions was becoming ever more extensive and covered nearly all Ukraine, Academy institutes or institute branches were operating in every oblast center. There was a necessity to set up an integral ordered Academy structure whose influence would cover the whole country. Through the Academy's initiative, in 1981 the Government approved the decision according to which all Ukrainian oblasts were grouped under six regional science centers of the Academy:

Donetsk Science Center included Donetska and Luhanska oblasts;

Western Science Center included Volynska, Zakarpatska, Ivano-Frankivska, Lvivska, Ternopilska and Chernivetska oblasts;

Southern Science Center included Odeska, Krymska, Mykolaivska and Khersonska oblasts;

South-West Science Center included Vinnytska, Zhytomyrska, Kyivska, Khmelnytska, Cherkaska and Chernihivska oblasts;

North-East Science Center included Poltavska, Sumska and Kharkivska oblasts;

Prydniprovskyi Science Center included Dnipropetrovska, Zaporizka and Kirovohradska oblasts.

All centers operated under the scientific management supervision of the Academy Presidium and formed the scientific infrastructure of regions' interaction among themselves and with the central power bodies. That provided better management of S&T progress and the economic development of the regions.

We should also note two more important features which at that time opened up new prospects of the all-Academy rise — they were the purposeful formation of the powerful experimental basis of scientific research and the unprecedented capital construction. It is well known that the development of new equipment, materials and procedures of their use is the key way to scientific discoveries. Hence, the funding of Academy's experimental infrastructure was regularly increased. Every year, its institutions procured approximately five thousand items of new scientific devices. The national instrument-making network was being formed; in many cases it is still operative. Even at that time, steps were taken to organize centers for the shared use of valuable scientific equipment. Academy's institutes were among the first in the USSR to develop and deploy automated research systems and automated control systems. In actual fact, the AS of Ukraine became the center for advancing engineering sciences in the USSR. A number of its institutes — E.O. Paton Electric Welding Institute, the institutes for Materials Science Problems, of Geotechnical Mechanics, the Physico-Mechanical Institute — got the status of head institutes in the USSR in priority areas of the S&T progress.

In the early 1960s the Academy launched capital construction. Near Svyatoshyn settlement the Academy started the construction of the academy township — a housing estate and scientific center comprising the institutes of Geophysics, Geochemistry and Physics of Minerals, General and Inorganic Chemistry, Colloidal and Water Chemistry, Metal Physics, Problems of Materials Science, Problems of Casting. In today's Ho-

losiivskyi District, the construction of Nauky Avenue was started, with the buildings for the Institute of Semiconductor Physics, Institute of Physics, Institute of Physical Chemistry, Institute for Nuclear Research, and a new building of the Institute for Theoretical Physics was constructed in the Feofaniya Park near the southern outskirts of Kyiv. Apartment houses and premises for the Cybernetics Center were built in Teremky, in Shulyavka — apartment houses and buildings for the institutes of Mechanics, Hydromechanics and Engineering Thermophysics. A building for the institutes of socio-humanities was erected on 4 Hrushevskoho Street. Academy buildings were also constructed in Donetsk, Kharkiv, Dnipropetrovsk, and Lviv. The construction process in the Academy continued till the mid-1980s.

Relying on the basic research carried out at the Academy in the 1960—1980s, noteworthy results in the advancement of traditional industries were obtained, new industries were started, such as special electrometallurgy, powder metallurgy, new types of metal treatment, highly efficient welding processes, various methods of depositing coatings with predefined properties, and novel casting processes. Many technologies, facilities, materials, preparations, automation systems and hardware found their applications; a large part of those had no foreign counterparts in terms of their properties and performances. The whole world appreciated the results of basic research in numerous areas of mathematics, nonlinear mechanics, the theory of random processes and the probability theory, geometry and functional analysis, cybernetics, theoretical physics and solid state physics, physics of plasma, molecular biology and genetics, space research.

Social sciences and humanities also built up their achievements. They were overcoming the pressure of ideological dictate and asserted objective scientific knowledge. Socio-humanities formed a scholarly system of basic knowledge that became a powerful element of the Academy along with engineering and natural sciences[68].

Since the very foundation of the Academy the achievements of its scientists played the decisive role in the scientific and methodological support to the advancement of Ukrainian education, progress in research carried out at institutions of higher education, the rise of the Ukrainian culture, diffusion of scientific knowledge and the general enhancement of the intellectual and spiritual potential of the society.

An outstanding role in that was played by the Academy's academic publishing activities launched in the first years of its existence, using the premises and printing hardware of Kyiv Pechersk Lavra, which was transferred to the AUAS. It is with this historically significant and carefully maintained equipment that the first works of AUAS scientific divisions were printed. They were approved for publication by the Editorial and Publishing Board of the Academy chaired by Acad. A.Yu. Krymsky. After him the Editorial and Publishing Board (now it is the Academic Publishing Board of the NAS of Ukraine) was headed by a constellation of brilliant scientists: Acads. O.V. Palladin, B.S. Chernyshov, in the post-war decades — G.V. Kurdyumov, M.F. Gulyi, V.M. Glushkov, V.S. Gutyrya, K.M. Sytnyk, I.I. Lukinov, I.K. Pokhodnya, V.V. Skopenko, V.G. Baryakhtar, V.V. Nemoshkalenko, Ya.S. Yatskiv (since 2002).

The amount of Academy book publishing was steadily growing. From 1918 till

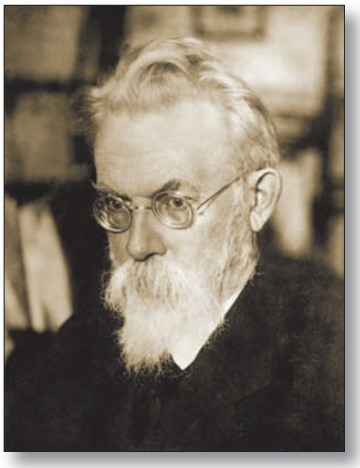
[68] Онищенко О.С. 85 років Національної академії наук України: історія формування вітчизняного комплексу фундаментальної науки. Вісник НАН України. 2004. № 1. Р. 15—22.

1929 a total of nearly 500 book titles were issued; nearly 300 of those were printed in the aforementioned printing plant. In the years of World War II, in evacuation, over fifty books were published that addressed, first and foremost, the current issues of national economy. In the late 1950s the Academy published nearly 200 titles of scientific monographs annually. In the times of wars and homicide famines, repressions intended for the total extermination of the national movement, the Ukrainian culture and conscious intellectuals, the Ukrainian academic book was an active factor of the intellectual progress of the nation. Sometimes those editions were included in the list of books prohibited on the territory of the USSR and were destroyed, sometimes were reprinted and translated many times, became the cornerstones of scientific achievements acknowledged by the whole world. Afterwards, during the thaw and in the period of the USSR stagnation, when strict control and party centralization ruled over, annual publication plans of the Academy of Sciences of Ukraine were approved in Moscow. But even that could not prevent the advancement of Ukrainian publishing. Academy's '*Naukova Dumka*' publishers gained worldwide recognition as the leading academic publisher just in those years. It won awards at international exhibitions, was allocated centralized funding for issuing academic literature in all science areas, issued over 80 % of all printed products of the Academy of Sciences of Ukraine — monographs, collected scholarly works, journals. The intense publishing activities, in particular, the publication of scientific literature and periodicals in foreign languages, enhanced the international prestige of the Ukrainian science.

Due to close Academy's ties with the international scientific community, it became the host of international scientific centers.

It would not be out of place here to remind that the Academy has become the conceptual source and organizational donor of the five state-supported (now national) sectoral academies — the medical, agrarian, educational, legal and art ones. That became possible due to the existence of an extensive system of basic research that was formed in the closing decades of the twentieth century.

Thus, the Academy was able to generate S&T progress in the Ukrainian society, move ahead on the waves of S&T revolution, and demonstrate in practice the socially significant role of science. It made a sizeable contribution to the transformation of Ukraine into an industrially developed country with powerful intellectual potential. Ukrainian independence gave the Academy new stimuli and opportunities but it also brought new challenges. The need to comprehend new social transformations and cope with new aspects of the S&T revolution is on the agenda.



Volodymyr I. ***Vernadsky*** *(12.03.1863 – 16.01.1945). Founder and first President of the Ukrainian Academy of Sciences in 1918 – 1921*

Volodymyr I. Vernadsky is an eminent researcher in natural sciences, an emblematic figure in the history of the national and world science.

He was born in St. Petersburg, graduated from St. Petersburg University (1885). From 1891 till 1915 he was an associate professor and then professor of Moscow University. Academician of the St. Petersburg Academy of Sciences since1909. The President of the Ukrainian Academy of Sciences (1918—1921). Professor and Rector of Tavrida University in Simferopol (1920—1921). Director of Radium Institute (1922—1939), the Biogeochemical Laboratory (1928—1939) of the USSR AS.

V.I. Vernadsky's parents lived in Kyiv, were descendants of well-known Ukrainian families. "Both families, — the scientist recollected, — maintained living Ukrainian traditions"[69]. He spent most of his childhood and a part of adulthood in Ukraine — in Kharkiv, Poltava, Kyiv, Simferopol. He was spiritually united with Ukraine and wherever he might be he sincerely aspired to work for its good. That he admitted in a letter to his friend and colleague M.P. Vasilenko, Ukrainian historian, jurist and statesman: "You know how dear Ukraine is to me and how Ukrainian revival penetrates deeply into my national and personal outlook. And I think that it is my great fortune to take part in this"[70].

V.I. Vernadsky exerted profound personal influence on the formation of the national science system and the national system of higher education in Ukraine. He was one of the initiators, founders and the first President of the Ukrainian Academy of Sciences in Kyiv (now it is the National Academy of Sciences of Ukraine), one of the main initiators and the Chairman of the Provisional Committee for Founding the National Library of the Ukrainian State in Kyiv (now its V.I. Vernadsky National Library of Ukraine). V.I. Vernadsky also headed commissions on higher education, exploration of natural resources, the Scientific Committee on Agriculture. He was the President (Rector) of the Tavrida University and actually saved it from destruction. He advanced effective decisions which were able to ensure progress in the science, education and economy of Ukraine. V.I. Vernadsky's world outlook was inspired with humanistic principles of individual freedom, equality, progress and democracy.

The greatest merit of V.I. Vernadsky was that he, jointly with his like-minded colleagues, implemented the idea of founding the National Academy of Sciences, which ever since the late 19th century more and more captivated the Ukrainian scholarly community. V.I. Vernadsky elaborated a viable, far-sighted model of the Academy. According to his plan, the Academy was to meet such important requirements: 1) national (to promote the growth of the Ukrainian national self-awareness and Ukrainian culture), 2) those related to the Ukrainian statehood (be instrumental in enhancing the productive forces of the country and the man) and 3) local (be tied as closely as possible with common issues of practical life). And three main principles were also assumed as the basis of Academy's life: its state status, self-governance in scientific matters, a harmonious union of natural, engineering sciences and socio-humanities[71]. The implementation of this model made the Academy the topmost scientific institution of Ukraine and an internationally acknowledged center of basic research.

Even today the genius of V.I. Vernadsky is exemplary. He was a natural scientist of encyclopedic knowledge, historian, philosopher, an expert in science methodology. He started several (which is a rare phenomenon) new scientific areas that still retain their heuristic potential — genetic mineralogy, geochemistry, biogeochemistry, radiogeology, geo-ecology. As a thinker and scientist he rose to wide-ranging philosophical generalizations: alongside French scientists E. Le Roy and P. Teilhard de Chardin he was a co-founder of the noosphere doctrine, which now is the symbol of the future civilization. What is more, it was V.I. Vernadsky's lectures on geochemistry at Sorbonne in 1922—1923 that encouraged Le Roy and Teilhard de Chardin to develop the theory of the noosphere.

V.I. Vernadsky lived and worked in hard times of dramatic social turns, wars, revolutions, social troubles and, simultaneously, in the times of the flight of scientific ideas, rapid development of the industrial era. And in spite of all difficulties, as a scientist and as a man he remained a convinced optimist, as he believed in the power of science and that mankind equipped with knowledge is becoming a true geological force. "The time of science lies ahead of us", — he said. And in his declining years he sent us a cheerful message: "I believe in the great future of both Ukraine and the Ukrainian Academy of Sciences"[72].

And the path of the genius to the heights of world science started with the interest of gymnasia pupil Volodymyr Vernadsky in the structure of common salt crystal.

[69] Вибрані наукові праці академіка В. І. Вернадського: у 10 т. Т. 1: Володимир Іванович Вернадський і Україна. Кн. 1: Науково-організаційна діяльність (1918—1921). Київ, 2011. P. 543.

[70] ЦДАМЛІМ України, ф. 542, оп. 1, спр. 20, арк. 22.

[71] Вибрані наукові праці академіка В. І. Вернадського: у 10 т. Т. 1: Володимир Іванович Вернадський і Україна. Кн. 1: Науково-організаційна діяльність (1918—1921). Київ, 2011. P. 195—196.

[72] Там само. P. 643.

Mykola P. ***Vasilenko*** *(14.02.1866 – 03.10.1935). President of the All-Ukrainian Academy of Sciences in 1921 – 1922*

The name of Mykola P. Vasilenko, the second President of the All-Ukrainian Academy of Sciences, is written in golden letters in the history of Ukrainian science, the formation of the Ukrainian state and legislation. He became famous not only due to his rich scholarly legacy, but also because he consistently grounded the idea of establishing the Ukrainian Academy of Sciences and made a sizeable personal contribution to its implementation.

Mykola Vasilenko was born in the Hlukhiv District, which was rich in Cossack traditions. He himself was of Cossack origin. He got higher education at the department of history and philology of the Derpt (now Tartu) University, which he graduated from in 1890.

Then he tied his life with Kyiv. After the overthrow of the Russian autocracy, he took the office of the Superintendent of Kyiv Educational District. Later he was invited to St. Petersburg to take the post of the Deputy Minister of Education in the Provisional Government. The other Deputy Minister was V.I. Vernadsky, a well-known scientist in geophysics.

It was at that time that M.P. Vasilenko was captivated by the idea of creating the Ukrainian Academy of Sciences. As V.I. Vernadsky recollected later, M.P. Vasilenko "was the first to generate the idea of founding the Ukrainian Academy of Sciences. At once there was a friendly feeling dear to both of us".

After the declaration of the Ukrainian People's Republic, M.P. Vasilenko returned to Kyiv and was involved in the process of the national state building. In the period of the Tsentralna Rada, he became a member of the General Court of the Ukrainian People's Republic, and during Hetman P. Skoropadsky's rule he was taking the offices of the Minister of Public Education and Art and the President of the State Senate.

M.P. Vasilenko effectively used his ministerial powers to implement the idea of the academy. He invited V.I. Vernadsky to head the commission for preparing a draft legislation on founding the Ukrainian Academy of Sciences and its draft Statute.

After M.P. Vasilenko resigned from his ministerial post, the participants of the second General Meeting of the UAS, held in Kyiv on 30 November 1918, unanimously resolved to send him a greeting and warm gratitude for his contribution to founding the Academy. The greeting, in particular, said: "Being the Minister of Public Education, you wholeheartedly took measures to found the Ukrainian Academy of Sciences".

In the beginning, soviet authorities treated the scholar reasonably. On 26 July 1920 he was elected an UAS Academician, and on 18 July 1921 — the second President of the Academy. In that difficult time, M.P. Vasilenko achieved a certain improvement in the financial situation of the Academy, replenishing its membership with renowned scholars, and expansion of its publishing activities.

Yet the new authorities could not forgive M.P. Vasilenko his political and public activities of the past. He became a victim of a

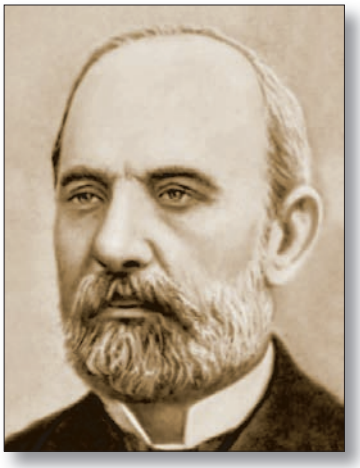
political repression wave, a "purge" of the Academy from "harmful elements". In September 1923 he was arrested together with his younger brother Kostyantyn on the fabricated charges under the case of "Kyiv Oblast Action Center".

The Academy rose in defense of him. The struggle for their colleague deserves deep respect. Eventually, in 1925 M.P. Vasilenko was indemnified against all punishment measures.

The scholar's experience of repression undermined his health. But he continued his research and the number of his publications nearly reached 500. Most of them addressed the history of the state and law in Ukraine. M.P. Vasilenko, relying on numerous arguments, consistently proved the independent development of the Ukrainian law, deeply analyzed its legacy of historical sources.

As M.P. Vasilenko's wife, well-known Ukrainian historian N.D. Polonska-Vasilenko, wrote later, her husband belonged to the Academy with all his heart, was its ardent advocate and patriot. Till his death "he lived by Academy's interests, took hard its ruining, and his very last thoughts were about the Academy of Sciences".

In the independent Ukraine, M.P. Vasilenko's name has taken its due place. Books and brochures have been written about him. V.M. Koretsky Institute of State and Law of the NAS of Ukraine has edited and published 3 volumes of scholar's works.



Orest I. ***Levytsky*** *(25.12.1848 – 9.05.1922). President of the All-Ukrainian Academy of Sciences in 1922*

Orest I. Levytsky was one of those who even under Russian autocracy cherished the idea of the Ukrainian Academy of Sciences. Though he was not a university professor, he won general respect due to his scholarly studies and literary essays on the history, ethnography and legal practices of the Ukrainian people, was a founder and active member of numerous public scholarly associations, gave much personal effort for the newly founded Ukrainian Academy of Sciences to inherit the best traditions of the Ukrainian Scientific Society in Kyiv.

The academician-to-be was born in the Mayachka village of the Kobelyatsky District, Poltavska Province, into the family of a rural deacon, a descendant of the old noble Cossack family of the Nis-Levytskys. In 1874 he graduated from the Department of History and Philology of St. Volodymyr University in Kyiv.

Scholar's views on history took shape under the influence of V.B. Antonovych. Under his guidance O.I Levytsky started the work as the secretary of the Provisional Commission on Systematizing Old Documents (Kyiv Archeographic Commission), taking that post till 1921. Simultaneously he was a many-year assistant to the Director of the Central Archive of Old Acts under Kyiv University, taught at Kyiv educational institutions.

Over 200 scholarly writings came from the pen of this historian, archeographer and archivist, jurist and man of letters. Those were works on the history of Ukraine in the 16^{th}—18^{th} centuries and the history of common law, way of life, court procedures, the Ukrainian Church, as well as historical short stories.

He was involved in the preparation of the multi-volume series edition "Archive of South-West Russia", in particular, publications of Lutsk act registration books, the "Eyewitness's Chronicles" and a collection of documents concerning the history of clerical and religious relations. Of special importance for the development of the Ukrainian jurisprudence were O.I. Levytsky's studies addressing family relations, customs and family law. He was also one of the founders of the Ukrainian legal and historical belles-lettres genre.

Rather sizeable was O.I. Levytsky's contribution to the development and codification of the Ukrainian scientific terminology, first and foremost, of the legal one. He was the chairman of public and state committees for its adjustment. As an admirer and renowned connoisseur of the Ukrainian language, the scholar was personally involved in the Ukrainian translation of the Gospel.

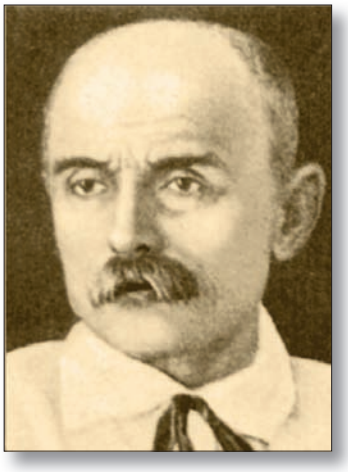
O.I. Levytsky was a member of Kyiv Community, his authority among Ukrainian intellectuals was high. He was an active member of the History Society of Nestor-the-Chronicler, one of the founders and Deputy-Chairman of the Ukrainian Scientific Society in Kyiv (USS), an active contributor of the *Kievskaya Starina* (*Kyiv Old Times*) magazine, a co-editor (jointly with M.S. Hrushevsky) of the *Ukraina* magazine. The scholar actively collaborated in the South-West Depart-

ment of the Russian Geographic Society, in the Kyiv Law Society (in its common law department), T. Shevchenko Scientific Society in Lviv and in numerous other well-respected scholarly centers. In the years of Ukrainian Revolution he was a member of the Committee for the Protection of the History and Art Heritage.

As one of the USS leaders, O.I. Levytsky was actively involved in preparing the draft legislation on the foundation of the Ukrainian Academy of Sciences and was among the first 12 founders of the UAS. In the Academy he headed the Chair of the Common Law of Ukraine, was the Chairman of the Commission for Studying Common Law, the Commission for Legal Terminology and the Law Society, was a member of the Commission for Studying the History of the West-Rus and Ukrainian Law and a number of other Academy institutions.

O.I. Levytsky was the Secretary (since 1918) and the Head (since 1920) of the Socio-Economic Division, acted as the UAS President from December 1919 till July 1921, and in March 1922, when the authorities refused to approve M.P. Vasilenko for the presidential post, was elected the third President in the history of the UAS.

O.I. Levytsky suddenly died on 9 May 1922 when he was visiting the Drabovo agricultural experimental station (now Cherkaska Oblast) and was buried nearby, in Mytlashivka village. For a long time, his scholarly works were neglected and the fact that he had headed the Academy was concealed. Now a kind of scholar's exoneration has taken place, a number of studies concerning him have been published, and a commemorative plaque informing that he was a President of the UAS has been placed on the building of NAS Presidium.



Volodymyr I. ***Lipsky*** *(11.03.1863 – 24.02.1937). President of the All-Ukrainian Academy of Sciences in 1922 – 1928*

Volodymyr I. Lipsky, prominent scientist in botany, was born into the family of a priest in Samostrily village, Rivne region. In 1877—1881 he studied at Pavlo Galagan College, then at the Department of Physics and Mathematics of St. Volodymyr University in Kyiv. During his studies under the guidance of Prof. I.F. Schmalhausen, expert in botany, V.I. Lipsky took a great interest in exploring the flora of Ukraine, and after graduation in 1887 he was appointed a lecturer of the Botany Chair and the keeper of the herbarium of the University Botany Office and Botanical Garden. At that time he was an active member of the Kyiv Society of Nature Explorers.

In 1894—1902 V.I. Lipsky worked as a conservator and later, till 1917, as the chief botanist, a department head at the Petersburg Botanical Garden. Due to his broad and versatile activities he became one of the leaders in Russian botany.

For many decades, V.I. Lipsky's many-sided activities were focused on the problems of floristics, plant systematics and geography, herbarium collection and conservation, management of botanical gardens, and botany history. He described 4 genera that were new for science, as well as 220 new plant species and varieties. 2 genera and 54 plant species were named after him. V.I. Lipsky visited all continents, except Australia and Antarctica. Quite a number of his studies addressed the vegetation of Ukrainian Podillya, Volyn, Kyiv region, Bessarabia, the Crimea, as well as the Caucasus, the Altai Mountains, Central Asia, North Iran. He carried out many lengthy expeditions and collected herbaria containing several dozen thousand sheets of herbarium samples.

In violent 1918, V.I. Lipsky returned to his native land and became actively involved in the work of the Ukrainian Academy of Sciences, first and foremost, of the Commission for Exploring the Natural Resources of Ukraine. He was elected an Active Member of the UAS in 1919, a member of the UAS Board — in 1920, the Vice-President of the Academy — in 1921, and made a noticeable contribution to organizing the work of its institutions, chairs and commissions, in particular, to the advancement of publishing activities, expanding the work of the National Library of Ukraine, which now bears the name of V.I. Vernadsky.

V.I. Lipsky headed the Commission for Compiling the Encyclopedic Dictionary, represented the Academy in the Military-Industrial Committee.

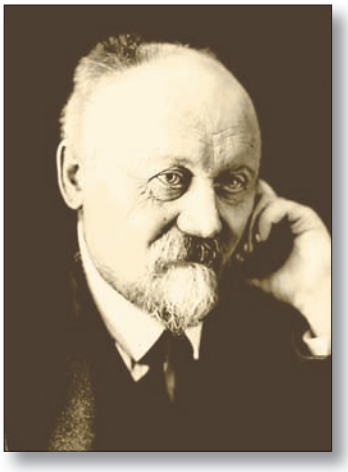
In the following years, V.I. Lipsky laid scientific foundations for setting up a botanical garden of the Ukrainian Academy of Sciences in Kyiv, drew up the draft of reorganizing the 'Askania-Nova' Reserve, with the purpose of conservation and exploration of the virgin lands of Southern Ukraine.

As he headed the AUAS in 1922, when the totalitarian regime was gradually becoming firmly established in the country, V.I. Lipsky, jointly with his fellow-fighters — Acads. S.O. Yefremov, A.Yu. Krymsky and others — for six years had to lead continuous, exhausting and, surely, unequal struggle for retaining the democratic principles

of academy science organization, facing grave political charges in the process. In the 1920s, the Academy retained the basic principles of free creative work, and elements of scholarly community self-organization. That considerably promoted the growth of the Ukrainian science, first of all, in the areas of social sciences and humanities, which at the time were taking leading positions in the AUAS.

The election of V.I. Lipsky a Corr. Memb. of the USSR AS in 1928 was the recognition of his achievements as a scientist, science manager and public figure by the scientific community.

After leaving the office of Academy's President in 1928, V.I. Lipsky headed the Botanical Garden of Odesa University, and from 1933 till the end of his life he worked as an adviser of this institution. In those years he carried out several Black Sea expeditions, and the results of his research were of great importance for the progress of medical industry.



Danylo K. ***Zabolotny*** *(28.12.1866 – 15.12.1929). President of the All-Ukrainian Academy of Sciences in 1928 – 1929*

The name of D.K. Zabolotny, eminent scientist and science manager in the history of national and world medicine and biology, is closely related to the establishment of modern epidemiology and microbiology.

A son of peasants from Podillya, D.K. Zabolotny inherited the best features of the national character — industriousness, strength of mind, thirst for knowledge, eagerness to be useful to people. His way to great science was determined by studies at the sub-department of natural sciences of the Department of Physics and Mathematics of Novorossiya University in Odesa and the work which he started in 1889 at the first in the Russian Empire Odesa Bacteriological Station, set up by I.I. Mechnikov. In 1891—1894, D.K. Zabolotny was a student of the Medical Department of St. Volodymyr University in Kyiv. After graduation he was definitely shaped as a researcher whose interests were focused on the fight against dangerous epidemiological diseases of that time, first and foremost, cholera, plague and spotted fever.

Since 1897, D.K. Zabolotny repeatedly went as a member of scientific and medical missions to fight the plague in India, Arabia, East Mongolia, China, Iran, Scotland, to the steppes of Kirghizia and the Volga region. He made a sizeable theoretical and practical contribution to investigating the pathways and mechanisms of plague spreading, was the first to reveal the role of wild rodents in it and the existence of the natural pestholes of that infection.

D.K. Zabolotny was a talented academic, mentor of scientific and medical personnel, a resolute advocate of the preventive orientation in medicine and public health service. In January 1918 he set up the epidemiology department of the Institute of Experimental Medicine in Petrograd, in 1920 took part in the foundation of Odesa Medical College and was its first rector. In 1924, D.K. Zabolotny set up and headed the chair of microbiology and epidemiology at Army Medical College in Leningrad. His scientific and practical achievements, as well as managerial abilities, gained him wide recognition.

In 1928 D.K. Zabolotny was elected the President of the All-Ukrainian Academy of Sciences. The major feature of his activities at the head of the Academy was his striving for integrating the achievements of basic science with practice, the actual needs of the development of industry, agriculture, social sphere, in particular, public health service and medicine. D.K. Zabolotny started to reorganize the Academy's activities, taking into account promising trends in the development of the national economy of Ukraine. Very soon his efforts resulted in the strengthening of engineering, agrarian and biological areas of research, the foundation of quite a number of Academy institutions, specifically, the Institute of Microbiology and Epidemiology, which D.K. Zabolotny headed. The AUAS membership was replenished with leading scientists of the major and most promising areas of physical, engineering, chemical and biological research; O.O. Bogomoletz, O.V. Palladin,

E.O. Paton, M.M. Fedorov, O.V. Leontovych, D.K. Tretyakov and A.O. Sapiegin were among them.

A sudden death from pneumonia late in 1929 cut short the work of D.K. Zabolotny, eminent scientist and public figure, in high flight. The further development of the Ukrainian Academy of Sciences clearly demonstrated that exactly at the time when it was headed by D.K. Zabolotny it implemented crucial steps to the large-scale activities of the AUAS as the leading science center of Ukraine which promoted the formation of its powerful intellectual, S&T, industrial potential in the 20th century, i.e. to fulfil the task outlined by V.I. Vernadsky at the time of Academy's foundation.

D.K. Zabolotny's activities were immensely fruitful and many-sided. Not only were his scientific achievements in the fight against extremely dangerous human infectious diseases amazing, but so were his comprehensive interests as well, in particular, the harmonious fusion of the prominent scientist and talented poet. The Ukrainian people duly appreciated the accomplishments of their son. The NAS Institute of Microbiology and Virology, which D.K. Zabolotny had founded, and Vinnytsia Medical College were named after him. The National Academy of Sciences of Ukraine awards D.K. Zabolotny prizes for outstanding scientific research in microbiology, virology and epidemiology.

Oleksandr O. ***Bogomoletz*** *(24.05.1881 – 19.07.1946). President of the URSR Academy of Sciences in 1930 – 1946*

The name of O.O. Bogomoletz, eminent scientist and science manager, entails an important epoch full of dynamic changes and outstanding achievements of Ukrainian scientists. That was also the time of trials and hardships, ordeals of the war years. The life of the scientist was filled with many bright moments of the active patriotic service to his country, development of its science, medicine, and health care.

O.O. Bogomoletz was born in Kyiv, in Lukyanivska prison, where his mother, Sophia M. Bogomoletz, in 1881 was under inquiry into the activities of the radical narodnik movement. His growth as a scientist began in Odesa, where he graduated from the medical department of Novorossiya University and from 1909 on worked as assistant professor of the general pathology chair. The internships of O.O. Bogomoletz at the leading clinics and universities of France and Germany were of great importance for the final shaping of his numerous research interests. Nearly 15 following years of scientist's work were connected with Saratov, where he worked as a professor of the general pathology and bacteriology chair of the university's medical department. From 1925 till 1930, O.O. Bogomoletz headed the chair of pathological physiology of the 2-nd Moscow State University and concurrently headed the world's first institute involved in blood transfusion — the Moscow Central Institute of Hematology and Blood Transfusion. In those years O.O. Bogomoletz made a great contribution to science and displayed his brilliant managerial abilities.

In 1929 O.O. Bogomoletz was elected an Active Member of the Academy of Sciences of the Ukrainian RSR. He entered the history of the national science as the founder of the Ukrainian schools of pathological physiology, oncology, endocrinology and gerontology, the author of numerous fundamental scientific works in endocrinology, the problems of metabolism and immunity disorders, and of allergy, cancer, aging.

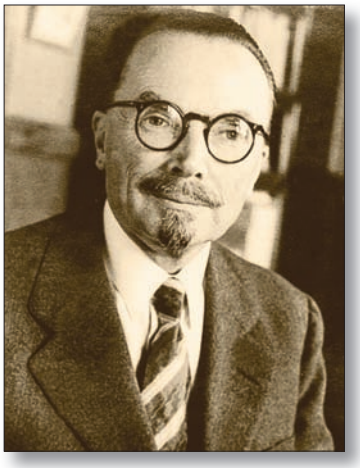
O.O. Bogomoletz, who was elected the President of the Academy of Sciences of the URSR in 1930, headed the radical reorganization of its structure, the transition from the existence of disconnected chairs, commissions, offices and other elements of science infrastructure that were obsolete even at that time to setting up a system of powerful research institutes. The Academy structure which he laid has been preserved in its general outline until today.

In 1931, O.O. Bogomoletz founded the Institute of Experimental Biology and Pathology under the People's Commissariat of Public Health of the URSR in Kyiv, and in 1934 — the Institute of Clinical Physiology of the Academy of Sciences of the URSR, where he gathered the best medical scientists of Ukraine. In the pre-war years, the scientist, jointly with the team of his followers, produced the multi-volume fundamental work "Fundamentals of Pathological Physiology", founded the *Medical Journal*, which for 20 years was the herald of theoretical medical thought in Ukraine, annually organized numerous conferences on the most relevant medical problems, which

started a new stage in the development of respective science areas. Through the efforts of O.O. Bogomoletz Kyiv turned into one of the most prestigious science centers of the then Soviet Union. The scientist established the USSR-largest science school in the field of pathophysiology and its sections: oncology, endocrinology, gerontology, hematology. O.O. Bogomoletz was a true innovator in science, stimulated the interest of his disciples in his ideas and encouraged their creative scientific work. His ideas became the cornerstones of modern theories, and the principles of prophylactics and treatment specified by them are still widely used in medicine.

In July 1941, O.O. Bogomoletz, together with the URSR Academy of Sciences, moved to Ufa, where all major Ukrainian institutes were functioning in evacuation. Under his guidance, Ukrainian scientists made a significant contribution to the development of defense industry. After the liberation of Kyiv, in the spring of 1944, O.O. Bogomoletz returned to Kyiv, where he headed the work on the reconstruction of the Academy of Sciences of the URSR.

O.O. Bogomoletz, scientist and science manager, in his lifetime won high esteem of the scientific community and the state. In 1932 he was elected an Active Member of the USSR Academy of Sciences, in 1942—1945 he was its Vice-President. In 1939, O.O. Bogomoletz became an Active Member of the Academy of Sciences of the Belorussian RSR, in 1944 — an Active Member of the USSR Academy of Medical Sciences and an Honorary Member of the Academy of Sciences of the Georgian RSR. The scientist was elected a deputy of the Verkhovny Soviet of the USSR and the Verkhovna Rada of the URSR. He was honored with the titles of the URSR Honored Worker in Science (1943), Stalin Prize laureate (1941), the Hero of Socialist Labor (1944) and was awarded with numerous orders and medals.



Oleksandr V. ***Palladin*** *(10.09.1885 – 06.12.1972). President of the URSR Academy of Sciences in 1946 – 1962*

Academician O.V Palladin was an outstanding person in many dimensions: a scientist, excellent science manager, talented academic, a well-known public figure and statesman.

The path of O.V. Palladin to great science was very natural. He was born into the family of V.I. Palladin, renowned plant physiologist and biochemist, academician of the Russian Academy of Sciences, a disciple of K.A. Timiryazev. Eminent physiologists I.P. Pavlov and M. Ye. Vvedensky were the mentors of the scientist-to-be at Petersburg University, where he studied in 1903—1908. Under their guidance O.V. Palladin chose an innovative and promising, as of that time, trend in animal physiology — physiological (biological) chemistry. In 1909—1913 he repeatedly went for internships in Germany to upgrade his knowledge and skills in that area.

In 1916, O.V. Palladin moved to Kharkiv — the city of his early childhood. At first he worked as lecturer, later — as professor of physiology of Novooleksandria Institute of Agriculture and Forestry, gave a course of lectures in physiological (biological) chemistry at Kharkiv University. In 1921 he was elected professor and the head of the chair of physiological chemistry of Kharkiv Medical Institute, set up a research chair of biochemistry, where he started research into the biochemistry of vitamins and metabolism in muscle and nerve tissues. In 1925, on the basis of this chair, O.V. Palladin organized the Ukrainian Biochemical Institute — the first on the territory of the former Soviet Union (now it is Palladin Institute of Biochemistry of the NAS of Ukraine). There he launched several new scientific trends in biochemistry: the biochemistry of muscles, vitamins and nervous system, or neurochemistry. Through his initiative, the Ukrainian Society of Physiologists, Biochemists and Pharmacologists was founded in 1928. O.V. Palladin was a co-founder of the International Neurochemistry Society, a member of the Chemistry Society of France, a member of the editorial boards of the authoritative international journals *Journal of Neurochemistry* and *The International Journal of Neurochemistry*.

At that time O.V. Palladin's achievements already won the high appraisal of the scientific community. In 1926 he was elected a Corresponding Member and in 1929 — an Active Member of the AUAS. In the 1930s, when the reforming of the Academy was started, the talent of O.V. Palladin as science manager unfolded fully. From 1935 he worked as the permanent Scientific Secretary of the URSR AS Presidium, and in 1939—1946 as Academy's Vice-President.

In the years of World War II, when the institutions of the URSR AS were working in Ufa, O.V. Palladin gave much effort to organizing their work for defense. In particular, under his supervision the Institute of Biochemistry synthesized *VIKASOL* preparation, which was successfully used in medical practice for stopping bleeding and treatment of the wounded.

In 1946 O.V. Palladin was elected the President of the URSR Academy of Sciences. His first years at the head of the Academy fell on

the difficult time of the post-war restoration of the Academy, revival of its institutions. O.V. Palladin's achievements in restoring and advancing scientific research according to the standards of the world science were significant. In the early 1950s the Academy launched extensive theoretical research in nuclear physics, semiconductor physics, radio physics and electronics, geophysics, mechanics, materials science, macromolecular chemistry, biochemistry, physiology etc. Many Ukrainian research institutes gained leading positions among the counterpart institutions of the Soviet Union.

The activities of O.V. Palladin were highly appraised. He was honored with the highest state awards — the titles of the Hero of Socialist Labor and the Honored Worker in Science and Technology of the URSR, the laureate of the State Prize. He was elected an Academician of the USSR Academy of Sciences, the Academy of Medical Sciences of the USSR, an Honorary Member of the Academy of Sciences of Belarus, a Foreign Member of the Academies of Sciences of Bulgaria, Poland, Romania, and Hungary.

In 1967, the I International Neurochemistry Congress in Strasbourg recognized O.V. Palladin the patriarch of the world functional neurochemistry, and in 1970 the II International Neurochemistry Congress in Milan awarded him the Gold Medal for his achievements in neurochemistry.

O.V. Palladin's sphere of activities was very broad: the work at the URSR AS Presidium and the Institute of Biochemistry, teaching at Kyiv University, duties of a deputy of the USSR Verkhovny Soviet (1946—1958) and of the Verkhovna Rada of the URSR (1947—1959). He was the first Chairman of the URSR *Znannia* society, founded in 1947. As a public figure and statesman, O.V. Palladin represented Ukraine at the UN Constituent Assembly in San-Francisco in 1945, attended international peace conferences.

Borys E. ***Paton.*** *Elected President of the NAS of Ukraine in 1962*

Borys E. Paton is an eminent Ukrainian scientist in the field of welding, metallurgy and technology of materials, an acknowledged public figure and talented science manager, an Academician of the National Academy of Sciences of Ukraine, a member of numerous foreign scientific organizations, professor, an Honored Worker in Science and Technology of the URSR, a winner of the Lenin Prize and State prizes of the USSR and Ukraine, a Hero of Ukraine, Twice Hero of Socialist Labor of the USSR.

B.E. Paton was born on 27 November 1918 in Kyiv into the family of Evhen O. Paton, professor of Kyiv Polytechnic Institute.

B.E. Paton's engineering and scientific activities started in 1942 at the Electric Welding Institute, which at that time was located on the territory of 'Uralvagonzavod' plant in Nizhny Tagil. From that time on he worked for 11 years together with his father, who headed the Electric Welding Institute. Those were the years of his development as a scientist and researcher, and later as the leader of a large team of scientists and production workers. He continued and brilliantly advanced the cause started by his father. Together with him B.E. Paton set up the world-famous Paton's science school and has headed the S&T complex recognized in the whole world — E.O. Paton Electric Welding Institute of the NAS of Ukraine.

The international authority of B.E. Paton stemmed from his versatile and extremely fruitful scientific and engineering work, his eagerness to aim basic scientific research at pressing issues of the S&T progress. His research laid the foundations of arc welding, namely, the theory of automata for arc welding, which was later developed by many experts in the field of the automated control of welding processes. Under the guidance of B.E. Paton, Institute's researchers carried out studies in the field of welding power sources, developed processes of arc, electroslag, contact, electron-beam welding and numerous other welding processes and related technologies; a large complex of basic and applied research in the field of static and cyclic strength of welded joints, their resistance to brittle and fatigue fracture and the ability to work under low temperatures. They were the first in Ukraine to develop systems for diagnostics of welded structures meeting the requirements of high operation safety. B.E. Paton led the research for using the electroslag process to improve the quality of metals and alloys, which gave rise to a novel area in metallurgy — electroslag remelting and casting. The technologies of electroslag remelting developed at the Institute found wide application and won world-wide recognition.

B.E. Paton is an innovative scientist. The technologies developed under his supervision work successfully on land, under water and in space. He proposed to use welding methods for joining live tissues. Boris Paton fostered hundreds of talented scientists and engineers. There are many academicians and corresponding members of the NAS of Ukraine among his disciples.

In 1962 B.E. Paton was elected the President of the Academy of Sciences of the Ukrainian RSR (now it is the National Academy of Sciences of Ukraine). Keen insight into the role of science in society, its goals and tasks, great international prestige of the scientist, devotion to science, inexhaustible energy and high ethics, civil and political activity, an experience in leading large scientific teams were the decisive arguments in electing him the President of the Academy. Since then he has headed this topmost scientific organization of Ukraine for 56 years.

The responsible post of the NAS President has unfolded his talent of science manager still further. He participated in elaborating a new structure of the Academy of Sciences and its new Statute, aimed at the most rational use of scientific personnel and means, concentrating them for the solution of major basic and applied problems that are of great importance for country's economy, in founding dozens of new institutions and organizations that promoted and extended research in key science areas.

The outstanding abilities of B.E. Paton as a leader, scientist and organizer were revealed in the dramatic days of the Chornobyl disaster. Research teams of numerous institutes of the URSR Academy of Sciences, its Presidium became involved in the work to abate its impacts from the very first days of the accident.

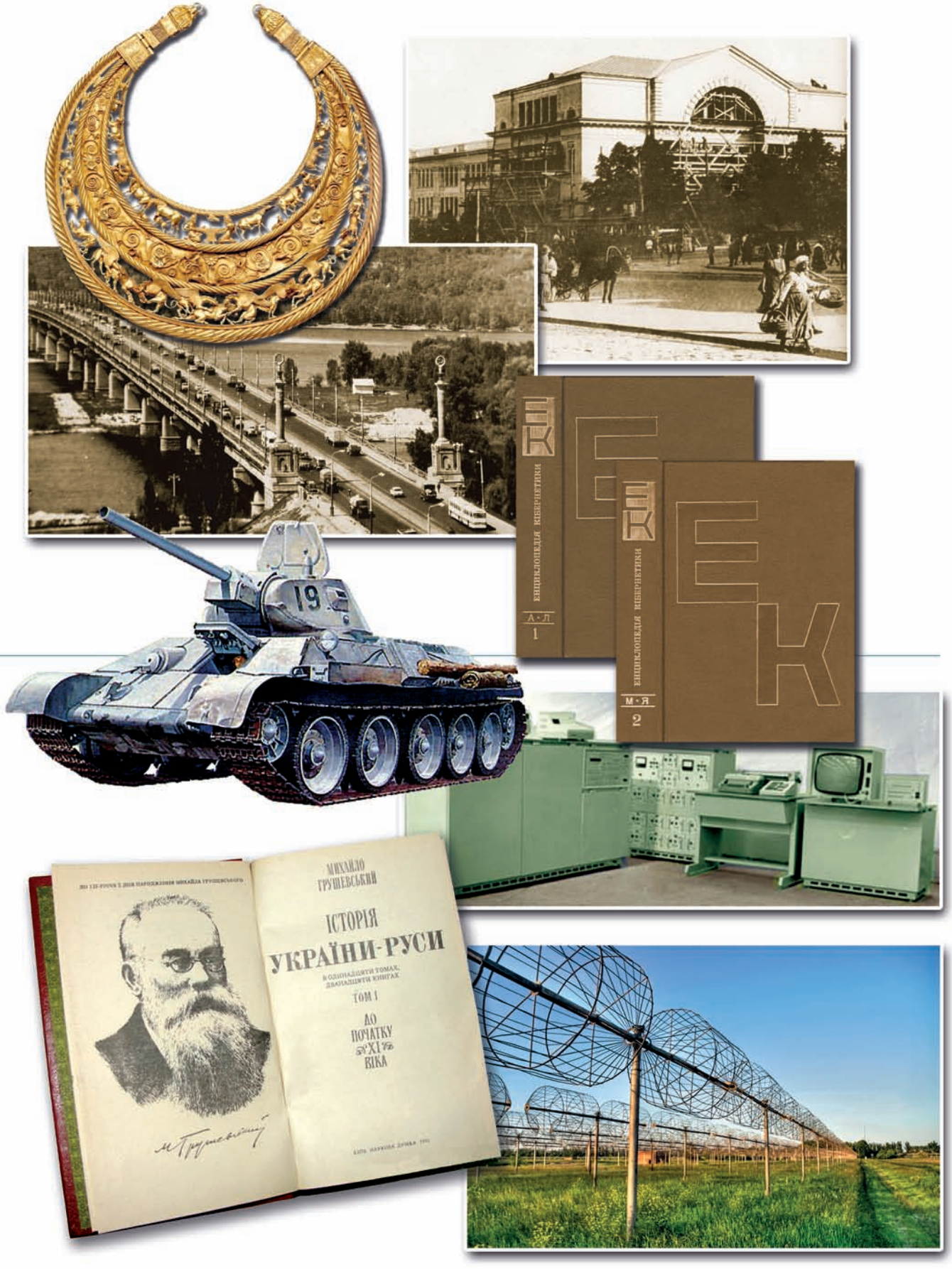
In the years of independence, B.E. Paton has done much for retaining and enhancing the potential of the Ukrainian science, advancing new scientific trends necessary to build up an independent European state, its economy, S&T, educational, social and cultural spheres, to increase Ukraine's defense capability.

B.E. Paton has made a major contribution to promoting the international scientific collaboration of Ukraine, the accession of its science to the European and global scientific area. Through his initiative the International Association of the Academies of Sciences (IAAS) was established in 1993. It brought together national academies of 15 countries of Europe and Asia. For nearly 25 years Boris Paton was the long-standing President of that organization.

B.E. Paton is a renowned statesman and public figure. He was repeatedly elected to the supreme bodies of state power of the USSR and Ukraine, was and still is the chairman and a member of distinguished committees and commissions. Taking positions of influence, he fruitfully works with the feeling of personal responsibility towards the state, people and his own conscience.

Academician B.E. Paton is a creative individual, wise, honest and warm-hearted person, he has fantastic energy, efficiency, a sharp analytical mind. His worldly wisdom, experience, profound knowledge in many fields of science and engineering, international authority in science and society played a major role in preserving the scientific potential of Ukraine in the first, difficult years of its independence.

Boris Paton continues to lead the Academy of Sciences of Ukraine, the entire scholarly community in the advancement of science, education, culture, the dynamic progress of his Motherland.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FORMING THE INTELLECTUAL AND S&T POTENTIAL OF UKRAINE IN THE 20-TH CENTURY

CHAPTER 2

Implementing the concept of the advancement of Ukrainian academy science elaborated by V.I. Vernadsky, great scientist of the 20th century, and his associates and followers, since the very first years of its activities the Academy brought together and directed the efforts of the leading scientists of Ukraine towards a wide range of basic and applied research in the most promising areas that were to determine the scientific, S&T and intellectual vectors of social progress. Despite difficult problems in the life of the country at that time, sudden changes and hardships in Academy's functioning, its relations with authorities in particular, especially in the 1920—1930s, the chosen course proved very encouraging and played a major role in the establishment and incessant rise of Ukraine's scientific, educational and cultural potential, its accession to the economically, scientifically, technologically, socially and culturally developed countries, and within the Soviet Union of that time — its affirmation as a republic with a high human potential in science and priority advancement of high-tech industries, in particular, mechanical engineering and instrument making, energy engineering, aerospace industry, as well as agriculture and medicine. Powerful Ukrainian research schools were formed at the Academy; their founders were its prominent scientists: mathematicians D.O. Grave, M.M. Krylov, M.M. Bogolyubov, Yu.O. Mitropolsky; in the field of mechanics — S.P. Timoshenko, O.M. Dynnyk, M.O. Lavrentyev, G.S. Pisarenko; physicists K.D. Sinelnikov, L.V. Shubnikov, V.Ye. Lashkaryov, O.I. Akhiezer, O.S. Davydov, A.F. Prikhotko, O.Ya. Usikov; astronomers O.Ya. Orlov, M.P. Barabashov, Ye.P. Fedorov, S.Ya. Braude; in geological sciences — P.A. Tutkovsky; in materials sciences — I.M. Frantsevich, V.I. Trefilov; in energy engineering — G.F. Proskura, S.O. Lebedev, in chemical sciences — L.V. Pisarzhevsky, O.I. Brodsky, A.V. Dumansky; in biology and medicine — D.K. Zabolotny, F.G. Yanovsky, M.D. Strazhesko, O.O. Bogomoletz, V.P. Filatov, M.G. Kholodny. I.I. Schmalhausen, O.V. Palladin, V.P. Komisarenko, R.E. Kavetsky, M.M. Amosov, P.G. Kostyuk. The Ukrainian science schools of E.O. Paton — in electric welding, and of V.M. Glushkov — in cybernetics won world-wide recognition. A significant contribution to the advancements of Ukrainian science, education and culture was made by Academy schools in socio-humanities, which were founded by demographer M.V. Ptoukha, economists K.G. Vobly, P.M. Pershyn, I.I. Lukinov, historians M.S. Hrushevsky, I.P. Krypiakevych, law scientist V.M. Koretsky, philosophers P.V. Kopnin, V.I. Shinkaruk, M.V. Popovych, orientalist A.Yu. Krymsky, linguists L.A. Bulakhovsky, V.M. Rusanivsky, scholars in literature S.O. Yefremov, M.S. Vozniak and O.I. Biletsky.

The decisive role in Academy's development, implementation of its capabilities and achievements was played by the strategy towards the active involvement of its institutions in solving key problems of S&T progress, forming S&T potential of Ukraine. It was fulfilled in promoting efficient collaboration with leading sectoral ministries and agencies, major science-intensive industrial enterprises, setting up a powerful fleet of research and pilot facilities.

2.1. PHYSICAL, MATHEMATICAL AND ENGINEERING SCIENCES

Extensive research and foundation of a wide network of powerful institutions specializing in physics, engineering and mathematics, the establishment of new science areas, segregation of a broad spectrum of independent scientific disciplines date back to the 1930s, when the Academy was entrusted with the task of building up a powerful industrial and technological potential. It was at that time that the Electric Welding Institute, the institutes of Mining Mechanics, Mathematics, Geophysical Observatory and a series of experimental laboratories were founded.

The years before World War II witnessed a significant contribution of Acad. D.O. Grave's school to the development of algebra and the theory of numbers. Among the most outstanding achievements of that period in mathematics a notable place belongs to the asymptotic theory of nonlinear oscillations, which was elaborated by M.M. Krylov and M.M. Bogolyubov and later, in the post-war times, developed further by Yu.O. Mitropolsky and A.M. Samoilenko. That was a novel mathematical apparatus that became an integral part of today's mathematics, mechanics, theoretical physics and was instrumental in investigating such complex phenomena as passing through resonance, bifurcations, theories of branching processes. Acads. M.P. Kravchuk, S.N. Bernstein, Corr. Membs. N.I. Akhiezer, M.G. Krein also obtained major results in mathematical sciences.

A significant boost was given to research in semiconductor physics, electronic phenomena on metal surfaces (Corr. Memb. N.D. Morgulis). Among the most prominent achievements of the Academy science was the man-made nuclear reaction — splitting of lithium nucleus — effected in 1932 by Acads. K.D Sinelnikov, O.I. Leipunsky, A.K. Valter and Corr. Memb. G.D. Latyshev — scientists of the Ukrainian Institute of Physics and Technology.

A major contribution to the development of construction mechanics were the studies of the strength of engineering structures and materials carried out by Acads. K.K. Syminsky, F.P. Belyankin, M.V. Kornoukhov; Corr. Memb. B.M. Gorbunov; Prof. O.A. Umansky, Dr. Sci. (Eng.); Prof. M.D. Zhudin, Cand. Sci. (Eng.). A special place among those studies belonged to Acad. E.O. Pa-

ton's investigations concerned with bridge design and calculation. Under the guidance of Acad. S.V. Serensen, research into the strength of aviation engines was carried out, which was of utmost importance for the country.

In the 1930s, significant theoretical and practical results were achieved in the national economy owing to the discoveries of new coal and iron ore deposits, oil and gas fields, which was to a great extent facilitated by the involvement of Academy institutions in solving geological and economic problems of the Great Dnieper and Great Donbas.

In the years of World War II, Academy scientists made a great contribution to the development and deployment of cutting-edge technologies in aircraft construction, motor and tank industries, to studying the problems of power industry, fuel-and-energy sector and mineral resources mining. The domestic technology and equipment for high-speed automatic submerged-arc welding of armored T-34 tank hulls, which was at that time developed under the guidance of Acad. E.O. Paton, became the basis for their flow-line production.

Post-war years saw the quick emergence of new research areas in physical, engineering and mathematical sciences.

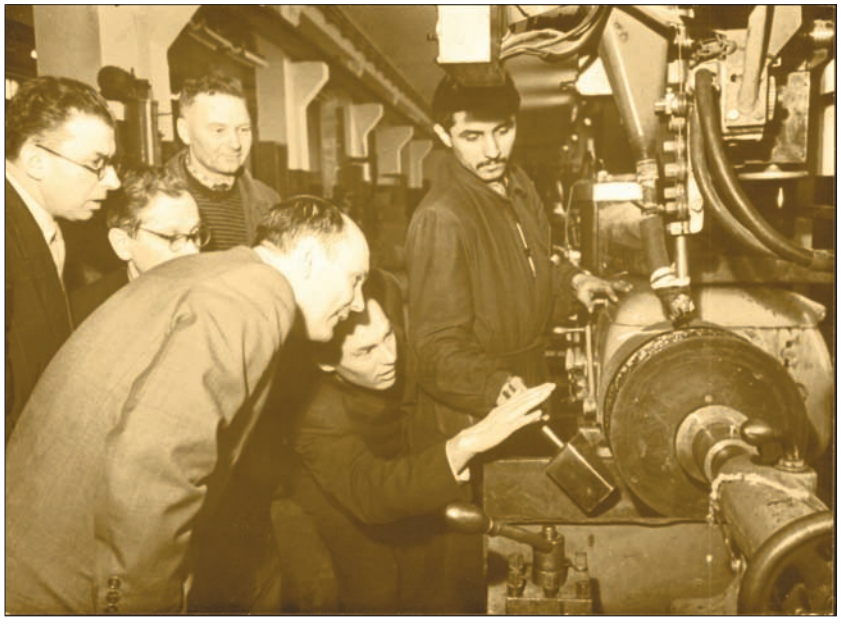
The theory of quasiconformal mappings, which was elaborated by Ukrainian mathematician M.O. Lavrentyev, Acad. of the USSR and Ukrainian RSR academies of sciences, won wide recognition. Numerous applications for hydromechanics, gas dynamics and continuum mechanics were proposed on its basis.

A significant achievement of the Ukrainian Academy of Sciences was the discovery of thermoelastic equilibrium in martensitic phase transformations made by Acad. G.V. Kurdyumov and Prof. L.G. Khandros, Dr. Sci. (Phys. & Math.), — the *Kurdyumov effect*, which radically changed the concept of martensitic transformations involving reversible changes in the shape of solids. Later, relying on this phenomenon, specialists produced alloys with shape memory effect, which found wide application in engineering for direct transformation of thermal energy into mechanical (thermoregulation equipment, mechanical joints), and in space equipment, in surgical, orthopedic and dental instruments.

The well-known achievement of the Ukrainian Academy of Sciences in informatics, which led to its fast advancement in the following decades, was the creation of the first in Continental Europe small electronic calculating machine *MELM*, constructed under the guidance of Acad. S.O. Lebedev in 1950. It was the first to be used for calculating the stability of country's power system. In 1957 Acad. V.S. Korolyuk and Corr. Memb. K.L. Yushchenko developed the first in the former Soviet Union algorithm programming language — the language of addressable programming. Soon after that Academy's scientists proposed methods for the synthesis of digital automata, on whose basis the first all-purpose asynchronous electronic computing machine (ECM) *Kyiv* was developed and commissioned, as well as *Dnipro* controlling ECM (1961), which was the first in the country.

Since the early 1960s, with the acceleration of S&T progress, the growing keen competition of great powers in space exploration, the attention of the country and society to science, the demand for its results became a systemic phenomenon. When Acad. B.E. Paton was elected the President of the URSR Academy of Sciences, the Academy entered the period of rapid progress in scientific research, notable for the intense development of novel research areas called

In one of the shops of 'Krasnoye Sormovo' plant, where tanks were assembled using the technology of submerged-arc welding. Gorki (now – Nizhni Novgorod), 1942–1943



At E.O. Paton Electric Welding Institute. The process of automatic submerged-arc surfacing

for by the needs of the society, setting up an extensive network of institutions, laboratories, pilot production facilities, the rise in the research and human potential. The Section of Physical, Engineering and Mathematical Sciences, which was set up in 1963 in the process of Academy structure reforming, focused on the advancement of basic research, first and foremost, on top-priority trends whose mission was to become the basis for S&T progress, and on purposeful practical implementation of the results obtained in the development and deployment of new breakthrough technologies. In the 1970—1980s, when the trend towards technologization became clearly visible in the world science, the institutions of the Section that concentrated two thirds of Academy's research potential started the fast extension of their pilot production network.

Those processes quite naturally encouraged the progress in basic theoretical research, which forms the reliable foundation of scientific knowledge. In mathematics, outstanding results were achieved: the general theory of convergence of stochastic processes, advanced by Acad. A.V. Skorokhod; a new ordering of natural numbers, the so-called Sharkovsky order, which played a fundamental role in one-dimensional dynamics and was named after its author — Acad. O.M. Sharkovsky; the theory of expansion in generalized eigenvectors of self-adjoint operators, elaborated by Acad. Yu.M. Berezansky.

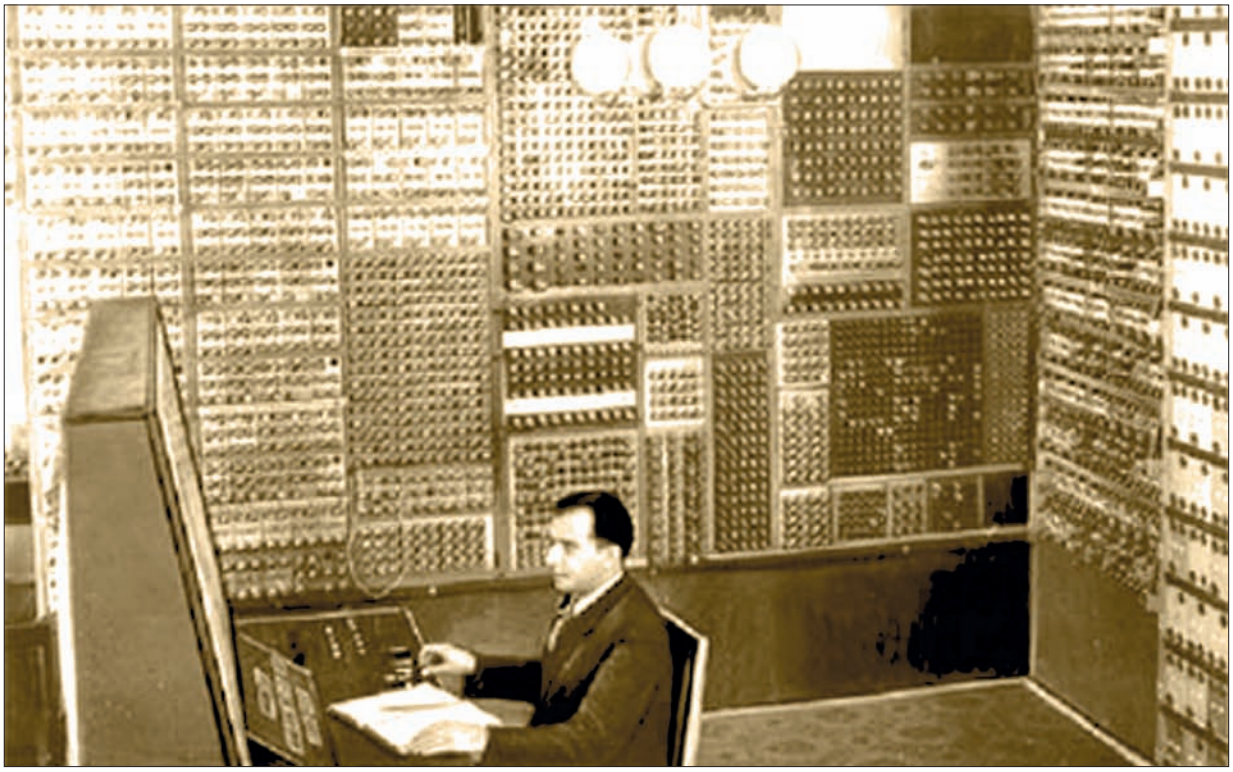
Acad. Ya.S. Pidstryhach developed scientific principles of studying and optimizing the thermomechanical behavior of deformable bodies under the combined action of force, thermal and electromagnetic loads to provide the reliable functioning of structural elements in instrument-making, heat-and-power engineering and space-rocket hardware.

Acad. O.V. Pogorelov solved a number of modern geometry problems related to the fourth Gilbert problem, Weyl, Minkovsky problems and the problem of the unique definition of ovaloid. Acad. B.O. Marchenko solved the inverse problem of quantum dissipation theory and developed methods that were successfully used in the theory of solitons. Corr. Memb. V.G. Drinfeld proved the Lenglends hypothesis for L(2) group over positive characteristic field and constructed a quantum group concept, which won him the well-deserved Fields Medal in 1990.

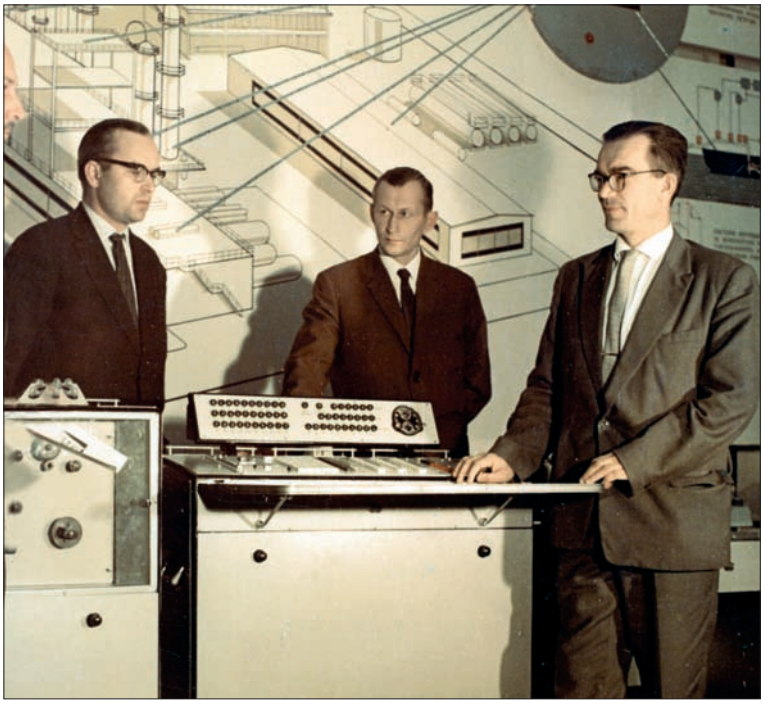
Since the mid-1960s the Institute of Cybernetics of the URSR Academy of Sciences, headed by Acad. V.M. Glushkov, whom it was named after later, produced a series of electronic calculating machines *MIR* ('machine for engineering calculations' in Ukrainian) — the world-first prototype of today's personal computers. One of those machines was purchased by IBM in 1967 (that was the only case of American company buying an ECM produced in the Soviet Union). In the late 1980s, scientists of this institute proposed the principle of macroconveyor calculations by parallel ECMs and created the first in the former Soviet Union system of macroconveyor calculations — ЄС-1766. In total, over 30 original ECMs and computer complexes intended for a variety of purposes, which had no domestic counterparts, were produced and deployed in industry.

Pioneering works were carried out in the theory and practice of programming. V.S. Korolyuk and K.Yu. Yushchenko created the first in the USSR address programming language. P.I. Andon, O.A. Letichevsky and K.M. Lavrishcheva developed fundamentals of component programming theory and engineering.

Under the guidance of Acads. V.S. Mikhalevich, I.V. Sergiyenko and N.Z. Shor, math-



'MELM' – small electronic computing machine – the first in Continental Europe



'Dnipro' versatile controlling machine. Left to Right: V.I. Skurikhin, B.M. Malinovsky, Acad. V.M. Glushkov. Kyiv, 1962

ematical methods and software were developed to solve problems of optimal control and planning with ECMs. Due to that, highly relevant problems of calculating the optimal loads of metallurgical plants, decision-making in the construction of long-distance pipelines, making oil product shipping schedules in the united transport network were solved.

In the 1960—1980s, Acad. V.M. Glushkov developed the concept of the world-first nationwide automated system of information acquisition and processing for accounting, planning and control in economy, which integrated automated control systems of various types. At the same time, Acads. V.I. Skurikhin and I.V. Sergiyenko created the first systems of production control that had no counterparts in the world: *Lviv*, deployed at Lviv-based 'Electron' plant, and *Galvanic* — for Kyiv-based 'Arsenal' plant.

In the interests of the defense sphere, Acads. V.S. Mikhalevich and P.I. Andon developed and implemented the first in the former Soviet Union large-scale distributed information analytics system *Yupiter* for supporting the reliable functioning of the Navy infrastructure.

In 1973 the world-first "Encyclopedia of Cybernetics" was published (in Ukrainian), which contained nearly 1700 entries on informatics, cybernetics and computer engineering; it became the ontological foundation for further development of cybernetics in the whole world.

In 1986, under the guidance of Acads. V.S. Mikhalevich and A.O. Morozov, a modeling system was developed to analyze the situation at the Chornobyl NPP and forecast Chornobyl accident impacts. It processed on-line the current data on the contamination of the Chornobyl Zone, the Prypiat River and the Kyiv Reservoir, provided monitoring and produced projections of contamination spreading.

The mathematical apparatus to analyze cryptographic transformation algorithms, which was created in the mid-1980s by Acad. I.M. Kovalenko, increased the speed of deciphering the encoded data by the available algorithms by 5—6 orders of magnitude and found wide application in information protection systems, in the defense sphere, in particular.

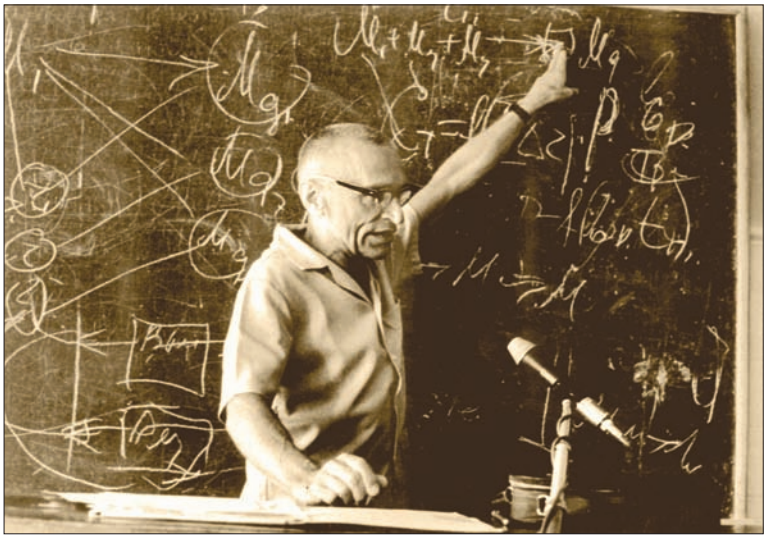
In 1988—1990, informatics scientists led by Acad. V.V. Petrov for the first time ever developed the technology of the optical dynamic immersion recording of information, which is widely used in today's microelectronics.

Acads. M.M. Bogolyubov and M.M. Krylov started a new scientific area — nonlinear mechanics — and founded the world-renowned Kyiv School of nonlinear mechanics, which formed well-known scientists, Acad. Yu.O. Mitropolsky being among them. Acads. G.M. Savin and A.D. Kovalenko, in collaboration with their disciples, developed methods to calculate a number of rocket elements which were used by '*Pivdenne*' Design Bureau. Acad. Ya.M. Grigorenko constructed a numerical method to study revolution shells of irregular shapes. Acad. Yu.M. Shevchenko developed the theory of materials thermoplasticity under non-isothermal deformations and methods for calculating structural elements. Acad. O.M. Guz advanced the 3D theory of deformable body stability and, relying on it, investigated the stability of structural elements made of composite materials and the stability of mine workings. He also elaborated the 3D theory of elastic wave propagation in bodies with initial (residual) stresses and on its basis, jointly with specialists of E.O. Paton Electric Welding Institute, elaborated the first

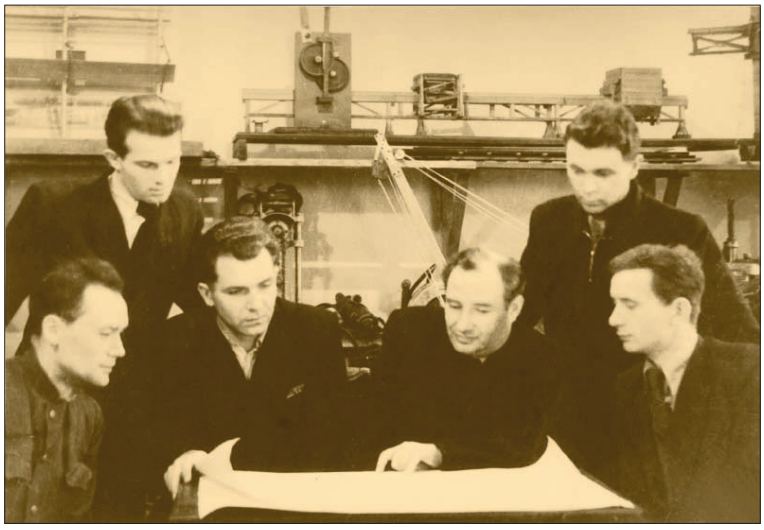
Acad. Yu.O. Mitropolsky, Director of the Institute of Mathematics of the URSR AS, (Left) and Prof. S. Lefshits, American mathematician, (Center) at I International Symposium on Nonlinear Oscillations. Kyiv, 12 – 18 September 1961

Acad. G.M. Savin (Second Row, First Right) at the International Mathematical Congress. RSFSR, Moscow, August 1966

method to determine biaxial and triaxial stresses under non-destructive ultrasound testing. Acad. V.D. Kubenko developed analytical and numerical methods for investigating non-stationary hydroelasticity of shells. Acad. A.A. Martynyuk constructed the method of Lyapunov matrix-valued functions in the theory of stability of mechanical system motion. Corr. Memb. L.P. Khoroshun worked out methods to predict physical and mechanical properties of composite materials of various structures and developed the theory of multiphase media. The Specialized Design Bureau of S.P. Timoshenko Institute of Mechanics developed technologies for producing radio-



Acad. M.M. Amosov, Head of the Biological Medicine Department, speaks at a workshop in the Institute of Cybernetics. Kyiv, the 1980s



Acad. M.V. Kornoukhov (Second Left) gives advice to students of Kyiv Civil Engineering Institute. Kyiv, the 1951 – 1957s

transparent fiberglass structural elements that were used, e.g., by '*Antonov*' Design Office in constructing the world-largest transport aircraft An-124 *Ruslan*.

The decisive role in the establishment and development of the USSR leading design center of space-rocket hardware — '*Pivdenne*' Design Office — was played by Acads. M.K. Yangel, V.S. Budnik, V.F. Utkin and other renowned scientists of the URSR Academy of Sciences.

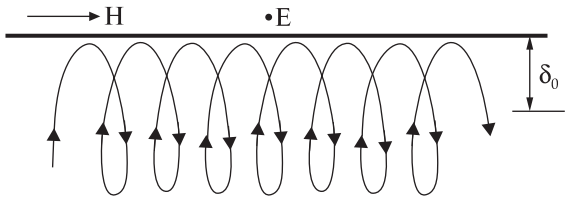
Acad. V.V. Pilipenko constructed the theory of low-frequency cavitation-induced vibrations in pump systems of liquid-propellant rocket engines and the theory of high-frequency high-amplitude fluid pressure oscillations in hydraulic systems with cavitation vibration generators. Acads. G.S. Pisarenko, V.V. Matveyev, and Prof. A.P. Zinkovsky, Dr. Sci. (Eng.), elaborated the theory of calculating mechanical system vibrations, which took into account energy dissipation

in cyclically deformed material of elastic elements in the nonlinear formulation and proposed new methods to determine characteristics of damping the vibrations in hysteresis-type mechanical systems.

Acad. V.M. Poturayev, the founder of the school for computing and designing vibration machines with linear and nonlinear elastic ties, corroborated the theory of resonance-type machines, mining transport vehicles and technological equipment that interact with loose mining environment, developed methods to calculate and design equipment for mining and processing mineral resources, preparing burdening materials for powder metallurgy. Acad. G.V. Logvinovich and Corr. Memb. Yu.M. Savchenko worked out scientific principles and technologies to realize stable controlled underwater high-velocity motion of arbitrarily shaped bodies, which permitted specialists to develop super-fast *Shkval* torpedo.

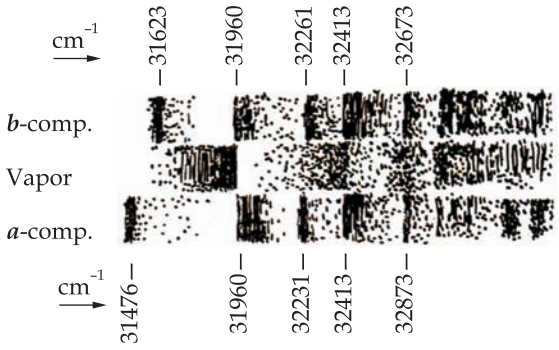
Outstanding results were achieved in physics and astronomy. Among those was the discovery of cyclotron resonance in metals, made by Corr. Memb. E.A. Kaner and M.Ya. Azbel, Dr. Sci. (Phys. & Math.), (*Azbel—Kaner effect*). It made scientists revise the theory of metals and their properties in electromagnetic wave propagation that had been considered as impossible before.

Acads. O.S. Davydov and A.F. Prikhotko discovered a new type of quasiparticles in crystals — small-radius excitons. That provided evidence that even weak intermolecular interaction radically change the crystal spectrum, generating collective rather than single-particle states (*Davydov splitting*). When light is absorbed, excitons that are exited in crystals carry their energy all over the crystal volume; that determines the behavior characteristics of many processes in macromolecular and biological systems. The works of Acads. M.S. Brodin, M.P. Lysytsia,



Azbel – Kaner effect (cyclotron resonance)

Acad. A.F. Prikhotko, Director of the Institute of Physics of the URSR AS, (First Left) and Dr. V.L. Broude (Center) receive a foreign scientific delegation. Kyiv, the 1970s



*Davydov splitting in the absorption spectrum of naphthalene single crystal. For the light polarized along the **a** axis of the crystal, the absorption line at the 31476 cm^{-1} frequency is observed, while for the light polarized along the **b** axis of the crystal — another line at the 31623 cm^{-1}. The absorption spectrum of naphthalene vapors is shown for comparison*

The phenomenon of cold electron emission in the case of current transmission through island metal films. One of the first color photos of the electroluminescence of 10 μm-long gold island film

M.T. Shpak; V.L. Braude, A.F. Lubchenko, E.Yo. Rashba, Drs. Sci. (Phys. & Math.), played a major role in the formation of exciton physics as an internationally recognized research area.

The discovery of quantum diffusion phenomenon, made by Profs. B.N. Eselson, V.M. Grigoryev and V. A. Mikheyev, showed that in quantum crystals the impurity atoms do not stay in fixed positions but, rather, are "spread" and propagate as waves. So, these scientists found another phenomenon in physics where quantum laws are manifested at macro level. At the Institute of Semiconductor Physics, Acad. S.I. Pekar constructed the theory of new quasiparticles in crystals — *polarons* — and studied their properties. The account for the electron interaction with elastic medium showed that there are no free electrons in certain types of crystals while there are electrons "wearing a fur coat" of the neighboring atom displacements and it is these very structures (polarons) that possess mass, energy and spin.

The discovery of carrier energy redistribution in micro contacts, made by Acad. I.K. Yanson and Corr. Membs. O.I. Kulyk and O.M. Omelyanchuk, gave rise to a new research trend — micro contact spectroscopy, which provided an insight into the detail of solid spectra that had not been known earlier. Scientific achievements of Acad. I.K. Yanson were honored with the Hewlett-Packard Europhysics Prize in 1987 and with Lise Meintner Prize in 2008.

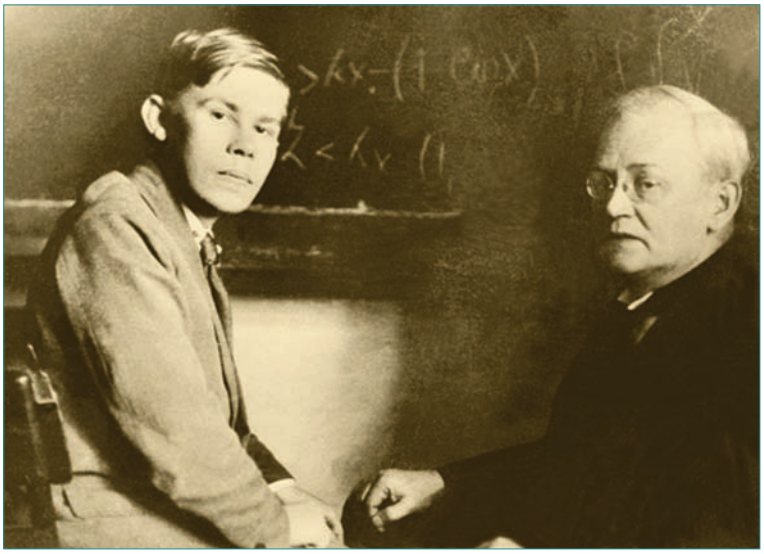
E.Yo. Rashba, Dr. Sci. (Phys. & Math.), constructed the theory of spin-orbital interaction in crystals without an inversion center and predicted its spectral manifestation as the so-called '*Rashba splitting*', which became the basis for the development of a novel microelectronics area — spintronics.

Acad. O.I. Akhiezer, the founder of the well-known school in theoretical physics, and Acads. V.G. Baryakhtar and S.V. Peletminsky — his disciples — predicted the existence of bound magnetic and elastic waves in magnetics, which showed that in the vicinity of their resonances the elementary excitation spectrum is completely restructured while the elementary excitations are neither elastic nor magnetic any longer.

Investigating the propagation of electromagnetic wave in crystals with spatial dispersion, Acad. S.I. Pekar predicted the existence of *extra waves* of electromagnetic nature in them that are generated by the mixing of common waves with electronic (including excitonic) excitations. These results made an essential contribution to the development of modern crystal optics.

Acads. M.M. Bogolyubov and O.S. Parasyuk worked out a step-by-step procedure to remove disagreements in the quantum field theory (*Bogolyubov – Parasyuk R-operation*); it became a widely used method to calculate the properties observed in elementary particle physics.

The phenomenon of cold electron emission when current passes in thin island-structured metal films, which was discovered by Corr. Memb. P.G. Borzyak, Prof. O.G. Sarbey, Dr. Sci. (Phys. & Math.), and R.D. Fedorovych, Dr. Sci. (Phys. & Math.),



Acad. M.M. Krylov (Right) with his disciple – post-graduate student N.N. Bogolyubov. The 1920s

Acad. M.M. Bogolyubov, founder and the first Director of the Institute for Theoretical Physics, at the inauguration of the new building of the URSR AS Institute for Theoretical Physics. In the background (Third Right in First Row) is Acad. O.S. Davydov, who headed the Institute from 1973 till 1988. Kyiv, 1970

enabled them to develop innovative cold metal cathodes. The diffraction theory of nuclear processes, advanced by Acad. O.G. Sitenko and known in literature as the 'Sitenko—Glauber diffraction method', formed present-day ideas about collisions of complex particles with different energies and was widely spread not only in nuclear physics but in high energy and atom physics as well. Acad. V.M. Loktev, Prof. M.O. Ivanov, Dr. Sci. (Phys. & Math.), and Prof. Yu.G. Pogorelov, Cand. Sci. (Phys. & Math.), relying on the pioneer ideas of Acad. I.M. Lifshitz, advanced the theory of impurity ferro- and antiferromagnetic dielectrics (*Ivanov – Loktev – Pogorelov theory*) and predicted the existence of coherent impurity-type states. This theory provided the

Antennas of UTR-2 radio telescope

qualitative and quantitative explanation of certain phenomena in disordered magnetic materials and was used in developing signal delay lines with record delay times.

Acads. S.Ya. Braude and L.M. Litvinenko made efforts towards founding the Radio Astronomy Institute, where they in collaboration with Acad. O.O. Konovalenko, Corr. Memb. A.V. Men and Prof. L.G. Sodin, Dr. Sci. (Phys. & Math.), constructed the world-largest decameter radio telescope UTR-2 and URAN interferometers for measuring low-frequency cosmic radiation of various universe objects that were beyond the possibilities of traditional astronomy. In particular, excited atoms with the highest recorded main quantum numbers in excess of 1000 were discovered in the interstellar space.

Analyzing the operation of millimeter-range magnetrons, Acad. O.Ya. Usikov, I.D. Truten, Cand. Sci. (Phys. & Math.), found their operation regimes that permitted the frequency range of generation to be extended by an order of magnitude (the so-called *Kharkiv regime*) and those devices to be used as key elements of special-purpose equipment.

Corr. Membs. B.I. Lev and P.M. Tomchuk, Profs. Yu.O. Reznikov and V.G. Nazarenko, Drs. Sci. (Phys. & Math.), developed a theory and experimentally discovered the effect of gyrotropic impurity molecules on the optical axis realignment in liquid crystals under the action of external fields, which resulted in the development of efficient liquid-crystal displays by Liquid Crystal Institute of Kent State University (USA).

Corr. Memb. N.D. Morgulis and P.M. Marchuk, Cand. Sci. (Phys. & Math.), discovered the technology of direct heat energy conversion into electricity by thermal emission diodes filled with cesium vapor. That resulted in the optimization of the work function of cathode and anode electrons and a radical increase in the efficiency of thermionic power converters, which gave rise to their practical application as powerful power sources in space vehicles.

Acad. A.G. Naumovets, Corr. Membs. Yu.G. Ptushinsky, O.M. Braun and O.A. Marchenko; O.G. Fedorus, I.M. Yakovkin, Drs. Sci. (Phys. & Math.); Yu.S. Vedula, V.M. Gavrylyuk, B.O. Chuikov, G.A. Katrych and E.V. Klimenko, Cand. Sci. (Phys. & Math.), carried out a unique series of investigations of metal and gas adsorption on metal crystal faces in super high vacuum and in a wide temperature range. They discovered a strong effect of the atomic structure of the substrate surface on the kinetics of adsorption, desorption and surface diffusion. They also experimentally demonstrated that the information about surface phase diagrams opens up new opportunities in the directed control of emission, diffusion, optical, catalytic and friction properties of surfaces.

Acads. V.N. Gridnev, V.I. Trefilov, Corr. Membs. Yu.Ya. Meshkov, S.P. Oshkadyorov, V.T. Cherepin proposed a method for significant hardening of metals and alloys by fast and superfast heating, which found

Geological tour of Dr. M.P. Balukhovsky (First Left) and Acad. V.G. Bondarchuk (Center), researchers of the Institute of Geological Sciences of the URSR AS. Bulgaria, 1972

Dr. G.N. Dolenko, Deputy Director of the Institute of Geology and Geochemistry of Combustible Minerals, (Third Left) on the territory of the well which started the development of 'Zhovtneve' gaseous condensate deposit. Crimea Oblast, Simferopol, 1961

wide application in metallurgy, aircraft building, shipbuilding and military industrial complex.

Acads. O.Ya. Orlov, E.P. Fedorov and Ya.S. Yatskiv, in collaboration with their disciples, obtained important results in determining the Earth Pole coordinates and elaborating the theory of real Earth's model nutation. Specifically, they carried out a number of investigations in such areas: daily latitude variations, methods to analyze latitude observations and study peculiarities of Earth pole movements, construction of coordinate systems and their practical implementations, terrestrial and space observations of Halley's Comet, studies of Earth's rotation. In 2013, for his research of the changes in the Earth axis orientation within the Earth body and in outer space, Acad. Ya.S. Yatskiv, as a member of the European research team, was awarded the prestigious René Descartes Prize of the European Union.

Corr. Memb. A.O. Yakovkin obtained the most precise, as of that time, values of lunar physical librations, discovered the dependence of Moon's radius on latitudinal optical libration.

By the decision of the International Nomination Committee, Acad. A.G. Naumovets, First Vice-President of the NAS of Ukraine, Chief Research Associate of the NAS Institute of Physics, was awarded the UNESCO Medal 'For Contributions to the Development of Nanoscience and Nanotechnologies' in 2016.

The International Committee for Optics awarded the 2009 International Galileo Galilei Prize to Corr. Memb. M.S. Soskin, department head at the NAS Institute of Physics, for his significant contribution to physics of tunable wavelength lasers, dynamic holography and singular optics, and the 2017 Prize — to Prof. O.Yo. Nosich, Dr. Sci. (Phys. & Math.), Chief Research Associate of O.Ya. Usikov Institute of Radio Physics and Electronics of the NAS of Ukraine, for basic mathematical physics research concerned with modeling of real photonic and optoelectronic devices.

For several decades the range of theoretical and applied research of Academy institutions in the Earth sciences has been broad and practically important for the Ukrainian economy. Acad. V.G. Bondarchuk grounded a new scientific theory — 'tectonic orogeny', i.e. the doctrine of Earth's planetary faults and the existence of the regular global fault network, as well as the hypothesis about crowning structures of the Earth's crust. Fundamental fault studies showed that natural resource deposits, including those of oil and natural gas, are confined to them.

Acad. V.B. Porfiryev developed the theory of abiogenic oil and natural gas synthesis at great depths; relying on it, up to 30 deposits were discovered in the subsurface of Eastern Ukraine, the Europe largest Shebelinka gas deposit was among them.

Acads. S.I. Subbotin, A.V. Chekunov, V.I. Starostenko and Corr. Memb. V.B. Sollogub worked out a theory to interpret the data of the deep seismic probing and seismic prospecting in general. They also proposed the algorithm and relevant software to compute wave fields in multi-layered viscous-elastic geological media for theoretical prediction and analysis of natural gas deposits. Under the guidance of Acad. S.I. Subbotin, geophysicists developed and implemented a procedure of geological mapping, prospecting and examination of the deep structure of deposits in the Ukrainian iron-ore province with geophysical methods.

Acad. M.P. Semenenko worked out an oxygen-hydrogen model of Earth's formation and evolution: according to it, the mantle and the Earth's crust form a framework

Acad. M.P. Semenenko, Vice-President of the URSR AS, (First Left) at the Precambrian Geochronology Symposium held by the International Commission on Stratigraphy under the International Union of Geological Sciences with Canadian scientists. Canada, Edmonton, 14 June 1967

Acad. M.P. Semenenko (Right) during a geological expedition exploring the Rakhiv Mountain Range. Zakarpatska Oblast, September 1974

while the Earth's core is the primary (proplanetary) hydride substance that remained undifferentiated since the time of the Earth formation. According to that model, the basis of all geological and geochemical processes was hydrogen dissipation from the core outwards from the Earth. The oxygen-hydrogen model allows researchers to explain the mechanism of plume formation and gas columns existence, abiogenic carbohydrates origin and other contemporary issues of theoretical and practical geology.

Acad. Ya.M. Belevtsev grounded and elaborated the theory of metamorphogenesis formation of iron, gold and uranium ore deposits, which made possible the uranium deposits discovery in the South-Ukrainian ore region.

In the post-war period the Academy completed the formation of its powerful materials science center, which won world-wide prestige due to the outstanding theoretical and practical results it obtained.

A large complex of R&D works in welding processes of different structural materials permitted specialists to elaborate and deploy unique welding technologies, equipment and materials, innovative types

Research engineers of advanced low-toxicity welding electrodes. Left to Right: Dr. Sci. (Eng.) I.K. Pokhodnia, A.Yu. Marchenko, I.R. Yavdoshchyn. Kyiv, 1971

of welded structures, specifically, E.O. Paton all-welded bridge, which is the longest in Europe (Acads. E.O. Paton, B.E. Paton, D.A. Dudko, V.K. Lebedev; Corr. Membs. A.M. Makara and B.S. Kasatkin; V.E. Paton, Cand. Sci. (Eng.)).

The development of the technology of electroslag welding of thick metal parts (Acad. B.E. Paton; G.Z. Voloshkevich, Dr. Sci. (Eng.)), as well as that of electroslag remelting aimed at improving the quality of steels and alloys (Acads. B.E. Paton, B.I. Medovar; Yu.V. Latash, Dr. Sci. (Eng.)), became the achievements of the international scope. Highly efficient welding materials (coated electrodes, solid wires, flux-cored wires) developed under the supervision of Acad. I.K. Poykhodnia and the technologies of their industrial manufacturing considerably improved the environments and productivity of welding operations. The world-first technologies and mobile equipment for welding railroad tracking rails and large-diameter long-distance pipelines in the field (Acads. B.E. Paton, S.I. Kuchuk-Yatsenko, V.K. Lebedev and Chief Designer V.O. Sakharnov) won wide recognition, and the experiments in structures welding, cutting, soldering and coating deposition in the outer space remain unique (Academician B.E. Paton; V.F. Lapchinsky, Cand. Sci. (Eng.); I.A. Zagrebelny).

The elaboration of the materials-science principles of powder metallurgy by Acads. I.M. Frantsevich, I.M. Fedorchenko, V.V. Skorokhod and Profs. I.D. Radomyselsky, R.O. Andriyevsky, G.A. Vinogradov, Drs. Sci. (Eng.), and founding of powder metallurgy plant opened up the way for an innovative science-intensive industry.

Acad. Yu.V. Naidich; B.D. Kostyuk, Cand. Sci. (Chem.); I.I. Gab and V.S. Zhuravlyov, Cands. Sci. (Eng.), developed theoretical principles of high-temperature capillarity and a system of technological processes for soldering non-metallic materials — in particular, ceramics, quartz glass, diamond and cubic boron nitride — with metals. That was the start of the industrial manufacturing of high-tech soldered products, including porthole windows for space vehicles and super powerful proton accelerators.

Innovative materials and products (super refractory, heat insulating and radio transparent materials for rocket engines, nose cones and fins of R-12 and R-16 ballistic missiles) were developed under the guid-

Acad. K.K. Khrenov at a laboratory of E.O. Paton Electric Welding Institute. Kyiv, the 1960s

Dr. B.I. Medovar, Head of Electroslag Surfacing Department of E.O. Paton Electric Welding Institute, presents new developments to A.M. Tupolev, aircraft designer, Acad. of the USSR AS. Kyiv, 1965

ance of Acad. I.M. Frantsevich, Corr.Memb. G.G. Gnesin and Prof. D.M. Karpinos, Dr. Sci. (Eng.). That played an important role in the progress of space-rocket industry. The micromechanisms of deformation and fracture, as well as ways to prevent low-temperature brittleness of refractory metals, which were studied at the atom dislocation level, enabled Acads. V.I. Trefilov and S.O. Firstov, Corr. Memb. Yu.V. Milman to develop and implement a number of innovative alloys on that basis.

Widely used in various areas of engineering were the principles of refractory compounds science and technologies of their production that were elaborated, under the guidance of Corr. Memb. G.V. Samsonov and Acad. P.S. Kysly, by Prof. M.S. Kovalchenko, Dr.Sci.(Eng.); Yu.B. Paderno, Cand.Sci.(Eng.); Profs. O.S. Bolgar and T.Ya. Kosolapova, Dr. Sci. (Chem.); M.D. Smolin and E.O. Zhurakovsky, Drs. Sci. (Eng.). Relying on those studies, specialists synthesized hundreds of new compounds — 'samsonides' — and systemically generalized data on their electronic structures, physical and mechanical properties.

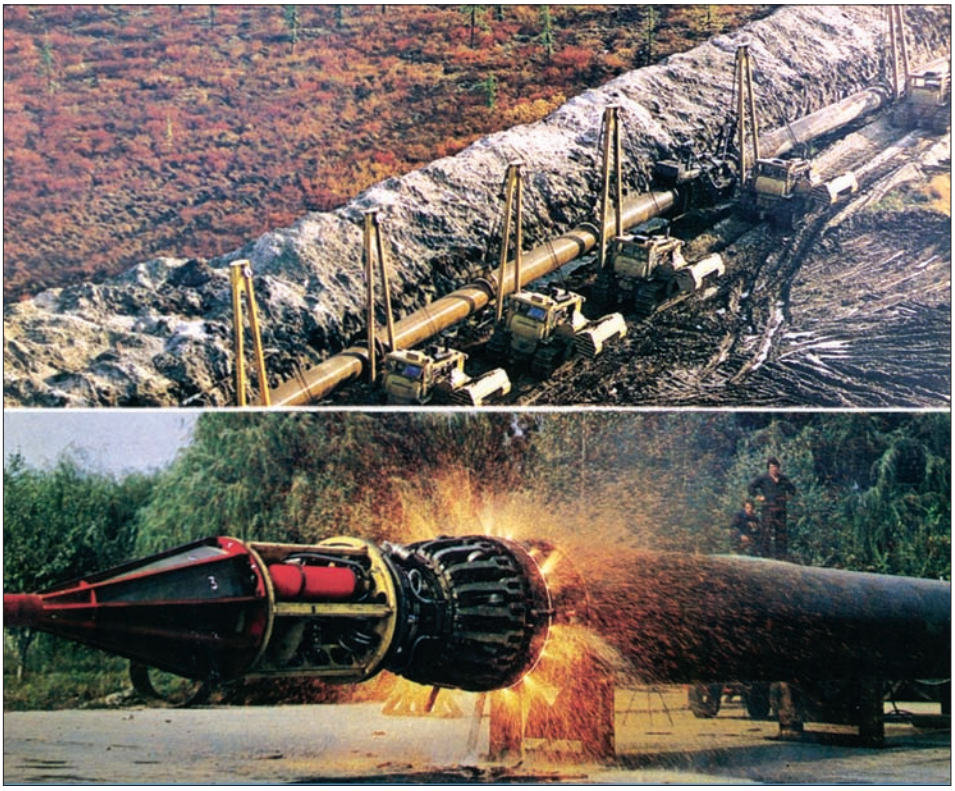
Industrial technologies of synthesizing man-made diamonds and cubic boron nitride, sintering super hard polycrystalline composites based on them, and diamond—hard-alloy wafers found wide application in electronics, machining of high-strength and tough structural and functional materials, in manufacturing glass products, germanium and silicon semiconductors, engineering ceramics of high surface purity.

Over 32 million running meters of oil and natural gas boreholes were drilled, using rock-breaking elements of boring bits based on diamond-containing *Slavutych* and *Tvesal* materials that were developed by V.M. Bakul and I.F. Vovchanovsky, Drs. Sci. (Eng.).

The technology of steel casting under slag layer and external forces applied to the molten metal that was deployed in industry provided high production efficiency and metal product quality.

Metallurgical plants implemented a complex of unique equipment and innovative technological processes to produce critical bimetallic parts (O.I. Shevchenko, Dr. Sci. (Eng.)); new magnetodynamic dosing pumps for automated casting of non-ferrous alloys into molds (Acad. V.I. Dubodelov; Prof. V.P. Polishchuk, Dr. Sci. (Eng.); V.K. Pogorsky, Cand. Sci. (Eng.)); low-waste technologies to obtain high-quality cast synthetic iron products by induction smelting (Prof. V.S. Shumikhin, Dr. Sci. (Eng.); V.T. Shulga and V.P. Kutuzov, Cand. Sci. (Eng.)); technological processes for producing high-quality continuously cast iron blanks (V.M. Babich, A.S. Kazmirsky), novel materials and efficient technologies to manufacture cast products for mining industries, cutting and broaching instruments (Profs. S.E. Kondratyuk and B.B. Vinokur, Drs. Sci. (Eng.)).

Under the guidance of Acad. Z.I. Nekrasov, for the first time in the world practice, researchers worked out theoretical and technological principles of casting in large blast furnaces, using natural gas and oxygen-enriched air blast in metallurgy. The research team under the leadership of Ya.A. Shneyerov, Dr. Sci. (Eng.), elaborated a technology for producing semi-killed makes of steel, which essentially broadened the application of this new material with pre-defined properties. Under the guidance of Acad. O.P. Chekmaryov, theoretical and technological foundations of the continuous rolling of a wide range of products were developed. The teams involving researchers of the Institute of Ferrous Metallurgy and E.O. Paton Electric Welding Institute devel-



'Sever' mobile equipment for contact welding of powerful main pipelines of 1420 mm diameter

Cleaning and sorting facility with upgraded SBR-100 scrubber butara for the treatment of quartzites at the Vasylkivske deposit

oped the design and, with the active participation of Acads. O.I. Tselikov and B.E. Paton, produced prototypes of mobile junction welding machines, which permitted them to implement the first ever process of infinite rolling at mill 350-2 of the Makiivka metallurgical plant.

Acad. G.V. Karpenko and his disciples and followers — Corr. Membs. V.I. Pokhmursky, G.G. Maksimovich, O.M. Romaniv — made a considerable contribution to the development of fundamental principles of materials physico-chemical mechanics, which takes into account and practically applies physico-chemical mechanisms of the interaction of surface-active, aggressive-corrosion and hydrogen-containing media with solids. The further progress in physico-chemical mechanics of materials was due to the use of fracture mechanics approaches (Prof. M.Ya. Leonov, Dr. Sci. (Phys. & Math.), Acad. of the AS of the Kirghiz RSR; Acad. V.V. Panasyuk) and the elaboration of its new theoretical principles (Acad. Z.T. Nazarchuk, Corr. Memb. O.E. Andreykiv).

The development of physimetrics — a new scientific area that gave rise to methods of information selection, processing and transfer in control, telemechanics and communication systems — enabled specialists to develop the USSR first airborne geophysical survey equipment, solve a number of important problems in the theory of signals and electric circuits, propose new methods of signal conversion and improving their interference immunity (Corr. Memb. of the AS of the USSR K.B. Karandeyev, Corr. Memb. V.V. Mikhailovsky), and to produce important space instruments (Corr. Memb. V.V. Grytsyk).

An outstanding achievement of NAS scientists in the field of energy physics and engineering was the technology and equipment to use natural gas in steel melting, which was developed under the guidance of Acad. M.M. Dobrokhotov and deployed at metallurgical plants.

Under the leadership of Acad. S.O. Lebedev, relying on the unique capabilities of the newly-created small electronic machine, scientists calculated the robustness of major power systems.

Cooling disks and gas turbine blades developed by Acads. I.T. Shvets and E.I. Dyban found wide application in the manufacturing of aviation and ground engines. The method of discrete-pulse power input proposed by Acad. A.A. Dolinsky gave rise to a new class of heat mass exchangers.

The elaboration of the scientific principles of intensifying heat mass exchange by Acads. O.O. Kremnyov and Yu.F. Snezhkin provided an increase in the efficiency of available resource-saving technologies and the development of new ones. E.g., the resource-saving heat technology and equipment for producing functional food powders was deployed at more than 60 enterprises in various countries.

Acad. G.F. Proskura founded a scientific school in hydro and gas turbine manufacturing. He led R&D work to produce horizontal shaft turbines, inverse turbines performing combined turbine and pump functions etc.

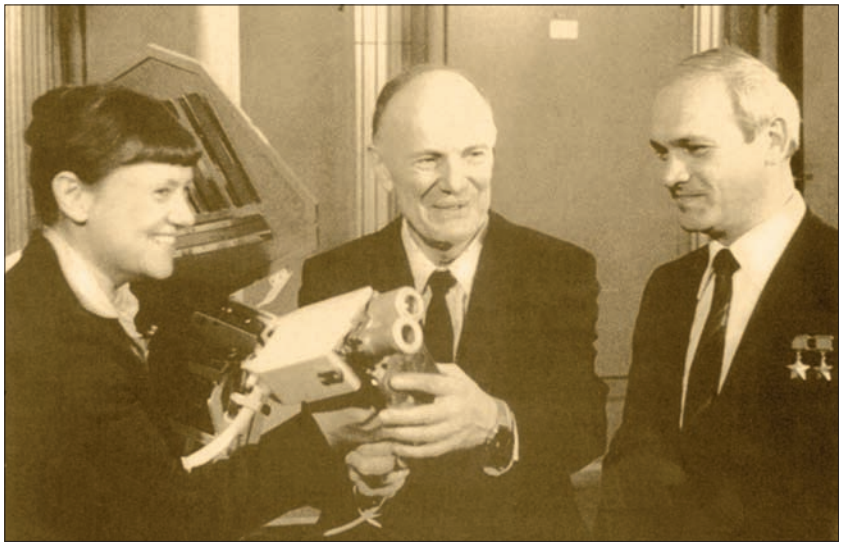
The world-first *SKR-100* 100 MW steam turbine with supercritical initial steam parameters (Acad. L.O. Shubenko-Shubin) was built in collaboration with Kharkiv Turbine Plant.

Acad. V.L. Rvachov created the theory of R-functions, which helped solve the inverse problem of analytical geometry for the first time, and worked out the method of R-functions intended for modeling physical processes in power systems.

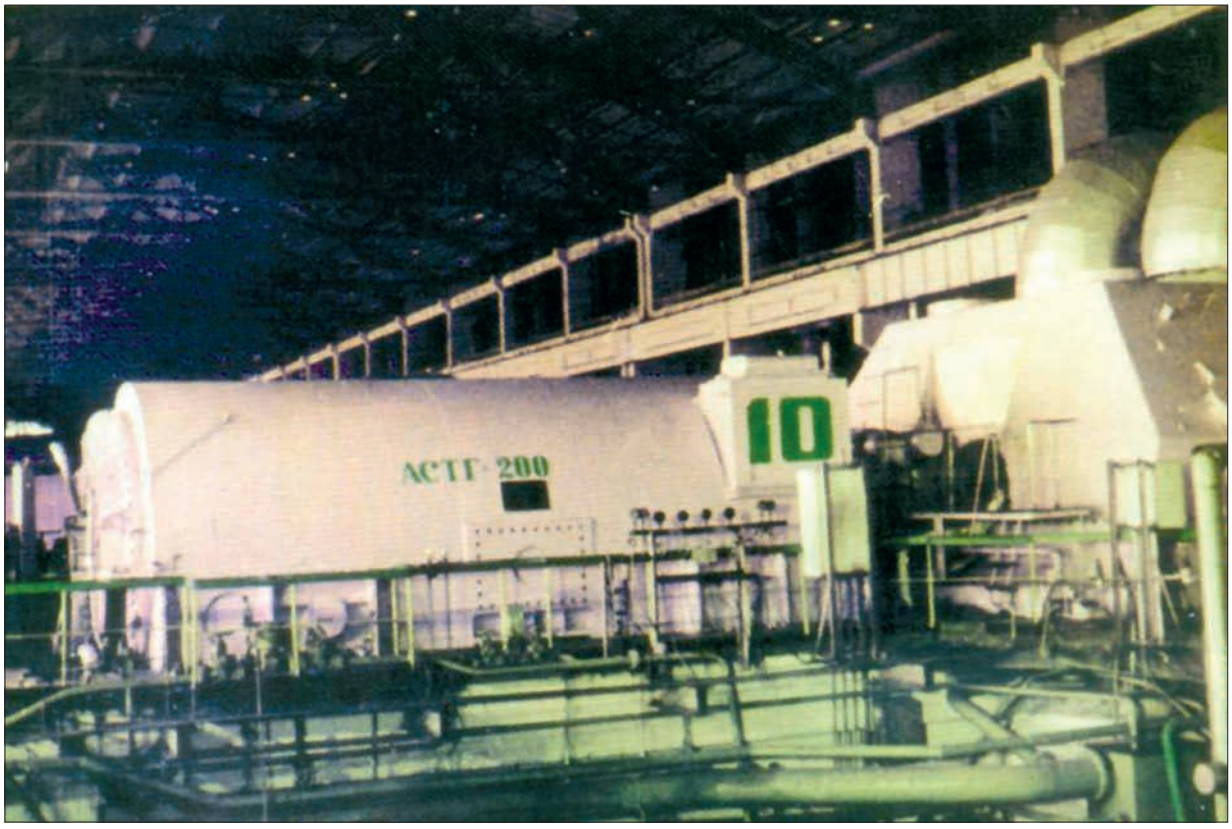
Theoretical foundations and principles of constructing automated instruments for

The Ukrainian delegation at the II International Conference on the Peaceful Uses of Atomic Energy. Acad. K.D. Sinelnikov is First Left in First Row; Second Row Left to Right: Acad. O.N. Shcherban, Cor. Membs. M.V. Pasichnyk, A.F. Makarchenko and V.N. Gridnev. Switzerland, Geneva, 1 – 13 September 1958

A ceremonial opening of the Institute for Modeling in Energy Engineering of the URSR AS presided by Acad. B.E. Paton, President of the Academy. Kyiv, 1981



USSR space pilots S.E. Savitskaya and V.O. Dzhanibekov at E.O. Paton Electric Welding Institute. Kyiv, 1984



The world-first asynchronous turbogenerator ASTG-200

measuring integral electrical parameters were used in the serial manufacturing of digital automatic AC bridges and magnetic measuring instruments (Acad. F.B. Grinevich; Profs. A.I. Novik and M.M. Surdu, Drs. Sci. (Eng.); V.P. Karpenko, Cand. Sci. (Eng.)).

Under the leadership of Acad. B.S. Stogniy, for the first time in the world practice, researchers developed the theory, designing method and produced a unique electric current transformer with specified characteristics in transient operation modes for 1150 kV power lines. Such current transformers were installed in the Ekibastuz—Tsentr super high-voltage transmission line.

In collaboration with E.O. Paton Electric Welding Institute, scientists in energy engineering developed a number of specialized high-reliability and energy-efficiency power supply systems. They were used in onboard technological equipment of space vehicles and were intended for unique assembly and maintenance operations, specifically, those in the outer space during the flight of the *Salut-7* orbital station (Acad. A.K. Shidlovsky; Yu.I. Drabovych, Cand. Sci. (Eng.); M.M. Yurchenko, Dr. Sci. (Eng.)).

The outcomes of research conducted under the guidance of Corr. Memb. I.M. Postnikov became the basis for designing the world-first ASTG asynchronized turbo generator intended for compensating reactive power and, due to that, for improving the quality of electrical power in networks.

World-wide recognition as the *Differential Transformation Method* was won by the new mathematical tool of differential transformations (Acad. G.E. Pukhov) and fundamentals of the theory of its application to solve dynamical problems in electrical engineering, heat engineering, mechanics and computer science.

2.2. CHEMICAL AND LIFE SCIENCES

A creative impulse to the foundation of leading research institutions that now worthily represent major areas of chemical science in Ukraine and in the whole world was given by Academician V.I. Vernadsky, who set up the Chemical Laboratory as a scientific institution within the Department of Physics and Mathematics of the newly-established Ukrainian Academy of Sciences.

In 1931 the Chemical Laboratory was integrated with the Scientific Research Institute of Chemistry functioning under the People's Commissariat of Education and was attached to the Academy of Sciences as the Institute of Chemistry (since 1945 it has been the Institute of General and Inorganic Chemistry of the Ukrainian RSR AS). A number of Academy's chemistry institutions were organized on the basis of its departments: the Institute of Organic Chemistry (1939), A.V. Dumansky Institute of Colloid and Water Chemistry (1968), O.V. Bogatsky Physico-Chemical Institute (I977), the Institute for Sorption and Problems of Endoecology (1991). The Institute of Macromolecular Chemistry (1958) and the Institute of Bioorganic Chemistry and Petrochemistry (1987) branched off from it, and in 1991 the Institute of Biocolloidal Chemistry was organized on the basis of several departments of A.V. Dumansky Institute of Colloid and Water Chemistry.

L.V. Pisarzhevsky Institute of Physical Chemistry, founded in 1927, is the oldest in the NAS Department of Chemistry. L.M. Litvinenko Institute of Physical-Organic Chemistry and Coal Chemistry (1975) and the Institute of Surface Chemistry (1986) were set up on its basis.

The foundations of electronic theory in chemistry, which were developed by Acad. L.V. Pisarzhevsky, were entered into the treasury of the world science and became the foundations of the chemical structure theory and today's ideas of the electronic nature of chemical phenomena. Having proposed electronic theory as the basis for explaining the structure of molecules, Acad. L.V. Pisarzhevsky was the first to transfer the physics' concept of the complex structure of the atom to chemistry. That enabled him to lay the foundations of the present-day theory of chemical structure, the concept of the chemical bond and valence, reactivity, as well as electrochemistry, catalysis and other areas of chemis-

try. The principles of this theory revealed the nature of numerous physico-chemical processes and phenomena, which at that time was uncertain, in particular, the nature of very common reactions of oxidation and reduction, the cause of electric current generation in galvanic cells, they also explained the properties of molecules by their electronic structure.

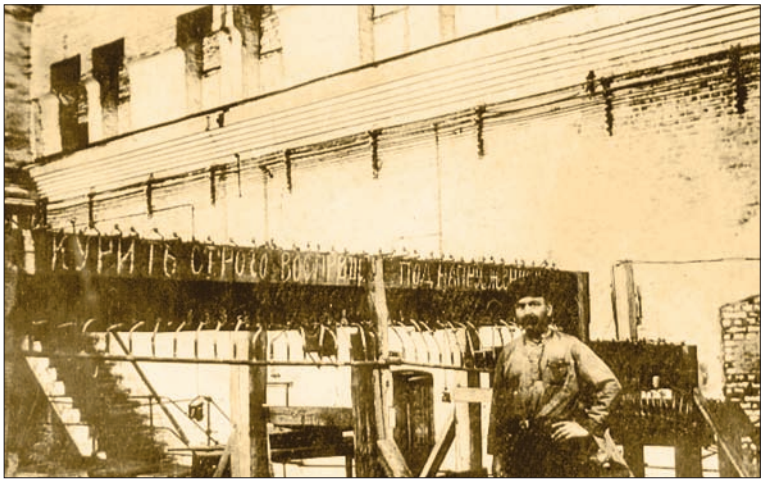
Pioneering works in obtaining "heavy" water — D_2O — in the USSR were started in 1934 at the Institute of Physical Chemistry of the AS of the Ukrainian RSR in Dnipropetrovsk under the guidance of Acad. O.I. Brodsky. In the same year, by water electrolysis, the Europe's first samples of pure D_2O were obtained, to be widely used afterwards as neutron moderator in nuclear reactors. That was an outstanding achievement that was of tremendous importance both for the start of isotope chemistry as a new area in science and for the progress of nuclear physics. It also provided a boost for the research into the possibility of using the energy of atom for peaceful and military purposes. After producing heavy water, in 1937 O.I. Brodsky obtained the first in the USSR concentrate of heavy oxygen isotope ^{18}O, and in 1949 — the concentrate of heavy nitrogen isotope ^{15}N.

The topmost place in the research of chemical kinetics in the first half of the XX century belonged to the theory of the heterogeneous & homogeneous catalysis, which was advanced by Prof. M.V. Polyakov at the Ukrainian Research Institute of Physical Chemistry (now it is L.V. Pisarzhevsky Institute of Physical Chemistry). Later the theory won world-wide recognition. The works of M.V. Polyakov, addressing the mechanisms of combustion and explosions, made a significant contribution to the verification and advancement of the theory of chain reactions, permitted him to corroborate and improve the generally recognized Semenov—Hinshelwood theory of chain reactions. M.V. Polyakov's discovery played a seminal role in producing and using catalysts of numerous industrial processes.

In 1960, scientists of the Institute of General and Inorganic Chemistry discovered the phenomenon of metal transfer from the cathode to the anode during ionic melt electrolysis; the discovery was introduced to the USSR State Register of Discoveries in 1975. That gave rise to the theory of intermetallic electrochemical refining of non-ferrous metals, which was advanced by discovery's authors. Relying on it, innovative technological processes were developed and implemented in the practical nonferrous metallurgy. They provided a significant reduction in the electrical power and reactant consumption, since additive metals only were involved in the electrode processes. These investigations resulted in innovative highly efficient processes of cleaning cast metal products from ceramics and burnt-on substances (Acad. Yu.K. Delimarsky, Corr. Memb. O.G. Zarubitsky, engineer V. G. Budnik).

An outstanding achievement of NAS scientists was the discovery of selective heterocoagulation of mineral colloid particles with microorganisms made by scientists of F.D. Ovcharenko Institute of Biocolloidal Chemistry. The results obtained laid the foundation for state-of-the-art scientific trends: biogeochemistry and biogeotechnology, colloidal biotechnology and biocolloidal ecology, they made an essential contribution to pharmacy, human and veterinary medicine. The outcomes of that research brought about a wide range of highly efficient technological processes and functional materials — from colloidal biotechnologies of extracting noble and rare metals to bio-nano-reactors, nano-sized metal and composite hydrogel systems (Acad. F.D. Ov-

L.V. Pisarzhevsky (Right) and O.I. Brodsky on the jubilee day – the 40th anniversary of L.V. Pisarzhevsky's scientific work, 1935



The construction and start of the USSR-first semi-industrial facility for producing "heavy" water that was installed at Dnipropetrovsk Power Plant, 1934

Nobel Laureate Ch. Raman (Center) during his visit to L.V. Pisarzhevsky Institute of Physical Chemistry of the URSR AS (Left to Right): Y.Y. Dilung, B.Ya. Dayin, O.I. Brodsky, I.O. Neimark, Ya.V. Zhigailo, V.A. Roiter, M.S. Ashkinazi, T.S. Glikman. Kyiv, 1958

charenko; Z.P. Ulberg, Dr. Sci. (Chem.); M.V. Pertsov, Dr. Sci. (Chem.); V.P. Estrella Lopez, Cand. Sci. (Chem.)).

In the early 1990s, Acad. U.S. Lipatov discovered the earlier unknown behavior of liquid polymer mixtures near stratification areas: during the transition from the single-phase state to the micro-heterogeneous two-phase state the extreme values of physico-chemical parameters were achieved — the minimum viscosity and maximum thermodynamic potential. The results of those investigations found wide application in the industrial production of polymer materials, filled composites in particular, elastomeric materials, glues, adhesives, and other polymer materials.

Since the very first days after the accident at the Chornobyl Nuclear Power Plant Academy chemistry and biology scientists were actively involved in studies towards territory decontamination and population protection. Researchers of L.V. Pisarzhevsky Institute of Physical Chemistry formulated a composite sorbent agent based on natural and man-made materials that could absorb various radionuclides. Nearly ten thousand tons of that sorbent were used to improve the environmental situation in the Prypiat River (I.A. Tarkovska, Dr. Sci. (Chem.); L.S. Ivanova, Dr. Sci. (Chem.); Prof. V.G. Ilyin, Dr. Sci. (Chem.); F.M. Bobonich, Dr. Sci. (Chem.); A.N. Tomashevska, Cand. Sci. (Chem.); D.I. Shvets, Cand. Sci. (Chem.); N.V. Turutina, Cand. Sci. (Chem.), et al.). Researchers of V.I. Vernadsky Institute of General and Inorganic Chemistry developed the method of anodic electrochemical purification of metal surfaces contaminated with radionuclides (Corr. Memb. A.O. Omelchuk, Corr. Memb. O.G. Zarubitsky). Scientists of the Institute of Macromolecular Chemistry developed polymer composites and technologies for soil solidification, produced a polymer composition for sealing 'Ukryttya' ('Shelter') facility roof (R.O. Veselovsky, Dr. Sci. (Chem.)). Scientists of A.V. Dumansky Institute of Colloidal and Water Chemistry developed and deployed highly efficient technologies to remove radionuclides from water and a technology for waste water treatment after washing contaminated transport vehicles (Acads. A.T. Pilipenko and V.V. Goncharuk; N.A. Meshkova-Klimenko, Dr. Sci. (Chem.)). Specialists of the Institute of Surface Chemistry produced composite materials to localize, decontaminate and prevent recontamination of the surfaces of Chornobyl NPP facilities (Acad. O.O. Chuiko; V.A. Tyortykh, Dr. Sci. (Chem.); V.M. Bogatyrev and Yu.V. Plyuto, Cands. Sci. (Chem.)). The Institute of Bioorganic Chemistry and Petrochemistry elaborated highly efficient technologies of chemical and chemico-biological solidification of dust-loaded territories (Acad. V.P. Kukhar). Scientists of the Institute for Sorption and Problems of Endoecology carried out R&D of medical hemo- and enterosorbents, obtained positive results of their application to protect clean-up workers from radioactive irradiation (Acad. V.V. Strelko).

The successful deployment of basic research results in various industries and agriculture branches was facilitated by the pilot production plants, design offices, engineering and training centers, R&D complexes set up at the institutions operating under the Department of Chemistry, including intersectoral enterprises.

Academy biological science dates back to the establishment of the Ukrainian Academy of Sciences. Among its first twelve founding academicians was Acad. M.F. Kashchenko, scientist in biology and prominent Ukrainian botanist. He was entrusted not only with the Acclimatization Garden, which he had created, but also was to head 'The Com-

Acad. O.I. Brodsky with I.P. Gragerov and post-graduate students. Left to Right: M.M. Aleksankin, O.I. Brodsky, L.L. Gordiyenko, I.P. Gragerov, V.D. Pokhodenko, L.S. Degtyarev. Kyiv, 1962

A group of scientists of the URSR AS after awarding them with the Orders of Lenin and 'Sickle and Hammer' Gold Medals. First Row (Left to Right): Acads. O.I. Brodsky, B.E. Paton, Z.I. Nekrasov; Second Row: Acads. V.M. Glushkov and I.M. Frantsevich. 1969

Acad. Yu.S. Lipatov, Director of the Institute of Macromolecular Chemistry of the URSR AS, (Right) presents scientific developments of the Institute to M.M. Emanuel, Acad. of the USSR AS. Kharkiv, 1982

mittee for Studying the Fauna of Ukraine'. With every new election to the Academy its membership was gradually replenished with eminent scientists in biology and medicine. Elected academicians were V.I. Lipsky, E.P. Votchal, O.V. Korchak-Chepurkivsky, D.K. Zabolotny, I.I. Schmalhausen, I.Ya. Gorbachevsky, L.O. Tarasevich, V.Ya. Danilevsky, M.F. Melnikov-Razvedenkov, F.G. Yanovsky, M.M. Volkovich, O.O. Bogomoletz, M.I. Vavilov, O.V. Palladin, M.G. Kholodny.

As early as in 1921, the Zoology Office, Zoological Museum, the Commission for Studying the Flora of Ukraine, Botanical Office (Museum) and Herbarium, Microbiology Institute, the Institute of Experimental Medicine, headed by O.V. Korchak-Chepurkivsky, the Commission for Studying the Central Nervous System functioned in the Academy. Later, these institutions were joined by the Commission on Experimental Biology and Genetics and the Commission for Studying Pathology Problems, as well as the Institute of Biochemistry (1925) and the Institute of Botany (1927), which in the beginning operated under the Ukrainian RSR People's Commissariat for Education and were transferred to the AUAS in 1931. Before WW II, when the Academy structure was reshuffled, the Division of Biological Sciences was set up. At that time it consisted of the following institutes: Botany, Zoology, Hydrobiology, Biochemistry, Clinical Physiology, D.K. Zabolotny Institute of Microbiology (and Epidemiology), and the Karadag Biological Station. With that structure the Division existed till 1963, when it was divided into the Division (Department) of Biochemistry, Biophysics and Physiology, and the Division (Department) of General Biology.

Afterwards, the number of institutions investigating the problems of biochemistry, physiology and molecular biology was enlarged through the accession or establishment of new institutes: the Institute of the Problems of Oncology (1971, now it is R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology), the Institute for Problems of Cryobiology and Cryomedicine (1972, Kharkiv), the Institute of Molecular Biology and Genetics (1973), and the Institute of Cell Biology (2000, Lviv).

Three prominent representatives of the Ukrainian 'life sciences' — Acads. D.K. Zabolotny, O.O. Bogomoletz and O.V. Palladin — headed the Academy for nearly 35 years — from the late 1920s to the early 1960s. V.I. Vernadsky, the first UAS President, can also be considered as involved in 'life sciences', as he studied the problems of biosphere, noosphere, and biogeochemistry.

D.K. Zabolotny made the definitive contribution to creating contemporary Ukrainian epidemiological and microbiological science. The credit goes to O.O. Bogomoletz for starting and strategically foreseeing the ways of further progress in major medicobiological sciences: oncology, endocrinology, immunology, hematology, gerontology. He founded a unique institution which integrated research efforts of the scientists of two institutes — a clinical and an experimental ones (the Institute of Clinical Physiology of the AUAS and the Institute of Experimental Biology and Pathology functioning under the URSR People's Commissariat of Public Health). It employed such prominent scientists in medicine: therapist M.D. Strazhesko; ophthalmologist V.P. Filatov; psychiatrist V.P. Protopopov; oncologist R.E. Kavetsky; endocrinologist V.P. Komisarenko; gerontologist and pathophysiologist M.M. Gorev, Full Member of the USSR Academy of Medical Sciences; corresponding members —

Acad. O.V. Bogatsky, founder of Odesa science school in organic, bioorganic and supramolecular chemistry, (Center) with Drs. Sci. M.G. Lukyanenko, Yu.L. Zherebin; Second Row: O.S. Yavorsky, S.A. Andronati

A meeting in the office of the URSR AS Chief of Staff: V.G. Ilyin, O.S. Kovalenko, Acad. G.M. Flyorov (Right) and members of the directorate of the Joint Institute for Nuclear Research. 1987

surgeon I.M. Ishchenko, endocrinologist N.B. Medvedeva, gynecologist O.Yu. Lurie and many others.

Academician O.V. Palladin was the promoter of Ukrainian biochemical science, the patriarch of the world neurochemistry, the founder and first director of the Institute of Biochemistry of the AS of the Ukrainian RSR (1925), which now bears his name. In 1942, during WW II, Institute's scientists, under the supervision of O.V. Palladin, developed a technology to produce water-soluble vitamin K preparation (*VIKASOL*), which was widely used as a hemostatic agent in military hospitals.

Acad. O.O. Bogomoletz in the 1920—1940s laid the foundations of pathological physiology as a science in the Ukrainian and international dimensions. He created the concept of the physiological system of connective tissue and its role in pathological processes. Besides, he wrote fundamental works and was the founder of numerous science schools in the leading areas: therapy and hematology, oncology, endocrinology, gerontology, laid the foundations for using the achievements of medical and biological research in clinical medicine. That opened the way for setting up numerous medical research institutions: the Institute of Clinical Medicine — by Acad. M.D. Strazhesko, the Institute of Oncology Problems — by Acad. R.E. Kavetsky, the Institute of Endocrinology and Metabolism — by Acad. V.P. Komisarenko, the Institute of Gerontology — by M.M. Gorev, Acad. of the USSR Academy of Medical Sciences.

In the 1930—1940s, scientists of the Institute of Zoology of the AS of the Ukrainian RSR, under the guidance of Acad. S.M. Gershenson, discovered the DNA's mutagenic action. Those were the experiments — among the world's first ones — that proved the DNA role in genetic processes. The scientific relevance of that discovery was to demonstrate the top-priority role of this molecule in the variability phenomenon and mutation process dynamics while its practical importance was to establish the principles of directed mutagenesis, which is widely used in today's genetic engineering and biotechnology, and in breeding as well.

Later, in 1961, Acad. S.M. Gershenson made a discovery of immense significance — the possibility of reverse transcription of genetic information from the RNA to the DNA.

In the post-war years, researchers led by Acad. R.V. Chagovets obtained experimental evidence that gave rise to the rational use of vitamins PP, ubichinon, A, B_1 and E in medicine, livestock farming and food industry. These vitamins were used to develop preparations for prophylactics and treatment of diabetes, multiple sclerosis, tuberculosis, diseases of the nervous and cardiovascular systems etc. Under the supervision of Prof. V.P. Vendt, a technology was developed for industrial production of vitamin D3 preparation to be used in poultry farming and of vitamin D3 and cholesterol (*VIDECHOL*) for rachitis prophylactics and treatment in children. V.P. Vendt's ideas formed the basis for investigations of his followers, who developed a number of unique vitamin & mineral complexes containing vitamin D3 (*VIDEIN-3*, *CALMIVID*, *CALMIVID-M* etc.). Under the guidance of Acad. S.V. Komisarenko, the USSR first studies of protein and peptide immunochemical structures were carried out, immunoenzymatic assay methods and the techniques of producing monoclonal antibodies were developed; the immunomodulating and anti-tumor action of bisphosphonates was detected, *MEBIPHON* preparation was formulated.

Scientists of the URSR AS among clean-up workers of the Chornobyl NPP accident. 1986

Acad. V.P. Kukhar, founder and the first Director of the NAS Institute of Bioorganic Chemistry and Petrochemistry, lays a memorial capsule at the construction site. Kyiv, 1988

At Bogomoletz Institute of Physiology, for the first time ever, Acad. P.G. Kostyuk, in collaboration with his followers — today's Acad. O.O. Kryshtal and Corr. Memb. V.I. Pidoplichko — registered the calcium conductance of the neuronal membrane — currents through individual potential-dependent calcium channels (1969) and discovered its self-regulatory properties (1976). Due to this discovery the role of calcium as a major universal intracellular messenger was established.

In the 1970—1990s, research of Acads. G.Kh. Matsuka, A.V. El'skaya, M.A. Tukalo; B.S. Negrutsky, Dr. Sci. (Biol.) (the Institute of Molecular Biology and Genetics) provided significant insights into the molecular basis of protein biosynthesis, that in higher eukaryotes in particular. The discovered functional adaptation of the DNA and aminoacyl tRNA synthetases (ARSASES) to the synthesis of specific proteins proved to be a universal factor that regulates gene expression at the translation level, while decoding the structure of a number of the tRNA and ARSASES enabled researchers to determine catalytic and active sites of enzymes and propose a model of correcting translation errors.

In the 1960—1980s, scientists of D.K. Zabolotny Institute of Microbiology and Virology, guided by Corr. Membs. L.Yo. Rubenchik and K.I. Andreyuk, for the first time developed the theory of forming and functioning of an aggressive microbe grouping, which enabled them to make long-term forecasts of microbially induced corrosion in various environments and elaborate scientifically grounded techniques of anti-corrosion protection. Those scientific developments have no counterparts anywhere in the world.

Under the supervision of Acads. V.V. Smirnov and V.S. Pidgorsky, Corr. Membs. E.I. Kvasnikov and N.K. Kovalenko, specialists of D.K. Zabolotny Institute of Microbiology and Virology in the 1960—1990s conducted basic research into probiotic properties of bacilli and lactic acid bacteria as well as their effects on endothermic animals, which allowed them to produce a number of biologically active preparations. The first bacillus-based probiotic in Ukraine was *BAKTERIN-SL* preparation for prophylactics and treatment of gastrointestinal diseases in farm animals. Later, on the basis of the community of spore-forming bacteria, *BIOSPORIN* probiotic was produced; it was intended for prophylactics and treatment of human intestinal diseases. Functional food products were created on the basis of lactobacillus multi-strain probiotics: *GEROLACT*, *GEROSAN* probiotic, and *LACTOGEROVIT* possessing anti-oxidant properties, *ENDOSPORIN* preparation for treatment of puerperal endometritis, probiotics for young cattle, pigs, and poultry — *BOVILAC*T, *LAKTOSAN*, *LAKTIN*, as well as *LITOSIL* biopreservation agent for silage maturing.

Under the guidance of Acad. S.V. Komisarenko, immediately after the Chornobyl NPP accident, scientists of Palladin Institute of Biochemistry carried out research into the immune status of people who were engaged in the liquidation of accident impacts. As a result of integrated examination of "liquidators" (clean-up workers) in the late 1986 — early 1987, S.V. Komisarenko and his collaborators demonstrated for the first time ever that low total irradiation doses (under 25 rem — biological dose equivalent) caused a significant decrease of antitumor and antiviral immunity in clean-up workers, specifically, of the number and functional activity of natural killer cells. The results obtained were proved by repetitive examinations of the same people after a certain period and by experiments on apes. S.V. Komisarenko called such suppression of natural immu-

Acad. O.O. Bogomoletz with his followers and co-workers. First Row (Left to Right): Corr. Memb. N.B. Medvedeva, Prof. R.E. Kavetsky, Acad. O.O. Bogomoletz, Prof. V.P. Komisarenko. Second Row (Left to Right): Profs. P.D. Marchuk and O.O. Bogomoletz (the son of Acad. O.O. Bogomoletz), Dr. M.V. Zelensky, Prof. V.D. Yankovsky. Kyiv, 1945

Leading scientists of the Institute of Biochemistry of the URSR AS at the I Ukrainian Congress of Biochemists. Right to Left: Acad. O.V. Palladin, Prof. S.I. Baluyev, Acads. V.O. Belitser, R.V. Chagovets, M.F. Gulyi. Chernivtsi, 1965

nity the "Chornobyl AIDS". The discovery made scientists revise the doses that had been considered safe for human health.

In the 1970—1990s, researchers of R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology, led by Acad. V.G. Pinchuk and Corr. Memb. V.G. Nikolayev, formulated the first concept of the principal hemosorption mechanisms and proposed unique methods of hemo-carboperfusion, which provided efficient therapeutic effects in the treatment of acute radiation sickness of liquidators in the first days after the Chornobyl accident.

Studies in botany and zoology date back to the time of Academy foundation. The Botanical and Zoological offices were set up; later they were transformed into institutes with their own museum subdivisions.

A constellation of famous scientists worked at the institutions of biological specialization; the high scientific relevance of their research results and discoveries was recognized by the whole world. Among those discoveries were the hormonal theory of tropisms, which was developed by Acad. M.G. Kholodny in 1926. It is known under the name Kholodny—Went model

and is still the basis of the phytohormone theory.

Among other important discoveries and achievements of scientists in botany one should mention the finding of genetic ties between leuco-, chromo- and chloroplasts, and the revealing of chlorophyll formation scheme by Acad. V.N. Lubimenko in 1935; the development of the phylogeny system of avascular plants by Acad. D.K. Zerov in 1972; the publication of the concept of pigment system in photosynthetic plants by O.H. Sudyina, Dr. Sci. (Biol.), in 1982; the concept became a notable contribution to the up-to-date theory of photosynthesis. The multifunctional paradigm of nature conservation, developed by Acad. Yu.R. Shelyag-Sosonko in 1992, gave rise to innovative approaches to biodiversity conservation.

The priority in developing the theory of stabilizing selection proposed by Acad. I.I. Schmalhausen belongs to zoology scientists. Corr. Memb. L.I. Frantsevich discovered the phenomenon of astroorientation in Coleopterans during homing and the ability of insects to recognize random two-dimensional images by their texture. In 1982 I.I. Shalimov, Cand. Sci. (Biol.), and prospective Acad. V.G. Radchenko discovered the effect of short-term narcotization of young bumblebee females with carbon dioxide on blocking the obligatory diapause. Due to that, for the first time ever, the year-round bumblebee breeding for greenhouse plant pollination was successful; now the technology is widely used in many countries. In the 1980s, Corr. Memb. I.A. Akimov made a significant contribution to the studies of various aspects of the Varroa mite biology and worked out scientifically validated methods to control this dangerous bee parasite, while Corr. Memb. M.M. Shcherbak grounded the herpetological zoning of the Palearctic zoogeographic region and produced the relevant map.

The work on the preparation and publication of the fundamental multi-volume generalizing editions "Flora of Ukraine" and "Fauna of Ukraine" has been going on since the mid-20th century.

Ukrainian hydrobiologists were the first to determine the causes and general patterns of the mass development of blue-green algae in large water reservoirs, work out scientific principles of measures towards reducing the negative impacts of water "blooming", improving water quality, sanitary and biological situation in the Dnieper cascade reservoirs. The priority in this research belongs to Acad. O.V. Topachevsky; L.A. Sirenko, O.Yo. Sakevich, Drs. Sci. (Biol.), and other members of their research team. The revealing of the determining role of the tissue and cell metabolism of inorganic elements and their relations to bioenergetics and biosynthetic processes in water animal organisms, which was achieved by the research team headed by Acad. V.D. Romanenko, laid the foundations for the biotechnology of intensive aquaculture in Ukraine.

The research of Acad. P.A. Vlasyuk and his disciples into the physiological role of manganese in plant nutrition, as well as the determination of the biological roles of molybdenum, boron, zinc, cobalt, and lithium in the life of plants, won them international recognition. Besides, relying on the isotopic labelling technique they discovered the circulation patterns of carbon, phosphorus, sulfur, calcium and other substances, which provided insights into the mechanisms of intake, transport and distribution of nutritive substances. All that enabled them to elaborate the organo-mineral system of plant nutrition in crop rotations and to launch industrial production and use of mineral fertilizers with trace elements.

Left to Right: Acad. B.E. Paton, President of the URSR AS; V.A. Masol, Head of the Council of Ministers of the URSR; V.S. Shevchenko, Head of the URSR Verkhovna Rada Presidium; Acad. V.V. Morgun; V.V. Shcherbytsky, First Secretary of the Central Committee of the Communist Party of Ukraine; and M.S. Gorbachev, Head of the USSR Verkhovny Soviet Presidium. Kyiv, the 1980s

A significant contribution to studying the dynamics of the binding and mobilization of nutritive substances in soils and the possibility of using Ukrainian agronomic ores as fertilizers was made by Acad. O.I. Dushechkin. He grounded and enriched the scientific area concerned with plant nutrition, which permitted specialists to use rational and efficient introduction of fertilizers.

Acad. A.M. Grodzinsky was one of the founders of allelopathy — the science about the circulation of biologically active substances in biogeocenosis. He proposed the scheme of donor—acceptor interaction of plants in biogeocenoses through root exudates, volatile phytogenic (phytoncide) compounds and waste products of soil microorganisms. He determined the role of allelopathy in forming the structure, robustness and productivity of phytocenoses, agrocenoses in particular.

Prominent scientist Acad. D.M. Grodzinsky validated the theory of biological system reliability that became the scientific foundation for practical ways of increasing crops resistance to unfavorable environments and increasing their productivity. Under his guidance the processes of the major metabolites turnover in plants were investigated, as well as the phenomenon of the heterogeneity of plant cell metabolic pools, which formed the current ideas of metabolism processes in plants and their mineral nutrition.

Many basic research results in plant physiology were widely implemented in agriculture, which enabled the state to deal with the problem of proper supplies of high-quality food to Ukrainian people. Specifically, the discovery of the monospermy of sugar beet gave the boost to industrial production epoch in the breeding and growing of sugar and fodder beet.

Acad. M.M. Gryshko made an essential contribution to the development of Ukrainian plant genetics, breeding and acclimatization. Having studied various aspects of hemp biology, in particular, the possibility of escaping the dioecy and sex separation, he created a new variety which, in terms of fiber yield, exceeded its counterparts and permitted the mechanical harvesting of those plants.

The second half of the 20th century witnessed the beginning of the revival of

Site of the archeological dig of the Mezhyrichska Late Paleolithic camp of mammoth hunters carried out under the supervision of Acad. I.G. Pidoplichko (in the foreground). Cherkaska Oblast, Kanivsky District, Mezhyrich village, 1974

Reconstruction of Late Paleolithic early man dwellings. The National Museum of Natural History of the NAS of Ukraine, Kyiv

Ukrainian genetics, which had experienced suppression and had been considered a pseudoscience for a long time. As a result, Acad. S.M. Gershenson obtained his certificate for the discovery "The property of exogenous DNAs to cause selective gene mutations", which he had made in 1947.

In the 1970s, Acad. V.V. Morgun created the first USSR transgenic maize plants, which was an innovative result both in Ukraine and in the world. He also carried out research towards developing the theoretical principles of induced mutational variability and grounding a new area of genetic plant im-

provement — the mutational breeding. Afterwards he and his colleagues created the first in the USSR early-ripened inter-strain hybrids of maize, which allowed specialists to essentially extend its growing areas and for the first time ever produce seeds in those parts of Eurasia where this crop had never ripened. That provided a significant rise in gross grain yields.

Acads. Yu.Yu. Gleba and K.M. Sytnik, jointly with their colleagues, were the first to discover the phenomenon of polygenic inheritance of cytoplasm genes in plant somatic hybridization, which laid theoretical scientific foundations of cell (genetic) plant engineering. That work was a starting point for developing the biotechnology of plant cell cultivation and plant genetic reconstruction through somatic hybridization.

In 1986, a scientific team involving A.P. Galkin, Dr. Sci. (Biol.), obtained the first functional transgenic plants with a DNA fragment of tobacco that had promoter properties. Afterwards, those pioneer studies resulted in producing transgenic plants that were transformed by the metallothionein gene chemically synthesized by the authors.

An important discovery in hydrobiology was made in the late 1950s by Acad. Yu.P. Zaitsev, who discovered an unknown community of organisms in the subsurface layer of the Black Sea; later it was named "neuston". Later he obtained proofs that the marine neuston not only is the largest biocenosis of the planet in terms of area but also is the most important element of marine ecosystems. He was also the first to launch investigations of marine boundary surfaces — the so-called "contour biotopes".

In 1964, Acad. G.G. Polikarpov started a new research area in biology — marine radiobiology. He elaborated scientific principles of radiation and chemical ecology as well as the conceptual model of the impact of radioactive and non-radioactive contaminations on sea ecosystems.

Among the most important results of Ukrainian paleontology was the comprehensive association scheme of the development of small mammals of the North Black Sea area over the past 11—12 million years, which was developed by Acad. V.O. Topachevsky, and the reconstruction of the late Paleolithic homes of early humans who lived on the territory of today's Ukraine, made by Acad. I.G. Pidoplichko. That reconstruction became the visiting card of one of the best displays of natural history museums in Europe — the exposition of the National Museum of Natural History of the NAS of Ukraine.

2.3. SOCIAL SCIENCES AND HUMANITIES

Since the very beginning of its existence the Academy attached an important role to socio-humanities studies. It is only sufficient to mention that in the first Academy Statutes, which was approved by Hetman P. Skoropadsky on 14 November 1918, two of the three its departments were those of social sciences and humanities: the Division of History and Philology and the Socio-Economic Division. They were entrusted with the task to develop the main branches of historical, philological, economical and juridical studies.

The Division of History and Philology covered eighteen scholarly areas. The Statutes envisaged the research in all basic trends in the studies of the Ukrainian people, language, literature, folklore, art, church. Specially noted were "the archeology of Ukraine and its associated sciences" — ethnography and historical geography of Ukraine. The study of national history was conceived in the context of the world history. Special disciplines were also introduced — world history and the history of world literature, as well as two such integrative areas as Turcology and Byzantology.

Besides, the Statutes aimed towards regular studies of a broad range of philology issues: the grammar of the Ukrainian language, classical, Arabic-Iranian, Slavic philology, general linguistics.

A special place was reserved for philosophy as the necessary generalizing discipline determining the world outlook.

Specially mentioned was the organization of "the Class of Slavic peoples and peoples that had historical ties with them" within the Division of History and Philology. Those were: the history of Russia, Lithuania and Slavic peoples, as well as languages and literatures — Russian, Belorussian, Polish, Czech, Slovak, Serbian, Croatian, Bulgarian, Slovenian, Lithuanian, Hungarian, Romanian, Jewish. Here we see a strategic plan to comprehend the history, language and culture of the Ukrainian people in the pan-European context, in the context of its mutual ties with the peoples it has had continuous contacts with over its entire history.

The Socio-Economic Division covered twenty areas of juridical and economic sciences. The Juridical cycle incorporated nine areas. They were concerned with re-

search into the historical and theoretical foundations of the law: philosophy, comparative history of the law, the history of the West Rus and Ukrainian law, Slavic legislation. And more than that — of quite a number of particular kinds of law, which included Ukrainian common law, the state, administrative, international, church, criminal, civil law and civil politics.

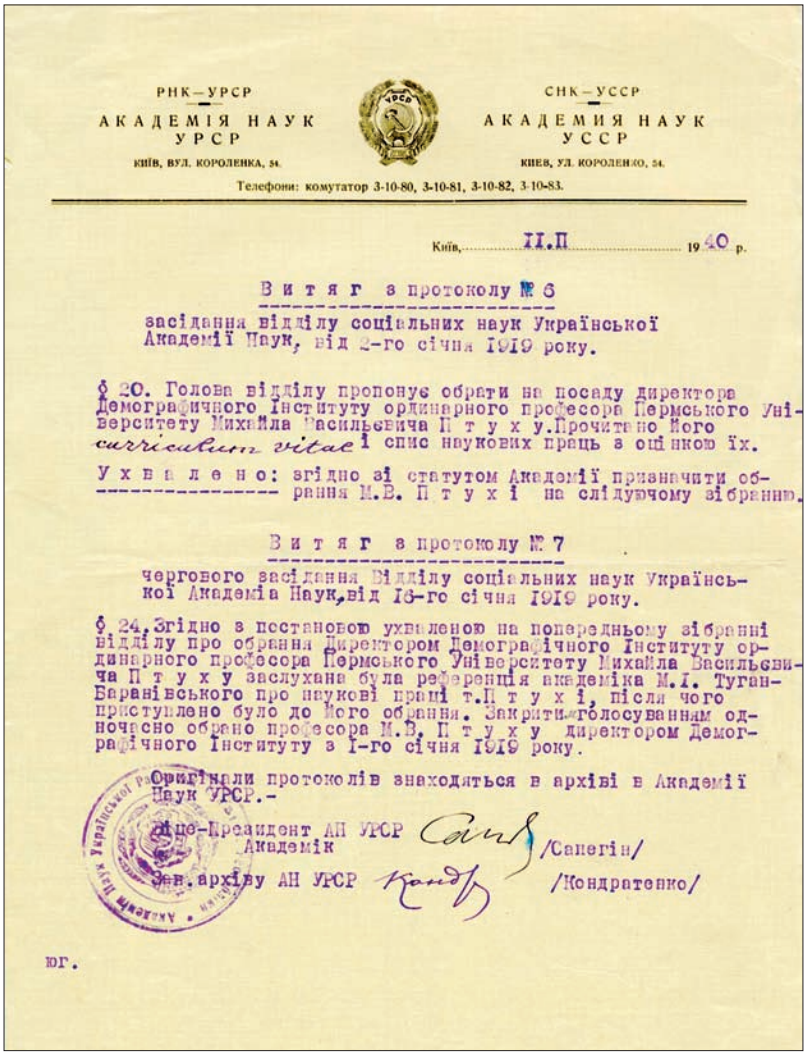
The economic cycle consisted of eleven areas. It also combined sciences of broad subject ranges and those studying particular spheres of economic activities. The first group included sociology, theoretical (political) economy, social politics, statistics, and economy history. Others were concerned with studies in the economics of agriculture, trade, industry, credit, banks, money turnover, finance, cooperation, economic geography. Envisaged were the studies of the economy in Ukraine as a whole.

No ideal program is ever implemented in full, which was also the case with the program to develop socio-humanities. That was due to a number of well-known historical and political causes that did not depend on the Academy. But the strategic program of research that was determined by the first Statutes along Academy's whole historical way was the roadmap for socio-humanities studies. At various development stages the achievements in their different areas were far from similar. But, undoubtedly, they were there and were instrumental in accumulating scientific knowledge about the society and the man, filling the education and mass media with it and increasing the intellectual potential of the society.

The ideology of the soviet epoch was characterized with a great overestimation of the economic factor, though, undoubtedly, it is one of the most important ones. The double dictate — the ideological one and that of thematic planning — restrained the development of the whole sphere of socio-humanitarian ideas. On the other hand, the state-supported trend towards increasing the role of science and education was promoted. In that contradictory situation it was very difficult for scholars to work. Still, economic scientists, following the logic of science and the results of economic observations, produced genuine economic knowledge.

That was started by the first two Academy institutions — the Institute for Studying the Market Conjuncture and the National Economy, and the Institute of Demography. Both were founded by Acad. M.I. Tugan-Baranovsky, prominent economist. The Institute for studying the Market Conjuncture investigated the development of coal mining industry in the Donetsk Basin, collected statistical data on agriculture, sugar-making, iron-ore and salt-mining industries. The economic zoning of Ukraine was elaborated. Unfortunately, the Institute did nor exist for long. Yet, it forever established the ideas of studying the market situation, the role of statistical data and economic zoning. The closer researchers approach market problems, competitiveness, the greater becomes their importance.

The Institute of Demography since its establishment demonstrated itself as a powerful research team. Its invariable director was world-renowned demographer, Prof. (since 1920 Acad.) M.V. Ptoukha. That was the world's first specialized scientific institution for studying demographic problems. The Institute's team became famous for elaborating indicators and tables of mortality- and birth-rate, heredity, morbidity, disablement, crime rate, professions, expertise and skills. M.V. Ptoukha proposed the idea of integrated synthetic table that would summarize the results of studying the intensity and duration of all significant demographic



РНК—УРСР
АКАДЕМІЯ НАУК
УРСР
КИЇВ, ВУЛ. КОРОЛЕНКА, 54.

СНК—УССР
АКАДЕМИЯ НАУК
УССР
КИЕВ, УЛ. КОРОЛЕНКО, 54.

Телефони: комутатор 3-10-80, 3-10-81, 3-10-82, 3-10-83.

Київ, II.II 1940 р.

Витяг з протоколу № 6

засідання відділу соціальних наук Української Академії Наук, від 2-го січня 1919 року.

§ 20. Голова відділу пропонує обрати на посаду директора Демографічного Інституту ординарного професора Пермського Університету Михайла Васильєвича Птуху. Прочитано його curriculum vitae і спис наукових праць з оцінкою їх.

Ухвалено: згідно зі статутом Академії призначити обрання М.В. Птухі на слідуючому зібранню.

Витяг з протоколу № 7

чергового засідання Відділу соціальних наук Української Академіа Наук, від 18-го січня 1919 року.

§ 24. Згідно з постановою ухваленою на попередньому зібранні відділу про обрання Директором Демографічного Інституту ординарного професора Пермського Університету Михайла Васильєвича Птуху заслухана була реферепція академіка М.І. Туган-Барановського про наукові праці т.Птухі, після чого приступлено було до його обрання. Закрито голосуванням одночасно обрано професора М.В. Птуху директором Демографічного Інституту з 1-го січня 1919 року.

Оригінали протоколів знаходяться в архіві в Академії Наук УРСР.-

Віце-Президент АН УРСР Академік /Санегін/

Зав. архіву АН УРСР /Кондратенко/

юг.

Abstract of minutes of the meeting of the Division of Social Sciences of the Ukrainian Academy of Sciences on electing Prof. M.V. Ptoukha the Director of the Demographic Institute beginning from 1 January 1919

phenomena and processes in generations' lifetimes. That idea was successfully implemented by UN demographers in the 1970s while elaborating the unified integral system of socio-demographic indicators.

The Institute worked out the concept of the cyclic recurrence of the global demographic development, started research into ethnic demography, produced the demographic prognosis for Ukraine till 1960. That prognosis was made public at the session of the International Statistical Institute in Tokyo in 1930 and aroused considerable interest. Institute's researchers obtained notable results in the philosophy and methodology of examining the social and hygienic consequences of World War I and the Civil War, as well as implementing and analyzing population censuses. However, after the 1937 Census, when the true size of the population loss in Ukraine as a result of the Genocide Famine of 1932—1933 became known, its leading scholars were subjected to repressions and the Institute was liquidated. Yet, demographic studies were carried on by other Academy institutions. And

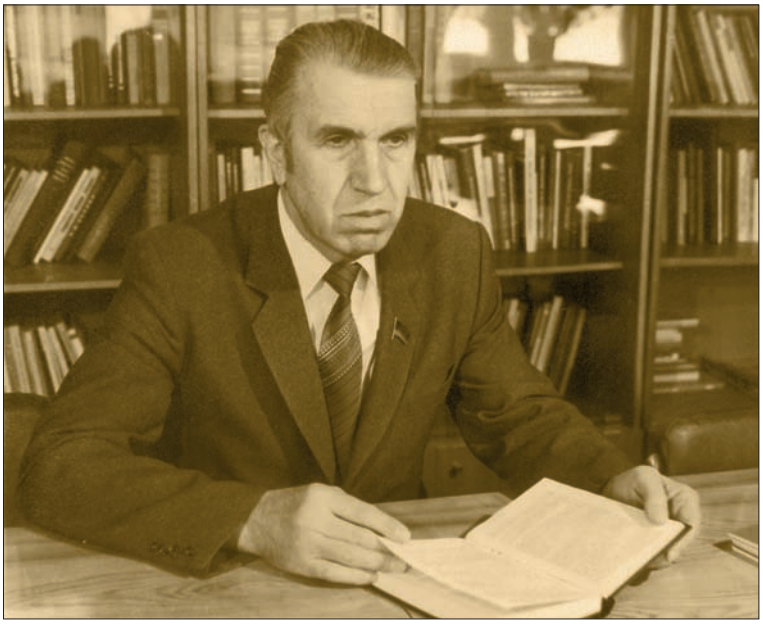
in the new period it was revived by Acad. S.I. Pirozhkov in 2002 Institute for Demography and Social Studies. In 2009 the Institute was named after Acad. M.V. Ptoukha.

An exceptionally important institution — the Commission for Studying Natural Resources and Productive Forces of Ukraine — started its work at the Academy in March of 1919. At first it was headed by Acad. V.I. Vernadsky, Academy's President. The institution changed its name several times. But it was mostly known as the Council for the Study of Productive Forces of Ukraine. For many years it was headed by Acad. P.M. Pershin — the economist of the highest authority in the Academy. The research team of that institution lived up to its name. Integrative studies of Ukraine's natural resources were carried out, as well as those for their preservation, conservation, utilization and restoration. Its scientists addressed the issues of the economic evaluation of natural resources, distribution of productive forces, fundamental principles of forecasting their development, economic zoning. Special focus was given to the development of land and human resources. Proposals for strategies and programs of the socio-economic development of the regions and Ukraine as a whole were prepared. In fact, scientists worked out elements of the concept that is now known as sustainable development.

Economic issues began to be widely and comprehensively studied after the Institute of Economics was set up at the Academy in the mid-1930s. It became a catalyst of new science schools and new scientific research agencies in the sphere of economics. One should mention, in particular, the schools of economic problems of S&T progress, agro-industrial sector, public production management, modeling and macroeconomic forecasting. The school of economic history received wide recognition. The past economic experience proved instructive in many respects. The history of the national economy became an independent branch of economics and a mandatory discipline in economic education schedules. "History of Economic Doctrines" — the monograph by Acad. P.I. Lyashchenko, the founder of the respective science school — was republished 6 times, including 3 times in Japanese.

Economics scientists spent much time for examination of current economic life, paying tribute to the plan-based economy. However, by introducing improvements in the economic mechanism, they brought the society closer to the necessary transition to market relations, self-financing system, the principle of the material incentives of labor. Acad. P.I. Bagrii constructed innovative models of cause-effect relations of commodity production and factors of product value change. One of the principal research topics of Acad. P.M. Pershin was land rent. Acad. I.I. Lukinov entered the zone of pricing problems, the effect of the law of value, equivalence of exchange, optimum profitability, which was critical at that time. His breakthrough monographs "Reproduction and Prices", "Pricing and Profitability of Agricultural Production" brought him both renown and a lot of trouble in relations with economic managers of those days.

Here, it is worth mentioning the concept of conservation and rational management of land, water and forest resources, which was elaborated under the supervision of Acad. O.M. Alimov, his argumentation for the industrial enterprises transfer to waste-free and low-waste technologies. The unique and still scientifically relevant work — "Atlas of Natural Conditions and Natural Resources of the Ukrainian RSR" — was published. O.M. Alimov carefully examined the development of nuclear energy engineering



Acad. I.I. Lukinov,
Vice-President of the URSR AS. 1989

and the rational location of energy facilities from the viewpoints of both economic efficiency and technological safety. His studies were the basis for Academy's negative conclusion concerning the feasibility of constructing NPP in Chornobyl.

The expansion of economic complexes in Ukrainian regions in the 1960—1970s and the necessity to analyze their efficiency brought about the organization of the regional divisions of the Institute of Economics in Donetsk, Lviv, Odesa, Kharkiv. Studying regional economic problems, they simultaneously investigated broader issues of Ukrainian economy. The Donetsk Division specialized in studying the economy of coal industry. But at the same time, its scientists elaborated scientific principles for developing automated systems of production control (Acads. O.M. Alimov and M.G. Chumachenko). A whole school of researchers of social and regional security, human resource management and social development was formed (its founder was Acad. O.I. Amosha).

The Lviv Division (Corr. Memb. M.T. Meleshkin, Acad. M.I. Dolishniy) demonstrated its potential by preparing the integrated plan of the particular enterprise's social development — the leading plant of the '*Electron*' production association. Soon that plan became the model for such plans in various regions and various industries. The school of examining manpower resources, which was formed in the Lviv Division, quickly gained all-Ukrainian renown. And one of its leaders — Prof. S.Yo. Vovkanych, Dr. Sci. (Econ.), was elected an Ordinary Academician of the Pontifical Academy of Social Sciences (Vatican).

The Odesa Division (its first Director was Corr. Memb. M.T. Meleshkin) was set up due to the necessity for studying the economy of maritime regions. Later it focused its efforts on the World Ocean economy. A powerful school of marine economy was formed there. The imitation model of the Sea of Azov ecosystem developed at the Division was awarded the USSR State Prize in Science and Technology.

Kharkiv is a well-known center of mechanical engineering. There a Division of the Institute of Economics was founded, which focused on economic issues of mechanical engineering. The research outcomes of its researchers even now are used in planning the industrial policy under more active interregional collaboration and Eurointegration.

An important event in organizing Academy's economic science was the establishment of the Institute of Social and Economic Problems of Foreign Countries in 1978. For a long period it was headed by Acad. A.M. Shlepakov. The institute started "fitting" of the Ukrainian economy to the world one, a search for the ways of the accession of Ukrainian institutions to the international economic area.

In the first decade of Academy's existence, its history studies continued those of university schools, Shevchenko Scientific Society in Lviv, the Ukrainian Scientific Society in Kyiv, the Commission for Studying Early Documents, Odesa Society of Old History and Antiquities, Historical Society of Nestor the Chronicler, Kyiv Ecclesiastical Academy. The first academicians in humanities, including the leaders of Academy's historical studies came from that sphere. D.I. Bagaliy, Honored Professor of Kharkiv University, became the Chairman of the Division of History and Philology and advanced further the historiography school. O.I. Levytsky, the Secretary of the Commission for Studying Early Documents, for some time was at the head of the Academy and maintained the tradition of archeographic studies. Similarly, M.P. Vasylenko, one of Academy founders, was its President and advanced research in law history.

After M.S. Hrushevsky, a prominent Ukrainian scholar, returned to Ukraine in 1924, large-scale history research was launched in the Academy. He organized history study centers all over Ukraine, where over 100 scholars worked. That was integrated research. The history of Ukraine of all periods was studied, the research addressed all social strata, the entire territory and all aspects — political, social, economic, cultural, and religious. Relying on the data collected, new volumes of the famous "History of Ukraine—Rus" were prepared. The historical outline put forward by Acad. M.S. Hrushevsky for a long time has become (and still largely is) the general outline of Ukraine's history. So, studies in history laid the constitutive foundations for the whole spectrum of Ukrainian studies.

In the early period of the Academy, juridical science also addressed Ukraine-centered issues. West Rus, Ukrainian and customary laws were studied. The concept of Ukrainian law independence was substantiated. Analyzed was the state and legal system of Ukraine in the 16th—18th centuries, which had been reflected in the Lithuanian statute, the Magdeburg Law of Ukrainian cities, and the practice of state institutions of the Hetmanate. The special role of customary law in Ukraine was examined.

The rise in historical, archeological, legal, and simultaneously, in philosophical and sociological research became evident after World War II. The first signs of that were the two-volume "History of Ukraine", published in a large number of copies in 1953 and 1957, and "Essays in the Early History of the Ukrainian RSR" (1957).

The Institute of Philosophy, which was set up in 1946 under the guidance of Acad. M.E. Omelyanovsky, promoted studies of Ukrainian philosophical ideas. A collection of H.S. Skovoroda's writings was published, the study of the legacy of Kyiv-Mohyla Academy professors and socio-political views of Ukrainian writers of the 19th — early 20th centuries was started. Corr. Memb.

Academician M. Hrushevsky with employees of AUAS history institutions during the celebration of his 60th jubilee. Sitting in First Row (Left to Right) are: Varfolomii Ignatiyenko, Ivan Shchitkivsky, Osyp Germayze, Oleksandr Hrushevsky, Volodymyr Shcherbyna, Mykhailo Hrushevsky, Vasyl Danylevych, Kateryna Kondratieva, Mariya Zhukovska, Vasyl Kaminsky, Ivan Kravchenko. Standing are (Left to Right): Oksana Stepanyshyna, Vasyl Denysenko, Ivan Mandziuk, Mykhailo Karachkivsky, Pavlo Hliadkivsky, Fedir Savchenko, Sylvestr Hlushko, Olga Savchenko, Liudmyla Shevchenko, Kost Antypovych, Todor Gavrylenko. Standing in Third Row on the Right (Left to Right) are: Mykola Tkachenko (behind L. Shevchenko), Volodymyr Evfimovsky (wearing eyeglasses, between K. Antypovych and T. Gavrylenko). Kyiv, 37/29 Korolenka (now Volodymyrska) str., apt. 12-a, meeting hall. October 1926

D.Kh. Ostryanyn, having become the Institute's Director, initiated new trends — philosophical aspects of natural sciences, esthetics and ethics.

In the post-war period of Academy renovation a new juridical institution appeared in it — the Sector of the State and Law, which later became an institute. The newly created institute, headed by Acad. V.M. Koretsky — an internationally renowned scholar, a participant of the Paris Peace Conference of 1946, a member of the USSR and Ukrainian RSR delegation at the UN Assembly sessions, the Head of the International Court of Justice — carried out systemic research in criminal, civil and international law. Academy scholars in law actively elaborated new legal systems — the criminal, administrative, criminal procedure, land and labor codes. The formation of new scientific trends that are now widely known was started.

The 1960—1980s witnessed a rapid upsurge of the Academy. It was noticeable in the socio-humanities as well, though the to-

talitarian ideology set its thematic and methodological confines. Yet, Academy scholars in social sciences addressed highly relevant issues and formed professional research teams. Fundamental multi-volume works were published.

First and foremost, the 26-volume edition of the "History of Cities and Villages of the Ukrainian RSR" should be mentioned. That was a monumental work of a huge research team under the supervision of Acad. P.T. Tronko, which still does not have any counterparts. It provided information about every inhabited settlement of Ukraine, with characteristics of its famous people and their role in history. The work was honored with the State Prize in Science and Technology, which at that time was infrequently awarded to researchers in sociohumanities.

Also published were the 8-volume "History of the Ukrainian RSR", 4-volume "Soviet Encyclopedia of the History of Ukraine", and 3-volume "History of Kyiv". Quite a number of works on the history of science and technology were issued for the first time. The 4-volume "History of Mathematics in the USSR", prepared by the research team headed by Acad. Yo.Z. Shtokalo, won the Award of the International Academy of the History of Science. Generalizing works on the histories of electric welding, biology, geology, chemistry, materials science, the 2-volume "History of Technological Development of Coal Industry in Donbas" revealed thick strata of the history of Ukrainian science and technology.

Archeology also achieved new heights. The topics of its examinations became broader, and large amounts of expedition work were carried out. If in the past the archeological data had been merely accumulated and not adequately generalized, now the time for their theoretical analysis has came.

Scholars studied various aspects of early and medieval history and culture of Ukraine, the initial settlement of Eastern Europe's lands and the dispersion of tribes over the territory of Ukraine, the genesis and development of economy forms, the history of tribes of the Neolithic, Bronze and Early Iron ages, the cultures of Scythians and Sarmatians, the ancient cities of the Northern Black Sea Region. A lot of attention was given to studying the ethnogenesis and early history of East Slavs, the place and role of Slavic tribes in European events. The studies of the origin and development of Kyiv Rus cities, the history and culture of ancient Kyiv remained the main priorities. The excavations of the landmarks of the Trypillian and Pit Grave cultures were carried out. The studies of Bronze Age cultures in the forest-steppe zone of Ukraine were of immense importance for the insight into the ethnogenesis of East Slavs.

The 3-volume "Archeology of the Ukrainian RSR" was published. The finding of the unique Gold Pectoral (an ornamental breastplate) of a Scythian king of the 4th century B.C., which was made by B.M. Mozolevsky in 1971, became a scientific sensation. That is an unmatched masterpiece of Hellenic-Scythian art. There were no similar findings in terms of historical, artistic and cultural value either before or after this epoch-making discovery. UNESCO included the Scythian Pectoral in the list of "the major archeological discoveries of mankind in the 20th century". The world is also amazed at four dwellings made of mammoth bones dating back to the Late Paleolithic Age. Archeologists found them in the Mezhyrich village in the Cherkasy oblast. No more than half a dozen such living quarters were found in the world. One lodging is on permanent display at the National Museum of Natural History in Kyiv.

Scholars of the Institute of Philosophy of the URSR AS led by V.I. Shynkaruk, its Director (First Left) among the participants of the International Congress on Logic and Science Methodology. Kyiv, 1976

Another was given as a present to the famous American Museum of Natural History. The third travels around the world with mobile exhibitions.

Strong public response was evoked by the discovery of graffiti (inscriptions) on the walls of ancient Rus cathedrals (St. Sophia Cathedral, Vydubychi Monastery, St. Cyril Church in Kyiv), especially those of the oldest alphabet in Kyiv Rus, which consisted of both Greek and Slavic letters. Archeology became a respectable science and excited the admiration of the whole society, as every people and every generation are interested in their primordial roots.

Philosophers and scientist lawyers to a great extent liberated themselves from ideological stereotypes, essentially broadened the scope of their research, and formed research teams that were able to find new approaches to important issues in sociohumanities. At the Institute of Philosophy, under the guidance of Acads. P.V. Kopnin and V.I. Shynkaruk, a scientific school was formed that studied problems of man, philosophical and sociological aspects of S&T

progress, the methodology of science. Scholars in jurisprudence produced a number of interesting works in international law and legal regulation of economic relations, the history of the state and law.

Linguistics, literature and art studies in the 1920—1980s developed within the general trend of Academy studies, sharing with them the periods of upsurges and declines. Although they experienced the same oppressions and limitations from the totalitarian regime as all other social sciences, still they were more noticeable in the academic circles. The authorities that wish to remain in power for long have to face such factors as language and literature, since they are the most sensitive exponents of thoughts and aspirations of the people. So, limitations went hand in hand with support.

In turn, scholars did all they could to develop and deepen scholarly approaches elaborated at the early stages of Academy's life (first and foremost, the achievements of the Division of History and Philology, which included a number of chairs, centers and commissions that later got the status of independent institutes), to promote the development of language, literature, art, and bring their accomplishments to people. Linguists were able to standardize the literary Ukrainian language. They created orthography, standard spelling dictionaries, grammars, which produced noticeable influence on the advancement of the Ukrainian-language education at all levels, science, literary writing, mass media.

Considerable successes were achieved in literature studies, which since the foundation of the Academy of Sciences were represented by eminent scholars — Acads. D.I. Bagaliy, S.O. Yefremov, V.M. Peretz, M.I. Petrov, A.Yu. Krymsky. Under their supervision, landmarks of early Ukrainian literature and a comprehensive academic edition of I.P. Kotlyarevsky's writings were prepared for publication, the work on academic edition of T.H. Shevchenko's works was started.

It was in those years that the theoretical foundations and a wide empirical base were laid and contributed to the implementation of long-term fundamental projects that afterwards ensured a high level of Academy linguistics in the second half of the 20th and early 21st centuries.

To the honor of the founders of philological studies at the Academy, they profoundly realized the seminal importance of comprehensive national scientific terminology for science, culture and education. That is the template of research. Any research begins with mastering the terminology and it also ends up with the terminology (new and enriched).

On the basis of the Ukrainian Language Chair, headed by Acad. S.Yo. Smal-Stotsky, the Institute of the Ukrainian Scientific Language was set up. It set an ambitious goal — to work out a most comprehensive categorial language for each science. By the late 1920s a long series of dictionaries of the scientific Ukrainian language was published. Printed were zoological and engineering dictionaries, six dictionaries (those of basic natural sciences, basic engineering, electrical engineering, pedagogics, psychology, botany) went to print. Mathematical, manufacturing, transport, economic, agricultural, chemical dictionaries, as well as the dictionary of business language, were in preparation.

Preliminary materials for future sectoral encyclopedias and comprehensive terminological editions were collected. The terminology-forming experience of that time is still valuable for creating a new conceptual basis of science that emerged due to S&T, technological and social revolutions.

A group of philology scholars of the URSR AS. First Row, Left to Right: Acad. Leonid Bulakhovsky, Prof. Mykola Grunsky, Acads. Oleksandr Biletsky and Pavlo Tychyna; Second Row: Corr. Membs. Pavlo Popov and Serghiy Maslov

Employees of the Institute of Archeology examine finds from the dig of Tovsta Mohyla burial kurhan. Left to Right: Vitaliy Otroshchenko, Yevhen Chernenko, Oleksiy Terenozhkin, Borys Mozolevsky, Varvara Illinska. Kyiv, 1977

Winners of 1988 Taras Shevchenko State Prize: Oleksa Zasenko, Mykhailo Bernshtein, Oleksa Myshanych, Igor Dzeverin, Nadiya Vyshnevska, Fedir Pogrebennyk, Mykhailo Yatsenko

Noticeable among linguistic works of the soviet period was "Dictionary of the Ukrainian Language" in 11 volumes. That was the first comprehensive explanatory dictionary in the history of Ukrainian lexicography. It gave a rather full presentation of the vocabulary and phraseology of the literary Ukrainian language from I. Kotlyarevsky till the late 1970s. Each word was provided with detailed explanations, examples of usage, grammatical and lexical characteristics. This work became the basis for the fundamental 20-volume "Dictionary of the Ukrainian Language", whose publication has been started recently. That earlier dictionary was compiled at O.O. Potebnya Institute of Linguistics under the supervision of Academician I.K. Bilodid. Scholars who made the largest contributions to its compilation were honored with the State Prize of the USSR in Science and Technology.

Noticeable achievements of the linguists of that period were also "Ukrainian—Russian Dictionary" in 6 volumes and "Russian—Ukrainian Dictionary" in 3 volumes. They not merely were better than all their predecessors but also were among the most comprehensive dictionaries in the world translation lexicography. Those dictionaries became reliable advisers for writers and translators, handbooks at editorial offices and publishing houses, public institutions, research institutes and establishments of higher education.

Among profound theoretical linguistic works of the soviet period also were fundamental "Modern Literary Ukrainian Language" in 5 books and "History of the Ukrainian Language" in 4 volumes. They contained the thorough analysis of all structural levels of the Ukrainian literary language. Lviv scholars prepared the two-volume "Dictionary of the Old Ukrainian of the 14th — 15th centuries". All in all, a reliable scholarly foundation was produced for the development and establishment of the Ukrainian Language.

In the 1960—1970s, noticeable events in the scholarly and cultural life were the academic edition of the Collected Works by T.H. Shevchenko, issuing of the 50-volume Collected Works by I.Ya. Franko, the unique 2-volume "Shevchenko Dictionary", which later grew into the 6-volume "Shevchenko Encyclopedia", Collected Works by Lesia Ukrainka in twelve volumes.

Amongst the achievements of Academy's literature studies in the times of the USSR the "History of Ukrainian Literature" in 8 volumes should be mentioned. Its authors tried to give a most comprehensive picture of the complex centuries-long process of the development of Ukrainian literature at all its historical stages, reveal the origins of various ideological and artistic trends, tendencies, styles and genres, demonstrate its interrelations with the literatures of other nations. One should also note more extensive studies of foreign (Acad. D.V. Zatonsky) and Slavic (Acad. G.D. Verves) literatures.

During the Restructuring ('Perebudova'), Ukrainian literature scholars took the opportunity to bring back to readers the belles-lettres works of the authors banned by the totalitarian regime: they created literary profiles, published selected works from the legacy of the Ukrainian writers who had been removed from nation's life by the arbitrary rule. The book "From Oblivion — to Immortality" by Acad. M.G. Zhulynsky, which presented such writers, was honored with Shevchenko Prize. It and other similar works helped the history of the Ukrainian literature sparkle with new names and new colors.

Considerable achievements were noticeable in the activities of ethnographers and folklorists.

In 1921 the Ethnographic Commission, Khv. Vovk Museum Office of Anthropology and Ethnology were set up, in 1922 — the Office of Musical Ethnography, in 1928 — the Division of Ethnology. They played the leading role in promoting folklore and ethnographic studies, collecting the source base of ethnology, and also started such specialized editions as "Ethnography Bulletin", "Materials for Ethnology", "Primeval Communities and Their Remnants in Ukraine", "Proceedings of Ukrainian Ethnographic Society" and "Everyday Folk Life".

Those publications gave rise to the unique "Ukrainian Folklore" series that included "Historical Songs", "Riddles", "Christmas Carols and New Year Songs", "Wedding", "Dancing Songs", "Recruit's and Soldier's Songs", "Tchoomak's Songs", "Folk Stories", "Legends and Tales". The golden assets of Ukrainian people's spiritual treasures were returned to society.

The achievements in art studies also built up. Traditional studies of folk and professional fine arts were supplemented with the expansion of musicology, theatre studies, the appearance of cinema studies, museum science, and landmark (monument) studies. An outstanding event was the publication of the six-volume "History of the Ukrainian Art" — a thorough analytical review of the millennial development of various arts in the Ukrainian lands. It elucidated the most prominent achievements of Ukrainian people's artistic genius, showed the unique originality of their contribution to the global artistic treasury of mankind. This fundamental edition, as well as numerous works on the history and theory of ethnography, ritual culture, artifacts still are the gems of Ukrainian ethnography and sources of today's studies.

In general, Academy's Sector of Socio-Humanities, having experienced in the late 1920—1940s a number of reorganizations (dividing of AS into divisions, commissions, institutes, the founding of the so-called AUAMLIN) and geopolitical catastrophes (World War II), in the 1960—1980s enhanced its research potential and was ready to meet the challenges of social transformations.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THE ACADEMY IN THE YEARS OF UKRAINE'S INDEPENDENCE: MAJOR SCIENTIFIC RESULTS AND THEIR PRACTICAL APPLICATION

CHAPTER 3

Winning Ukraine's independence has essentially changed the status of the National Academy of Sciences of Ukraine, increased its role and importance as the leading scientific institution of the country. The NAS of Ukraine was faced with the task of providing self-reliance of the state in the S&T sphere, promoting positive changes in its economy by taking the way of stable growth, dynamic innovative development, ensuring Ukraine integration into the world science and its efficient participation in the international division of labor.

Despite significant economic problems of the transition period, since the very first years of independence the Presidium, sections, departments and research institutions of the NAS of Ukraine aimed their work towards the advancement of basic and applied research, R&D in top-priority areas of science and technology, deployment of research results in the real sector of the economy.

The international collaboration of the Academy with leading scientific centers, academies and universities of the countries of Europe and the entire world has been significantly extended. Recent years have witnessed the increasingly wider involvement of NAS institutions in the implementation of research programs and projects supported by the European Union. The publication activity of Academy scientists in foreign academic journals has grown, especially in those that are indexed in the leading international scientometric bases *Web of Science* and *Scopus*.

Significant results have also been achieved in the scientific support to the development of Ukrainian education, combining the potential of academy science with the needs of institutions of higher learning. The establishment of numerous joint research centers, laboratories and training departments has become an efficient form of integrating the academy and university science. Besides, notable success has been achieved in establishing the system of educational institutions in the Academy itself.

3.1. PHYSICAL, MATHEMATICAL AND ENGINEERING SCIENCES

In the years of Ukraine's independence scientists of the institutions operating under the NAS Section of Physical, Engineering and Mathematical Sciences carried out extensive pioneering research and produced many first-rate developments in the major fields of mathematics, physics and astronomy, mechanics, information science, Earth sciences, physical and technological problems of materials science and energy engineering, nuclear physics and energy.

Efforts of the institutions of the NAS Department of Mathematics were focused on investigating fundamental scientific problems that are the top-priority research topics in the international mathematical community.

At the NAS Institute of Mathematics, Acad. A.M. Samoilenko extended the general theory of differential equations. He proposed and, in collaboration with his colleagues, developed the theory of the impulsive systems of differential equations, which now occupies an important place among the achievements of the world mathematical science.

Acad. Yu.M. Berezansky created the theory of Jacobi fields, obtained a significant generalization of the classical theory of moments, and applied these results to the problems of contemporary mathematical physics.

Acad. Yu.S. Samoilenko carried out a profound research into the structure of the sets of subspaces of Gilbert spaces, including orthoscalar representations of star graphs and the configurations of subspaces.

Corr. Memb. M.L. Gorbachuk solved the Hille problem on the possibility of representation of a semi-group of linear operators in a Banach space via the exponent of its generator.

Acad. M.P. Korneichuk introduced the notion of adaptive information widths, found their values for some important classes of functions, and developed a new concept of optimal reconstruction of the elements of functional space elements according to implicit information.

Acad. V.S. Korolyuk solved the problem of large deviations for random evolutions with independent increments in the scheme of asymptotically small diffusion.

Prof. A.A. Dorogovtsev, Dr. Sci. (Phys. & Math), created the theory of stochastic equations with advance

relative to the time variable and, on the basis of this theory, developed the stochastic analysis of the flows of Brownian particles with interaction.

Corr. Memb. P.M. Tamrazov proposed a constructive method for the determination of all extrema of the Chebotarev and Grotzsch problems by using the proper class of rectilinear graphs.

Corr. Memb. O.I. Stepanets proposed a new approach to the classification of periodic functions and, together with his colleagues, created new methods for solving numerous classical extreme problems of the approximation theory.

Corr. Memb. V.I. Fushchich and his colleagues developed a method of conditional symmetry in the theory of modern group analysis and gave a rigorous mathematical substantiation of this method.

Corr. Mem. A.G. Nikitin gave a constructive description of quantum Hamiltonian systems admitting generalized integrals of motion of the Laplace—Runge—Lenz type with arbitrary spin and constructed an infinite number of integrated systems of coupled Schrödinger equations.

Acad. O.M. Sharkovsky and O.Yu. Romanenko, Dr. Sci. (Phys. & Math.), developed a new approach to the mathematical modeling of turbulence and, on this basis, investigated the evolution of the cascade process of structure formation and the emergence of the space-time deterministic chaos.

Corr. Memb. Yu.A. Drozd proposed a novel approach to the analysis of stable homotopy classes based on the technique of triangulated categories and matrix problems and used this approach to give a stable homotopy classification of new broad classes of polyhedra.

Corr. Memb. V.V. Sharko made a considerable contribution to the Morse theory by finding the minimal numbers of critical points of the Morse functions and close orbits of the vector fields without singular points on manifolds. Acad. I.O. Lukovskyi created a non-linear theory of the dynamics of bounded volumes of liquid and, together with Corr. Memb. O.M. Timokha, constructed an approximate analytical solution of the complex boundary-value problem with free surface. That enabled them to give a quantitative and qualitative description of all possible resonance waves for random 3D periodical disturbances of liquids in cylindrical vessels and investigate the stability of emerging extreme non-linear waves.

On the basis of nonvariational principles of mechanics, they developed numerous multimode nonlinear mathematical models for the solution of the problems of dynamics and stability of liquids for various mechanical objects, such as launchers of space vehicles, tankers, tank cars etc.

Acad. V.L. Makarov, in collaboration with his colleagues, developed the theory of superfast numerical-analytic methods for the solution of differential operator equations with unbounded operator coefficients.

Corr. Memb. O.A. Boichuk advanced the general theory of boundary-value problems for a broad class of differential-operator problems with normally solvable and generalized normally solvable operators in Banach spaces. Corr. Member A.N. Kochubey developed the theory of Cauchy problem for fractional-parabolic and fractional-hyperbolic equations used to describe the processes of diffusion and propagation of stress pulses.

S.F. Koliada, Dr. Sci. (Phys. & Math.), obtained important results in the theory of topological dynamics, in particular, he proved that the Li—Yorke chaos follows from the positivity of topological entropy.

Prof. O.L. Rebenko, Dr. Sci. (Phys. & Math.), proposed a new approach to the in-

vestigation of infinite continuous systems in physics.

Prof. Yu.B. Zelinsky, Dr. Sci. (Phys. & Math), laid the foundations of complex linearly convex analysis.

At the Mathematical Division of B. Verkin Institute for Low Temperature Physics and Engineering of the NAS of Ukraine, Acad. L.A. Pastur and Corr. Memb. M.V. Shcherbyna proved the well-known Dyson hypothesis concerning the universal nature of the local distribution of random matrix eigenvalues. Acad. E.Ya. Khruslov obtained pioneering results in the homogenization theory for partial differential equations concerning the construction of non-standard homogenized models of physical processes in micro-inhomogeneous media, particularly, multi-component models and models nonlocal in space or time. V.P. Kotliarov, D.G. Shepelsky and I.E. Egorova, Drs. Sci. (Phys. & Math.), developed new effective methods for studying integrable nonlinear evolution equations of the Korteweg de Vries type. Corr. Memb. G.M. Feldman proved the main theorems that characterize important classes of probability distributions on locally compact Abelian groups.

At the Institute of Applied Mathematics and Mechanics of the NAS of Ukraine, Acad. I.V. Skrypnik proposed a number of new topological methods to investigate the solubility of nonlinear operator equations and nonlinear elliptic boundary-value problems related to the investigation of the 19^{th} and 20^{th} Gilbert problems. Corr. Memb. V.Ya. Gutlyanskii solved the well-known F. John's rotation problem that concerns nonlinear elasticity theory, conformal geometry and dynamics. Prof. A.L. Zuyev, Dr. Sci. (Phys. & Math.), solved the problem of the stabilization and compensation of external disturbances for a mathematical model of elastic shells with constraints on control. These results have a wide range of practical applications — from stabilizing the vibrations of ultra-light weight structures to the designing of mechatronic tethered systems for removing non-operational satellites from their near-Earth orbits.

At Ya.S. Pidstryhach Institute of Applied Problems of Mathematics and Mechanics, Corr. Memb. Ya.Yo. Burak and Prof. O.R. Hachkevych, Dr. Sci. (Phys. & Math.), jointly with their disciples, constructed a version of quantitative description theory for interrelated electromagnetic, thermal and mechanical processes in electrically conducting deformable bodies with different values of electric conductivity, magnetic and polarization susceptibility. The theory is used to compute the residual strength of structural elements in instrument-making and heat-and-power engineering. Corr. Memb. H.S. Kit and his pupils advanced mathematical foundations of the theory of cracks in solids under force and heat loads and generalized the method of potentials on 3D dynamic problems that are used in developing the procedures of nondestructive control of structural elements. Acad. R.M. Kushnir, in collaboration with Prof. V.S. Popovych, Dr. Sci. (Eng.), and their disciples developed approaches to numerical and analytical solutions of thermoelasticity problems for laminated heat-sensitive bodies under complex heat exchange with the environment. Cor. Memb. B.Yo. Ptashnyk, together with his disciples, obtained solutions of non-classical problems for differential equations in partial derivatives, whose solvability is related to the problem of small denominators. Prof. V.Ya. Skorobogatko, Dr. Sci. (Phys. & Math.), and his disciples introduced branched chain fractions as the multidimensional generalization of continued fractions, created the theory of those and proposed its numerous applications.

V.O. Pelykh, Dr. Sci. (Phys. & Math.), proved the geometrical origin of Witten spinor field, obtained new solutions of Maxwell equations in Kerr field, and discovered new effects in it. Professor M.V. Marchuk, Dr. Sci. (Phys. & Math.), constructed a mathematical model for the deformation of composite changeable-thickness shells that interact through a hyperelastic interlayer and produced the proper software for calculating a standard case of solid-propellant rocket engine.

At the NAS Center of Mathematical Modeling within Ya.S. Pidstryhach Institute of Applied Problems of Mechanics and Mathematics, Ya.D. Pyanylo, Dr. Sci. (Eng.), M.H. Prytula, Cand. Sci. (Phys. & Math.), and N.M. Prytula, Cand. Sci. (Eng.), developed mathematical models of operative control of natural gas motion and its extraction from underground gas storage facilities of the gas transportation system of Ukraine. That provided an average 2.5 fold increase in the recovery rate from underground reservoirs, a 5—10 % rise in the productivity of compressor plants at the *Soyuz* gas pipeline, and a 14 % saving of power gas.

Basic theoretical research and numerous applied developments of the institutions of the Information Science Department of the NAS of Ukraine were of decisive significance for the establishment of advanced information technologies in Ukraine and successful transition of our country to information society.

Institutions of the NAS Cybernetic Centere, under the leadership of Acads. V.S. Mikhalevich and I.V. Sergiyenko, were actively involved in the development and implementation of the National Informatization Program, which opened up new opportunities for the broad employment of information technologies for citizens and society, ensuring the information security of the state, and contributed to the formation of national information resource systems.

Scientists of V.M. Glushkov Institute of Cybernetics of the NAS of Ukraine, under the guidance of Acad. I.V. Sergiyenko, created state-of-the-art computer technologies of mathematical modeling for supporting the analysis and improving complex systems that, specifically, were used to substantiate the choice of versions of Ukrainian oblasts' budgets, making strategic decisions in construction. They developed and implemented four generations of SKIT supercomputer complexes, which are the fastest in Ukraine, to solve super difficult problems in science and technology. The resource center of the Ukrainian National Grid was unrolled on that basis. In collaboration with the '*Electronmash*' State R&D enterprise, the *Inparcom* family of intelligent computers was created, which performed the innovative function of automatic adaptive adjustment of computer algorithm, program and architecture to the task properties. In particular, those computers were employed in calculating aerodynamic performances of the *AH-148* airframe produced by '*Antonov*' state-owned enterprise and in modeling of fracture processes in thick-walled pipeline elements (Corr. Membs. O.L. Perevozchikova, O.M. Khimich).

Scientists of V.M. Glushkov Institute of Cybernetics of the NAS of Ukraine developed exceptional cryptographic algorithms on whose basis the national standard of electronic digital signature and the infrastructure of public key certification centers in Ukraine were created. On a government commission, new algorithms for solving the problems of computer stedganography were developed, which made it possible to draw conclusions concerning the availability of hidden information in digital audio

and video containers and images (Acads. I.M. Kovalenko, V.K. Zadiraka).

An insertion modeling system was developed to analyze multi-agent distributed information systems, to create instrumental design systems that support the development of distributed software systems from requirements analysis to software code generation (Acad. O.A. Letichevsky).

Researchers of the NAS Institute of Software Systems, which is headed by Acad. P.I. Andon, developed the philosophy of component-based assembly programming and software quality engineering (Prof. K.M. Lavrishcheva, Dr. Sci. (Phys. & Math.)); elaborated a comprehensive technology of constructing complex integrated systems to support the activities of Ukraine's central executive bodies, specifically, for supporting and monitoring migration processes in Ukraine (*Hart* and *Arkan* systems) (V.A. Alekseyev, Cand. Sci. (Eng.)).

At the NAS Institute for Information Recording of the NAS of Ukraine, Acad. V.V. Petrov and Corr. Memb. A.A. Kryuchin developed a technology for long-term information storage on optical media made of high-stability materials, which was successfully used for digital information.

A team of scientists of the Institute for Applied System Analysis of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" functioning under the MES and the NAS of Ukraine, which is headed by Acad. M.Z. Zghurovsky, worked out a system-analysis methodology to investigate complex interrelated objects and processes of social, economic, environmental and technological nature, elaborated methods to foresight the medium-term (till 2020) and long-term (till 2030) socio-economic development of Ukraine.

At the International Research and Training Center for Information Technologies and Systems under the NAS of Ukraine and the MES of Ukraine, a group of researchers headed by Corr. Memb. V.I. Grytsenko obtained internationally recognized results in the field of intelligent information technologies for image perception and recognition, natural language comprehension, analysis and processing of textual information and signals of varied physical nature.

INPARCOM intellectual computer. V.M. Glushkov Institute of Cybernetics and 'Electronmash' State Research-and-Production Enterprise

Relying on the situational modeling and control, scientists of the NAS Institute of Mathematical Machines and Systems, under the leadership of Acad. A.O. Morozov, created a number of situation centers for decision-making support, as well as RADA system for supporting the legislative activities of the deputies of various levels.

In recent years, researchers of the Information Science Department of the NAS of Ukraine have produced notable practical results in the development of equipment and technologies for medicine. Specifically, experts of the International Research and Training Center for Information Technologies and Systems of the NAS of Ukraine and the MES of Ukraine developed PHAZAGRAPH portable device, which for the first time implements the effective method of

processing electrocardiogram on the phase plane (L.S. Fainzilberg, Dr. Sci. (Eng.), TRENAR® portable devices for therapeutic rehabilitation of motion and speech, which are used for the treatment and rehabilitation of patients after severe diseases — stroke, children's cerebral paralysis, facial neuritis, spine pathologies, post-surgery complications etc. (M.I. Vovk, Cand. Sci. (Biol.). The model of country's telemedical network proposed by Corr. Memb. V.I. Grytsenko; O.S. Kovalenko, Dr. Sci. (Med.), and V.G. Ostashko, Cand. Sci. (Med.)) was a pioneering work in Ukraine. It provided computerization for the preparation and transmission of medical data, digital medical images, and created a storage system for various medical records.

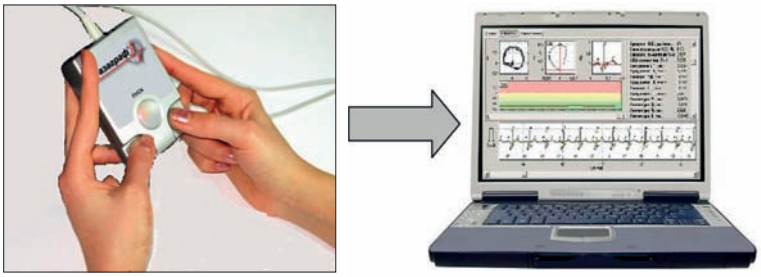
Relying on novel information technologies, researchers of V.M. Glushkov Institute of Cybernetics, under the leadership of Corr. Memb. V.P. Boyun, produced a number of intelligent video systems, in particular, a digital optical capillaroscope with automated measuring of static and dynamic parameters of human blood microcirculation, a hemodynamic laboratory for checking the state of human cardiovascular system.

At the NAS Institute for Information Recording, researchers headed by Acad. V.V. Petrov and S.M. Shanoilo, Cand. Sci. (Eng.), developed a ground-breaking technology for diagnostics and treatment of strabismus. The world knows no counterparts of those devices, and they are now being introduced to medical practice both in Ukraine and abroad — in Uzbekistan and China.

O.O. Rodionov, Cand. Sci. (Eng.), O.M. Sukhoruchkina and Corr. Memb. A.I. Shevchenko obtained important theoretical and practical results in creating intelligent computer technologies for controlling remote task-oriented self-contained mobile robots to fulfill tasks in the military sphere, at Customs and in dealing with emergencies.

The determining feature of the research conducted by the institutions of the NAS Department of Mechanics is the deep integration of basic theoretical studies and effective implementation of their results in practice.

At S.P. Timoshenko Institute of Mechanics of the NAS of Ukraine, Acad. O.M. Guz worked out the foundations of mechanics of quasi-brittle fracture of materials with initial (residual) stresses and fracture mechanics of composite materials under compression: he developed dynamics of compressible ductile liquid for wave processes at arbitrary frequencies. Acad. Ya. M. Grigorenko constructed numerical methods to investigate anisotropic shells of variable stiffness, flexible membranes and shells of various shapes and structures under power and temperature loads. Acad. Yu.M. Shevchenko developed the theory of thermo-plasticity of materials in the processes of complex loadings at elevated temperatures and methods to calculate structural elements. Acad. V.D. Kubenko constructed the theory of shock interaction of rigid and deformable bodies with a liquid and an elastic medium, as well as the theory of non-stationary wave processes in elastic bodies with planar boundaries. Acad. A.A. Martyniuk advanced the theory of large-scale system stability under structural disturbances, fuzzy dynamical systems, and dynamic systems on a time scale. Acads. V.L. Bogdanov, O.M. Guz and Corr. Memb. V.M. Nazarenko worked out fundamentals of fracture mechanics for materials compressed along the system of interacting parallel cracks. Corr. Memb. L.P. Khoroshun constructed the theory of deformation and damage of heterogeneous and composite materials of different structures. Corr. Memb. M.O. Shulga developed



FAZAGRAF® finger-electrode device for registration and processing of electrocardiosignal. International Research and Training Center for Information Technologies and Systems under the NAS of Ukraine and the MES of Ukraine

a rigorous method to investigate wave processes in layered composite materials of periodic structure with determination of zones (in terms of frequency) of wave transmission. Corr. Memb. I.S. Chernyshenko elaborated numerical methods for calculating shells with holes under physically and geometrically non-linear deformations. Prof. V.G. Karnaukhov, Dr. Sci. (Phys. & Math.), developed the foundations of the non-linear dynamics of viscoelastic materials, taking into account the interaction of mechanical, temperature and electromagnetic fields.

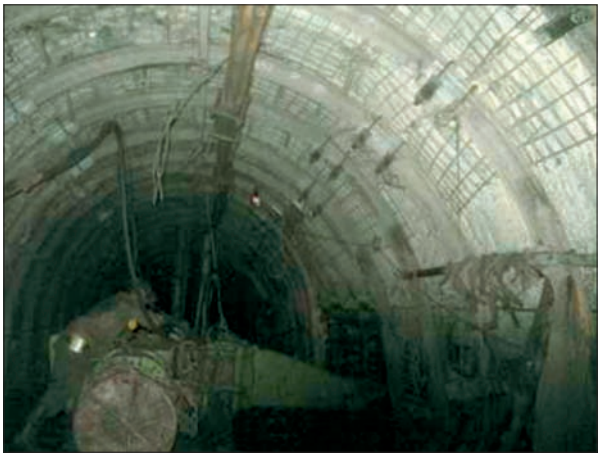
A collaborative development of researchers of the NAS Institute of Technical Mechanics, the SSA of Ukraine and specialists of space-rocket industry was a system of on-board scientific equipment for monitoring the state of ionospheric plasma (Prof. V.O. Shuvalov, Dr. Sci. (Eng.)). Its operation on board *Sich-2* spacecraft proved its potential for identifying the space—time localization of earthquake epicenters, volcanic eruptions and other natural cataclysms that emerge and occur on the sub-satellite track on the Earth surface and in the ocean.

Under the guidance of Corr. Memb. O.V. Pylypenko, a theory and procedures were developed to analyze the longitudinal stability of a liquid-propellant launch vehicle in the boost path, which have no counterparts in other countries. For the first time in the world practice of building heavy and super heavy liquid-propellant rockets, a

TRENAR® portable electronic device for motion and speech rehabilitation in post-stroke patients, people with cerebral spastic infantile paralysis, facial nerve neuritis, spine pathologies, post-surgical complications. International Research and Training Center for Information Technologies and Systems of the NAS of Ukraine and the MES of Ukraine

theory was developed and ground-breaking highly efficient hydrodynamic and thermodynamic dampers of longitudinal vibrations were produced. Practical recommendations were also made for providing the longitudinal stability of liquid-propellant launchers developed at '*Pivdenne*' Design Office (*Zenit*, *Zenit-2SL* and *Zenit-3SL*, *Zenit-2SLB* and *Zenit-3SLB*, *Cyclon-4*, *Dnipro*), as well as *Antares* launch vehicle.

Acads. S.M. Konyukhov, O.V. Degtyarev and Corr. Memb. V.Yo. Dranovsky gave much effort to the retention and further ad-



Mine face of the Ternovska mine of 'Pavlohradvuhillya' company, where frame anchoring technology is employed. M.S. Polyakov Institute of Geotechnical Mechanics of the NAS of Ukraine

vancement of the scientific potential of the '*Pivdenne*' Design Office — an internationally renowned space-rocket development center.

At G.S. Pisarenko Institute for Problems of Strength of the NAS of Ukraine, Acads. V.T. Troshchenko, A.O. Lebedev and V.V. Kharchenko, Corr. Membs. A.Ya. Krasovsky and V.O. Stryzhalo developed criteria of the limiting state of materials and methods to evaluate the strength and service life of structural elements under extreme conditions of thermomechanical loading for space-rocket and aviation objects, nuclear energy facilities and other high-tech industries. They also proposed a theory of fatigue failure of metals, which is based on strain energy approaches, and, relying on it, validated models of transition from fatigue failure to brittle fracture.

At M.S. Polyakov Institute of Geotechnical Mechanics of the NAS of Ukraine, Acad. A.F. Bulat discovered an earlier unknown general pattern of failure of extremely stressed rocks under low-energy impacts and, in collaboration with Prof. V.V. Vinogradov, Dr. Sci. (Eng.), developed on its basis a technology of anchor support of mine workings, which was deployed in numerous coal mines of Ukraine. Corr. Memb. E.I. Efremov, in collaboration with a team of specialists, worked out a cyclic-flow technology of ore mining in deep pits.

Researchers of the NAS Institute of Hydromechanics, led by Acad. V.T. Grinchenko, produced a computer facility for recording and spectral analysis of human breathing sounds.

On the basis of developments and with the direct involvement of scientists of the NAS Institute of Transport Systems and Technologies, a new science-intensive import-substituting accumulator battery industry was built up, which has a significant export potential. In 1993—2012, eight state-of-the-art high-tech plants were designed, built and equipped for manufacturing and recycling lead-acid accumulator batteries in Ukraine.

Under the guidance of Acad. D.S. Kiva, *An-148*, *An-158* and *An-178* passenger and transport airplanes were developed, deployed in serial manufacturing and put into operation. Corr. Memb. O.V. Shimanovsky elaborated the general theory of computing and automated designing of long linear aerial crossings of pipelines and bridges.

Institutions of the NAS Department of Physics and Astronomy performed basic research that won high appraisal of the international scientific community.

In the early 1990s, scientists of the NAS Institute of Physics, in collaboration with their colleagues from Taras Shevchenko National University of Kyiv, discovered and investigated a new physical phenomenon — the effect of liquid crystal photo-induced alignment, when light aligns all molecules of a liquid crystal in the given direction determined by the direction of light polarization.

Plant for production and recovery of lead acid accumulator batteries developed under the scientific supervision and with the participation of scientists of the NAS Institute of Transport Systems and Technologies

The discovery was based on the ability of some classes of polymers to acquire anisotropic properties when they are irradiated with polarized light. Since today's wide application of liquid-crystal displays is accounted for by these unique optical properties of aligned liquid crystals, this discovery of Ukrainian scientists, which provided the alignment of the bulk of the liquid crystal under the action of laser light only, without any machine working, launched the extensive research of photo-induced alignment in the whole world. The results were published in nearly 8000 papers, and around 2010 the practical application of the technologies of liquid crystal photo-induced alignment was launched: relying on this method, leading international corporations set up mass manufacture of displays for mobile phones and tablet computers (Prof. Yu.O. Reznikov, Dr. Sci. (Phys. & Math.); T.Ya. Marusiy, Cand. Sci. (Phys. & Math.); A.G. Dyadyusha; Prof. V.Yu. Reshetnyak, Dr. Sci. (Phys. & Math.); O.V. Yaroshchuk, Cand. Sci. (Phys. & Math.), et al.). A major contribution to the theory of liquid crystals was made by Corr. Membs. P.M. Tomchuk and B.I. Lev.

Researchers of the Institute of Physics were the first to observe the formation of 2D (surface) glasses, which are formed when monolayer metal films adsorbed on a metal substrate and melted at high temperature are quickly cooled to low temperatures. Two-dimensional vitreous layers contain a large

number of defects, and due to that could find numerous useful applications, e.g., in catalysis (Acad. A.G. Naumovets; O.G. Fedorus, Dr. Sci. (Phys. & Math.); V.P. Koval, Cand. Sci. (Phys. & Math.).

It was found experimentally that the element composition of the surface of polar compounds, when thermally evaporated in vacuum in the presence of external electric field, deviates from the stoichiometric composition in such a way that, depending on the evaporation temperature, the intensity and sign of the field, steady-state congruent crystal evaporation is achieved. This effect is important for practical applications of multicomponent oxides and other polar compounds. The research was carried out by Acad. A.G. Naumovets; K.M. Pylypchak, Cand. Sci. (Phys. & Math.) (NAS Institute of Physics); V.F. Shniukov, Dr. Sci. (Phys. & Math.), and O.Ye. Lushkin, Cand. Sci. (Phys. & Math.) (Taras Shevchenko National University).

Acads. O.G. Sitenko and A.G. Zagorodnyi worked out the kinetic theory of dusty plasma, i.e. a plasma with macroscopic solid objects (interstellar clouds, space and solar plasmas, plasma in technological devices, fusion plasma etc.), which takes into account self-consistent grain charging by plasma currents and makes it possible to describe electromagnetic fluctuations in dusty plasmas. They found that charging processes result in long-range interactions of dust particles producing significant effects on the properties of dusty plasma and, thus, on the feasibility of its technological applications.

V.Ye. Lashkaryov Institute of Semiconductor Physics of the NAS of Ukraine developed methods, technologies and advanced materials for producing light-emitting micro- and nano-structures, worked out electronic systems for controlling their optical parameters, methods of illuminating equipment diagnostics and organized manufacture of a wide range of those devices. The employment of such high-tech products provided a reduction in power consumption, a better quality of illumination and decreased the negative impact of human activities on the environment (Acads. S.V. Svechnikov, O.Ye. Belyaev; Corr. Membs. P.F. Oleksenko, V.M. Sorokin; R.V. Konakova, Dr. Sci. (Eng.)).

Researchers of G.V. Kurdyumov Institute for Metal Physics of the NAS of Ukraine, together with their colleagues from the NSC 'Kharkov Institute of Physics and Technology', developed technologies to produce materials with predefined functional properties. In particular, a method was proposed for metastable amorphous, micro- and nanostructured crystalline states formation in metals and alloys obtained by rapid melt cooling. The application of these materials enabled researchers to launch manufacturing of high-quality ribbons, ribbon magnetic cores and energy-efficient transformers and throttles, which are used in industry, namely, efficient pulsed power supplies with reduced mass—size for electric vehicles and special-purpose machinery; ultrasensitive sensors of fluxgate and induction magnetometers used in mineral prospecting and investigations of magnetic anomalies in outer space; systems of commercial accounting of electricity consumption with at least double precision (Acads. A.P. Shpak, O.S. Bakay, V.V. Nemoshkalenko; Profs. V.V. Maslov, O.V. Romanova, O.G. Ilyinsky, G.P. Brekharya, Drs. Sci. (Phys. & Math.); V.K. Nosenko, Dr. Sci. (Phys. & Math.).

The concept of the purposeful formation of micro- and submicro-inhomogeneous solid solution structures with the optimal combination of physical and mechanical properties was designed. The revealing of the mechanisms of heterogeneities for-

mation at different scale levels in solid solutions became its basis. Such controlled chemical inhomogeneities resulted in their subsequent transformation into optimal phase and structural states through the incomplete process of high-temperature solid solution homogenization. Such an approach enabled researchers to propose novel titanium alloys and steels, alongside their rapid working technologies that are widely used in aerospace and ship-building industries (Acad. O.M. Ivasyshyn; Prof. V.G. Gavrylyuk, Dr. Sci. (Eng.); Prof. V.V. Kokorin, Dr. Sci. (Phys. & Math.); R.V. Telyovych, Dr. Sci. (Eng.)).

At M.M. Bogolyubov Institute for Theoretical Physics of the NAS of Ukraine, Corr. Memb. V.P. Gusynin and S.G. Sharapov, Dr. Sci. (Phys. & Math.), predicted the quantum Hall effect in graphene and showed that Hall resistance of electrons in it has the value $R_H = h/\upsilon e^2$, where the filling factor $\upsilon = 2(2n+1)$, with $n = 0, \pm1, \pm2,..$ That makes graphene radically different from all known systems for which υ is an arbitrary integer. It is this experimentally observed effect which proved that charged quasi-particles in graphene are massless and their motion is described by the Dirac equation. The quantum Hall effect in graphene is already used in metrology to define the resistance unit.

At the Main Astronomical Observatory of the NAS of Ukraine, Acad. Yu.I. Izotov and N.G. Guseva, Dr. Sci. (Phys. & Math.), in cooperation with specialists of the USA, France and Germany, carried out the most precise determination of the abundance of primordial helium that had been produced in the very first moments of Universe existence. This research, which relied on their own observations of galaxies with the world's largest telescopes, was recognized as the most reliable one in the statistical and systemic senses.

At the Institute of Magnetism of the NAS of Ukraine and the MES of Ukraine, Acad. V.G. Baryakhtar; Corr. Memb. B.O. Ivanov; Prof. V.M. Kryvoruchko, Dr. Sci. (Phys. & Math.); O.G. Danilevich, (Cand. Sci. (Phys. & Math.)), worked out the theory of dissipative processes in magnetic crystals that described the relaxation of magnetization in terms of both direction and strength. They also explained experimental results related to manipulating the magnetic moment with femtosecond laser pulses. This scientific result opens up the prospect of superfast information recording and processing on magnetic media.

Experts of the NAS Institute of Applied Problems of Physics and Biophysics developed and used a technology for emergency neutralization of containers with chemical toxicants drowned as far back as World War II. The technology helped neutralize many tons of dangerous chemical toxicants in the Black Sea and decontaminate large areas of intensive mariculture, in particular, territories near Sevastopol and Kerch (V.V. Guryk; A.G. Mysiura, Dr. Sci. (Biol.)).

Scientists of B. Verkin Institute for Low Temperature Physics and Technology of the NAS of Ukraine for the first time ever discovered the quantum diffusion of lightweight admixture particles in carbon nanostructures. Using a unique gas analyzer, they investigated with unprecedented sensitivity the temperature dependences of the diffusion coefficients of admixture particles (^{3}He, ^{4}He, etc.) in C_{60} fullerite, carbon nanotubes, graphene oxide, which enabled them to determine the temperature range where diffusion coefficient remained stable, i.e. identify the sphere of quantum diffusion existence (Acad. V.G. Manzheliy; O.V. Dolbyn, Dr. Sci. (Phys. & Math.); V.B. Yeselson, V.G. Gavrylko, M.A. Vinnikov, S.M. Popov, Cands. Sci. (Phys. & Math.)).

At O.Ya. Usikov Institute for Radio Physics and Electronics of the NAS of Ukraine, G.P. Pochanin, Cand. Sci. (Phys. & Math.), and V.G. Sugak, Dr. Sci. (Phys. & Math.), developed subsurface radiolocation. This scientific area is based on two approaches. The first one uses ultrawide band signals, while in the other one the wide band signals with stepwise frequency tuning are applied. To sound the state of underground structures, novel equipment was developed and produced. It was used by enterprises of the Ukrainian Road Service and applied to explore the basement of St. Cyril Church and underground tunnels of St. Sophia Cathedral in Kyiv.

Researchers of the NAS Institute of Radio Astronomy carried out the comprehensive upgrading of the world largest radio telescopes *UTR-2*, *URAN* and built the *GURT* radio telescope of the next generation. Its equipment increased hundredfold the sensitivity, resolution and the amount of information obtained in the exploration of the Universe. Specifically, it enabled scientists to discover in the interstellar medium atoms in super high excited states, their principal quantum number exceeding 1000 (Acad. O.O. Konovalenko; Corr. Memb. V.V. Zakharenko; S.V. Stepkin).

At O.O. Galkin Donetsk Institute for Physics and Engineering of the NAS of Ukraine, Prof. V.O. Biloshenko, Dr. Sci. (Eng.), V.D. Doroshev and O.S. Karnachov, Cands. Sci. (Phys. & Math.), developed a safe and easily operated portable computer device for the screening examination of women, which is intended for the early diagnostics of breast tumors — the digital direct-contact thermograph. The device is in serial manufacture in Ukraine and is effectively used in primary medical care clinics, permitting a several fold reduction in female mortality from breast cancer.

At the Institute for Physics of Mining Processes of the NAS of Ukraine, Corr. Memb. A.D. Alexeev; Prof. V.G. Grinyov, Dr. Sci. (Eng.); Prof. E.P. Feldman, Dr. Sci. (Phys. & Math.), proposed a relevant model of coal and established the mechanisms of methane motion in coal matrix, which enabled them to investigate mass transfer processes in the coal— methane system and the loss of its stability. The application of these results improves the work safety in deep mines with gas-bearing coal.

Scientists of the NAS Institute for Condensed Matter Physics proposed new algorithms for molecular dynamics simulations of classical and quantum many-particle systems and showed that, if the similar resource was used, those algorithms were $10-10^4$ times more efficient than the standard ones. In particular, the new procedure taking into account solvation interactions for complex biochemical systems provided an essential rise of the time step in solving the equations of motion and accelerated calculations by up to 500 times. The programs developed were implemented in the new version of the AMBER package (Acad. I.M. Mryglod; I.P. Omelyan, Dr. Sci. (Phys. & Math.)).

Scientists of the NAS Institute of Electron Physics studied elementary processes occurring in the interactions of electrons, ions, photons with atoms and molecules, as well as photonuclear processes; synthesized a number of materials for functional electronics; for the first time investigated the resonance and correlation phenomena related to the excitation and decay of negative ion states and autoionization states. It was demonstrated that physical processes in atomic systems are collective multi-electron phenomena, and studies of multi-electron interactions in atoms and ions are of fundamental importance for discovering and using new physical properties of multi-atom com-

pounds, as well as plasma and gas environments (Acad. O.B. Shpenyk; Profs. I.P. Zapisochny, A.M. Zavilopulo, Drs. Sci. (Phys. & Math.); A.Y. Imre, V.M. Mazur, Drs. Sci. (Phys. & Math.); O.P. Sabad, Cand. Sci. (Phys. & Math.); Prof. M.I. Golovey, Dr. Sci. (Chem.)).

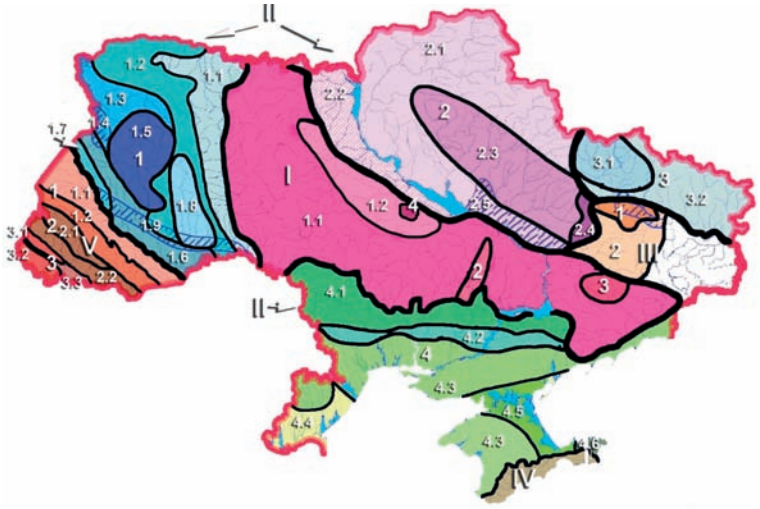
The outcomes of basic and applied R&D works of the institutions of the Department of the Earth Sciences of the NAS of Ukraine are of great practical importance in addressing the challenges of today's and future economic progress.

Scientists of the NAS Institute of Geological Sciences created the "Stratigraphic Code of Ukraine", which meets international standards, contains a set of stratigraphic schemes of the Phanerozoic, the late Precambrian periods of Ukraine and is the basis for geological surveys under the *Derzhgeolmap – 200* program (Acad. P.F. Gozhic); developed a concept of fluid lithogenesis, whose implementation provided them with new data on the deep geofluids nature of tectonic plumes that play the leading role in the formation of deep oil- and gas-bearing basins, and to substantiate the scientific principles of the novel synergy concept of carbohydrates origin (Acad. O.Yu. Lukin); produced a new "Typification of Mineral Waters" and identified new groups of mineral waters, which permits a more valid assessment of their use for the treatment and prophylactics of diseases (Acad. V.M. Shestopalov et al.). Institute's researchers developed the theory of hypogenous (deep-seated) karstogenesis, involving the ascending discharge of pressure waters and endogenous fluids, made a global generalization of its manifestations and patterns. The theory won wide international recognition and led to a change in the general research paradigm and the revision of karst origin concepts (Corr. Memb. O.B. Klymchuk).

Super broadband georadar within mobile laboratory. O.Ya. Usikov Institute of Radio Physics and Electronics of the NAS of Ukraine

GURT next-generation radio telescope. NAS Institute of Radio Astronomy

Researchers of S.I. Subbotin Institute of Geophysics of the NAS of Ukraine, on the basis of combined geophysics and tectonophysics studies, mathematical modeling and known geological data, constructed integrated models of deep-seated structures of the Dnieper—Donets Depression (the major oil-and-gas region), the Kirovohrad ore-mining region (uranium deposits, deposits of rare metals, kimberlites, kimberlite-like rocks and lamproites (Acad. V.I. Starostenko, Corr. Memb. O.B. Gintov);



Zoning scheme of the territory of Ukraine according to conditions of mineral waters generation. NAS Institute of Geological Sciences

relying on the observations of the national network of seismology stations, specialists created instrumental and macroseismic data bases and compiled seismic zoning maps, which became a part of the state construction regulations (Corr. Memb. O.V. Kendzera). Under the guidance of Corr. Memb. V.A. Danylenko, they developed scientific fundamentals of non-equilibrium dynamics and deformation of structured geo-environments as well as cutting-edge technologies to intensify the extraction of mineral raw materials — oil, gas, condensate, and natural water.

Researchers of M.P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation of the NAS of Ukraine worked out new methods to change the magnetic properties of hematite and goethite that yield strong-magnetic magnetite; they also produced equipment for transforming magnetic characteristics of submagnetic iron oxides, facilities for separating highly dispersed raw iron ore by the combined action of constant and alternating magnetic fields (Acads. M.P. Shcherbak, O.M. Ponomarenko and Corr. Memb. O. B. Brik). Under the guidance of Cor. Memb. E.Ya. Zhovinsky, relying on geochemical criteria, specialists carried out zoning of the territory of Ukraine in terms of the content of fluorine and its forms in environment objects and proved that the defluoridation of water with an abnormal fluorine content can be done with natural sorbents.

A team of scientists of the State Institution 'Scientific Center for Aerospace Research of the Earth under the NAS Institute of Geological Sciences', headed by Acad. V.I. Lalko, developed a technology for carbohydrates prospecting that relies on information-based integration of aerospace survey data, field spectrometry, geological and geophysical data. It provides the identification of anomalous areas associated with hydrocarbon deposits with an 80 % efficiency.

Scientists of the Institute of Geography of the NAS of Ukraine, led by Acad. L.G. Rudenko, produced and published in 2007 the comprehensive National Atlas of Ukraine — an encyclopedic edition providing the consistent and integrative presentation of various aspects of the natural resource, demographic and economic potential of the country.

Specialists of the NAS Institute of Geology and Geochemistry of Combustible Minerals, headed by Acad. M.I. Pavlyuk, investigated the deep-seated structure of the Carpathian,

Dnieper—Donets and Black Sea—Crimea oil-and-gas provinces, studied their geodynamic regimes and constructed respective geodynamic models. That provided them with a deeper insight into the genesis, general patterns of the formation and localization of oil and gas deposits, showing the feasibility of their prospecting in Ukraine.

At the NAS Institute for Problems of Nature Management and Ecology, under the guidance of Corr. Memb. A.G. Shapar, scientific principles were elaborated to develop high-efficiency environment-oriented technologies of open-cut mining operations. Their application would lead to a significant reduction in the areas of fertile land occupied by mine dumps, save transportation and ore mining costs, lower the negative impact on the environment and decrease the scope of reclamation operations.

Researchers of the NAS State Scientific Institution 'Department of Marine Geology and Sedimentary Ore-Formation', led by Acad. Ye.F. Shnyukov, revealed the nature of gas volcanism in the Black Sea. Relying on the outcomes of their integrated studies of geophysical data and newly formed minerals in mud volcano breccia in different areas of the Azov—Black Sea areas, they proposed a new hypothesis concerning the decisive role of fluid plumes in mineral formation, which is a new argument in favor of the important role of the endogenous factor in oil and gas origin.

Specialists of the Carpathian Branch of S. Subbotin Institute of Geophysics of the NAS of Ukraine, on the basis of their observations on the reference geomagnetic network, for the first time produced maps of magnetic declination and variations of magnetic field components on the territory of Ukraine. The data obtained are used in constructing models of Earth's normal magnetic field and in updating topographical maps of different scales (Corr. Memb. V.Yu. Maksymchuk).

Encyclopedic edition of the "National Atlas of Ukraine". NAS Institute of Geography

In the years of independence, institutions of the NAS Department of Physical and Technological Problems of Materials Science have carried out research into fundamental problems related to the retention and advancement of the S&T potential of the country, development and deployment of cutting-edge technologies, ensuring the technological security. Among them were the creation of structural and functional materials with pre-defined properties, methods of their joining and treatment, physico-chemical mechanics, strength and diagnostics, corrosion and materials protection. Development works to create materials and technologies intended for medicine, extending the operation life of materials and products were significantly broadened.

E.O. Paton Electric Welding Institute carried out innovative research into materials science problems of fusion welding of high-strength high-temperature and heat-resistant high-alloy steels, materials for cryogenic

equipment, alloys based on aluminum, titanium and other structural materials and developed new technological processes of pulsed arc, plasma and micro-plasma, electron-beam, laser, hybrid laser-microplasma and underwater welding, as well as specialized equipment used both in Ukraine and in numerous foreign countries (Acads. B.E. Paton, D.A. Dudko, S.I. Kuchuk-Yatsenko, V.K. Lebedev, I.K. Pokhodnya, K.A. Yushchenko, I.V. Krivtsun, G.M. Grigorenko; Corr. Membs. A.Ya. Ishchenko, O.K. Nazarenko, V.M. Nesterenkov, S.V. Anokhin; V.D. Shelyagin, Cand. Sci. (Eng.). Studies of welded joint strength in various climates and under different temperatures, taking into account their mechanical inhomogeneity, residual stresses, resistance to brittle and fatigue fracture, as well as their operational capability, enabled experts to produce a number of efficient, reliable and durable welded structures that operate reliably, in particular, metal structures of 'Olimpiyskyi' National Sports Complex, baulk structures of Podilskyi bridge over the Dnieper River, high-load structures of mining and metallurgical industries etc. (Acads. B.E. Paton, L.M. Lobanov, V.I. Makhnenko; Corr. Membs. V.I. Trufyakov, V.I. Kyryan, V.D. Poznyakov, V.V. Knysh). Efficient technologies were developed and implemented for welding high-strength alloyed steels in manufacturing the cases of light-armored fighting vehicles (Corr. Memb. V.D. Pozdnyakov; O.V. Gaivoronski, Dr. Sci. (Eng.)).

Specialists widely applied effective methods and equipment for nondestructive quality testing and diagnostics of welded joints and structures, in particular, automatic equipment for ultrasound control of welded joints of pipes, systems for digital radiation control, laser interferometry methods, a system of continuous acoustic emission monitoring of pipelines, tanks and equipment elements (Acads. B.E. Paton, L.M. Lobanov; A.Ya. Nedosieka, Dr. Sci. (Eng.); Prof. V.O. Troitsky, Dr. Sci. (Eng.)).

Manufacturing of the next generation of machines for welding rails of unlimited length intended for high-speed express lines, which relies on the method of pulsed flash butt welding, has brought economic effect amounting to billions of hryvnas due to their use by the *Ukrzaliznytsia* railway company; their export has exceeded $ 200 million (Acads. V.K. Lebedev, S.I. Kuchuk-Yatsenko). R&D in the field of surface engineering enabled scientists to develop technologies and equipment for depositing coatings by electron beam evaporation and condensation of vapor components. It is used, in particular, for the significant extension of gas turbine operation life, the technology to produce consolidated nanostructured materials from the vapor phase, as well as the electron beam technology for depositing nano-sized coatings on powdered inorganic and organic substances, including medical substances and preparations (Acads. B.E. Paton, B.O. Movchan; Prof. A.I. Ustinov, Dr. Sci. (Eng.)). Technologies and equipment for joining and treatment of live biological tissues were developed and introduced into surgical practice at more than 50 hospitals in Ukraine. Nearly 30 thousand surgical procedures are annually performed relying on them (Acads. B.E. Paton, V.K. Lebedev, I.V. Krivtsun; G.S. Marinsky, Dr. Sci. (Eng.).

Scientists of I.M. Frantsevich Institute for Materials Science of the NAS of Ukraine developed a rheological theory of sintering and formation of properties of microheterogeneous materials, proposed continuous models of the densification of powders and semi-finished porous products, which formed the basis for developing numerous means to control physical properties and operational

characteristics of construction and tooling sintered materials (Acad. V.V. Skorokhod, Cor. Memb. M.B. Shtern); constructed and specified a series of state diagrams for two-, three- and multi-component metal and oxide systems, which are promising for developing the next generation of materials with improved performance characteristics (heat-resistant alloys and those with high-temperature strength, quasicrystals, thermal barrier coatings, transparent ceramics, ionic conductors, directionally crystallized eutectics) (Profs. T.Ya. Velikanova, L.M. Lopato, Drs. Sci. (Chem.); O.R. Andryevska, O.V. Shevchenko, Drs. Sci. (Chem.)), worked out scientific principles of developing innovative permeable powder materials and high-efficiency thermal pipes based on them, developed next-generation tribotechnical materials intended for heat exchange systems and friction units of spacecraft (Acad. A.G. Kostornov).

The results of studying capillary and surface phenomena gave rise to technologies of soldering certain dissimilar materials and manufacturing parts and units for aerospace and tool-making equipment on their basis (Acad. Yu.V. Naidich). Relying on the newly developed scientific principles of production and thermomechanical treatment of a number of multi-alloyed tool steels, carbide steels and wear-resistant cast iron, Ukrainian plants launched commercial production of effective multi-purpose cutting tools and wear-resistant articles for agricultural machines (Corr. Membs. L.O. Poznyak, K.O. Gogaev; G.A. Baglyuk, Dr. Sci. (Eng.)). For the first time ever, ultra-high-temperature ceramics was produced by liquid-phase sintering of eutectic systems; it is able to operate at temperatures of 1700—2000 °C (Corr. Memb. O.M. Grigoriev). A number of competitive next-generation materials and technologies were produced — multi-component materials (including high-entropy ones) with ultimate hardening, increased high-temperature strength (for propulsion engineering and aircraft building) and biocompatibility (for medicine) (Acad. S.O. Firstov; Corr. Memb. Yu.V. Milman; M.P. Brodnikovsky, Cand. Sci. (Phys. & Math.)).

Soldered knit-structured hinge sheets and polymer composite films based on them are used for lightning protection in aviation and wind power engineering. In particular, their application at *Antonov* State Enterprise in manufacturing AN-148 airplane permitted it to be recognized as an all-weather aircraft (Prof. L.R. Vishnyakov, Dr. Sci. (Eng.)). Novel efficient materials were developed, which are promising for use in the systems of producing, storing and using hydrogen. Those materials with high hydrogen capacitance, which are based on intermetallic compounds and magnesium, are also used in photo-electro-chemical production of hydrogen and in ceramic fuel cells (Acad. Yu.M. Solonin; O.D. Vasiliev, Dr. Sci. (Phys. & Math.); V.D. Dobrovolsky, Cand. Sci. (Phys. & Math.)). Widely used in today's industries are innovative products — nanopowders of various compounds and sintered nanostructured ceramic materials, which are produced relying on theoretical and technological principles of thermally activated non-isothermal processes with controlled sintering rate (Corr. Memb. A.V. Ragulya).

Scientists of V.M. Bakul Institute for Superhard Materials of the NAS of Ukraine grew large single crystals of diamond (up to 10 mm) (Corr. Memb. S.O. Ivakhnenko); invented a method to sinter hybrid diamond-hard alloy plates with CVD diamond-set polycrystalline layer, which provide a significant rise in the efficiency of innovative drilling tools (Corr. Memb. O.O. Shulzhenko); determined the conditions of depositing diamond-like carbon films from the gaseous

phase onto optical elements, which ensured their mechanical durability when used in infrared cameras, gas and moisture analyzers, laser systems, metrological instruments for optical devices (Acad. M.V. Novikov); constructed over 20 state diagrams of two- and three-component systems containing carbon and boron nitride and operating under high pressure (Acad. V.Z. Turkevych); developed a pilot-production technology for synthesizing bulky articles from superconducting nanostructured high-density magnesium-diboride materials with high bonding strength, which are intended for superpower current-limiting equipment, electric motors and magnetic ball bearers (Corr. Memb. T.O. Prikhna). The method of diamond crystallization in the (Mg-Zn-B-C) system, implemented under high pressure and at high temperature, provides electrical conductance of diamond crystals and increases their thermostability from 800 to 1100 °C, which is important for abrasive machining of non-metal surfaces (O.O. Bochechka, Dr. Sci. (Eng.)). Innovative ceramic composite armor blocks provide extra protection for light-armored vehicles against large-caliber armor-piercing bullets (Corr. Memb. A.L. Maistrenko).

Specialists of the NAS Physical-and-Technological Institute of Metals and Alloys developed and deployed an economically efficient and environmentally friendly process of the centrifugal casting of blanks in the automated rotary conveyor facility (Acad. V.L. Naidek; V.G. Gorenko, and P.M. Karichkovsky, Cands. Sci. (Eng.)); implemented resource-saving technologies of competitive steel products, using bucket furnaces and continuous casting machines (Acad. V.O. Efimov); developed and deployed innovative technological processes of alloy treatment with reactive plasma media submerged into liquid metal (Acad. V.L. Naidek, Corr. Membs. A.V. Narivsky, V.M. Movchan); developed technologies of superheating, cooling and electromagnetic casting of iron-carbon alloys with the use of next-generation magnetodynamic facilities (Acad. V.I. Dubodelov; V.K. Pogorsky, Cand. Sci. (Eng.); M.S. Goryuk, Dr. Sci. (Eng.)); worked out a technology to manufacture critical items from aluminum and copper alloys by using nanostructured modifiers (A.M. Verkhovlyuk, O.A. Shcheretsky, Drs. Sci. (Eng.); V.L. Lakhnenko, Cand. Sci. (Eng.)).

Cast antifriction materials based on Cu-Fe composite are widely used in high-load friction units (Prof. S.S. Zatulovsky, Dr. Sci. (Eng.); A.S. Zatulovsky, Dr. Sci. (Eng.)). The technologies of nitride dispersion hardening of high-quality heat-resistant, corrosion-resistant and tool steels provided a two-fold reduction in the consumption of scarce alloying elements (Corr. Memb. Yu.Z. Babaskin; S.Ya. Shipitsyn, Dr. Sci. (Eng.); I.F. Kirchu, Cand. Sci. (Eng.)). Of great importance are technologies for producing zirconium-alloy pipe blanks for Ukrainian nuclear fuel cycle, titanium and nickel-titanium implants and cast products for medicine, as well as curved cast refractory-metal parts for different purposes (Prof. S.V. Ladokhin, Dr. Sci. (Eng.); I.I. Maksyuta, Cand. Sci. (Eng.)). Specialists proposed coin alloys for producing base, small and jubilee coins of independent Ukraine (Prof. V.S. Shumikhin, Dr. Sci. (Eng.); A.M. Verkhovlyuk, Dr. Sci. (Eng.)).

Scientists of G.V. Karpenko Physico-Mechanical Institute of the NAS of Ukraine considerably advanced a science area — the physico-chemical mechanics of materials — due to accounting for the diffraction interaction of sounding physical fields or those generated by crack-like defects (Acads. V.V. Panasyuk, Z.T. Nazarchuk; Corr. Membs. O.Ye. Andreikiv, V.I. Pokhmursky, I.M. Dmytrakh, V.M. Fedirko). A major con-

'Olimpiyskyi' National Sports Complex in Kyiv, reconstructed relying on state-of-the-art welded structures. E.O. Paton Electric Welding Institute

Light-armored combat vehicle of the BTR-4 family. The technology for its case welding was developed at E.O. Paton Electric Welding Institute of the NAS of Ukraine

Welding of live human tissues at O.O. Shalimov Institute of Surgery and Transplantology of the NAMS of Ukraine (1997). E.O. Paton Electric Welding Institute of the NAS of Ukraine

tribution was made to the development of electromagnetic, acoustic-emission, acoustic methods and X-ray TV imaging for non-destructive control of defects in construction materials and to information technologies for the processing of defectoscopy images. In particular, the theory of physical fields propagation in heterogeneous media was elaborated, mathematical models of primary measuring and functional transformers were created, algorithms and programs for information selection, processing and for metrological support were constructed (Corr. Memb. V.R. Skalsky; Prof. P.M. Soprunyuk, Dr. Sci. (Eng.)).

Scientists of the NAS R&D Complex 'Institute for Single Crystals' carried out extensive research that resulted in the development of next-generation scintillation detectors for heavy-duty operation; created the theories of radiolysis and secondary radiation processes, evolution of point and linear defects in alkali halide crystals, scintillation response of dielectric crystals to ionizing radiation; developed unique technologies to produce plastic scintillators, large-size alkali halide single crystals and heavy oxide scintillators. They developed an innovative technology for the fast growing of large-size nonlinear optical KDP and DKDP crystals as well as new types of combined nonlinear optical crystals. A technological cycle of growing large-sized and shaped sapphire single crystals for manufacturing a wide range of products was developed. The first domestic samples of transparent armor were produced for protection from modern ballistic firearms. Significant results were achieved in creating nanomaterials for both engineering and medico-biological applications. In the field of organic chemistry and chemical technology, innovative approaches to selective production of various heterocyclic systems were developed. Novel methods were proposed to obtain micronized medical substances with improved pharmacological properties. New highly efficient fluorescent colorants were produced for clinical diagnostics in medico-biological and pharmacological studies (Acads. V.P. Semynozhenko, B.V. Grinyov, V.M. Puzikov; Corr. Membs. O.V. Tolmachov, Yu.V. Malyukin, O.V. Gektin, I.M. Prytula, V.A. Chebanov; O.V. Shyshkin, Dr. Sci. (Chem.); Prof. L.A. Litvinov, Dr. Sci. (Eng.); Prof. V.D. Ryzhikov, Dr. Sci. (Phys. & Math.); L.L. Nagorna, Cand. Sci. (Chem.)).

Experts of the NAS Institute of Pulse Processes and Technologies developed scientific principles of discharge pulse technologies, refined the theory of electro-explosive energy conversion in condensed media, formulated the physical aspects of underwater high-voltage discharge. The research performed gave rise to the production of high-density pulse power sources that have no counterparts in the world, unique hydroacoustic projectors for the World Ocean exploration and military application, systems to control pulsed discharge processes in materials synthesis and treatment, which are widely used for increasing the flow rate of oil and water wells, cold sheet-alloy stamping, cleaning of castings, breaking hard bottom soils, cleaning underwater metal structures from biological fouling, and for the treatment of water-coal fuel (Corr. Memb. O.I. Vovchenko).

Researchers of Z.I. Nekrasov Iron & Steel Institute of the NAS of Ukraine carried out unique studies and implemented technologies to intensify blast-furnace melting by using recycled top gases, pulverized coal and oxygen-enriched blast, using heat and chemical energy of peripheral gases due to the distribution of burden material (Acad. V.I. Bolshakov; Prof. I.G. Tovarovsky, Dr. Sci. (Eng.)). The theoretical and technologi-

cal principles of cast iron desulfurization with granular magnesium were worked out and the related state-of-the-art technology was developed and introduced into the international practice (N.O. Voronova and A.P. Shevchenko, Drs. Sci. (Eng.)). In steel industry, specialists developed technological principles of converter updating by combined venting in the production of up-to-date steel grades (Ya.A. Shneyerov, Dr. Sci. (Eng.)). Also, advanced was a radically new method of thermal hardening of rolled iron that uses rolling heat in the production of reinforcing iron, mill bars, shaped iron, railway wheels and tires (I.G. Uzlov and O.I. Babachenko, Drs. Sci. (Eng.)). Relying on new results concerning the mechanism of low-carbon steel hardening, a process of thermomechanical treatment — the combination of deformation and quenching — was developed; it provides steel with additional strength and plasticity (Profs. I.G. Uzlov, V.V. Parusov, Drs. Sci. (Eng.)).

Scientists of the NAS Institute of Thermoelectricity created a generalized theory of thermoelectric energy conversion, discovered the law of current thermoelectric induction, invented and developed almost 300 thermoelectric devices, thermoelectric space equipment operating on board nearly 250 Earth satellites being among them (Acad. L.I. Anatychuk); developed the theory of and technologies for increasing thermoelectric equipment reliability, as well as information and energy theory of measuring thermoelectric systems (O.Ya. Luste, Dr. Sci. (Phys. & Math.)); produced a number of functionally gradient materials (L.M. Vykhor, Dr. Sci. (Phys. & Math.)); created a theory of and technology for miniaturization in thermoelectricity (P.V. Gorsky, Dr. Sci. (Phys. & Math.)); proposed a theory and technology of novel thermoelectric power sources (V.Ya. Mikhailovsky, Dr. Sci.

Small-size electrohydraulic press for forming parts of irregular shapes (800 items/hr.). NAS Institute of Pulse Processes and Technologies

(Phys. & Math.)); developed thermoelectric converter for the military standard of AC voltage unit (V.I. Bodnaruk, Cand. Sci. (Phys. & Math.)); produced thermoelectric radiation receivers with unprecedented characteristics, which found application in military hardware (V.V. Razinkov, Cand. Sci. (Phys. & Math.)).

R&D of the institutions of the NAS Department of Physical and Technological Problems of Power Engineering is known for its important practical results deployed in the leading branches of Ukrainian industry.

Experts of the Institute of Engineering Thermophysics of the NAS of Ukraine developed an innovative design of up-to-date boiler unit, which was produced and deployed in Kharkiv (V.G. Demchenko, Cand. Sci. (Eng.)); for the first time in Ukraine developed and deployed (in the town of Kramatorsk) an industrial heat pump station of hot-water supply with reliable 1.4 MW heat pump equipment (Acad. Yu.F. Sniezkin; M.M. Ulanov, Cand. Sci. (Eng.)).

A. Podgorny Institute for Mechanical Engineering Problems of the NAS of Ukraine,

led by Acad. Yu.M. Matsevyty, developed a new method for the region-structured regularization of the solutions of inversed thermal conductivity problems. Under the guidance of Corr. Memb. A.V. Rusanov, new methods were elaborated for modeling spatial flows and designing flow parts of power generation facilities (steam turbines of HPPs, HPCPs and NPPs, hydro turbines of HEPs and HAPPs, gas turbines, gas compressor equipment, turbo-expanders). They facilitated the modification and development of numerous power turbo facilities whose performance characteristics meet the best world standards (Prof. V.I. Gnesin, Dr. Sci. (Eng.); S.V. Yershov, Dr. Sci. (Eng.)).

Scientists of the NAS Institute of Electrodynamics developed theoretical foundations and control information systems for electric power engineering (Acads. B.S. Stogniy and O.V. Kyrylenko); advanced the theory and principles of designing special types of power conversion equipment and new technical means for adjusting electrical power parameters (Acad. A.K. Shidlovsky, Corr. Membs. I.V. Volkov and V.G. Kuznetsov).

Experts of G.E. Pukhov Institute for Modeling in Energy Engineering of the NAS of Ukraine created new mathematical models and methods of modeling the equilibrium states of electric power markets with inadequate competition, which are the basis for producing software systems to analyze the processes of pricing in the liberalized electric power market of Ukraine (Prof. S.Ye. Saukh, Dr. Sci. (Eng.)).

Scientists of the NAS Institute of General Energy developed the theory and structure of systems for adjusting frequency and power in the United Power System of Ukraine in routine and emergency operation that employ controlled electric heat generators (Acad. M.M. Kulyk; I.V. Dryomin, Cand. Sci. (Eng.)); took part in elaborating the Energy Strategy of Ukraine till 2030, which was approved by the Cabinet of Ministers decree #145-p of 15.03.2006.

At the NAS Coal Energy Technology Institute, upgrading the solid fuel boiler units and steam-gas plants, specialists developed new highly efficient and environmentally safe methods of burning, gasification and thermal processing of coal concentration waste in various modifications of fluidized coal bed under atmospheric and increased pressure and for different compositions of the oxidizing agent. For the first time ever, the technology of burning anthracite and by-product of its concentration was fine-tuned in the boiler of power unit #4 of the Starobeshivska TEP (Acads. Yu.P. Korchevoy and O.Yu. Maistrenko).

Researchers of the Gas Institute of the NAS of Ukraine developed a technology and equipment for switching the power plants of offshore oil drilling rigs to the use of associated petroleum gas instead of diesel fuel; the equipment is deployed at nearly 70 50—800 kW power plants at offshore platforms of Ukraine, Azerbaijan and Vietnam (O.I. Pyatnychko, Cand. Sci. (Eng.)); developed heating systems of industrial furnaces and boiler plants using biofuel and products of biomass gasification, which are deployed at seven industrial facilities and ensure the substitution of 55 million m^3 of natural gas annually (Acad. I.M. Karp; K.Y. Pianykh, Dr. Sci. (Eng.)); worked out the technologies and equipment to produce and use thermally expanded graphite — an efficient absorber of organic liquids, the material for manufacturing seals for gas transport system and a promising material for hydrogen and nuclear energy engineering (Acad. B.I. Bondarenko; O.P. Kozhan and V.M. Dmytriyev, Cands. Sci. (Eng.)).

Specialists of the NAS Institute of Renewable Energy developed the theory of the

conversion of energy from different types of renewable sources, the scientific fundamentals of improving the efficiency of electricity and water supply systems; relying on those they investigated the feasibility of the integrated use of these energy sources, worked out methods to calculate the energy potential and compiled atlases of renewable energy resources of Ukraine (Corr. Membs. V.F. Reztsov and S.O. Kudria).

At the NAS Institute of Technical Problems of Magnetism, under the guidance of Corr. Memb. V.Yu. Rozov, researchers generalized the features of different classes of technological objects as magnetic field sources and made a significant contribution to the new scientific trend in electrical engineering — 'magnetism of technological objects', which addresses the magnetic properties of technological objects and phenomena in their interaction with the natural environment *via* magnetic field. Novel results were obtained, which are deployed in the aerospace industry as well as the fuel and energy sector of Ukraine.

The NAS Institute for Safety Problems of Nuclear Power Plants (ISP NPP) provides S&T support to the current operation of the Shelter Object and its transformation into an environmentally safe system (Prof. V.S. Karasev, Prof. V.V. Tokarevsky, Acad. O.O. Klyuchnikov, Corr. Memb. A.V. Nosovskyi). The New Safe Confinement (NSC) installation was completed late in 1917. It replaces an old shelter that was installed as an emergency measure to contain the radioactive materials in the destroyed unit shortly after the disaster in 1986. The NSC provides a controlled and weatherproof environment where the solid radioactive remains of the destroyed unit can be held for the next 100 years. The Confinement is the largest land-based movable structure in the world.

Researchers of the Institute implement work aimed at improving the safety of Ukrainian NPPs and extending their design lifetime, S&T support for the decommissioning of NPP's power units and other nuclear and radiation hazardous facilities. They have developed scientific principles for decommissioning nuclear facilities, radiation monitoring devices, pilot versions of remotely controlled complexes and technologies for dismantling works and operations with dismantled structures and equipment for performing radiation-hazardous works (Acad. O.O. Klyuchnikov; Corr. Memb. A.V. Nosovsky).

With a view to advancing basic and applied research in nuclear physics and S&T support to the nuclear power sector of Ukraine, early in 2004 the NAS of Ukraine established the Department of Nuclear Physics and Energy Engineering.

The most potent scientific institution of the Department is the National Science Center 'Kharkov Institute of Physics and Technology' (NSC KIPT), which was transferred by a presidential decree to the jurisdiction of the NAS of Ukraine in February 2004. A significant part of Center's R&D activities is carried out under international agreements, in accordance with agreements and contracts concluded with over 75 institutions and firms of economically developed countries. The center maintains and promotes collaboration with numerous international organizations and scientific centers: IAEA, CERN, Thomas Jefferson National Accelerator Facility (USA), and Joint Institute for Nuclear Research in Dubna.

A computer system as a structural element of the international and Ukrainian Academy GRID for processing experimental data from the Large Hadron Collider (Geneva) operates at NSC KIPT. The system is officially involved in the monitoring

1060 kW plant for power generation from biogas at the ground for solid domestic waste in Pidhirtsi village, Kyivska Oblast, developed in collaboration with 'INGAZ' Research-and-Production Firm. Gas Institute of the NAS of Ukraine

of CERN infrastructure (Prof. P.V. Sorokin, Dr. Sci. (Phys. & Math); L.B. Levchuk, Cand. Sci. (Phys. & Math.)).

One of Center's most prominent achievements in the period after 2004 was its participation in the project on nuclear fuel qualification for Ukraine. Relying on its results, alternative supplies of *Westinghouse* nuclear fuel for VVER-1000 domestic nuclear reactors were grounded and the behavior of this fuel under mixed loading of reactor core was validated. That provided country's independence in choosing the suppliers of nuclear fuel for Ukrainian NPPs. Besides, specialists of the Center completed an R&D cycle for producing domestic effective absorbers with extended operation life and are actively involved in organizing the manufacture of neutron absorbing rods for the control and safety systems of VVER-1000 reactors. The Government approved the decision to organize the industrial production of those elements for 13 VVER power units in Ukraine (V.S. Krasnorutsky, Cand. Sci. (Phys. & Math.); O.I. Zhukov, Cand. Sci. (Phys. & Math.); A.M. Abdullayev).

Another major success of the Center is the completed construction of the research installation 'Neutron source based on the sub-critical assembly driven by electron linear accelerator'. This is the first nuclear facility developed by Ukrainian specialists in the years of independence. Its construction was financed by the US Government in the framework of implementing Ukraine's initiatives at the 2010 Washington Nuclear Security Summit (Acads. I.M. Karnaukhov, I.M. Neklyudov, M.F. Shulga; I.V. Ushakov, Cand. Sci. (Phys. & Math.)).

The first investigations in nuclear physics at the Institute for Nuclear Research of the NAS of Ukraine were launched by the neutron physics scientific school led by Acad. M.V. Pasichnyk. They experimentally determined the cross sections of neutron interaction with a large number of elements, which resulted in the neutron constants database for structural materials of nuclear reactors.

One of the brilliant achievements of the scientific school in physics of nuclear reactions with charged particles, founded by academician O.F. Nemets, was the experimental finding (M.V. Sokolov, B.G. Struzhko, Drs. Sci. (Phys. & Math.)) and theoretical grounding (K.O. Terenetsky, M.V. Yevlanov, Drs. Sci. (Phys. & Math.)) of the non-monotonic dependence of deuteron splitting cross sections on the nucleus mass. This result was named 'Nemets effect'. Scientists carried out research on the interactions of protons, deuterons, ^{3}He ions and α-particles with atomic nuclei (V.V. Tokarevsky, Dr. Sci. (Phys. & Math.)), polarization phenomena in proton scattering by nuclei (M.I. Zaika and M.M. Pucherov, Drs. Sci. (Phys. & Math.)), the effect of accompanying particles on the parameters of two-particle resonances

Series of flowing parts of Francis-type turbines of turbo-expander facilities for integrated gas treatment ('Turboatom' Company, Kharkiv). A. Podgorny Institute of Mechanical Engineering Problems of the NAS of Ukraine

A system of synchronized measurements of main mode parameters of the Ukrainian Power System. NAS Institute of Electrodynamics

(Corr. Memb. V.M. Pugach; Yu.M. Pavlenko, Dr. Sci. (Phys. & Math.)).

Theoretical investigations in nuclear physics conducted by Corr. Memb. V.M. Strutinsky and the followers of his school won world-wide recognition. The shell correction method to calculate nuclear binding energy and nuclear deformation energy became a major contribution to the advancement of nuclear theory and provided quantitative calculations of nuclear masses and equilibrium deformations, the investigation of nuclear fission properties and prediction of the existence of superheavy nuclei. As a continuation of those studies, scientists developed methods to describe the dynamic properties of the nucleus by introducing such macroscopic characteristics as nucleus shape parameters, nuclear density, nuclear friction, nuclear viscosity (Corr. Memb. V.M. Kolomiets). A unified model of α-decay and α-adsorption was developed, which allows absorption cross sections and lifetimes of quantum and nuclear processes to be calculated; a new microscopic approximation for calculating nucleus—nucleus interaction between spherical and deformed nuclei was proposed (Corr. Memb. V.Yu. Denisov).

In the field of nuclear spectroscopy, scientists generalized a large amount of data concerning internal conversion coefficients, multipolarity of γ-transitions, determined quantum characteristics of excited states of nuclei, found different aberrations in nuclear processes (Corr. Memb. G.D. Latyshev; V.T. Kupryashkin and O.I. Feoktistov, Drs. Sci. (Phys. & Math.); V.I. Gavrylyuk, (Cand. Sci. (Phys. & Math.)). They discovered a number of new excited states in atomic nuclei, revealed a new phenomenon — excitation of nuclei in the annihilation of positrons by atomic electrons (Acad. I.M. Vishnevsky; V.O. Zheltonozhsky, Dr. Sci. (Phys. & Math.); V.V. Trishin, Cand. Sci. (Phys. & Math.)).

The NAS Institute for Nuclear Research is the leading organization of the country in materials-science support to the safe operation of NPP reactors in Ukraine, which carries out routine examinations of the status of irradiated nuclear reactor vessels and other structural elements of reactor facilities. The results obtained are used in grounding the safe operation of VVER reactor vessels and extending their operation over designed lifetime, which permits the state to save large sums of money by eliminating the need for new power units in the near decades (Corr. Memb. V.I. Slisenko; L.I. Chyrko, V.M. Revka, Yu.V. Chaikovsky, V.M. Bukanov, O.V. Trygubenko, Cands. Sci. (Phys. & Math.)).

Researchers of the Institute investigated with a new degree of sensitivity the β-decay in more than 20 nuclei, for the first time ever observed the two-neutrino double β-decay of ^{96}Zr, ^{116}Cd, ^{130}Te nuclei, measured neutrino fluxes from the Sun, deep space, and Earth's interior and also discovered new rare α- and β-decays. They refined methods of low background nuclear spectrometry, deep purification from radioactive contaminations, developed new nuclear radiation detectors, for the first time produced scintillators based on enriched Cadmium and Molybdenum isotopes (Corr. Memb. Yu.G. Zdesenko; Prof. F.A. Danevich, Dr. Sci. (Phys. & Math.); V.V. Kobychev and V.I. Tretyak, (Cands. Sci. (Phys. & Math.)).

The consistent theory of nuclear irradiation effect on the properties of metals, alloys, semiconductors, liquid crystals was developed, including the theory of self-organization phenomena, namely, the formation of periodical structures, self-oscillations and superconducting areas in crystals under nuclear irradiation. Particular features of the

The start of commissioning the research subcritical nuclear facility 'Neutron Source Based on the Subcritical Assembly Driven by Electron Linear Accelerator', which was attended by P.O. Poroshenko, President of Ukraine; G. Pyatt, US Ambassador Extraordinary and Plenipotentiary to Ukraine; I.L. Rainin, Head of Kharkiv Oblast State Administration; Acad. A.G. Naumovets, First Vice-President of the NAS of Ukraine, Head of the NAS Section of Physical, Engineering and Mathematical Sciences; Acad. M.F. Shulga, Acting Director General of NSC 'KIPT', member of NAS Presidium, Academician-Secretary of the NAS Department of Nuclear Physics and Energy Engineering; Kharkiv scientists. National Science Center 'Kharkov Institute of Physics and Technology' (NSC 'KIPT'), 23 March 2016

formation of exciton condensed phase in a 2D system were investigated (Corr. Memb. V.I. Sugakov).

After the Chornobyl NPP accident, Institute's specialists carried out an immense amount of work to determine the levels of radioactive contamination of the 30-kilometer zone around the Chornobyl NPP and of the territory of Ukraine with long-lived radionuclides and, relying on them, built maps of the transuranic contamination of the territory of Ukraine, which were included in the National Atlas of Ukraine and theme map atlases (E.B. Lyovshin, V.A. Ageyev, V.V. Trishin, O.V. Gaidar, Cands. Sci. (Phys. & Math.)).

The new trend of applied research in nuclear forensics, which was started in the late 1970s, was continued. A Government resolution appointed the NAS Institute for Nuclear Research the country's leading expert organization in investigating radioactive materials withdrawn from illicit trafficking. The Institute set up a state-of-the-art specialized laboratory, which is internationally acknowledged as the regional nuclear forensic laboratory for GUAM member states (V.V. Trishin, A.M. Berlizov, O.V. Gaidar, Cands. Sci. (Phys. & Math.); A.D. Sazhenyuk, Cand. Sci. (Chem.)).

The Institute produced a unique system of engineering means for physical protection,

Operator room of "hot" cells. Examinations of witness samples of reactor vessel steel. NAS Institute for Nuclear Research

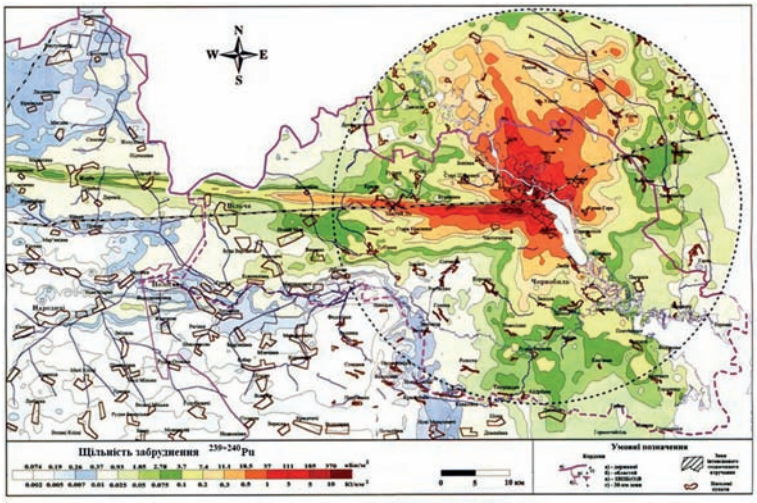
which got high ratings from leading specialists of IAEA, Japan, the USA, Sweden, other countries and is used for training Ukrainian and foreign specialists in physical protection (V.I. Gavrylyuk, Cand. Sci. (Phys. & Math.)); O.P. Romanova, Cand. Sci. (Biol.)).

An up-to-date control system was developed and deployed at the VVR-M research reactor; the majority of reactor's critical systems were upgraded or substituted with new ones; under the international program for the global reduction of nuclear threat, the conversion of the research nuclear reactor to low-enriched nuclear fuel was carried out (Corr. Memb. V.I. Slisenko).

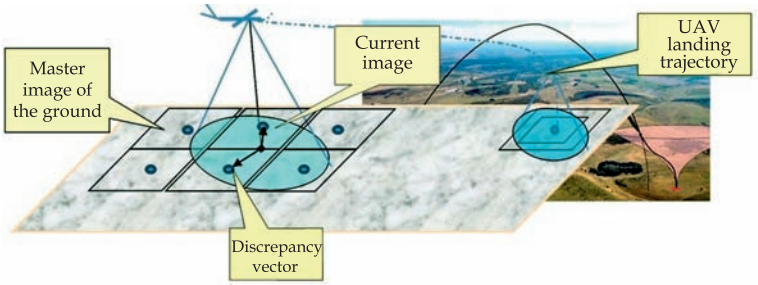
In the field of plasma physics and controlled thermonuclear fusion, the nonlinear theory of wave interaction in confined plasma was advanced, "explosive" instabilities involving negative energy waves were investigated by V.M. Orayevsky, Dr. Sci. (Phys. & Math.), who made the discovery of the decay instability of waves in plasma that was officially registered in the USSR. The possibility of plasma instabilities excitation with thermonuclear reaction products was theoretically demonstrated for the first time ever (Ya.I. Kolesnichenko and V.M. Orayevsky, Drs. Sci. (Phys. & Math.)). That result encouraged further experimental and theoretical investigations of instabilities on energetic ions in many laboratories across the world.

Drift-dissipative instability, anomalous plasma diffusion and properties of capacitive high-frequency discharge were investigated (L.L. Pasichnyk, Dr. Sci. (Phys. & Math.); the mechanisms of ion beam relaxation in plasma were studied (G.S. Kirichenko, Dr. Sci. (Phys. & Math.); A.G. Borysenko, V.G. Khmaruk, Cands. Sci. (Phys. & Math.)). The phenomenon of plasma wave barrier tunneling was discovered due to fruitful collaboration of theoreticians and experimenters (V.M. Orayevsky, L.I. Romanyuk, Drs. Sci. (Phys. & Math.)).

Scientists of the NAS Institute of Applied Physics of the NAS of Ukraine proposed a solution of the fundamental quantum mechanics problem — an instant change in the description of the quantum number of the object that happens during measurements (Corr. Memb. P.I. Fomin). The relativistic theory of the parametric interference effect of quantum electrodynamics in strong pulsed laser fields, which was developed at the Institute, in 2015 was included in the list of problems to be verified experimentally under the FAIR international megaproject (Germany) and the relevant collaboration agreement was signed (Prof. S.P. Roshchupkin, Dr. Sci. (Phys. & Math.); R.I. Kholodov, O.I. Voroshilo, O.P. Novak, O.A. Lebed, Cands. Sci. (Phys. & Math.)). The prediction and high isotopic purity (97.5 %) of experimental evidence for the phenomenon of anomalous natural enrichment of metal isotopes, ^{208}Pb in particular, in ancient thorium minerals of Ukrainian ores is an important result for the development of nuclear energy engineering, since



Map of Plutonium (339 + 240) contamination density of the Exclusion Zone and adjacent territories, 1999. NAS Institute for Nuclear Research



High-precision visual navigation systems for unmanned aircraft and missiles. NAS Institute of Mathematical Machines and Systems Problems

^{208}Pb isotope is considered as a promising minimum neutron absorption coolant for this industry (A.A. Valter, Dr. Sci. (Geol. & Mineral.)).

Researchers of the NAS Institute of Electrophysics & Radiation Technologies developed and verified the procedure for remote thermographic monitoring of the state of NPP service lines, structures and equipment. It is intended for nuclear energy engineering, enables its specialists to inspect equipment without shutdown and prevent emergencies (Corr. Memb. V.F. Klepikov; M.I. Bazaleyev, Dr. Sci. (Eng.); B.B. Banduryan, Cand. Sci. (Phys. & Math.); V.V. Lytvynenko, E.M. Prokhorenko, Drs. Sci. (Eng.)). The Institute determined the conditions of temperature-induced deformation of certain aluminum alloys, which, if met, facilitate their transition to superplasticity, permit the manufacture of complex-shaped parts due to preventing internal stresses. That significantly increases the operation life and reliability of such products under cyclic loads (V.V. Bryukhovetsky, Dr. Sci. (Phys. & Math.); Prof. R.I. Kuznetsova, Dr. Sci. (Phys. & Math.)).

Scientists of the NAS Research and Training Center 'Physical and Chemical Materials Science' developed a methodology for synthesizing ceramic composite materials which possess unique structure, physicochemical properties and high strength. These materials can serve as the basis for manufacturing domestic multi-layered armor systems (Corr. Memb. V.V. Makara;

Tests of 'RADA IV' system in the building of Kyiv City Council. NAS Institute of Mathematical Machines and Systems Problems

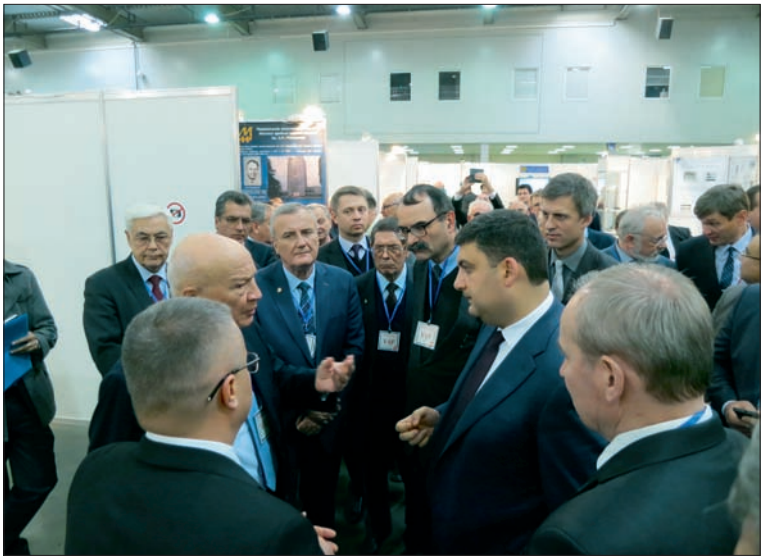
O.Yu. Popov and S.V. Chornobuk, Cand. Sci. (Phys. & Math.)).

Experts of the Institute of Problems of Mathematical Machines and Systems carried out a number of important interdisciplinary R&D works, specifically those intended for enhancing the defense capability of the state: the draft of the United Automated Control System for the Armed Forces of Ukraine and *Mars* automated tactical control system, whose elements were successfully tested in the ATO zone (Acad. A.O. Morozov; V.V. Vishnevsky, V.F. Grechaninov, Cands. Sci. (Eng.)).

Under the order of the State Enterprise 'M.K. Yangel *Pivdenne* Design Office', a new method of visual 3D navigation for driving drones was developed and a pilot version of domestic high-precision visual navigation system was produced. According to test results, its precision is more than two times better than that of the best foreign counterparts (*Iskander*, *Tomahawk*) (O.M. Riznyk, Dr. Sci. (Eng.); D.V. Novitsky, Cand. Sci. (Phys. & Mathematics); V.P. Voloboyev, Cand. Sci. (Eng.); Yu.V. Tykhy, Cand. Sci. (Phys. & Math.); Yu.V. Medvedsky, Cand. Sci. (Eng.); O.D. Karmazin).

The national system of responding to nuclear accidents, which provides the continuous monitoring of the radiation situation in Ukraine, relies on the cross-platform version of the JRODOS European computer emergency management system for nuclear accidents. It was developed with the active involvement of scientists of the Institute of Problems of Mathematical Machines and Systems of the NAS of Ukraine, which carried out JRODOS installation work in many countries of Europe, namely, Austria, Germany, Spain, Poland, Slovakia, the Czech Republic and is continuing this work in other countries (I.V. Kovalets, Dr. Sci. (Eng); E.O. Yevdin, Cand. Sci. (Eng.); M.Yo. Zheleznyak, Cand. Sci. (Phys. & Math.); O.V. Khalchenkov; R.V. Bezhenar, Cand. Sci. (Phys. & Math.); V.I. Koshebutsky; Prof. V.S. Maderych, Dr. Sci. (Phys. & Math.)).

Relying on the developed intellectualized technologies for information and analytical provision of the legislative and law-enforcement activities, Institute's specialists produced the *Rada IV* system for information provision of deputies with the touch key for personal voting, which was deployed in the Kyiv City Council (*Rada IV Kyiv*) (Acad. A.O. Morozov; L.B. Baran, Cand. Sci. (Eng.)). They also produced *Elecon* standardized microprocessor automation hardware, on whose basis over 6000 automated systems for boiler unit control were installed at different facilities of the municipal and industrial spheres of Ukraine and CIS; those permit 15—30 % of energy to be saved (Prof. V.P. Klimenko, Dr. Sci. (Phys. & Math.); S.D. Lutov, Cand. Sci. (Eng.); O.V. Gedz). To save energy, a number of illuminating devices and illumination systems were developed using up-to-date light emitting diodes. They have high performance characteristics and consume 5—10-fold less power than the



V.B. Groisman, Prime Minister of Ukraine, communicates with the delegation of the NAS of Ukraine during a presentation exposition of R&D products and technologies 'Science – for Defense and Security of the State'. Kyiv, 19 October 2016

The Second International Scientific-and-Practical Conference 'NANOTECHNOLOGIES AND NANOMATERIALS'. Prof. V.P. Melnyk, Dr. Sci. (Philos.), Rector of Ivan Franko National University of Lviv, welcomes the participants. Sitting are (Left to Right): Corr. Memb. L.P. Yatsenko, Director of the NAS Institute of Physics; Gianmario Martra, Professor of the Chemistry Chair of the University of Turin; V. Arkhangelsky, expert of European Profiles SA (Greece); O.M. Fesenko, Cand. Sci. (Phys. & Math.), Head of the Department of International S&T Activities, Technology Transfer and Intellectual Property Protection of the NAS Institute of Physics; L. Dolgov, Cand. Sci. (Phys. & Math.), Senior Researcher of the Institute of Physics of Tartu University (Estonia). Lviv, 27 August 2014

systems using incandescent lamps. These developments are protected by 18 patents of Ukraine and deployed in transport (50 Kyiv Metro cars) and in state institutions (Prof. V.P. Klymenko, Dr. Sci. (Phys. & Math.); V.B. Korbut; V.G. Butko; M.G. Ievlev, Cand. Sci. (Eng.)).

In order to intensify multidisciplinary priority research, enhance its innovative orientation towards solving important problems of Ukraine's economic development, since 2003 scientists of more than 40 Academy institutions have been conducting research under NAS targeted programs involving nanostructured systems, nanomaterials, nanotechnologies. They produced new fundamental knowledge related to the formation mechanisms of nanosystems and nanomaterials, studied the properties of a wide class of nanomaterials, developed novel high-performance nanomaterials, scientific fundamentals of nanotechnologies for mechanical engineering, medicine and other branches, instruments relying on nanomaterials for nanoelectronics, optoelectronics, spintronics, information display systems, new methods of diagnostics and studies of nanosystems and nanomaterials.

In addressing the problems of structure, facility and machine wear, of special relevance is the control of the functional reliability and working life of respective objects, determination of their operation conditions and residual life, as well as scientifically grounded operation life. The solution of those problems is facilitated by the 'Resource' targeted program concerned with the development of the methodological basis, hardware and technologies for evaluating and extending the operation life of technologically and environmentally hazardous facilities of long-term service.

To meet the needs of the nuclear power sector of Ukraine, the NAS of Ukraine since 2011 has been implementing the targeted research program 'S&T support to the development of nuclear energy engineering and use of radiation technologies in economy branches', whose main task is S&T backup to the safe and reliable functioning and development of Ukraine's nuclear energy engineering, its resources, the use of radiation technologies, designing nuclear facilities of the next generation, as well as applied research in promising areas of nuclear physics, plasma and accelerator physics, radiation materials science and instrument-making, controlled thermonuclear fusion. The results of research conducted under the program enabled NAS scientists to participate in extending the operation life of Ukrainian NPPs, which permitted a considerable reduction of costs for the construction of new power plants. Academy's scientists contributed to extending the safe exploitation of reactor vessels of power unit #1 of Pivdennoukrainska NPP, power units #1, 2, 3 and 6 of Zaporizka NPP and the third power unit of Rivnenska NPP.

In 2015, NAS institutions launched the targeted S&T program 'R&D for enhancing the defense potential and security of the state'. They have been carrying out research for the needs of the Ukrainian Armed Forces, other law enforcement agencies, as well as enterprises of defense industrial sector. 34 research institutions started 86 projects (44 of those have been completed and 42 are being implemented) that address important tasks for state security and defense, in particular, information protection, development of the advanced means of armored protection for military personnel and vehicles, design of surveillance systems and camouflage means, advancement of aviation and rocketry, development of maintenance hardware and survival facilities for military personnel.

3.2. CHEMICAL AND LIFE SCIENCES

In the years of Ukraine's independence, the institutions of the Department of Chemistry and Biology, relying on their powerful human potential of highly qualified scientists, were actively involved in solving problems of utmost importance facing the Ukrainian and world science. Their research addressed such areas of high scientific relevance: studies of the chemical structure, kinetics and reactivity of molecules; research into basic principles of catalysis, directed synthesis of chemical and biologically active substances, investigation of physico-chemical fundamentals of functional polymers and composites, scientific foundations of coal processing; physico-chemical and biological properties of water; physico-chemical pharmacology, nanotechnologies and nanomaterials; studies of new substances and compounds for medicine and agriculture.

Scientists of L.V. Pisarzhevsky Institute of Physical Chemistry of the NAS of Ukraine advanced a new scientific trend — nanophotocatalysis, which was generalized in the world's first fundamental monograph "Nanophotocatalysis" (Acad. V.D. Pokhodenko; Corr. Memb. S.Ya. Kuchmiy; Prof. A.I. Kryukov, Dr. Sci. (Chem.); O.L. Stroyuk, Dr. Sci. (Chem.)).

Researchers developed new efficient methods of producing graphene, a number of graphene-like inorganic analogs (MoS_2, WS_2, BN, germanane etc.), graphene oxides with different degrees of oxidation, and related nanocomposites, which are promising materials for nanoelectronics, energy storage and transformation, sensorics, catalysis etc. (Acad. V.D. Pokhodenko; Acad. V.G. Koshechko; O.Yu. Posudiyevsky, Dr. Sci. (Chem.)).

The principal statements concerning size and quantum-size effects in heterogeneous catalysis were formulated; new nanophase catalysts were produced for obtaining a number of valuable organic substances, environment protection, and for implementing the integrative process of methane tri-reforming. That permits a more profound integrated processing of natural gas, which is the basis of numerous processes in chemical industry (Corr. Membs. P.Ye. Stryzhak and S.M. Orlyk; Prof. S.O. Solovyov, Dr. Sci. (Chem.)).

The next generation of supramolecular coordination polymers for various functional applications was pro-

The Academic Council of L.V. Pisarzhevsky Institute of Physical Chemistry of the NAS of Ukraine, Left to Right, First Row: Yu.V. Bilokopytov, Yu.I. Piatnitsky, S.M. Orlyk, Acads. K.B. Yatsymirsky and V.D. Pokhodenko, Corr. Memb. V.G. Koshechko, V.G. Golovaty, L.Yu. Dolgikh, S.Ya. Kuchmiy; Second Row: I.V. Shpakovsky, V.G. Ilyin, F.M. Bobonych, P.A. Manorik, V.M. Granchak, M.F. Guba. Kyiv, 2002

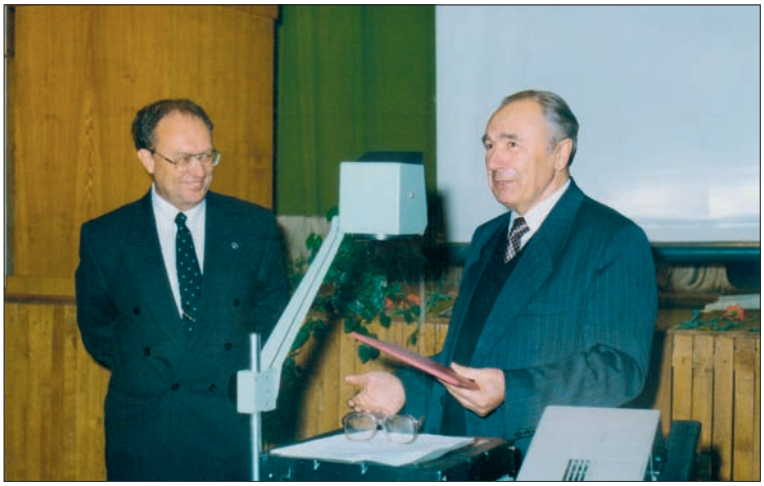
duced: single-chain molecular magnets, photoluminescent materials where excitation energy can be transmitted over large distances, carriers for separating isomers of optically active organic substances etc. (Acad. V.V. Pavlishchuk; Prof. Ya.D. Lampeka, Dr. Sci. (Chem.); S.V. Kolotilov, Dr. Sci. (Chem.)).

Important general patterns of the synthesis, chemical and structural modification and functionalization of new generations of zeolites, mesoporous molecular sieves, porous oxides of transition metals and related composites were found; those substances are intended for various purposes. New extra wide pore zeolites based on element germanosilicates, hierarchically porous Al, Ga, Sn, Zr-containing zeolites of various structural types and morphologies with high acidic properties were obtained. Researchers showed the potential of using such materials as selective catalysts of isomerization processes, alkylation, acylation, condensation, etherification involving different organic substrates and yielding valuable substances and half-products for pharmaceutics, perfumery and food-processing industries (Prof. V.G. Ilyin, Dr. Sci. (Chem.); F.M. Bobonych, Dr. Sci. (Chem.); O.V. Shvets, Cand. Sci. (Chem.)).

Acad. V.D. Pokhodenko, Director of L.V. Pisarzhevsky Institute of Physical Chemistry, opens the ceremonial meeting to celebrate the 80th anniversary of the Institute. In the meeting presidium (Left to Right), First Row: A.M. Gurzhii, First Deputy of the Minister of Education and Science of Ukraine; Acad. B.E. Paton, President of the NAS of Ukraine; A.I. Martynyuk, First Deputy of the Head of Verkhovna Rada of Ukraine; Acad. A.P. Shpak, First Vice-President – Chief Scientific Secretary of the NAS of Ukraine; Acad. V.V. Skopenko, Rector of Taras Shevchenko National University of Kyiv; Second Row: Dr. Sci. V.M. Granchak, Chairman of Trade Union Committee of the Institute; V.V. Goncharuk, Academician-Secretary of the NAS Department of Chemistry. 6 November 2007

Scientists of V.I. Vernadsky Institute of General and Inorganic Chemistry advanced scientific principles of the controlled synthesis of new composite and hybrid organo-inorganic substances and nanostructured systems (bulk, multilayered, film-like, ceramic, liquid-crystalline) with optimized properties (electrophysical, optical, catalytic, membrane-sorption ones). Those are aimed at the development of up-to-date functional materials for electrochemical devices intended for various purposes and for alternative energy engineering, systems of special communication and satellite navigation (GPS GLONASS), sensors, medical and prophylactic means, biostimulators, preparations for biotechnologies and reclamation of soils contaminated with heavy metals and radionuclides (Acads. S.V. Volkov and A.G. Bilous; Corr. Membs. V.M. Belyakov, V.M. Ogenko, G.Ya. Kolbasov; T.A. Myrna, Dr. Sci. (Chem.)).

Relying on basic research in the chemistry of organophosphorus compounds that had been conducted by academician O. V. Kirsanov's school, scientists of the NAS Institute



NAS Acads. V.V. Goncharuk and A.A. Dolinsky during the celebration of the 30th anniversary of A.V. Dumansky Institute of Colloidal and Water Chemistry of the NAS of Ukraine. 1998

'Vega' multifunction modular facility for producing potable water, intended for schools and kindergartens, catering and health-care agencies, housing facilities, railway and water transport

of Organic Chemistry developed a strategy of constructing novel types of nitrogen-containing organic heterocyclic compounds as promising substances to be used in medicine (O.M. Kostyuk, Dr. Sci. (Chem.)).

New radionuclide extraction agents and sorbents based on nano-sized calixarenes and tiacalixarenes functionalized by phosphine oxide groups were produced. The materials obtained are superior to industrial complexing agents by 2—3 orders of magnitude (Acad. V.I. Kalchenko).

Experts synthesized the first representatives of the new type of dianionic squarates and croconates based on tetranitrofluorene kernels, which intensively absorb light in the longest wave range among their known analogs (Corr. Memb. O.O. Ishchenko).

At the NAS Institute of Macromolecular Chemistry, its researchers discovered main features of the effect of chemical structure and the content of oxides, salts and dispersed metals on polymerization reactions and on the formation of organo-inorganic systems

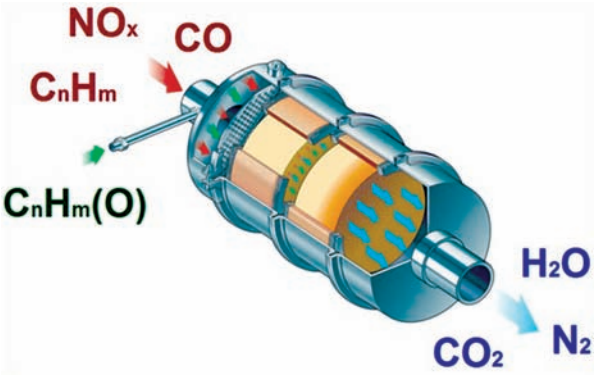
O.V. Bogatsky Physico-Chemical Institute of the NAS of Ukraine, in collaboration with 'INTERKHIM' Company implemented the first full cycle of manufacturing patent pill medicines meeting the EU requirements

New laboratory and production building of 'INTERKHIM' Company

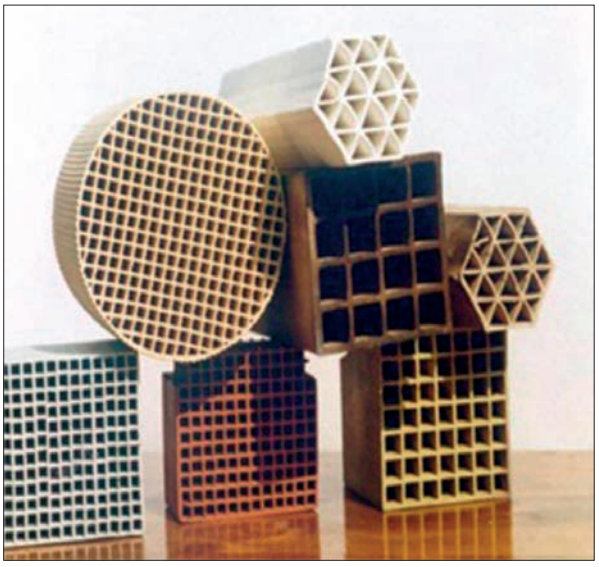
containing urethane, epoxy and inorganic components, which makes them promising for industrial use (Acad. E.B. Lebedev).

The dependence of lyophilic and physico-mechanical properties of organo-inorganic composites on the chemical structure of polymer matrices, inorganic components and the nature of modifier was found. The composites produced can be used as super-sorbents, UV-absorbing and construction materials with high performance characteristics (Acad. E.V. Lebedev; E.P. Mamunya, Dr. Sci. (Phys. & Math.); V.D. Myshak, Cand. Sci. (Chem.)).

To provide scientific support to the development of chemical industry in the East of Ukraine, L.M. Litvinenko Institute of Physical-Organic Chemistry and Coal Chemistry was founded. Academician L.M. Litvinenko and researchers of his school made a major contribution to advancing the theory of the effect of organic substances structures on their reactivity. They discovered a new phenomenon in organic chemistry — a positive bridge effect, bifunctional and nucleophilic catalysis in acyl transfer reactions, advanced the theory of organic substances reactivity in the reactions of nucleophilic and homoge-



Catalysts for the treatment of gaseous waste from automobiles and independent power supply sources



Catalysts for treatment of waste gases of industrial heat facilities, cogeneration plants in particular, to neutralize nitrogen oxides by their selective reduction

neous catalysis. The Institute made a significant contribution to identifying the causes of industrial accidents and environmental disasters, and to developing new methods to prevent them (Acad. A.F. Popov; V.V. Zamashchikov, Dr. Sci. (Chem.)).

A.V. Dumansky Institute of Colloid and Water Chemistry is the only research institution in Ukraine where activities are focused exclusively on research into various aspects of water chemistry and technology, colloid and analytical chemistry. Here scientists for the first time ever isolated new mutagenic forms of microorganisms resistant to chlorine and heat in the process of water and equipment disinfection. Ceramic water-conditioning membranes were produced from natural clay minerals. New state standards that have no counterparts in the world were developed and approved: SSTR 7525:2014 'Potable water. Requirements to and methods of quality control' and SSTR 7487:2013 'Water quality. A method to detect microorganisms in water'. A novel *Cluster* system was developed and certified, which allows water and aerosol structures to be analyzed with laser diffraction method (Acad. V.V. Goncharuk).

At A.V. Bogatsky Physico-Chemical Institute, scientists studied the main patterns in relations between the structures, molecular mechanisms and pharmacological properties of nitrogen-containing heterocyclic, carbocyclic compounds and peptide mimetics that possess neurotrophic, interferon-inducing, antiviral, analgesic, anti-inflammatory and antihypoxic action. They developed and, jointly with the '*InterKhim*' company, deployed: *GIDAZEPAM* daytime anxiolytic, *AMIXIN* low-molecular weight interferon inducer with antiviral action and *CINAZEPAM (LEVANA IC*) hypno-sedative drug, which does not change sleep architecture. Besides, among 3-substituted 1,4-benzodiazepin-2-ones researchers identified promising compounds with analgesic anti-inflammatory activity, which are now in preclinical trials (Acad. S.A. Andronati; T.O. Voronina, Dr. Sci. (Med.); A.S Reder, Cand. Sci. (Chem.)).

For the first time in Ukraine, specialists of A.V. Bogatsky Physico-Chemical Institute,

in collaboration with the '*InterKhim*' company, implemented the full production cycle of medical preparations in compliance with GMP requirements. A new laboratory and production facility of '*InterKhim*' was commissioned in 2016. '*InterKhim*' carries out the industrial production of substances and drug dosage forms of original preparations developed by this Academy institution: *PHENAZEPAM*, *AMIXIN*, *GIDAZEPAM*, *LEVANA* and a wide range of other preparations (over 50 products) (Acad. S.A. Andronati; A.S. Reder, Cand. Sci. (Chem.)).

The scientific foundation for developing physico-chemistry of surface phenomena at O.O. Chuiko Institute of Surface Chemistry were pioneer studies of Acad. O.O. Chuiko, who started a new research trend in the NAS of Ukraine — surface chemistry — concerned primarily with surfaces of dispersed solids, first and foremost, the surface of highly dispersed silicon dioxide. Institute's scientists conduct extensive research into the chemical structure, surface reactivity of solids and the physical chemistry of medico-biological and biochemical problems of surface phenomena, the technology of producing nanomaterials based on oxide and carbon systems, their modified forms and composites.

The conceptual apparatus of surface chemistry was created: it fully covers the research cycle from fundamental principles to industrial technological developments. The formation of a new area in pharmacology was initiated, namely, the development of medical preparations with regulated pharmacodynamics, synergism effect and prolonged action. Unique modified nanomaterials were also synthesized (Acad. O.O. Chuiko; Corr. Memb. V.V. Turov; V.A. Tyortykh, Dr. Sci. (Chem.)).

The reactivity of graphene-containing carbon nanostructures with vacancy-type

The technology of deep sludge dewatering at aeration plants with container geotextile fabrics: a filter unit in the aerobic stabilizer of Bortnytska Aeration Station, Kyiv

Thermosetting primer for improving corrosion protection of underground pipelines, modification of pipe surface with old covering residue in the case of pipeline re-insulation with bituminous polymer coatings

'Monolit. KMT' system for package solution of a wide range of problems in waterproofing, soil consolidation, protection and renewal of building structures and installations functioning under various hydrological conditions (public utilities, underground railways etc.)

CARBON carbon-based hemosorbent and hemosorption columns

defects and oxygen and nitrogen heteroatoms was studied, high reactivity of some structures (nanotubes, graphenes) in model fermentation reactions of reductase and hydrolase types was discovered. Besides, using spin probes, researchers proposed a method to evaluate carbon nanotube cytotoxicity for cell organelles (mitochondria) of certain tissues and organs of experimental animals (Acad. M.T. Kartel; Yu.I. Sementsov, Cand. Sci. (Phys. & Math.)).

Scientists of the NAS Institute of Bioorganic Chemistry and Petrochemistry perform high-quality research into chemistry and biology of low molecular weight bioregulators — growth regulators for plants and animals, medical and veterinary preparations, high-specificity and low-toxicity pesticides, pheromones, they study the mechanisms of biological processes by means of chemical models and also carry out R&D for oil refining and petrochemistry. Synthetic approaches were developed and cyclam derivatives were obtained for the first time. The high efficiency and action selectivity of some compounds of this series shows the possibility of producing novel protein tyrosine phosphatases as potential preparations for the treatment of numerous diseases (Corr. Membs. A.I. Vovk, O.I. Kolodiazhnyi; V.S. Brovarets, L.K. Patrylyak, Drs. Sci. (Chem.); V.I. Kashkovsky, Cand. Sci. (Chem.)).

New methods of synthesis were developed and samples of β-fluorine containing aminobutyric acids — *Pregabalin* analogs — were obtained; they are promising agents for biochemical studies of neuronal activity and diagnostics of neuropathologies (Acad. V.P. Kukhar; V.D. Romanenko, Dr. Sci. (Chem.); I.I. Gerus, Cand. Sci. (Chem.)).

The Institute for Sorption and Problems of Endoecology of the NAS of Ukraine, founded in the years of independence, is one of the leading Academy institutions

'Biotsitan' mobile facility for bio-colloid gold extraction from cyanide solutions

that conduct theoretical research and develop practical applications of sorbents and catalysts, as well as related cutting-edge technologies. It has worked out a concept of producing and using combined carbon and inorganic sorbents, which permits the content of the most harmful toxicants to be controlled. Institute's scientists have successfully completed clinical trials of novel carbon hemosorbents registered in Ukraine under *CARBON* and *CARBON+* trade marks (Acad. V.V. Strelko).

Researchers of F.D. Ovcharenko Institute of Biocolloidal Chemistry carry out basic and applied research addressing the biochemical and biophysical problems of natural and synthetic dispersed systems and materials, biological nanosystems and nanotechnologies, biotechnologies of mineral resources beneficiation and environment protection. Their investigations of mineral colloid particles heterocoagulation with microorganisms produced internationally recognized basic and applied results. Those laid the foundations of a new science — biocolloidal chemistry; its main task is to examine interactions between objects of living and non-living nature, to develop biochemical mechanisms of the heterocoagulation of living cells with colloid mineral particles that depend directly on cell metabolism or cell physiological activity. The results obtained were of seminal importance for novel research trends: biogeochemistry, colloid biotechnologies, biocolloidal ecology and also made a significant contribution to nanopharmacy, nanomedicine and veterinary nanomedicine. The practical dimension of this fundamental research was the development of numerous highly efficient technological processes and functional materials — from colloid biotechnologies for extracting noble and rare metals, nano bioreactors and nano-sized metal and composite hydrogel systems to a large variety of substances for human and veterinary medicine (Acad. F.D. Ovcharenko; Z.R. Ulberg, M.V. Pertsov, Drs. Sci. (Chem.); V.R. Estrela Llopis, Cand. Sci. (Chem.)).

The principal objectives of the NAS Joint Department of Electrochemical Energy Systems are basic, applied and blue-sky scientific research in electrochemical energy; the elaboration of new relative technological processes and engineering designs; production of prototypes and small series of different chemical current supplies for industrial and military use, equipment and instruments for their manufacturing, other engineering devices and materials.

Today's progress of basic and applied research in *biological sciences*, in particular, molecular and cell biology, biochemistry, physiology, oncology, immunology, to a great extent stems from the rapid advance of genomics, proteomics and bioinformatics. Today scientific studies are aimed at the structure of individual genes, systems of gene expression regulation, revealing functional relations between the proteins of individual organism, which facilitates disease diagnostics and prevention, the development of next-generation medical preparations.

Fundamental scientific research of the NAS Palladin Institute of Biochemistry, which in the past was conducted under the guidance of Acad. V.O. Belitser, is now carried on and addresses fibrinogen transformation into fibrin, i.e. is concerned with biochemical mechanisms of thrombosis in cardiovascular diseases (Acad. S.V. Komisarenko; Corr. Memb. E.V. Lugovskoy; L.V. Medved, Dr. Sci. (Biol.)). It has resulted in separating the enzymatic component of the polymerization phase of the process, formulating the concept of the domain structure of fibrinogen and fibrin. In recent years, relying on immunochemical analysis that uses monoclonal antibodies, researchers have discovered earlier unknown centers of fibrin polymerization, revealed the molecular mechanisms of its polymerization and formation of 3D fibrin network (the thrombus frame). That has resulted in the development of immunodiagnostic test systems for early diagnostics of clot formation risks and control of antithrombotic therapy efficiency, as well as effective anti-hemorrhagic agents.

In the process of the 1990—2000 research, scientists of Palladin Institute of Biochemistry (Acads. M.V. Skok, S.V. Komisarenko) for the first time ever discovered nicotinic acetylcholine receptors (nAChRs) on immune system β-lymphocytes and on intracellular organelles — mitochondria. In determining the biological role of these receptors they found out that nAChR activation is necessary for the normal development of β-lymphocytes, in particular, for the formation of their specific repertoire; those also regulate immune response. The researchers discovered the involvement of mitochondrial nAChRs in the regulation of intrinsic pathways of apoptosis — the programmed cell death. These data provide an insight into the important role of nAChRs in immunity, and in supporting brain cell robustness, especially in Alzheimer's disease. The Institute also obtained fundamental results concerning the properties and functional role of energy-dependent Ca ions transport in smooth muscles, biochemical patterns of regulating the concentration of this cation in myoplasm (Acad. S.O. Kosterin). Diagnosticums for tuberculosis and diphtheria were developed (Acad. S.V. Komisarenko; D.V. Kolybo, Dr. Sci. (Biol.)).

Scientific results that meet the highest international standards were achieved by Bogomoletz Institute of Physiology of the NAS of Ukraine in the field of molecular physiology. The concept of cell membrane as the apparatus of excitation perception was developed; fully confirmed was the idea of the receptor systems of various animal cells, while the idea of two-step excitation processes was instrumental in determining the essence of intracellular processes under the action of hormones, antigens and various pharmacological substances on the cell. Institute's researchers were the first to develop the method of intracellular perfusion of nerve cells, which enabled them to control processes on the inner side of neuronal membrane (Acad. P.G. Kostyuk).

In the last 20 years, scientists under the leadership of Acad. O.O. Krishtal have been

Acad. B.E. Paton, NAS President, congratulates Acad. M.F. Gulyi on his centenary and on awarding him the 'Hero of Ukraine' honorary decoration at Palladin Institute of Biochemistry of the NAS of Ukraine. Beside them is Acad. S.V. Komisarenko, Director of the Institute. Kyiv, 2005

Scientists of Palladin Institute of Biochemistry demonstrate Institute's developments to Nobel Laureate Jean-Marie Lehn. Right to Left: First Row – Acads. S.V. Komisarenko and Jean-Marie Lehn (France), Corr. Memb. E.V. Lugovskoy; Second Row – Acad. S.O. Kosterin, Prof. P. Bregestovski (France). Kyiv, 2008

studying a top-priority trend in today's cell and molecular physiology – the mechanisms of intracellular signaling in different types of nerve cells. They have discovered a complex system of molecular mechanisms that are formed by calcium signaling in the development dynamics of short-term and long-term physiological processes and are caused by the formation of neuronal systems with various forms of activities. It has been found that those mechanisms are disrupted in the most common and most severe pathological changes in the organism: to get insights into their nature is of the utmost scientific relevance for today's medicine.

At the NAS Institute of Molecular Biology and Genetics, Corr. Membs. V.M. Kavsan and A.V. Ryndych obtained the reverse tran-

Test systems for detecting diphtheria toxin antibodies in human blood serum

'Helicotester' innovative device for noninvasive express diagnostics of stomach helicobacteriosis

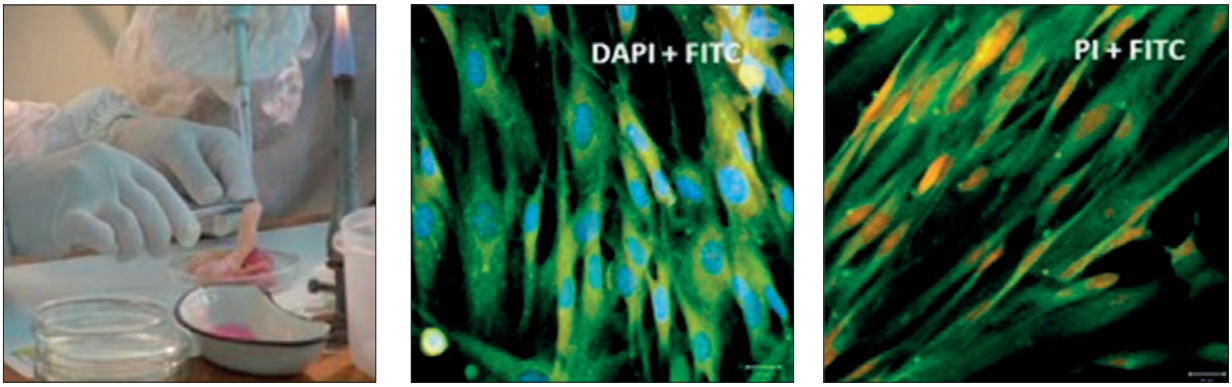
scriptase ferment. That allowed them to synthesize the eukaryotic gene and provided conditions for the advancement of gene engineering and molecular oncogenetics. Further development of genomics at the Institute enabled its specialists to obtain important results concerning structural genetic/epigenetic and functional changes of human genome in oncological and severe hereditary diseases. A number of diagnostic and prognostic DNA test systems were proposed; most of them are already used in medical practice. A highly relevant area of Institute's research is concerned with bioelectronics (Acads. A.V. El'skaya and O.P. Soldatkin). Fundamental studies concerning the interaction of biological macromolecules with surfaces of physical transformers and the creation of high-selectivity molecularly imprinted polymer membranes have become the basis for producing novel analytical devices — biosensors — for medicine, industry, environment protection and biotechnology. The Institute established the only Ukrainian virtual laboratory of molecular dynamics, while computer technologies, besides solving fundamental problems, are employed to develop new medicines, anti-cancer and anti-bacterial drugs in particular.

D.K. Zabolotny Institute of Microbiology and Virology of the NAS of Ukraine, in addition to investigating fundamental issues of microbiology and virology, have been giving a lot of attention to developing novel biotechnological preparations, products and processes for medicine, agriculture, industry and environment protection. In the last ten years, the industrial production of numerous preparations has been organized on the basis of Institute's developments. Among them were *BIOSPORIN* — for prophylactics and treatment of various forms of dysbacteriosis and acute diseases of human gastrointestinal tract; *SUBALIN* with antiviral and antibacterial action, human immunoglobulins against viruses of common herpes of type II and Epstein—Barr virus, cytomegalovirus, chlamydia etc.

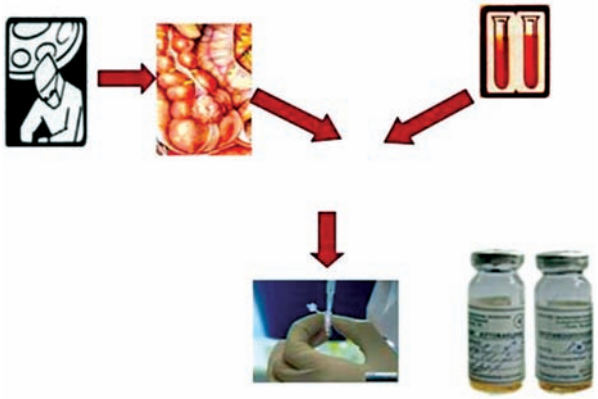
V.M. Kiyenko, Scientific Secretary of Bogomoletz Institute of Physiology of the NAS of Ukraine; G.P. Rogovyk, Executive Deputy Director of the Institute; Corr. Memb. V.F. Sagach, Acad. P.G. Kostyuk, Director of Bogomoletz Institute of Physiology (1966 – 2010), Acads. F.M. Serkov and M.S. Veselovsky. Kyiv, 1993

Acad. A.V. El'skaya, Director of the NAS Institute of Molecular Biology and Genetics, with young scientists of the Institute. Kyiv, 2006

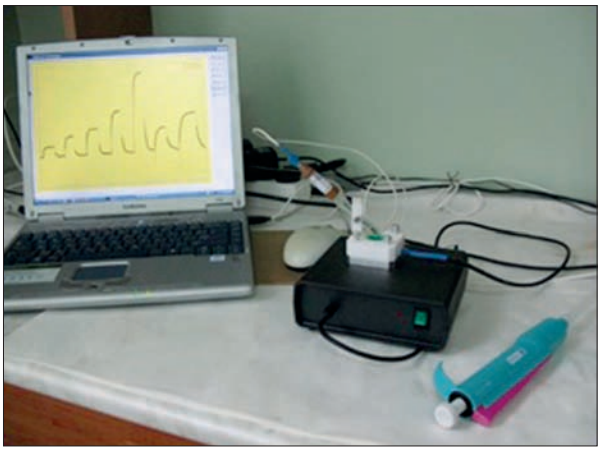
Researchers of R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology of the NAS of Ukraine, led by Acad. V.F. Chekhun, for the first time in Ukraine developed a next-generation anti-tumor ferromagnetic nanocomposite — *FERROPLAT*. The preparation contains nanoparticles of a magnetic substance and a cytostatic — *Cisplatin*. Preclinical trials proved that in terms of anti-tumor and anti-metastatic action, *FERROPLAT* is superior to the official *Cisplatin* preparation, especially in cases of resistant malignant neoplasms. Relying on the research performed, the Institute published methodological recommendations "Criteria and methods to evaluate the biological safety of metal-containing nanomaterials in developing anti-tumor vector systems". At the Institute, under the guidance of Prof. D.F.



Using human umbilical mesenchymal stem cells for cell therapy



Antitumor autovaccine for personified therapy of oncological patients, preventing recurrent tumors and metastases, increasing the survivability indices of cancer patients and improving their quality of life



Portable biosensor analyzer of alkaloids and other natural toxins in agricultural crops and foodstuffs

Gluzman, Dr. Sci. (Med.), and Corr. Memb. S.P. Sydorenko, a unique collection of hybridomas — producers of monoclonal antibodies — was gathered for early and differential diagnostics of tumors of various hystogenesis and for assessing the immune system status.

In recent years, scientists of the NAS Institute of Cell Biology (Acad. A.A. Sybirny; O.V. Stasyk, Cand. Sci. (Biol.)) have established molecular mechanisms of selective autophagy of cell organelles — peroxisomes. By means of the yeast model they have identified several genes unknown earlier, namely, Atg26, Atg28 and Atg35, which are involved in selective peroxisome degradation (pexophagy process), and studied their molecular functions. This discovery provides insights into the processes of selective degradation of cell components at the molecular level. It can be used for directed control of those mechanisms in a number of biological and medical technologies.

The NAS Institute for Problems of Cryobiology and Cryomedicine, under the guidance of Acad. A.M. Goltsev, demon-

Celebration of the 80th anniversary of D.K. Zabolotny Institute of Microbiology and Virology of the NAS of Ukraine. Acad. B.E. Paton, NAS President, with Acad. V.S. Pidgorsky, Institute's Director, (Right) and Acad. I. K. Pokhodnya. Kyiv, 2008

strated for the first time the feasibility of directed redistribution (under the effect of certain regimes) of cryopreserved constituent elements of fetal nerve cells with an increased content of the subpopulation of glial (GFAP+) cells and activation of IDO gene expression and anti-inflammatory mediators (TGF-β and IL-10) in them. Such a modification of quantitative and qualitative characteristics of fetal nerve cells significantly enhances their immune-modulating activity and the ability to treat diseases of autoimmune genesis. A cryotechnology for long-term storage of donated human blood cells at ultralow temperatures was worked out to create their strategic reserves. Technological documentation of the equipment prototypes developed was prepared for their future serial manufacturing.

In the years of Ukraine's independence, researchers in the field of biology have obtained important results that have been recognized in the world.

In plant sciences, Corr. Memb. E.L. Kordyum in the mid-1990s discovered gravisensitivity of plant cells that are not specialized to the perception of the gravity vector, and in 2005 she discovered the phenomenon of switching the positive gravitropic response of the root to the negative one under gravistimulation in a weak combined magnetic field. In 1994, Acad. Ya.P. Didukh proposed theoretical approaches to and a methodology of synphytoindication of ecological factors. In 2013, the international team of researchers including S.Ya. Kondratyuk, Dr. Sci. (Biol.), completed their work on the first sequencing of a lichen draft genome, while Corr. Memb. S.L. Mosyakin developed a new classification scheme of angiosperm plant families and orders in 2016. Corr. Memb. T.M. Cherevchenko for the first time discovered a weakened geotropic response in epiphytic species of tropical orchids, which gave rise to a series of successful experiments on board manned space vehicles. Corr. Memb. N.V. Zaimenko developed the principles of space soil science, determined theoretical foundations of the structural and functional organization of man-made ecosystems under microgravity to provide conditions for human life support in space.

In the 1990s our country was faced with acute problems of the conservation of the

Ukrainian Carpathians, as human activities, climate change and other factors resulted in a dramatic deterioration of the environment in the region. Thus, scientists of the Institute of Ecology of the Carpathians of the NAS of Ukraine, led by Acad. A.M. Golubets, developed and substantiated ecological and forestry foundations for restoring the functional role of the Carpathian forests and compiled the relevant nomenclature list that included 106 forest types.

In the field of zoology, Acad. V.G. Radchenko in 1992 found the solution to one of the most interesting and intriguing problems in contemporary biology — the origin of the true sociality (or eusociality) in insects and the genetic mechanisms of the evolution of sterile castes of worker insects in their societies. In the same year he discovered that narcotization of small numbers of bees with carbon dioxide enhances oogenesis processes in female bees, which provides a manifold increase of their reproductive ability in industrial farming. In 2003, Prof. V.P. Sharpylo, Dr. Sci. (Biol.), and R.V. Salamatin, Cand. Sci. (Biol.), published their paratenic (reservoir) parasitism concept, which discloses the unique ecological strategy of parasites that aims at increased reliability and sustainability of parasitic systems. Acad. V.I. Monchenko worked out the concept of regressive limb oligomerization in copepod crustaceans as the main morphological trend of their group evolution.

Among other outcomes of zoology studies, one should also mention the advancement of the theory of cospeciation formation, which earlier had not received due attention in the studies of animal evolution: the finding that genetic differences among taxa of higher vertebrates are comparatively smaller than those among lower vertebrates; the revealing of cytological (cellular) mechanisms of adaptive skeleton remodeling during space flights.

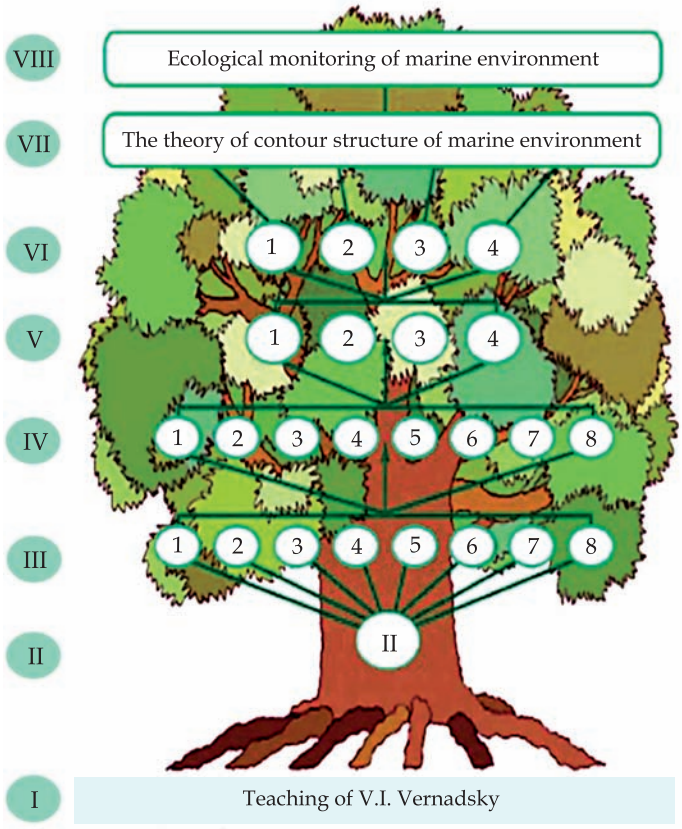
Acad. I.G. Emelyanov was the first to use the systemic approach in formulating the alternative diversity principle, which forms the basis of ecosystem robustness and evolution. In collaboration with Acad. Yu.R. Shelyag-Sosonko, he worked out a scheme of hierarchical levels of diversity in the biosphere.

Relying on the outcomes of their research in hydroecology, scientists led by Acad. Yu.P. Zaitsev and Corr. Memb. B.G. Aleksandrov, proposed new functional indicators of marine biota communities and developed scales for estimating the ecological status class of the marine environment in the Ukrainian sector of the Black Sea. That provided new possibilities for the ecological monitoring of seas and oceans and was implemented in the system of environmental monitoring of Ukraine and other countries of the Black Sea region. Also, researchers headed by Acad. V.D. Romanenko and Corr. Memb. S.O. Afanasyev developed a procedure for assessing and prioritization of point sources of pollution in hydroecosystems. It was adopted in the UNIDO document 'Methodology "Identification, Assessment and Prioritization of Pollution Hot Spots"' and is used by the United Nations Organization in all transboundary river basins of the world. To fulfill Ukraine's commitments to the EU, the assessment of the ecological status of Ukrainian river systems, which was harmonized with the Water Framework Directive, and their typization were carried out. Corr. Memb. S.O. Afanasyev analyzed the processes of historical development of the river network in the territory of Ukraine and its effect on the river biota genesis.

The years of Ukraine's independence have witnessed novel trends in biological research. In particular, focus was set on those biology

**"New Knowledge Tree"
in marine biology and ecology**

I Teaching of V.I. Vernadsky
II The discovery of marine neuston on the surface of the Black Sea
III The study of marine neuston components and their distribution
IV The study of environmental conditions in the marine neuston biotope
V The study of the biospheric significance of marine neuston
VI The study of other ultrastructures (contour habitats and their communities)
VII Elaboration of the theory of contour structure of the hydrosphere
VIII Development of new monitoring methodology "Environmental sentinels of the Black Sea" for the marine environment



Scheme of the "New Knowledge Tree", developed by Acad. Yu.P. Zaitsev

areas that are directly related to the development and application of computer and biological technologies: genetics and breeding, cell biology and genetic engineering. Acad. V.V. Morgun and his co-workers elaborated theoretical principles of creating new semidwarf varieties of soft winter wheat. In total, the outcome of their research amounts to 145 varieties of wheat, rye, triticale, and maize hybrids. Those are widely introduced into the agriculture of Ukraine and its neighbor countries. In recent years the varieties of soft winter wheat bred by NAS scientists have been grown on over 2 million hectares — 30 % of the whole area occupied by that crop in this country, which enables agriculturists to harvest wheat amounts that fully satisfy Ukraine's annual needs in bread grain of wheat. Such large-scale use results, first and foremost, from the unique properties of new varieties and their high yields. Specifically, *Smuglyanka*, *Zolotokosa*, *Favorytka* and *Astarta* varieties for the first time in Ukraine produced record-setting wheat grain yields: 124, 125, 138 and 140 centners per hectare, respectively.

Cell biologists created a bank of plant germplasm of the Ukrainian and world flora, which became the basis for fundamental studies in plant biotechnology and conservation of plant species diversity.

Acad. of the NAS of Ukraine and NAAS of Ukraine O.O. Sozinov started using molecular genetic markers to search for genes that encode economically valuable plant traits and, in collaboration with Acad. Ya.B. Blume, also developed and implemented molecular genetics methods to de-

Members of NAS Presidium led by Acad. B.E. Paton, visit experimental fields of the NAS Institute of Plant Physiology and Genetics. Acad. V.V. Morgun, Institute's Director, presents its work

tect genes of wheat resistance against various diseases, yellow, brown and stem rust in particular. They also identified new genes of cereal resistance against these diseases.

Acad. Ya.B. Blume and Corr. Memb. A.I. Yemets discovered the ability of ultraviolet B to cause the programmed death of plant cells and revealed cytoskeleton involvement in mediating its action. They also found a number of post-translational modifications of plant tubulin, for the first time identified the mechanisms of their action involving microtubules in autophagy and cell death development under the influence of various environmental stress factors. That opens up new opportunities for biotechnological improvement of agricultural plant properties.

Corr. Memb. M.V. Kuchuk for the first time in Ukraine developed state-of-the-art technologies for the genetic transformation of plants, which are at least equal to their best foreign counterparts, and created valuable breeding material of several economically important species: alfalfa, pea, wheat etc. He also proposed new methods of genetic information transfer into chloroplasts to obtain transplastomic plants, invented novel approaches to using plants, including edible ones, as systems for synthesizing recombinant proteins intended for pharmaceutics.

After the tragic accident at the Chornobyl NPP that happened in April of 1986, amendments were made in the topics of biological

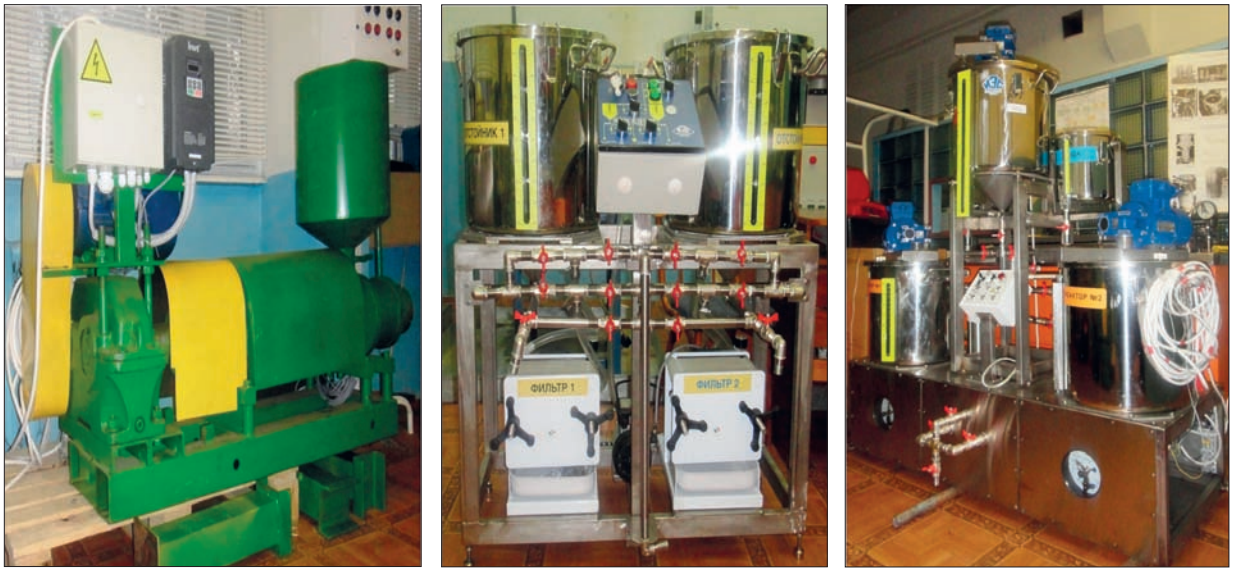
'Smuhlyanka' is the leader among winter wheat varieties in productivity and sown area, and is unique in terms of its trait aggregate

research conducted at the NAS of Ukraine: much attention of scientists was focused on studying disaster's impacts on human health and the exclusion zone's biota, and on predicting the changes to come. In particular, a scientific team under the leadership of Acad. D.M. Grodzinsky investigated a number of radiobiological and radioecological consequences of the Chornobyl accident and developed measures to minimize them. For the first time they investigated biotic factors of the ruination of "hot particles" from Chornobyl fallout and determined the contribution of higher plants and soil microflora to the change in the mobility of long-lived radionuclides and their inflow to trophic chains. Besides, the researchers established the natural radioactivity of the vegetation and soils in Ukraine, the mechanisms of forming radiobiological responses in plants, discovered the ways of recovery from radioactive damage at different levels of plant system organization.

Taking into account the peculiarities of radioactive contamination of Ukrainian agricultural lands, specialists developed an analytical method to evaluate and predict radiation dosage loads on humans due to consuming contaminated food products. The method is used in epidemiological studies of Chornobyl accident consequences.

Hydrobiology scientists — M.I. Kuzmenko and D.I. Gudkov, Drs. Sci. (Biol.) — determined the role of freshwater hydrobionts in the processes of radionuclide migration and distribution. They worked out recommendations on the minimization of Chornobyl accident impacts related to the safety of water intake points of potable water supplies, water resources management, fishing and fish consumption.

Almost immediately after declaring Ukraine's independence, the country was faced with the problem of ensuring its energy independence. Scientists of the NAS of Ukraine actively joined the search for sources of alternative renewable energy and the development and deployment of energy-efficient technologies. One of the main research areas was using biological raw materials as



Technology of producing biodiesel from camelina plants

Two editions of the Red Data Book of Ukraine, prepared by a large team of botany and zoology scientists, mainly, — researchers of NAS scientific institutions

fuel. In view of that, the unique collection of energy plants gathered by the research team led by D.B. Rakhmetov, Dr. Sci. (Agr.), is an important source material for breeding biofuel crops. The collection contains over 600 species, varieties and cultivars of the plants that are both traditional and non-traditional crops in Ukraine and are cultivated on experimental plots of M.M. Gryshko National Botanical Garden. Among those are many new plant varieties that have high productivity of components which are valuable for alternative energy (oils, sugars, cellulose etc.) and have already won high appraisals of producers.

Researchers of the NAS Institute of Food Biotechnology and Genomics, led by Acad. Ya.B. Blume and S.P. Tsygankov, Dr. Sci. (Eng.), developed technologies for obtaining biosynthetic fuel components from renewable plant raw materials. They are based on bioethanol, complex fuel components using bioethanol and its derivatives, as well as biofuel containing up to 40 % of ethanol, which are intended for internal combustion engines. A pilot facility was built to produce biodiesel compositions from plant oils, and camelina oil in particular.

Immense and extremely important work has been done by scientists in botany, zoology, hydrobiology and ecology to establish many new nature reserves and extend the protected areas already existing in Ukraine. Significantly enlarged were the protected areas of reserves that belong to the NAS of Ukraine: the Black Sea and the Danube Biosphere Reserves, Ukrainian Steppe and Luhansk Nature Reserves, '*Oleksandria*' State Dendrological Park etc. That contributed to the formation of a comprehensive ecological network in Ukraine and to the strategy of biotic and landscape diversity conservation. Nature protection and environmental education activities of NAS institutions under whose jurisdiction are state-protected nature objects of Ukraine (reserves, botanical gardens, dendroparks, parks that are landmarks of garden architecture) is also important for the society, since they provide a new mindset for our citizens, envisaging the harmonious coexistence of people and nature that is to be preserved for the present and future generations. Natural history museums of the NAS of Ukraine are also among institutions whose activities aim at environmental

education. Recently they have initiated the work towards a new concept of Ukrainian museums of natural history as up-to-date institutions of environmental education for young people and methodology centers of nature museum studies.

A large scientific team of botanists and zoologists, mainly specialists of research institutions of the NAS of Ukraine, prepared two editions of the Red Data Book of Ukraine (each of those contained two volumes: "Plant Kingdom" and "Animal Kingdom"), as well as the Green Data Book of Ukraine. These fundamental works were published in 1994, 1996, and 2009. A large amount of work went into compiling the "State Cadaster of Plants and Animals of Ukraine".

Academy institutions of biological specializations developed a number of efficient technologies for recovering the natural environments affected by human activities. In particular, in Donetsk and Kryvyi Rih the technologies for biological reclamation of various types of land damaged by technological processes were proposed. Hydrobiologists also elaborated theoretical principles of reviving mountainous rivers.

3.3. SOCIAL SCIENCES AND HUMANITIES

Civilizational challenges of the late 20th — early 21st centuries, the establishment of independent state — Ukraine, the accession of Ukraine into the international space promoted socio-humanitarian research. The National Academy of Sciences of Ukraine puts among its priorities the systemic analysis of all transformations of the Ukrainian society, building-up of Ukraine's statehood, the development of strategies and models for forming high-tech industries, knowledge-based economy and harmonious personality. The national historical experience in the international context, national heritage, memory, uniqueness, identity have become continuous topics of research and publications of Academy's socio-humanitarian institutions. The priority was given to inter-disciplinary research to get the comprehensive picture of our past, present and the desired future.

There was a profound qualitative transformation of the methodological instruments of the socio-humanities. Resolute discarding of obsolete thinking stereotypes, the open-mindedness of scholars, young scholars in particular, to the best assets of the world science, brave search for new ideological paradigms had a profound influence on the formation of outlook pluralism in the academic environment, overcoming the artificial isolation of Ukrainian socio-humanities from the global processes.

In accordance with the new tasks, the network of the Socio-Humanitarian Section institutions was extended. Novel institutes were formed on the basis of the previous structures: the Institute of Economics and Forecasting, the Institute of Sociology, I.F. Kuras Institute of Political and Ethno-National Studies, the Institute of World History, M.I. Dolishniy Institute of Regional Studies (Lviv), I. Krypiyakevych Institute of Ukrainian Studies (Lviv) and a number of institutes' branches and centers.

New research institutions rapidly organized their work and won authority: the Institute of the Ukrainian Language, Ukrainian Lingua-Information Fund, the Ethnology Institute (Lviv) and I. Franko Institute of the NAS of Ukraine. New research areas are embodied in the works of Ptoukha Institute for Demography and Social Studies, the Institute for Market Problems and Economic & Ecological Research (Odesa), the Institute of Problems of Nature Management and Ecology, M.S. Hrushevsky

Scientists and public and political figures. The House of Scientists, Lviv. The 1990s

Institute of Ukrainian Archeography and Source Studies, and the Institute of Encyclopedic Studies. Alongside traditional and recognized centers of academic research in socio-humanities, such as the Institute of the History of Ukraine, the Institute of Archeology, H.S. Skovoroda Institute of Philosophy, V.M. Koretsky Institute of State and Law, T.H. Shevchenko Institute of Literature, O.O. Potebnya Institute of Linguistics, M.T. Rylsky Institute of Art Studies, Folklore and Ethnology, these institutions form a wide database for the scholarly support to progressive transformations in the Ukrainian society.

Before the annexation of Crimea by Russia, the Crimean Branch of the Institute of Archeology and the Crimean Branch of A.Yu. Krymsky Institute of Oriental Studies were working fruitfully.

A bright evidence of the research activity and, at the same time, maturity of respective fields of knowledge is the boom of encyclopedic editions. Encyclopedias are the generally recognized intellectual visiting cards of states and nations. Published were: "Shevchenko Encyclopedia" (6 vols.), "Encyclopedia of the History of Ukraine" (10 volumes; the preparation of an index volume and additional volumes is underway), "Juridical Encyclopedia' (6 vols.), "Ukrainian Music Encyclopedia" (3 vols.), "Political Encyclopedia", "The Ukrainian Language" Encyclopedia. The work on the 30-volume

Acad. B.E. Paton, President of the National Academy of Sciences of Ukraine; Acad. S.I. Pyrozhkov, NAS Vice-President, (Second Right); Acad. V.M. Heyets, Director of the Institute Economics and Forecasting, (First Left); Acad. E.M. Libanova, Director of Ptoukha Institute for Demography and Social Studies

"Encyclopedia of Modern Ukraine" is going on. The publication of the 7-volume "Ivan Franko Encyclopedia" has been started. In collaboration with the state scientific institution *Encyclopedia Publishers*, the 20-volume "Great Ukrainian Encyclopedia" is being prepared; jointly with the National Academy of Legal Sciences, the preparation of the "Great Ukrainian Juridical Encyclopedia" in 20 volumes is being carried on. Various new specialized encyclopedias, encyclopedic dictionaries and reference books are underway.

An important place in the activities of the NAS of Ukraine belongs to the elaboration of strategic forecasts and economic development models, conceptual approaches to preventing crisis phenomena and overcoming them, achieving social consolidation in Ukraine. The most significant example of such activities is the practice of preparing national reports on highly relevant issues of Ukrainian society development, which was started by the Section of Social Sciences and Humanities of the Academy in 2009. Those were: "Socio-economic situation in Ukraine: consequences for people and the state", "New course: reforms in Ukraine 2010—2015", "National sovereignty of Ukraine under globalization", "Sustainable human development: ensuring equity", "Innovative Ukraine—2020", "The policy of integrating the Ukrainian society in the context of challenges and threats of the events in Donbas", "Civilizational choice of Ukraine: the paradigm of analysis and the strategy of action", "Ukraine: the way to society consolidation".

National reports are socially significant documents. Relying on the analysis and forecasts of processes and phenomena, they propose strategies, models and instruments to solve problems that are epoch-making for the Ukrainian society. The reports present the integrated analysis of the state and determining trends in the economic, social, political, legislative and humanitarian development of the state, advance proposals concerning its stimulation in conditions of Ukraine's integration to the world economic and S&T space. The reports provide a holistic vision of the strategy, ways and mechanisms for overcoming the systemic crisis and leading the country towards the economic growth goals.

Specialists of the NAS of Ukraine relate the solution of socio-economic problems to preserving and strengthening the demographic potential, human development priorities, the tasks of consolidating the Ukrainian political nation and forming the integrated socio-humanitarian space of Ukraine. Those documents were highly appreciated by the society and specialists, which is proved by their numerous citations in various publications, analytical reviews etc. In particular, the report "The policy of integrating the Ukrainian society in the context of challenges and threats of the events in Donbas" had a major public resonance (Acad. E.M. Libanova headed the team of its authors, 2015). It provided a systemic analysis of the causes and effects of the events in the East of Ukraine. The main focus was given to the economic, socio-political, information potentials of minimizing and overcoming threats that stem from the events in Donbas, as well as new opportunities and priorities of integrating the Ukrainian society. The report outlined the integral vision of advancing the up-to-date economy in the East of Ukraine, recovery of traditional industries on new technological principles, accelerated development of infrastructure, formation of the Ukrainian civil nation and society consolidation around the idea of building up the independent state, as well as the vision of the ways to establish mutual understanding among citizens and form a new information system based on the state-of-the-art global technologies.

The team of authors analyzed the events in Donbas both in local and broad international contexts, as the aggression of the Russian Federation against Ukraine, the attempts to implement 'Novorossia' and 'russkiy mir' projects were the consequences and sign of global shifts, whose significance by far transcend not only the boundaries of the region and national borders but those of the continent as well. The confrontation does not stem from economic, ethnic or linguistic factors — it involves the civilizational choice between the European and Asian development vectors, democratic values and totalitarian strivings. Not only the future of Donbas and Ukraine depends on the victory of one or the other choice but in large part the stability of the entire European community is at stake. This national report is a sizeable contribution of Academy scholars in socio-humanities to comprehending the essence and ways of resolving this apparently Ukrainian regional but actually a major international problem.

Civilizational choice, national idea, images of the society and the individual which we strive for are many-year themes of society's reflections and discussions. Academy's socio-humanities institutions, each in its own particular way, studied their multifaceted depths and elaborated models of practical measures to achieve the goals chosen. The synthesis of generalizations, ideas and proposals is embodied in the national report "Civilizational choice of Ukraine:

Acad. E.M. Libanova, Director of Ptoukha Institute for Demography and Social Studies, opens the International Scientific and Practical Conference 'Evolution of Lifespan', held jointly with the Mission of the Polish Academy of Sciences in Kyiv, the Institute of Ukrainian – Polish Collaboration and 'Ukraine – Poland' Association. Kyiv, 7 November 2017

the paradigm of analysis and strategy of actions" (the head of its research team was Acad. S.I. Pirozhkov, 2016). The society was offered a scientifically grounded methodology, an integrated vision of the content and direction of our nation's civilizational choice.

This is the concept of truly historic choice, which will determine Ukrainian society development for many years to come. First and foremost, this is the choice of the way of life and values, not merely of its geopolitical place in the world. Accordingly, the document theoretically outlines the strategy of implementing that choice — the civilizational project of Ukraine. In it Ukraine is seen as an innovative information-based society where creative personality is the principal value and the main subject.

The civilizational project of Ukraine is the social project that envisages reforms not merely in the sphere of production and distribution but it also involves profound mechanisms of social life that concern the interaction of man and society, creates an open system capable of self-regulation and built on the principles of humanistic self-government.

Scholars working in socio-humanities follow up the issues of unity, consolidation, mutual understanding in the Ukrainian society disturbed by large-scale transformations, incessant reforms, crisis situations, various foreign influences. They study historical

origins and effects, contemporary causes of confrontation, prepare scholarly recommendations for administrative decisions and forming public opinions that are able to bring peace, consensus and co-operation. The significant summary result of that work was the National report "Ukraine: its way to society's consolidation" (its team of authors was led by Acad. S.I. Pirozhkov, 2017).

The main message of the academic community to the authorities and socium was that society's consolidation is only possible on the basis of common values, common goals and can rely on democratic and humanistic principles, the domination of man-centered approach. The report proposed strategies and models of society consolidation that take into account home and international factors. Special focus was given to the possibility of resolving social contradictions without ending up in conflicts and antagonisms. The role of elites (especially of the liberal one) in the consolidation processes was shown. Scholars substantiated the necessity of ensuring the status of compulsory subject at all education levels for the socio-political knowledge as the basis of cultures dialogue. As opposed to emotion-ridden pessimistic forecasts, the academic analysis of the issues of Ukrainian society's consolidation brings optimism, the assurance of Ukraine's historical prospects.

Analytical and prognostic reports, concepts, strategies, programs of actions in the respective areas of social life are typical results of socio-humanitarian studies in the Academy. That has become the rule in recent years. Here science directs its conclusions immediately to practice. Academy researchers reveal the true picture of transformation processes, note positive phenomena, warn about challenges and threats, model possible two-edged trends, and analyze scenarios of alternative actions.

Socio-humanitarian institutions of the Academy provide practical assistance for executive authorities in building up the Ukrainian statehood. In particular, they developed the strategies of: Ukraine's sustainable development till 2020, enhancing its human and intellectual potential, humanitarian sphere, improving the competitiveness of its economy, innovative development and European integration. Experts in juridical sciences and politology provide comprehensive scholarly support to the legislative process in Ukraine. Scholars made well-grounded proposals concerning the constitutional, judicial, territorial and administrative reforms, towards the reform of law-enforcement bodies, improvement of all legislation drafting and adoption.

Every serious policy begins with the development of its concept. Authorities and general public are offered concepts of industrial, energy, food and rent policies, a policy to reduce poverty and unemployment, to prevent social tensions, inter-ethnic, inter-confessional and inter-regional conflicts.

In the aggregate, analytical, prognostic, conceptual research results of NAS socio-humanitarian institutions have already formed a powerful base of scientific information that serves as a foundation for the development of political consciousness, culture and practice of the broad community. It is also a treasury of knowledge, ideas, arguments and proposals which, if implemented, will provide noticeable drivers for society innovation.

In the years of Ukraine's independence the socio-humanitarian research at the Academy has been promoted in spite of objective and subjective difficulties and obstacles. Studies in the classical disciplines — economics, history, philosophy, law, linguistics, literature and art studies — have achieved a qualitatively new level. These areas are the primary

Academic Council of the State Institution 'NAS Institute of Economics and Forecasting'

and eternal platform of the whole sphere of socio-humanities, which gives rise to all its rich diversity.

The nation witnessed a simultaneous explosion and flourishing of numerous social and human sciences, which attracted researchers with their new objects, methods and tasks. They were also nurtured by the practically unlimited source base, the freedom of creative search, the emergence of next generations in the academic environment and, last but not least, the dedicated work of the tireless researchers of previous generations.

Traditionally, such science as economics in many respects sets the tone in socio-humanities, since it determines the criteria of the quality of life and social progress. Academy economists have conducted and are conducting extensive research to create the objective picture of real economy, identify the ruinous and productive trends in it, elaborate programs and scenarios of overcoming its crisis and lead the Ukrainian economy to the path of stable growth.

The Institute for Economics and Forecasting, headed by Acad. V.M. Heyets, made the analysis and forecasts of economic macro processes, structural reforms, balancing the leading economy branches, flows of funds and investments, the advantages and risks of Ukraine's accession to the international economy, its integration into the European Union. Its researchers formulated fruitful ideas of economy neo-industrialization, the neo-modernization of the whole society, systemic introduction of new technological setups. The institute acts as a kind of navigator in the high seas of economic changes with all their contradictions, crisis phenomena, astonishing interweaving of the elements of the old and new economies, domination of the shadow economy and corruption, and beside all that, sprouts of the new economy — innovative, efficient, competitive, bringing an increase in the well-being. The analysis of the negative sides does not interfere with the ability to see the prospects.

Academy institutions carry out large-scale research into the problems of human development, human capital and demographic potential. Actually, here are the primary sources of all social life. The quality of human capital is known to be of decisive

importance. Ptoukha Institute for Demography and Social Studies, headed by Acad. E.M. Libanova, grounded the ways to ensure the high quality of human capital in Ukraine in conditions of progressive aging of its population, unemployment, employable manpower drain, low average salaries, the devaluation of intellectual labor and education in general. The care for human development is rightly considered as an invariable state and national priority.

A forecast, concept and strategy of Ukraine's demographic development till the mid-21st century, the concept of encouraging social security, pension reform implementation were worked out. Researchers proposed ways to transform social infrastructure aimed at providing quality services for people. They showed the priority and irreplaceable role of social investments as a factor of human capital development, grounded the ways to neutralize the negative factors of using natural, economic and social resources, providing the equal access to resources for different population groups and social strata. That was generalized in the national report "Sustainable human development: providing equity" (the head of the authors' team was Acad. E.M. Libanova, 2012).

The Academy traditionally gave much attention to studying *industrial economics*. In recent decades, the industrial sector of Ukraine has undergone essential transformations. Giant enterprises that in the past determined the economic might of Ukraine are declining. The production output is falling, former large product markets have been lost, engineer employees are leaving for other spheres, engineering and technological facilities are becoming obsolete. Accordingly, the revenues to the state treasury are decreasing. Yet, there are ways to upgrade industrial production, deploy innovations, and increase the output of competitive products.

Scientists in economics provide integral monitoring of this complicated situation in the industrial production sphere of Ukraine. The highest praise can be given to the Institute of Industrial Economics, headed by Acad. O.I. Amosha and Research Center for Industrial Problems of Development (its director is Corr. Memb. M.O. Kizim). Research teams of these institutions consider as their civic duty and professional task to contribute to restoring powerful industrial facilities in Ukraine, restructuring the industrial economy on the engineering and technological principles provided by contemporary S&T revolutions.

They proposed a concept of the state industrial policy of Ukraine, which was developed further by the Cabinet of Ministers of Ukraine. They carried out systemic research of the theoretical and practical issues of improving the economic activities of enterprises, their valuation, the peculiarities of founding and operating joint-stock companies, the efficiency of industrial development management in conditions of systemic imbalances, and assessed the competitive environment in industrial markets.

Researchers elaborated a set of economic mathematical models for medium- and long-term forecasting of regional budgets, models for evaluating the potentials of leading industrial enterprises of the country that are present in international markets, determined internal and external potentials of their further development, as well as the feasibility/infeasibility of their reconstruction. The targeted analysis of such a new area as the economy of nanoproducts, prospects of their commercial use, the peculiarities of forming and forecasting the international market of nanoproducts and nanotechnologies was conducted.

Publications of Ptoukha Institute for Demography and Social Studies of the NAS of Ukraine

Looking into the future, economic scientists developed a concept of forming the neo-industrial model of economic development. It is concerned, in particular, with the ways of transition to the neo-industrialization of major enterprises of Ukraine — metallurgical, coal-mining, chemical ones. A large-scale neo-industrialization can be considered as a reliable prospect for Ukraine as an advanced high tech country.

Academy institutions that are engaged in the studies of regional (and sectoral) economy have become socially necessary. Those are: the Institute for Market Problems and Economic & Ecological Research (Odesa), whose permanent director since its foundation has been Acad. B.V. Burkinsky; M.I. Dolishniy Institute of Regional Research (Lviv; directors: before 2006 — Acad. M.I. Dolishniy, since 2006 — Prof. V.S. Kravtsiv, Dr. Sci. (Econ.); the Transcarpathian Regional Center of Socio-Economic and Humanitarian Studies (Uzhhorod), headed by S.V. Sember, Cand. Sci. (Econ.).

Alongside theoretical regional research, scientists carry out targeted studies of the socio-economic development of Ukraine's regions, first and foremost, of their production, labour, natural resource and intellectual potentials. They have prepared a number of fundamental works on macroeconomic zoning of Ukraine, regional economy, environment, development of territorial communities, the status of demographic and migration processes, transborder collaboration. As a result, the concept of the state regional policy has been developed, which is focused on harmonizing nation-wide and regional policies, integrating regions into the all-Ukrainian processes, as well as the concept of the management and conservation of the Black-Sea and the Carpathians natural resources.

The main center for exploring natural resource potential of Ukraine is one of the youngest Academy institutions — the Institute for Nature Management Economics and Sustainable Development, which is headed by M.A. Hvesyk, Acad. of the National Academy of Agrarian Sciences. This institute, in turn, is the successor to one of the oldest Academy institutions — the Council for the Study of Productive Forces of Ukraine, which started a powerful tradition of studying the key issues of nature management economics. The institute provides comprehensive research of the economic aspects of the rational use, conservation, recovery of natural resource potential and the strategic potential of sustainable development. Natural resources are the primary source of life support. The acute problem of the rational nature resource use results from its gradual exhaustion. Institute's scientists have developed models to control natural resources in today's market economy. The Institute successfully coordinates the implementation of the targeted scientific research program launched by the NAS Department of Economics 'The trajectory of Ukraine's sustainable development till 2030'.

The switch to market-based economy, economic reforms, orientation towards innovative, competitive economy, economic transformations in general led to the foundation of the Institute of Economic and Legal Research, headed by Acad. V.K. Mamutov, who was succeeded by Corr. Memb. V.A. Ustimenko in 2012.

Institute's activities are aimed at providing scientific legal support to the functioning of the economic system of Ukraine. The Institute was the host organization in preparing the Economic Code of Ukraine, enacted in 2004, and the concept of updating the economic legislation, relying on the Economic Code.

Scientists grounded the advisability of extending the system of guarantees of Ukrainian people's rights to property ownership objects that are the basis of the economic sovereignty. In particular, they proposed to introduce the "social asset" category to the legal terminology to denote the body of material and immaterial wealth the exclusive rights to which belong to people. The principles of nationalization, requisition, confiscation as special grounds for the cessation of the right of ownership were specified, as well as principles of ensuring the balance of interests between the investor, the state and the civic society.

The broadest spectrum of studies in the socio-humanitarian sphere is carried out by institutions specializing in history, philosophy and law. And that is quite natural, since these very sciences provide the principal knowledge for forming the historical, present and future images of the society, the people and the state. After winning independence, Ukrainian social scientists were faced with the super difficult task to provide

Signing a collaboration agreement between the Scientific Research Center of Industrial Development Problems of the NAS of Ukraine and the Institute of Economics of the NAS of Belarus. Minsk, 2018

State Institution 'M.I. Dolishniy Institute of Regional Research'. International Scientific and Practical Conference 'Migration Processes in Ukraine: Current Challenges and Regional Peculiarities'. Lviv, 2013

Acad. V.K. Mamutov, former Director of the NAS Institute of Economic and Legal Research, and V.A. Ustimenko, Corr. Memb. of the NALS, the current Director of the Institute, (left)

Publications of the NAS Institute of Economic and Legal Research

integrated, objective re-thinking of the past, relying on the responsible scholarly basis, make a comprehensive panoramic picture of ideas about current processes in the country and try to look over the horizon.

History research is at the forefront of those activities. The understanding of everything that exists in the society begins with the historical data base. The Institute of the History of Ukraine, headed by Acad. V.A. Smolii, is the leader in elaborating a novel historical vision and treatment of events. Its scholars critically analyzed the established stereotypes, one-sided views on our past that are

Ceremonial congratulation of Yaroslav Kalakura on his 80th birthday at a session of the Presidium of the Ukrainian National Local Lore Union (UNLLU). Left to Right: Corr. Memb. O.P. Reyent, Deputy Director of the NAS Institute of the History of Ukraine, UNLLU Chairman; Acad. V.A. Smolii, Director of the NAS Institute of the History of Ukraine, member of UNLLU Presidium; Ya.S. Kalakura, professor of Taras Shevchenko National University of Kyiv, Dr. Sci. (Hist.). 28 September 2017

mirrored in today's life as well, they worked out the methodology of multidimensional, unbiased, realistic, systemic approach to comprehending the historical process in Ukraine. They used a number of new archival and printed documents. The range of historical analysis objects was significantly extended. The traditional descriptions of socio-political, military events and rulers' acts were supplemented with noticeable interest to folk life, education, culture, science, engineering and technologies. The so-called oral history has become a common practice. Widely used are "specialized" history disciplines — archeography, source studies, archive studies, bibliography, biographistics, historical geography, heraldry studies etc. On the background of such a methodological and historical source base the Ukrainian history emerged as a rich, complex, evoking mixed feelings, but also bright, attractive, didactic and encouraging narrative.

In the light of new methodological approaches, a comprehensive study of all stages of Ukrainian history — from early times to the present — was carried out. Their major achievement is the 10-volume "Encyclopedia of the History of Ukraine" (the project was headed by Acad. V.A. Smolii), which is the richest treasury of historical information about our native land.

Academy's scholars in history and archeology published fundamental works "Early History of Ukraine" and "Ethnic History of Early Population of Ukraine" (the scholarly supervisor of both publications was Acad. P.P. Tolochko). The editions reveal profound depths of life in our lands. The innovative generalizing edition — the 15-volume series "Ukraine through Centuries" (under the guidance of Acad. V.M. Lytvyn) was issued. The publication of multi-volume series "Exonerated by History" and "Register of Landmarks of Ukrainian History and Culture" is going on. Each Ukrainian oblast will have one or more volumes. The credit for starting these series goes to Acad. P.T. Tronko. The school of Ukrainian Cossacks' History has been revived and functions successfully. Researchers of the Scythian, Early Slavic and Kiev Rus epochs always attract interest to their findings. Odesa Museum of History

and Archeology (headed by I.V. Bruyako) and 'Olvia' National History and Archeology Reserve professionally work for enhancing the reputation of Ukrainian historical and archeological science. These institutions keep the largest and most interesting collections of antiquities of the entire Black Sea region.

Owing to the scrupulous work towards conservation, studying and management of the historical and archeological heritage carried out by the NAS Center for Monumentology and the Ukrainian Society for the Protection of Monuments of History and Culture (its Director is O.M. Titova, Cand. Sci. (Hist.), monument study has become an influential scholarly area.

Scholars of the socio-humanities institutions work in close cooperation, which encourages the growth of the scope and quality of interdisciplinary studies. A significant role in forming the document base of socio-humanities research is played by M.S. Hrushevsky Institute of Ukrainian Archeography and Source Studies, implementing the long-term program of publishing 30 series of documents on the history of Ukrainian Cossacks, socio-political movements, modern history of Ukraine, its international ties, and the landmarks of Ukrainian chronicles and historical ideas (specifically, multi-volume publications of the legacy of prominent Ukrainian historians — Acads. M.S. Hrushevsky (50 volumes), D.I. Yavornytsky (20 volumes), D.I. Bahaliy (6 volumes).

The research school of historical region studies has virtually been revived and has advanced in recent years. The interest to the wealth and uniqueness, and, especially, to the common heritage of all geographic parts of Ukraine — east, south, west, north and center is growing. I. Krypiakevych Institute of Ukrainian Studies (Lviv), which is the successor and keeper of the traditions of Taras Shevchenko Scientific Society, has the greatest experience in regional studies. Its precedence in studying the history, culture, social life of Western Ukraine cannot be challenged. It is important that all those aspects are considered in the context of the analysis of traditional Galicia's strive for the unity with the whole Ukraine and Western Europe. Today the orientation towards Europe and simultaneous desire to preserve both state integrity and historically formed unique identity of its parts is inherent to the absolute majority of the population of Ukrainian regions. To study the experience of implementing these two orientations and, what is most important, to search for the ways to harmonize them, is of nationwide importance.

The end of the previous century saw the growth and strengthening of actually new areas in Ukrainian socio-humanities — sociology, socio-economics, politology, ethnology, and information studies. Each of them generate a substantial social return.

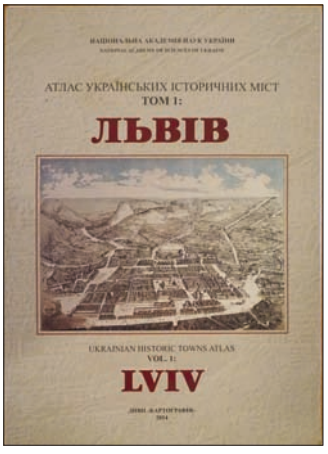
The NAS Institute of Sociology, headed by Acad. V.M. Vorona, advanced practically every influential trend of today's sociology — from its history and theory to the specific sociological examination of the dynamics of change in the main spheres of Ukrainian society's life. The greatest interest of the academic circles and community was drawn to the results of the sociological studies of mass consciousness, social well-being of the population, individual psychology, and the formation of needs and value orientations. Every year the Institute carries out monitoring of people's well-being. It has published a series of collaborative monographs "Ukrainian Society. Its State and Dynamics of Changes", compiled an immense sociological archive containing a lot of varied information for authorities, public organizations, mass media, educa-

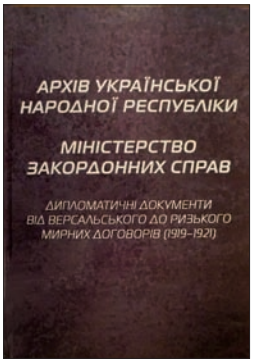
Handing awards to mark the 75th anniversary of the NAS Institute of the History of Ukraine, Right to Left: Acad. V.M. Lytvyn, Head of the Verkhovna Rada of Ukraine, and Dr. Sci. L.D. Yakubova, leading research associate of the department of the history of Ukraine of the 1920 – 1930s

The International Scientific Conference 'The Institute of the History of Ukraine at the Turn of the Epoch, in the Light of Traditions and Transformations. 75 Years of Institutional Being': Acad. O.S. Onyshchenko, Academician-Secretary of the NAS Department of History, Philosophy and Law (Left) and Acad. V.A. Smolii, Director of the NAS Institute of the History of Ukraine. Kyiv, 20 October 2011

tional institutions and researchers per se. In 2004—2015 the Institute took part in the pan-European sociological monitoring "European Social Survey", which was supported by the European Commission and held in 26 countries. It is important for obtaining the generalized comparative indicators of the social changes on Ukraine's road to the European community.

I.F. Kuras Institute of Political and Ethnic Studies has won a respected place in Ukrainian and international political sphere. Institute's works have proved that Ukrainian politology has become a full-fledged academic area. Its scholars profoundly studied the history and current state of political ideas in Ukraine; published the 6-volume "Political History of Ukraine"; issued a series of works on socio-political development of Ukraine in the context of current geo-political, modernization and globalization processes; prepared a number of scholarly analytical reports addressing various issues of reforming and improving the efficiency of political system, forming the political conscience, political culture, the activities of political elites, development of civic society, the policy of European integration.





Publications of the institutions of the NAS Department of History, Philosophy and Law

Handing the Certificate of the Foreign NAS Member to historian Igor Shevchenko at the Ukrainian Research Institute at Harvard University (Left to Right): Corr. Memb. I.F. Kuras, Academician-Secretary of the Department of History, Philosophy and Law of the AS of Ukraine, I.I. Ladyvir, Academic Secretary of the Department, Acad. Ya.D. Isayevych. USA, Cambridge, 1992

Owing to the efforts of Acads. I.F. Kuras, Yu.A. Levenets, Corr. Memb. O.O. Rafalsky (Directors of the Institute), a powerful academic ethno-politology school has appeared. It addresses the sensitive and socially important sphere of ethno-national relations, works out proposals for their harmonization, preventing inter-ethnic and inter-confessional conflicts. The Concept of the State Ethno-National Policy has been prepared.

In the years of its independence Ukraine has become an autonomous subject of the international community. That necessitated the analysis of the history of civilizations, trends in contemporary world history process, characteristic features of economies, cultures, ways of life of the peoples and countries with which Ukraine has to interact. Sporadic studies conducted at various institutions were insufficient, so a specialized Institute of the World History has been founded. Its scholarly potential is focused on top-priority research areas in the world history, the development of novel concepts and paradigms of world history progress, globalization, competing versions of civilizational development and principles of Ukraine's accession to the European and global community. Institute's experts, led by Corr. Memb. A.I. Kudryachenko, regularly prepare analytical and prognostic documents on international relations for state authorities. The publication of the multi-volume encyclopedia "World Countries and Ukraine" has been started.

Orient has left many memorable marks in the history of Ukraine, and today it is of strategic importance for our state. Specialists of A.Yu. Krymsky Institute of Oriental Studies (its Director is O.V. Bogomolov, Cand. Sci. (Philol.)) examine in detail the characteristic features of socio-political and ethno-political transformations in the countries of this region, in particular, those which have made fast economic and technological breakthroughs (China, India, Saudi Arabia, the United Arab Emirates, Qatar etc.). On a regular basis the Institute produces highly qualified information and analytical documents on the opportunities for promoting diplomatic relations, economic, cultural, academic, informational ties with countries of the East, which demonstrate unprecedented geopolitical growth.

In the years of independence, V.I. Vernadsky National Library of Ukraine, headed

Presidium of the 7th Congress of Ukrainian Politologists 'Ukraine's Civilizational Self-Determination in the Late 20th – Early 21st Centuries'. I.F. Kuras Institute of Political and Ethnonational Studies of the NAS of Ukraine. Kyiv, 23 March 2018

Acad. Yu.A. Levenets and Acad. B.E. Paton during commemorative events to mark the 70th birth anniversary of I.F. Kuras, Vice-President of the NAS of Ukraine, the first Director of the NAS Institute of Political and Ethnonational Studies. Kyiv, 2009

by Acad. O.S. Onyshchenko, Corr. Membs. V.I. Popyk and L.A. Dubrovina, has become a research center in library science, book studies, examining the heritage of Ukrainian manuscripts and archive documents, national bibliography, historical biography studies, bibliometrics and scientometrics, that is well known far beyond the boundaries of Ukraine. Systemically studied are the integration and using of large-scale databases, forming digital literacy and digital culture in Ukraine (K.V. Lobuzina, Dr. Sci. (Soc. Commun.). Analytics departments of V.I. Vernadsky National Library of Ukraine launched research into up-building of the highly integrated national integration space, strengthening the information sovereignty and security of Ukraine, the role and place of social networks in the socio-political progress of the nation (V.M. Horovy, Dr. Sci. (Hist.)).

V. Stefanyk National Science Library of Ukraine, under the leadership of L.I. Krushelnytska, Dr. Sci. (Hist.), and Corr. Memb.

Members of NAS Presidium, heads and scholars of NAS institutions at the inauguration of the memorial plaque to Acad. I.F. Kuras on the façade of the building of I.F. Kuras Institute of Political and Ethnonational Studies (Kyiv, 8 Henerala Almazova St.). 20 December 2016

M.M. Romanyuk, has carried out integrated examinations of the landmarks of Ukrainian manuscript, book and archive heritage in Ukraine and beyond its borders, as well as the history of Ukrainian press and publishing.

The highest level of theoretical generalizations in the socio-humanities sphere belongs to *philosophy*. In all times and in all civilizations philosophy defined spiritual guidelines. This honorary and responsible task is successfully fulfilled by H.S. Skovoroda Institute of Philosophy, which for many years was headed by Acads. V.I. Shynkaruk and M.V. Popovych. Institute's studies have been focused on the analysis of historical and today's life of the Ukrainian people, the development of philosophical ideas in Ukraine and in Ukrainian diaspora, the essence of Ukrainian national idea. In terms of philosophy, the national idea is seen in the choice of viable values and social practices rather than in the implementation of specific socially significant projects.

The Institute also continues the traditions of classical studies in philosophy. A number of innovative works in philosophical anthropology, social philosophy, science logics and methodology, the history of philosophy, philosophical issues of natural sciences, ecology, culture and religion were published. Monograph "The Red Century"

by Acad. M.V. Popovych has become a good read for intellectual elite as it provides a profound analysis of civilizational failures and breakthroughs of the 20th century, draws multi-valued conclusions for today's society.

The actual affiliation of the Institute of Philosophy if the NAS Center for Humanitarian Education (its Director is V. A. Ryzhko, Dr. Sci. (Philos.). Here the latest research results in philosophy, often first-hand ones, are promptly and directly introduced into education practice. Besides, the center is known for its innovative publications in the area of post nonclassical methodologies and expertise in humanities.

With all the rich diversity of research topics, the socio-humanitarian studies at the Academy are focused on state formation. Here the main theoretician, organizer and coordinator is V.M. Koretsky Institute of state and Law, whose top-priority research object is law — the basis of state's unity. The Institute (its Director is Acad. Yu.S. Shemshuchenko), in collaboration with scholars of sectoral juridical institutions and legal educational establishments, forms the scientific base for drawing up draft bills, adopting and administering laws.

The Institute provides expertise of draft laws, conceptual proposals concerning the improvement of Ukrainian legislation, harmonizing it with the European international laws, monitoring the efficiency of law functioning. The scientific and consultative support of the legal acts in Verkhovna Rada Committees, President's Administration, the Cabinet of Ministers and ministries has become everyday work.

New scientific schools doing research in human rights, constitutional, banking, energy, environmental, space, maritime, international and property right law were formed. The development of these juridical science areas was necessitated by the need for legal support to the activities of the state in its own right. Institute's researchers prepared proposals concerning amendments to the effective Constitution of Ukraine, laws on judicial system and the status of judges, preventing and counteracting discrimination, corruption, as well as the civil, criminal, economic, tax codes. The 5-volume series "Legal Doctrine of Ukraine" was published (Acads. Yu.S. Shemshuchenko, V.Ya. Tatsii, O.L. Kopylenko). Two editions of the 6-volume "Juridical Encyclopedia" were issued.

The integration of legal science and education is successfully implemented at Kyiv University of Law under the NAS of Ukraine, which under the leadership of Prof. Yu.L. Boshytsky has become one of the major Ukrainian institutions of higher education in the sphere of law.

The socially important efficiency of science is the highest when its ideas and theories become a part of social conscience. Scholars of the NAS Institute of History prepared a fundamental work "25 Years of Independence: Sketches in the History of Nation and State Formation", which proposes a new view on the Ukrainian history after 1991. It describes the present period in terms of Ukrainian society activity, which achieved peaks during three revolutions — Revolution on the Granite (October 1990), Orange Revolution (2004) and the Revolution of Dignity (2013—2014). Each of them gave a powerful boost to the state build-up. The book provides a profound analysis of the complex processes that resulted in the collapse of the Soviet Union, ways of new Ukraine development, the causes of its plunging into the systemic crises of the 1990s and 2000s, formation of the oligarchic system and its negative impact on socio-political processes, which still inhibits reforms so urgently needed by the country.

P.O. Poroshenko, President of Ukraine, hands over the first copy of the "Book of Good" to the stock of V.I. Vernadsky National Library of Ukraine. The book is received by Corr. Memb. V.I. Popyk, Director-General of the Library. Mystetskyi Arsenal Exhibition Facility, Kyiv, 9 December 2017

A. Van der Bellen, President of Austria, during his visit to Vasyl Stefanyk National Library of Ukraine in Lviv. 15 March 2018

Special interest of Academy's researchers is drawn to the Ukrainian Maidan as a complex and novel socio-political and cultural phenomenon that has had varied manifestations. This phenomenon is studied in a broader context of revolutionary events, protest actions, civil conflicts and confrontations that have happened in the world lately and are happening now, beginning with "velvet revolutions" in the countries of East-Central Europe in the late 1980s and to the latest public outrages in the post-soviet area, in Northern Africa, the Middle East, South-East Asia, Latin America and other regions of the world. Here of special importance is the analysis of the regional specificity of revolutionary events, the examination of socio-cultural values inherent in revolutionary and protest movements.

The events of recent years related to the annexation of Crimea by Russia and the Russian aggression in Donbas added new

impetus to studies of Ukrainian South and East, encouraged Ukrainian scholars to prepare new works that reveal the socio-cultural causes of the tragic events and their impacts, analyze the prospects of conflict settlement and resuming Ukraine's jurisdiction over temporarily occupied territories. Varied studies of Ukrainian researchers in socio-humanities are instrumental in creating a consistent and impartial picture of the existing situation, a broad search for ways of establishing peace, ensuring the cohesion of Ukraine's society and stable progress of the Ukrainian state.

In 2014, the NAS Institute of the History of Ukraine started a new research series 'Studies in regional history' aimed at providing scientific basis for the elaboration of conceptual approaches to the studies of Ukrainian regions and popularization of scientific knowledge of the regional history in the Ukrainian society. A number of essential scholarly works were published under this unique academic project, which revise the traditional narrative of the national history from the viewpoint of territorial and regional identity. Those are: the 2-volume collaborative monograph "East and South of Ukraine: Time, Space, Socium", which was prepared jointly with V.I. Vernadsky National Library of Ukraine, the monograph "Donetsk and Luhansk Regions in the 17th—21st Centuries: Historical Factors and Political Technologies of Forming the Specific and the General in Regional Space", "Southern Ukraine on Civilizational Borderline", analytical reports 'Donetsk and Luhansk oblasts: ethno-national situation, prospects and instruments of state regulation', 'Donetsk and Luhansk oblast: their place in modern Ukrainian national projects', collections of scholarly writings "Crimea from Antiquity to Contemporaneity: Studies in History", "Cultural Treasures of Crimea and Donbass in War and Occupation", "Crimea under Socio-Political Transformations (1940—2015)" etc.

Great social response was triggered by annual scholarly conferences 'Crimea in the History of Ukraine' started by M.S. Hrushevsky Institute of Ukrainian Archeography in 2014. They discuss a wide range of issues of Crimean history and culture, political and socio-economic ties of the peninsula with the mainland Ukraine.

Assessing in general the tragic events in Crimea and Donbas, Academy scholars in socio-humanities emphasize that not only they create major threats for political and socio-economic progress in Ukraine but, at the same time, should disseminate among people the understanding of the importance of their personal choice and their inevitable responsibility for it as opposed to state paternalism. Social integration should become the dominant principle of Ukraine's state policy. They advanced convincing arguments that the idea of sobornist — the spiritual community of many jointly living people — is and will remain dominating among both the people and Ukrainian political circles.

The recent period of national revival has witnessed intense progress in Academy's *linguistic, literature and art studies* — research areas that reach the greatest depths of people's spiritual life and exert the most profound influence on person's general culture. Linguistic scholars, relying on both time-tested and modern methods, studied and revealed the contentual, esthetic, stylistic richness of the Ukrainian language, its viability and vital energy. Broad comparative studies of the Ukrainian, Slavic and non-Slavic languages were carried out. Experts prepared detailed analytical documents and recommendations towards comprehensive development and functioning of the Ukrainian

Signing a collaboration agreement between the NAS Institute of Archeology and the National Museum in Warsaw. Poland, Warsaw, 30 May 2017

Ukrainian – German collaboration in the field of Antique Archeology. Participants of the Ukrainian – German Forum of Young Researchers. 7 – 12 December 2017

language as the official one in all spheres of social life on the entire territory of the state, while ensuring the freedom of the development of the languages of all ethnic groups in Ukraine.

The unchallenged priority of Academy philologists has been and remains their concern for the high quality of the Ukrainian language. They carefully study the details and fine points of the eternal linguistic ar-

Remains of two potter's stonehearths on Taliankivske (Trypillia, 2015)

eas — phonetics, morphology, syntax, and word formation. The Institute of the Ukrainian Language (its Director is P.Yu. Grytsenko, Dr. Sci. (Philol.)) is engaged in versatile research of the Ukrainian language in its literary and dialect manifestations at present and in the past.

For many decades the leading positions in Academy's philological sector have been taken by O.O. Potebnya Institute of Linguistics. Acad. V.G. Sklyarenko was its director for many years, since 2017 the institution has been headed by B.M. Azhnyuk, Dr. Sci. (Philol.). The Institute has won international recognition by its research into theoretical and methodological issues of general, Slavic, Baltic, Germanic and, naturally, Ukrainian linguistics, structural, computational and other aspects of linguistics. The focus has been on comparative studies of the Slavic languages, research into the origins, evolution and functioning of the languages of the East, West and South Slavs. The Institute is the leader in such promising research areas as sociolinguistics, psycholinguistics, ethnolinguistics, and cognitive linguistics.

The difficult and urgent task of introducing innovative information and computer technologies into linguistics was assumed by the Ukrainian Lingua-Information Fund, which operates successfully under the leadership of Acad. V.A. Shirokov. Its scientists have created Ukraine's first comprehensive electronic dictionary of the Ukrainian language — an integrated lexicographic system 'Dictionaries of Ukraine'. Ten versions of that have been released. It contains information about Ukrainian words in five mod-

Archeological artifacts stored in the collections of the 'Olvia' National Historical and Archeological Conservation Area of the NAS of Ukraine and Odesa Archeological Museum of the NAS of Ukraine: perfume container from Aphrodite Temple in Borysthenes (Miletus, the second half of the 6th century B.C.); gold decorations from burial places (expeditions of 2010 and 2015); kylix bowl with the picture of runners (Athens, early 5th century B.C.); vessel (Trypillian culture, 4th millennium B.C.); gold coin of Prince Volodymyr (10th century A.D.); treasure of coins (Kizik, Asia Minor, 5 – 4 century B.C.)

Ukrainian scholars among the participants of the International Colloquium at Charles de Gaulle University. France, Lille, 22 September 1993

ules: inflection, transcription, synonymy, antonymy and phraseology. This system is in free access on the Web-site 'Ukrainian dictionaries on-line', which functions under the umbrella of the Ukrainian Language Portal and is the foundation of the Ukrainian Dictionary Base, which is a scientific facility with the status of the National Asset of Ukraine. The Ukrainian Lingua-Information Fund is creating a large-scale electronic linguistic corpus in which it plans to include all kinds of Ukrainian texts in existence. The implementation of such an idea has become linguists' brand in all developed countries. The Fund has initiated the adoption of the State Program 'Information. Language. Intellect', which sets an ambitious goal — to create intellectual digital linguistic systems able to handle the natural language. In general, fundamental theoretical and highly efficient practical developments of the Fund have laid reliable basis for the development of Ukrainian computer linguistics.

Having fundamental scientific results as their goal, Academy philologists also focus on practical issues of preserving the inherent features of the Ukrainian linguistic tradition, following the norms of the Ukrainian language, its stylistic improvement, preventing its vulgarization and contamination with calques from foreign languages. Improvements in mass linguistic culture

Scholars of the NAS Institute of the Ukrainian Language with Acad. B.E. Paton, President of the NAS of Ukraine, in the session hall of NAS Presidium. Left to Right: NAS Corr. Memb. N.F. Klimenko; K.G. Gorodenska, Dr. Sci. (Philol.); N.G. Gorgoluk, Cand. Sci. (Philol.); P.Yu. Grytsenko, Dr. Sci. (Philol.); NAS Acad. B.E. Paton; NAS Corr. Memb. S.Ya. Yermolenko. 18 April 2018

Sitting of the academic council of O.O. Potebnya Institute of Linguistics of the NAS of Ukraine. 2017

are facilitated by the "Ukrainian Language" encyclopedia (3 editions were published), 3-volume "Atlas of the Ukrainian Language", 7-volume "Etymological Dictionary of the Ukrainian Language", "Pan-Slavic Linguistic Atlas" (an international project, 16 volumes have been issued and the publication is being continued). The publication of the 20-volume "Dictionary of the Ukrainian Language" was started (7 volumes have been released). A number of terminology, grammar, translation, bi-lingual and multilingual dictionaries have been published.

There is the International School of Ukrainian Studies (headed by Corr. Memb. R.P. Radyshevsky), which elaborates and implements scientific methods of teaching Ukrainian and related disciplines to foreign learners. It has organized a number of annual summer schools for learners from European and American countries. The International School of Ukrainian Studies, in

Ceremonial session to mark the 75th anniversary of T.H. Shevchenko Institute of Literature of the NAS of Ukraine. Acad. M.G. Zhulynsky, Director of the institution, makes a congratulatory speech. Kyiv, November 2001

collaboration with the Philology Institute of Taras Shevchenko National University of Kyiv and T. Shevchenko Institute of Literature, publishes works of foreign scholars in Ukrainian studies, belles-lettres of diaspora authors, as well as such series as "Ukrainica studies" and "Kyiv Polonica studies".

The NAS Research and Educational Center of Foreign Languages (its Director is V.Ya. Zhalai, Cand. Sci. (Philol.) provides the purposeful teaching of foreign languages to young Academy scientists, focusing on academic writing, studies theoretical and practical issues of translation from Ukrainian into major European languages and vice versa.

Traditionally, the major influential center in Ukrainian literature studies is T.H. Shevchenko Institute of Literature. In all the years of independence the Institute has been headed by Acad. M.H. Zhulynsky. The common denominator of Institute's research is the demonstration how the rich language and high mentality of the people generates a rich literature of high artistic merit.

The Ukrainian literature is studied over the entire period of its existence, in all its trends, styles and genres, written in its native land and abroad. The Ukrainian literary process is considered in the multi-dimensional comparison with the general Slavic, European and the global ones. In recent decades, a number of hitherto little-known texts in literature history, creative work of diaspora authors, literatures of national minorities have been involved in the research sphere. Special focus has been given to the scholarly studies and popularization of the collection of manuscripts of T. Shevchenko and other classics. The manuscript collection of the Institute is the largest one in Ukraine — over 100,000 items — and contains priceless documents. With its studies of early, new and modern Ukrainian literature, foreign literatures, textological, theoretical and comparative studies, the Institute has created a reliable research basis that promotes the development of literature in Ukraine, training and education in literature, providing information about Ukrainian literature for the Internet space.

Here are the major achievements of Academy's researchers in literature: T. Shevchenko

Sitting of the International Commission on Studying the Culture of the Population of the Carpathians and the Balkans. Chairman – S.P. Pavlyuk, Dr. Sci. (Hist.). Late November – early December 1993

Presentation of NAS Acad. S.I. Pirozhkov at the round table talk 'Humanitarian challenges and social consequences of the war in eastern Ukraine' at the M.T. Rylsky Institute of Art, Folklore Studies and Ethnology of the NAS of Ukraine. Kyiv, 22 September 2015

Institute of Literature published the fundamental 6-volume "Shevchenko Encyclopedia". It contains the most comprehensive data on Great Kobzar's life, creative work and personality, his epoch and milieu, his place in the national and world cultures. Concurently, the "Complete Works by Taras Shevchenko" in 12 volumes, which contain his entire known literary and artistic legacy, were published. All information about Shevchenko is presented on the Web portal of the Junior Academy of Science, which has been created collaboratively by the Institute of Literature and the National Center 'Junior Academy of Sciences' (Its President is Acad. S.O. Dovhyy). There one can follow every episode and every year in Shevchenko's biography and virtually follow the life path of Great Taras.

The Institute of Literature has started publishing the "History of Ukrainian Literature" in 12 volumes (the project is headed by Acad. V.G. Donchyk; as of today, 4 volumes of this work have been issued).

Ivan Franko studies have been developed in harmony with those of T. Shevchenko.

The Institute of Literature, jointly with I. Franko Institute of the NAS of Ukraine, which has recently been established in Lviv (its Director is Acad. Ye.K. Nakhlik), implements a project of the national scope — the 7-volume "Franko Encyclopedia" (its 1st volume has been issued). The task was set to compile the catalogue of all Franko's manuscripts and printed works written and published in all languages both in Ukraine and abroad.

T.H. Shevchenko Institute of Literature was the host institution for preparing and publishing the fundamental culturological work "History of Ukrainian Culture" in 5 volumes, 9 books, which won the 2014 State Prize of Ukraine in Science and Technology. It provides a systemic description of the many centuries of Ukrainian culture, reveals its individuality and ties with other cultures, shows its contribution to the world cultural heritage.

The Academy develops ethnography and art studies on new scopes and at new levels. These studies are centered at M.T. Rylsky Institute of Art Studies, Folklore and Ethnology (its Director is Acad. H.A. Skrypnyk) and the Institute of Ethnology, headed by Acad. S.P. Pavlyuk. All layers of folk culture — folklore, music, decorative art, everyday practices and moral principles are examined without constraints, bans and bias. All that is combined with the studies of professional art and the newly-emerged digital culture. The analysis of rich artistic experience results in fundamental theoretical generalizations in ethnology, folklore, culture and art studies.

True contributions to the Ukrainian culture are numerous multi-volume collaborative works: "Ukrainian Music Encyclopedia", "History of Ukrainian Music" in 5 volumes, "History of Ukrainian Art" in 5 volumes, "History of Decorative Art of Ukraine" in 5 volumes, "Ethnic and Ethno-Cultural History of Ukraine" in 3 volumes, "History of Ukrainian Ethnography" in 3 volumes, "History of Ukrainian Theatre" in 3 volumes, "Ukrainian Encyclopedic Cinema Dictionary" in 3 volumes, "Modern Foreign Ethnology" in 2 volumes, the "Ukrainian Ethnological Heritage" series. Lviv ethnologists have published fundamental collaborative monograph "Ethnogenesis and Ethnic History of Ukrainian Carpathians Population", numerous individual monographs concerned with Ukrainian folk medicine, folk fabrics, sacral wooden architecture, T. Shevchenko's heritage of paintings in the context of European art, Pre-Romanticism and Romanticism folklore etc.

A large-scale folklorist and ethnographic study of all Ukrainian regions is carried out and an electronic data base of the available and lost cultural heritage objects is being formed.

The Ethnology Institute has under its jurisdiction the unique Museum of Ethnography and Art Crafts (Lviv) with its immense collection of rare furniture, clocks, china, pottery, artistic glass and embroidery (nearly 90,000 items) and the Ceramology Branch in the town of Opishnya (Poltava Oblast) with its collection of folk pottery that is the best in Ukraine and, perhaps, in the whole world. These are two sites of international interest.

Academy's achievements in today's socio-humanities are a tremendous contribution to the intellectual, cultural, spiritual self-determination of Ukraine and its presentation to the world community.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ПРИРОДОЗНАВСТВО
ТЕХНІЧНІ НАУКИ
ГОЛОВНИЙ РЕДАКТОР ЖУРНАЛУ академік НАН УКРАЇНИ А.Г. НАУМОВЕЦЬ
2 2018


УРНАЛИ НАН УКРАЇНИ, ВИПУЩЕНІ
«АКАДЕМПЕРІОДИКА»


ЖУРНАЛИ НАЦІОНАЛЬНОЇ АКАДЕМІЇ НАУК УКРАЇНИ

SCIENTIFIC INFORMATION PROVISION AND PUBLISHING ACTIVITIES AT THE NAS OF UKRAINE

CHAPTER 4

Provision of scientific information is an important element of Academy' life. It covers a large system of interrelated areas of information-providing and publishing work that includes publicizing and propagation of scientific research outcomes, integration, secure storage, classification, analysis, generalization and dissemination of scientific and S&T information, providing the access to knowledge sources for both a wide circle of experts — scientists and academics — and the targeted, addressed, aimed at facilitating basic and applied research information support to programs and projects of various scopes. An increasingly important place in scientific information provision is taken by coverage of the work of research institutions, vertical and horizontal communication in the scientific community. The invariable task of NAS information-providing activities over a hundred years has been the popularization of knowledge, its dissemination in the society.

In the Academy, scientific information work is carried out by libraries, publishing houses, archives, museums, and recently they have been joined by websites and web portals of NAS institutions, a grid network and the all-Academy *UARNET* web network, information analytics services, centers and councils for intellectual information technologies. The activities of all those structures are organized and coordinated by NAS Presidium, sections, departments, Library-Information and Academic Publishing councils, Academy committees and commissions.

The independence of Ukraine considerably enhanced requirements to the organization of scientific information provision and publishing work.

Since the early 1990s new opportunities have been opened up for free dissemination of scientific research results, all ideological barriers and regulations that for decades restricted the development of Academy book publishing have been eliminated. New times demanded the updating of the scholarly achievements of Ukrainian scientists, renovation of the language in general and scholarly terminology in particular, which was of utmost importance for the confident accession of the Ukrainian academy science to the global space of scientific information, involvement in the scientific discussion of the world scope.

Under the very difficult conditions of restructuring the business principles and the entire economy of the country, the Academy and its Academic Publishing Board (APB), which was headed by Acad. V.V. Nemoshkalenko, put a lot of effort into preserving, updating and developing publishing work, switching it to new organizational principles and new technologies. In the first half of the 1990s the NAS of Ukraine set up the Center for Publishing Process Automation, which started text processing with publishing computer systems, and the Specialized Printing Office of Scientific Journals. The publishing of the all-Academy journals *Herald of the NAS of Ukraine* and *Proceedings of the NAS of Ukraine*, first of all, was transferred to the latter.

All scientific institutions of the Academy were granted the unlimited right to publish monographs, collected works and conference proceedings outside publishing houses. The publication of scientific journals was transferred from "Naukova Dumka" Publishing House to relevant scientific institutions, which shortly afterwards adopted computer technologies, introduced up-to-date methods of producing printer layouts and alternative, less expensive, types of printing. Now up to 85 % of Academy's published products are issued by scientific institutions on their own or with the involvement of outside publishers. The proportion of books issued by specialized academic publishers abroad is rising, lately it has been over 20 %.

At the same time we had to find out the ways of distributing academic editions, as after the collapse of the USSR the system of scientific publications distribution was actually ruined. Purposeful efforts resulted in the general increase in the statistics of published books and periodicals. In 1992, 661 books and 81 periodicals were issued, while in 2002 — 727 books and 102 periodicals.

Since 2002 the further upgrading of Academy's publishing activities has been continued by Acad. Ya.S. Yatskiv, APB Chairman. The specialized printing office was reorganized into the 'Akademperiodyka' Publishing House of the NAS of Ukraine, which is the host organization for the APB. A group for scientific and methodological support to the NAS publishing was set up; it has prepared various documents, approved by NAS Presidium, that regulate various aspects of academic publishing at research institutions and the Academy at large. Among them was the regulation on issuing published products at the NAS of Ukraine, on the academy book series and periodicals, on providing major libraries, scientific and educational institutions with copies of published editions, on functioning of individual publishing projects etc. Academic publications were included in the state assignments.

In the years of Ukraine's independence, NAS publishers and institutions have issued over 12 thousand scientific editions; more than 12 thousand titles of collected scholarly works, popular-science and educational literature; nearly 1200 scientific monographs abroad; over half a million scientific papers in total, including nearly 100 thousand in foreign periodicals. The Academy traditionally publishes nearly 60 thousand copies of books and journals annually. The maximum numbers were published in 2006—2008, which can be explained not only by the relatively stable economic and political situation in the country but also by the celebration of Academy's 90th anniversary: it is only natural that such a notable jubilee required summing up and publicizing major scientific results and historical studies.

Over recent decades, quite a number of socially important fundamental editions have been published; those have won rec-

ognition both in Ukraine and beyond its borders. Issued were: "Juridical Encyclopedia" (2004), "National Atlas of Ukraine" (2007), "History of Ukrainian Culture" (2013), "Encyclopedia of the History of Ukraine" (2013), "Shevchenko Encyclopedia" (2015), "Encyclopedia of International Law" (its publication is to be completed in 2019). The projects of preparing "Franko Encyclopedia", "History of Ukrainian Literature", "Dictionary of the Ukrainian Language" and "Encyclopedia of Contemporary Ukraine" are underway.

Through the initiative of the SPB of the NAS of Ukraine and Academy publishers, the following ongoing publishing projects were launched: 'Academic Book' (implemented since 2001), 'Academic Translations', 'Science for Everybody', 'Program in Support of NAS Journals' (2004), 'Academic Book. Young Scientists', and 'Ukrainian Academic Book in a Foreign Language' (2009). As of today, 470 titles of scholarly monographs in the total number of nearly 150 thousand copies have been published in Ukrainian and Russian under 'Academic Book' project. Young scientists were able to publish the results of over 50 individual and collaborative studies within the project allotted for them. Under the project 'Ukrainian Academic Book in a Foreign Language' 28 scientific monographs were published in English. The project 'Science for Everybody' now consists of 18 editions addressing various branches of science. Under the program in support of NAS journals, over the time of its functioning, more than 40 titles of periodicals were published, the total number of issues being in excess of three thousand and the overall number of copies amounting to 700 thousand.

The projects mentioned are divided between Academy publishers, whose work is complementary in this respect, as that in the sphere of scientific methodology as well. 'Naukova Dumka' Publishing House are working on the development of the national scientific terminology, organizing the annual conference 'Ukrainian scientific terminology' and preparing fundamental dictionaries for publication, e.g., those of Ukrainian synonyms, foreign borrowings, proper names, collocations, spelling etc. In 1994—1998, for the first time in the history of Ukraine a "Russian—Ukrainian Dictionary of Scientific Terminology" was published in three books: physical, technological and mathematical terminology; chemical and biological terms; and terminology of socio-humanities.

'Akademperiodyka' Publishing House carries out considerable work for introducing advanced information and communication technologies and international standards to publishing activities in Ukraine. For that purpose, with the support from the APB, the annual scientific conference 'Academic periodicals: traditions and innovations' has been organized, methodological recommendations on harmonizing Ukrainian periodicals with the international standards and requirements have been published, and the concept of forming the segment of NAS published products in the electronic medium has been approved.

The APB of the NAS of Ukraine provides scientific and methodological support to the publishing activities and monitors the representation of Academy's scientific products, since 2004 it has been presenting regularly updated catalogues of books and periodicals on its web resource.

Today's challenges encourage the optimization of the academic book publishing system and the network of academic periodicals, adoption of the international experience in publishing business and require new relevant decisions to enhance the publishing activities and publicizing activity of

the Academy. The integration of traditions and innovations in Academy's publishing activities is the guarantee of harmonious development of the respective segment of the world information space and the purposeful information policy of the state.

The principal role in the information support to scientific research, as well as publicizing and popularizing its results, is played by the network of Academy's libraries including V.I. Vernadsky National Library of Ukraine (VNLU), Vasyl Stefanyk Lviv National Scientific Library of Ukraine (LNSLU) — two largest libraries of Ukraine — and 98 specialized libraries of research institutions. This library complex is the most powerful in Ukraine and one of the most powerful library systems in Europe. The stock of VNLU, which is among the twenty largest libraries of the world, now amounts to 15.7 million documents recorded on all types of information media — first and foremost, books, manuscripts, journals and magazines, annual newspaper filings, compact disks; the stock of LNSLU is over 8 million, and in total the Academy library network possesses nearly 32 million documents.

The stocks of the largest Academy libraries of Ukraine are of the utmost historical and cultural value, they have the National Asset status. According to experts, VNLU keeps up to 70 % of all national and world manuscript and book heritage possessed by Ukraine. VNLU and LNSLU play the leading part in preserving, studying and publishing them.

At the same time these libraries respond to present day challenges. The information resources of VNLU, LNSLU and other Academy libraries efficiently cope with both the needs of NAS institutions carrying out basic and applied research and efficiently meet increasing information requests of all scientific and educational sphere, cultural and administrative establishments and, in general, of the political, legal, socio-political, S&T and innovation progress of Ukraine as a sovereign European state.

In recent decades, VNLU, LNSLU and libraries of scientific institutions have covered a long distance from traditional book depositories to information centers that provide integration, processing, backed with intellectual technologies, dissemination of scientific information recorded on all kinds of media, and form large-scale data bases. They embody the novel conceptual model of the 21st century library as an *infopolis*, which conducts research, provides scientific information and scientific analysis, is engaged in publishing, is a cultural and educational complex with a developed infrastructure to form and process, relying on advanced intellectual information technologies, streams of documents, to meet ever increasing needs of science, industry, education and science, provide support to innovative development.

VNLU has developed a powerful information resource of printed and electronic documents on a national scope, which includes the interrelated system of electronic catalogue, abstract database, a repository of national scientific periodicals, which is unique in terms of entirety, full-text online libraries, digital collections, archives, databases about the past, and even to a greater extent, about today's Ukraine, first and foremost, its science.

In total, the electronic resources that can be accessed through the *Main Information Portal of VNLU* now contain 4.3 million records and over 850 thousand full texts. The buildup of electronic resources and the extension of their use is made in three mutually related ways: digitizing traditional resources, collecting digital copies of printed works and

editions that only exist in electronic form, and providing the access to web resources through the library.

Today the largest library of Ukraine provides free access to its resources not only for all regions of the country but for the whole world: 20 % of remote users of VNLU electronic resources are from other countries. For them the Library is a kind of "window" to Ukraine. The total number of remote users has amounted to 4 million, the average daily number of their calls to VNLU web resources is 60 thousand; in 2017 a total of 401.5 various requests were made. And users downloaded 26.1 million text files from VNLU resources into their computers, which was nearly 30 times more than the number of printed documents provided to users in its reading halls.

The *Repository 'Scientific periodicals of Ukraine'* — an integrated scientific multidiscipline digital library of professional publications — takes the central place in the structure of VNLU electronic stock. Now the Repository contains papers from nearly 2600 Ukrainian scientific journals and continued collected works — all in all, over 800 thousand full texts. Every year the demand for the *'Ukrainica Naukova' abstract database* is increasing. It was started in 1998 in collaboration with NAS Institute for Information Recording (IIR) and has been built up by VNLU. As of today, that is the only Ukrainian public multipurpose database containing information about scientific publications in all knowledge fields. The total number of sources represented in the '*Ukrainica Naukova*' abstract database now exceeds 650 thousand and increases by approximately 50 thousand annually. Due to the effective collaboration of IIR and VNLU with the editorial boards of periodic and continued editions, the 100 % representation of NAS scientific journals has been achieved, and editions of higher education institutions of all Ukraine's regions have also been involved. The number of journals and collected works publications reviewed in '*Ukrainica Naukova*' is now 53 % of the total number of Ukraine's professional scientific editions. The printed*"Dzherelo" Ukrainian review journal*, which was started back in 1995, is based on '*Ukrainica Naukova*'.

Amongst the information innovations of VMLU a special place is taken by the ***portal*** *'Science of Ukraine: access to knowledge'*, which today integrates data on 420 research institutions and organizations, as well as universities. It carries out search across stocks of 230 scientific libraries and across publications of over 133 thousand researchers, provides access to full texts and data on their citations.

The information potential of the 'Science of Ukraine: access to knowledge' portal combined with the *base 'Bibliometrics of Ukrainian science'*, created by VNLU and whose task also is to form the integral picture of the national scientific community, provides unique data for analyzing the state and achievements of the Ukrainian science. That information-analysis system, which was launched in 2014, contains the united register of scientific declarations (bibliometric profiles) of scientists and research teams; analytical information on sectoral, departmental and regional structure of Ukraine's science; the source base for expert assessment of scientific research efficiency.

Of fundamental importance for analyzing the problems of today's Ukraine is another VNLU website *'Center for studying social communications'*, which presents the data of national monitoring carried out by VNLU subunits — the Service of Analytical Information Provision, the Ukraine's Presidents Foundation and the National Legal Library — covering the national information space in its socio-political dimension and

provides scientific analysis. In recent years the amount of prognostic, information and analytical documents, and data prepared by VNLU has significantly increased. The total number of collective users is over 3000. They have been provided with 19 titles (over 700 issues) of information, analytical, review and prognostic bulletins, in particular, the series "Ukraine: events, facts, comments", "Public opinion on law-making", "Resonance", "Social networks as a factor of information security", "Ways of Ukrainian science advancement".

No less proactively is V.I. Vernadsky National Library of Ukraine, which is the major keeper of the national book and manuscript heritage, building up its electronic resources in the field of culture. In the recent decade, the *digital collections of old printed books* and *bases of Ukrainian scholars' document heritage* have been created. The electronic *'Ukrainian national biography archive'*, *'Shevchenko collection'*, *electronic archives of academicians V.I Vernadsky and M.S. Hrushevsky, eminent scholars of Ukraine*, are being filled. The latter is a joint information project with the NAS Institute of the History of Ukraine.

'*Shevchenko portal*', created by collaborative efforts of T.H. Shevchenko Institute of Literature and the National Center 'Junior Academy of Science', is unique in its scholarly, cultural and nation-consolidating significance. It has integrated the information about Great Kobzar, his life and creative achievements that was accumulated by scholars while preparing the 6-volume "Shevchenko Encyclopedia".

The Institute of the History of Ukraine fulfils a scientifically and scholarly important mission of publicizing the achievements of Ukrainian historical science in the electronic information space — from its origins to the works of present-day researchers, including works addressing numerous burning issues. Its web site provides free access to 10 thousand documents, specifically, the electronic versions of the "Encyclopedia of the History of Ukraine", produced by the Institute, archeographic publications, collaborative and individual monographs, brochures, proceedings prepared by its scholars as well as researchers of numerous other scholarly and higher education institutions of all Ukrainian regions.

VNLU has recently started work towards compiling the '*Ukrainica*' *electronic library*. It already consists of many thousand documents and in the near future will be like those fundamental national collections of books and manuscripts that have long been actively enriched in many countries and have become important elements of their national information complexes. The goal of the project is to collect in the digital format the works in any language, irrespective of the place of their publication, about the Ukrainian people, the territory of Ukraine and about all ethnoses that ever lived or are living now on its lands. That will provide the users of electronic library with a large amount of varied information about Ukrainians, their history, traditions and culture, achievements of the Ukrainian nation and state. The data on the natural, geographic environment of our home country, its demographic, economic, social, educational and scientific potential are being accumulated. To a great extent, the implementation of such large-scale information project has become possible due to the compilation of fundamental retrospective national bibliography by several generations of scholars.

Recent years have witnessed a noticeably broader repertoire and genre diversity of reference and encyclopedic editions, bibliographic and biobibliographic reference books. To accelerate the formation of ency-

clopedic resources and their proper presentation on the Internet, in 2016 the Institute of Software Systems developed relevant Wikipedia-compatible software.

It is the availability of such reliable reference and bibliographic foundation, as well as software systems, that enables experts to implement the general idea of forming the integrated digital resource of Ukraine's document heritage and organize the access to scientific reference, bibliographic full-text materials and simultaneous presentation of authentic documents in the digital format on the sites of research and educational institutions, libraries, museums, archives both on the national and the world Internet.

Now, relying on the research performed, VNLU is launching a new, innovative in its organization principles, project — the buildup of the fundamental nation-wide electronic scientific library '*Scientific Assets of Ukraine*', equipped with highly intellectual software add-ons, which will ensure the integration of national scientific information resources and provide free online access to them from all Ukrainian regions and from abroad, and hence, will help enhance the efficiency of scientific research and scientists' work.

Traditionally, an important place in the information-providing activities of leading Academy libraries also belongs to collecting safety funds of unique documents and exchanging their replicas with other research institutions, in particular, on the principles of partnership with foreign organizations. This work plays a noticeable role in integrating information on the landmarks of national historic, cultural and scientific heritage, many of which were scattered around the world for centuries. In this respect, VNLU has implemented mutually advantageous information projects with libraries of Poland and Belarus. VNLU has been exchanging electronic replicas of documents with Polish institutions for many years.

The formation of considerable information massifs and active scientific information exchange is also related to scientific research, including the involvement of NAS institutions in implementing international scientific projects, forming large databases and databanks by using their results. E.g., going on is the accumulation of initial research data of e-science, their processing and supplying them to users in grid clusters of the Main Astronomical Observatory, V.M. Glushkov Institute of Cybernetics, Bogolyubov Institute for Theoretical Physics, National Science Center 'Kharkov Institute of Physics and Technology', and a number of other leading Academy institutions. The NAS Institute of Sociology, relying on the results of its many-year involvement in the all-European sociological monitoring carried out under the auspices of the European Union, has collected a bank of primary information.

Also significant is the information potential of Academy's museums, whose stocks contain over 3.5 million artefacts. The importance of those is often underestimated. Yet, each museum exhibit contains a bunch of information, visual information at that. Museums are the earliest information collectors and media. Extremely rich collections that always attract visitors, irrespective of their age and education, are displayed in the National Museum of Natural History, the State Natural History Museum (Lviv), Odessa Archeological Museum, 'Olvia' National Historical and Archeological Conservation Area (Parutine village, Mykolaiv Oblast). They have won the worldwide fame. The technological museum of E.O. Paton Electric Welding Institute, archeological museums of the Institute of Archeology and I. Krypiakevych Institute of Ukrainian

Studies, the Museum of Ethnography, Folk Art and Crafts of the Ethnology Institute, Opishne Ceramology Museum of the Ethnology Institute, Ethnographic Museum of M.T. Rylsky Institute of Art, Folklore Studies and Ethnology, Manuscript Museum of the T.H. Shevchenko Institute of Literature are also the gems of museum collections. Academy's museums are true national assets. They preserve, scientifically describe and popularize unique artefacts that give evidence of the rich history, language, culture and nature of Ukraine.

The Academy gives relentless attention to extending the network information provision of scientific research. Its key element is organizing a system of online access to the resources of leading world providers of scientific information, which was launched in 2006 and enabled Academy institutions to use a number of network resources, the most important of those being: information products on the *EBSCOhost* platform, which cover nearly 8 000 periodicals; the scientific library of *Elsevier* publishers, which contains 24 subject collections with the total number of over 2 thousand journals; scientometric systems *Scopus* and *Web of Science*. Besides, a number of various science information resources are occasionally available for Academy scientists in the testing regime. NAS researchers received over 0.5 million full text documents annually from those sources. The coordination work to organize access to data bases is carried out by V.I. Vernadsky National Library of Ukraine.

An essential element of NAS information activities is popularization of S&T achievements, diffusion of knowledge, presentation of new engineering inventions, technologies and Academy editions to the general public. These activities are organized and coordinated by the Press Center of the Academy, Information and Library Board, Academic Publishing Board, '*Nauka*' Exposition Center. Numerous scientific councils, committees, commissions, associations and societies functioning in the Academy at large and in its institutions in particular are also involved in this work.

The need for more intense S&T propaganda is growing not only because Ukraine becomes engaged in the global process of building the knowledge-based society, with science increasingly revealing its role of a direct productive force. However paradoxical it may seem, but today's society is witnessing, alongside the enhanced importance of science, the dissemination of unscientific, pseudoscientific and antiscientific views and ideas, mysticism, occultism, and even the early primitive shamanism. All that penetrates the vacant cracks and niches of public conscience that are free from science. Fast knowledge updating, accelerated information turnover, varied information noise prevent people who are not used to quick analysis of large amounts of information from promptly distinguishing between the true and the false, including information about science, scientists, scientific generalizations or achievements of one kind or another. They can form an inadequate, even hostile, attitude to science and its institutions. Knowledge popularization has always been instrumental in science's self-support and self- defense.

The demand for information support will grow alongside the advancement of the information- and knowledge-based society. The future of information services and information provision depends on the degree and the rate of digital culture adoption, provided that the best accomplishments of the print culture are retained. Integrated, widespread and wide-scale switch to pathways which will build in the information

infrastructure into the digital culture is on today's agenda. Yet, it should be remembered that all achievements of the human genius in the pre-digital era are recorded as the handwritten or printed word or on the sound or video media. And digitization alone does not solve all problems of their storage and using. To harmonize the traditional and digital cultures, traditional and digital resources, traditional and digital services is the true and reliable way of a new rise of the information sphere.


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ВИ І ВАША АУДИТОРІЯ
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INTEGRATION OF SCIENCE AND EDUCATION

CHAPTER 5

Strengthening the ties of science and education is an important area of the activities of the National Academy of Sciences of Ukraine. The NAS of Ukraine takes the principled stand that integration processes should be implemented, bearing in mind the national traditions in the functioning and development of both science and education, in particular, through establishing the efficient continuous interaction of universities with NAS research institutions.

Such interaction has become an established practice and covered the entire education process: from school to the training of masters and research personnel of the highest qualification, which is implemented through joint scientific research, training highly qualified researchers, writing monographs, compiling dictionaries, preparing educational, encyclopedic and reference editions by collaborative teams of authors and in some other ways. Namely, NAS research institutions annually conclude about 200 collaboration agreements with educational institutions. Under them, students' internships are carried out at Academy's research institutions, individual consulting is provided by scientific advisers, who are research associates of Academy institutes, for students preparing their term and graduation papers. Year after year, around 200 joint scientific projects have been implemented. Leading scientists of NAS research institutions are also widely involved in training future specialists at institutions of higher education. Over recent years, annually: about 1200—1300 NAS scientists have provided training courses of various disciplines, delivered cycles of lectures in highly relevant science areas, every tenth of them being NAS academician or corresponding member; 200—240 academics defend their doctoral or PhD theses at the specialized councils of NAS scientific institutions; 1100—1300 students write their graduation papers under the guidance of leading NAS scholars. Besides, every year nearly 400 research associates and lecturers of the establishments of higher learning and institutions of the MES of Ukraine raise their proficiency at NAS scientific institutions.

The NAS of Ukraine also provides expert assessment of draft study curricula for core subjects of comprehensive secondary schools and participates in their develop-

ment. In the autumn of 2017 the Ministry of Education and Science of Ukraine, supporting a NAS initiative, commissioned its scientists to prepare study curricula in physics and astronomy for students of the 10—11th years of secondary schools. The committees set up for that purpose, which involved scientists of NAS institutions, leading teachers, instructors of gymnasia, lyceums, universities, promptly fulfilled those projects. They were positively appraised by NAS scientists and approved by the Ministry of Education and Science of Ukraine.

Academy's scientists are also regularly involved in the expert assessments of textbooks for secondary schools, in order to establish whether their contents agree with modern scientific ideas.

The creative partnership of scientists and academics gives rise to collaborative monographs, textbooks and manuals for institutions of higher education.

In particular, the NAS Institute of Mathematics, jointly with Taras Shevchenko National University of Kyiv, prepared and published in English "Differential Equations: Textbook"; Bogolyubov Institute for Theoretical Physic, in collaboration with Taras Shevchenko National University of Kyiv, produced and issued the manual "Fundamentals of Graphene Physics"; a team of authors of M.G. Kholodny Institute of Botany of the NAS of Ukraine and the National University of Bioresources and Nature Management of Ukraine published the manual "Geobotany: Explanatory Dictionary"; a joint team of scientists of M.M. Gryshko National Botanical Garden of the NAS of Ukraine, State Institution 'Institute of Food Biotechnology and Genomics of the NAS of Ukraine', NAS Institute of Cell Biology, academics of the National University of Bioresources and Nature Management and Vinnytsia National Agrarian University published the monograph "A System of Using Bioresources in Innovative Technologies of Producing Alternative Fuels"; scientists and academics of the State Institution 'M.I. Dolishniy Institute of Regional Research of the NAS of Ukraine', the Scientific Research Institute of Intellectual Property of the National Academy of Legal Sciences of Ukraine and Kyiv National University of Trade and Economics prepared and published the monograph "National Innovation Systems: Evolution, Determinants of Effectiveness"; scholars of H.S. Skovoroda Institute of Philosophy of the NAS of Ukraine published a textbook for students of higher education institutions "Theoretical Issues of Modern Ethics"; a team of authors of V.M. Koretsky Institute of State and Law of the NAS of Ukraine issued the manual "Theory of State and Law".

In 2013—2015, 'Akademperiodyka' Publishing House of the NAS of Ukraine published in its 'Academic book in a foreign language' series the three-volume fundamental edition "Dark Energy and Dark Matter in the Universe". The team of its authors included scientists and academics of Ya.S. Pidstryhach Institute for Applied Problems of Mechanics and Mathematics of the NAS of Ukraine, Bogolyubov Institute for Theoretical Physics of the NAS of Ukraine, the Main Astronomical Observatory of the NAS of Ukraine, NAS Institute of Radio Astronomy, the National Science Center 'Kharkov Institute of Physics and Technology' of the NAS of Ukraine, NAS Institute for Nuclear Research, Taras Shevchenko National University of Kyiv, Ivan Franko National University of Lviv, and I.I. Mechnikov National University of Odesa. In 2016 the International Academy of Astronautics honored this book with its award in the category 'The best basic science book'.

A network of joint research-and-education structures, which are hosted by both

Participants of the All-Ukraine contest of research works of schoolchildren – members of the Junior Academy of Sciences (JAS) of Ukraine. In the center of First Row (Left to Right) are: Acad. V.T. Grinchenko, Director of the NAS Institute of Hydromechanics, member of JAS Presidium; Corr. Memb. S.O. Dovhyy, JAS President; L.K. Kadenyuk, the first cosmonaut of independent Ukraine, Hero of Ukraine. Kyiv, 7 April 2014

NAS scientific institutes and higher education establishments, has been functioning for many years running. In the last ten years, over 140 joint complexes, centers, laboratories, chair branches, and other education-and-research units have been set up, permitting NAS intellectual potential to be widely used for training highly qualified specialists to meet the needs of higher education and the NAS of Ukraine. In particular, this network contributes to using Academy's capability for providing training of masters of sciences and humanities to about 400 students of higher education institutions annually.

In this context it should be noted that the chemico-pharmaceutical training, research and production complex operating under the NAS of Ukraine and the MES of Ukraine, which was founded in 1997 on the basis of O.V. Bogatsky Physico-Chemical Institute of the NAS of Ukraine and I.I. Mechnikov National University of Odesa, provides training of specialists who are urgently needed by medicine and who possess profound fundamental knowledge in the field of physico-chemical biology. Of great importance is the fact that those experts actually during their training acquire experience which is necessary for future scientists and specialists in pharmacology, practical skills of using their knowledge, specifically, that of developing novel medical substances and deploying them in pharmaceutical industry.

In the early 2000s, in order to unite efforts of Academy institutions and universities in research and education, M. Dolisniy 'Ekonomosvita' Research-and-Training Center was

founded in Lviv. It became a new innovative form of collaboration of the academy and university science and merged the potentials of higher education and scientific institutions, as well as NGOs, around the idea of exchanging the progressive assets and experience of the best educational and research practices.

Now, M. Dolishniy 'Ekonomosvita' complex functions under the auspices of the Western Science Center of the NAS of Ukraine and the MES of Ukraine and consists of: the State Institution 'M.I. Dolishniy Institute of Regional Research of the NAS of Ukraine'; State Higher Education Institution 'Banking University'; National University 'Lvivska Politekhnika'; Ternopil National Economic University; Lviv University of Trade and Economics; Lutsk National Technical University; Lesya Ukrainka East European National University; NGO 'The Institute of Cross-Border Collaboration and European Integration'.

The key areas of M. Dolishniy 'Ekonomosvita' RTC are: development of joint professional specialized courses; involvement of Academy's leading scientists in the education process in the member institutions of the complex; supervision and assessment of term and master's papers; preparation and mutual reviewing of scientific and educational methodological works; advanced training of academics at partner institutions; training PhD students, doctorate fellows etc.; holding methodology workshops for young lecturers; collaborative work on public and self-financed research projects; joint participation in international projects and grants, holding joint international conferences and workshops; promoting international academic mobility of students and academics.

In 2017 the Complex launched the M. Dolishniy Contest of research works of PhD students and young scholars in regional economic development and cross-border collaboration.

Practical work showed that the successful operation of the Complex enables academics to incorporate research achievements into the education process, develop economic science and improve the quality of training professionals for the economy of Ukraine.

In 2003, 'Resurs' Academy Research-and-Training Complex (ARTC) was founded in Kharkiv. It is a regional research-and-training coordinating institution of two NAS scientific institutes and eight leading institutions of higher education of the Kharkiv region.

Educational activities of 'Resurs' ARTC are aimed at the comprehensive implementation of the principles of open-ended lifelong education that starts with studies at specialized lyceums, then continues at various departments and chairs of higher education institutions that are members of the complex, and further — at PhD students courses and doctoral fellowships, with research opportunities for the most talented young people; that assists in replenishing the academy, university and sectoral science with young talented researchers.

The Ukraine's first Department of Physics and Energy Engineering of dual subordination — to V.N. Karazin National University of Kharkiv and A. Podgorny Institute of Mechanical Engineering Problems of the NAS of Ukraine — functions within the ARTC. Leading scientists of Academy's Kharkiv research institutions are involved in teaching there.

It should be noted that considerable work for selecting talented young people and their involvement in scientific research is carried out by Bogolyubov Institute for Theoretical Physics of the NAS of Ukraine. For that purpose, a nonstructural

Meeting of the NAS delegation headed by Acad. B.E. Paton, President of the NAS of Ukraine, with the students of Physics and Technology Research-and-Training Center of the NAS of Ukraine. Kyiv, March 2007

sub-unit — Scientific Education Center — functions at the Institute. It works according to the system of continuous education in physics and mathematics for pupils of physics & mathematics lyceums and students of university physics & mathematics departments who are interested in studying under curricula beyond standard school and university ones. This system aims at training high-qualification researchers in theoretical and mathematical physics for scientific institutions of the NAS of Ukraine and higher education institutions. The Department of Physics of Taras Shevchenko National University of Kyiv, 'Igor Sikorsky Kyiv Polytechnic Institute' National Technical University of Ukraine, 'Kyiv Mohyla Academy' National University are actively involved in Center's work. Now the Center is integrated into the newly established Kyiv Academy University.

In 1995, the Higher Law School was founded under V.M. Koretsky Institute of State and Law of the NAS of Ukraine, which in 2000 was transformed into Kyiv University of Law (KUL), subordinated to the NAS of Ukraine.

Kyiv University of Law of the NAS of Ukraine is a state higher education institution that carries out the training of legal experts at a high professional level, with the account being taken of international education standards in professional fields 081 "Law" and 082 "International law".

Today, when radical changes take place in the Ukrainian education, KUL promptly responds to all contemporary challenges and provides training of next-generation specialists, taking into account the requirements of today's labor market. In the years of its existence the university graduated over 14 thousand specialists in law.

Kyiv University of Law of the NAS of Ukraine is a unique for the Ukrainian higher education combination of legal science and education, a kind of research-and-training complex in the sphere of jurisprudence. Such integration of education and science enables it to train legal experts according to European standards.

The training of students in their chosen areas and under master's programs is carried out by leading scientists in jurisprudence, NAS academicians and corresponding members at the chairs of: general theoretical and state-and-law disciplines; specialized legal sciences; international law and comparative jurisprudence; philosophy and socio-humanities; foreign languages.

International collaboration is one of the top priority areas of university's activities. Today it effectively collaborates with the

World Intellectual Property Organization (Geneva, Switzerland), and with educational institutions of Georgia — Shota Rustaveli State University in Batumi, Poland — Gdansk University, Hungary — Debrecen University, Tel-Aviv University, Ono Academic College etc.

The high reputation of the University is shown by the fact that Kyiv University of Law of the NAS of Ukraine has been awarded the honorary titles "Leader of Modern Education" and "Leader of Postgraduate Education of Ukraine", it was a first-degree laureate in the nomination 'Innovative activities of higher education institution in the integration into the European education and science'. And that is the evidence that the whole country has recognized the modernization of the education process at this higher educational institution.

The Higher School of Philosophy functions under NAS Institute of Sociology. Its activities are aimed at upgrading the qualification of university academics, sociologies and other specialists of various institutions, preparing textbooks and methodology manuals in sociology.

Since the late 1980s, the targeted training branches of Taras Shevchenko National University of Kyiv and the National Technical University 'KPI' have been functioning successfully under the NAS of Ukraine. Every year, graduates of these branches — highly qualified specialists and masters in priority areas of science and engineering — come to work and join PhD studies at NAS institutions.

In 2014, the targeted training branch of Taras Shevchenko National University of Kyiv started the contest of research projects implemented by joint scientific teams of the National Academy of Sciences of Ukraine and Taras Shevchenko National University of Kyiv. As of today, two contests have been held. According to their results, 19 of the 186 projects submitted have been implemented.

All those joint structures employ scientific and cognitive potential of the NAS of Ukraine, as well as its state-of-the-art research achievements, which contributes to training highly qualified research personnel for science, higher education and innovative activities.

The Junior Academy of Sciences of Ukraine (JAS) is a unique form of Academy's work towards discovering and supporting gifted schoolchildren. Leading NAS scientists regularly take part in holding events for JAS pupils in most diverse areas of natural, social sciences and humanities. JAS members are provided with opportunities to use scientific libraries and archives of NAS research institutions, to take part in scientific expeditions, archeological digs, field explorations, some experimental work, etc. As a result, every year 20—30 university graduates who attended JAS study groups back in their school years come to work to NAS scientific institutions as young specialists.

In fact, the partnership of scientists and academics embraces the entire education process: from secondary school to master's studies and training highly qualified research personnel.

Joint meetings of NAS Presidium and MES Board are held to discuss pressing issues of common interest. According to their results, relevant resolutions are adopted. In 2015—2016, two such meetings were held. In particular, they addressed the issues of implementing the provisions of the Law of Ukraine 'On Scientific and S&T Activities', implementing the agreement on Ukraine's participation in "Horizon — 2020" EU program for research and innovation, fulfilling the agreement between Ukraine and the European Organization for Nuclear Research (CERN) on granting Ukraine the associate

membership in that organization, founding Kyiv Academy University (KAU) as a state-supported research institution of dual subordination — to the NAS of Ukraine and the MES of Ukraine etc.

It is important to emphasize that the Law of Ukraine 'On Scientific and S&T Activities' entitles the NAS of Ukraine and its scientific institutions to founding higher educational institutions for training specialists of various qualification levels, including those of master and PhD. Kyiv Academy University, the decision on whose establishment has been approved by the Cabinet of Ministers of Ukraine, is the first practical step towards exercising that right. The foundation of KAU is effected through the reorganization of the Physical and Engineering Education and Research Center of the NAS of Ukraine, which won recognition by its many-year effective work in training highly qualified researchers to meet the needs of the NAS of Ukraine and high tech branches of the Ukrainian economy. KAU is to become a true research university, where the education would be organized relying on the so-called "Phystech System", which was successfully realized at California Institute of Technology, Massachusetts Institute of Technology, and later — at Moscow Institute of Physics and Technology. In the future, that will guarantee its graduates high demand and competitiveness in the market of labor, scientific and educational services. Besides, KAU foundation is to provide necessary conditions for high-quality training of PhDs of relevant specializations at the NAS of Ukraine and for Ukraine's integration to the global science and education sphere.

The implementation of the Law of Ukraine 'On Scientific and S&T Activities' provides a broad framework for strengthening and promoting dynamic and mutually beneficial interaction of the National Academy of Sciences of Ukraine and the Ministry of Education and Science of Ukraine.


НАЦІОНАЛЬНА АКАДЕМІЯ
МЕДИЧНИХ НАУК УКРАЇНИ
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COLLABORATION OF THE NAS OF UKRAINE WITH NATIONAL SECTORAL ACADEMIES OF SCIENCES

CHAPTER 6

In the 1990s, alongside the National Academy of Sciences functioning in Ukraine, five sectoral, which are now national, academies of sciences were founded: the National Academy of Agrarian Sciences of Ukraine (NAAS), the National Academy of Educational Sciences of Ukraine (NAES), the National Academy of Medical Sciences of Ukraine (NAMS), the National Academy of Legal Sciences of Ukraine (NALS), the National Academy of Arts of Ukraine (NAA). Such multi-sectoral system of the academy sphere of scholarship induced the systemic consolidation and coordination of the activities of all branches of academy science to enhance their efficiency and successfully achieve their common goals. In order to join efforts of country's academies of sciences, create a mechanism of elaborating mutually agreed measures and actions, through the initiative of the NAS of Ukraine, the Council of the Presidents of the Academies of Sciences of Ukraine (further — the Council of Presidents) was set up in 1994.

The regulations on the Council of Presidents of the Academies of Sciences of Ukraine, which were approved by academies' presidents, stated that the Council of Presidents is the coordinating body involving *ex officio*, on a voluntary basis, the President of the National Academy of Sciences of Ukraine and the presidents of the sectoral academies of sciences of Ukraine, while its main goal is to work out the coordinated policy for the advancement of basic research in Ukraine.

The Council of Presidents has always promptly responded to the most pressing challenges and issues facing science and educational area, first and foremost, the academy segment of science. In accordance with the discussions held at its meetings, the Council of Presidents adopted grounded proposals and recommendations for draft laws and other legal acts aimed at administration, regulation and support of science and education. In particular, those meetings considered and elaborated proposals for amendments to the laws of Ukraine that are basic for science and education — 'On Scientific and S&T Activities', 'On Higher Education', to draft budgets for the following years concerning the expenditures for scientific (academic) segment, the issues of training specialists of the highest qualification — candidates

(PhDs) and doctors of science, about the advantages and consequences of Ukraine joining the Bologna Process, social welfare of the researchers of academy institutions and organizations. Addresses of the Council of Presidents with proposals, recommendations and requests on the most important issues considered (signed by the presidents of all national academies) were sent to the Verkhovna Rada of Ukraine and its committees, the President of Ukraine, the Cabinet of Ministers of Ukraine.

On the initiative of the NAS of Ukraine, with a view to improving the coordination of basic research in the major problems of natural, engineering sciences and socio-humanities carried out by institutions, organizations and higher education establishments, the planning and expert assessment of the topics of basic research to be funded by the State Budget of Ukraine, the NAS of Ukraine, in close interaction with the national sectoral academies of sciences of Ukraine and with the involvement of the Ministry of Education and Science of Ukraine, identified the principal scientific areas and major topics of basic research in natural, engineering sciences and socio-humanities for 2009—2013 (further — Principal Research Areas List). All work to prepare and coordinate the Principal Research Areas List was done under the supervision of the Interdepartmental Council on Coordinating Basic Research, which was set up under the NAS of Ukraine in conformity with the Law of Ukraine 'On Scientific and S&T Activities' of 1998 and, first of all, the Council of Presidents. The Principal Research Areas List, after agreeing it with the national sectoral academies of sciences of Ukraine, was approved and enacted by a joint order of the MES of Ukraine and NAS of Ukraine, which got special governmental registration. Since the Principal Research Areas List proved useful in practice as an efficient instrument of coordinating, registering and organizing basic research over five years, the National Academy of Sciences of Ukraine and national sectoral academies of sciences worked out and the Council of President by its resolution approved the List of Principal Research Areas and Major Topics of Basic Research to be conducted in natural, engineering sciences and socio-humanities by the national academies of sciences of Ukraine in 2014—2018.

It should be noted that in compliance with the new, adopted in 2015, Law of Ukraine 'On Scientific and S&T Activities' the Council of the Presidents of the academies of sciences of Ukraine is legitimized as the standing collegiate body under the NAS of Ukraine, which brings together the President of the National Academy of Sciences of Ukraine and presidents of national sectoral academies of sciences for coordinating the activities of these academies. The new status of the Council of Presidents, the experience of its 23 years of work in the interests of, primarily, national academies of sciences were taken into account in the new Regulations of the Council of Presidents developed within the context of implementing the abovementioned Law of Ukraine. These regulations were approved by the Council of Presidents in March 2016.

The scholarly communities of the National Academy of Sciences and national sectoral academies of sciences also extensively collaborated on the bilateral basis.

The partnership of the National Academy of Sciences of Ukraine and the National Academy of Agrarian Sciences is long and well known. Its origins go back to the 1930s, when the All-Ukrainian Academy of Agricultural Sciences was founded.

In the years of independence, the collaboration between the NAS of Ukraine and the NAAS of Ukraine has been significantly pro-

A meeting of the Council of the Presidents of the Academies of Sciences of Ukraine under the chairmanship of Acad. B.E. Paton, President of the NAS of Ukraine. Left to Right: NAA Acad. A.V. Chebykin, President of the National Academy of Arts of Ukraine; NAMS Acad. V.I. Tsymbalyuk, President of the National Academy of Medical Sciences of Ukraine; NAS Acad. B.E. Paton; NAS Acad. V.G. Kremen, President of the National Academy of Educational Sciences of Ukraine; NAAS Acad. Ya.M. Gadzalo, President of the National Academy of Agrarian Sciences of Ukraine; NALS Acad. O.V. Petryshyn, President of the National Academy of Legal Sciences of Ukraine. Kyiv, 7 April 2017

moted. First and foremost, that concerns important basic and applied scientific research aimed at the advancement of the national agro-industrial sector, ensuring country's food security etc.

Historically, institutions of the two academies have had close scientific ties. In their framework, collaboration agreements have been concluded and joint studies carried out. Among the most striking examples of successful interaction of scientists in biology and agrarian scientists is the creation of new varieties of important crops, such as soft winter wheat, barley, maize. New varieties of these cereals, besides producing high yields, have high tolerance to drought and soil salinity, resistance to pests and diseases. It is to a great extent due to the new varieties bred by specialists of such institutions as the NAS Institute of Plant Physiology and Genetics, V.M. Remeslo Myronivka Institute of Wheat of the NAAS, NAAS Plant Breeding & Genetics Institute — the National Center of Seed and Cultivar Investigation that the nation has been able to harvest unprecedented yields in recent years. That has permitted Ukraine both to strengthen its food security and to enhance its export potential and increase the amount of foreign currency earnings for the state budget.

The progress in molecular genetics, genomics, gene engineering, and state-of-the-art technologies has provided new opportunities for essential enhancement of breeding efficiency and plant seed production, creation of new valuable plant and animal genotypes, development of recombinant vaccines and diagnosticums.

Scientists of the two academies carry out joint R&D of novel preparations for treatment and prophylactics of cattle, pig and poultry diseases. Palladin Institute of Biochemistry of the NAS of Ukraine and the National Science Center 'Institute of Experimental and Clinical Veterinary Medicine' of the NAAS of Ukraine have obtained important results for early diagnostics of tuberculosis.

The powerful human scientific potential of the academies is able to solve the most difficult problems of biotechnology by using cutting-edge methodologies (cell and genetic engineering, hybridoma technologies etc.).

Scientists of M.M. Gryshko National Botanical Garden of the NAS of Ukraine, acting in synergy with researchers of the NAAS Institute of Irrigated Agriculture, L.P. Symyrenko Institute of Pomology of the NAAS of Ukraine, the National Scientific Center 'V.Ye. Tairov Institute for Vine Growing and Wine Making', the Institute of Fodder and Agriculture of Podillya of the NAAS of Ukraine have created and introduced to farming new bioenergy, plant-fertilizer, fodder, vegetable and fruit crops of their own breeding.

Joint research of scientists of D.K. Zabolotny Institute of Microbiology and Virology of the NAS of Ukraine and the NAAS Institute of Agricultural Microbiology and Agro-Industrial Production has resulted in large-scale deployment. They have created highly efficient strains of nitrogen-fixing bacteria, developed complex microbial preparations and launched their production.

The NAS Institute of Cell Biology and Genetic Engineering successfully and effectively interacts with the NAAS Institute of Bioenergy Crops and Sugar Beet and the NAAS Institute of Irrigated Agriculture in gene modification of sugar beet and maize, while jointly with the NAAS Institute of Veterinary Medicine they have produced a transgenic lettuce variety with the integrated gene of human α-interferon to be used in veterinary medicine.

The practice of scientific forums on problems of high scientific relevance is maintained. E.g., the South Center for Plant Biotechnology of the NAAS annually hosts joint scientific conferences of NAS and NAAS institutions under the integrative title 'Plant genome'.

Active collaboration is going on in other areas of scientific and legal support to the development of agro-industrial sector as well. E.g., economics scientists of both academies were involved in preparing draft Agrarian Code of Ukraine, laws of Ukraine, Government resolutions and other regulatory acts, in particular, the National Doctrine of Reforming and Advancing the Agro-Food Industry of Ukraine.

The Interdepartmental Scientific Council of the NAS and NAAS of Ukraine for Agro-Industrial Sector has been successfully functioning for many years running. Scientists of the two academies and leading specialists of relevant ministries and agencies of Ukraine are its members. Council's activities promote and strengthen ties between institutions, scientists and specialists in order to improve the quality and efficiency of scientific studies concerning the agro-industrial sector, identify top-priority areas of basic and applied research intended for various branches of agribusiness, produce recom-

Meeting of the Council of Presidents of the academies of sciences of Ukraine. Left to Right: Acad. of the NAAS of Ukraine A.S. Zaryshniak, Chief Scientific Secretary of the NAAS of Ukraine; Acad. of the NAA of Ukraine V.A. Bitayev, Vice-President of the NAA of Ukraine; Acad. of the NAS of Ukraine S.I. Pirozhkov, Vice-President of the NAS of Ukraine; Acad. of the NAS of Ukraine V.P. Gorbulin, First Vice-President of the NAS of Ukraine; Acad. of the NAMS V.I. Tsymbaliuk, President of the NAMS of Ukraine; Acad. of the NAS of Ukraine A.G. Naumovets, First Vice-President of the NAS of Ukraine; Acad. of the NAS of Ukraine B.E. Paton, President of the NAS of Ukraine; Acad. of the NAS of Ukraine V.G. Kremen, President of the NAES of Ukraine; Acad. of the NAS of Ukraine V.G. Koshechko, Vice-President of the NAS of Ukraine; Acad. of the NALS of Ukraine O.V. Petryshyn, President of the NALS of Ukraine; Acad. of the NAS of Ukraine V.L. Bogdanov, Chief Scientific Secretary of the NAS of Ukraine. Kyiv, 13 June 2018

mendations towards their advancement, and also nurture mission-oriented studies that could contribute to solving particular problems of agrarian science.

Recent achievements of national science in agriculture show that the partnership of the two academies is successful, efficient and, no doubt, very promising, while the field to apply this collaboration is almost limitless.

The National Academy of Sciences of Ukraine gives much focus to advancing and extending its partnership with the National Academy of Medical Sciences of Ukraine in the context of joint involvement of their S&T potential, the use of up-to-date managerial and economic mechanisms for implementing promising research results in medicine. They set the goal of developing innovative treatment methods, medical instruments and agents to improve the system of medical services to the people of Ukraine. The collaboration is carried out in such areas of utmost priority: working out methods of prophylactics, diagnostics and treatment of various diseases, producing medical drugs, designing medical instruments and equipment, producing different materials intended for medicine etc. Relying on their joint basic research, the NAS of Ukraine, NAMS of Ukraine and institutions functioning under the Ministry of Public Health of Ukraine proposed up-to-date, innovative and highly

efficient medical preparations, methods, procedures, devices and equipment for diagnostics and treatment of numerous diseases.

E.O. Paton Electric Welding Institute of the NAS of Ukraine, the NAMS Institute of Clinical and Experimental Surgery, the Ukrainian Advisory and Diagnostic Center of Mother and Child, functioning under the Ministry of Public Health, and the Medical Department of the Security Service of Ukraine have developed and widely deployed in hospitals the methods of electric welding of viscera and tissues, blood vessels and nerves. Test systems for accelerated diagnostics of tuberculosis have been proposed (Palladin Institute of Biochemistry of the NAS of Ukraine, F.G. Yanovsky National Institute of Phthisiology and Pulmonology of the NAMS of Ukraine). Researchers have developed methods for therapy of acute cardiac infarction with water-soluble lipoxygenase inhibitor and *CORVITIN* antioxidant; *FLOKALIN* cardioprotective agent based on fluorine-containing activator of ATP-dependent potassium channels (Bogomoletz Institute of Physiology of the NAS of Ukraine, M.D. Strazhesko Institute of Cardiology of the NAMS); a medicine to prevent recurrent tumors and metastases in patients with breast cancer (R.Ye. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology of the NAS of Ukraine, P.L. Shupik National Academy of Post-Graduate Education of the Ministry of Public Health and the NAMS of Ukraine).

Joint efforts of the institutions of the NAS of Ukraine, the NAMS of Ukraine and the Ministry of Public Health of Ukraine gave rise to a number of novel medical preparations: *MEBIPHON* anti-tumor drug (Palladin Institute of Biochemistry, NAS Institute of Organic Chemistry and R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology; Kyiv City Oncology Center of the Ministry of Public Health; the NAMS Institute of Pharmacology and Toxicology); *TOMERZOL* cerebral circulation regulator (NAS Institute of Organic Chemistry, the State Scientific Center for Medical Preparations under the NAS of Ukraine and the Ministry of Public Health, the NAMS Institute of Gerontology). Also developed were *BATUMIN* antibiotic for treatment of staphylococcus infections, *DIASTAPH* preparation for staphylococcus infections diagnostics (D.K. Zabolotny Institute of Microbiology and Virology of the NAS of Ukraine, L.V. Gromashevsky Institute of Epidemiology and Infectious Diseases of the NAMS).

Scientists produced highly effective *METOVITAN* adaptogen (Palladin Institute of Biochemistry of the NAS of Ukraine, 'Tekhnolog' Company (Uman)), *AMITOSIN* anti-tumor, antiviral and immunomodulatory preparation (NAS Institute of Molecular Biology and Genetics), *CORECTIN* pharmaceutical composition of multipurpose action (Palladin Institute of Biochemistry of the NAS of Ukraine, the National Research Center for Radiation Medicine of the NAMS of Ukraine), etc.

NAS experts in informatics, mechanics, physics, jointly with medical scientists, proposed state-of-the-art instruments and medical equipment: a multi-channel computer audio-video-system for automated diagnostics of respiratory organs (NAS Institute of Hydromechanics, O.O. Bogomolets National Medical University), diagnostic equipment for detecting and identifying neoplasms (NAS Institute of Applied Problems of Physics and Biophysics), '*Fluorograph*' mobile X-ray diagnostic apparatus (V.Ye. Lashkaryov Institute of Semiconductor Physics of the NAS of Ukraine), sensors for diagnostics of the immune and biochemical status of the

Jubilee Session of the General Meeting of the National Academy of Sciences of Ukraine and the national sectoral academies of sciences of Ukraine to mark the 25th anniversary of Ukraine's Independence. Kyiv, 23 August 2016

human organism (V.Ye. Lashkaryov Institute of Semiconductor Physics of the NAS of Ukraine, the NAMS Institute of Pediatrics, Obstetrics and Gynecology), radiation equipment and technologies (pasteurizers, sterilizers, isotope neutralizers, analyzers, ozonizers) intended for industry and medicine (NAS Institute for Nuclear Research) etc.

Much attention goes to the development of novel materials for medicine. NAS scientists, in collaboration with their partners, have developed polymer bone implants with bioceramics (the Institute of Macromolecular Chemistry of the NAS of Ukraine; the Institute of Traumatology & Orthopedics under the Ministry of Public Health of Ukraine), '*Energoinformatic*' applicators (A.V. Dumansky Institute of Colloidal and Water Chemistry of the NAS of Ukraine; A.P. Romodanov Neurosurgery Institute of the NAMS of Ukraine), reticular endoprostheses with nanocomposite chitosan coatings for abdominal and reconstructive surgery (the Institute of Applied Problems of Physics and Biophysics of the NAS of Ukraine), the support head of hip joint endoprosthesis made of titanium alloy (I.M. Frantsevich Institute for Problems of Materials Science of the NAS of Ukraine; V.M. Bakul Institute for Superhard Materials of the NAS of Ukraine), '*Levkin*' medical glue to be used in the treatment of neoplastic processes in the locomotor system (the Institute of Macromolecular Chemistry of the NAS of Ukraine, the Institute of Traumatology & Orthopedics under the Ministry of Public Health of Ukraine), '*Bioderm*' combination coating for the treatment of wounds and burns (the Institute of Macromolecular Chemistry of the NAS of Ukraine, the Institute of Urology of the NAMS of Ukraine).

All that is the result of extensive and many-sided collaboration of NAS and NAMS research institutions, which is to be furthered for the improvement of public healthcare in Ukraine.

The National Academy of Sciences of Ukraine has been co-operating with the National Academy of Educational Sciences since its foundation in addressing a broad range of highly relevant problems, from the general updating of the education and science sphere to theoretical, strategic, and methodological support to the innovative development of the Ukrainian society, educating global competitive human capital, patriotic citizens of the Motherland.

In the quarter of a century, regular forms of collaboration between the two academies have been established. Among them are:

- joint scientific, practical and exhibition events, academic publications and international collaboration projects, in particular those under EU Erasmus+ project;
- participation of NAS and NAES members in the governing bodies (presidiums) of the academies of sciences;
- approvals of the topics of basic research carried out at the NAES by the NAS of Ukraine;
- advisory co-operation in the working teams for drawing up education and science legislation, specifically, the laws of Ukraine 'On Scientific and S&T Activities', 'On Higher Education', educational standards, contents of education programs and study curricula for educational institutions, preparing textbooks and up-to-date technologies;
- membership in the national bodies regulating the issues of the efficiency and quality of scientific and educational activities, in particular, in the National Council of Ukraine for the Development of Science and Technologies, the National Agency for Quality Assurance in Higher Education of Ukraine.

The National Academy of Sciences of Ukraine collaborates with the National Academy of Legal Sciences of Ukraine. Well-known scholars in law are active members (academicians) of both academies of sciences. They are Yu.S. Shemshuchenko, who heads V.M. Koretsky Institute of State and Law of the NAS of Ukraine, V.K. Mamutov, V.Ya. Tatsii, V.M. Lytvyn. The National Academy of Sciences of Ukraine and the National Academy of Legal Sciences of Ukraine co-ordinate their activities in the certification of their research institutions, licensing post-graduate studies, harmonization of research topics etc.

After achieving independence by Ukraine in 1991, there emerged the necessity for the accumulation and systematization of legal science knowledge under free and democratic activities of Ukrainian research institutions. Guided by the need for creating a major fundamental publication, NAS Presidium adopted the resolution of 8 September 1993 'On preparing fundamental "Legal Encyclopedia"'. The encyclopedia was authored by leading jurisprudence scholars and highly qualified practical lawyers, first and foremost, academicians and corresponding members of the National Academy of Sciences of Ukraine and the National Academy of Legal Sciences of Ukraine.

The encyclopedia is based on the advanced achievements of both national and world legal sciences, it states the core principles of the Constitution of Ukraine as the main normative and legislative act of the state, provides information on the research and higher education institutions of legal specialization in Ukraine, presents the biographies of the renowned jurisprudence scholars of today and of the past. It gives a broad picture of the history of law in Ukraine, contains information about Ukrainian legal landmarks. The encyclopedia provides data on the state, political and legal systems of various countries, as well as facts concerning their governmental bodies

and presents scientific assessments of those countries' documents.

The National Academy of Sciences of Ukraine, jointly with the National Academy of Legal Sciences of Ukraine, have also initiated the preparation of the "Comprehensive Ukrainian Legal Encyclopedia" — a multi-volume universal encyclopedic edition, whose publication is scheduled for 2013—2026. The edition is to generalize scientific information on the development of human civilization and Ukraine's contribution to global history and culture, as well as disseminate that knowledge. It will consist of 20 volumes. The first three volumes — "History of State and Law", "Philosophy of Law" and "General Theory of Law" — were published in 2016—2017.

The National Academy of Sciences of Ukraine attaches great importance to close collaboration with the National Academy of Arts of Ukraine. Due to joint efforts of NAS scholars and those of NAA, a number of scholarly and methodological works concerned with highly relevant issues of art theory and history, modern culturology were prepared and published, in particular, "Essays on the History of Ukrainian Artistic Design in the 20th Century", "Ukrainian Encyclopedia of Ethnic Art and Ethnic Culture Studies" in 5 volumes, "Aspects of Ukrainian Culture Morphology: Genesis, Typology" etc.

NAS art scholars, in their creative interaction with the NAA of Ukraine, maintain ties with artists, Ukrainian ensembles and artistic unions, art study centers, implement numerous cultural and artistic projects, e.g., 'Avant-Garde Artists and Ukrainian Embroidery', 'Take Me across Maidan', they actively collaborate with foreign scholarly and art institutions, diplomatic missions in Ukraine, promoting cultural exchanges and our country's integration into global culture. One of the top-priority areas of NAS collaboration with the NAA of Ukraine is holding joint all-Ukrainian and international scholarly conferences and round-table discussions, organizing joint exhibition projects.

NAS scholars publish extensively in NAA scholarly proceedings (*Art Studies in Ukraine*, *MIST (Art, History, Contemporaneity, Theory)* et al.), while NAA scholars publish their research outcomes in the editions of the National Academy of Sciences of Ukraine, which enables them to present and confirm new concepts, discoveries and findings in the sphere of arts.

The annual exhibitions of the works of NAS scholars organized by the National Academy of Arts are worth special note, as they represent the most significant achievements of Ukrainian art studies.

The partnership of the two academies contributes to Ukrainian art overcoming ethnic and national narrow-mindedness, implementing the international principle of cultural pluralism, which is necessary in view of Ukraine's aspiration to become an EU member. Creative collaboration also assists in preserving national art traditions, propagating the Ukrainian art in the world and increasing its social action. The goal of academies' collaborative projects is to make Ukrainian art a natural element of the state-formation process.


UNESCO
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ЕВРАЗИЙСКАЯ АССОЦИАЦИЯ УНИВЕРСИТЕТОВ
ALMA MATER
EUROASIAN UNIVERSITIES ASSOCIATION
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МЕЖДУНАРОДНАЯ АССОЦИАЦИЯ АКАДЕМИЙ НАУК • INTERNATIONAL ASSOCIATION OF ACADEMIES OF SCIENCES •
1993

INTERNATIONAL SCIENTIFIC COLLABORATION OF THE NAS OF UKRAINE. INTEGRATION INTO EUROPEAN AND GLOBAL SCIENCE

CHAPTER 7

In the years of Ukraine's independence, entirely new opportunities have opened up for the Academy to extend its existing international scientific ties and establish new ones. While in the first years of Ukraine's independence, in the period of its economy restructuring, under drastic cuts in funds for international activities, even the retaining of existing international ties was at stake, afterwards those relations were strengthened, took new forms, and were filled with new substance.

All this time the NAS of Ukraine has been energetically integrating into the international science system, developing the legal framework of collaboration with foreign research centers, broadening its scope, positioning itself as an integral science complex. Such purposeful work has resulted in positive shifts in both broadening the range of foreign partners and improving the qualitative characteristics of the collaboration.

The figures concerning the scope of Academy's international ties speak for themselves. While mere 15 agreements on scientific and S&T collaboration between the URSR AS and the academies of sciences and science centers of foreign countries were functioning in 1990, just 10 years later there were 58 such agreements, in 2010 — 107 of them, and today over 120 various documents on the collaboration with scientific institutions of 50 countries are operative. Nearly 90 % of NAS institutions are involved in the implementation of various forms of international co-operation.

Since the early 1990s, the ties with the Ukrainian scientific diaspora have been significantly extended, and in some areas they have been started, which is of crucial importance for the sphere of socio-humanities. Academician B.E. Paton's deep comprehension of the necessity to rely on the experience of scholars acknowledged by the whole world has resulted in the Institute of Oriental Studies and the Institute of European Studies (now — State Institution 'NAS Institute of World History') being founded in the Academy and in O. Pritsak, Ya. Pelensky and R. Shpolyuk being elected among its first foreign members.

In those years the Academy of Sciences of Ukraine extensively used scholarships and fellowships of international organizations and foundations: those of Alexan-

Participants of the constitutive meeting of the International Association of the Academies of Sciences. Kyiv, 23 September 1993

der von Humboldt Foundation and R. Kerber Memorial Foundation (FRG), of Royal Society and British Council (Great Britain), the branch of G. Soros Foundation (USA) in Ukraine and IREX US service for academic exchanges. The lion's share of scholarships and grants for the Academy was provided by Max Planck Society, D. Diderot Programme and the 'Renaissance' International Foundation, 'Sabre—Світло' Ukrainian—American Charitable Foundation, the International Association for Promoting Collaboration with Scientists of New Independent States of the Former USSR (INTAS), Volkswagen Foundation, NATO, and UNESCO. Participation in such programs enabled the Academy to demonstrate itself as a powerful science center.

NAS participation in international scientific organizations has achieved a new level. Of great importance for positioning the Academy in the global scientific community has become its membership since 1992 in the International Council for Science (formerly, the International Council of Scientific Unions, ICSU) — an influential NGO set up in 1931, which now brings together 98 interdisciplinary national scientific organizations (academies, science councils) and 26 international unions of certain science areas.

The role of utmost importance for retaining scientific ties with the countries of the former Soviet Union was played by the 1993 NAS initiative to found the International Association of the Academies of Sciences (IAAS), which till 2016 was continuously headed by Acad. B.E. Paton, President of the NAS of Ukraine, and the NAS of Ukraine performed the functions of the host academy.

The majority of the academies of sciences of the newly established states on the terri-

Meeting of the Council of the International Association of the Academies of Sciences. Almaty, the Republic of Kazakhstan, 12 October 2016

tory of the former USSR and the academy of Vietnam joined the Association as its full-fledged members, the academies of sciences of Slovakia and the Czech Republic — as observers. New opportunities for promoting the international scientific collaboration appeared for the NAS of Ukraine and other member academies when the IAAS was granted the associate member status by well-known scientific organizations, universities, foundations. Now the IAAS has associate membership in seven such institutions.

In the mid-1990s, IAAS efforts were aimed towards restoring and promoting the exchange of information resources, first and foremost, of scientific periodicals, monographs, reports on the academies' activities.

Today, there are 18 scientific councils and other public advisory structures functioning on the inter-academy basis.

In particular, the collaboration in developing information and library services that involves directors of scientific libraries and scientific centers of the IAAS member academies has become regular. For many years, it has been carried out under scientific, methodological and organizational leadership of V.I. Vernadsky National Library of Ukraine.

Since 2003, the IAAS has been among the organizations with which UNESCO supports working relations, and in 2012 it was granted a new status in its partnership with UNESCO — the consultative one. In 2017, in accordance with an IAAS Council decision, the Association headquarters moved to Minsk.

In 1993 the Academy became a co-founder of the European Federation of the Academies of Sciences and Humanities (ALLEA) — EC advisory body — and has been actively involved in its work.

The participation of the NAS of Ukraine in international professional unions has been furthered through the membership of individual Academy institutions in them.

Bilateral scientific ties essentially promote the involvement of NAS research teams in

Visit of a Ukrainian delegation to CERN. Left to Right: Corr. Memb. Ye.R. Bersheda, Ambassador Extraordinary and Plenipotentiary to the Swiss Confederation and the Principality of Liechtenstein (in combination); Prof. G.M. Zinovyev; Acad. B.E. Paton, President of the NAS of Ukraine; Acad. A.P. Shpak, First Vice-President of the NAS of Ukraine. CERN. Geneva, June 2002

international professional organizations and programs. To achieve effective integration into the European scientific community and economy, NAS chemistry scientists, jointly with academy institutions of the Czech Republic, Slovenia, Poland, Hungary and Romania have founded the Central and East European Polymer Network.

The partnership within individual projects and programs of numerous leading international science centers plays an important role in the development of many priority research trends at the Academy, advancement of Ukrainian scientists' achievements to the European science area. The outcomes of joint research in the sphere of international politics, diplomacy, economy, technological and social issues in the context of global change, including the studies of global processes taking place on the territory of the former Soviet Union, are repeatedly used in governmental strategic documents.

NAS scientists are integrated into the work of many international scientific centers and associations. This concerns, first and foremost, many years of fruitful collaboration with the European Organization for Nuclear Research (CERN), which had started long before the agreement on granting Ukraine the status of its associate member was signed. Quite a number of Ukrainian scientists contributed to upgrading the equipment of the Large Hadron Collider, planning and carrying out experiments in it under long-term programs ALICE, LHCb, CMS, HERA-B, which were supported by the Academy program in high energy physics. Scientists of the National Science Center 'Kharkov Institute of Physics and Technology' and S&T Complex 'Institute for Single Crystals' participated in the epoch-making seminal discoveries related to the fundamental issues of the Universe structure and evolution, which were made due to the Large Hadron Collider. Scientists of Bogolyubov Institute for Theoretical Physics were actively engaged in developing the concept of and searching for quark–gluon plasma. Not only did NAS institutions contribute to the experimental part proper of the CERN work, they joined in the development of Collider's detectors as well. Scintillators produced by the STC 'Institute for Single Crystals' are responsible for CMS operation. For the first time ever, Ukrainian scientists have been able to take part in the state-of-the-art experiments in high energy physics and have already co-authored more than 200 publications of their results.

The positive experience of the long-term involvement of Ukrainian scientists in the computational part of the Large Hadron Collider complex due to the well-developed GRID infrastructure and NAS readiness to start new collaboration forms are also worth noting. We mean, in particular, the preparation of the project to develop electronic infrastructure for the Eastern Partnership member countries and their accession to the GEANT European research and education networking.

The many years of Ukraine's participation in the work of the International Institute of Applied Systems Analysis (IIASA) is another striking example of the successful integration of Ukrainian scientists into the international scientific community. The IIASA is a reputable non-governmental scientific center that, relying on systemic interdisciplinary approaches and close international scientific cooperation, performs research into global economic, environmental, social phenomena and processes.

The Committee for Systems Analysis that operates under NAS Presidium and has been permanently headed by Acad. B.E. Paton, President of the NAS of Ukraine, is the national member organization representing Ukraine in the IIASA.

Ukrainian scientists are extensively involved in IIASA activities, and Acad. V.S. Mikhalevich, Director of the NAS Institute of Cybernetics, headed the IIASA Council in 1987—1992, which was, first of all, due to the significant role of Ukrainian science in the formation and development of systems analysis. Now the third stage (2017—2021) of the long-term program of the NAS—IIASA collaboration is underway, with seven Academy institutions taking part in it. The involvement of Ukraine in the IIASA work shows that the international scientific community acknowledges the high quality of the research conducted by Ukrainian scientific institutions, NAS institutions, in the first place.

During a ceremonial meeting of the NAS Presidium to mark the 60th anniversary of Ukraine entering UNESCO. Acad. B.E. Paton, President of the International Association of the Academies of Sciences (IAAS) honored Irina Bokova, UNESCO Director General, with the IAAS diploma and Silver Medal 'For the Contribution to Science Development' and presented her with the National Atlas of Ukraine

The activity of Academy institutions in UNESCO research programs has always been high. That is shown, in particular, by the many years of regular participation of NAS representatives in the executive bodies of various UNESCO commissions. Since 1973, the Academy has been the host to the National Committee of Ukraine for UNESCO's 'Man and the Biosphere' Programme, whose major achievement is the establishment of the national network of UNESCO biosphere reserves in Ukraine. In the years of independence, UNESCO chairs have been set

Lecture of Dr. Ryōji Noyori, Nobel Laureate in Chemistry, Director of RIKEN Japanese Institute for Physical and Chemical Research, at the Great Conference Hall of the NAS of Ukraine. Kyiv, 22 July 2013

up at Bogomoletz Institute of Physiology, the Institute for Problems of Cryobiology and Cryomedicine and the International Research and Training Center for Information Technologies and Systems under the NAS of Ukraine and the MES of Ukraine. In the framework of Ukraine's membership in the IOC-UNESCO, the role of Ukrainian scientists in the program of the International Oceanographic Information and Data Exchange has become more sifnificant. The visit of Irina Bokova, UNESCO Director-General, to Ukraine in 2014 and her participation in the grand meeting of NAS Presidium to mark the 60th anniversary of Ukraine's joining UNESCO was an important event demonstrating the high level of Academy's interaction with this organization.

An important area of Academy's international collaboration is its involvement in the 'Science for Peace and Security' NATO program. Today NAS scientists are running 25 long-term projects under it. The visit of Ambassador S. Ducaru, Assistant Secretary General for Emerging Security Challenges, to Kyiv in May 2016 was a notable event for furthering collaboration with NATO. An Information Day on program's new opportunities was held in the framework of the visit.

The European direction of promoting its international collaboration is dominant for Ukraine. The dynamics of NAS institutions' participation in the frame programs of the European Union is very indicative: while in the FP 5 EU in 1997—2001 Ukraine was in the "third country" list and fulfilled 32 projects, according to the results of the latest FP 7, 53 Academy's research teams implemented as many as 98 projects, which is one half of all projects. On the grounds that Ukraine, having the partner country status, obtained the total of about € 27 million in 2007—2014 and researchers of NAS institutions have been taking part in the implementation of more than a half of all projects, it can be said that NAS institutions engaged over € 10 million for performing joint research. The involvement of NAS scientists in FP 7 projects essentially contributed to further advancement of highly relevant studies, obtaining the experience of international collaboration by Ukrainian scientists, increasing the inflow of extra-budgetary funds for scientific activities.

Academy institutions perform extensive research under the projects of "Horizon 2020" program. As of today, they have become involved in the implementation of 19 competitive projects of this program, whose total funds amount to nearly € 3 million.

10 national contact offices, hosted by NAS institutions, provide essential information and advisory support on entering the contests of EU "Horizon 2020" program, the rules and procedures of preparing applications, administering the projects, searching for partners etc. They receive current information from the European Commission directly and spread it during numerous

Meeting of B.E. Paton, President of the National Academy of Sciences of Ukraine, with the EU delegation headed by Carlos Moedas, EC Commissioner for Research, Innovation and Science, at E.O. Paton Electric Welding Institute. Kyiv, 20 March 2015

information events, in relevant information resources, through social networks and individual consultations. All that promotes the participation of Academy institutions in the projects of the EU "Horizon 2020" program. In the end of 2017, there were 25 of them.

The collaboration with European research institutions outside "Horizon 2020" program is also extending. The signing of the agreement on scientific and S&T collaboration and the associate participation of Ukraine in the 'Euratom' scientific research and training program (2014—2018) with the European Atomic Energy Community in 2016, initiated by Ukraine, allowed the involvement of Ukrainian scientific institutions in European thermonuclear research. On 31 January 2017, the Academy was declared the program owner on the part of Ukraine and NSC KPTI — its administrator. NSC KPTI established Ukrainian Research Unit, which coordinates the work of seven Ukrainian scientific institutions. Now NAS representatives are members of Ukraine—Euratom Coordination Committee and Euratom's principal technological platforms.

The Joint Research Center of the European Commission is an important and efficient partner of the NAS of Ukraine in international collaboration. On the one hand, it is the main coordinating and advisory body of the EC on scientific and S&T issues, and on the other, is a powerful research-performing organization that brings together numerous scientific institutes.

As a result of signing a letter of intent concerning the collaboration of the NAS of Ukraine with JRC and the academies of sciences of the Danube River Basin countries in 2015, our Academy was declared the main organization for scientific support to the implementation of the EC Strategy for the Danube Region in the territory of Ukraine in all

Signing of the Framework Agreement in support of research activities during the Information Day of the EC Joint Research Centre (JRC). In the photo (Left to Right): Acad. A.G. Zagorodnyi, Vice-President of the NAS of Ukraine; V. Šucha, JRC Director-General; H. Mingarelli, EU Ambassador to Ukraine. 14 September 2016

the 11 priorities of this strategy. The furthering of this letter as a framework agreement in support of research activities between JRC Directorate General and the NAS of Ukraine in 2016 enabled Academy scientists not merely to use Center's powerful S&T infrastructure for running joint projects but also to carry out their own research as they get financial rewards from JRC.

The major role in the NAS international collaboration with foreign partners is played by bilateral agreements with scientific organizations of other countries. The availability of such agreement framework provides legal basis for the full use of all forms of international collaboration, permits active integration into global science.

Under agreements on bilateral collaboration with the academies of sciences of Central European countries and leading scientific centers of other states (CNRS, TUBITAK, DFG), over 200 joint projects are run annually. The largest number of bilateral projects is implemented with research institutions of Poland, Bulgaria, the Czech Republic, Hungary, Slovakia and France.

The agreement on scientific collaboration between the NAS of Ukraine and Polish Academy of Sciences, which was signed in 1997, laid a reliable legal basis for promoting and encouraging bilateral co-operation. Over 50 bilateral projects are fulfilled annually in the framework of that agreement. New forms of collaboration have been started recently, namely, contests for the prize of the National Academy of Sciences of Ukraine and the Polish Academy of Sciences, awarded for joint studies, as well as competitive grants for young NAS researchers for internships at Polish scientific centers. Several dozens of young researchers have already taken internships under the latter program, they, in particular, were given access to state-of-the-art equipment, the absence of which in Ukraine does not permit them to present their research results internationally.

Explorations of Ukrainian and Czech scientists address directly the problems of seismology, ecology and environment protection.

Coordinated efforts of the scientists of the NAS of Ukraine and the Slovak Academy of Sciences have enabled them, in the process of international collaboration, to produce novel research results, develop innovative technologies and discover the properties of structural and functional materials which were not known before.

The collaboration of the scientists of the NAS of Ukraine and the Bulgarian Academy of Sciences in physics and astrophysics, Earth exploration from the outer space, analysis of space activities, assessment and restoration of the environment of aquatic ecosystem environment has been effective.

Due to joint work of geography scientists of Ukraine and Hungary, "Ukraine in

Meeting of the NAS leadership with a delegation of the Polish Academy of Sciences. Left to Right: Acad. S.I. Pirozhkov, Vice-President of the NAS of Ukraine; Anna Kuzma, Counsellor, head of the section of scientific and educational cooperation of the Embassy of the Republic of Poland in Ukraine; Acad. A.G. Naumovets, First Vice-President of the NAS of Ukraine; Prof. Jerzy Duszyński, President of the PAS; Acad. B.E. Paton, President of the NAS of Ukraine; Acad. V.G. Koshechko, Vice-President of the NAS of Ukraine. Kyiv, 25 September 2015

Maps" book was published. This is a unique edition containing 77 maps, over 20 tables and diagrams that give the general idea of Ukraine's position in Europe, peculiarities of its historical evolution, natural environments and resources for development, as well as its population and economy. The first presentation of the book took place in Kyiv in 2008 and was attended by the Presidents of the NAS of Ukraine and the Hungarian Academy of Sciences.

NAS research scientists in biochemistry, jointly with their colleagues from Israel, Turkey and the Czech Republic, effectively work at solving the pressing problems of fighting oncological diseases.

NAS biochemists, in particular, members of the Ukrainian Biochemical Society, in conjunction with their Israeli and Polish colleagues every other year hold the international conference on biochemistry and molecular biology, commemorating Yakov Parnas, outstanding Polish and Ukrainian biochemist, in Ukraine, Poland and Israel in turn.

In 1999—2017, with the support of the Government of Ukraine, Ukrainian geophysical organizations, jointly with experts of European countries (the Netherlands, Denmark, Germany, Finland, Hungary, Austria, Poland, Great Britain) and the USA, using up-to-date digital seismic stations, carried out unique explorations of the deep structure of Donbas, the Crimea, shelves of the Azov and Black seas and the Carpathians. They obtained entirely new data, which were highly appraised by the global community.

In the years of independence, the range of the Ukrainian—Lithuanian inter-academy co-operation has become considerably broader, particularly, in marine exploration. The academies implement the memorandum on mutual understanding in the field of marine sciences and technologies, and studies in this area have been included in the list of top priority research trends of the Program of Collaboration in Science and Technologies under the ministries of education and science of Ukraine and the Lithuanian Republic for 2016—2020.

The collaboration of the NAS of Ukraine and the National Academy of Sciences of Belarus (NASB) is promoted. Since 2015, the NAS of Ukraine and the NASB have held joint contests of research projects every two years; those are funded by the two sides on a par. Bilateral collaboration is also carried out

Signing the agreement of the transfer of 'Faraday' British Antarctic Station to Ukraine (now it is 'Akademik Vernadsky' Station). Left to Right: S.V. Komisarenko, Ambassador Extraordinary and Plenipotentiary of Ukraine to Great Britain; D. Davis, the State Secretary for Foreign Affairs of Great Britain. London, 20 July 1995

under state foundations for basic research of Ukraine and the Republic of Belarus.

Scientists interact efficiently in the framework of regional collaboration of the academies of sciences of Ukraine, Belarus and Moldova. Since 1996 the most significant research results obtained by Ukrainian, Belorussian and Moldovan scientists have been honored by the prizes of the academies of sciences of Ukraine, Belarus and Moldova.

For many years, our scholars have been collaborating effectively with their Macedonian colleagues. Holding Science Days of Ukraine in Macedonia and Science Days of Macedonia in Ukraine has become a good tradition. Scholarly efforts of the two countries have implemented the collaborative project on preparing and publishing the Ukrainian—Macedonian and Macedonian—Ukrainian dictionaries.

The integration of Ukraine's science sphere into the European research area envisages the application of new approaches to evaluating the research work of Academy institutions and to the expert appraisal of research projects, which would be in harmony with the European procedures. NAS gives much attention to the experience of foreign, German in particular, centers that perform scientific research. Hence, in March 2015 the Academy, jointly with the international experts representing the scientific community of the FRG, held the workshop 'Determination of approaches to evaluating the efficiency of NAS research activities'. On 26 April 2017, during the meeting of the presidents of the NAS of Ukraine and of the German Research Society (DFG), a bilateral Memorandum of Understanding was signed, which started a new form of co-operation — implementation of joint projects funded by the two sides on par.

Stable scientific ties of Ukrainian scientists with '*Demokritos*' National Research Center of Greece and the National University of Athens have been established.

There are also good traditions of scientific collaboration with the Italian National Research Council (CNR), which is the topmost state-supported research institution of Italy and unites nearly one hundred scientific research institutes, *Accademia dei Lincei* and the leading universities of Italy.

Ukrainian Academy institutions interact quite extensively with the state-supported and public scientific institutions of the USA. NAS scientists carry our basic research jointly with more than 70 US scientific organizations and universities, while applied developments they produce in collaboration with more than 20 US firms and companies, among them being widely known INTEL, MOTOROLA, BOEING, and GENERAL ELECTRIC. A large part of collaborative research is carried out under the auspices of US Civil Research and Development Foundation. NAS scientists have been provided

with over 200 grants over the years of this foundation's activities in Ukraine. The collaboration with the Defense Advanced Research Project Agency (DARPA) under the US Defense Department has been started.

The efficient interaction of NAS institutions and their Canadian partners is going on, in particular, that in basic Earth sciences and rational nature management, in partial differential equations, operator theory and mathematical physics equations, electrokinetic phenomena etc. Supporting Academy's talented young researchers, the Royal Society of Canada provides competitive grants for 2-month research visits to carry out scientific work at Canadian scientific institutions.

Collaboration with Japan is becoming ever more extensive. In particular, Ukrainian and Japanese scientists are working at developing a system for identifying nuclear materials in bulk with methods of destructive nuclear chemical analysis. Six Academy institutions implement the Japanese—Ukrainian R&D project 'Improvement of environment radiation control and Ukrainian legislation framework for environmental rehabilitation of radioactively contaminated sites', which is financed by SATREPS Japanese state-supported program. A Ukrainian—Japanese laboratory for hemoblastosis diagnostics in Chornobyl accident victims operates successfully at R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology of the NAS of Ukraine.

A wide variety of international collaboration forms is characteristic of the NAS ties with the National Center for Scientific Research of France (CNRS): implementation of bilateral projects, joint participation in 'Dnipro' program, realization of international scientific collaboration projects (PICS), participation in European scientific associations (GRDE) and EU programs. The establishment of an associate laboratory in high energy physics in June 2015 became a new form of NAS and CNRS partnership.

Signing of the Collaboration Agreement between the NAS of Ukraine and the National Academy of Sciences of Belarus. First Row, Left to Right: Acad. of the NAS of Belarus V.G. Gusakov, Head of the Presidium of the NAS of Belarus; Acad. B.E. Paton, President of the NAS of Ukraine; Above: O.G. Lukashenko, President of Belarus; P.O. Poroshenko, President of Ukraine. Kyiv, 21 July, 2017

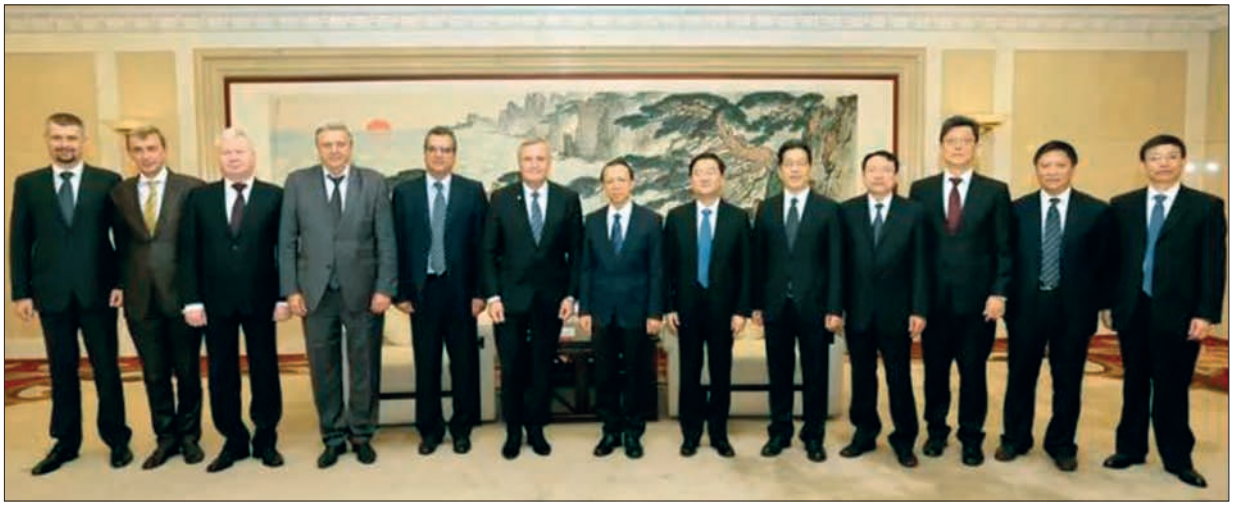
An important element of the whole system of NAS international S&T ties is S&T collaboration with scientific institutions, organizations, industrial enterprises and commercial structures of the People's Republic of China, which is now taking on entirely new features of pragmatic multi-dimensional co-operation. A positive trend towards extending and deepening the bilateral collaboration in science and technologies, as well as the availability of bilateral collaboration potential in S&T, provides the necessary prerequisites for its dynamic progress. In particular, Palladin Institute of Biochemistry of the NAS of Ukraine has founded a joint laboratory with the Biological Institute of the PRC Shandong Academy of Sci-

Signing of the Memorandum of Understanding between the National Academy of Sciences of Ukraine and the German Research Foundation (DFG) by Acad. B.E. Paton, President of the NAS of Ukraine, and Prof. Peter Strohschneider, President of the DFG. Kyiv, 26 April 2017

Meeting with the delegation of the Defense Advanced Research Projects Agency (DARPA) of the US Department of Defense at the National Academy of Sciences of Ukraine. Kyiv, 28 September 2016

ences for developing novel medicines, and with Beijing Genomics Institute (BGI) — the world's largest genomics center — signed an agreement on setting up a joint genomics center in Ukraine.

A new feature of today's Ukrainian—Chinese S&T collaboration is joint action towards long-term collaboration in technology transfer and commercialization of scientific developments, foundation of joint scientific research institutions, laboratories, centers, integrated research-and-training and research-and-production structures. Such a form of international collaboration



Meeting of Acad. A.G. Zagorodnyi, Vice-President of the NAS of Ukraine, with the Vice-Governor of the Shandong Province (Center). November 2017

permits more varied mechanisms of commercializing NAS scientific developments.

Collaboration has also been started with scientific institutions of the Republic of Singapore: the National University and the National Research Foundation of Singapore. The co-operation in nuclear energy, safety and radiation medicine with the Agency for Science, Technology and Research of the Republic of Singapore (A-STAR) is going on.

The NAS Institute of Geography has been successfully working in conjunction with the Institute of Geography of the Vietnam Academy of Sciences and Technologies.

The collaboration of NAS Socio-Humanities institutes with their partners from the EU countries has been furthered, e.g., the international project 'Pan-Slavic Linguistic Atlas' is being implemented with the involvement of NAS scholars.

In 2004—2012, the NAS Institute of Sociology, jointly with its partners from 32 countries, was a participant of five stages of a major comparative monitoring project — the European Social Survey. The data of four stages of this monitoring that were collected by national research groups have been deposited at the Central Archive for Empirical Social Research (Köln, the FRG) and consists unbiased, objective comparative information about the trends of political processes.

NAS international S&T collaboration transcends national borders and has no geographical limits. It is an important element and mechanism of forming and maintaining a positive image of Ukraine in the global scientific community.

Visits of foreign states' leaders and heads of influential international organizations to the NAS of Ukraine show the interest of not only scientific but also of political circles in the profound development of S&T ties with NAS institutions. In the years of the independence of Ukraine the Academy was visited by Abdul Kalam, President of the Republic of India, (2005); Heinz Fischer, Federal President of the Republic of Austria, (2009). In December 2000, during an official visit of the NAS delegation to Vietnam, Acad. B.E. Paton, NAS President, had a meeting with the SRV President and was elected an Honor-

Meeting of Acad. B.E. Paton, President of the NAS of Ukraine, with H. Fischer, Federal President of the Republic of Austria. Kyiv, 2009

ary Doctor of Hanoi University. I. Bokova, UNESCO Director-General, (2014); C. Moedas, EU Commissioner for Research, Science and Innovation, (2015); Ambassador S. Ducaru, NATO Assistant Secretary General for Emerging Security Challenges, were guests of the NAS of Ukraine.

S&T collaboration with Middle East countries has been advancing rapidly. A joint collaboration agreement with the Mathematical Department of the University of United Arab Emirates is being implemented by the NAS Institute of Mathematics. The NAS Institute of Renewable Energy is implementing several agreements in the field of windpower engineering with UAE research and production companies. Collaboration with Kuwait Institute for Scientific Research in biotechnologies and gene engineering has been started. In the years of independence, close contacts have been established with the Israeli Academy of Sciences and Humanities, the Israeli Institute of Technology, Haifa University Evolution Institute and Weizmann Institute. The key NAS partner in the Turkish Republic is the Scientific and Technological Research Council of Turkey (TUBITAK). Collaboration with the leading universities of the country is going on.

NAS scientists are well known in African countries, in particular, in Mozambique, Algeria and Egypt. Efficient S&T collaboration in the sphere of peaceful atom between institutions of the NAS Department of Nuclear Physics and Energy Engineering and South Africa Nuclear Energy Corporation (NECSA) is underway. Negotiations on resuming the bilateral scientific collaboration between the NAS of Ukraine and Conakry 'Rogbane' Scientific Research Center in the Republic of Guinea, where Ukrainian scientists once worked, are being conducted.

Literary scholars collaborate closely with Australian colleagues from Monash University, Western Sydney University, Victoria University. A number of NAS institutions fulfill foreign contracts on exporting their R&D products, which have been concluded with leading firms and institutions of New Zealand.

Scientific ties of Academy institutions with Scandinavian countries are varied in their form and content: the collaboration with the Research Council of Norway has become more active; joint projects with Finnish universities (in Helsinki and Oulu) are underway; collaboration with Swedish research institutions — Chalmers University of Technology in Göteborg, KTH Royal Institute of Technology in Stockholm, Uppsala and Lund universities — is developing dynamically. NAS institutions actively co-operate with international organizations located in Switzerland.

All in all, it can be said that the scope of NAS international collaboration is being consistently extended, involving ever increasing numbers of partner countries, and

new forms of collaboration conforming to the international trends and rules are started. Academy's S&T collaboration is one of the effective ways of our country's integration into the European and world science and technology and is also a practicable mechanism of enhancing its S&T potential. This collaboration is aimed at harmonizing the interaction of science and practice, basic and applied research, novel theoretical ideas and innovative technologies.

Today the need to support extensive international ties of Ukraine through new joint programs, using the mechanisms provided by its status of the EU associate country, as well as its membership in various inter-state regional associations, is evident. The necessary condition which would enable Ukraine to remain an attractive partner is the updating of the NAS research infrastructure and the extensive involvement of our Academy's scientists in solving important and pressing scientific problems. The priority development of new forms of international S&T collaboration is to become a long-term way of retaining and building up Academy's research potential, efficient integration of the NAS of Ukraine into European and world science.

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TASKS AND PROSPECTS OF FURTHER DEVELOPMENT OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE

CHAPTER 8

The strategy of science advancement in Ukraine should be to move in line with and even ahead of the world stream of scientific research, technologies, and innovations. Three factors invariably determine the priority of science in the state and social life: the global boom of scientific research, the technologization of the entire way of life, and the transformation of science into an immediate and major productive force. Where the state policies fully take those factors into account, the society is on the rise. In the projects, programs, models and strategies of the leading countries' futures one cannot omit the concern for enhancing the intellectual potential as the driving force of their progress. Accordingly, national science centers are mobilized and given the efficient support of the state, community, business. The success of traditional leader countries and the so-called tiger economies, which in the late 20th and early 21st centuries made an actual leap from backwardness to prosperity, was due to their stake on the advancement and use of science.

Since the very beginning of its existence the NAS of Ukraine has aimed at the highest level of research in order to be equal in rights and value in the international circle of academies. Its research topics and achievements over a hundred years have shown that in general it has been moving concurrently with European academic centers both in the areas of classical sciences and in the cutting-edge research. Genetics, cybernetics (in spite of the temporary lack of understanding on the part of soviet authorities), nuclear physics, electronics, space exploration and all today's nanosciences were advanced at the Academy simultaneously with research in European countries and produced similar results.

Today, the aim at the state-of-the-art science and its maximum social returns still remains the invariable basic goal the NAS of Ukraine has set for itself. That, first and foremost, determines the objectives and prospects of research at the Academy. The proof of that is the involvement of Ukrainian scientific institutions in all-European programs of research and innovations. During the implementation of the EU 7th Framework Program, Ukraine took the leading place among the Eastern Partnership countries and was among ten most active partner

countries, only yielding to the USA, Canada and BRICS countries[73]. Now Ukraine is an associate partner in the "Horizon 2020" program of research and innovation — the largest in the European Union's history. New opportunities are implemented for the accession of Ukrainian research institutions to the European research area and promoting their collaboration with scientific centers of the world.

Strategic goals and research areas of the NAS of Ukraine and European scientific communities basically coincide. "Horizon 2020" program is aimed at the advancement of the state-of-the-art science, industrial leadership and search for responses to social challenges[74]. In particular, special focus is given to large-scale interdisciplinary research that expand the scientific basis for deploying technologies which are new today and provide the platform for developing future ones. Likewise, among program's top priorities is the development and deployment of the next generations of nanomaterials, nanoinstruments and nanosystems, as well as industrial biotechnologies, space research. The NAS of Ukraine deals with these issues under special targeted topical programs of scientific research to be outlined hereinafter.

The response to social challenges has been among NAS priorities as well, especially in the recent decades. Seven challenges which "Horizon 2020" focuses on are the common subject field and research objectives of both European and Ukrainian scientists. Those are: health care, demographic changes and well-being; food security, resource-saving economy, water and bioeconomy; safe, clean and efficient energy; intellectual, "green" and integrated transport; climate change and the environment. The world is faced with fast and multidimensional change. In varying degrees it involves all countries without exceptions. "Horizon 2020" envisages research into Europe's place and role in the changeable world, the experience and ways of forming innovative, "intelligent", secure and safe societies.

In Ukraine these global and European challenges are modified in accordance with national conditions. What is more, they are supplemented with and exacerbated by major socio-economic transformations, lingering reforms, economic problems, and, last but not least, the hybrid war in its eastern regions.

Ukraine, like the whole world, experiences technological shifts. The elements of the fifth innovation wave, whose scientific foundation is microelectronics, are being expanded. There are nascent signs of the sixth innovation wave, which will be based on nanotechnologies. Looming in the distance is the seventh innovation wave, which will rely on intellectual and socio-humanitarian technologies. Ever increasing is the need for the neoindustrialization of the country, establishment of knowledge-based economy and digital culture, introduction of European life standards.

All those processes and phenomena, as well as their impacts, are multidimensional and, as a rule, long-lasting. They also give rise to multidimensional and long-lasting challenges — the adequate responses to those could only be found through basic research meant for near and distant future. Hence, the NAS of Ukraine identifies its tasks and prospects. Accordingly, the topical range of research and its deployment in the S&T, natural-science and socio-humanitarian sectors of Academy science has been drawn up.

[73] Горизонт 2020. Національний портал. URL: http://h2020.com.ua/uk

[74] Horizon 2020. URL: http://ec.europa.eu/programmes/horizon2020

Physical, engineering and mathematical sciences

In the future, NAS institutions of the physical, engineering and mathematical specializations will address scientific problems that are of high relevance for Ukraine and, simultaneously, are in line with the cutting-edge basic and applied research in the world.

More careful attention will be given to the implementation of S&T (experimental) projects aiming at the development and deployment of competitive technologies and novel equipment. The efforts of Academy institutions will be directed towards scientific and S&T support to the functioning and development of such nationally important industries as energy engineering, including nuclear energy, mechanical engineering and instrument-making, information technologies, aerospace industry, mining and metallurgy, medicine. The technologies relying on new scientific achievements will encourage the production of promising materials, new equipment and instruments, enhance the defense capability of the state, contribute to developing novel energy sources and technologies of energy saving, manufacturing new goods and boosting new types of services.

A significant amount of research results is to be obtained through international collaboration.

Taking into account the ***evolution of mathematics*** over the last century, it is envisaged that its further progress will lead to the deeper penetration of mathematical methods into various fields of science and technologies, aim at bridging the gap between theory and practice. Top-priority basic research will be conducted using the methods of the theory of partial differential equations, geometry, algebra, mathematical physics and functional analysis, mathematical problems of mechanics, computational mathematics and mathematical modeling, general theory of relativity etc. The outcomes of those investigations will find application, particularly, in solving the problems of financial mathematics, hydrodynamics, stabilizing vibrations and neutralizing external disturbances, in the theory of heat conductivity and diffusion, thermoelasticity and strength of heterogeneous structures etc. They will be instrumental in developing up-to-date methods of the navigation of self-contained mechanisms in environments with obstacles, techniques of non-destructive testing and evaluating the integrity of structural elements, producing composite envelopes for space-rocket hardware, implementing innovations in medicine and electronics. Further investigations in *mathematical physics* will provide insights into processes in the strong gravitational fields of black holes and supernova remnants.

The progress in *computational mathematics* and mathematical modeling will give a boost to the development of information technologies, first and foremost, of a broad class of computing methods and techniques to construct algorithms for operations with large information arrays (Big Data), build self-learning neural networks etc. Due to that, significant progress will be achieved in studying climate, globalization processes, development of public and private economy sectors etc. Such mathematical software could be used in biology and medicine, specifically, for detecting genetic causes of inborn abnormalities, studying biological patterns of human organism functioning, DNA restructuring, which will contribute to the start of personalized medicine. The improvement of mathematical approaches to developing new algorithms of information protection will remain a priority.

Informatics and information communication technologies will ever faster enter

all spheres of human life and various science fields. Basic research in informatics will continue to advance in such areas as the theory of computing systems and their use in various human activities; the theory and methods of optimizing the transcomputational complexity in high-performance computing systems; control, systems analysis and technological forecasting; software, circuitry, cloud computing, Big Data and smart technologies, artificial intelligence; information network computation, promising methods of information recording, transmission and representation, as well as information protection and personalization. The outcomes of such investigations will find application, e.g., in solving problems in economics, environment management, public health system, optimum planning, control of technological processes, for enhancing country's defense potential. In particular, the development of heterogeneous media analysis and modeling will help solve problems in medicine, space technologies etc. The construction of information protection systems in computer networks by means of encryption as well as audio signal and image steganalysis will allow them to be used efficiently for safeguarding the national interests of the state.

Due to the progress in intellectual data analysis, which relies on novel algorithms of fuzzy mathematics and approximate calculations, there is a possibility of increasing the validity and accelerating the analysis of super large data volumes, which is of importance in administrative decision-making.

An extremely important and promising area is the creation of software for complex cloud computing, development of information telecommunication technologies based on promising service-oriented architectures for providing general and easy access to shared computational resources that can be quickly obtained and used with minimal administrative expenses.

R&D in ***mechanics*** will retain its high relevance, specifically basic and applied research in the mechanics of composite and heterogeneous media; fracture and fatigue mechanics; dynamics and motion stability of mechanical systems, dynamics and aerothermo-gas dynamics of mechanical and hydromechanical systems, power generation units, aircraft and spacecraft and their subsystems; the limit state and strength criteria of materials and structures; reliability and optimization of mechanical systems, fracture mechanics and structure robustness; dynamics of mechanical and hydromechanical systems, hydromechanics of water jets and hydraulic equipment, as well as the development of scientific basis of mining processes, equipment and technology of mineral resources mining and processing.

Special importance will be attached to research in mechanics aimed at enhancing the defense potential of our state, increasing Ukraine's presence in the national and international markets of aerospace facilities, technologies and services; development of technologies for available and alternative power generation; improvement in mining technologies and safety; upgrading the alternative sources of natural gas production, coal mine methane in particular, as well as R&D in railway and automobile transport mechanics to increase its efficiency, reliability and safety.

Research in ***physics and astronomy***, as before, will address basic problems of these sciences and obtaining applied results, with a view to their further introduction in science, engineering, economy.

There are still a large number of problems in physics whose solution until recently was considered unattainable. Those are, first and foremost, studies of the properties

of small-sized objects, mainly in the nanometer range, with the purpose of elaborating scientific principles of nanotechnologies and producing nanostructured materials with predictable characteristics; measuring the conductivity and other properties of novel, the so-called Dirac, condensed systems (graphene, silicene, germanen etc.); investigating physical properties of solids with different types of conductivity and structural organization; studying surfaces and interfaces, as well as phenomena occurring on them; analysis of physical and technological conditions of producing fast-operating nano- and optoelectronic devices, in particular, next-generation sensors; investigating the properties of metallic systems with strong inter-electron correlation, which demonstrate high-temperature superconductivity and the effect of giant magnetoresistance; developing the concepts of the processes occurring during the formation of heterogeneous structure of high-entropy materials to improve their service properties; revealing the causes of multi-scale — temporal and spatial — correlations in condensed (specifically, soft) matter; development of novel materials based on complex oxides; exploration of numerous phenomena and objects in space with astronomy and radio astronomy methods.

In the future, basic research in physics and astronomy will be conducted in the areas that correspond to the main trends of physical science development in the world: physics of fundamental interactions and microscopic structure of matter, solid state physics, low- and super low-temperature physics, optics and laser physics, nanophysics and nanotechnologies, radio physics and electronics, soft matter physics, physics of plasma processes, as well as astrophysics, astronomy and radio astronomy. Applied studies will address such important applications as producing transceiver equipment, antennas, radars, energy-efficient technologies in electric power engineering, development of circuitry and resource-saving technologies for aircraft-, ship-building and space-rocket industries, synthesis of innovative materials, including nanostructured ones, producing software for economical color and 3D printing etc.

Amongst promising research in the Earth sciences a special focus is on conducting R&D that would correspond to new realities of today as closely as possible and would elaborate integrated scientific approaches to evaluating and developing mineral deposits, prospects of developing raw materials resources, as well as the technological aspects of explorations for promising minerals, geo-ecological studies with a view to stabilizing and improving the natural environment in Ukraine.

The implementation of such R&D will essentially extend resources of some useful minerals, assist in planning exploration and prospecting operations, in fast informing the stakeholders about geology- and geophysics-related emergency events, implementing the advanced techniques and technologies of Earth remote sensing, seismic, geodynamical, geophysical, meteorological and other methods for dealing with various tasks associated with emergencies.

Experts in the field of ***physical and technological problems of materials science*** have powerful research potential sufficient for making an even greater contribution to the progress of materials science, increasing its influence on the processes of S&T progress. Further advancement of science-intensive economy branches, including nuclear and thermal energy engineering, aerospace industry, mechanical engineering, ship-building, instrument-making, transport, electronics, chemical industry, construction, — they

all need state-of-the-art construction and functional materials that are able to ensure the functionality of the long-lived facilities operating under high static, cyclic and dynamic loads, in aggressive environments, under radioactive irradiation, at high and low temperatures.

Future R&D in materials science will be focused, primarily, on fundamental problems of producing materials with predefined properties and scientifically grounded methods of their joining, machining and diagnostics. Priority development is to be provided for such areas as novel construction materials with high specific strength, up-to-date ceramic and composite materials, nanostructured materials, optical and laser materials, innovative welding technologies and additive technologies of obtaining products and structural elements by using high-concentration power. Of high scientific relevance is the R&D of novel powder metallurgy technologies, surface engineering, producing single-crystalline and superhard materials, methods for increasing the strength and extending the operation life of materials and structures. There will also be more extensive research towards developing materials, technologies and equipment for medicine, particularly, the equipment and technologies to weld live tissues, biocompatible and bioactive materials, implants, artificial bones, stents etc.

Development prospects in the field of ***physical and technological problems of energy engineering*** are related, first and foremost, to the necessity of Ukraine implementing a large-scale and difficult task — to increase the efficiency of energy supplies to all branches of the economy through improving the structure of fuel-and energy sector, ensuring the robustness of energy system in crisis situations, enhancing the efficiency of the systems of power generation, transmission and use, promoting the renewable energy.

The solution of these problems requires scientific research into electrophysical, thermophysical, electrochemical processes that determine the efficiency of transformation of different energy types during its generation, transformation, transportation, distribution, use and that determine the technologically induced effects of energy transformation processes on the environment.

S&T (experimental) studies of scientists in energy will promote the innovative development of the industry and create the background for transition to the "new energy", which is characterized by the large-scale use of distributed generation, the development of intelligent energy networks and systems, a balance between fossil fuels and renewable energy, new technologies of energy storage, transmission and consumption, turning energy consumers into its producers.

Important tasks and development prospects in ***nuclear physics and energy engineering*** are related to basic research of new interactions and forms of matter in nuclear physics, elementary particle and high energy physics; with the construction of novel nuclear facility — the neutron source based on subcritical assembly driven by electron accelerator; development of new acceleration methods; R&D in plasma physics and controlled thermonuclear fusion, physics of fast neutron reactors and reactor materials science; solving S&T problems of nuclear fuel cycle in Ukraine and extending the operation life of nuclear power plants; development and deployment of radiation technologies.

In addressing those issues, a special emphasis will be placed on mineral resources for nuclear energy, radiation, technological and environmental safety, management of

spent nuclear fuel and radioactive waste disposal, radioecology and radiogeochemistry.

Chemical and biological sciences

In the 20th century, many changes have taken place in ***chemical science***. From an experimental science concerned with substances and their transformations, which it mainly was in the 19th century, chemistry turned into a system of methods, expertise and theoretical concepts. Atomic-molecular theory, which today is the foundation of physics, chemistry and natural sciences, was essentially advanced or expanded, and some of its postulates were radically revised. The appearance and fast development of new research methods and means provided deeper insights into chemical entities, enabled scientists to reconsider fine detail of the mechanisms of chemical processes and, relying on that, advance new theories, ideas, hypotheses, concepts etc. Besides, the necessity emerged to innovatively reconcile classical physical chemistry (thermodynamics and kinetics) with structural ideas concerning nano-sized systems (nanochemistry) that are advancing quickly.

The following research areas in chemical sciences are envisaged to be the major ones:

- development of fundamental principles of chemical processes behavior, search for new methods to accelerate them, as well as investigations in top-priority areas of creating new chemical substances and materials;
- research in a wide range of problems of the physical chemistry of nanomaterials, methods of their production, modification and possible use;
- development of biologically active compounds of a wide spectrum of action;
- advancement of functional polymer chemistry;
- studying physico-chemical and biological features of water systems and fundamental principles of colloid and biocolloid chemistry;
- elaboration of novel methods of synthetic chemistry as the basis for producing materials with practically important functional characteristics and systems with the properties of the so-called molecular machines;
- development of new selective sorbents, catalysts and technologies of using them;
- application of methods and approaches of "green chemistry" to obtaining important products and materials.

Significant changes also occurred in biological science, which no longer was essentially descriptive and a science of observation. Society and continuous technological advances pose new difficult tasks for it, and modern biology can fulfil them.

The processes of global transformations in the field of basic biology and medicine, in conjunction with fast progress in biomedical technologies, called for a new level of characterizing molecular, cell and system processes of pathological state development. The integrated analysis of molecular networks, metabolic pathways and epigenetic mechanisms provides insights into pathogenic processes that occur in the cell and cause such pathologies as cardiovascular, oncological diseases, metabolism dysfunctions, neurodegeneration etc.

In the future, research will be carried out in the following major areas:

- investigations of molecular-biology and biochemical mechanisms controlling systemic intercellular interactions, signal cascades, cellular ion channels and pumps in the normal and various pathological states;
- research of the stability of important protein-protein complexes, their compo-

nents, membrane structures and factors affecting their functioning, in particular, in cryoconservation;
- studying the peculiarities of molecular-genetic and biochemical mechanisms regulating vital functions of plants, microorganisms, viruses under the action of exogenous factors and adaptation to environmental conditions, using experimental approaches and bio-information analysis;
- the analysis of genetic and epigenetic mechanisms of the realization of genetic information by investigating the effect of genome reorganizations and DNA methylation, histone modification, as well as the microRNA effect on changes in gene expressions;
- search for and characterization of new genes involved in oncogenesis with the purpose of prognostication, diagnostics and formulation of new medical drugs;
- search for new medicines, revealing the genetic, molecular-biological and biochemical mechanisms of their action, in particular, the regulation of the resistivity to antibiotics, antiviral and antitumor preparations; development of innovative approaches for targeted design of drugs and their delivery;
- studying the peculiarities of the clinical course of contagious and noncontagious diseases, using pharmacogenetic, bioinformation and proteomic approaches;
- investigating systemic biological processes under different pathological states as a basis for personified and regenerative medicine.

In the field of general biology the following principal research areas can be envisaged:
- basic studies in botany, zoology, hydrobiology and ecology of fauna and flora with the purpose of revealing the general patterns of the origin, evolution and functions of biodiversity, developing measures towards its conservation, restoration and sustainable use;
- minimizing the negative impacts of current climate change on people, the state of ecosystems, biodiversity and the economy of Ukraine;
- targeted basic research in genetics, cell and molecular biology to produce new high-yield crop varieties that are resistant to negative biotic and abiotic factors of the environment;
- more extensive research relying on state-of-the-art biological technologies intended for agriculture, medicine etc.;
- advancement of resource-renewable (green) energy engineering and studies towards biofuel production, which also are elements of our state's energy security;
- development of research in space biology;
- promotion of nature-conservation and ecological-education activities of reserves, botanical gardens, dendrological parks, museums of natural history, landmarks of garden and park architecture, which gives rise to new mentality of our citizens — the harmonious coexistence of man and nature.

Social sciences and humanities

Today the major task of Academy socio-humanities institutions is comprehensive and unbiased analysis of current processes and trends of global civilizational development, first and foremost, of the opportunities, threats and risks they may bring for the Ukrainian state and its national identity, the grounding of ideological guidelines, general lines, strategies and programs, effective algorithms of overcoming the systemic crisis that is now enveloping Ukraine, for the

society and the state to take the ways of dynamic forward movement, the integration of our country into the world economic, political and cultural space.

Here of special importance is the involvement of socio-humanities scholars in protecting and safeguarding national and state interests, ensuring economic, political, social, and information security, intellectual and cultural independence of Ukraine. The fulfillment of those tasks requires, besides political will and civic cohesion, considerable intellectual efforts of socio-humanities scholars towards conceptual grounding of and practical support to the building up of the Ukrainian project in the 21st century.

The imperatives of the time have placed the focus of research interests of **socio-humanities scholars** on the problems of ideological and civilizational choice of Ukraine aimed at overcoming the post-totalitarian syndrome and establishing European values, human freedom and open society. A new vision of the Ukrainian national idea appears in this discourse. It determines the approaches of social scientists to the search for ways of overcoming the systemic crisis — economic, political, social — and consolidating the Ukrainian society on the basis of forming its up-to-date, developed political culture and neutralizing the manifestations of social injustice, of establishing tolerance in interregional, interethnic, and intercultural relations.

In this context, of special importance is the top-priority task of the state policy — the elaboration of effective strategies for reintegrating the occupied territories of the East and South of Ukraine that would provide a natural combination of political, economic, social and cultural, humanitarian dimensions of their recovery.

Joint interdisciplinary research efforts of scholars — those working in ***economics, law, politology, sociology*** — and the involvement of many Academy institutions specializing in engineering and natural sciences will be needed for elaborating realistic strategies, programs and plans to overcome systemic crisis and for Ukraine to take the way of dynamic innovative progress and build up the knowledge-based economy. In view of that, the present situation demands more effective research into the key issues of socio-economic development, primarily, those aimed at the implementation of political, legal, economic and social transformations in the state, the soonest possible active involvement of national S&T and innovation potential to encourage the innovative progress of Ukraine, accelerate its further integration into the global economy, science and technology. An integral part of that would be a profound analysis of the ways to enhance the socio-economic and demographic potential of the individual regions of the country, determine the real vectors of their development.

The issues of *state building*, upgrading the national legislation, implementation of the norms of international and European laws in Ukraine also need deep interdisciplinary studies. Among top-priority tasks of Academy's scholars in law and politology today are the implementation of *judicial reform*, renovation of the *administrative and territorial structure of Ukraine*, relying on principles of regional economy management, improvement of local self-government, support to innovations and investments, completion of land reform, solution of environmental problems and achievement of rational nature management, essential shifts in state's social policy, first and foremost, the implementation of transformations in education, public health system, social welfare services that would meet the interests of broad social strata. Today there is a pressing need for the

elaboration of legal mechanisms to improve the human and civil rights protection.

Hence, the comparative studies of socio-political, economic, social and cultural development of foreign countries, the reformation experience in today's world deserve careful attention of scholars in socio-humanities. Now special importance is attached to comprehending the place and role of Ukraine in the formation of new world law and order, the system of international relations, elaboration of effective strategies of equitable integration of Ukraine into international economic and political structures. That, in turn, demands more profound understanding of the entire complex of civilizational, ideological, spiritual and cultural processes, trends in globalization and the development of information society. In the next years, futurological studies in the NAS of Ukraine are to be given accelerated promotion.

The implementation of inspiring tasks for the future of Ukraine demands that Academy scholars in socio-humanities elaborate the systemic vision, produce scientifically grounded long-, medium- and short-term forecasts of the development in the major spheres of society's life, in the regional contexts in particular, efficiently use operative social technologies for the purposeful support to the processes of society consolidation, increase in human capital, formation of the new individual, self-dependent and self-reliant, who would be capable of successful activities under changing innovation waves, upbuilding of knowledge-based society.

The achievement of that calls for essential promotion of research into *subjective, socio-psychological and socio-cultural factors* of social progress, broader monitoring of public opinion on important issues of today's socio-economic, socio-political and cultural development, specifically, among different age and professional groups as well as regional communities. It is also necessary to continue studies of current social transformations. Here, of special importance would be the broader involvement of Ukrainian scholars into comparative studies under European sociological projects.

The increasing role of humanitarian factors in the development of contemporary Ukrainian society requires thorough research of the ideological, political, legal, economic, innovative and environmental culture of Ukraine's citizens, the culture of interethnic communication, improvement of the entire system of education and upbringing.

Today, special significance is also attached to studies of the establishment of the intellectual, cultural and spiritual self-reliance in the Ukrainian society, forming Ukrainian citizens' mental immunity to destabilizing foreign influences and information wars, which is of utmost importance for the security and integrity of the state. That requires the elaboration of both conceptual principles and particular humanitarian technologies for defending Ukrainian national identity, forming the integral national cultural and information space, since that is the framework for individual's socialization, the establishment of national consciousness, passing moral values and traditions from generation to generation.

Our time naturally requires significant research efforts to provide scholarly support to the rise of *society's general humanitarian culture, forming the culture of historical thinking, national memory, respect to the historical experience and traditions of the Ukrainian people, the instillation of patriotic national conscience.* At issue is not only extensive research into and methodological support of measures to popularize the national historical and cultural heritage but also the elaboration of effective algorithms for re-evaluat-

ing the national assets, providing their new understanding and integration into the life of contemporary urbanized society, into the awareness of new generations that socialize in conditions of information revolution and the establishment of high tech knowledge-based society.

The task of truly strategic importance is now to elaborate the *principles* that would be adequate in the current realities *of linguistic and cultural policy of Ukraine* as a state with multicultural and multiethnic population. Of great importance here is the extension of Ukrainian lingua-cultural environment, in particular the wide use of advanced information technologies for that purpose, and the grounding of optimum decisions that would meet ethno-cultural needs of ethnic communities.

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The fulfilment of important tasks of the national academy science now requires an essential re-arrangement and enhancement of the research potential of the NAS of Ukraine, as well as extension of interdisciplinary research, thus — the resolute choice of innovative progressive management of scientific research, especially that relying on principles of program-based, competitive, grant funding. A necessary element of boosting scientific research and ensuring the efficient introduction of its results into the practice of state, public, S&T, economic, social, innovative and cultural life is the broadening of the rights and potentials of scientific institutions, research teams, enhancing the social protection of scientists, introducing effective mechanisms to stimulate the creative work of young researchers, improving the legal framework for using intellectual property objects created by them, achieving the level of academic mobility and the information provision of the Ukrainian science that would meet the European standards, providing the state support to the integration of the national science into the world scientific space.

At the same time, an important condition for the development of today's society is stronger civic activity of the Academy scientific community, the persistent propagation and resolute support of scientifically grounded approaches to and decisions on important current issues among authorities, politicians and fellow countrymen. That should concern their conceptual analysis, legislative procedures, the conformity of political and practical administrative decisions to the national and state interests, principles of social justice, openness and transparency, civil responsibility of the authorities. A considerable role in this respect is to be played by Academy's expert activities, which are among its major statutory tasks and, to an even greater degree, the preparation of analytical reports and data with recommendations, scientifically grounded proposals both on assignments from the state authorities and through the initiative of research institutions and scientists themselves.

Embodying the intellect of the nation, guided by its patriotic responsibility for the fate of our native land, the National Academy of Sciences of Ukraine, its scholars, the entire scientific community will give all their efforts to the vigorous support of national interests, elaborating democratic ideological guidelines for the society, establishing in citizens' consciousness the vision of the 21st century Ukraine as a state of enhanced S&T and human potential, high tech economy, the nation capable of dynamic innovative development, meeting ever increasing social and spiritual interests and aspirations of its citizens.

SERVICE TO SCIENCE AND PEOPLE IS OUR UNVARYING GOAL

Over one hundred years of Academy's existence many things have changed in nature, society, culture, science itself. But the goal of the Academy remained constant. And that is recorded in its statutes. The first Statutes (1918) stated that the Ukrainian Academy of Sciences was trying to expand, deepen and disseminate scientific knowledge and at the same time enrich it with new discoveries to the advantage of mankind and "sets itself the goal, besides general scientific tasks, to study the present and past of Ukraine, Ukrainian land and people (§ 2)[75]. Now its Statutes currently in force (the version of 1916) declare: "The aim of the NAS of Ukraine shall be to obtain new and generalize the existing knowledge about nature, the man and society, develop scientific fundamentals of the scientific, technological, socio-economic and cultural progress of the nation, provide comprehensive support to the practical application of scientific research results, train highly qualified research personnel, form science-based view of the world in the society" (§ 1.4)[76]. Academy's tasks from Statutes to Statutes repeat the essential functions of science — to get to know the world, the place and role of the man in it, as well as using the knowledge obtained for the good of society and for conservation of nature.

In the 21st century those tasks become much broader and the need for their accelerated implementation grows. The scales of natural and social changes are increasing and their rates accelerating, which becomes crucial both for the civilization at large and for individual countries and peoples. No one, save Great Science, can provide the entire picture of these changes and find responses to their comprehensive challenges, the responses both universal and national. Each country has been many times involved in the global cycle and has an unlimited number of its own individual transformations. And every scholarly community tries to make its own contribution to the state-of-the-art science and proposes solutions of current and future problems.

[75] Історія Академії наук України, 1918—1923 : док. і матеріали. Київ: Наук. думка, 1993. P. 167.

[76] Статут Національної академії наук України (нова редакція). Київ: Академперіодика, 2016. P. 3.

NAS of Ukraine, guided by the unvarying goal of service to science and people, defines its research programs whose implementation will encourage the entire Academy system to ensure progressive social changes and provide conditions for successful and secure future of the people and the state. These efforts agree with the general vision of perspectives presented in the UN document (2012) under the significant title "The Future We Want". The future wanted is an economically, socially end environmentally developed society that would embody prosperity and be robust against current and new challenges. In the annual National Reports the Academy proposes ideas and models for integrating the economic, social, environmental and technological components in the Ukrainian society's movement to the future the world wants. To be sure, alongside the recommendations towards solving the imperative problems of today.

The Academy continuously keeps in sight the technical and technological upgrading of industrial production and the entire way of life of the Ukrainian society. The so-called post-industrial society is not a good metaphor. Mankind will never dismiss the industrial component from its life. Industry is materials, instruments, mechanisms, machines, buildings, transport, and communication means — in general, technical and technological means to support human existence. Now and in the future mankind will not survive without powerful industry. And only those nations and peoples that will rely on new rounds of industrialization will be advanced, successful, and competitive. Actually, the process of superindustrialization is taking place — the industrialization based on highly science-intensive materials, technical means, and technologies.

Ukraine is on the threshold of such industrialization. Its Academy of Sciences has vast experience of creative participation in the classical industrialization and a strong potential for the scientific support to neoindustrialization. Academy's S&T institutions aim at developing science-intensive materials and high technologies and demonstrate high-quality samples and models of those. The problem is to accelerate the transfer of discoveries and technologies to industrial production. Of great importance here is the interaction of science, state authorities and business. The NAS of Ukraine regularly sends driving pulses to the members of this triangle for constructive collaboration.

Neoindustrialization that evolves into superindustrialization will accompany the development of new waves of innovation. The technological choice is the basis of civilizational choice. It is the technological choice and its consolidation in the way of life that ensures the leadership roles of peoples and states. The NAS of Ukraine heads for scientific grounding and implementation of new waves of innovation. They are relying and will rely on intellectual (information, nano-, bio-, socio-humanitarian) technologies. Hence, the Academy favors basic research whose results, when implemented in practice, yield intellectual technologies.

The characteristic feature of new innovation waves (the sixth, which will dominate in advanced countries till the mid-21st century, and the seventh, which will become visible from that time on) is their integrative nature. That means the ever growing interrelation of *production, way of life and administration*. The response of the NAS of Ukraine to that trend is the enhanced integration of engineering, natural-science and social research that would give rise to comprehensive recommendations towards the technological upgrading of the society. With increasing frequency, socio-humanities use ideas, methods and results of engineering, and

especially, "exact" sciences, while the latter take into account humanitarian approaches and social dimensions. The integrated scientific outcomes improve the accuracy of forecasts concerning the transformation and strategies of the Ukrainian society modernization.

Here, global trends of civilizational changes and respective changes in science priorities, are taken into account. The idea that the 21st century will be a humanitarian age has become firmly established in the international academic circles. Socio-humanitarian technologies will dominate in it — human sciences and sciences about all living things will come to the foreground. The draft of the new Research Framework Programme of the European Union (FP—9), which will succeed "Horizon 2020", envisages that till 2030 the EU will focus its scientific and innovative policy on projects "with high social return". The priority and full funding will be provided to those studies which will respond to major social challenges such as overcoming the social and economic inequities, public health, disease prevention, improvement of the environment, mitigation of the negative impacts of climate change, social security. Technology transfer will be given utmost priority. The Programme (FP9) planners were given the task of comprehensive representation of social sciences and humanities. The Programme will run from 2021 to 2027, its budget is planned at €150 billion.

The dynamics of priorities in scientific research shows the trend of levelling the statuses of engineering, natural sciences and socio-humanities. Since the establishment of the industrial society, engineering sciences have been at the forefront. They were the driving force of industrialization. Natural sciences were either moving hand in hand or followed them but were overshadowed by them. Socio-humanities were given the third place, though at the moments when nations and national states were born they pulled ahead. In developed industrial societies, where the role of technological factors has enhanced, the status of natural sciences has caught up with that of the engineering sciences and in some respects even exceeded them. With the dawn of information civilization, where knowledge, intellectual, social, human factors are becoming the principal productive force, the role and importance of socio-humanities grows considerably. They are becoming equal to engineering and natural sciences in their influence on social transformations and not infrequently they are shaping the image and the foundations of the new civilization.

In general, alongside its growing inner differentiation, science is becoming increasingly integrative. That enhances the objective need for the functioning of integrative scientific associations such as academies. Only joint science can ensure the formation of a harmonious society and a harmonious individual, which is an ideal version of building a future.

The major achievement of the NAS of Ukraine in one hundred years of its tireless work is the formation of the major national center of integrated science around it. Engineering, natural sciences and socio-humanities have united into a nation-wide creative complex that embodies the intellectual strength of the Ukrainian people. Every field of knowledge has revealed its might. In fact, the hierarchy of sciences has melted. The division of the Academy into three Sections — the First (physical, engineering and mathematical sciences), the Second (chemical and biological sciences) and the Third (socio-humanitarian studies) is merely a conventional representation of the traditional structure of the Academy. All three Sections are making important contributions to the national and

global treasury of knowledge. None of them can do without the synergy of the other two. An integrated scientific resource of triple strength has been formed.

Socio-humanities have won their place at the forefront of cognition. That resulted both from the large-scale accumulation of knowledge where quantity has been transformed into quality and the well-grounded responses to the challenges of turbulent transformations in the Ukrainian society. Academy's socio-humanitarian scholars are involved in constructing an innovative, high tech society in Ukraine, democratic, social, law-governed, sovereign state, in forming the national identity, patriotic conscience, scientific view of the world, political, legal, linguistic culture. There is an objective study of hybrid war phenomena: economy, culture, information, politics and corruption. Special focus is given to revealing, preventing and overcoming threats, crises, conflicts. Analytical and prognostic conclusions are closely related to the development of constructive social technologies that are instrumental in developing the statehood, updating all aspects of the Ukrainian society, ensuring the rights and freedoms of the man and citizen. All that has brought the Academy's socio-humanities to the vanguard of the national and social life and caused a high social demand for it.

The strength of science is in its prognostic ability. A forecast, a view over the horizon is the generic function of science. Over its entire history, mankind, relying on science, has been looking for and finding ways out of various critical situations. There are many scenarios concerning the future of today's complex, contradictory Ukrainian society: pessimistic, neutral and optimistic ones. The National Academy of Sciences of Ukraine is elaborating well-grounded optimistic scenarios of country development, as well as realistic models of their implementation. Its centennial experience gives confidence in the reliability of the strategies proposed. The Academy invariably sees its historical mission and its utmost goal of the social service to people in the scientific support to building the society of peace and prosperity in Ukraine.

ADDENDUM 1

RESEARCH INSTITUTIONS OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE

REGIONAL SCIENCE CENTERS OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE AND THE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

Donetsk Science Center of the National Academy of Sciences of Ukraine and the Ministry of Education and Science of Ukraine

Established in 1965.

Key research areas:

- restructuring and enhancing the efficiency of fuel-and-energy, metallurgical, chemical, engineering industries and agribusiness in the Donetsk region;
- improving human health and rational use of the natural resource potential of Donbas;
- environmental and technological safety of coal mining;
- development of scientific fundamentals for the creation of energy-saving technologies, innovative materials and methods of processing them;
- deployment of R&D results at defense enterprises;
- financial support of scientific, technological and innovative development;
- ensuring the maximum involvement of financial investors to improve research efficiency and the quality of life of temporarily displaced scientists.

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Director — PhD (Phys. & Math.) Olexandr Konovalov
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Western Science Centre of the National Academy of Sciences of Ukraine and of the Ministry of Education and Science of Ukraine

Established in 1971.

Key research areas:

- implementation of measures towards energy and resource saving, using local and alternative energy sources, reducing the energy intensity and materials consumption of products;
- technological support to strengthening construction materials, methods of anticorrosion protection of metal structures to extend their operation life in long-term exploitation;
- rational use of region's natural raw materials and environment protection;
- drawing up programs and strategies of socio-economic development of the region, intensification of the cross-border cooperation and European integration;
- increasing the oil and gas output of the Pre-Carpathian fields strata, upgrading Ukraine's gas transportation system;
- study and preservation of art landmarks of the region, folk crafts, research into human's socio-humanitarian problems;
- promoting the S&T potential of the region relying on better coordination, promotion of international relations, improving the informatization of research institutions and the system of training highly qualified scientific personnel.

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Zinoviy Nazarchuk
tel.: +38 032 261 0719
Director — Assoc. Prof. Oleh Zynyuk, PhD (Eng.)
tel.: +38 032 297 0774

Southern Science Centre of the National Academy of Sciences of Ukraine and the Ministry of Education and Science of Ukraine

Established in 1991.

Key research areas:

- increasing the role of science in the development and implementation of efficient state regional policy in Ukraine, that aims at combining the national and regional interests;
- resolving regional scientific, social, economic, environmental and other problems by joining the efforts of research institutions, universities, organizations and businesses located in the southern region of Ukraine.

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Sergey Andronati
Director — Assoc. Prof. Khutornoy Oleksiy, PhD (Chem.)
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North-East Science Centre of the National Academy of Sciences of Ukraine and the Ministry of Education and Science of Ukraine

Established in 1971.

Key research areas:

- providing independent evaluation of the economic and technological development in the region, the state of its economy, the impact of market mechanisms on the social and economic situation;
- development and implementation of low- and zero-waste environment-friendly science-intensive technologies in manufacturing to foster well-developed industries in the region, machine-building in particular;
- development and improvement of production and reproduction processes of the most important crop and livestock species and varieties in the region;

- addressing fuel and energy issues, relying on the available natural and secondary resources of the region;
- promoting educational activities in the region, increasing scientists' influence on the development of creative forces and improving the intellectual level of its population.

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Director — Prof. Pavlo Bubenko,
Dr. Sci. (Econ.)
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Prydniprovskyi Science Centre of the National Academy of Sciences of Ukraine and the Ministry of Education and Science of Ukraine

Established in 1971 as an NGO. Science division of the NAS of Ukraine since 1990.

Key research areas:

- organizing events aimed at increasing the prestige of scientific work;
- upgrading the training of highly qualified research personnel;
- innovative activities;
- performing scientific research.

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SECTION OF PHYSICAL, ENGINEERING AND MATHEMATICAL SCIENCES

Department of Mathematics of the NAS of Ukraine

Institute of Mathematics, National Academy of Sciences of Ukraine (IM NAS of Ukraine)

Established in 1934.

Key research areas:

- theory of differential equations, dynamical systems and nonlinear oscillations;
- mathematical physics, methods of functional and nonlinear analysis;
- probability theory and mathematical statistics;
- theory of functions of real and complex variables;
- algebraic and topological structures;
- computational mathematics, analytical mechanics and dynamics of mechanical systems.

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Institute of Applied Mathematics and Mechanics, National Academy of Sciences of Ukraine (IAMM NAS of Ukraine)

Established in 1965.

Key research areas:

- theory of partial differential equations and theory of operators, constructive and geometric function theory, theory of random processes and mathematical statistics;
- solid body dynamics, stability and control theory, rock mechanics;
- modelling, identification and recognition of control systems.

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Pidstryhach Institute for Applied Problems of Mechanics and Mathematics, National Academy of Sciences of Ukraine (PIAPMM NAS of Ukraine)

Established in 1978.

Key research areas:

- methods of nonlinear functional analysis, linear algebra, differential geometry and topology;
- non-classical problems of the theory of differential and integral equations and mathematical physics;
- mathematical and thermodynamic modeling and investigation of coupled processes of different nature in complex technical and medico-biological structures;
- methods of determining and optimizing the stress-strain state and limit equilibrium of structurally inhomogeneous systems as applied to the problems of estimating their strength, prediction of service life and function reliability.

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Director — Prof., NAS Acad. Roman Kushnir
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Centre of Mathematical Modelling of Pidstryhach Institute for Applied Problems of Mechanics and Mathematics, National Academy of Sciences of Ukraine (CMM PIAPMM NAS of Ukraine)

Established in 1992.

Key research areas:

- R&D in modern areas and problems of mathematical modeling;
- developing methods of computational experiment and optimization as applied to the invention of novel equipment and technologies;
- development of new forms and methods of mathematical education, training and upgrading of scientific personnel focused on the implementation of international projects and programs;
- creation of new information technologies and informational support to scientific activities, international information exchange in the field of mathematical modeling and computational experiment.

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Mathematical Division of B. Verkin Institute for Low Temperature Physics and Engineering, National Academy of Sciences of Ukraine (MD VILTPE NAS of Ukraine)

Established in 1987.

Key research areas:

- mathematical physics;
- analysis;
- geometry.

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Head of the Division — Prof., NAS Corr. Memb. Gennadiy Feldman,
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Department of Information Science of the NAS of Ukraine

Glushkov Institute of Cybernetics, National Academy of Sciences of Ukraine (IC NAS of Ukraine)

Established in 1961.

Key research areas:

- development of the general theory and methods of systems analysis, mathematical modelling, optimization, reliability and artificial intelligence;
- development of general control theory, methods and means for building intelligent control systems of different levels and purposes;
- constructing the general theory of computers and development of advanced facilities for computers, artificial intelligence and computer science;
- developing advanced mathematical software for general and applied purposes;
- development of novel information technologies and intelligent systems;
- solving fundamental and applied problems of information society.

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Institute of Software Systems of the National Academy of Sciences of Ukraine (ISS of NAS of Ukraine)

Established in 1992.

Key research areas:

- theoretical and applied problems of developing programming systems and technologies, models and tools of software engineering, problem assessment and quality assurance, standardization and certification of software systems;
- formal logic foundations, methods and tools for the development of intelligent information systems, data and knowledge banks;
- mathematical models, methods and software for creating complex distributed computer systems.

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Institute for Information Recording of the National Academy of Sciences of Ukraine (IIR of NAS of Ukraine)

Established in 1987.

Key research areas:

- physical fundamentals, principles, methods and systems of information recording and transformation, development of long-term digital information storage technology;
- theoretical foundations and applied methods for creating computer information-analytical systems, investigation and development of information protection methods in computer systems and networks, creating systems of decision-making support;
- developing methods to create a system of computer networks for data banks, databases and knowledge bases;
- creating systems for sound and image reproduction from rarity information carriers;
- theoretical fundamentals and applied methods of computer simulation;
- creation of automated systems for real-time monitoring of a set of moving objects.

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Space Research Institute of the National Academy of Sciences of Ukraine and the State Space Agency of Ukraine (SRI NAS of Ukraine and SSA of Ukraine)

The Space Research Institute of the National Academy of Sciences of Ukraine (NAS of Ukraine) and the State Space Agency of Ukraine (SSA of Ukraine) was established pursuant to the Agreement between the Presidium of the NAS of Ukraine and NSA of Ukraine of 14 February 1996 and their joint order of 8 April 1996, # 55/63. As specified in the order of the SSA of Ukraine #165 of 29 June 2011 'On Renaming the National Space Agency of Ukraine' the name National Space Agency of Ukraine (NSA of Ukraine) was changed to the State Space Agency of Ukraine (SSA of Ukraine).

Key research areas:

- solar and terrestrial relations and space weather;
- space information systems and technologies, aerospace data processing technologies;
- space materials science;
- development of advanced instrumentation for space research;
- theory and methods of complex space dynamic systems control.

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State Enterprise 'Lviv Centre of the Institute for Space Research of the National Academy of Sciences of Ukraine and the State Space Agency of Ukraine' (SE 'LCISR NAS of Ukraine and SSA of Ukraine')

Established in 1996.

Key research areas:

- fundamental and applied space research;
- investigations of acoustic-electromagnetic interactions in the atmosphere and ionosphere;
- studies and measurements of electromagnetic field parameters in conducting media (space plasma, sea water, etc.);
- space information systems and technologies;
- development and creation of on-board primary sensors and systems for measuring, collecting and processing measurement data of physical field parameters.

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Educational and Scientific Complex 'Institute for Applied System Analysis' of the National Technical University of Ukraine 'Igor Sikorsky Kyiv Polytechnic Institute'

Established in 1997.

Key research areas:

- systems analysis;
- systems mathematics;
- global modelling and scenario planning of sustainable development;
- service-oriented computing for collective engineering design in grid/cloud environments.

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Scientific Director — Prof., NAS Acad.
Mykhailo Zgurovsky
Director — Prof. Pavlo Kasyanov, Dr. Sci.
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International Research and Training Center for Information Technologies and Systems, NAS and MES of Ukraine

Established in 1997.

Key research areas:

- solving fundamental and applied problems of novel technologies and intelligent information systems;
- creating ICT for science and education;
- development of the theory of systems information technologies and scientific fundamentals for problems of information society, economy and industry;
- development and use of advanced computer technologies and telematics in education and social sphere.

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Institute of Artificial Intelligence Problems of the MES and NAS of Ukraine (IAIP of MES and NAS of Ukraine)

Established in 1991.

Key research areas:

- fundamental principles of creating intelligent systems for decision-making support with formal artificial consciousness models;
- fundamental and applied problems of creating innovative knowledge-based intelligent systems and technologies;
- theoretical fundamentals of artificial intelligence philosophy;
- development of scientific and theoretical basis for wide application of computerized robotic hardware and SMART-systems;
- analysis and pattern recognition in diagnostics of engineering and biological objects; creation of a cutting-edge theory and applied systems of pattern recognition;
- implementation of state-of-the-art information technologies in medical and biological research, education, and digital economy.

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Department of Mechanics of the NAS of Ukraine

S.P. Timoshenko Institute of Mechanics, National Academy of Sciences of Ukraine

Established in 1918.

Key research areas:

- mechanics of composite and inhomogeneous media;
- structural mechanics of shell systems;
- mechanics of coupled fields in materials and structural elements;
- fracture mechanics and fatigue;
- dynamics and stability of mechanical system motion.

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Institute of Technical Mechanics of the National Academy of Sciences of Ukraine and State Space Agency of Ukraine

Established in 1966.

Key research areas:

- dynamics of mechanical and hydromechanical systems, launch vehicle systems, rail and motor transport;

- aero-thermo-gas dynamics of power plants, flying and space vehicles, and their subsystems;
- strength, reliability and optimization of mechanical systems, launch vehicles and spacecraft;
- mechanics of the interaction of a solid with ionized media and electromagnetic radiation;
- systems analysis of trends and prospects in space engineering.

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G.S. Pisarenko Institute for Problems of Strength National Academy of Sciences of Ukraine

Established in 1966.

Key research areas:

- ultimate state and strength criteria of materials and structures;
- calculation and experimental methods for studying the stress-strain state;
- fracture mechanics and durability of structures with cracks;
- vibrations of non-conservative mechanical systems.

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N. Poliakov Institute of Geotechnical Mechanics of the National Academy of Sciences of Ukraine

Established in 1967.

Key research areas:

- properties of rocks and massifs, their fraction and stress-strain state control;
- scientific fundamentals of mining and technological processes, equipment and technologies for extraction and processing of natural resources;
- physical, engineering and geological fundamentals of technologies for coal-mine methane production;
- processes and technologies of coal and methane energy conversion, functioning parameters and structure of energy complexes; energy saving and safety of mining.

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Institute of Hydromechanics, National Academy of Sciences of Ukraine

Established in 1938.

Key research areas:

- hydromechanics of moving objects and turbulent flows;
- hydromechanics of water jets and hydraulic engineering

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Internet: www.hydromech.kiev.ua
Director — Prof., NAS Acad.
Viktor Grinchenko
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Institute of Transport Systems and Technologies of the National Academy of Sciences of Ukraine ('Transmag')

Established in 1995.

Key research areas:

- physical and technological problems of developing maglev transport systems and devices, their control and power supply means;
- problems of mechanics and aerodynamics of maglev vehicles and trains;
- design and operation of high energy power supplies for maglev transport.

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Department of Physics and Astronomy of the NAS of Ukraine

Institute of Physics of the National Academy of Sciences of Ukraine

Established in 1929.

Key research areas:

- condensed matter physics, physics of soft matter included;
- nanophysics and nanoelectronics;
- laser physics, nonlinear and singular optics, holography;
- surface physics, emission and plasma electronics.

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Director — Prof., NAS Corr. Memb. Mykhailo Bondar
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V.Ye. Lashkaryov Institute of Semiconductor Physics, National Academy of Sciences of Ukraine

Established in 1960.

Key research areas:

- physics of the interaction processes of electromagnetic radiation with matter;
- physics of low-dimensional systems, micro- and nanoelectronics;
- optoelectronics and solar energy engineering;
- semiconductor materials science and sensor systems.

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G. V. Kurdyumov Institute for Metal Physics of the N.A.S. of Ukraine

Established in 1945.

Key research areas:

- physics of strength and plasticity of metals and alloys;
- atomic constitution of metals and metal-containing heterophase structures;
- electronic structure and properties of metals and metal-based compounds;
- nanoscale and nanostructured systems.

36 Akademika Vernadskoho Blvd., Kyiv, 03142, Ukraine
tel.: +38 044 424 3110; fax +38 044 424 2561
e-mail: metall@imp.kiev.ua
Internet: www.imp.kiev.ua
Director — Prof., NAS Acad. Orest Ivasyshyn
tel.: +38 044 424 1005

Bogolyubov Institute for Theoretical Physics of the National Academy of Sciences of Ukraine

Established in 1966.

Key research areas:

- physics and high-energy astrophysics, quantum cosmology;
- quantum field theory, symmetry in quantum physics, theory of nuclear systems;

- theory of nonlinear processes in macromolecular structures, nanosystems and plasma;
- dynamics of open physical, biological and economic systems.

14-B Metrolohichna Str., Kyiv, 03143, Ukraine
tel./fax: +38 044 526 5998
e-mail: itp@bitp.kiev.ua
Internet: www.bitp.kiev.ua
Director — Prof., NAS Acad.
Anatoly Zagorodnyi
tel.: +38 044 526 5362

Main Astronomical Observatory of the National Academy of Sciences of Ukraine

Established in 1944.

Key research areas:

- positional astronomy, geo- and planet dynamics;
- physics of the Sun and the Solar System;
- physics of stars, galaxies and interstellar medium;
- astronomical and space instrumentation.

27 Akademika Zabolotnoho Str., Kyiv, 03143, Ukraine
tel.: +38 044 526 3110; fax +38 044 526 2147
E-mail: office@mao.kiev.ua
Internet: www.mao.kiev.ua
Director — NAS Acad. Yaroslav Yatskiv, Dr. Sci. (Phys. & Math.)
tel.: +38 044 526 3110

Institute of Magnetism of the National Academy of Sciences of Ukraine and the Ministry of Education and Science of Ukraine

Established in 1995.

Key research areas:

- nonlinear phenomena and tunneling processes in magnetic materials;
- physics of electrochemical processes at the fluid-metal boundary;
- physics of magnetic multilayers;
- magnetic sensors and materials for magnetic storage devices;
- ecology;
- pedagogics, issues of science and education.

36-B Akademika Vernadskoho Blvd., Kyiv, 03680, Ukraine
tel./fax: +38 044 424 1020
e-mail: vbar@imag.kiev.ua
Internet: www.ukr.imag.kiev.ua
Director — Prof., NAES Corr. Memb.
Yurii Gorobets
tel.: +38 044 452 9654

Institute of Applied Problems of Physics and Biophysics of the National Academy of Sciences of Ukraine

Established in 1989.

Key research areas:

- physical phenomena in biological structures;
- —physics of lasers and optical processes in materials;
- physics of biotechnical structures.

3 V. Stepanchenka Str., Kyiv, 03680, Ukraine
tel./fax: +38 044 423 0845
e-mail: biophys@ukr.net
Internet: www.iappb.kiev.ua
Director — Dr. Sci. (Biol.) Anatoliy Mysiura
tel.: +38 044 423 0834

International Center 'Institute of Applied Optics', National Academy of Sciences of Ukraine

Established in 1994.

Key research areas:

- laser physics and physical basics of laser technologies;
- nanooptics, digital optics and holography;
- optical protective technologies.

10-G Kudryavska Str., Kyiv, 04053, Ukraine
tel.: +38 044 272 2158; fax: +38 044 272 4812
e-mail: iao@i.com.ua
Internet: www.iao.kiev.ua

Director — Prof. Victor Taranenko,
Dr. Sci. (Phys. & Math.)
tel.: +38 044 272 2158

B. Verkin Institute for Low Temperature Physics and Engineering of the National Academy of Sciences of Ukraine

Established in 1960.

Key research areas:

- low and ultralow temperature physics;
- solid state physics;
- nanophysics and nanotechnologies, nanobiophysics included;
- mathematical physics, analysis, geometry;
- physical and engineering problems of materials science.

47 Nauky Ave., Kharkiv, 61103, Ukraine
tel.: +38 057 340 2223; fax: +38 057 340 3370
e-mail: ilt@ilt.kharkov.ua
Internet: www.ilt.kharkov.ua
Director — Prof., NAS Acad. Sergii Gnatchenko
tel.: +38 057 340 2223

O. Ya. Usikov Institute for Radio Physics and Electronics of the National Academy of Sciences of Ukraine

Established in 1955.

Key research areas:

- electronics and radio physics of millimeter and submillimeter waves;
- interaction of electromagnetic waves with solids and biological objects;
- radio wave propagation in the environment;
- radio physical sensing of natural and artificial objects.

12 Akademika Proskury Str., Kharkiv, 61085, Ukraine
tel./fax: +38 057 315 0000
e-mail: secretar@ire.kharkov.ua
Internet: www.ire.kharkov.ua
Director — NAS Acad. Petr Melezhik
tel.: +38 057 315 1129

Institute of Radio Astronomy of National Academy of Sciences of Ukraine

Established in 1985.

Key research areas:

- radio astronomy of the Universe;
- remote sensing of the geospace and the Solar System;
- physical fundamentals of constructing radio telescopes and radio systems for remote sensing.

4 Mystetstv Str., Kharkiv, 61002, Ukraine
tel./fax: +38 057 720 3758
e-mail: rian@rian.kharkov.ua,
rai@ri.kharkov.ua
Internet: www.rian.kharkov.ua
Director — NAS Corr. Memb. Viacheslav Zakharenko, Dr. Sci. (Phys. & Math.)
tel.: +38 057 720 3758

Institute of Ionosphere, National Academy of Sciences of Ukraine and Ministry of Education and Science of Ukraine

Established in 1991.

Key research areas:

- development of the theory of the ionosphere in quiet and naturally or artificially disturbed conditions;
- experimental studies of ionospheric parameters in quiet and naturally or artificially disturbed conditions;
- creating and improving the means of remote radio sensing of the ionosphere, including incoherent scattering installations.

16 Kyrpychova Str., Kharkiv, 61002, Ukraine
tel./fax: +38 057 706 2287
e-mail: iion@kpi.kharkov.ua
Internet: www.iion.org.ua
Director — Prof. Igor Domnin, Dr. Sci. (Eng.)
tel.: +38 057 706 2599

Donetsk Institute for Physics and Engineering named after O.O. Galkin of the National Academy of Sciences of Ukraine

Established in 1965.

Key research areas:

- properties of materials under extreme conditions;
- development and production of novel constructional and functional materials, nanostructured ones included.

46 Nauky Ave., Kyiv, 03028, Ukraine
tel./fax: +38 044 524 0480
e-mail: donfti.nanu@ukr.net
Internet: www.donphti.kiev.ua
Director — Prof. Victor Beloshenko, Dr. Sci. (Eng.)
tel.: +38 044 524 0480

Institute for Physics of Mining Processes, National Academy of Sciences of Ukraine

Established in 2002.

Key research areas:

- physics of mining processes at great depths;
- development of methods for active rock massif control in mining;
- development of physical and chemical technologies for preventing coal, gas, and rock bursts;
- development of methods for forecasting rock massif state during coal mine flooding.

2-A Simferopolska Str., Dnipro, 49600, Ukraine
tel./fax: +38 056 247 0917
e-mail: grinevv@ukr.net
Internet: www.ifgp.dp.ua
Director — Prof. Oleksandr Molchanov, Dr. Sci. (Eng.)
tel.: +38 056 247 0917

Institute for Condensed Matter Physics, National Academy of Sciences of Ukraine

Established in 1990 on the basis of Lviv Statistical Physics Division of the Institute for Theoretical Physics set up in 1969.

Key research areas:

- statistical theory of condensed matter;
- computer simulations of processes in solids and soft matter;
- physics of complex systems.

1 I. Svientsitskoho Str., Lviv, 79011, Ukraine
tel./fax: +38 032 276 1158
e-mail: icmp@icmp.lviv.ua
Internet: www.icmp.lviv.ua
Director — NAS Acad. Ihor Mryglod
tel.: +38 032 276 1978

Institute of Electron Physics, National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- basic (theoretical, experimental and applied) studies in low-energy atomic and nuclear physics, physics of electron and ion collisions, physical and quantum electronics, non-linear optics; elaboration of new research methods;
- development of novel devices and optical materials for functional and quantum electronics.

21 Universytetska Str., Uzhhorod, 88017, Ukraine
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e-mail: annagomonai@gmail.com
Internet: www.iep.org.ua
Director — Dr. Sci. (Phys. & Math.) Anna Gomonai
tel.: +38 0312 64 3650

Department of the Earth Sciences of the NAS of Ukraine

Institute of Geological Sciences, National Academy of Sciences of Ukraine

Established in 1926.

Key research areas:

- basic and applied geology;
- paleontology and stratigraphy;

- hydrogeology, engineering geology and environmental geology;
- geology of Ukraine and mineral deposit formation;
- geology of seas and the World Ocean.

55-B O. Honchara Str., Kyiv, 01054, Ukraine
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Internet: http://igs-nas.org.ua/
Director — Prof., NAS Acad. Petro F. Gozhyk
tel.: +38 044 486 9446

State Institution 'Scientific Centre for Aerospace Research of the Earth of the Institute of Geological Sciences of the National Academy of Sciences of Ukraine'

Established in 1992.

Key research areas:

- improvement of theoretical and methodological fundamentals for remote environment monitoring, physical and mathematical simulation of electromagnetic radiation generation, reflection and scattering by natural surface features (vegetation, soil, water) and by man-made surfaces;
- development of methods and technologies for environmental remote sensing, natural resources management and dual-purpose tasks; monitoring of geosphere global changes (prospecting for natural resources, climate change, forestry, desertification etc.);
- development of methods and technologies for agricultural remote monitoring, including crop mapping, yield forecasting, assessment of renewable natural resources (soil, forests, water bodies);
- justification of requirements for Earth remote sensing facilities, development of methods for on-board sensors calibration and satellite data/technologies validation;
- creation of the national regulatory conceptual framework and its harmonization with the international rules and standards in remote sensing;
- international cooperation in research into Earth remote sensing with a view to the intake of advanced foreign equipment and technologies for the needs of the economy and environment protection in Ukraine.

55-B O. Honchara Str., Kyiv, 01054, Ukraine
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e-mail: casre@casre.kiev.ua
Internet: www.casre.kiev.ua
Director — Prof., NAS Corr. Memb.
Mykhailo Popov
tel.: +38 044 482 0166

State Science Institution 'Marine Geology and Ore Formation Centre of the National Academy of Sciences of Ukraine'

Established in 1992.

Key research areas:

- study of the structure of the Earth's crust in the seas and oceans;
- study of the process of deposits and ore formation in the seas and oceans;
- prospecting for deposits of mineral resources of the Black and Azov seas and the World Ocean;
- geoecology and scientific fundamentals of environment protection and the rational use of natural resources;
- protection of natural resources, popularizing the scientific achievements of geological science in Ukraine and abroad.

55-B O. Honchara Str., Kyiv, 01054, Ukraine
tel./fax: +38 044 234 3475
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Internet: www.omgor.naukovamolod.org.ua
Director — NAS Corr. Memb.
Volodymyr Yemelyanov
tel.: + 38 044 234 3475

S. Subbotin Institute of Geophysics of National Academy of Sciences of Ukraine

Established in 1960.

Key research areas:

- studying the deep structure, tectonics, texture and geodynamics of continental and ocean lithosphere by geophysical methods (seismics, gravimetry, magnetometry and electrometry) with the aim of mineral deposits prospecting;
- development of the theory, methods, hardware, and automated systems for geophysical surveys and the processing and interpretation of their results;
- geophysical research of the environment in order to study and forecast seismic hazards and other dangerous natural phenomena;
- studying fundamentals of non-linear non-equilibrium geophysics and using them to develop novel technologies and equipment for intensification of fossil fuels extraction.

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e-mail: earth@igph.kiev.ua
Internet: http://www.igph.kiev.ua
Director — Prof., NAS Acad. Vitaly Starostenko
tel.: +38 044 424 0112

Carpathian Branch of S. Subbotin Institute of Geophysics, the National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- studies of the space-time structure of geophysical fields and their relation to the deep structure and modern lithosphere dynamics in the Carpathian region;
- –development of physical and geological fundamentals and novel geophysical technologies for forecasting geological environment and mineral prospecting;
- –development of the theory, methods and instrumentation for predicting environmentally hazardous geodynamic processes by means of geophysical environment monitoring.

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Internet: www.cb-igph.lviv.ua
Director — Prof., NAS Corr. Memb.
Valentyn Maksymchuk
tel.: +38 032 264 8563

Poltava Gravimetric Observatory of S. Subbotin Institute of Geophysics of the National Academy of Sciences of Ukraine

Established in 1926.

Key research areas:

- studies of the Earth's rotation and related geodynamic phenomena by methods of space geodesy and optical astrometry;
- studies of the Earth's crust dynamics and the gravity force relying on geodesic and geophysical observations;
- investigation of geodynamic processes with experimental and theoretical methods;
- geophysical investigations in earthquake prediction;
- studies of the sources of space radio emissions in the decametre frequency band.

27/29 Miasoyedova Str., Poltava, 36014, Ukraine
tel./fax: +38 053 256 9238
e-mail: pgo@poltava.ukrtel.net
Internet: pgo.geoplanet.org
Director — Prof. Mikhail Lubkov,
Dr. Sci. (Phys. & Math.)
tel.: +38 053 256 9238

State Institution 'Hydroacoustic Branch of S. Subbotin Institute of Geophysics of National Academy of Sciences of Ukraine'

Established in 1974.

Key research areas:

- acoustics;
- physics of the sea;
- theory of integral equations and linear operators;
- continuum dynamics;

- environmental safety;
- development of computer systems, software and algorithms;
- development of remote monitoring systems and tools for solving social and economic problems, emergency forecasting and prevention, protection of the marine environment and coastal areas with methods and means of informational acoustics, country defense;
- instrument making

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e-mail: info@vgaigph.org.ua
Internet: www.vgaigph.org.ua
Director — Senior Researcher Skipa Mikhail, PhD **(**Eng**.)**
tel.: +38 048 723 2013

Institute of Geography, National Academy of Sciences of Ukraine

Established in 1964 (as Sector), since 1991 it has been the Institute.

Key research areas:

- revealing the general trend of Nature evolution, patterns of functioning of landscapes and their elements with the purpose of rational nature management;
- geographical studies of sustainable economic, social and ecological development of Ukrainian regions;
- cartographic research of nature and society in their interaction, with a view to validating the balanced development of Ukrainian regions;
- scientific fundamentals of environment conservation and improvement, of the rational management of natural resources and seas.

44 Volodymyrska Str., Kyiv, 01030, Ukraine
tel./fax: +38 044 234 3230
e-mail: geo-ins@kiev.ldc.net
Internet: http://igu.org.ua/
Director — Prof., NAS Acad. Leonid Rudenko
tel.: +38 044 234 6193

M.P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation, the National Academy of Sciences of Ukraine

Established in 1969.

Key research areas:

- geochemistry of rock- and ore-forming processes, prospecting geochemistry and environmental geochemistry;
- regional and genetic mineralogy, physics of minerals, nano-mineralogy;
- petrology of endogenous processes;
- geology, metallogeny and assessment of the mineral deposits of Ukraine.

34 Akademika Palladina Ave, Kyiv, 03142, Ukraine
tel./fax: +38 044 424 1270
e-mail: office.igmr@gmail.com
Internet: www.igmof.org.ua
Director — Prof., NAS Acad. Oleksandr Ponomarenko
tel.: +38 044 501 1520

Institute of Geology and Geochemistry of Combustible Minerals, National Academy of Sciences of Ukraine

Established in 1951.

Key research areas:

- the theory of oil and gas formation, studying the formation and location of deposits of oil, gas, methane-coal fields and shale gas;
- geological and geochemical paleoceanography of ancient continental margins;
- geoecology and development of scientific fundamentals for energy-efficient geotechnologies;
- geochemistry, thermobarometry of fluids of mineral-forming environments.

3-A Naukova Str., Lviv, 79060, Ukraine
tel./fax: +38 032 263 2209
e-mail: igggk@mail.lviv.ua
Internet: www.iggcm.org.ua
Director — Prof., NAS Corr. Memb. Myroslav Pavliuk
tel.: +38 032 263 2541, +38 032 263 5196

Institute for Nature Management Problems and Ecology, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- development and validation of the methodology for a strategy for sustainable development of Ukraine's regions with high technogenic loads;
- development of scientific foundations of a regional environment monitoring system;
- estimation and prediction of the environmental consequences of the application of mining technologies and layout schemes.

6 Volodymyra Monomakha Str., Dnipro, 49000, Ukraine
tel.: +38 056 745 3043; fax: +38 056 744 7192
e-mail: ippe-main@svitonline.com
web: http://www.ippenan.com/
Director — Prof., NAS Corr. Memb.
Arkadii Shapar
tel.: +38 056 745 3043

State Institution 'Scientific Hydrophysical Centre of the National Academy of Sciences of Ukraine'

Established in 2016.

Key research areas:

- hydrophysical studies;
- formation and maintenance of automated oceanographic data bank, improvement and development of technologies for collecting, processing, long-term archiving, systems analysis and exchange of oceanographic information;
- planning and implementation of integrated (hydrophysical, hydrochemical, hydrobiological, marine geological and environmental) scientific expeditions by marine and river research vessels;
- organization of maintenance (repair and upgrading), using, disposal, construction (procurement) of self-propelled and non-self-propelled floating constructions (including research and small-size vessels) and other marine facilities, survey and R&D works.

42 Akademika Glushkova Ave., Kyiv, 03187, Ukraine
tel./fax: +38 044 596 9011
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Internet: www.cpas-nanu.pp.ua
Director — Prof., NAS Corr. Memb.
Oleksandr A. Shchyptsov
tel.: +38 044 596 9011

Ukrainian Hydrometeorological Institute, State Emergency Service of Ukraine and National Academy of Sciences of Ukraine

Established in 1953.

Key research areas:

- investigating patterns of physical processes occurring in the atmosphere and hydrosphere, hydrometeorological regime, agrometeorological conditions, including those hazardous for industry, agriculture and people;
- development of new and improvement of the available methods of meteorological, hydrological and agrometeorological forecasts and calculations and implementing them in practice; producing forecasts of hazardous and severe natural hydrometeorological disasters and processes;
- studies of Ukraine climate and factors of its dynamics; producing climate forecasts and recommendations for different industries concerning the response to climate change;
- basic research of active influence on hydrometeorological processes and events;
- scientific and methodological support to the State System of Hydrometeorological Observations and Forecasts and basic observations of environmental pollution;
- designing new and upgrading the available instruments for hydrometeorological measurements;
- drafting of standards and regulatory documents in the sphere of hydrometeorology and environmental monitoring;

- integrated studies of the effect of hydrometeorological conditions on environmental pollution, its socio-ecological and socio-economic impacts on the territory of Ukraine;
- development of scientific principles of organizing and recommendations for the basic monitoring of natural environment pollution; development of new and improvement of the available methods of forecasting the pollution of natural environment with environmentally hazardous discharges;
- studies of environment radioactive contamination and related changes in the radioecological status of Ukraine's territory;
- integrated study of hydrometeorological regime and pollution of the Black Sea and the Sea of Azov.

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Director — NAS Corr. Memb.
Volodymyr Osadchyi
tel.: +38 044 525 8666

State Institution 'Radioenvironmental Center, National Academy of Sciences of Ukraine'

Established in 1991.

Key research areas:

- integrated radiological, hydrogeological, geological, geophysical, landscape-geochemical, ecological and eco-medical studies on the test sites; research to substantiate the geological disposal of hazardous waste;
- hydrogeological research to assess groundwater resources.

55-B O. Honchara Str., Kyiv, 01001, Ukraine
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Internet: www.ukrnet.net/~hydro/
Director — Prof., NAS Acad.
Viacheslav Shestopalov
tel.: +38 044 486 8272

Department of Physical and Technological Problems of Materials Science of the NAS of Ukraine

E. O. Paton Electric Welding Institute of the NAS of Ukraine (PWI of the NAS of Ukraine)

Established in 1934.

Key research areas:

- welding and related technologies for joining and treatment of advanced structural and functional materials, physico-chemical processes in their implementation;
- physical and structural strength of materials, welded joints and structures, their diagnostics and life extension;
- automation and robotization of technologies for joining and treatment of materials, mathematical modelling of the processes;
- development of novel functional, structural and nano materials using special electric metallurgy methods and application of highly concentrated energy flows;
- state-of-the-art processes and technologies for deposition of various coatings and surface engineering;
- technologies of joining and treatment of live biological tissues;
- additive technologies for producing parts and structural elements that rely on laser, electron beam and arc power sources;
- economic studies of the efficiency of welding technologies, materials and equipment.

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Internet: www. paton.kiev.ua
Director — Prof., NAS Acad. Boris Paton
tel.: +38 044 287 3183

I.M. Frantsevich Institute for Problems of Materials Science, National Academy of Sciences of Ukraine (IPMS, NAS of Ukraine)

Established in 1955.

Key research areas:

- physical and chemical fundamentals for the technology of inorganic material formation, investigation of phase equilibria, surface and contact phenomena in multicomponent systems;
- physics of strength, development of structural materials with high specific strength, nanocrystalline metals;
- novel powder metallurgy technologies, metal, composite materials, and powder coatings;
- high-temperature composite materials, non-oxide ceramics and cermets;
- consolidated and dispersed nanostructured materials, nanoceramics and nanocomposites;
- hydrogen materials science and hydrogen technologies for materials synthesis and processing.

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solonin@ipms.kiev.ua
Internet: www.materials.kiev.ua
Director — Prof., NAS Acad. Yury M. Solonin
tel.: +38 044 424 2034

V. Bakul Institute for Superhard Materials, National Academy of Sciences of Ukraine (ISM of the NAS of Ukraine)

Established in 1961.

Key research areas:

- studies of high pressure effect on materials; high pressure technology in manufacturing processes;
- studies of physico-chemical processes of obtaining monocrystalline, dispersed, film, structured composites of superhard materials in a wide range of temperatures and pressures, new technologies of producing functionally oriented materials and products based on them;
- advancement of scientific fundamentals for developing novel high-tech machining of metals and non-metals with superhard materials tools, methods and technologies of using functional materials in basic industries.

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e-mail: secretar@ism.kiev.ua
Internet: www.ism.kiev.ua
Director — Prof., NAS Acad.
Volodymyr Turkevych
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Physico-Technological Institute of Metals and Alloys, National Academy of Sciences of Ukraine (PTIMA NASU)

Established in 1958.

Key research areas:

- development of scientific principles of controlling the formation of structure and properties of cast alloys and castings by using an external multifactor energy and physico-chemical effect on the melt;
- development of theoretical and technological fundamentals of the processes of producing highly wear-resistant nanostructured surface layers, single- and multi-layered reinforced cast structures, cast composite materials;
- development of the theory and practical implementation of continuous steel casting, casting&rolling technologies, shaping processes using cryo-vacuum technologies and rotary conveyor principles of creating casting complexes;
- development of methods for rapid non-destructive testing of structure and hardness of steels and cast irons and means for thermometry of thermal processes.

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Internet: www.ptima.kiev.ua
Director — NAS Corr. Memb.
Anatolii Narivskyi, Dr. Sci.
tel.: +38 044 424 3515

Karpenko Physico-Mechanical Institute of the National Academy of Sciences of Ukraine (PhMI NAS of Ukraine)

Established in 1951.

Key research areas:

- physical fundamentals and information technologies of the technical diagnostics and remote sensing;
- physico-chemical fracture mechanics and strength of materials: the problems of hydrogen effect and corrosion.

5 Naukova Str., Lviv, 79060, Ukraine
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Internet: http://www.ipm.lviv.ua
Director — Prof., NAS Acad.
Zinoviy Nazarchuk
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State Scientific Institution 'Institute for Single Crystals' of National Academy of Sciences of Ukraine' (SSI ISC NASU)

Established in 1955.

Key research areas:

- chemistry and technology of organic and inorganic functional materials, including supramolecular, nanosized and liquid crystalline materials and their components, luminophores and dyes;
- analytical chemistry, physico-chemical and structural investigations of functional materials and their components;
- chemistry and technology of pharmaceutical and medico-biological materials and physiologically active compounds.

SSI ISC of NAS of Ukraine is the leading organization for the following institutions of the NAS of Ukraine (the subjects of SSI ISC of the NAS of Ukraine):

Institute for Single Crystals of the NAS of Ukraine;

Institute for Scintillation Materials of the NAS of Ukraine;

State Enterprise 'Plant for Chemical Reagents' of SSI ISC of the NAS of Ukraine;

State Enterprise 'Scientific Research Institute of Microdevices' of SSI ISC of the NAS of Ukraine;

Scientific and Technological Center of Immunobiotechnology of SSI ISC of the NAS of Ukraine;

State Enterprise 'Scientific Research Technological Institute of Functional Microelectronics' of SSI ISC of the NAS of Ukraine;

State Enterprise 'Donets' Central Design Bureau of Machine Building.

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fax: +38 057 341 0273
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Internet: www.isc.kharkov.com
Director-General — Prof., NAS Acad.
Volodymyr Semynozhenko
tel.: +38 057 341 0170

Institute for Single Crystals of the National Academy of Sciences of Ukraine (ISC NASU)

Established in 1961.

Key research areas:

- development of basic research into the processes of crystal growth; search for new crystalline and nanostructured media with important functional properties; fundamentals of nanotechnology;
- integrated studies of physical phenomena in optical single crystals, nanosystems and their physical and chemical properties;
- theory of non-linear phenomena, transport and structure formation in condensed matter.

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tel.: +38 057 341 0449; +38 057 340 2230;
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Internet: http://isc.kharkov.ua/
Director —NAS Corr. Memb.
Igor Pritula, Dr. Sci.
tel.: +38 057 340 2230,
+38 057 341 0452

Institute for Scintillation Materials of National Academy of Sciences of Ukraine (ISMA NAS of Ukraine)

Established in 2002.

Key research areas:

- materials science of scintillation and luminescent media;
- fundamental research of radiation and matter interaction;
- development of technologies and nano-technologies for producing scintillation detectors and devices on their basis.

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tel./fax: +38 057 340 4474
e-mail: isma@isc.kharkov.com
Internet: http://www.isma.kharkov.ua
Director — Prof., NAS Acad. Boris Grinyov
tel.: +38 057 341 0390

Institute of Pulse Processes and Technologies of the National Academy of Sciences of Ukraine (IPPT NASU)

Established in 1962.

Key research areas:

- research of pulse effect of high-intensity energy flows on multiphase media, various materials and structures; developing novel technologies on their basis;
- development of the theory of pulse processes of energy transformation; producing high energy density pulsed power sources and their control systems.

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Z.I. Nekrasov Iron and Steel Institute of the National Academy of Sciences of Ukraine (ISI NAS)

Established in 1939.

Key research areas:

- research into physico-chemical and thermodynamic processes in multicomponent metal systems and in liquid slag-metal melts; development of new materials with preset properties;
- development of scientific fundamentals of Fe-C alloys forming and control of their structure and properties;
- development of innovative energy-saving technologies, equipment, monitoring and management systems in manufacturing of pig-iron, steel and rolling products;
- S&T support to the Program of the development of mining and metallurgical complex of Ukraine.

1 Akademika Starodubova Square, Dnipro, 49107, Ukraine
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e-mail: office.isi@nas.gov.ua
Internet: www.isi.gov.ua
Director — Dr. Sci. (Eng.)
Oleksandr Babachenko
tel.: +38 056 790 0512

Institute of Thermoelectricity of the National Academy of Sciences and the Ministry of Education and Science of Ukraine (Institute of Thermoelectricity)

Established in 1990.

Key research areas:

- Basic and applied scientific research in thermoelectricity:
- major issues of physics, mathematics and engineering;
- fundamental problems of modern materials science;
- information and communication technologies;

- energy and energy efficiency;
- life sciences, novel technologies for prevention and treatment of the most common diseases;
- novel substances and materials.

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Internet: www.ite.inst.cv.ua
Director — Prof., NAS Acad.
Lukyan Anatychuk
tel.: +38 0372 24 4422

Department of Physical and Technological Problems of Energy Engineering of the NAS of Ukraine

Institute of Engineering Thermophysics, National Academy of Sciences of Ukraine

Established in 1947.

Key research areas:

- investigations of heat transfer in heat and power equipment using traditional, renewable and alternative energy sources, and development of methods to improve its efficiency, reliability and environmental safety;
- theory of heat and mass transfer and its application for improving the efficiency of heat transfer and heat using in new technologies and equipment;
- theory of heat and mass transfer for improving the energy efficiency of available resource-saving heat technologies and developing fundamentally new ones;
- theory of measuring thermal values and development of novel thermophysical devices and systems for monitoring the state of engineering facilities and technologies.

2-A Zhelyabova Str., Kyiv, 03057, Ukraine
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e-mail: admin@ittf.kiev.ua
Internet: www.ittf.kiev.ua
Director — Prof., NAS Acad. Yury Snezhkin
tel.: +38 044 456 6282

A. Podgorny Institute of Mechanical Engineering Problems of the National Academy of Sciences of Ukraine

Established in 1972.

Key research areas:

- forecasting of reliability, dynamic strength and operation life of energy equipment;
- optimization of the processes in energy machines and improving their performances;
- energy-efficient technologies and alternative energy facilities;
- modeling and computer technologies in energy engineering.

2/10 Pozharskoho Str., Kharkiv, 61046, Ukraine
tel./fax: +38 057 294 5514; +38 057 294 4635
e-mail: admi@ipmach.kharkov.ua
Internet: www.ipmach.kharkov.ua
Director — Prof., NAS Corr. Memb.
Andrii Rusanov
tel.: +38 057 294 5514

Institute of Electrodynamics of the National Academy of Sciences of Ukraine

Established in 1947.

Key research areas:

- operation modes of electric systems and facilities, and their management;
- systems and complexes of electromechanical energy conversion;
- transformation and stabilization of electromagnetic energy parameters;
- information and measuring systems and metrological support to electric power industry.

56 Peremohy Ave., Kyiv, 03057, Ukraine
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Internet: www.ied.org.ua
Director — Prof., NAS Acad.
Oleksandr Kyrylenko
tel.: +38 044 456 0151

Department of Target Training of National Technical University of Ukraine 'Igor Sikorsky Kyiv Polytechnic Institute' of the National Academy of Sciences of Ukraine

Established in 1987.

Core science activities:

- electrical power and electrical systems and facilities;
- systems and complexes of electromechanical energy conversion;
- thermodynamics of high-power energy installations.

56 Peremohy Ave., Kyiv, 03057, Ukraine
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Director — Prof., NAS Acad.
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tel.: +38 044 366 2566; +38 044 456 0151

George Pukhov Institute for Energy Modelling, National Academy of Sciences of Ukraine

Established in 1981.

Key research areas:

- fundamental problems of theoretical electrical engineering, mathematical and electronic modeling of processes and systems in energy;
- problems of control and ensuring reliable operation of complex technological systems in energy engineering and other industries on the basis of computer technologies;
- creating modelling systems for scientific research and practical use.

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Internet: www.ipme.kiev.ua
Director — Prof., NAS Corr. Memb.
Volodymyr Mokhor
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Department for Hybrid Modelling and Control Systems in Energetics of George Pukhov Institute for Modelling in Energy Engineering of National Academy of Science of Ukraine

Established in 1988.

Key research areas:

- information technologies and systems in the energy sector;
- monitoring, diagnostics and control of energy processes and equipment;
- computer modelling of processes in the energy sector.

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Vsevolod Vasyliev
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Institute of General Energy of National Academy of Sciences of Ukraine

Established in 1997.

Key research areas:

- scientific fundamentals of forecasting the development of energy industry and energy consumption, systems analysis and optimization of the energy industry structure, of sectoral and regional systems of energy and fuel-and- energy balances; development of creation of information facilities and software for prognostication;
- research of structural development of the energy industry of Ukraine, key trends of the development of its fuel and energy complex, taking into account environmental requirements, forming of fuel and energy balances and optimization of import-export volumes of fuel and energy resources;
- systems analysis and prognostication of S&T progress in energy, research of main trends in improving power efficiency and energy sav-

ing, prognostication and realization of energy saving potential;
- scientific fundamentals of energy sector management in new economic conditions, forming legal framework and economic environment for functioning and development of energy sector.

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e-mail: info@ienergy.kiev.ua
Internet: www.ienergy.kiev.ua
Director — Prof., NAS Acad. Mykhailo Kulyk
tel.: +38 044 220 1670

Coal Energy Technology Institute, National Academy of Sciences of Ukraine

Established in 2002.

Key research areas:

- basic and applied studies to increase the effectiveness of energy derived from solid fuel;
- development of advanced methods of energy saving and energy efficiency;
- development of methods to diagnose and reduce harmful emissions;
- development of technologies for obtaining novel fuels;
- improvement of methods of fuel treatment and fuel supply;
- development of innovative high-efficiency environment-friendly technologies and improvement of the available technologies of thermal and chemical treatment of solid fuel to be used in the energy sector and industry.

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Internet: www.ceti-nasu.org
Director — PhD (Eng.) Nataliya Dunayevska
tel.: +38 044 425 2510

Gas Institute of the National Academy of Sciences of Ukraine

Established in 1949.

Key research areas:

- development of scientific fundamentals of improving the efficiency of natural gas and alternative energy use as the basis for the creation of novel energy- and resource-saving technologies;
- research in applied combustion theory, thermodynamics, interphase heat and mass transfer and development of new heat technologies and equipment on their basis;
- environment protection studies towards creating scientific and technological principles of atmospheric air protection from pollution, thermal neutralization of solid domestic waste and dangerous substances and waste.

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Director — Prof., NAS Acad.
Boris Bondarenko
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Institute of Renewable Energy, National Academy of Sciences of Ukraine

Established in 2003.

Key research areas:

- physical and technological fundamentals of the processes of solar energy transformation and utilization;
- research basis for wind power use and transformation;
- thermal basis for geothermal power use;
- scientific fundamentals for the transformation and use of small river and sea energy;
- scientific basis for biomass utilization;
- technologies and systems for integrated renewable energy use;
- organic biotechnologies of renewable energy.

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Internet: www.ive.org.ua

Director — Prof., NAS Corr. Memb.
Stepan Kudria
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Institute for Safety Problems of Nuclear Power Plants, National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- transformation of the Shelter into an eco safe system;
- safety of nuclear facilities operation;
- decommissioning,
- spent fuel and radioactive waste management.

36-A Kirova Str., Chornobyl, Kyiv Oblast, 07270, Ukraine
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Director — Prof., NAS Corr. Memb.
Anatolii Nosovskyi
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State Institution 'Institute of Technical Problems of Magnetism of the National Academy of Sciences of Ukraine'

Established in 1970.

Key research areas:

- theory of magnetism of technical facilities;
- determination of magnetic parameters of technical facilities;
- control of the magnetic field of technical facilities;
- reduction of electromagnetic impact of electric power facilities on humans and the environment.

19 Industrialna Str., Kharkiv, 61106, Ukraine
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Director — NAS Corr. Memb.
Volodymyr Rozov
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State Enterprise 'State Scientific and Technical Center for Nuclear and Radiation Safety', the State Nuclear Regulatory Inspectorate of Ukraine and the National Academy of Sciences of Ukraine

Established in 1992.

Key scientific areas:

- scientific and technical support to the state regulation of nuclear and radiation safety;
- nuclear and radiation safety in the operation and safety improvement of nuclear power plants, research nuclear facilities, spent nuclear fuel and radioactive waste management facilities, ionizing radiation sources;
- applied safety analyses of nuclear installations and radiation technologies;
- safety assessments in the implementation of novel technologies in the area of nuclear energy.

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Internet: www.sstc.kiev.ua
Director — Ihor Shevchenko
tel.: +38 044 450 0500

Department of Nuclear Physics and Energy Engineering of the NAS of Ukraine

National Science Center 'Kharkov Institute of Physics and Technology'

Established in 1928.

Key research areas:

- physics of radiation phenomena, ion beam technology and radiation materials science;
- plasma physics and controlled thermonuclear fusion;
- high-energy physics, nuclear physics and particle accelerators;
- plasma electronics and new methods of acceleration;

- theoretical nuclear physics, elementary particle physics, statistical physics and condensed matter theory.

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Internet:http://www.kipt.kharkov.ua
Director General — Prof., NAS Acad.
Mykola Shulga
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The NSC KIPT incorporates the following institutes:

- Institute of Solid-State Physics, Materials Science and Technologies;
- Institute of Plasma Physics;
- Institute of High-Energy Physics and Nuclear Physics;
- Institute of Plasma Electronics and New Methods of Acceleration;
- A.I. Akhiezer Institute for Theoretical Physics

Institute of Solid-State Physics, Materials Science and Technologies of the National Science Center 'Kharkov Institute of Physics and Technology'

Established in 1995.

Key research areas:

- physics of radiation phenomena, ion beam technology and radiation materials science.

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Director — Prof., NAS Corr. Member
Victor Voyevodin
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Institute of Plasma Physics of the National Science Center 'Kharkov Institute of Physics and Technology'

Established in 1994.

Key research areas:

- plasma physics and controlled thermonuclear fusion.

1 Akademichna Str., Kharkiv, 61108, Ukraine
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Internet: http://www.kipt.kharkov.ua
Director — Prof., NAS Corr. Memb.
Igor Garkusha,
tel.: +38 057 335 6122

Institute of High-Energy Physics and Nuclear Physics of the National Science Center 'Kharkov Institute of Physics and Technology'

Established in 1995.

Key research areas:

- high-energy physics, nuclear physics and particle accelerators.

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Director — Prof., NAS Corr. Memb.
Anatoly Dovbnya
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Institute of Plasma Electronics and New Methods of Acceleration of the National Science Center 'Kharkov Institute of Physics and Technology'

Established in 1995.

Key research areas:

- plasma electronics and new methods of acceleration.

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Internet: http://www.kipt.kharkov.ua
Acting Director — Prof., NAS Corr. Memb.
Ivan Onyshenko
tel.: +38 057 335 6140

A.I. Akhiezer Institute for Theoretical Physics of the National Science Center 'Kharkov Institute of Physics and Technology'

Established in 1996.

Key research areas:

- theoretical nuclear physics, elementary particle physics, statistical physics and condensed matter theory.

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Internet: http://www.kipt.kharkov.ua
Scientific Director — Prof., NAS Acad.
Mykola Shulga
tel.: +38 057 335 6462

Institute for Nuclear Research of the National Academy of Sciences of Ukraine

Established in 1970.

Key research areas:

- nuclear physics, elementary particles and high energy physics;
- nuclear energy;
- radiation physics and reactor materials science;
- plasma physics and controlled thermonuclear fusion;
- nuclear, radiation, technogenic and environmental safety.

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Internet: www.kinr.kiev.ua
Director — NAS Correspond. Member
Vasyl Slisenko
tel.: +38 044 525 2349

Institute of Applied Physics National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- research of interactions of ions, electrons and photons with matter, including biological objects and fields;
- development of nuclear and physical methods for studying the structure and composition of materials and electrostatic accelerators;
- development of equipment for research and training.

58 Petropavlivska Str., Sumy, 40000, Ukraine
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Internet: www.iap.sumy.org
Director — Prof., NAS Acad.
Volodymyr Storizhko,
tel.: +38 054 222 2794

State Institution 'The Institute of Environmental Geochemistry of National Academy of Sciences of Ukraine'

Established in 2001.

Key research areas:

- fundamental problems of the integral development of mineral resource base of nuclear energy;
- environmental geochemistry, radiogeochemistry, radioecology;
- physico-chemical, technological and geological problems of radioactive and toxic waste management;
- civil defense, integrated monitoring and S&T fundamentals of radiation, technogenic and environmental safety.

34-A Akademika Palladina Ave., Kyiv, 03142, Ukraine
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Internet: www.igns.gov.ua
Director — NAS Corr. Memb.
Yurii Zabulonov
tel.: +38 044 502 1229

Institute of Electrophysics and Radiation Technologies of the National Academy of Sciences of Ukraine

Established in 1990.

Key research areas:

- studies of radiation and nuclear processes and their application in nuclear energy engineering and radiation technologies;
- study of non-linear, non-stationary and stochastic processes and their application in nuclear physics and electrophysics.

13 Gudanova Str., Kharkiv, 61024, Ukraine
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Internet: www.iert.kharkov.ua
Director — Prof., NAS Corr. Memb. Vyacheslav Klepikov
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Scientific and Training Center 'Physical and Chemical Materials Science', National Academy of Sciences of Ukraine

Established in1997.

Core science activities:

- Fundamental and applied scientific research in materials science:
- mechanisms of formation and physico-chemical properties of micro- and nanocomposite materials and structures promising for nuclear energy and technologies;
- investigation of mechanisms of the effects of physical fields and radiation exposure on multifunctional nanoheterosystems, including biomolecules and biocells, with a view to developing methods of their effective use and protection from external factors.

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Internet: http://mscenter.pp.ua/
Director General — Prof., NAS Corr. Memb. Vladimir Makara
tel.: +38 044 258 7823

SECTION OF CHEMICAL AND BIOLOGICAL SCIENCES

Department of Chemistry of the NAS of Ukraine

L.V. Pisarzhevsky Institute of Physical Chemistry, National Academy of Sciences of Ukraine

Established in 1927.

Key research areas:

- theory of chemical structure, kinetics and reactivity;
- catalysis;
- adsorption and adsorbents;
- high energy chemistry;
- physical inorganic chemistry.

31 Nauky Ave., Kyiv, 03028, Ukraine
tel.: +38 044 525 1190;
fax: +38 044 525 6216
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Internet: www.inphyschem-nas.kiev.ua
Director — Prof., NAS Acad. Vyacheslav Koshechko
tel.: +38 044 525 1190

V.I. Vernadsky Institute of General and Inorganic Chemistry, the National Academy of Sciences of Ukraine

Established in 1929.

Key research areas:

- new high-tech functional inorganic compounds, materials and coatings;
- electrochemistry of molten, liquid, solid electrolyte and electrode systems;
- heterogeneous coordination chemistry;
- environmental and "economic" recycle of metal materials.

32/34 Akademika Palladina Ave., Kyiv, 03680, Ukraine
tel./fax: +38 044 424 3070
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Internet: www.igic.org.ua

Director — Prof., NAS Corr. Memb.
Vasyl Pekhnyo
tel.: +38 044 424 3461

Institute of Organic Chemistry, National Academy of Sciences of Ukraine

Established in 1939.

Key research areas:

- theoretical and experimental research of the structure, color and reactivity of organic compounds;
- fine organic synthesis;
- asymmetric synthesis and catalysis;
- chemistry of heteroatom organic compounds;
- supramolecular chemistry of macrocyclic compounds;
- scientific fundamentals for the synthesis of compounds with practically useful properties, including physiologically active substances, cyanine dyes, organic catalysts and complexing agents.

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Internet: www.ioch.kiev.ua
Director — Prof., NAS Acad. Vitaliy Kalchenko
tel.: +38 044 292 7150

Institute of Macromolecular Chemistry, National Academy of Sciences of Ukraine

Established in 1958.

Key research areas:

- chemistry, physical chemistry and technology of functional polymers and composites;
- theoretical fundamentals of modifying synthetic polymers and composites with products of low-tonnage chemistry;
- scientific principles of functional organic-inorganic polymers and composites based on natural compounds;
- theoretical foundations of the formation of polymers intended for medicine.

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L.M. Litvinenko Institute of Physical-Organic & Coal Chemistry, National Academy of Sciences of Ukraine

Established in 1967.

Key research areas:

- study of reaction mechanisms and reactivity of organic compounds, including those under conditions of homogenous and phase transfer catalysis;
- study of physico-chemical properties of coal and carbon materials with the purpose of developing methods of their processing and rational use;
- synthesis, structure and properties of heterocyclic compounds, including biologically active ones.

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Department of Physical Chemistry of Fossil Fuels of the Institute of Physical-Organic and Coal Chemistry named after L.M. Litvinenko, National Academy of Sciences of Ukraine

Established in 1986.

Key research areas:

- investigation of radical polymerization in heterogeneous systems, reactivity and structure of polymer interfacial layers, development of novel compositive materials and studies of their properties;
- investigation of directional processes of the formation of nanomaterials and new functional nanosystems;

- research into reactivity, chemical kinetics and mechanisms of the chemical processes of organic raw materials oxidation;
- studies of biotechnological processes of synthesizing new environmentally safe substances and their functional properties;
- development of scientific principles of integrated ecological monitoring and the methodology of recovering technologically changed environment in the areas of oil production.

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Director — Senior Researcher
Halyna Midyana, PhD (Chem.)
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A.V. Dumansky Institute of Colloid Chemistry and Water Chemistry, National Academy of Sciences of Ukraine

Established in 1968.

Key research areas:

- chemistry, physics and biology of water;
- state-of-the-art technologies of water purification and treatment;
- fundamentals of colloid chemistry and nanochemistry, surface and electrokinetic phenomena, colloid chemistry of biological systems, physico-chemical mechanics;
- analytical chemistry of water systems;
- development of advanced methods for water quality evaluation.

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Internet: www.iccwc.kiev.ua
Director — Prof., NAS Acad.
Vladislav Goncharuk
tel.: +38 044 424 0196

A.V. Bogatsky Physico-Chemical Institute, National Academy of Sciences of Ukraine

Established in 1977.

Key research areas:

- studies of the relationships between structure and properties of supramolecular compounds, development of directed synthesis of biologically active substances — medicinal preparations (neurotropic, immunotropic, antiviral, antiaggregatory etc.);
- developing metods of synthesis (including catalytic synthesis) of inorganic coordination compounds of rare and rare earth elements, studying their structure and properties for creating novel functional materials and nanocomposites for optics and optoelectronics.

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Internet: www. physchemin-nas.od.ua
Director — Prof., NAS Acad. Sergey Andronati
tel.: +38 048 766 2044

Chuiko Institute of Surface Chemistry of National Academy of Sciences of Ukraine

Established in 1986.

Key research areas:

- theory of chemical structure and reactivity of solid surfaces;
- medico-biological and biochemical problems of surfaces;
- physico-chemistry of surface and interfacial phenomena;
- chemistry, physics, and technology of nanomaterials.

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Internet: www.isc.gov.ua
Director — Prof., NAS Acad. Mykola Kartel
tel.: +38 044 423 8058

V.P. Kukhar Institute of Bioorganic Chemistry and Petrochemistry, National Academy of Sciences of Ukraine

Established in 1987.

Key research areas:

- synthesis of potentially bioactive compounds and research of relations between structure and activity;
- chemical models of biological processes, synthesis of novel bioregulators and studies of their biological properties application in medicine and agriculture;
- development of scientific fundamentals for the synthesis and technology of obtaining practically important products and materials from hydrocarbon raw materials.

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e-mail: users@bpci.kiev.ua
Internet: www.bpci.kiev.ua
Director — Prof., NAS Corr. Memb.
Andriy Vovk
tel.: +38 044 558 5388

Institute for Sorption and Problems of Endoecology, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- theory of selective adsorption, scientific basics of synthesizing adsorbents with tailored properties;
- development of specific adsorbents and sorption methods and technologies for medicine (endoecology) and environment protection;
- development of non-traditional catalysts and catalytic processes based on renewable raw materials;
- disperse materials for energy storage systems.

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Director — Prof., NAS Acad.
Volodymyr Strelko
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F.D. Ovcharenko Institute of Biocolloidal Chemistry, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- biocolloidal chemistry of natural and synthetic disperse systems and materials, bioecology, biosensor systems, nanomedicine;
- physical and colloidal chemistry of disperse materials, nanoscale colloidal systems and nanomaterials, macrokinetics and fractal properties of disperse systems;
- biotechnologies of mineral dressing and environmental protection, colloidal chemistry materials science, principles, methods and technologies for producing nanomaterials and their practical use.

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Director — Dr. Sci. (Eng.) Vitaliy Prokopenko
tel.: +38 044 424 0214

Joint Department of Electrochemical Energy Systems, National Academy of Sciences of Ukraine

Established in 1996.

Main research areas:

- development of scientific principles for producing novel ion-conducting electrode materials and heat-accumulating materials;
- synthesis and study of physico-chemical and energy properties of energy-converting materials and systems under the influence of thermal, electric and magnetic field gradients;
- development of new electrochemical, thermoelectric, thermal energy converters and energy storage devices.

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Internet: www.jdees.com.ua
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Department of Biochemistry, Physiology and Molecular Biology of the NAS of Ukraine

Palladin Institute of Biochemistry, National Academy of Sciences of Ukraine

Founded in 1925 by Professor O.V. Palladin as Ukrainian Biochemical Institute.

Key research areas:

- investigation of the structure, physico-chemical properties and biological functions of complex proteins and supramolecular systems;
- molecular mechanisms of metabolic regulation by biologically active substances of low molecular weight;
- development of biotechnologies and nanobiotechnologies for medicine, agriculture, ecology and industry.

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Internet: www.biochemistry.org.ua
Director — Prof., NAS and NAMS Acad. Serhiy Komisarenko
tel.: +38 044 234 5974

Bogomoletz Institute of Physiology, National Academy of Sciences of Ukraine

Established in 1934.

Key research areas:

- identification of molecular mechanisms of specific changes of cell membranes conductivity in major nerve processes;
- studying cell organization of major brain systems and investigating the principles of information processing in them;
- studies of regulation mechanisms of functional systems under normal and pathological conditions.

4 Bogomoltza Str., Kyiv, 01001, Ukraine
tel./fax: +38 044 256 2400
e-mail: adoffice@biph.kiev.ua
Internet: www.biph.kiev.ua
Director — Prof., NAS Acad. Oleg Krishtal
tel.: +38 044 256 2524

D.K. Zabolotny Institute of Microbiology and Virology of the National Academy of Sciences of Ukraine

Established in 1928.

Key research areas:

- studying the physiological, biochemical and genetic biodiversity and biosynthetic ability of microorganisms of different taxonomic groups;
- developing scientific fundamentals of obtaining new biotechnological products and development of processes for industry, agriculture, medicine and environment protection;
- studying the molecular biology and genetic organization of bacteriophages, adenoviruses and plant viruses, their structural and functional interactions with living systems and the environment.

154 Akademika Zabolotnoho Str., Kyiv, 03143, Ukraine
tel./fax: +38 044 526 1179
e-mail: info@serv.imv.kiev.ua
Internet: www.imv.kiev.ua
Director — Prof., NAS Acad. Valentyn Pidgorskyi
tel.: +38 044 526 1179

Institute of Molecular Biology and Genetics, National Academy of Sciences of Ukraine

Established in 1973.

Key research areas:

- structural and functional genomics;
- proteomics and protein engineering;
- molecular and cell biotechnologies;
- bioinformatics and computational modelling and design.

150 Akademika Zabolotnogo Str., Kyiv, 03143, Ukraine
tel.: +380 44 526 1169; fax: +380 44 526 0759
e-mail: inform@imbg.org.ua
Internet: www.imbg.org.ua
Director — Prof., NAS Acad. Anna El'skaya
tel.: +380 44 526 0749

R.E. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology, National Academy of Sciences of Ukraine

Established in 1960.

Key research areas:

- detection of malignant transformation markers and identification of tumor stem cell layer signs for early diagnosis and prognosis of disease course;
- studies of the biological properties of tumor cells and factors of their microenvironment for developing the methodology for individualized correction of "tumor — host" relations;
- investigation of molecular genetic basis of metabolic processes regulation in malignant disease and the development of biotechnology and sorption means of their pharmacologic correction;
- studies of nanoparticles and nanocomposites impacts on the metabolism of normal and tumor cells and developing approaches to target therapy;
- studying the effects of hazardous carcinogenic environmental factors on the process of oncogenesis and developing effective prevention means.

45 Vasylkivska Str., Kyiv, 03022, Ukraine
tel./fax: +38 044 258 1656
e-mail: iepor@onconet.kiev.ua
Internet: www.iepor.org.ua
Director — Prof., NAS Acad. Vasyl Chekhun
tel.: +38 044 259 0183

Institute for Problems of Cryobiology and Cryomedicine of the National Academy of Sciences of Ukraine

Established in 1972.

Key research areas:

- studies of the mechanisms of cryoinjury, cryoprotection, natural resistance of biological objects to cold and their reparation after exposure to cold;
- creating the efficient means of artificial cryoprotection of biological systems of various organization levels, developing respective cryopreservation technologies for biological objects and technical means of their implementation;
- use of hypothermia, cryotherapy and cryopreserved biological objects in treatment of different diseases;
- cell and tissue therapy.

23 Pereyaslavska Str., Kharkiv, 61016, Ukraine
tel.: +38 057 373 4143; fax: +38 057 373 5952
e-mail: cryo@online.kharkov.ua
Internet: www.cryo.org.ua
Director — Prof., NAS Acad. Anatoliy Goltsev
tel.: +38 057 373 4143

Institute of Cell Biology, National Academy of Sciences of Ukraine

Established in 2000.

Key research areas:

- studying molecular-genetic and biochemical mechanisms of metabolic regulation in yeasts and developing new biotechnological processes and products based on these microorganisms;
- research into molecular mechanisms of the regulation of proliferation, differentiation and apoptosis in normal and tumor cells of animals and humans.

14/16 Drahomanova Str., Lviv, 79005, Ukraine
tel./fax: +38 032 261 2108; +38 032 261 2148;
e-mail: institut@cellbiol.lviv.ua
Internet: http://cellbiol.lviv.ua
Director — Prof., NAS Acad. Andriy Sibirny
tel.: +38 032 261 2148

State Institution 'Department of Biotechnical Problems in Diagnostics of the Institute of Problems of Cryobiology and Cryomedicine', National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- development of principles, methods and biotechnical systems of disease diagnostics in order to obtain new scientific knowledge and use it in practice;
- R&D (experimental) work based on scientific knowledge obtained as a result of scientific research, with the aim of bringing such knowledge to the stage of practical use.

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e-mail: vbpd-ipkk@ukr.net
Internet: www.morpho-cell.org
Head of Department — PhD (Med.)
Mychailo Sydorenko
tel.: +38 044 525 6447

Department of General Biology of the NAS of Ukraine

M.H. Kholodny Institute of Botany, National Academy of Sciences of Ukraine

Established in 1921.

Key research areas:

- taxonomy and evolution of plants and fungi;
- floristic and geographical research of phytobiota and mycobiota;
- phytosociology and ecology of phytosystems;
- monitoring and conservation of biodiversity of plants and fungi;
- paleobotany and palynology;
- management of plants resources;
- cell and space biology;
- phytohormonology;
- membranology and phytochemistry.

2 Tereshchenkivska Str., Kyiv, 01601, Ukraine
tel./fax: +38 044 234 4041
e-mail: inst@botany.kiev.ua
Internet: www.botany.kiev.ua
Director — Prof., NAS Corr. Memb.
Sergei Mosyakin.
tel.: +38 044 234 4041

I.I. Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine

Established in 1930.

Key research areas:

- studies of fauna, evolutionary and morphological fundamentals of phylogeny and systematics of wildlife in Ukraine;
- developing scientific bases for conservation and sustainable use of wildlife resources, wildlife monitoring under anthropogenic impacts;
- developing zoological fundamentals of plants and animals protection and enhancing their productivity.

15 Khmelnytskoho Str., Kyiv, 01030, Ukraine
tel./fax: +38 044 234 1569
e-mail: iz@izan.kiev.ua
Internet : www.izan.kiev.ua
Director — Prof., NAS Corr. Memb.
Igor Akimov
tel.: +38 044 235 1070

Institute of Plant Physiology and Genetics, National Academy of Sciences of Ukraine

Established in 1946.

Key research areas:

- resistance and adaptation of plant systems;

- photosynthesis, mineral nutrition of plants, biological nitrogen fixation, action of biologically active substances and herbicides;
- studies of the mechanisms of genetic processes, plant breeding;
- preservation of plant genetic resources;
- biotechnologies and nanotechnologies, genetically modified organisms.

31/17 Vasylkivska Str., Kyiv, 03022, Ukraine
tel./fax: +38 044 257 5150
e-mail: plant@ifrg.kiev.ua
Internet: www.ifrg.kiev.ua
Director — Prof., NAS Acad.
Volodymyr Morgun
tel.: +38 044 257 5160

Institute of Hydrobiology, National Academy of Sciences of Ukraine

Established in 1940.

Key research areas:

- studies of the biodiversity and functioning of freshwater ecosystems as the basis for developing technologies of biological indication, monitoring and management of the ecological state of water bodies;
- investigations of physical and chemical fundamentals of migration, transformation and biological effects of radionuclide and chemical contaminations on hydrobionts, and ways of their control;
- assessment and forecasting of fish fauna in water bodies of different types intended for the environment management and conservation of fish diversity;
- molecular, cellular and physiological research of aquatic organisms as a basis for developing highly efficient aquaculture technologies.

12 Geroiv Stalingradu Str., Kyiv, 04210, Ukraine
tel./fax: +38 044 418 2232
e-mail: post_mail@hydrobio.kiev.ua
Internet: www.hydrobio.kiev.ua
Director — Prof., NAS Corr. Memb.
Sergiy Afanasyev
tel.: +38 044 419 3981

Institute of Cell Biology and Genetic Engineering, National Academy of Sciences of Ukraine

Established in 1990.

Key research areas:

- studying the molecular and genetic mechanisms of plant cell functions in natural and experimental systems;
- development of biotechnologies based on fundamental studies in cell biology and genetic engineering, using methods of molecular genetics, biophysics and radiobiology.

148 Akademika Zabolotnoho Str., Kyiv, 03680, Ukraine
tel./fax: +38 044 526 7104
e-mail: info@icbge.org.ua
Internet: www.icbge.org.ua
Director — Prof., NAS Corr. Memb.
Mykola Kuchuk
tel.: +38 044 522 1786

Institute of Ecology of the Carpathians, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- integrated studies of the ecosystems of the Ukrainian Carpathians and adjacent territories, elaboration and implementation of ecosystemological concepts, bioindication methods and habitat-oriented approaches for territorial nature protection and biodiversity conservation;
- ontogenetic, morphological, structural and functional variability and adaptation potentials of plant and animal populations under the impact of natural and anthropogenic factors.

4 Kozelnytska Str., Lviv, 79026, Ukraine
tel./fax: +38 032 270 7430
e-mail: ecoinst@lviv.mail.ua
Internet: www.ecoinst.org.ua
Director — NAS Corr. Memb.
Mykola Kozlovsky, Dr. Sci. (Biol.)
tel.: +38 032 270 7430

State Institution 'Institute of Marine Biology, National Academy of Sciences of Ukraine'

Established in 1954.

Key research areas:

- fundamental principles of the structural and functional organization of marine ecosystems, limans (lagoons) and estuary areas under climate change and anthropogenic pressures;
- development of scientific fundamentals of marine ecosystem monitoring, management of marine environment quality and environmental management;
- biodiversity and the evaluation of the biological resources of the Azov-Black Sea basin potential, validation of methodological aspects of forming the marine ecological network of Ukraine.

37 Pushkinska Str., Odesa, 65011, Ukraine
tel./fax: +38 048 725 0918
e-mail: imb@nas.gov.ua
Internet: www.imb.odessa.ua
Director — Prof., NAS Corr. Memb. Borys Aleksandrov
tel.: +38 048 725 0918

State Institution 'The Institute of Food Biotechnology and Genomics, National Academy of Sciences of Ukraine'

Established in 1992.

Key research areas:

- investigation of the molecular and cellular mechanisms of plant cell functioning, relying on the development of plant structural and functional genomics and bioinformatics, structural biology and molecular genetics;
- development of novel molecular biotechnologies and nanobiotechnologies for plant and prokaryotic systems;
- development of scientific fundamentals of resource-saving technologies for the processing of agricultural raw materials and production of new types of foodstuffs and biofuel from biomass;
- development of food biotechnologies, including the production of food additives and biologically active compounds; molecular genetic and biochemical methods of phytosanitary and health-and-safety control of raw food materials, food additives and fodder quality, elaboration of the scientific principles of biosafety.

2-A Osipovskoho Str., Kyiv, 04123, Ukraine
tel./fax: +38 044 434 3777
e-mail: office.ifbg@nas.gov.ua
Internet: www.ifbg.org.ua
Director — Prof., NAS Acad. Yaroslav Blume
tel.: +38 044 434 3777

State Institution 'Institute for Evolutionary Ecology, National Academy of Sciences of Ukraine'

Established in 2004, renamed in 2013.

Key research areas:

- mechanisms of ecosystem evolution;
- structural and functional organization and adaptation of plant and animal populations and their communities to conditions of the transformed environment;
- scientific principles of conservation, recreation and sustainable use of biological resources and landscapes of the natural reserve fund of Ukraine.

37 Akademika Lebedeva Str., Kyiv, 03143, Ukraine
tel./fax: +38 044 526 2071
e-mail: info@ieenas.com
Internet: www.ieenas.org
Director — Prof., NAS Acad. Volodymyr Radchenko
tel.: +38 044 526 1918

National Museum of Natural History, National Academy of Sciences of Ukraine

Established in 1966.

Core science activities:

- building, enrichment, conservation and investigation of museum collections and exhibitions;

- scientific and educational activities; popularization of science, cultural education;
- fundamental research into the evolution of the biosphere and geosphere, into biological and geological diversity, ecology of organisms, stratigraphy, and natural history museology;
- development of applied methods for conservation and restoration of the natural diversity;
- development of methodological principles of the functioning and advancement of Ukrainian natural history museums and of their integration into the European and global informational space.

15 Bohdana Khmelnytskoho Str., Kyiv, 01030, Ukraine
tel./fax: +38 044 234 3851
e-mail: nmnh@museumkiev.org
Internet: www.museumkiev.org
Director: Prof., NAS Acad. Igor Emelyanov
tel.: +38 044 234 3851

State Museum of Natural History, National Academy of Sciences of Ukraine

Established in 1940.

Key research areas:

- systematics, evolution and geographical distribution of recent and fossil representatives of animal and plant worlds;
- principles of strategies of preservation and restoration of the biotic diversity;
- development of the methodology of natural history museology, creation, enrichment and preservation of fund collections.

18 Teatralna Str., Lviv, 79008, Ukraine
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E-mail: office@smnh.org
Internet: http://www.smnh.org/ua/
Director — PhD (Biol.) Taras Yanytskyi
tel.: +38 032 235 4307

M.M. Gryshko National Botanical Garden, National Academy of Sciences of Ukraine

Established in 1935.

Key research areas:

- plant introduction, acclimatization and breeding;
- biodiversity phytomonitoring and conservation;
- structural and functional principles of the formation of natural and man-made biogeocenoses;
- ecological and biological principles of landscape design and garden and park construction;
- chemical interactions of plants;
- biotechnology;
- bioindication and chemosystematics;
- medicinal botany;
- phytoenergetics.

1 Timiryazevska Str., Kyiv, 01014, Ukraine
tel./fax: +38 044 285 2649
e-mail: nbg@nbg.kiev.ua
Internet: www.nbg.kiev.ua
Director — Prof., NAS Corr. Memb.
Nataliia Zaimenko
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Donetsk Botanical Garden, National Academy of Sciences of Ukraine

Established in 1965.

Key research areas:

- industrial botany;
- introduction, acclimatization and selection of plants with the aim of enriching and sustainable use of plant resources in the steppe zone of Ukraine in the technological environment;
- development of scientific fundamentals of plant diversity preservation;
- the efficient use of anthropogenic pressure;
- population biology and genetics in anthropogenically altered regions.

16-A Marshaka Str., Kryvyi Rih, 50089, Ukraine
tel./fax: +38 0564 38 4922; +38 0564 38 4803
e-mail: sv.sv.nikolaevna@gmail.com
Acting Director — Prof. Ivan Korshykov, Dr. Dci. (Biol.)
tel.: +38 0564 38 4922

Kryvyi Rih Botanical Garden, National Academy of Sciences of Ukraine

Established in 1992 on the basis of the Kryvyi Rih Branch of the Donetsk Botanical Garden of the Academy of Sciences of Ukraine.

Key research areas:

- introduction and acclimatization of new promising plant species, studies of physiological, biological, anatomical and morphological peculiarities of their resistance and adaptation to the effects of natural and anthropogenic environmental factors;
- scientific principles for phytodiversity conservation in the Right-Bank Steppe of Ukraine; protection, genetic selection enrichment and rational use of biological diversity;
- development of scientific principles for reclamation of industrially disturbed lands and practical implementation of those principles; inventory and reconstruction of plantings in urban and industrial territories; landscape design and indoor greenery.

50 Marshaka Str., Kryvyi Rih, 50089, Ukraine
tel./fax: +38 056 438 4922; +38 056 438 4803
e-mail: garden7@meta.ua
Internet: http://garden.gov.ua
Director — Prof. Ivan Korshykov, Dr. Sci. (Biol.)
tel.: +38 056 438 4922

National Dendrological Park 'Sofiyivka' ('Sofiyivka' National Arboretum), National Academy of Sciences of Ukraine

Established in 1796.

Key research areas:

- studies, monitoring, conservation and preservation of plants in the forest-steppe zone of Ukraine;
- introduction, acclimatization, biotechnology, breeding and reproductive biology of plants;
- horticulture and landscape construction.

12-A Kyivska Str., Uman, Cherkasy Oblast, 20300, Ukraine
tel.: +38 047 443 6319; fax: +38 047 443 7294
e-mail: ndp.sofievka@gmail.com,
http//www.sofiyivka.org.ua
Director — Prof., NAS Corr. Memb. Ivan Kosenko
tel.: +38 047 443 6319

'Olexandria' State Dendrological Park, National Academy of Sciences of Ukraine

Established in 1788.

Key research areas:

- conservation of native flora phytodiversity and plant introduction;
- recreation and reconstruction of historical park landscapes.

Bila Tserkva, Kyiv Oblast, 09113, Ukraine
tel./fax: +38 045 634 0547
e-mail: alexandriapark@ukr.net
Internet: www.alexandria-park.com.ua
Acting Director — PhD (Biol.) Natalia Boiko
tel.: +38 045 634 0547

'Trostianets' Dendrological Park, National Academy of Sciences of Ukraine

Established in 1938.

Key research areas:

- introduction, conservation and enrichment of phytodiversity;
- garden and park landscape development.

Trostianets, Ichnianskyi District,
Chernihiv Oblast, 16742, Ukraine
tel./fax: +38 046 332 4758
e-mail: dendropark@ukr.net
Director — Senior Researcher, Oleksiy Ilyenko, PhD (Biol.)
tel.: +38 046 332 4758

Black Sea Biosphere Reserve, National Academy of Sciences of Ukraine

Established in 1927; a structural unit of the NAS of Ukraine since 1956; has had biosphere reserve status since 1983.

Key research areas:

- conservation and research of natural ecosystems;
- ongoing monitoring of ecosystems;
- biological and ecological research;
- development of scientific principles of natural ecosystems conservation;
- research and monitoring of anthropic transformation of the environment.
- environmental education.

1 Lermontova Str., Hola Prystan,
Kherson Oblast, 75600, Ukraine
tel./fax: +38 055 392 6471
e-mail: bsbr-priemn@ukr.net
Internet: www.bsbr.ks.ua
Director — PhD (Agr.) Anatoliy Yurchenko
tel.: +38 055 392 6757

The Danube Biosphere Reserve, National Academy of Sciences of Ukraine

Established as a biosphere reserve in 1998 (protected area since 1967).

Key research areas:

- integrated studies of land and water ecosystems, including their biodiversity; updating of periodical "Chronicles of Nature";
- development of scientific fundamentals for environment protection and sustainable development;
- scientific analysis of the state of environment affected by anthropic activities.

132-A Tatarbunarskogo Povstanniya Str.,
Vilkovo, Kiliya District, Odesa Oblast, 68355,
Ukraine
tel./fax: +38 048 434 4619
e-mail: reserve@it.odessa.ua
Internet: www.dbr.org.ua,
office.dbr@nas.gov.ua
Director — PhD (Biol.)
Oleksandr Voloshkevych
tel.: +38 048 434 4619

Ukrainian Steppe Nature Reserve, National Academy of Sciences of Ukraine

Established in 1961.

Key research areas:

- monitoring research of the ecosystems of the Ukrainian Steppe Nature Reserve, development of measures towards their conservation and protection;
- studies of structural peculiarities and formation patterns of biodiversity in unique natural complexes for their preservation and sustainable use.

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Zaporizka Oblast, 71001, Ukraine
tel./fax: +38 06147 20840
e-mail: zapovidnyk110@ukr.net;
s.yarovoy18@gmail.com
Acting Director — Sergiy Yarovyi
tel.: +38 06147 20840

Luhansk Nature Reserve, National Academy of Sciences of Ukraine

Established in 1968.

Core science activities:

- research and monitoring of natural objects and processes of Luhansk Nature Reserve and adjacent areas;
- development of recommendations for nature conservation, revival and sustainable use of natural resources;
- environmental education.

95 Rubizhna Str., Stanytsya Luhanska,
Stanychno-Luhansky District,
Luhansk Oblast, 93602, Ukraine
tel./fax: +38 064 725 2391
e-mail: lug.zapovidnik@i.ua
Internet: www.zapovednik.lg.ua
Acting Director — Vadim Moroz
tel.: +38 064 725 2391

Kherson Hydrobiological Station, National Academy of Sciences of Ukraine

Established in 1952.

Key research areas:

- biodiversity research of the Dnieper-Buh estuarine area as a part of the South Ukrainian (Seaside-Steppe) ecological corridor; development of recommendations for its preservation and restoration;
- studies of the ecological state of the Dnieper-Bug estuarine area in terms of anthropogenic pollution and its impact on the ecological state of the Black Sea shelf zone.

87 Marii Fortus Str., Kherson, 73016, Ukraine
tel./fax: +38 055 227 0335
e-mail: hgbs@nas.gov.ua
Internet: www.hgbs.nas.gov.ua
Director — PhD (Biol.) Serhiy Ovechko
tel.: +38 055 227 0335

G.M. Vysotskiy Ukrainian Research Institute of Forestry and Forest Melioration, State Forest Resources Agency of Ukraine and National Academy of Sciences of Ukraine

Established in 1929.

Key research areas:

- forestry, forest exploitation and forest management systems;
- forest regeneration and afforestation;
- forest melioration and recultivation;
- forest breeding, research and conservation of the genetic potential of Ukrainian forests and their biodiversity;
- forest ecology, protection, conservation and stability improvement;
- economics and organization of forestry, forest management;
- inventory, monitoring and certification of forests;
- new information technologies in forestry;
- forest radioecology;
- hunting management.

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tel.: +38 057 707 8001;
fax: +38 057 704 1002
e-mail: uriffm@uriffm.org.ua
Internet: www.uriffm.org.ua
Director — Prof., NAAS Corr. Memb.
Viktor Tkach
tel.: +38 057 707 8001

P.S. Pasternak Ukrainian Research Institute of Mountain Forestry, State Forest Resources Agency of Ukraine and NAS of Ukraine

Established in 1991 as the Carpathian Branch of G.M. Vysotskiy Ukrainian Research Institute of Forestry and Forest Melioration, State Forest Resources Agency of Ukraine and the NAS of Ukraine. Started in 1964.

Key research areas:

- basic and applied scientific research in the fields of forestry, hunting and rational nature management;
- elaborating scientific fundamentals of multipurpose forest management and forest regeneration on the genetic selection basis, enhancing productivity, strengthening protective functions and mountain forest robustness;
- developing theoretical principles of nature protection measures and improvement of forests' recreational properties;
- working out criteria and indicators of the environmental role of forests.

31 M. Hrushevskoho Str., Ivano-Frankivsk, 76018, Ukraine
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Internet: www.ukrrimf.org.ua
Director — PhD (Agr.) Oleksii Holubchak
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SECTION OF SOCIO-HUMANITIES

Department of Economics of the NAS of Ukraine

State Institution 'Institute for Economics and Forecasting, National Academy of Sciences of Ukraine'

Established in 1997

Key research areas:

- economic theory and social transformation;
- economic growth and structural changes in the economy;
- macroeconomic modeling and forecasting;
- innovation policy and technological forecasting;
- development of competition and industrial policy;
- the financial sector and financial policies;
- economics and politics of agrarian reforms;
- market conditions and sectoral forecasting;
- monitoring studies of socio-economic transformation;
- problems of territorial development;
- economic management and public administration.

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Internet: http://www.ief.org.ua
Director — Prof., NAS Acad. Valeriy Heyets
tel.: +38 044 280 1234

Institute of Industrial Economics, National Academy of Sciences of Ukraine

Established in 1969.

Key research areas:

- regulatory regimes of stimulation, modernization and socio-economic development; structural dynamics of spatial formations, innovation support systems in industrial regions;
- socio-economic issues of industrial production; social governance, industrial relations and social responsibility, human capital; social policy and sustainable development;
- the strategy of industrial development in the context of global transformations and its financial and economic regulation;
- issues of microeconomics, recovery and creation of modern production with high value-added in the industry.

2 Zhelyabova Str., Kyiv, 03057, Ukraine
tel. +38 044 200 5571
e-mail: admin@econindustry.org
Internet: http://iep.com.ua
Director — Prof., NAS Acad.
Oleksandr Amosha
tel. +38 044 200 5571

State Institution 'Institute of Environmental Economics and Sustainable Development of the National Academy of Sciences of Ukraine'

Established in 2010.

Key research areas:

- environmental economics, natural and technogenic safety;
- economic efficiency of use, protection and restoration of natural resources potential;
- the strategy of sustainable development of Ukraine and its regions.

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info@ecos.kiev.ua
Internet: http://www.ecos.kiev.ua
Director — Prof., NAAS Acad.
Mykhailo Khvesyk
tel.: +38 044 486 9127

Institute of Economic and Legal Research, National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- economic law;
- state regulation of the economy;
- economic and legal issues of the socio-economic development of territorial systems and the distribution of powers between central governments and regions;
- legislative support of entrepreneurship, formation of new organizational and economic structures;
- economic and legal problems of preventing economic offences;
- harmonization of legislative acts regulating the economic relations.

60 Shevchenko Blvd., Kyiv, 01032, Ukraine
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Internet: www.iepd.kiev.ua
Director — Prof., NAS Corr. Memb.
Volodymyr Ustymenko
tel.: +38 044 200 5568

Institute for Market Problems and Economic-and-Ecological Research, National Academy of Sciences of Ukraine

Established in 1970.

Key research areas:

- institutional factors of market environment development;
- development of transport and transit potential of Ukraine and the mechanisms of its realization;
- institutional arrangements for the ecologization of the economy;
- overcoming the regional disparities and upgrading the management of socio-economic development of the southern regions of Ukraine.

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tel.: +38 048 722 2905; fax: +38 048 722 6611
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Internet: http://www.impeer.od.ua
Director — Prof., NAS Acad. Borys Burkynskyi
tel.: +38 048 722 2905

State Institution 'M.I. Dolishniy Institute of Regional Research of the NAS of Ukraine'

Established in 1994.

Key research areas:

- scientific principles of regional policy and spatial development;
- environmental and economic issues and prospects of the rational exploitation of natural resources in the regions of Ukraine and the sustainable development of mountain areas;
- financial resources of the region and the problems of its innovation and investment support;
- regional social policy, demographic problems in the region, regulation of migration processes;
- prospects of territorial communities development, transborder cooperation and improving the competitiveness of border areas.

4 Kozelnytska Str., Lviv, 79026, Ukraine
tel.: +38 032 270 7168; fax: +38 032 270 7058
e-mail: irr@mail.lviv.ua
Internet: http://www.ird.gov.ua
Director: Prof. Vasyl Kravtsiv, Dr. Sci. (Econ.)
tel.: +38 032 270 7168

Ptoukha Institute for Demography and Social Studies of the National Academy of Sciences of Ukraine

Established in 2002.

Key research areas:

- human development in Ukraine: signs, risks, direction of influence;
- social transformation of the Ukrainian society;
- socio-demographic trends, cycles and differentiation;
- socio-demographic modelling and forecasting.

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tel./fax: +38 044 486 6238; +38 044 486 6237
Internet: http://www.idss.org.ua

e-mail: demography@idss.org.ua
Director — Prof., NAS Acad. Ella Libanova
tel.: +38 044 486 6237

Research Center for Industrial Problems of Development of the National Academy of Sciences of Ukraine

Established in 2006 on the basis of the Kharkiv Branch of the Institute of Economics, NAS of Ukraine.

Key research areas:

- reforming the national economy and substantiating the economic policy in Ukraine in line with integration processes in the world economy;
- industrial policy, modernization of economy sectors and ensuring the energy security of Ukraine;
- S&T and innovation policy;
- socio-economic problems of the spatial development of the territory of Ukraine.

1-A Inzhenernyi Lane, Kharkiv, 61166, Ukraine
tel./fax: + 38 057 702 0867
e-mail: ndc_ipr@ukr.net
Internet: http://ndc-ipr.org
Director — Prof., NAS Corresponding Member Mykola Kyzym
tel.: +38 057 702 0867

Zakarpattya Regional Centre for Socio-Economic and Humanities Research of the National Academy of Sciences of Ukraine

Established in 1995.

Key research areas:

- integral description of the socio-economic development of the region;
- administrative division of the territories of the region, development of the territories and cross-border cooperation.

21 Universitetska Str., Uzhhorod, 88017, Ukraine
tel./fax: +38 0312 64 0733
e-mail: z.r.centre@gmail.com
Internet: http://www.hzrcentre.org.ua
Director — Assoc. Prof. Stepan Sember, PhD (Econ.)
tel.: +38 0312 64 0733

Department of History, Philosophy and Law of the NAS of Ukraine

Institute of the History of Ukraine, National Academy of Sciences of Ukraine

Established in 1936.

Key research areas:

- early and medieval history of Ukraine;
- history of Ukraine of modern era;
- history of Ukraine in the 20th century;
- national and ethno-cultural processes: the past and present;
- Ukraine in the European and global history;
- historiography and special historical disciplines.

4 Hrushevskoho Str., Kyiv, 01001, Ukraine
tel./fax: +38 044 279 6362
e-mail: institute@history.org.ua
Internet: www.history.org.ua
Director — Prof., NAS Acad. Valerii Smolii
tel.: +38 044 279 6362

M. S. Hrushevsky Institute of Ukrainian Archeography and Source Studies of the National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- theoretical and methodological issues of archeography and source studies;
- introduction of the written landmarks of history and culture of the Ukrainian people to the academic context;
- studying and publishing the creative heritage of outstanding scholars, political and cultural figures of Ukraine.

4 Triokhsviatytelska Str., Kyiv, 01001, Ukraine
tel./fax: +38 044 279 0863

e-mail: inst_archeos@ukr.net
Internet: www.archeos.org.ua
Director — Dr. Sci.(Hist.) Heorhii Papakin
tel.: +38 044 279 0863

I. Krypyakevych Institute of Ukrainian Studies, National Academy of Sciences of Ukraine

Established in 1951.

Key research areas:

- political history, history of society and national liberation movements in Western Ukraine;
- historical and cultural heritage as a factor of developing Ukrainian people's self-awareness;
- theory and history of Ukrainian culture, its uniqueness and relations with other cultures;
- Ukrainian-Polish relations in the context of European history and culture;
- the Ukrainian language history and functioning, historical and dialect vocabulary in Western Ukraine;
- material and spiritual culture of early (pre) historical population in the western territories of Ukraine.

4 Kozelniyska Str., Lviv, 79026, Ukraine
tel./fax: +38 032 270 7022
e-mail: inukr@inst-ukr.lviv.ua
Internet: www. inst-ukr.lviv.ua
Director — Dr. Sci. (Hist.) Igor Soliar
tel.: +38 032 270 7022

Institute of Archeology of the National Academy of Sciences of Ukraine

Established in 1934.

Key research areas:

- theory and methodology of archeological research;
- ancient anthropology;
- history and culture of the ancient population of Ukraine in the Stone Age;
- history and culture of the ancient population of Ukraine in the Paleometalice Age;
- history and culture of Kimmerians, Scythians and Sarmatians;
- history and culture of the Greek and Roman colonies;
- history and culture of ancient Slavs and their neighbours;
- history and culture of Kyiv Rus and its capital;
- history and culture of Medieval Ukraine;
- historical anthropology and bioarcheology.

12 Geroiv Stalingrada Ave., Kyiv, 04210, Ukraine
tel.: +38 044 418 2775; fax: +38 044 418 3306
e-mail: sekretar@iananu.org.ua
Internet www.iananu.org.ua
Director — NAS Corr. Memb. Victor Chabai
tel.: +38 044 418 2775

National Historical-Archeological Reserve 'Olbia' of National Academy of Sciences of Ukraine

Established in 1926.
Key research areas:

- exhibit registration research and scientific cataloguing of collection stock;
- certification of movable and immovable ancient objects;
- acquisition of museum collections and their scientific attribution;
- development of scientific fundamentals of museum organization;
- scientific, educational and cultural work.

47 Olbian Str., Parutyne Village,
Mykolayivska Oblast, 57540, Ukraine
tel./fax: +38 051 549 2453
e-mail: olbio1111@ukr.net
Internet: www.olbio.ochakiv.info
Acting Director — Serghiy Shein
tel.: +38 051 549 2453

A.Yu. Krymsky Institute of Oriental Studies, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- history, politics and economy of Asian countries;
- languages, literatures, religions and philosophies of the peoples of Asia;
- Ukraine and Asian countries, Middle-Eastern sources on the history of Ukraine;
- studies of historical documents and artifacts of Oriental origin.

4 Hrushevskoho Str., Kyiv, 01001, Ukraine
tel./fax: +38 044 278 7652
e-mail: instkrymsk@gmail.com
Internet: www.oriental-studies.org.ua
Director — PhD (Philol.) Alexander Bogomolov
tel.: +38 044 279 1593

Kuras Institute of Political and Ethnic Studies of the NAS of Ukraine

Established in 1991.

Key research areas:

- formation and development of political systems and political technologies;
- national minorities and ethno-national policy in Ukraine;
- ethno-confessional relations and modern religion policy in Ukraine;
- political regionalism and local self-government;
- ethno-political issues of international relations.

8 Generala Almazova Str., Kyiv, 01011, Ukraine
tel./fax: +38 044 285 7311
e-mail: office@ipiend.gov.ua
Internet: www.ipiend.gov.ua
Director — Prof., NAS Corr. Memb.
Oleg Rafalsky
tel.: +38 044 285 6261

State Institution 'The Institute of the World History of the National Academy of Sciences of Ukraine'

Established on 21 September 2011 by renaming the Institute of European Studies of the NAS of Ukraine established on 7 October 1992.

Key research areas:

- theoretical issues of the world history process;
- world history;
- history of international relations;
- world's cultural and civilizational development;
- world-system transformations under globalized development, the system of international relations in the context of planetary challenges;
- civilizational shifts and competing versions of modern progress;
- social, political and cultural relations of Ukraine and countries of the world, the analysis and forecasting of their development;
- socio-political and information factors of modern world development;
- international security, settlement of international conflicts;
- the impact of geopolitical processes, inter-ethnic and inter-confessional relations on international security;
- globalization and regionalization;
- world economy and international economic relations.

5 Leontovycha Str., Kyiv, 01030, Ukraine
tel./fax: +38 044 235 4499
e-mail: office.ivinanu@nas.gov.ua
Internet: www.ivinas.gov.ua
Director — Prof., NAS Corr. Memb.
Andriy Kudryachenko
tel.: +38 044 235 4499

H.S. Skovoroda Institute of Philosophy of the National Academy of Sciences of Ukraine

Established in 1946.

Key research areas:

- logic and methodology of science;
- philosophical problems of science and ecology;
- social philosophy;
- philosophical anthropology;
- philosophy of culture and theory of arts;
- aesthetics and ethics;

- history of Ukrainian philosophy and culture;
- history of foreign philosophy;
- religious studies.

4 Tryokhsviatytelska Str., Kyiv 01001, Ukraine
tel./fax: +38 044 278 0605
e-mail: if-ukr@i.kiev.ua
Internet: www. filosof.com.ua
Director — NAS Corr. Memb.
Anatolii Yermolenko
tel.: +38 044 278 0605

Department of Religious Studies of the H.S. Skovoroda Institute of Philosophy of the National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- philosophy of religion;
- history of religion;
- freedom of religion;
- practical religious studies.

4 Triokhsviatytelska Str., Kyiv, 01001, Ukraine
tel./fax: +38 044 279 5149
e-mail: cerif2000@gmail.com
Internet: www.filosof.com.ua/v8.htm
Head of the Department — Prof.
Anatoliy Kolodny, Dr. Sci. (Philos.)
tel.: +38 044 279 4812

Institute of Sociology of the National Academy of Sciences of Ukraine

Established in 1990.

Key research areas:

- theory, methodology and methods of sociological research, sociology of science;
- social structure of the Ukrainian society, trends and mechanisms of social differentiation and stratification;
- socio-cultural transformations in Ukraine, consolidation and integration of the Ukrainian society;
- monitoring of public opinion and social changes in the Ukrainian society;
- social well-being and value orientation of Ukraine's population, individual adaptation to crisis and post-crisis society;
- social aspects of globalization and European integration, international comparative social studies.

12 Shovkovychna Str., Kyiv, 01021, Ukraine
tel./fax: +38 044 255 7696
e-mail: i-soc@i-soc.org.ua
Internet: www.i-soc.com.ua
Director — Prof., NAS Acad. Valerii Vorona
tel.: +38 044 255 7107

Koretsky Institute of State and Law of the National Academy of Sciences of Ukraine

Established in 1969 on the basis of the Sector of State and Law of the URSR Academy of Science.

Key research areas:

- issues of state- and law-making in Ukraine: theory, history, practice;
- theoretical and applied issues of the implementation of the Constitution of Ukraine and modernization of the legal system of Ukraine;
- legal problems of the civil society, the rights and freedoms of man and citizen;
- organization issues of legislative, executive and judicial power in Ukraine;
- legal issues of the national sovereignty of Ukraine;
- legal issues of the economic, energy and environmental security of Ukraine, the fight against corruption and crime;
- development and improvement of the national information legislation;
- legal support to S&T activities in Ukraine;
- Ukraine in the system of contemporary international law and European integration: theory and practice;
- issues of encyclopedic legal studies, philosophy and sociology of law, comparative law.

4 Triokhsviatytelska Str., Kyiv, 01001, Ukraine
tel.: +38 044 278 5155; fax: +38 044 278 5474

e-mail: jus@ukrpack.net
Internet: www.idpnan.org.ua
Director — Prof., NAS Acad.
Yurii Shemshuchenko
tel.: +38 044 278 5155

Kyiv University of Law of the National Academy of Sciences of Ukraine

Established in 1995 on the base of Koretsky Institute of State and Law of the National Academy of Sciences of Ukraine.

Key activities:

- educational activities;
- manages the educational process and provides higher and postgraduate education to individuals according to their vocations, interests and talents;
- provides training for individuals working towards PhD degree in the field of law;
- carries out scientific, S&T, innovative, methodological, cultural and educational, publishing, financial, economic and international activities.

7-A Akademika Dobrokhotova Str., Kyiv, 02142, Ukraine
tel./fax: +38 044 423 9087
e-mail: kul@kul.kiev.ua
Internet: http://kul.kiev.ua
Rector — Prof. Yuriy Boshytskii, PhD (Law)
tel.: +38 044 409 2328

Monumentology Centre of the National Academy of Sciences of Ukraine and the Ukrainian Society for Protection of Historical and Cultural Monuments

Established in 1991.

Key research areas:

- monumentology;
- the protection and preservation of cultural heritage;
- history of monumentology, museums and reserves in Ukraine;
- methodological studies in monumentology.

9 Lavrska Str., Kyiv, 01015, Ukraine
tel./fax: +38 044 280 7879
e-mail: m-center@ukr.net
Internet: www.pamjatky.org.ua
Director — Ph.D. (Hist.) Olena Titova
tel.: +38 044 280 7127

Odesa Archeological Museum of the National Academy of Sciences of Ukraine

Established in 1825.

Key research areas:

- scientific research in the archeology and ancient history of the Northern Black Sea area;
- museum and inventory studies and scientific cataloguing of the repository collections, forming the museum collections and their scientific attribution, development of the scientific principles of archeological museology. Museum's collections belong to the scientific objects of the National Assets (order of the Cabinet of Ministers of Ukraine of 22.10.08, # 1345-p);
- scientific, educational and cultural activities.

4 Lanzheronivska Str., Odesa, 650261, Ukraine
tel./fax: +38 048 722 0171
e-mail: archaeology.odessa@gmail.com
Internet: www.archaeology.odessa.ua
Director — Dr. Sci. (Hist.) Igor Bruyako
tel.: +38 048 722 0171

V.I. Vernadsky National Library of Ukraine

Established in 1918.

Key research areas:

- theoretical, methodological, information and technological issues of knowledge management in libraries, forming library funds and Dbases, integration and using of information resources; development of the national scientific and information area;
- research, conservation and publication of manuscript, book and document heritage of Ukraine; foundation of national bibliography

and biobibliography, development of Ukrainian biographystics;
- issues of developing the information society, global informatization and social communications, information security of Ukraine.

3 Holosiyivsky Ave., Kyiv, 03039, Ukraine
tel./fax: +38 044 525 8104
Email: library@nbuv.gov.ua
Internet: www.nbuv.gov.ua
Acting Director General — Prof.,
NAS Corr. Memb. Lubov Dubrovina
tel.: +38 044 525 8104

Vasyl Stefanyk Lviv National Scientific Library of Ukraine

Established in 1940.

Key research areas:

- library science;
- bibliography science;
- book science;
- media studies;
- source studies;
- art studies;
- preservation, conservation and restoration of documents.

2 V. Stefanyk Str., Lviv, 79000, Ukraine
tel./fax: +38 032 261 5292
e-mail: library@lsl.lviv.ua
Internet: www.librarylviv.ua
Director General — PhD (Edu.) Vasyl Fershtei
tel.: +38 032 261 6372

State Institution 'Institute of Encyclopedic Research', National Academy of Sciences of Ukraine

Established in 2004.

Key research areas:

- history of encyclopedic science;
- theoretical encyclopedic science;
- applied encyclopedic science;
- encyclopedias publishing.

3 Tereshchenkivska Str., Kyiv, 01004, Ukraine
tel./fax: +38 044 234 1934
e-mail: esu@esu.com.ua
Internet: encyclopedia.kiev.ua
Director — PhD (Philol.) Mykola Zheleznyak
tel.: +38 044 234 1934

Department of Literature, Language and Art Studies of the NAS of Ukraine

Shevchenko Institute of Literature, National Academy of Sciences of Ukraine

Established in 1926.

Key research areas:

- history of Ukrainian literature from early times to the present day;
- Shevchenko studies;
- Ukrainian literature of the Ukrainian diaspora;
- modern theory of literature and methodology of literary studies;
- history of world literature;
- Slavic studies;
- source and textual studies in Ukrainian literature;
- comparative studies;
- literary bibliography.

4 Hrushevskoho Str., Kyiv, 01001, Ukraine
tel.: +38 044 279 1084; +38 044 278 5321;
fax: +38 044 279 6362
e-mail: admin@ilnan.gov.ua
Internet: www.ilnan.gov.ua
Director — Prof., NAS Acad.
Mykola Zhulynsky
tel.: +38 044 278 5281

State Institution 'Ivan Franko Institute, National Academy of Sciences of Ukraine'

Established in 2011.

Key research areas:

- Ivan Franko's literary and scholarly heritage in the context of Ukrainian and world cultures;

- integration of I. Franko studies and Ukrainian humanities studies into the all-European research and cultural area;
- Ukrainian literature of the 20th—21st centuries in Ukraine and Ukrainian diaspora; emigration literature in the all-Ukrainian and world contexts;
- studies in Polish and German literatures; comparative literary studies.

18 Drahomanova Str., Lviv, 79005, Ukraine
tel./fax: +38 032 261 1390
e-mail: lvilsh@ukr.net
Internet: www.ifnan.gov.ua
Director — Prof., NAS Corr. Memb.
Yevhen Nakhlik
tel.: +38 032 261 1390

O.O. Potebnia Institute of Linguistics, National Academy of Sciences of Ukraine

Established in 1930.

Key research areas:

- theory and methodology of linguistic studies;
- comparative studies of Slavic languages;
- functioning of Russian in Ukraine. Comparative studies of Russian and Ukrainian;
- comparative studies of Romance, Germanic, Baltic and Slavic languages;
- language factor of inter-ethnic interaction in Ukraine.

4 Hrushevskoho Str., Kyiv, 01001, Ukraine
tel./fax: +38 044 278 3273
e-mail: inmo2006@ukr.net
Website: www.inmo.org.ua
Director — Prof., Dr. Sci. (Philol.)
Bohdan Azhniuk
tel.: +38 044 278 3272; +38 044 278 3273

Institute of the Ukrainian Language, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- the public status, functions of the Ukrainian language;
- structure of literary Ukrainian — vocabulary, grammar, normalization and codification of literary language at different levels;
- social, professional and territorial differentiation of Ukrainian;
- sources of formation and historical development of Ukrainian;
- relations of Ukrainian with other Slavic and Non-Slavic languages in different periods of its formation and development;
- formation and dynamics of the onomastic system of Ukraine;
- development of terminological subsystems in various areas of intellectual and professional activities.

4 Hrushevskoho Str., Kyiv, 01001, Ukraine
tel.: +38 044 279 1885; tel./fax: +38 044 279 5619
e-mail: ukrmov@gmail.com
Internet: www1.nas.gov.ua
Director — Prof., Dr. habit. Pavlo Hrytsenko
tel.: +38 044 278 5327

Rylsky Institute of Art Studies, Folklore and Ethnology, National Academy of Sciences of Ukraine

Established in 1936.

Key research areas:

- Ukrainian ethno-cultural heritage in today's cultural-and-information area;
- historical and ethnographical studies of culture and ethnic history of the Ukrainian people, ethnic minorities of Ukraine and Ukrainian diaspora in the context of today's transformation processes;
- historical and theoretical aspects of researching the Ukrainian art: the Middle Ages, modern history, contemporary history, and modernity;
- the ethnic culture and art of foreign countries: history, problems and trends of current development;
- modern folkloristic studies: history, theory, and innovation techniques.

4 Hrushevskoho Str., Kyiv, 01001, Ukraine

tel./fax: +38 044 278 3454
e-mail: etnolog@etnolog.org.ua
Internet: www.etnolog.org.ua
Director — Prof., NAS Acad. Hanna Skrypnyk
tel.: +38 044 278 3454

Ethnology Institute, National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- transformation processes in Ukrainians' traditional and modern culture in globalized society;
- folk art achievements in the enrichment and development of Ukrainian society's spirituality;
- artistic process as an important factor of integrating Ukraine into the global cultural area.

15 Svobody Ave., Lviv, 79000, Ukraine
tel./fax: +38 032 297 0157; +38 032 297 0155
e-mail: ina@mail.lviv.ua
Internet: www.etnology.lviv.ua
Director — Prof., NAS Acad. Stepan Pavliuk
tel.: +38 032 297 0157

Ceramology Branch of Ethnology Institute, National Academy of Sciences of Ukraine

Established in 2000.

Key research areas:

- integral studies of pottery handicraft as a phenomenon of human activities;
- fundamental studies in ceramology aimed at obtaining new knowledge about the patterns of pottery origination and evolution, its role and place in the traditional life and in the modern culture of Ukrainians and other nations;
- applied research to gain new scientific information on clays and earthenware, and to use it for increasing the national wealth of the Ukrainian State.

102 Partyzanska Str., Opishne, Poltava Oblast, 38164, Ukraine
tel./fax: +38 05353 42175
e-mail: ceramology@ukr.net
internet: www.ceramology-inst.gov.ua
Director — Prof., Dr. Sci. (Hist.)
Oles Poshyvailo
tel.: +38 053 534 2175

Ukrainian Lingua-Information Fund, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- theoretical, mathematical and applied linguistics;
- lingua-information systems;
- linguistic aspects of intellectual activities.

3 Holosiivsky Ave., Kyiv, 03039, Ukraine
tel./fax: +38 044 525 8165
e-mail: hostmaster@ulif.org.ua
Internet: www.ulif.org.ua
Director — Prof., NAS Acad.
Volodymyr Shyrokov
tel.: +38 044 525 8165

International School of Ukrainian Studies, National Academy of Sciences of Ukraine

Established in 1991.

Key research areas:

- Ukrainian literature, Polish literature studies, literary criticism;
- literary and scholarly heritage of writers of the Ukrainian-Polish borderlands;
- Ukrainian studies in the European research area.

60 Volodymyrska Str., Kyiv, 01601, Ukraine
tel.: +38 044 239 3431
e-mail: msu2006@ukr.net
Director — Prof., NAS Corr. Memb.
Rostysław Radyshevsky
tel.: +38 044 239 3431

INSTITUTIONS UNDER PRESIDIUM OF THE NAS OF UKRAINE

Institute of Mathematical Machines and Systems Problems of the National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- the theory and practical methods for creating information and analytical decision-support systems, including situational centers in the sphere of public administration;
- development of mathematical modeling for studying and forecasting meteorological phenomena, regional climate changes, environmental pollution, ecosystem dynamics and creation on their basis of computer systems of forecasting and decision-making support concerning environmental safety and rational nature management;
- research, development and implementation of information, communication technologies, neurotechnologies in the creation of various information processing systems, including systems of automated control of equipment and technological processes; systems of medical informatics, artificial intelligence systems, and computer algebra systems;
- research of physical phenomena, development of new classes of physical and mathematical models and creation on their basis of complex systems, including dependability (fault-tolerant, reliable, safe, robust) computer systems and energy efficient appliances and systems, development of security management methods.

42 Akademika Glushkova Ave., Kyiv, 03187, Ukraine
tel.: +38 044 526 2497; fax: +38 044 526 6457
e-mail: ipmms@immsp.kiev.ua
Internet: http://www.immsp.kiev.ua
Director — Prof., NAS Acad. Anatolii Morozov
tel.: +38 044 526 2497

Institute of Telecommunications and Global Information Space, National Academy of Sciences of Ukraine

Established in 2001.

Key research areas:

- information, communication and knowledge-oriented technologies;
- mathematical modeling and computing technologies;
- environmental safety and balanced nature management.

13 Chokolivskiy Blvd., Kyiv, 03186, Ukraine
tel./fax: +38 044 245 8838
e-mail: itelua@kv.ukrtel.net
Internet: http://itgip.org/
Director — Prof., NAS Corr. Memb.
Oleksandr Trofymchuk
tel.: +38 044 245 8797

State Institution 'G.M. Dobrov Institute for Scientific and Technological Potential and Science History Studies of the NAS of Ukraine' (STEPS CENTER)

Established in 1986.

Key research areas:

- conducting research in the field of science of science, history of science, and technology and innovation;
- coordination of research carried out by other NAS institutions in the field of scientometrics, history of science and technology, innovation;
- summarizing the experience, long-term trends, patterns and validation of problem solving means in the development of S&T potential of Ukraine in the context of world science and the advancement of knowledge-based society and knowledge-based economy of Ukraine;
- science-management support to integrated analytical and prognostic research concerning the S&T progress of Ukraine that is carried out by NAS scientific institutions and departments;

- historical and scientometric analysis of the experience, the current status and validation of the prospects of S&T and socio-economic development of the NAS of Ukraine, enhancing its social role as the top self-governed research organization of Ukraine.

60 T. Shevchenko Blvd., Kyiv, 10032, Ukraine
tel./fax: +38 044 486 95 91
tel.: +38 044 236 99 29
e-mail: steps@nas.gov.ua
Internet: www.stepscenter.org.ua
Director — Prof. Boris Malitsky, Dr. Sci. (Econ.)
tel.: +38 044 486 45 68

International Centre for Astronomical, Medical and Ecological Research, National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- studying kinematic and physical characteristics of celestial bodies (galaxies, stars, the Sun, planets, exoplanets, etc.), gamma-ray bursts, and interstellar medium with astrometric, photometric and spectrophotometric methods;
- studying asteroid hazards and technogenic pollution of the near-Earth space;
- ground-based support to space projects and experimental astronomical observations;
- extreme medicine and physiology, climate therapy and sports medicine;
- investigations of novel biomedical issues related to environmental impacts on humans and animals;
- molecular-genetic, immunological studies and innovative technologies in emergency medicine and biology;
- development of methods for preventing and correcting extreme and pathological states associated with hypoxia impact on humans and animals;
- scientific and technical support of astronomical and biomedical research;
- development of novel methods and equipment for astronomical observations and their information support; developing and designing instruments and equipment for astronomical facilities.

27 Acad. Zabolotnoho Str., Kyiv, 03143, Ukraine
tel/fax: +380 44 526 2286
e-mail: tarady@mao.kiev.ua
Internet: www.terskol.com
Director — Dr. Sci. (Phys. & Math.)
Volodymyr Taradii
tel.: +38 044 526 2286

Technical Center of the National Academy of Sciences of Ukraine

Established in 1989.

Key research areas:

- mechanics of deformable solids;
- solid state physics;
- physical electronics;
- standardization;
- metrology and metrological support.

13 Pokrovska Str., Kyiv, 04070, Ukraine
tel./fax: +38 044 485 2384
e-mail: tc_secretary@nasu.kiev.ua
Director — PhD (Eng.) Georgiy Vlaykov
tel.: +38 044 425 5527

Centre for Humanitarian Education, National Academy of Sciences of Ukraine

Established in 1992.

Key research areas:

- scientific and methodological support for acquiring basic (philosophical) competences of graduate students and applicants of NAS institutions under the PhD training programs;
- conducting basic and practical scientific research in priority areas of philosophy and methodology of science;
- scientific and humanitarian expert examination.

4 Triokhsvyatytelska Str., Kyiv, 01601, Ukraine
tel./fax: +38 044 278 3013
e-mail: philosophia@ukr.net
Internet: www.cgo.nbuv.gov.ua

Director — Prof. Volodymyr Ryzhko,
Dr. Sci. (Philos.)
tel.: +38 044 279 3959

Research and Educational Center of Foreign Languages of the National Academy of Sciences of Ukraine

Established in 1954.

Key research areas:

- general linguistics;
- Germanic linguistics;
- Romance linguistics;
- comparative linguistics;
- translation studies;
- methods of teaching foreign languages.

4 Triokhsviatytelska Str., Kyiv, 01601, Ukraine
tel./fax: +38 044 279 3185
e-mail: langcenter@ukr.net
Internet: http://langcenter.kiev.ua/
Director — Assoc. Prof. Vasyl Zhalai,
PhD (Philol.)
tel.: +38 044 279 2292

State Institution 'Center for Evaluation of Activity of Research Institutions and Scientific Support of Regional Development of NAS of Ukraine'

Established in 1990.

Key research areas:

- scientific, methodological, information and analytical support of the procedure for assessing the activities of research institutions of the National Academy of Sciences of Ukraine;
- research into the problems of innovative development and investment attractiveness of Ukraine's regions; scientific, methodological and organizational support to the activities of the regional science centers of the NAS of Ukraine and the MES of Ukraine.

54 Volodymyrska Str., Kyiv-30, 01601, Ukraine
tel./fax: +38 044 234 8408
e-mail: innov@nas.gov.ua
Director — PhD (Chem.) Gennadii Koreniako
tel.: +38 044 234 8408

Center for Intellectual Property Studies and Technology Transfer, National Academy of Sciences of Ukraine

Established in 1997.

Key research areas:

- basic and applied scientific research in the field of copyright, industrial property rights, antitrust laws, intellectual property and technology transfer;
- improving the legal and economic principles of the protection of research results in the NAS of Ukraine;
- participation in drafting the laws of Ukraine and legal acts of the National Academy of Sciences of Ukraine in the field of intellectual property and technology transfer;
- implementation of measures of intellectual property protection and legal support to technology transfer in NAS scientific institutions and organizations.

54 Volodymyrska Str., Kyiv, 01601, Ukraine
tel./fax: +38 044 239 6502
e-mail: ciptt@nas.gov.ua
Internet: www.ciptt.nas.gov.ua
Director — PhD. (Law) Yuriy Kapitsa
tel.: +38 044 239 6764

State Institution 'Scientific Center for Medical and Biotechnical Research of the National Academy of Sciences of Ukraine'

Established in 1995.

Core science activities:

- studying current bioethical problems related to the employment of advanced bio- and nanotechnologies in Ukraine;
- bioethical examination of scientific projects in the field of biomedicine;
- support to the establishment of commissions and committees on bioethics in scientific and medical institutions;
- investigation of synchronization processes in neuron systems and methods to control their collective dynamics;

- studying modern problems of nonlinear science in neurophysiology, including solitary and chimera states in neuron ensembles;
- operational management and information support of the National Contact Point 'Health, demographic changes and well-being' of the EU Program 'Horizon 2020'.

54 Volodymyrska Str., Kyiv, 01601, Ukraine
tel./fax: +38 044 234 8356
e-mail: biomed@nas.gov.ua
Internet: www.biomed.nas.gov.ua
Director — PhD (Biol.) Mykola Chashchyn
tel.: +38 044 239 6623

Center for Practical Informatics of the National Academy of Sciences of Ukraine

Established in 1993.

Core science activities:

- scientific research in the field of digital transformation of large geographically distributed corporations;
- development and practical implementation of approaches to, methods, technologies for, regulations on centralization, integration and systemic presentation of digital information resources of the NAS of Ukraine and its scientific institutions;
- systemic Internet presentation of the National Academy of Sciences of Ukraine, its scientific results and products;
- implementation of modern cloud technologies for digital corporate knowledge creation and use, unified communication and collaboration technologies.

54 Volodymyrska Str., Kyiv-30, 01601, Ukraine
tel.: +38 044 239 6640; +38 044 239 6650
e-mail: cpi@nas.gov.ua
Internet: http://cpi.nas.gov.ua
Director — PhD (Eng.) Olexandr Platonov
tel.: +38 044 239 6640; +38 044 239 6650

Research and Training Centre for Applied Informatics of the NAS of Ukraine (RTCAI NASU)

Established in 1987.

Core research and educational activities:

- technologies of computer modeling, optimization and analysis of complex systems;
- technologies of integrated database systems and knowledge, their practical use in national information resources;
- technologies of the development and practical application of software for educational purposes;
- training of graduate students and staff of NAS research institutes for the efficient use of advanced information technologies in their research activities.

40 Akademika Glushkova Ave., Kyiv, 03680, Ukraine
tel./fax: +38 044 526 6428
e-mail: nucpi@nucpi.nas.gov.ua, Viktor.Raspopov@gmail.com
Internet: www.nucpi.nas.gov.ua
Director — Assoc. Prof. Viktor Raspopov, PhD (Phys. & Math.)
tel.: +38 044 526 6428; +38 044 360 2401

National Center 'Junior Academy of Sciences of Ukraine' of the Ministry of Education and Science of Ukraine and the National Academy of Sciences of Ukraine (NC 'JASU')

Established in 2004.

Core science activities:

- organization and coordination of research of school students by promoting their intellectual, spiritual, creative development and vocational self-determination, formation of the scientific elite of the nation;
- search for and support of talented, intellectually gifted students, their involvement in solving the most important problems of natural, technological, social and human sciences;

- conducting basic and applied research in transdisciplinary development to create a single ontology information and education area of the Junior Academy of Sciences of Ukraine;
- creation of information systems and methodological tools for monitoring and evaluating the educational achievements of students in the system of science education of the JAS.

38-44 Dehtyarivska Str., Kyiv, 04119, Ukraine
tel./fax: +38 044 489 5599
e-mail: man@man.gov.ua
Internet: www.man.gov.ua
President — Prof., NAS and NAES Acad. Stanislav Dovgyi
tel.: +38 044 279 6362
Director — Assoc. Prof. Oksen Lisovyi, Ph.D. (Philos.)
tel.: +38 044 489 5599

*Physical Engineering Training and Research Centre**

Established in 1997.

Core activities:

- graduate and post-graduate programs in physics and technology with the focus on research training along with a strong curriculum in materials science, solid state physics, biophysics and information technologies;
- distance learning school in physics and technology to help Ukrainian school students prepare for university;
- R&D in scientific instrumentation.

36 Vernadsky Blvd., Kyiv, 03142, Ukraine
tel./fax: +38 044 424 3025
e-mail: ftc@imp.kiev.ua

* The decree of the Cabinet of Ministers of Ukraine of 14 December 2016 #962-p 'On establishing the state science institution 'Kyiv Academy University' through reorganizing the Physical Engineering Training and Research Centre of the National Academy of Sciences of Ukraine. The state science institution 'Kyiv Academy University' is in the registration process.

Internet: www.mfti.in.ua
Acting Director — NAS Corr. Memb., Dr. Alexander Kordyuk
tel.: +38 044 424 1031

Department of Target Training of Taras Shevchenko Kyiv National University within the National Academy of Sciences of Ukraine (DTT TS KNU NASU)

Established in 1987.

Key research areas:

- scientific and educational activities.

54 Volodymyrska Str., Kyiv, 01601, Ukraine
tel./fax: +38 044 424 7241
e-mail: edu@imag.kiev.ua
Director — Prof., NAS Acad. Anatoly Zagorodnyi
tel.: +38 044 235 7019; +38 044 239 6740

State Scientific Institution 'Centre of Innovative Medical Technologies of NAS of Ukraine' (SSI 'CIMT NAS of Ukraine')

Established in 2017.

Key research areas:

- scientific research in the sphere of preventive clinical medicine;
- development and implementation of novel measures of disease prophylactics, diagnostics and treatment, rehabilitation;
- elaboration and implementation of new innovative technologies in medical information system, telemedicine, medical diagnostics, treatment process etc.;
- formulation of new medicines, materials and medical equipment, medico-biological technical products.

22 Voznesenskyi Descent, Kyiv, 04053, Ukraine
tel./fax: +38 044 272 3403
e-mail: cimtnanu@ukr.net
Director — Prof. Ivan Todurov, Dr. Sci. (Med.)
tel.: +38 044 272 3101

State Institution 'Scientific-and-Production Enterprise "Naukova Dumka" Publishing House of the NAS of Ukraine'

Established in 1922. The publishing house of the URSR SA started to operate as an independent institution in 1927. In 1964 it was reorganized and renamed into 'Naukova Dumka' Publishers. Since 2007 its official name has been State Enterprise 'State Scientific-and-Production Enterprise "Naukova Dumka" Publishing House of the NAS of Ukraine".

Core science activities:

- publishing fundamental and generalizing scientific monographs of Ukrainian scientists and scholars;
- publishing works of historical and cultural heritage of the Ukrainian people;
- issuing literature intended for wide circle of readers;
- publishing encyclopedias.

3 Tereshchenkivska Str., Kyiv, 01601, Ukraine
tel./fax: +38 044 235 4170
e-mail: reklama@ndumka.kiev.ua
Internet: www.ndumka.kiev.ua
Director — PhD (Biol.) Ihor Alekseienko
tel.: +38 044 234 4068

'Akademperiodyka' Publishing House of the National Academy of Sciences of Ukraine

Established in 1995.

Core science activities:

- scientific and methodological support for publishing activities of the NAS of Ukraine;
- generating and applying new knowledge in the field of publishing, preparation and production of professional academic literature;
- introduction of new information and publishing technologies;
- coverage and popularization of the achievements of national science.

4 Tereschenkivska Str., Kyiv, 01004, Ukraine
tel.: +38 044 234 7554; tel./fax: +38 044 288 0347
e-mail: druk@nas.gov.ua
Internet: http://akademperiodyka.org.ua
Director — PhD (Biol.) Olena Vakarenko
tel.: +38 044 288 1699; +38 044 239 6493

ADDENDUM 2

THE MOST IMPORTANT PUBLICATIONS ABOUT THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE AND ITS PROMINENT SCIENTISTS

Василенко М. *До Ради Міністрів Української Держави од Міністра народної освіти та мистецтва : пояснююча зап. до законопроекту про заснування Укр. Акад. Наук у Київі*. Київ: Друк. Укр. наук. т-ва, 1918.

Збірник праць Комісії для вироблення законопроєкту про заснування Української Академії Наук у Київі. Київ: Друк. Укр. наук. т-ва, 1919.

Перший піврік існування Української Академії Наук у Київі та начерк її праці до кінця 1919 року. Київ: Вид-во Укр. Акад. Наук, 1919.

Статут і штати Української Академії Наук у Київі. Київ: Друк. Укр. наук. т-ва, 1919.

Звідомлення про діяльність Української Академії Наук у Київі до 1 січня 1920 року. [Київ, 1921].

Звідомлення за 1921 рік. Берлін: Вид-во укр. молоді, 1923.

Звідомлення Всеукраїнської Академії Наук у Київі за 1923 рік (З нагоди п'ятиріч. існування Академії, 1918 – 1924). Київ: Друк. Укр. Акад. Наук, 1924.

Особовий склад Академії на 1 червня 1923 року. Київ, 1924.

Птуха М. В. *П'ять років існування III Соціально-економічного відділу Української Академії Наук (1919 – 1923)* : дод. до 1-го т. «Записок Соціально-економічного відділу Української Академії Наук». Київ, 1924.

Звідомлення Всеукраїнської Академії Наук за 1922 рік. Прага: Вид-во укр. молоді, 1925.

Звідомлення Української Академії Наук у Київі за 1924 рік. Київ: Друк. Укр. Акад. Наук, 1925.

Звідомлення Української Академії Наук у Київі за 1925 рік. Київ: Друк. Укр. Акад. Наук, 1926.

Звідомлення Української Академії Наук у Київі за 1926 рік. Київ: Друк. Укр. Акад. Наук, 1927.

Діяльність Історичної Секції Всеукраїнської Академії Наук та зв'язаних з нею історичних установ Академії в році 1927. Київ: Друк. Всеукр. Акад. Наук, 1928.

Звідомлення Всеукраїнської Академії Наук у Київі за 1927 рік. Київ: Друк. Всеукр. Акад. Наук, 1928.

Матеріали до обрання нових академіків ВУАН: характеристики кандидатів на академіки ВУАН, подані з доручення особливих комісій : дод. до Вістей ВУАН № 5/6 1929. Київ: Київ-Друк, 1929.

Список праць Академії Наук, виданих за 10 літ її існування (1918 – 1928). Київ: Друк. Всеукр. Акад. Наук, 1929.

Каталог видавництва Всеукраїнської Академії Наук. Київ, 1930.

Систематичний каталог видань Всеукраїнської Академії Наук, 1918 – 1929. Склали: М. М. Іванченко, Я. І. Стешенко. Київ, 1930.

Статут Всеукраїнської Академії Наук. Проєкт статутарної комісії при президії. Уклад. О. Корчак-Чепурківський. Київ: Друк. Всеукр. Акад. Наук, 1930.

Артемський А. Я. *Що таке Всеукраїнська Академія Наук (ВУАН)*. Київ: Вид-во Всеукр. Акад. Наук, 1931. (Серія науково-популярна. № 7).

Каталог видань Всеукраїнської Академії Наук за 1930 рік. Склав М. Сагарда. Київ, 1931.

Систематичний каталог видань Всеукраїнської Академії Наук за 1931 рік. Склав М. Сагарда. Київ, 1932.

Всеукраїнська Академія Наук на службі соціалістичного будівництва : пр. ювіл. сесії ВУАН, присвяч. 15-літтю Жовтн. революції. Київ: Вид-во ВУАН, 1933.

Статут Академії наук Української Соціалістичної Радянської Республіки : затв. РНК УСРР 21.02.1936. Київ: Вид-во АН УСРР, 1936.

Проблематика і основні покажчики роботи АН УРСР в 1940 р. Склали: Б. М. Гарцман [та ін.]; за ред. А. А. Сапєгіна. Київ: Вид-во АН УРСР, 1940.

Академія наук УРСР у 1941 році. Склали: С. Є. Боржковський [та ін.]; за ред.: А. А. Сапєгіна, Б. М. Гарцмана. Київ: Вид-во АН УРСР, 1941.

Богомолець О. О. *Про завдання Академії наук УРСР в 1941 р.* Київ: Вид-во АН УРСР, 1941. (Окремий відбиток з журн. *Вісті АН УРСР*. 1941. № 1).

Богомолець О. О. Учені України в дні Вітчизняної війни. [Б. м.]: Спілка радян. письменників України, 1942. (Фронт і тил).

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Основні напрямки робіт академіка Олександра Олександровича Богомольця. Ред. Р. Є. Кавецький. Київ: Вид-во АН УРСР, 1946.

Александр Владимирович Палладин : [библиогр. указ.]; вступ. ст. А. М. Утевского; библиогр. сост. Н. М. Нестеровой. М.; Л.: Изд-во АН СССР, 1948. (Материалы к библиографии ученых СССР. Серия биохимии; вып. 2).

Полонська-Василенко Н. *Українська академія наук (нарис історії)*. У 2 ч. Ч. 1. (1918—1930). Мюнхен: Logos, 1955. (Досліди і матеріали : серія 1; ч. 21).

Кавецький Р. Є., Балицький К. П. *Вклад ученых Академії наук Української РСР в розвиток медицини*. Київ: Вид-во АН УРСР, 1957.

Барбарич А. І. *Володимир Іполитович Липський*. Київ: Вид-во АН УРСР, 1958. (Серія «Вчені Української РСР»).

Звіт про наукову діяльність Академії наук Української РСР за 1957 рік. Київ, 1958.

Полонська-Василенко Н. *Українська академія наук (нарис історії)*. У 2 ч. Ч. 2. (1931—1941). Мюнхен, 1958. (Досліди і матеріали: серія 1; ч. 43).

Список академіків та членів-кореспондентів АН УРСР (1919 – жовтень 1958 рр.). Київ, 1958.

Діяльність Академії наук Української РСР, 1944 – 1958 : бібліогр. покажч. Склали: О. М. Матві-

єнко [та ін.]; відп. ред. М. П. Рудь; бібліогр. ред. Л. І. Гольденберг. Київ, 1959.

Отчет о научной деятельности учреждений Академии наук Украинской ССР за 1958 год. Киев, 1959.

Отчет о деятельности Академии наук Украинской ССР в 1959 году. Киев: Изд-во АН УССР, 1960.

Утевский А. М. *Александр Владимирович Палладин* : [библиогр. указ.]. Отв. ред. Д. Л. Фердман; 2-е испр. и доп. изд. Киев: Изд-во АН УССР, 1960. (Серия «Ученые Украинской ССР»).

Отчет о деятельности Академии наук Украинской ССР в 1960 году : (проект). Киев: Изд-во АН УССР, 1961.

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Отчет о деятельности Академии наук Украинской ССР в 1964 году : (проект). Отв. за вып. А. А. Вовк; общ. ред. Н. И. Дубины. Киев: Наук. думка, 1965.

Історія Академії наук Української РСР : у 2 кн. Кн. 1—2. Редкол.: Б. Є. Патон (голов. ред.) [та ін.]. Київ: Голов. ред. УРЕ АН УРСР, 1967.

Видання Академії наук УРСР (1919 – 1967): суспільні науки : бібліогр. покажч. Склали: П. Ю. Висоцька (керівник) [та ін.]; відп. ред. М. М. Онопрієнко. Київ: Наук. думка, 1969.

Немошкаленко В. В., Новиков М. В., Пелих В. М. *Академія наук Української РСР, 1969* : [з нагоди 50-річчя засн. АН УРСР]. Відп. ред. М. П. Семененко. Київ: Наук. думка, 1969.

Терлецький В. М. *Академія наук Української РСР, 1919 – 1969* : корот. іст. нарис. Київ: Наук. думка, 1969.

Видання Академії наук УРСР (1919 – 1967): фізико-технічні та математичні науки : бібліогр. покажч. Склали: П. Ю. Висоцька (керівник) [та ін.]; відп. ред. М. М. Онопрієнко. Київ: Наук. думка, 1970.

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Видання Академії наук УРСР (1919 – 1967): Науки про землю і космос. Хіміко-технологічні та біологічні науки : бібліогр. покажч. Склали: П. Ю. Висоцька (керівник) [та ін.]; відп. ред. М. М. Онопрієнко. Київ: Наук. думка, 1971.

На магістралях науки. Відп. ред. Г. С. Писаренко. Київ: Наук. думка, 1976.

Академия наук Украинской ССР, 1919 – 1979 : справочник. Отв. ред. В. С. Гутыря. Киев: Наук. думка, 1979.

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Білай В. Й. *Данило Кирилович Заболотний* : [бібліогр. покажч.]. Київ: Наук. думка, 1979.

История Академии наук Украинской ССР. Редкол.: Б. Е. Патон (гл. ред.) и др. Киев: Наук. думка, 1979.

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Тонкаль В. Ю., Пелих В. М., Стогній Б. С. *Академія наук Української РСР*. Київ: Наук. думка, 1980.

Александр Александрович Богомолец : [библиогр. указ.]. Сост. Л. В. Сиренко; общ. ред. О. А. Богомольца. Киев: Наук. думка, 1981. (Библиография ученых Украинской ССР).

Александр Александрович Богомолец: воспоминания современников. Под общ. ред. О. А. Богомольца. Киев: Наук. думка, 1982.

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Добров Г. М., Марущак В. Т., Байдаков В. В. [и др.]. *Научные центры Академии наук Украинской ССР (опыт и перспективы)*. Отв. ред. К. М. Сытник. Киев: Наук. думка, 1986.

Санцевич А. В., Комаренко Н. В. *Развитие исторической науки в Академии наук Украинской ССР 1936 – 1986 гг.* Под ред. акад. Ю. Ю. Кондуфора. Киев: Наук. думка, 1986.

Байдаков В. В., Коновець О. Ф., Скляренко А. Є. *Наукові центри АН УРСР*. Київ: Т-во «Знання» УРСР, 1987. (Серія 8 «Нове в науці, техніці, виробництві; № 9).

Общее собрание Академии наук Украинской ССР, 1987 : сб. материалов. Редкол.: Б. Е. Патон (гл. ред.) и др. Киев: Наук. думка, 1987.

Добров Г. М., Стогний Б. С., Тонкаль В. Е. [и др.]. *Организация управления в Академии наук Украинской ССР: опыт и проблемы (1961 – 1986 гг.)*. Отв. ред. Б. М. Бабий. Киев: Наук. думка, 1988.

Шпак А. П., Цемко В. П., Новиков В. Д. [и др.]. *Академия наук Украинской ССР: история и современность*. Киев: Наук. думка, 1990.

Звіт про діяльність Академії наук Української РСР у 1989 році : проект : у 2 ч. Київ: Наук. думка, 1990. Ч. 1 – 2.

Микола Прокопович Василенко. Авт. вступ. ст.: Ю. С. Шемшученко, І. Б. Усенко; упоряд. В. В. Вороненко; ред. Р. І. Осипова. Київ: Наук. думка, 1990. (Біобібліографія вчених Української РСР).

Звіт про діяльність Академії наук України у 1991 році : в 2 ч. Київ: Наук. думка, 1992. Ч. 1 – 2.

Звіт про діяльність Академії наук України у 1992 році : проект : в 2 ч. Київ: Наук. думка, 1993. Ч. 1 – 2.

Академія наук України. За ред. А. П. Шпака. Київ: Наук. думка, 1993.

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The book is intended for broad circles of scientists, education and culture workers, politicians, public activists, and all those interested in the advancement of science in Ukraine.

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