NATIONAL ACADEMY OF SCIENCES OF UKRAINE

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Contents

Main Results

B. E. Paton,
President of the Academy

In 2007, researchers of the National Academy of Sciences of Ukraine (NAS) did much to promote science and strengthen its role in providing positive changes in the life of Ukrainian nation. They carried out over 3500 R&D works, and the results of those fundamental and applied studies give a convincing proof of the high scientific quality and practical significance of their efforts. The main emphasis was laid on purposeful fundamental research dealing with challenges in science, engineering, social, economic and cultural life, on the development of cutting-edge technologies.

Further progress was achieved in such areas as geometry and topology of multidimensional submanifolds; intellectual information technologies and systems; liquid, gas and plasma mechanics; low-frequency radio astronomy; state-of-the-art materials, including nanomaterials; genetic improvement of plants. Our scholars studied novel trends and phenomena in the current socio-political, socio-economic life and culture, made strategic forecasts, produced conceptual models and algorithms for solving urgent social problems.

Among the most significant results of the research done, I would like to mention the following. A new method of light pressure on the atom was proposed, which relies on counterrunning frequency-modulated waves and permits a pressure force that cannot be achieved by other means. The work on the "National Atlas of Ukraine" was completed. This contains 6 thematic map blocks, from history to environmental status, with 875 special maps compiled by specialists of many Academy institutions. A whole new adaptive system was developed for early detection of pre-emergency states in NPP technological systems.

An important area in the Academy's activities was improving the coordination of fundamental studies in the country, updating their subjects. In collaboration with specialized academies of sciences, a draft list of principal research areas and the major topics of fundamental research in natural, technical sciences and humanities was made, which is to become the basis for coordination plans of organizing fundamental research in Ukraine. This list will be soon considered by the Inter-Agency Board on Coordinating Fundamental Research.

The Academy continued its work on the expert assessment of the subjects of fundamental research to be conducted by science institutions of the country. About 1000 new subjects proposed by institutions of 13 major budget-money administrators were analyzed. Nearly one third of them were judged to be of applied nature and about 3% were rejected. Of great significance for practical recognition of the NAS status as the highest science institution of the nation is the fact that the Law of Ukraine 'On the 2008 State budget of Ukraine and amendments to some legislative acts of Ukraine' introduces a permanent regulation to the Law of Ukraine 'On science and R&D activities'. According to it, the budget money intended for financing fundamental research is allocated only if the validity opinion is made about the necessity of expenditures for every research subject; the opinion is to be provided by the NAS Expert Board.

Our scholars gave much attention to promoting innovative activities. For several years running, NAS has selected on a competitive basis promising R&D designs that are to become the basis of major innovative projects. Now we already have noticeable practical results of such projects, producing significant economic and social effects. I am glad to point out that the Government introduced an operative mechanism of state support to investment-and-innovation projects in 2007, and the State budget made provisions for the necessary finance.

The Academy made every effort towards broader use of the research potential of its institutions to improve engineering and technological standards of domestic industries and to promote co-operation with respective ministries and agencies to that effect. This concerns, in particular, R&D support to community facilities. It should be noted that in the recent years over 20 Academy's institutions have been implementing large-scale projects intended for providing the population with high-quality drinking water, updating public heat-and-power utilities, developing novel materials and producing structures for building industry, anti-seismic protection, energy saving etc.

In collaboration with the National Space Agency of Ukraine we initiated a number of joint R&D programs in space research. With the participation of the members of the Board of the State Statistics Committee, our specialists discussed demographic trends in Ukraine out to 2050. To take them into account is of utmost importance for increasing labour potential – and, therefore, building up Ukrainian economic, innovative and cultural resources in the near decades.

Permanent attention was given to the scientific backup to reliable and safe functioning of the nuclear-power industry in Ukraine. A meeting of NAS Presidium discussed the concept of a new multipurpose research nuclear reactor. Its construction will be of great significance not merely for nuclear physics and power engineering, but for the nation as a whole. On the eve of another sad anniversary of the largest and most terrible disaster in terms of its impacts – the catastrophe at Chornobyl NPP – NAS Presidium discussed the current condition of 'Ukryttia' ('Shelter') facility and R&D aspects of its transformation into an environmentally non-aggressive system. In various periods, over two thousand scientists of thirty institu-

tions of the National Academy of Sciences of Ukraine worked in the Exclusion zone. Over those years more than a thousand studies were conducted along many lines of research. They permitted a comprehensive system of measures to be developed and implemented, which are to minimize the impacts of the disaster.

No one doubts that the development of hi-tech industries will benefit from state targeted R&D programs initiated by NAS and approved by the Cabinet of Ministers of Ukraine in 2007. These address the development and refining of microelectronic technologies, organization of large-scale production of devices and systems on their basis and the creation of science-intensive sensor products. Academy scientists also prepared draft concepts of two more targeted state programs, namely, 'The development and introduction to the Ukrainian economy of energy-efficient LED light sources and illumination systems on their basis' and 'The development of nanotechnologies'.

We witnessed further progress in the collaboration between the Academy and the Ministry of Education and Science in integrating research and education processes, training skilled specialists. Over 130 university post-graduate students and academics working towards doctor's degrees were given training at NAS research institutions. Specialized councils of NAS research institutions considered theses and awarded Doctor's of science degrees to nearly 80 academics and Candidate's of science degrees to more than 300 university teachers. Over 1400 students prepared their university degree theses under the supervision of leading NAS scholars. NAS employees also conducted collaborative studies with university academics. In the year under review, they worked at nearly 250 joint research projects, whose results were published in over 90 collective monographic writings. They also co-operated in preparing curricula, textbooks and study manuals.

We should emphasize that work with young researchers, involving them to science is a major focus of the Academy's activities. NAS Commission on work with young researchers ensured a broad participation of young NAS scholars in various competitions held in Ukraine under the existing system of targeted support to talented youth. Much attention was given to furthering and upgrading the current forms of targeted financial support to young researchers and their studies. On NAS initiative, Verkhovna Rada of Ukraine established 30 personal VR scholarships for the most talented young researchers and 20 VR prizes for the most talented young scientists in the area of fundamental and applied research and R&D activities. The prize of the Cabinet of Ministers for special achievements of young people in nation's development was increased significantly. When another competition for young scholars to obtain NAS grants for research in 2007-2008 was announced, the number of grants and the amount of money they provide rose significantly.

A package of measures towards supporting talented young people at NAS stimulated a further rise in the number of candidates of sciences under 35 and of young scholars in general. Last year the number of young candidates of sciences increased by 8% and the number of young scholars mentioned – by 7% against respective figures in 2006.

Yet, there is still much to be done for attracting talented youth to NAS. So, NAS sections, departments and research institutions must attach top priority to this task.

A number of aspects of attracting young staff to research institutions can only be addressed at the government level. The Academy introduced to the Cabinet of Ministers a draft resolution providing for a package of measures that aim at enhancing the prestige of scientist's work, giving state support to talented young people, stimulating them to do research.

Certain progress in solving the personnel problem is, to a large extent, due to larger finance allocations and improved logistics support to scientific research in the recent years. State-budget expenditures for financing the activities of the National Academy of Sciences rose by nearly 30% in 2007, as compared to the previous year. We are to take into account, however, that a larger part of this increase is spent on salary increases in line with the growth of minimum wages, utility payments etc.

By and large, the Academy spends about 70% of its allocations from the State budget on salaries and pay-roll taxes. Last year the Cabinet of Ministers approved new, more stimulating, terms of remuneration for workers of NAS institutes; now the average salaries of Academy workers are comparable with the average wages in industry. A part of the finance left is channeled in full to target programs and to research subjects approved through competitive biddings. Last year, studies under 19 target integrated research programs were carried out, and UAH 63m was allocated for them, which is 18.7% more than in 2006.

In 2007, budget allocations for technical facilities for NAS research institutions rose. As in the previous years, the centralized purchase of expensive import equipment continued. UAH 60m was spent for this purpose, 30 unique devices being acquired. In total, over 90 units of science equipment and facilities have been purchased for 61 NAS institutions in the recent years. Over 50 centers of shared use were organized and have been functioning. The analysis of their performance, made last year, proved the efficiency of those expenses. Specialists of these centers provided trouble-free and reliable operation of the equipment and devices, as well as their professional maintenance. Of great importance is the fact that outside organizations interested in doing research are given ready access to the unique equipment – the centers spend as much as one third of their operating time for servicing them.

It is clear that budget finance alone is not sufficient for renewing the highly rundown equipment, purchasing materials and chemicals, for buying foreign science periodicals, paying for the access to media resources of advanced R&D information, sending scholars to foreign academic symposia. Large amounts of finance are allocated for these purposes from the specialized fund of the State budget. But off-budget revenues grow much slower than budgetary

provisions. So, Academy institutions are to speed up the commercialization of their research results, i.e. of works done under agreements and contracts with domestic and foreign customers, the sales of licenses and finished products etc.

'Naukova Dumka' publishers and 'Academperiodika' Publishing House make a significant contribution to the information provision of research. Last year, declared 'The Ukrainian book year' by a President's of Ukraine decree, these institutions marked dates that were of importance for them. 'Naukova Dumka' Publishers celebrated its 85-th anniversary. As everyone remembers, we witnessed its boom in 1980-ies, when it was the third in the world in terms of the printed academic output. The priceless experience gained in those years permitted 'Naukova Dumka' Publishers to become the leader in issuing academic books in the independent Ukraine. Merely in the last five years it published over 350 book titles of the total run of 900 thousand copies.

Recently NAS 'Academperiodika' Publishing House has marked the 10-th anniversary of the publication of its first academic journal. Since then, both the quantity and quality of its printed output has been steadily growing, with the complete in-house preparation of all publications. In 2007, 171 issues of 27 journals and inter-agency collections of writings with the participation of NAS institutions were published, their total run amounting to 56.7 thousand.

Summarizing the academic publishing in 2007, one should say that NAS scholars prepared and issued nearly 1000 titles of books, of which 685 are monographs.

As before, a major contribution to the socio-economic, R&D and cultural progress of the Ukrainian regions was made by the regional science centers operating under NAS and the Ministry of Education and Science. In their activities, the centers attached top priority to scientific backup to diversifying energy supplies, rational power consumption, improving the environment, developing innovation. Much attention was given to deeper integration of research and education at the regional level, to rationalizing the network and improving the functioning of specialized councils that award academic degrees. Much expert assessment work was done in the areas that are of great importance for tackling specific regional tasks.

International scientific ties of NAS continued to grow in 2007. The traditional central place was taken by furthering the collaboration with the academies of sciences of CIS countries and, first and foremost, with the Russian Academy of Sciences. NAS successfully performed the role of the host academy for the International Association of the Academies of Sciences (IAAS). Academic councils organized within IAAS function successfully, in particular those concerned with novel materials, fundamental problems of geography, book publishing; last year they were engaged in activities common for scholars of CIS countries. IAAS Council sent an address to the Council of CIS heads of states on broader collaboration of CIS member states in fundamental and applied research. After that they adopted a resolution to hold a conference of the heads of state-owned R&D organizations in 2008 with the participation of IAAS representatives. The co-operation of NAS with organizations that are IAAS associated members became more extensive. E.g., a joint competition of research projects of NAS and the Russian Basic Research Foundation was started. In collaboration with Russian Humanitarian Research Foundation, the third competition of joint projects of Russian and Ukrainian scholars was held.

NAS made a significant contribution to furthering IAAS collaboration with UNESCO. The international symposium 'Integration of research and education as the key factor in building knowledge-based society' was held in Kyiv under the aegis of IAAS and with UNESCO financial support. It was attended by nearly 200 scholars and specialists of 13 countries. The symposium gave rise to a vivid discussion on upgrading the system of education and training research personnel, the search for new forms of closer ties between academy science and education, and for stimuli for involving young people to research. The first all-Ukrainian science festival was a spectacular event in the life of academic community. One should point out that organization of science festivals is traditional in many developed countries. Last year the National Academy of Sciences, jointly with the Ministry of Education and Science, initiated the annual Science Festival, to be held on Science Day.

The results of Academy's work last year are the evidence of the significant contribution of its scholars to socio-economic, socio-political and cultural progress of our nation. Yet, one has to admit honestly that this contribution could have been greater. The Academy has a sufficient research potential for dealing with the most urgent tasks of Ukraine's social progress, ensuring its dynamic innovative economic growth. NAS has identified major lines of research and development, whose implementation will allow a significant boost in the socio-economic progress of Ukraine, ensure a qualitative growth in competitiveness of its economy. Among those areas are nanomaterials and nanotechnologies, information technologies and resources, energy supply and energy saving, advanced materials and methods of their joining and processing, the rational use of nature-resource potential, novel biotechnologies for medicine and agribusiness etc. No doubt, the work along these lines, that must become the major priority in NAS activities, is not possible without governmental support. The results of joint meetings of NAS Presidium with members of the Cabinet of Ministers, held at the beginning of this year, demonstrate serious intentions of the Government concerning the development of efficient mechanisms for interaction of science and state power.

Next November we are going to celebrate the 90-th anniversary of the establishment of the National Academy of Sciences of Ukraine. I am sure that Academy's scholars will mark this jubilee with new achievements; they will spare no efforts to ensure dynamic socio-economic, R&D and cultural progress of the nation.

Activities of NAS General Meeting and Presidium. Furthering of International Ties

A. P. Shpak,
First Vice-President — Chief Scientific Secretary of the Academy

In 2007 NAS focused its activities on furthering cutting-edge areas of science and technology, back-up to dealing with challenges that are important for the state and society, on integrating Ukrainian scholars to the international academic community.

The annual session of NAS General Meeting, held in April 2007 and attended by top-level state officials, representatives of ministries and agencies, Kyiv City State Administration, research institutions of the Academy, NGOs, by mass media and foreign guests, summarized the NAS activities in 2006 and determined its priority tasks for the near future. The annual report of NAS President academician B.E.Paton, the address of the President of Ukraine V.A.Yushchenko to the Meeting's participants and the message of welcome by the Speaker of Verkhovna Rada of Ukraine, the speech of the first Vice-Premier and presentations of the Meeting's participants emphasized that the results of NAS work in 2006 had demonstrated positive changes in both organization of and support to research activities and stronger influence of the Academy on scientific and R&D progress of the nation. Still, the top priorities of the leading research institution of Ukraine include the task of improving the efficiency of its work, in particular, its role in the scholarly backup to progressive transformations, identifying ways and means of accelerated development of science and technology in Ukraine in line with the innovative model, involving talented young people to research, preserving and promoting leading scientific schools.

Of symbolic meaning was the presentation of leading scientists with V. I. Vernadsky Gold Medal at the session of General Meeting. The medals were handed to NAS academician Yu. O. Mitropolsky for his outstanding achievements in the theory of differential equations, developing asymptotic methods of nonlinear mechanics and mathematical physics and to foreign NAS member, academician of the Russian Academy of Sciences, Yu. S. Osipov for prominent results in optimal control theory and spectral theory of stabilization of nonlinear system motion.

Taking into account that the Academy will mark its 90-th anniversary in the November of 2008, NAS General Meeting resolved to set up NAS Commission on preparing to the celebration of this remarkable event in the life of Ukrainian society.

In accordance with the tradition, the Academy commemorated prominent scholars in the year under review. In January, 2007, a Joint Session of the General Meeting of NAS and the Academy of Medical Sciences was held. It marked the 100-th birth anniversary of NAS and AMS academician V.P. Komissarenko, the outstanding scholar, science manager and public figure, who made enormous contribution to the formation of Ukrainian endocrinology school, established in Kyiv the Institute for Endocrinology and Metabolism in 1965, which has successfully combined experimental and clinical studies ever since. A joint Session of the General Meeting of NAS and the Ukrainian Agrarian Academy was held in November, 2007 to commemorate the 80-th anniversary of the academician of NAS and UAA I. I. Lukinov, who made a significant contribution to the development of fundamental economics research in Ukraine.

In the reporting year, NAS Presidium gave much attention to scientific backup to solving major national-scale problems. In particular, Academy scholars, jointly with specialists of the State Statistics Committee, improved the Strategy of demographic development of Ukraine for 2006-2015, worked out the Strategy of regional development up to 2015 and proposals towards the draft Budget strategy for 2008-2010. A draft Concept of the integrated state program for energy efficiency and energy saving and a Concept of the state ethno-national policy were prepared.

In 2007 Academy Presidium put an emphasis on the development of fundamental research in natural, technical sciences and socio-humanitarian studies, on addressing cutting-edge scientific and R&D subjects. In particular, its meetings heard presentations on the principal achievements of Academy scientists in the liquid, solid and plasma mechanics; on the concept of novel multipurpose research nuclear reactor; on the draft concept of the state R&D program 'Development and introduction of energy-efficient LED light sources and illumination systems on their basis to the national economy of Ukraine'; on ways and results of genetic improvement of plants. Scholars working in socio-humanitarian spheres made presentations on the challenges to Ukrainian economy and society in the XXI century; on relevant issues of international and national space law; on new methods of studies and present-day interpretations of the history and culture of Halych-Volyn Princedom. Research results obtained by Academy institutions were discussed, decisions were taken concerning the practical use of those results and respective proposals were sent to the Government of Ukraine.

At the end of 2007, NAS sections held academic sessions, and the results of their work had a positive effect on the organization of research in respective areas and on addressing important interdisciplinary issues. Given this and the interest of the academic community to the subjects presented, NAS Presidium approved the decision that academic sessions of NAS sections should be held annually and academics of universities, representatives of state specialized academies and respective ministries be invited to take part in them.

In order to combine fundamental research and applied studies in the interests of state power bodies, the Academy broadened its co-operation with the ministries and agencies of Ukraine. In January 2007, a joint visiting meeting of NAS Presidium and the board of the Ministry of Construction, Architecture, and Housing and Communal Services was held. It dis-

cussed a deeper collaboration of NAS with utility businesses for providing people with high-quality drinking water, modernizing communal heat-and-power systems, developing novel materials for construction, anti-seismic protection of structures and energy saving. NAS Presidium, in conjunction with the National Space Agency of Ukraine, discussed the implementation of joint R&D programs, and together with the board members of the State Statistics Committee and heads of several ministries and agencies, we discussed peculiarities of demographic development of the nation out to 2050. Due regard for those trends is of utmost importance for the future growth of its labour, economic, innovative and cultural potential.

In the period under review, we also zeroed in on organizing and checking the execution state of integrated research programs and providing expert assessment of technology parks activities. In particular, taking into account the results of the implementation of Academy's research programs, the prospects of further scientific search were determined; in accordance with those, 11 new programs were formed and new stages of investigations were started within 7 of them. Also approved were priority lines in the activities of technology park 'Mechanical-engineering technologies' (in Dnipropetrovsk) and areas of research at the technology park at E.O.Paton Electric Welding Institute.

NAS Presidium kept an eye on issues of efficient nature management, the functioning of Academy's reserves included, on developing scientific principles of optimal nature management in the Kerch Straight, solving environmental problems related, among other factors, to global environment changes etc.

A significant place in the NAS Presidium work was taken by the analysis of research and research-management activities of Academy institutions. 10 NAS institutes reported on those matters in 2007.

In the reporting year, NAS Presidium gave much attention to publishing activities, aiming them towards high-relevance research issues and meeting society needs. A decision was taken to academically prepare and publish collected works by I.Franko in 100 volumes; a NAS book series «The Presidents of the Academy of Sciences of Ukraine» was started. The work on publishing the 35-volume collected writings by P.Kulish began, as well as that on a new academic «History of the Ukrainian Literature» and «Ukrainian Universal Encyclopedia». Targets were approved for NAS publishing facilities for issuing state-ordered printed matter of 'Academic editions' orientation in 2007.

A special emphasis was placed on supporting and promoting research done by young scholars, improving their working and living conditions. NAS Presidium meetings heard academic presentations of young researchers, approved decisions on targeted financial support to their studies, organization of various competitions for the best works of young researchers and students, etc. On the Academy's initiative, supported by the Ministry of Education and Science of Ukraine and specialized academies of sciences, in order to popularize research activities and involve talented young people to them, the all-Ukrainian Science Festival was held in May 2007 for the first time and with great success. Thousands of young scholars and students participated. A major role in attracting young people to science was played by academic readings 'Nanosystems, nanomaterials, nanotechnologies', where leading Ukrainian and foreign scientists delivered public lectures for over 500 young scientists of more than 40 research institutions and universities of Ukraine.

The promotion of international R&D collaboration and further integration of NAS institutions' researchers to the world academic community were among top priorities in Presidium activities in 2007. Academy supported traditionally close relations with its partners in the Russian Federation, took part in organizing events under the aegis of UNESCO, OBSEC, NATO etc. Its work in the previous year contributed to the rising prestige of the International Association of the Academies of Sciences (IAAS). In particular, IAAS was granted the status of observer by the Council of the Inter-Parliament Assembly of CIS Member-States. The Council of CIS Heads of States adopted a resolution to hold a conference of the heads of state-owned R&D organizations on stimulating collaboration in fundamental and applied research. IAAS representatives are to attend it. A resonating event was the presentation by M.V.Kovalchuk, RAS corresponding member and its Vice-President, 'Nanotechnological basis of novel science-intensive economy. New opportunities for CIS in the XXI century', made at a meeting of IAAS Council. The Academy continued its fruitful collaboration with the European Organization for Nuclear Research (CERN), European Scientific Association for Geophysical Research, Ukrainian R&D Center and with academic, research and educational organizations of European countries, USA, China, Vietnam, Republic of Korea etc. This collaboration was based on 99 independent documents signed with partners from 45 countries.

The range of foreign ties of the Academy became broader in the reporting year. Namely, co-operation agreements were signed with Joint Institute for Nuclear Research on establishing the Inter-State Center for Nanotechnologies of CIS countries and with the Hungarian Academy of Sciences on a joint academic council in social studies. Besides, about 150 Academy institutions had effective international contacts under 762 direct agreements with research organizations of nearly 50 countries, they implemented long-term agreements, including joint research-collaboration programs, with a number of foreign academies, science foundations, national and international agencies. Academy scholars were involved in research financed by 625 international grants, 302 of them being won in 2007.

In 2008, scholars of the National academy of Sciences of Ukraine face tasks on actualization of major R&D areas, whose list has been approved at an enlarged meeting of NAS Presidium Bureau, held on January 31, 2008 and attended by members of the Cabinet of Ministers. The main priority in the Academy's activities is to be a closer co-operation with ministries, agencies and other central executive bodies, broader participation of NAS representatives in the activities of the boards and R&D councils of these bodies. NAS sections and departments are to boost their efforts on organizing scientific and R&D expert assessment of draft legal framework and on identifying and rationalizing priorities of innovative development.

Research of NAS Scientists as the Basis for Renovation and Creation of Science-Intensive Industry

A. G. Naumovets, Vice-President of the Academy

Today, among major challenges facing Ukraine, there is a necessity to increase the share of science-intensive production in all industries, which is a necessary prerequisite for improving the competitiveness of Ukrainian produce. It is for this very reason that the National Academy of Sciences of Ukraine focuses its efforts and concentrates financial resources not only in fundamental research, but on developing and commercializing novel technologies as well. It allows the scientists of our institutions, in cooperation with experts from various industries, to achieve significant progress in organizing and arranging the manufacture of new kinds of products.

E.g., the Institute of Engineering Thermophysics, on the basis of fundamental research into thermophysical and biotechnological processes occurring during pulse action, developed a new technology and respective equipment to obtain hypoallergenic product with hydrolyzed protein for feeding and curing babies and infants. The produce was clinically tested, and its production was launched at the Khorol factory of preserved milk baby food.

Spectroscopy studies of aqueous solutions, carried out at the Institute of Physics, formed a basis for developing 'Aqua Test' portable water-quality analyzer used to check water for the presence of harmful impurities.

Coal Energy Technology Institute, operating under NASU and the Ministry of Fuel and Energy of Ukraine, developed a technology of burning high-ash coal in a low-temperature fluid-bed with recirculated furnace gas as a result of comprehensive research into kinetics of interaction between power-generating coal or coke and air oxygen, making technological experiments and developing new mathematical models and techniques for engineering calculations. To implement this technology, the engineering design and execution plan of the boiler unit were elaborated. Such a boiler unit is planned to be built in 2008 for a municipal boiler-house in Gornyak urban-type community (Donetsk oblast). Besides, the theoretical and experimental studies done resulted in a technology of high-efficiency, environment-friendly firing of anthracite with high ash content. It was applied in the execution plan of burner with thermo-chemical coal conditioning for torch furnace of Darnitska heat-and-power plant. Commercialization of this technology permits a significant (nearly 5-fold) economy of gas used to intensify burning.

Studies of the processes of neutron thermalization and diffusion in geological media, carried out at the S. I. Subbotin Institute of Geophysics, resulted in novel high-efficiency prototype equipment for neutron-neutron logging. It has already been tested in oil and gas wells.

The results of studies of electro-physical processes in insulators, done by scientists of the NAS Institute of Electrodynamics, were commercialized at 'Pivdenkabel' factory in Kharkiv. Here, a large-scale manufacturing of competitive cables designed for 110-kV voltage was organized. Researchers involved in this project were awarded the 2007 State Prize of Ukraine.

A contact digital thermograph for diagnostics of mammary gland diseases was developed at O. O. Galkin Institute for Physics and Engineering in Donetsk. No X-ray irradiation is used in this method. A manual guide for physicians on its application was published in cooperation with Donetsk National Medical University.

Due to studying the interaction between infra-red radiation and living tissues, new medical facilities – a therapeutic booth with infra-red heaters – was developed at I. M. Frantsevich Institute of Problems of Materials Science. The new equipment provides radiation in the wavelength range of 4-20 microns, which ensures its unique physiotherapeutic effects.

Furthermore, NAS institutions proposed quite a number of other products for public health service. E.g., a computer-assisted audiovisual device for automated diagnostics of human respiratory organs was developed at the Institute of Hydromechanics; an instrument for welding living tissues was produced at E. O. Paton Electric Welding Institute, a magnetocardiograph – at the V. M. Glushkov Institute of Cybernetics, 'Fazagraf' device for cardiovascular screening – at International Research and Training Centre for Information Technologies and Systems, a two-detector single-photon emission computer tomographic scanner was developed at the Institute of Scintillation Materials, a mobile (mounted in a car) X-ray diagnostic installation – at V.E.Lashkarev Institute of Semiconductor Physics, and microprismoidal Fresnel lenses for treatment of infantile strabismus – at the Institute for Information Recording Problems.

All the abovementioned products, as well as many others which our institutes continue to work at, are the result of fundamental research carried out at the National Academy of Sciences of Ukraine by highly skilled scientists, who possess cutting-edge knowledge and can apply it to meet practical needs. While persistently working in purely fundamental advanced research areas, the Academy guides its scholars towards searching for ways to use their scientific results in practice. A priority support is to be given to purposeful fundamental research, which can become a basis for dealing with major challenges in the economy and society. Numerous NAS institutes are involved in such work. In the Section of Physical, Technical and Mathematical Sciences, it covers a wide range of subjects in natural science. We must ensure conditions – as favorable as possible – for its successful fulfillment and transformation into major innovative projects.

Unique Biological Collections as a Basis for Biodiversity Conservation and Preservation of Genetic Resources

V. D. Pokhodenko, Vice-President of the Academy

Several generations of biologists of the NAS of Ukraine were committed to gathering and preserving biological collections that are of exceptional value for Ukrainian and world science. Almost every biological institution in the world needs to create banks of biological entities, collections of living organisms and exhibits which serve as a basis for scientific research. Due to this such collections were usually started in the very first years of the existence of relevant biological institutions.

E.g., the Herbarium of the All-Ukrainian Academy of Sciences was formed in 1921. The National Herbarium of Ukraine at the M.G. Kholodny Institute of Botany is well-known and internationally recognized; it houses about 2 million specimens and is in the top 30 largest herbaria among 2.500 herbaria of the world, officially registered in the international *Index Herbariorum*. Herbarium collections enclose data on taxonomic composition, history of development, transformation, geographical distribution of plants in various floras, their ecological and coenotic peculiarities. They are scientific bases for phytobiological research, development of scientific principles of and approaches to rational use and conservation of plant resources, preservation and monitoring of the environment.

The Collection of hydrobionts of the World Ocean at the O. O. Kovalevsky Institute of Biology of Southern Seas is among the oldest biological collections of Ukraine; it numbers over 50,000 specimens and samples of algae, microphytobenthos, benthic animals, zooplankton, fishes and cephalopods, parasites of sea birds, fishes and invertebrates. The collection includes rare and very valuable specimens sampled back at the end of the XIX century and in the XX century during numerous expeditions in different regions of the World Ocean, the Black Sea and the Sea of Azov. Of special value are samples from floristic provinces of the Pacific and Indian oceans, islands of Madagascar, Mauritius and Ceylon, from South China, the Aegean and Mediterranean Seas. Some parts of the collection (zooplankton, benthos, and parasites) are unique and have no analogs in the world. The use of this collection provides possibilities for studies in biogeography, floral and faunal biodiversity of the World Ocean, transformation of species, modes and pathways of their distribution in varied and changing environmental conditions, and for description of new taxa. It is also used for species identification, for teaching students, postgraduate students and experts in mariculture and fish industry, advanced training of specialists in the field of ocean biology, for exchanging collections with leading sea museums, for preparing atlases, reference books and teaching aids for educational institutions.

Other biological collections, such as scientific funds and expositions of NAS natural history museums, zoological collections, contain information on biological diversity of some groups of organisms of Eurasia and other regions of the planet. These collections were being accumulated during more than 100 years and they play an important role in studying biodiversity dynamics, classifying biological objects, preserving rare and endangered species, in environmental education etc.

Collections of living organisms are of still greater importance for science. They facilitate fundamental and applied research in various fields of science, are used as standards for species identification, serve and will serve in the future as a basis for studying and preserving genetic pool, preserving biodiversity on the planet. Besides, they are of direct practical value for economic activities in such sectors as health protection, agriculture and food industry.

Banks of cell lines – unique cryopreserved collections of over 20,000 lines of human, animal, fungal, microorganism and viral cells – are included in those collections. They are used to investigate mechanisms underlying functioning and differentiation of living organisms, neurotransmitter secretion and can be applied in medicine, pharmacology, molecular biology, cytogenetics, biotechnology, biophysics etc. The collection of embryonic plasma of the Ukrainian and world flora of the Institute of Cell Biology and Genetic Engineering is one of the largest in the world among such collections. It covers over 5,000 seed samples and about 2000 cell lines of plant cultures in vitro. The collection contains many rare, endangered and endemic plant species, which enables their artificial reproduction and preservation and guarantees against their total extinction.

Collection of microorganisms at the D. K. Zabolotny Institute of Microbiology and Virology, which contains more than 17,000 strains of microscopic fungi, yeast, bacteria, actinomycetes and mycoplasma, is valuable for microbiological studies. Microbe stocks of the collection are inexhaustible resources for biotechnology and include strains which can be useful for medicine, agriculture, food industry, for protecting the environment against pollution.

The collection of valuable samples of winter wheat and maize of the Institute of Plant Physiology and Genetics, numbering more than 3,000 cultivars, populations, unique mutants, recombinant and inbred lines of cereal crops, is important for genetic and breeding research. It can be regarded as an insurance seed fund for years with unfavorable climatic conditions.

The State Register of the National Heritage of Science Objects was established for preserving and maintaining unique objects of considerable significance for science and practice. It includes all abovementioned collections. These objects are a priceless treasure for scientific research, for meeting economic and industrial needs of today's and future generations.

Socio-Humanities: Meeting the Challenges of the XXI Century

V. M. Litvin, Vice-President of the Academy

Now there is an urgent need for an integrated program of the development of the Ukrainian society in the XXI century. Scholars in socio-humanities persistently work on finding answers to cardinal questions: where is Ukraine going, what should be the crucial guidelines of its development, what horizons should the country reach in the next decades and what is to be done for that? Efforts of institutions under NAS Section of Socio-Humanities zero in on the analysis of the latest trends and phenomena in the current political, socio-economic and cultural life, on producing strategic forecasts, conceptual models and algorithms for tackling tasks of upgrading Ukraine's political and legal system, its economic processes, public administration, the spheres of education, science and culture.

These studies are conducted in the framework of both scheduled research and NAS target integrated programs 'Problems and prospects of socio-economic, political and legal progress of Ukraine', 'Development of intellectual and spiritual potential and modernization of science, education, culture and administration', 'Dialogue of cultures and civilizations in the XXI century: issues of Ukraine's integration to the international community', 'Studying mementoes of national historical and cultural heritage and their re-introduction to the spiritual life of the present-day Ukrainian society', alongside with projects carried out by joint Ukrainian-Russian intellectual teams under the aegis of NAS of Ukraine and the Russian Academic Humanitarian Foundation. In 2007, under government's assignments, institutions of the Section worked on major integral projects: 'Political system for Ukraine: historical experience and today's challenges', 'Contradictions of the administrative-territorial system and principles of administrative-territorial reform in Ukraine', 'Social risks of the Ukrainian society and their minimization', 'Ukraine in today's world: strategies of foreign-policy and economic choice' and 'Language processes in Ukraine and ways of finding conflict-free solutions to language problems'. On the basis of the results obtained, a number of proposals and recommendations for state authorities were prepared.

Under the supervision of NAS academician V. M. Heyets, an estimate of Ukraine's economic potential up to 2015 was made for its principal components, using advanced economic and mathematical tools in the shape of integrated models of economic forecasting. Methodological approaches to comprehensive estimation of competitive environment in industrial markets were developed (by NAS academicians N. G. Chumachenko and O. I. Amosha, L. A. Zbarazhska). NAS Institute of Demography and Social Studies, under direction of NAS corresponding member E. M. Libanova, made a forecast of demographic processes in Ukraine out to mid-XXI century, which is to become the core of improved social, labour, family and migration policy of the state. Conceptual principles of determining innovative areas of human progress and forming social innovations as a factor of the development of human capital were elaborated. The NAS Council for Ukraine Productive Forces Studying, under the direction of NAS corresponding member B. M. Danylyshyn, substantiated the priorities of ensuring competitiveness of human resources in the context of R&D and innovative progress of Ukraine.

A strategy of the state ethno-national policy was developed, an analysis of legal backup to ensuring energy security was made and recommendations towards its improvement prepared. On the basis of the results of Ukraine's participation in 'The European sociological research', carried out under EU aegis, NAS Institute of Sociology, under the supervision of NAS academician V. M. Vorona and Ye. I. Golovakha, published the monograph «Ukrainian Society in the European Space». A fundamental work «Ukraine: Political History. XX – Early XXI Century» was published (by NAS academicians V.M.Lytvyn and V. A. Smoliy, NAS corresponding members Yu. A. Levenets and M. I. Mykhalchenko), and the three-volume «History of Lviv», edited by NAS academician Ya. D. Isaievych. Under the direction of NAS academician O. S. Onyschenko, active research and practical work was done to form and use Ukrainian science-information resources.

Socially significant results were obtained in providing scholarly backup to the national and cultural revival of Ukraine, studying various stages in the development of the Ukrainian spiritual culture in the past and its status at the beginning of the XXI century (NAS academicians I. M. Dziuba, H. A. Skrypnyk and M. H. Zhulynsky), in research into establishing the Ukrainian language as the official language of the nation (NAS academician V.H.Skliarenko), and also in the field of computer linguistics, producing a new generation of Ukrainian conventional and electronic dictionaries (NAS corresponding member V. A. Shyrokov).

In the years to come, efforts of scholars of NAS Section of Socio-Humanities will be focused on achieving an even more significant theoretical and practical feedback of their research; on furthering broad and regular co-operation with high bodies of state power, ministries and agencies, specialized academies, academics of higher educational institutions in order to prepare conceptual, strategic and program documents; on developing scientific models, forecasts, proposals and recommendations to deal with new challenges of political, socio-economic and cultural progress of Ukraine.

Mathematics

A. M. Samoilenko, Academician-Secretary of the Department

In 2007, scientists of the institutions under NAS Department of Mathematics carried out important fundamental investigations and obtained a number of whole new results in major fields of mathematical science.

In the theory of functions and functional analysis, a theorem on the mean values of smooth functions in the neighborhoods of their regular and critical points of the type of the Lagrange finite-increments theorem was proved. A broad generalization of the extended Ito integral was proposed and studied in detail. The Phragmen–Lindelof principle was established for solutions of elliptic differential equations in Banach space. New contour-solid theorems and the generalized Dzyadyk theorem for complex functions were proved. The convergence of Fourier–Gegenbauer series was investigated.

In the field of differential equations, completed was the construction of foundations of a qualitative theory of first-order difference equations with continuous time that simulate the development of a space-time chaos. Investigated was the well-posedness of local and nonlocal problems for certain multidimensional quasilinear hyperbolic systems and nonlocal boundary-value problems for linear equations unsolved with respect to the leading time derivative. Proposed was a new method for the construction of periodic solutions of a fairly broad class of differential equations in the so-called critical case.

In mathematical physics, the solvability of the problem of vibration of an elastic medium with cavities filled with viscous inelastic liquid was proved, and the averaged model of this medium in the case of dispersed distribution of small cavities was constructed. The inverse problem of the theory of oscillations of large systems of interacting particles was solved, which enables one to find the parameters of interaction of all particles of a system from an observation of a small part of this system. A model of a quantum unordered system described by the Mott–Hubbard Hamiltonian with random interaction constant was proposed and its phase diagram investigated.

In geometry and topology, the exact value of the minimum number of closed orbits was found for vector fields of Morse–Smale type without fixed points. New comparison theorems for the volumes of balls and spheres in Finsler spaces were obtained.

In probability theory and mathematical statistics, an algorithm for the Poisson approximation of processes with locally independent increments in a Markov medium was constructed. Limit theorems were established for solutions of inverse stochastic equations in the case of irregular dependence of coefficients on a parameter.

In algebra, the structure of categories of representations of tame algebras was described. The functional bases of invariants for broad classes of Lie algebras were constructed. It was proved that irreducible Hilbert representations of algebras generated by linearly connected generatrices with fixed spectra that correspond to Dynkin graphs are finite-dimensional.

In the field of mathematical problems of mechanics, within the multimodal approach in problems of nonlinear dynamics of a solid body with viscous liquid, a numerical-analytic method for the determination of kinematic and dynamic characteristics of a liquid in a moving vessel was developed. A Lagrange model of an open bilinear control system for the transformation of heat energy into the energy of coherent control fields was proposed and studied. For dynamical systems that satisfy Barbashin–Krasovskii theorem, Lyapunov function was constructed. The thermoelastic state of semi-infinite bodies with thin heat-emitting inclusions was investigated. A method was developed for identifying the power of heat sources in a two-layer cylinder, that are located at the contact surface, on the basis of their surface displacements.

In mathematical modeling and computational and applied mathematics, a new algorithm for solving eigenvalue problems for a nonlinear Schrodinger operator was developed. The linear phase of stability of two-component reaction–diffusion systems with fractional time derivatives was investigated.

Within the framework of the target research program 'Advanced methods for investigating mathematical models in problems of natural sciences and social studies', a method was developed to investigate thermal and mechanical processes caused by electromagnetic infrared radiation in deformable partially transparent bodies with regard for the spectral dependences of radiation characteristics.

Information Science

I. V. Sergiyenko, Academician-Secretary of the Department

In 2007, scientists of Information Science Department obtained a number of new important results. In particular, polynomial boundary images of pseudoinverse matrices with positively marked and degenerated weights were derived and examined.

The problem of optimizing transport routes with time windows was investigated. It involves servicing a great number of clients, taking into account time limits for some transport means with imposed constraints on their capacity.

Theoretical fundamentals were developed and SKIT supercomputer system produced, with the speed of about 6 000 000 000 000 op/sec. The architecture of data storage system of the supercomputer was modified due to the installation of hardware/software-based SKIT cluster virtualization set, primarily for GRID-system.

Proceeding from the theory of optimal control of states of multicomponent distributed systems, a technology was developed for obtaining explicit expressions of gradients of functionals-discrepancies, with a view to solving the system analysis problem by means of the NADRA-3D supercomputer information technology concerned with hydro-geological multicomponent ground media states.

Cryptographic algorithms and methods for distribution and authentication of open keys of cryptographic transforms were developed and software-implemented, relying on open-key certificates and attributes certificates.

Conceptual fundamentals of personalization theory were worked out on the basis of timer algorithms of complex engineering systems, which permitted testing of hardware/software systems intended for protection from unauthorized access to textual, graphical and voice information. Mathematical and methodological bases were developed for technology of multifunctional signal and image processing and coding.

Architecture was developed for associative-projective networks with the storage/renewal functions, alongside with methods for distributed representation of information in the neural-networked memory on the basis of generation of a multidimensional distributed binary vector. The neural-networked associative memory was computer-simulated and information characteristics were obtained that are necessary for forming neural network structures in solving complicated classes of applied problems.

Conceptual fundamentals for synthesizing applied software systems in the semantic Internet-medium were developed.

A method to synthesize systems for robust stabilization of nonlinear objects of control was worked out.

New methods to forecast geomagnetic activity and determine geoeffective characteristics of solar winds were developed. Computer-aided networked services were implemented for forecasting space weather on-line.

New intelligent information technologies were elaborated in the following problem domains: activation of intelligent human-computer interaction and acquisition of new knowledge in situation centers, development and renewal of their information basis, support for decision-making concerning onset and progress of emergencies. Developed were new algorithms to adopt monitoring data in prognostication mathematical models and novel systems to support decision-making in preserving and upgrading the environment, which were used for re-engineering the RODOS European decision-support system.

System approach to qualitative and quantitative estimation of sustainable ecological, social and economic development of Ukraine was worked out. A system to measure sustainable development was proposed, which allows a quantitative analysis of the process to be made, depending on groups of economical, ecological and social indicators and data sets. Relying on the mathematical model of sustainable development, the impact of information society on it was studied in global and regional dimensions.

Theoretical foundations were elaborated and industrial technology developed to produce optical strabismus compensators with Fresnel microprism structure, intended for diagnostics and treatment of strabismus in children and patients with senile macular dystrophy.

Produced were mathematical models describing interaction between systems of respiration, blood circulation, heat exchange and immunity under conflict and uncertainty that arise in an organism when stability of their functioning is provided. A toolkit was designed and used to select and measure dimensions of capillaries in static regime, to stabilize images and measure dynamic capillary parameters in dynamic regime. Elaborated were algorithms and programs for automatic selection of a measurement channel with maximum signal amplitude, in order to improve results reproducibility in studying magnetic fields of human heart. Full magnetocardiographic examination of groups of patients with ventricular arrhythmia was made.

Mechanics

A. F. Bulat, Academician-Secretary of the Department

In 2007, scientists of the NAS Department of Mechanics obtained a number of significant novel results.

At the NAS S. P. Timoshenko Institute of Mechanics, a solution to the spatial dynamic problem for an elliptic crack under the action of harmonic tension – compression wave – was obtained. The local loss of stability of thin plates with two edge cracks under tension was studied experimentally. Studies of mechanical behaviour of anisotropic heterogeneous shells of various shapes were carried out on the basis of refined and 3D models; results were obtained concerning distribution of displacement fields, stresses and dynamic characteristics, depending on geometrical and mechanical parameters; they could be used to estimate strength and reliability of structural elements. An approach to constructing multi-parametrical models describing nonlinear dynamic deformation of thin "dry" and fluid-filled shells was proposed on the basis of the property of quasi-linear systems to respond selectively to periodic excitations under conditions of nonlinear resonances. Stability conditions were obtained for a set of trajectories in nonlinear dynamics as well as those for large-scale systems with aftereffect; a mathematical model of the motion of a mechanical system under conditions of uncertainty was proposed on the basis of fuzzy differential equations.

At the Institute of Technical Mechanics, operating under NAS and NSA of Ukraine, a complete nonlinear mathematical model of self-contained pneumatic hydraulic suspension for heavy multiwheeler was developed; it allowed a calculation of basic tractor characteristics, determination of its rational design parameters and production of suspension prototype. Field tests of the 'Dozor' tractor, developed by Kharkiv A. A. Morozov Design Bureau, showed that such suspension dramatically reduces the eigenfrequency of sprung-mass vibrations, improves crew vibroprotection, tractor ride quality and steerability. On the basis of mathematical modeling and experimental study of pulsing fluid flows in hydraulic systems with cavitating local resistance, the in-principle possibility of improving the efficiency of the use of liquid flow energy through the application of two sequentially located cavitating local resistances in such systems was proved for the first time ever.

Using equations of elastoplasticity theory for anisotropic bodies, researchers of NAS G. S. Pisarenko Institute for Problems of Strength obtained a numerical solution to a geometrically and physically nonlinear two-dimensional boundary-value problem of the stress-strain state of a multilayer thick-walled spirally orthotropic cylinder under axisymmetric internal-pulse pressure. Specific features of the deformation of single- and double-layer shells were revealed. A methodology and software to calculate the limit load of pipes with axial and circumferential complex-shaped defects were developed, which made it possible to assess the hazard of defects revealed by the in-line inspection of 'Snihurivka-Odesa', 'Lisichansk Pump Station – Lisichansk Oil Refinery' and 'Brody-Carpaty' oil-trunk pipelines.

At the NAS N. S. Polyakov Institute of Geotechnical Mechanics, structural-and-synergetic models of deformation and fracture of elastic-hereditary systems were developed, and on their basis three fracture criteria were found: the energy criterion of dissipative type, entropy criterion and the criterion of structure damage; algorithms were developed to calculate the system service life with an allowance for time instability of their structural parameters. Proceeding from the results of fundamental research, scientific principles were developed for constructing a wide range of state-of-the-art vibroseismoinsulators that enhance the safety of high-risk facilities.

At the NAS Institute of Hydromechanics, models of mass transport and removal of organic pollution by aerobic filtration were developed, taking into account different kinetic models of oxygen supply and the processes of boil and colmatage. Methods to study the processes of propagation, transformation, diffraction and refraction of surface gravitational waves under conditions of limited depth and intricate bottom topography were developed. A physical-and-mathematical model was constructed for the process of intensive mixing of passive additives due to chaotic advection in two-dimensional flows.

At the NAS Institute of Transport Systems and Technologies, determined were the necessary and sufficient conditions of exponential stability and exact criteria of providing motion stabilization for some classes of mechanical and controllable systems. Exact estimates of the phases and amplitudes of periodic solutions to Lipschitz vector differential equations of the first and second orders with arbitrary delay were obtained for the first time.

In 2008, the efforts of the scientists of the Department will be aimed at furthering scientific and R&D backup to respective branches of the national economy, in particular, to aerospace industry, mechanical engineering, mining, ore-dressing industry, aircraft construction, transport etc.

Physics and Astronomy

V. M. Loktev,
Academician-Secretary of the Department

For the Department of Physics and Astronomy, 2007 was a year of addressing topical problems of both theoretical and applied nature. By maintaining primarily fundamental line of research, institutions of the Department tried to expand their activities in practice-oriented areas. The scope of research conducted in co-operation with foreign partners grew, a number of important international grants were won, and novel information technologies (e.g., GRID) were applied in research.

Institutions of the Department, whose number rose to 19, did research in the following areas: fundamental interactions and microscopic structure of matter, solid state physics, low-temperature physics, optics and laser physics, nanophysics and nanotechnologies, radio physics and electronics, soft matter physics, physics of plasma processes, astrophysics, astronomy and radio astronomy. Results of international significance were obtained in all these fields.

In the area of fundamental interactions, stability diagrams for 3- and 4-particle Coulomb systems were plotted, and fluctuations of hadrons number in nuclear collisions were calculated, which was confirmed experimentally at CERN.

In solid state physics, much consideration was given to studies into the physics and technology of small-sized structures, i.e. thin films, semiconductor and superconductor laminated structures, quantum wells, and superlattices, i.e. of all that now makes up the basis of a major research area – nanophysics. Studies in this area are done at nearly all institutions of the Department under two different programs – that of NAS and a joint program of NAS and the Russian Academy of Sciences. Of great importance is the fact is that most of these investigations are of targeted nature and often result in the development of laboratory samples of materials or a technology. Worth of noticing are the following results obtained in this area: developing and manufacturing Gunn diodes generating SHF oscillations in a wide frequency range; producing laboratory samples of graded functional materials; determining conditions for coexistence of quasi-particle condensates in graphene; evaluating the effect of Van Hove singularities on critical parameters of superconductors.

In low-temperature physics, a vitreous phase was discovered in solid ^{4}He at T < 200 mK, and conditions of its existence were determined; non-linear phenomena occurring in Josephson q-bits, which are promising components of quantum computers, were studied; and effects indicative of collective phenomena in xenon clusters were observed for the first time ever.

Research in the area of optics and laser physics resulted in a method for applying light pressure to atoms, which cannot be achieved in any other way; determined were parameters of coherent thermal radiation of lamellar semiconductors; found was optical non-linearity of nanostructured SiC that is 100 times as high as that of semiconductor materials; achieved was control of wetting layer thickness in discontinuous nanofilms; found were criteria by which nanoparticles of magnetite can serve as information media; and self-trapped electronic states were calculated in carbon nanotubes.

Achievements in radio physics cover the development and application of a digital receiver with unique characteristics, the development of a radar system to monitor traffic in airports, a new classification of ionospheric disturbances etc.

Research into soft matter physics resulted in the development of helium compositions with photochromic components, the production of a controlled LC mirror, and calculation of electrostatic potentials in homogeneous ion-molecular systems.

In the area of physics of plasma processes, interaction potentials between macroparticles in plasma were calculated; spatial structure of plasma plume and the effect of excitation on laser plasma parameters were studied; and data on sections of ions formation from electrically active molecules were obtained.

Research results in astrophysics include a discovery of 5 galaxies with super-bright hydrogen lines, a detection of solar flares in the decameter range, development of software for high-precision determination of coordinates and location of about 20 sources of maser-like methanol radiation from the regions of star formation.

In order to promote R&D of advanced functional materials with predicted characteristics to be used in electronics, NAS Presidium Resolution No. 63 of March 2, 2007 reorganized the 'Reaktivelektron' R&D Center that had operated under Donetsk O.O. Galkin Institute of Physics and Engineering into the 'Reaktivelektron' State R&D Center of NAS of Ukraine, with granting it the right of a legal entity financed from the state budget.

Research done by scientists of the Department was duly appreciated. Three State Prizes of Ukraine in Science and Technology were awarded to associates of the NAS Institute of Physics, researchers of NAS V. Ye. Lashkaryov Institute of Superconductor Physics and of the Institute of Magnetism, which operates under NAS and MES.

The Prize of the President of Ukraine for young scholars was awarded to researchers of M. M. Bogolyubov Institute for Theoretical Physics and B. I. Verkin Institute for Low Temperature Physics and Engineering.

Next year, research and research-management activities of the institutions of the Department will be focused on developing new and preserving traditional fields of fundamental research, alongside with increasing the number of targeted-research areas.

Earth Sciences

V. M. Shestopalov, Academician-Secretary of the Department

In 2007, researchers of the NAS Department of Earth Sciences obtained a number of significant fundamental and applied results. Some of those won awards and prizes.

A comprehensive generalization of the evidence from stratigraphic study of Meso-Cenozoic sediments within the northwestern shelf of the Black Sea was made for the first time ever. This became a basis for geological prospecting of hydrocarbons.

Software backup was developed for automatic positioning of geologic boundary with given physical properties (density, etc.), on condition that it lies between known surfaces.

A map of fluorite presence within the Ukrainian Shield and its slopes was constructed. A database of ore-fluorite formations within the Ukrainian Shield was developed and promising sites for fluorite exploration selected.

Geodynamics of the Silurian reef formation in Volyn-Podillia region was reconstructed. Genetic relation between reef structures and tectonic breaks was determined.

A prototype of explosion-proof 24-channel seismic station for mines was developed to forecast mining and geological conditions in exhausted coal beds.

A deep-water facility was produced to measure the concentration of hydrogen sulphide dissolved in water. It permits high-sensitivity determination of the spatial distribution of dissolved hydrogen sulphide down to the depth of 2000 meters. The facility was tested in laboratory and in the environment.

For the first time in the world practice, a classification of bottom anthropogenic landscapes was made on the basis of experimental observations. The landscapes were ranged in accordance with the strength of their effect on the environment.

In the framework of the national plan of measures towards implementing the Kyoto's Protocol to the UN Frame Convention on Climate Change, the analysis of information was made concerning the national policy and measures on mitigation of climate change impacts, alongside with forecasts of anthropogenic emissions of greenhouse gases.

Regional and local criteria of oil-and-gas and diamond presence in the earth's crust within the territory of Ukraine were developed.

The work on the «National Atlas of Ukraine» under Government assignment was completed. 5000 copies of the 440-page Atlas were printed. Structurally, the Atlas consists of 6 thematic map blocks: 'General characteristics', 'History', 'Natural conditions and natural resources', 'Population and human progress', 'Economy', 'Ecological status of natural environment'. In total, the Atlas includes 875 original maps showing the essence of objects and phenomena, the maps being based on advanced scientific developments and information materials.

The first science conference 'Earth and Space Sciences – to Serve Human Society' was held with a view to involving NAS institutions and scientists in the international research programs of 2007-2009, which were officially recognized by the world community and given significant information, research and financial support from renowned international and national organizations. On June 25-26, 2007 the forum was hosted by the National Aviation University (1 Komarov Ave., Kyiv). It was held in the framework of research-management activities of the Ukrainian side, focused on declaring and conducting the International Heliophysical Year, International Year of the Earth Planet and celebrating the 50-th anniversary of launching the first space satellite.

A wide access to the cartographic database developed by the NAS S. I. Subbotin's Institute of Geophysics was provided for users through the Ukrainian Department of the World Data Center. The cartographic database covers spatio-temporal separation of geophysical fields (gravitational, thermal, magnetic, seismic, macroseismic, etc.) and information on internal structure of the earth's crust. This has become available due to scientific collaboration between NAS and the Institute of Applied Systems Analysis within KPI National Technical University of Ukraine, operating under NAS and the Ministry of Science and Education of Ukraine.

In the coming years, the efforts of scientists will go to developing fundamental and applied research in priority areas of geological science. The Department will give special attention to the coordination of studies, which would to the maximum degree address new challenges of today's world and ensure the most efficient use of state-budget finance and material resources of its institutions. Besides, in the future we plan to expand research concerned with environment issues, with the development of technological automated systems for processing and interpreting geophysical data and various banks of science data.

Physical-and-Technical Problems of Materials Science

I. K. Pokhodnya, Academician-Secretary of the Department

In 2007, scientists of the NAS Department of Physical-and-Technical Problems of Materials Science carried out a number of top-priority fundamental and applied studies, whose results became the basis for the development of new materials and methods of their treatment and joining.

Peculiarities of heating pipe edges with an arc moving in magnetic field at a super-high speed (300-400m/s) were investigated. It was found that an increase in arc movement speed permits pipes of high thickness and diameter to be welded; in particular, shown was the feasibility of producing high-quality joints of pipes of up to 300mm in diameter and with wall thickness of up to 12mm; this is much better than the current technology of magnetically-impelled arc butt welding.

To produce an adequate computer modeling of hydrogen distribution in the welded joint, a relevant non-linear mathematical model was formulated and studied; it takes into account the processes in surface and near-surface zones of the weld metal during hydrogen diffusion. A procedure for experimental-and-evaluative assessment of this model's parameters was developed. On the basis of an analytic solution to the problem of degassing a finite-sized cylinder with boundary condition, programs to determine the coefficient of hydrogen diffusion from experimental data were developed; they provide for the possibility of a change in the diffusion coefficient with time. Analyzed was the effect of the energy of interaction of metal-dissolved hydrogen with a return-tube trap and the density of hydrogen traps on the rate of hydrogen diffusion from the cylindrical sample.

The mechanism of destructive hydrogenation of intermetallic Ti compounds TiNi and Ti_3Al was discovered, where titanium hydride and nickel- or aluminium-enriched phases are formed. Such two-phase systems have nano-sized structural components and are characterized by increased hardness. Conditions were found under which the reverse processes occur, with recombination and return to initial single-phase intermetallics. The results obtained are important in terms of developing a technology of hydrogen-thermal treatment of titanium intermetallics, which can ensure the formation of nanostructured states with a new range of properties.

Investigated was residual contact fatigue life of rail steels when pitting develop under conditions of borderline lubrication, depending on such service parameters as intensity of contact pressure, friction between contacting bodies in the "wheel-rail" system, pressure of liquid (oil) trapped by cracks, initial angle of shear cracks orientation.

Methods were elaborated to grow large-sized diamond single crystals with the mass of up to 4 carats during 100-200 hours with programming p, T-parameters. Designs of cells with increased growth volume and the possibility of temperature changes were optimized, including cyclic ones. It was found that internal stresses in large crystals grown in Fe-Ni-C system are caused by a certain amount of paramagnetic nitrogen which is non-uniformly distributed over growth pyramids. It was proved that large-sized diamond crystals grown from melt of Fe-Al-C system are low-stressed and so suitable for application in diamond tools under high external loads.

Methods were proposed and equipment designed, that have no analogs in the world, for vacuum treatment of non-ferrous alloys with plasma jet immersed into the molten metal; determined were basic parameters and technological modes of the processes which allow refining (modifying) alloys in discrete and continuous casting. It was shown that a high (over 80%) degree of alloy degassing during vacuum-plasma treatment is achieved due to intensified diffusion, intermediate and kinetic processes of hydrogen removal from the melt.

For the first time ever, powdered zinc selenide, which possesses luminescent properties, was produced by direct solid-phase microwave synthesis of selenium and zinc.

Using methods of optimum control, a theory was worked out, algorithms and computer methods developed to design optimum discrete-inhomogeneous Bi-Te-based structures and sectional thermocouples of these materials for modules of cooling and electric power generation. The feasibility of increasing the refrigerating factor of these modules 1.2-1.4-fold and reaching the efficiency of 8% was proved.

The 2007 State Prizes of Ukraine in Science and Technology were awarded to two works done with participation of researchers of the NAS Department of Physical-and-Technical Problems of Materials Science. Ten scientists became the laureates.

Physical-and-Technical Problems of Power Engineering

B. S. Stogniy, Academician-Secretary of the Department

In 2007 scientists of the NAS Department of Physical-and-Technical Problems of Power Engineering did top-priority fundamental and applied research towards upgrading Ukrainian Power Engineering.

They continued their work under integrated NAS research programs: 'Energy efficiency', 'Integration', 'Operation life', as well as 'Biofuel' and 'Fundamental problems of hydrogen energy'.

Experts of the Department were involved in preparing and holding a session of the Joint Commission on R&D Security under the Council for National Security and Defense of Ukraine concerning the safety of thermal power plants and prospects of their updating and improvement.

In 2007 scientists of the Department obtained a series of significant fundamental and applied research results.

The theory of electro-physical processes in advanced modified polymeric insulation of high-voltage cables was developed, with an allowance for the effect of structure microheterogeneity on the distribution of electric-field strength.

A new method was developed to determine magnetic moments of engineering facilities, based on integral transformation of magnetic flux signatures in angular motion of an object. It was implemented in a loop measuring device minimizing errors in the determination of small (0.1-0.001 $A \cdot м^2$) magnetic moments of engineering facilities.

Theoretical principles were elaborated to synthesize major power systems with deep feed-back coupling. Studied were interconnected elements of power-generation and heat-supply systems with shared facilities, which are simultaneously controllable loads for the power system and sources of thermal energy.

A mathematical model and a numeral method was developed to calculate spatial frictional flows in turbo-machine stages, taking into account elastic vibrations of blade vehicles by solving the bound problem of transient aerodynamics and elastic vibrations of blades.

Numerical algorithms were obtained to implement methods of modeling heterogeneous dynamic systems with singular properties.

A theory, methods and algorithms were developed for restoring service in de-energized grids after blackouts, allowing for current technological limitations.

A prototyping system was produced for the back-up of decision-making by operating personnel, which successfully stood trials at Darnitska Power Station.

An update version of subcritical incident at Chornobyl NPP in June 1990 was analyzed. It was shown that the development and self-extinguishing of neutron anomaly resulted from water leakage to cavities in the sub-reactor space, formed after the meltdown.

Jointly with the Institute of Pediatrics, Obstetrics and Gynecology, operating under the Academy of Medical Sciences of Ukraine, a breakthrough energy- and resource-saving technology and respective equipment was developed, relying on effects of discrete-pulse power input to yield hypo-allergenic product with hydrolyzed albumen for dietetic therapy of infants and children of early age.

Developed and tested were 1 and 3 MW dual-fuel gas-ring devices intended for incineration of both natural gas and its mixtures with producer gas obtained by processing biomass.

To reduce natural-gas consumption and provide smooth anthracite burning in boilers of TPP-210A type, heat-loss tests of hard fuel incineration were conducted at 200 MW power units of Zmiyivska thermal power plant and ways to improve power unit efficiency were determined.

Scientific fundamentals were worked out to determine optimum combinatorial laws of controlling rotation frequency and rotation angle of hydro-turbine blade of hydro-turbine (distributor), with a view to providing the best energy efficiency of the transformation of water-power potential with variable water flow through a turbine. That allows turbine efficiency in non-nominal conditions to be boosted by 15% as compared with standard modes.

Proposed were approximation-operating methods for mathematical modeling of dynamic systems described by differential equations of fraction order, in particular, by two-dimensional partial differential equations of diffusive-wave type that are very common in mathematical physics.

A number of works of Department's scientists were duly appreciated.

NAS Acad. B. I. Bondarenko, A. A. Shurchal, A. F. Zharkin, O. D. Podoltsev and I. M. Kutcheryavaya, as members of research teams, were awarded the 2007 State Prizes of Ukraine in Science and Technology.

NAS Corr. Memb. Yu. F. Snezhkin, M. I. Nikitenko and N. M. Sorokova won NAS V. I. Tolubinsky Prize.

NAS Corr. Memb. Yu.I. Yakimenko was awarded the Order 'For Services' II Class, Ye. K. Garger and B. S. Prister received the Orders 'For Services' III Class.

NAS Acad. A. A. Dolinsky was awarded with the Honour Diploma of Verkhovna Rada of Ukraine. B. M. Protsishin and L. Yo. Vorobyov were awarded with Diplomas of Verkhovna Rada of Ukraine.

B.S. Soroka won NAS of Belarus O.V.Lykov Prize.

Nuclear Physics and Power Engineering

I. M. Nekludov, Academician-Secretary of the Department

The NAS Department of Nuclear Physics and Power Engineering incorporates six science institutions and three pilot-production facilities. The total number of their employees is almost 4000, including nearly 1500 scientists. Among them, there are 9 NAS academicians and 19 NAS corresponding members, 157 doctors of science and 557 candidates of science.

In the reporting period, the scientists of the Department obtained a number of significant results in fundamental and applied research.

A diffusion theory of high-amplitude nuclear collective motion was developed. It was found for the first time that memory effects in diffusion equations generate an additional conservative force which dramatically decelerates the descent of nucleus from the fission barrier and reduces the kinetic energy of fission fragments.

A theory was constructed for the formation of condensed-phase structures of excitons in semiconductor quantum wells in the presence of inhomogeneous fields under intensive laser irradiation.

Plasma density, plasma potential and their radial distributions were investigated as functions of magnetic field strength, current and energy of injected electrons in Jupiter-2M multi-slot electromagnetic trap.

A non-local quantum-electrodynamic approach was developed to investigate the relativistic structure of atomic nuclei in electromagnetic processes, with due regard to strict adherence to the requirements of the gauge-field quantum theory.

The effect of significant radiation-swelling growth was discovered in the Kh18N10T austenitic stainless steel (the basic material of in-vessel components of the reactors at Ukrainian NPPs) under simultaneous effect of damages by inert gas and hydrogen atoms.

It was demonstrated for the first time that a variation in oxygen concentration changes the behavior of dislocation ensemble in irradiated zirconium alloys. This largely determines the radiation resistance of the alloys and allows a new approach to be used in designing new-generation radiation-resistant zirconium alloys.

A range of works was performed to introduce novel nondestructive methods for diagnostic analysis of the equipment and pipe-line metal at Pivdennoukrainska NPP energy units. A 'Service Defects Atlas' was introduced into the work process for checking steam-generator heat-exchanging tubes.

Promising designs of absorber elements were developed for nuclear reactors, including absorber elements with combined absorbent materials. Liquid-scintillator-based electron detectors with a high relative energy resolution (7%) in the energy range of 1 MeV were designed for the 'SUPERNEMO' international project concerned with the search for neutrinoless double beta-decays of ^{82}Se and ^{150}Nd.

A physical startup was given to the first in the FSU countries nuclear scanning microprobe based on the electrostatic accelerator with the peak voltage of 2 MV. Beam parameters were achieved of the level of world analogs for this class of accelerators.

A compact electron injector for 10 cm-band linear resonant accelerator was developed, manufactured and tested.

A test-bench was produced for both the radiation treatment of materials employed in thermal neutron detectors and investigation into characteristics of semiconductors (Si, CdTe) and gas-discharge detectors under irradiation with electrons, gamma-quanta, "fast" and "slow" neutrons.

A pilot sample of automated multi-functional complex was developed for fast analysis of tritium; it has an increased sensitivity, high reliability and measurement rate of low-activity test samples.

A prototyping model of the early-warning system of pre-emergency status in the NPP technological systems was created; principles of its use in the systems of nuclear and radiation safety of the plants were elaborated.

An adaptive-integrated radiation monitoring system was produced; it is intended for fast detection and identification of nuclear radiation materials and ionizing radiation sources.

The structure of geoinformation system was developed for integrated assessment of radio-ecological situation on the territories subjected to the impact of nuclear-radiation facilities to be decommissioned, with due regard for the IAEA recommendations.

The Concept of the National Target Environmental Program of Radioactive Waste Handling was elaborated and approved.

The State Prize of Ukraine in Science and Technology was awarded to researchers of the National Science Center 'Kharkiv Institute of Physics and Engineering' of NAS, namely, to NAS academician I. M. Neklyudov, NAS academician V. F. Zelensky, V. I. Teryoshin, I. Ye. Garkusha, Ye. O. Kornilov, V. I. Karas, D. G. Solyakov, V. V. Chebotarev as co-authors of a series of works «Physical principles, development, production and use of powerful and superpowerful ion/plasma accelerators».

NAS Academician E. V. Sobotovich was awarded with the Honour Diploma of Verkhovna Rada of Ukraine.

NAS K.D. Sinelnikov Prize was given to F. A. Danevich, V. V. Kobychev and V. I. Tretyak for the cycle of publications «Experimental studies of rare processes in atomic-nucleus and elementary-particle physics».

Chemistry

V. V. Goncharuk, Academician-Secretary of the Department

Scientific research in chemistry is carried out at 11 institutes and 2 their divisions by nearly a thousand of highly skilled scientists. Among them, there are 11 NAS academicians and 24 NAS corresponding members, 167 doctors of sciences and 770 candidates of sciences.

In 2007 scientists of the institutions operating under NAS Chemistry Department and its Bureau zeroed in on fundamental research in advanced areas of chemistry, on the application of the results obtained in the national economy, on improving science management and on training a young generation of scientists.

General Meetings of Chemistry Department discussed the priority trends in chemistry, in particular, they analyzed ways and forecasts of the progress in theoretical, experimental and applied inorganic chemistry, in the field of synthesis and study of nanoparticles and nanomaterials, chemistry of ionic liquid crystals and anisotropic glasses, chemistry of elementary and coordination compounds etc., which resulted in brand new substances and materials with unique properties.

The energy crisis in the whole world, and particularly in Ukraine, stimulated its scientists to search for alternative energy sources and raw-material stock on the basis of renewable raw materials obtained from plants. In particular, advanced research is carried out in such areas as developing technologies for producing biofuel (biodiesel and bioethanol), developing methods for obtaining hydrocarbons – substitutes of mineral oil – from biomass, producing fuel and biofuel elements from biological raw materials.

The most known and widespread substance on the Earth – ordinary water – had kept its secrets for thousand years. Proceeding from studies of physicochemical, spectral, thermodynamic, isotope and other characteristics of water, a new view on the origin of life on Earth was proposed. Fundamental ideas concerning hydrosphere formation and evolution were formulated. They are based on the proven fact of the decisive effect of the concentration ratio of hydrogen isotope content in water on its physical, chemical properties and biological activity. Huge heterophase water clusters resulting from the presence of the heavy isotope – deuterium – were found. The number and sizes of these clusters, as well as their properties, depend on deuterium concentration in water.

A number of major studies in priority areas of modern chemistry, aimed at developing new high technologies, were carried out:

- for the first time in the synthesis of consecutive semi-interpenetrating polymeric networks, the features of formation of linear-structure polymers in the limited intranet space of polyurethane matrix were found;

- the feasibility of forming nano-scale single crystals in a matrix of electroconductive conjugated polymers under conditions of ultrasonic or mechanochemical processing was proved;

- new synthetic approaches were developed and a series of new coordination compounds with a high number of nuclei (4-12 nuclei) with original magnetic properties were produced individually on the basis of hydroxamic and oxym-contained ligands;

- changes in the aggregate state of decanoate and laurate binary liquid crystal systems with cations of d- and f-metals, and of temperature-concentration intervals of the existence of liquid crystals and mesomorphic glasses, were determined.

Doctor of Science (Chemistry) A. K. Trohimchuk was awarded the 2007 State Prize of Ukraine in Science and Technology for a series of studies 'Supramolecular coordination compounds'.

Academician Ye. V. Lebedev and doctor of physics and mathematics Ye. P. Mamunya, from the NAS Institute of High-Molecular Chemistry, won NAS A. I. Kiprianov Prize for a series of scientific works 'Synthesis, structure and properties of organo-inorganic polymer systems'.

N. V. Meshchaninova, a junior researcher of Donetsk National University, was awarded the NAS Prize for young scientists for her work 'Organic extracts as analytical forms in extraction atomic absorption spectroscopy determination of trace metals'.

S. O. But, a student of T. Shevchenko Kyiv National University, got the NAS Prize for university students for the work 'Molecular design of novel sulfur-containing tectons for crystal engineering of functional materials'.

A. D. Dadashev, a student of T. Shevchenko Kyiv National University, and I.O.Ledenev and D. P. Savitsky, collaborators of NAS A. V. Dumansky Institute of Colloid and Water Chemistry, were awarded A. V. Dumansky Prize of the NAS Chemistry Department for young scientists for their study 'Colloid-chemical fundamentals of environment-friendly surface modification'.

V. S. Naumchik, E. M. Ostapchuk and A. S. Plaskon, collaborators of 'Ukrorgsynthes' pilot production facility, won L. M. Markovsky Prize of NAS Chemistry Department for young scientists for the work 'Asymmetrical functionalized carbonyl compounds in regioselective heterocyclic synthesis'.

V. I. Gusarov, a student of National Pharmaceutical University, got L.M.Markovsky Prize of NAS Chemistry Department for university students for his study 'Cholic acid extraction from bile and iridoids of *Symphoricarpos albus* and synthesis of derivatives on their basis'.

Biochemistry, Physiology and Molecular Biology

S. V. Komisarenko, Academician-Secretary of the Department

In 2007, activities of the institutes under the NAS Department of Biochemistry, Physiology and Molecular Biology were concerned with fundamental research in biology, medicine and ecology. Much attention was also given to biotechnologies and R&D. A number of important scientific results of the international level were obtained.

O.V. Palladin Institute of Biochemistry, while investigating the immunochemical structure and functions of proteins of the fibrinogen/fibrin system, found that fibrin-specific monoclonal antibody (mAb) FnI–3C and its Fab-fragment inhibited the stage of fibrin protofibrils lateral association. This gave evidence for localization of the contact zone in Bβ 118-134 fragment, involved in the interprotofibril binding of fibrin molecules. It was found that epitopes for mAb against E-domain coincide with the polymerization site located in Bβ 12-46 fibrin fragment. The immune complex of Fab-fragment of mAb II-4d against fibrin D-domain with D-dimer was obtained for X-ray analysis.

Important investigations were carried out at O.O. Bohomolets Institute of Physiology concerning the effect of β-amyloid on the hippocampus structure, which is the basic component in the senile patches resulting in the development of Alzheimer disease. It was shown that β-amyloid produces significant effect on hippocampus calcium signalization.

Dynamics of *Saccharomyces cerevisiae* UKM Y-517 cell cycle under the effect of man-made non-ionizing electromagnetic radiation of non-thermal intensity was investigated at D. K. Zabolotny Institute of Microbiology and Virology. It was found that biological effects produced by electromagnetic radiation on *S. cerevisiae* population were due to individual characteristics of the emitter.

Researchers in the Institute of Molecular Biology and Genetics discovered the mechanism of chaperon-like effect of translation elongation factor eEFIA, which consists in combining the anti-aggregation effect of this protein with its ability to form protein-protein complexes and to maintain the native conformation of amino acyl-tRNA synthetases – the key enzymes of protein synthesis.

R. Ye. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology discovered that augmented expression of proteins associated with drug resistance was accompanied by hypomethylation of GST and mdr-1genes, and hypermethylation of promotor CpG-islets of genes associated with apoptosis (p53, p73, bcl-2), which could cause disturbances in transmission of apoptotic signals and lead to an increased drug resistance of tumors.

The NAS Institute of Cryobiology and Cryomedicine Problems found a correlation between morphological characteristics and chromosome status of native and cryopreserved human embryos.

Insertion mutants with impaired regulation of riboflavin synthesis in *Candida famata (Debaryumyces hansenii)* and *Pichia guilliermondii* yeast were produced at the Institute of Cell Biology. As contrasted to the recipient strain, the selected mutants of C. famata were incapable of riboflavin supersynthesis.

The significance and the degree of cAMP-dependent A protein kinase involvement in the processes of purinergic receptors modulation by endogenous opioids and canabinoids in rat neurons were investigated by the International Centre of Molecular Physiology. The data obtained indicate that canabinoids can inhibit nociceptive signal mediated by P2X2/3 receptors.

In the field of medicine, researchers developed methods of diagnostics and combined treatment of hypophysis adenomas; invented methods for differentiated therapy of urinary tract infections; introduced new surgery methods of gastroduodenal ulcer hemorrhages; methods of diagnosing benign tumors of uterine body were improved; new medical preparations on the basis of nano-dispersed silica were produced and investigated; more efficient methods were proposed to improve treatment of patients with malignant tumors of thoracic cavity; approaches were validated to reduce the risk of cardiovascular aftereffects in patients with essential hypertension complicated by heart and vascular-bed injuries; new results were obtained concerning the effect of xenobiotics on the vascular system; efficient and safe methods for early nephropathy diagnosis and treatment were developed.

In 2007, researchers of the Department Institutes were working under the following integral targeted science programs: 'Advanced Medico-Biological Research and Human Environment', 'Fundamentals of Genomics and Proteonics', 'Nanostructure Systems, Nanomaterials, Nanotechnologies', 'Sensor Systems for Medicine, Biology, Industry and Technology', 'Biomass as a Fuel Source', 'Fundamental Problems of Hydrogen Energy'. Significant scientific results were produced, which have considerable innovative and applied potential. No efforts were spared to introduce practical developments into practical medicine, agriculture and industry.

General Biology

D. M. Grodzinsky, Academician-Secretary of the Department

In 2007, the research done by science institutions operating under the Department of General Biology addressed major fundamental problems of present-day biology at all functional and structural levels of biological systems – from molecular to biocoenotic ones. Scientists suggested new possibilities of using theoretical generalizations in practice.

In genomics and genetic engineering, gene-transformed plants were produced, which can be used as both foodstuff and a vaccine against tuberculosis. Highly efficient methods of agrobacterium-mediated and biolistic gene transfer in barley plants were developed.

Much attention was given to studies of photosynthesizing system. They resulted in an improved model of dynamic regulation of the functioning of photosynthetic apparatus, in terms of the interaction of granum thilakoids and lateral redistribution of pigment-protein complexes in the light-gathering antennas in photosystems.

New data on the functioning of signaling systems in plant cells were obtained. In particular, involvement of cortical microtubules in the transfer of NO signals in vegetative cells was proved; antagonism was found between the action of jasmonate and salicylate-dependent signaling system in forming plant resistance to biotic stresses; elicitor activity of hexane and beta-aminobutiric acids was demonstrated. Phytotoxicity of herbicides that are inhibitors of acetyl-CoA was shown to be mediated by the active oxygen formed.

Radiobiology studies proved that cytomixis plays the key role in cell selection under chronic irradiation, when mechanisms leading to augmentation of heterozygosity in organisms are mobilized.

A number of new biologically active substances were detected in extracts from *Acremonium sp.* mushroom mycothallus. They are considered as promising plant growth regulators. Naturally occurring and synthetic preparations that protect plants from surface ozone were obtained for the first time.

Studied were issues concerning the development of raw material sources for biofuel: identified were microalgae species with high lipid contents, which are suitable for biodiesel fuel production; newly introduced alternative field crops were tested, they can be used for producing bioethanol, biodiesel, biogas and solid fuel.

A technology was developed for producing germicides in the form of silver nanoparticles in a template of biopolymers from sea organisms.

A critical nomenclature list of monocotyledons of Ukrainian flora was made, taking into account current phylogenetic systems. A new concept of alga species was formulated. The role of allelopathic interactions in meadow-steppe ecosystems was estimated. Different strategies of orchid plants survival in the wild were found. The level of genetic polymorphism and differentiation in rare species of *Pinaceae Lindl* family was thoroughly investigated within their natural habitats in Ukraine. The most viable tree species were identified in stands on iron-ore dumps and slopes in quarries of the mining enterprises in Kryvy Rih iron-mining basin. A concept of forming green stands was developed, with a view to optimizing the transformation of man-made landscapes.

Ecological and faunistic studies confirmed the finding of European mink *Mustela lutreola* on the territory of Ukraine. Signs of sinanthropization were observed in 23 species of wild mammals. Data on taxonomic diversification, distribution and evolution of invertebrates and vertebrates in the fauna of Ukraine and adjacent territories were generalized. Basic methods were worked out to control a dangerous invasive species – chestnut moth. Computer software was developed for processing data on the mechanics of hexapods locomotion and orientation.

In the continental and sea hydrobiology, new data were obtained on reduced diversity of hydrobionts fauna in rivers and estuaries due to anthropogenic impacts.

A prognosis of changes in the radiochemoecological situation in the Black Sea was made and ways were proposed to achieve sustainable development of the Ukrainian territories near the Black Sea. The deposition flows of ^{90}Sr, ^{137}Cs, $^{239,240}Pu$ radioactive nuclides, ^{210}Po natural radioactive nuclide, mercury and chlorinated hydrocarbons were estimated in sea-floor sediments on the shelf, continental slope and in abyssal fields of the Black sea.

New results were achieved in plant genetics, selection, acclimatization and introduction. Donors of high contents of proteins, carbohydrates and gluten were identified; they are promising for selection and improving the quality of grain crops. Four varieties of winter wheat and two hybrids of corn with high productivity and quality were introduced to the 2007 List of varieties of culture plants of Ukraine. Collections of botanical gardens and arboretums were replenished with new species and varieties of fruit and ornamental plants.

A technology of accelerated vegetative propagation of *Ginkgo biloba* plant was developed and patented for the first time in Ukraine.

Prerequisites were formed for further development of new areas in biology – gene taxonomy, genomics and bioinformation. Alongside with deeper insights into the classical life sciences they will ensure a further progress in discovering the fundamental laws of nature and finding efficient means to preserve biodiversity and enrich the potential of practical biotechnology.

Economics

V. M. Heyets,
Academician-Secretary of the Department

In 2007, the efforts of NAS Economics Department were directed, first and foremost, towards more profound fundamental and applied economics research addressing urgent scientific problems related to the development of efficient restructuring mechanisms in the national economy and improving its competitiveness.

A series of important results were obtained. On the basis of studies of formation and development of hierarchal and network relations and corresponding structures, our researchers produced a logical-and-historical periodization of the relationship between hierarchy and network in various economic systems. They formulated a conclusion about three most general development stages of that relationship. At the first stage, hierarchy and network are in syncretic unity; at the second stage, hierarchy becomes predominant; and at the third stage the decisive role is taken over by network relations. Economic implications of the relationship between hierarchy and network at each historical stage were shown.

The Department made an assessment of Ukraine's economic potential and its main components up to 2015 on the basis of an improved economico-mathematical set of tools consisting of comprehensive integrated models of economic forecasting and various scientific methodological projects aimed at improving the analysis and the technologies of economic forecasting as an efficient instrument to assess government's regulative policy.

For the first time, a categorial structure of the real sector was elaborated, which includes determination of its proportions, character and specific features of its interaction with the sector of all-state management and financial sector; a forecast and scenarios of the development of Ukraine's real sector up to 2015 were made.

Potential advantages and financial risks of integrating the national economy to the world monetary system were estimated; the main tendencies and patterns of the inter-national movement of private capitals were specified. The Department's institutions formulated the conceptual bases of financial policy for Ukraine in the present conditions; they proved that the development of market relations in Ukraine is sufficient for the revision of the state's functions in the economy, in particular, for the transition from the sectoral to functional principle in forming the executive power.

A scientific concept of economico-mathematical modeling of the implications of Verkhovna Rada's decisions was formulated; it concerned changes in central taxes for the economy of the whole nation and its individual regions. Principles of constructing a complex of mathematical models were validated and such a complex was produced for the economy of a region, with a view to forecasting medium-term trends in the development of real and financial sectors under existing taxation.

Researchers formulated methodological approaches to the gaining, distribution and re-distribution of intellectual rent in a market economy; they justified priorities in ensuring competitive human resources in the context of Ukraine's R&D and innovative development.

The Department developed conceptual fundamentals for determining innovative areas of human development and forming social innovations as a factor in the development of human capital. Conceptual principles for the determination of social risks were validated, their structure, contents and formation factors analyzed. Demographic risks in the context of global changes were estimated.

Theoretical aspects of forming the system of regional management and organizational and functional structure of oblast state administrations were worked out; models of forming basic administrative and territorial units were constructed.

Due to the analysis of civilizational drift in the context of changing vectors of civilizations movement and inter-civilization synthesis, our scholars validated novel approaches to the analysis of the world civilizations functioning under conditions of transformation of the global space and change in the global power distribution. Research into the evolution of civilization models (the West European and Chinese ones) produced new ideas in substantiating competitive properties of civilization values, which were analyzed in the context of competition and competitiveness. Conclusions as to the possibility of substituting the present (peripheral) model of Ukraine's competitiveness with that of a modernizer were formulated.

A dynamic assessment was made of the foreign-trade components (changes in the pattern of foreign trade turnover, foreign investments and international labor migration) of the potential of endogenous development of Ukrainian economy. Characteristics of Ukraine's participation in international capital flows were generalized and shown was the necessity of forming transnational corporations in Ukraine and expaning them abroad with simultaneous selective approach to involving foreign TNC to Ukraine's economy.

In the future, the efforts of the Department's researchers will focus on in-depth socio-economic processes in the development of the national economy and on improving its competitiveness.

History, Philosophy and Law

O. S. Onyschenko, Academician-Secretary of the Department

In the year under review, research institutions of the Department made a noticeable contribution to elaborating the strategy and studying theoretical and practical aspects of socioeconomic, political and cultural transformations in Ukraine, alongside with adaptation of the historical experience and spiritual heritage of the past.

NAS Institute of Sociology published academic writings: «Ukrainian Society in 1992 – 2007. Dynamics of Social Changes» (by NAS Acad. V. M. Vorona, M. O. Shulga) and «Employment in Ukraine: Changes and Trends» (by G. I. Chepurko).

Scholars of NAS I. F. Kuras Institute of Political and Ethnic Studies published the books: «Vynnychenko and Petlyura» (by NAS Corr. Memb. V. F. Soldatenko), «Presidency: a Ukrainian Version» (by M. S. Karmazina), «Civil Society in Present-Day Ukraine» (by F. M. Rudych).

NAS Institute of the History of Ukraine published the monographs: «State-Construction Process in Ukraine. 1991 – 2006» (by NAS Acads. V. M. Lytvyn and V. A. Smoliy); «Ukraine: Political History. XX – Early XXI Centuries» (by NAS Acads. V. M. Lytvyn, V. A. Smoliy and NAS Corr. Memb. Yu. A. Levenets); vol. 4 of «The Encyclopedia of the History of Ukraine» (by NAS Acads. V. A. Smoliy, V. M. Lytvyn); «History of Ukrainian Cossacks. Vol.2» (by NAS Acad. V. A. Smoliy et al.).

Scholars of NAS V. M. Koretsky Institute of State and Law published: «Comprehensive Legal Encyclopaedic Dictionary» (by NAS Acad. Yu. S. Shemshuchenko, NAS Corr. Membs. V. I. Semchyk, V. F. Sirenko); «Constitutions and Constitutional Statements of Ukraine. History and Today» (ed. by NAS Acad. Yu. S. Shemshuchenko); «Evolution of Civil Legislation in Ukraine: Theory and Practice» (by Ya. M. Shevchenko); «Codification of Ukrainian Legislation: Theory, Methodology, Techniques» (by O. I. Yuschyk); «Gender Equality in Conditions of Society Transformation» (by N. M. Onyschenko, N. M. Parkhomenko).

Issued were textbooks for higher schools: «Diplomatic History of Ukraine (from Earliest Times to XIX Century)» (by NAS Acad. L. V. Gubersky et al.), «Philosophy: Logos. Sofia. Intellect» (by NAS Acad. V. H. Kremen), «Logic (Traditional and Present-Day)» (by NAS Corr. Memb. A. Ye. Konversky).

Researchers of M. S. Hrushevsky Institute of Ukrainian Archaeography and Source Studies prepared and published: vols. 4 and 8 of «Complete Works by M. S. Hrushevsky in 50 volumes» (NAS Corr. Memb. P. S. Sokhan), «Manifestoes by Ivan Mazepa. Part II» (I. V. Butych), «A Province on Cultural Cross-Roads: Research into History of Slobidska Ukraine of XVII – XIX Centuries» (by V. L. Masliychuk).

Scholars of NAS H. S. Skovoroda Institute of Philosophy published the monographs: «Hryhoriy Skovoroda: Philosophy of Freedom» (by NAS Acad. M. V. Popovych), «Requests of Philosophical Meanings» (by S. B. Krymsky), «Civilization Dimensions of Morality: Change of Paradigms» (by V. A. Malakhov, O. O. Kyseliova), «Phenomenon of Identity in the Modern World» (by Ye. K. Bystrytsky and S. V. Proleyev), «Sociology of Public Opinion» (by O. V. Nelga), «The Reason of the Unreasonable» (by T. V. Liuty).

Researchers of NAS I. Krypiakevych Institute of Ukrainian Studies issued the books «History of Lviv. In 3 Volumes» (by NAS Acad. Ya. D. Isaievych et al.), «Halician Mytropolitanate. A Historical Sketch» (by I. V. Paslavsky), «Early Rus in Polemic Literature of Late XVI – XVII Centuries» (by S. V. Savchenko), «Armed Forces of Ukraine of the First Half of XX Century. Generals and Admirals» (by M. R. Lytvyn).

V. I. Vernadsky National Library of Ukraine published the study «The National Academy of Sciences of Ukraine: Development and Engagement in the European Scholarly Space» (by NAS academician O. S. Onyschenko and B. A. Malytsky) and prepared for printing the books: «Academies of Sciences of European Countries» (by NAS Acad. O. S. Onyschenko et al.), «Libraries of Ukraine in XX Century» (by NAS Corr. Memb. L. A. Dubrovina).

Scholars of NAS Institute of Archaeology prepared and published: «Archaeology and Early History» (by NAS Acad. P. P. Tolochko), «Ethnogenesis of the Ukrainian People» (by NAS Corr. Memb. V. D. Baran), «The Most Ancient Themenos of Pontic Olbio» (-by NAS Corr. Memb. S. B. Kryzhytsky and A. S. Rusiayeva).

NAS A. Yu. Krymsky Institute of Oriental Studies published the monographs: «V. P. Buzeskul – a Historian of His Time» and «O. Ju. Schmidt: 1891–1956» (-by L. V. Matveyeva), «Oriental Pathways of Lesia Ukrainka» (by O. D. Ognieva).

Achievements of leading scholars of the Department's institutions were honoured with high rewards. They received the decorations of the President of Ukraine: NAS Corr. Memb. V. I. Semchyk got the Order of Prince Yaroslav the Wise V Class; V. N. Denysov, H. O. Murashyn, V. F. Verstiuk, R. Ya. Pyrih, K. Ye. Naumenko – the Order 'For Services' III Class; Ya. M. Shevchenko – the Order of Princess Olga II Class.

In 2008, efforts of the Bureau and institutions of the Department will be focused on further search for new forms and methods to put to better use the creative potential of socio-humanities in the interests of economic, social, spiritually and cultural progress of the Ukrainian society, on finding ways of transition to new progressive models of organizing research and active introduction of the results obtained to practical work of government bodies, institutions of education and culture.

Philological Studies, Art Criticism, Ethnology

V. H. Skliarenko, Academician-Secretary of the Department

In the year under review, as before, scholars of the NAS Department of Literature, Language and Art Studies addressed fundamental and applied issues in the development of literature, language, arts, traditional every-day culture, computer linguistics, they tackled major issues of the academic backup to the national and cultural revival of Ukraine, providing an unbiased view of various stages in the progress of Ukrainian spiritual culture in the past and its status at the beginning of the XXI century.

The practical result of those studies was the publication of an all-time high – 168 collective and individual writings, including 108 monographic and collective works, 28 scholarly textbooks and manuals for universities and secondary schools, 25 reference books and dictionaries, 2 academically treated and commented belles-lettres texts, over 1500 papers in academic proceedings and periodicals.

The high level of the research done was demonstrated by awarding the 2007 National T. Shevchenko Prize to literature scholar D.V.Stus for his work «Vasyl Stus. Life as Creation», the State Prize of Ukraine in Science and Technology to arts scholar V. I. Tymofiyenko for his «History of Ukrainian Architecture», NAS I. Franko Prize to literature specialist Ye. K. Nakhlik for the 2-volume book «Panteleymon Kulish. Personality. Author. Thinker». For her outstanding services to the Ukrainian arts studies, arts scholar T. V. Kara-Vasiliyeva got the high title 'Honoured Arts Worker of Ukraine'; Order of Yaroslav the Wise V Class went to NAS academician V. H. Skliarenko and Order of Yaroslav the Wise III Class – to arts scholar Yu. O. Stanishevsky; Orders of Princess Olga III Class were awarded to T. B. Lukinova and L. Z. Moroz.

Scholars of the Department carried on their studies in literature theory, history of the Ukrainian and foreign literatures, in today's status of belles-lettres, continued preparation of encyclopedic and academic publications of artistic heritage. A number of fundamental works were issued: «Memories from Old Times» (vol.3) (by NAS academician I. M. Dziuba), «Comparative Studies and Literature History» (by NAS corresponding member D. S. Nalivayko), «Urbanism in Gogol's Artistic Prose» (by NAS corresponding member N. Ye. Krutikova), «Mythical and Poetic Images in I.Franko's Artistic World», «Novels by Emma Andiyevska: Artistic and Philosophic Quest. Mythologism. Imagery Poetics» (by O. S. Smerek), «-Word of Artistry, Word of Sacrality» (by P.V.Mikhed). Commented letters by I. Ya. Franko and M. S. Hrushevsky were published, and an anthology of XX-century poetry. Editorial work on the texts of volumes 1 and 2 of «Shevchenko Encyclopedia» and of 4 volumes of 12-volume academic «History of the Ukrainian Literature» is being completed.

In pursuance of the Presidential Decree 'On the Development of National Dictionary Base', linguists of the Department prepared for publication vol. VI of fundamental «Etymological Ukrainian Dictionary», completed and issued 10,000 copies of the laser disk 'Ukrainian Dictionaries' Integrated Lexicographic System», version 3.1 with the register of over 253 thousand entries. They produced and commissioned an on-line version of the Ukrainian National Linguistic Corpus covering over 55m usages and 'Dictionary of the Ukrainian Language' virtual lexicographic laboratory. Linguistics scholars published 8 new-generation dictionaries and such fundamental works as «Etymological Ukrainian Dictionary» (vol. 5), «Ukrainian-Russian Bilingualism. Lingual, Social and Cultural Aspects»; «Small Philological Encyclopedia»; «History of Ukrainian Accent: Noun» (by NAS Academician V. H. Skliarenko); «Language and Ukrainian-Studies Outlook» (by S. Ya. Yermolenko); «Ukrainian Ethno-Linguistics. Essays» (by V. V. Zhaivoronok).

Relying on their studies of versatile phenomena of traditional culture, scholars in arts, folklore and ethnology published 62 collective and individual writings, among them were: «History of XX-Century Ukrainian Arts» (vol. 5), «Brief Illustrated Encyclopedia of Folk Studies», «History of Decorative Arts in Ukraine (XVII-XVIII Centuries)» (vol. 2), «History of Ancient Architecture» (by V. I. Timofiyenko), «Folk Art of Ukraine at the Turn of Millennium» (by L. H. Orel), «Ukrainian Folk Doll» (by O.S.Nayden), «Les Kurbas» (by N. M. Korniyenko). Despite financial problems, integral folklore and ethnographic expeditions to 3 Ukrainian regions were organized, where unique mementoes of folk culture and arts were collected.

Principal research-organizing activities of the Department in the reporting year were aimed at developing new scholarly concepts, programs, projects, organizing national and Academy events which were prepared by its scholars in pursuance of Decrees of the President of Ukraine and under government assignments. 35 international and all-Ukrainian academic conferences were held.

Environment Preservation and Sustainable Development

P. H. Kostiuk,
Member of the Academy Presidium

In the period under review, NAS specialists were involved in research and management activities under 'The 2005-2030 state program for flood prevention and control', 'The state program of sustainable development for the region of uranium mining and primary processing', 'The 2003-2012 state program for radioactivity protection and social welfare of Zhovti Vody inhabitants', 'The state program of fundamental and applied research into the use of nuclear materials', 'Nuclear and radiation technologies in the economy', 'The 2004-2010 program of integrated development of Ukrainian Danube region', the target NAS integrated research program 'Biomass as raw material for fuel', NAS integrated research program 'R&D fundamentals of energy efficiency' and the program 'Measures towards engineering protection and construction of facilities on Tuzla Spit Isle'.

Scientists elaborated draft programs of solid waste utilization in the city of Lviv and Lviv oblast for 2007-2015, a program for creating green network in Lviv oblast, charts for green network in Ternopil oblast and a strategy for Donetsk development up to 2020. The work on a draft program to prevent natural and anthropogenic emergencies for 2009-2013 is in progress. NAS specialists were also involved in developing the procedure for coordinating activities to meet Ukraine's commitments under the UN Framework Convention on Climate Change and its Kyoto Protocol, as well as the National Action Plan on Implementing the Kyoto Protocol attached to the UN Framework Convention on Climate Change.

NAS scientists prepared and sent to the authorities of Ukraine reference and analytical data on soil quality in Ukraine and measures towards its improvement; on possible environmental impacts of waterworks and dredging in the navigation canals of the Romanian part of the Danube Delta, which do not have the status of border-area with the territory of Ukraine; conclusions on the necessity and feasibility of constructing refuse incineration plant in Kyiv. Also prepared were proposals towards furthering collaboration between the academies of sciences of Ukraine and the Republic of Moldova in the hydrological analysis of the Dniester river area, legal framework for implementing the UN Framework Convention on Climate Change and its Kyoto Protocol; proposals towards neutralization of toxic industrial waste in Kyiv city and Kyiv oblast. Amendments and proposals were also prepared to the draft laws of Ukraine 'On control of anthropogenic gas emissions and greenhouse gases regulations' and 'On soils protection'.

Those activities were coordinated by the NAS Academic Council for Environment and Sustainable Development and the National Committee of Ukraine for UNESCO 'Man and Biosphere' Program.

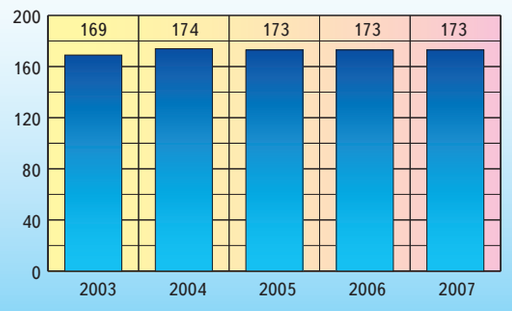
A number of significant scientific results were achieved in 2007. Structural changes in Ukraine's productive forces and their impact on the natural environment, alongside with the zoning of the Ukrainian territory, were studied in terms of economic security and the state of the environment. Analyzed were basic present-day methodological approaches to determining various factors of environmental security, the feasibility and methods of its management. Principal ways to providing environmental security at a regional level (its institutional, managerial and socio-economic factors) were identified.

Methodological guidelines for the criteria of evaluating innovative development were substantiated and legal framework for innovation activities was defined in terms of environmental security and sustainable development. A methodology for setting priorities in financing the development of industrially-ridden territories was elaborated, with regard to their ecological coefficients, alongside with guidelines for meeting sustainable-development criteria of industrially-ridden areas via restructuring their production complex; due account was taken of the ecological sustainability and nature-resource potential of those areas. A procedure was developed to estimate landscape resistance to human impacts in natural and economic zoning of Ukraine's territory. Theoretical principles of ecologically balanced nature management in the regional dimension were substantiated as a conceptual framework for regional environmental policy. Monitoring of the areas polluted with petroleum products was done. The Second National Report of Ukraine on Climate Change was prepared and published. Data on the national policy and activities to reduce the impact of climate change were analyzed; a forecast of greenhouse gases emissions was made. Studied were trends in climate change in Ukraine and carbon emissions of various industries; recommendations were produced to improve nation's adaptation to climate change. The work on the reference book «The Problem of Climate Change – Greenhouse Gases» is in progress. A set of principles, criteria and methods for landscape analysis was elaborated with a view to optimizing nature management in Ukraine.

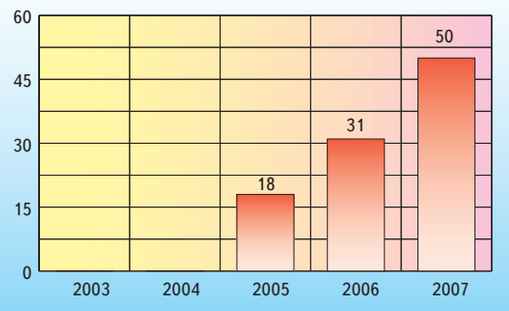
In the sphere of international collaboration, one should mention electing Ukraine a permanent member of the International Coordinating Council for UNESCO 'Man and the Biosphere' program, which was due to a significant contribution of Ukrainian scientists to its activities. Under numerous international projects relying on satellite data, Ukrainian scientists, jointly with their German, French and Austrian colleagues, study climate characteristics and atmospheric processes, including dangerous meteorological phenomena. Jointly with their Byelorussian and Polish colleagues, NAS scientists continue research in the framework of UNESCO-JFIT project 'Establishment of a trans-border biosphere reserve and a regional green network in Polissia' (2006-2008).

Regional Structure of the National Academy of Sciences of Ukraine

Total number of research institutions



Number of the Centers for shared use of scientific equipment



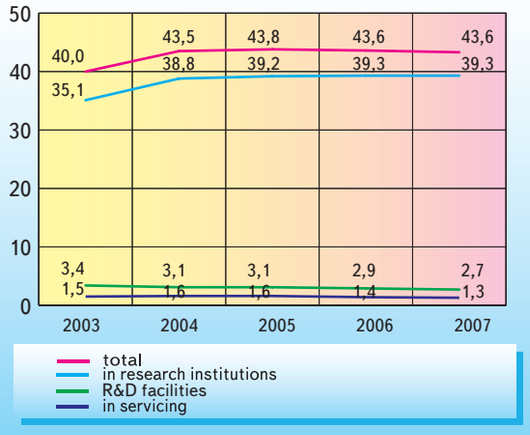
NAS of Ukraine 2007

Statistics

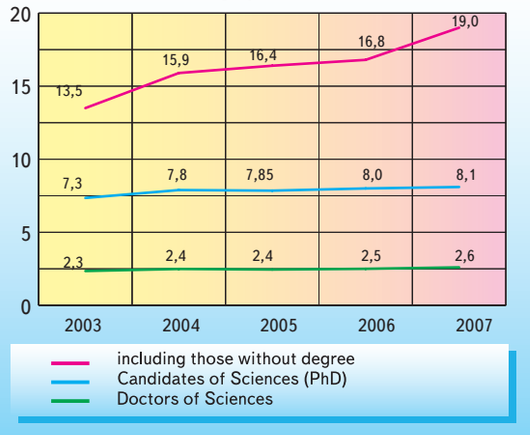
Total number of employees	**43349**
including:	
in research institutions	**39304**
in R&D organizations	**2733**
in service organizations	**1312**

R&D employees	**19024**
including:	
Doctors of Sciences	**2568**
Candidates of Sciences (PhD)	**8076**

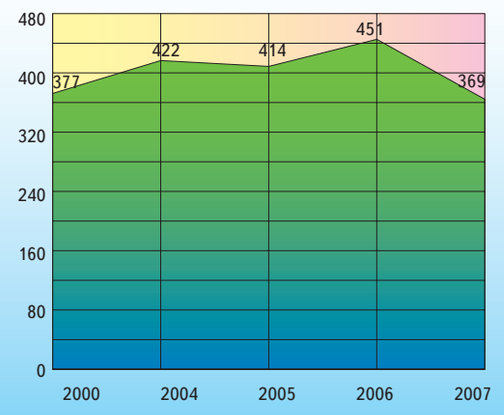
Number of employees (thousands)



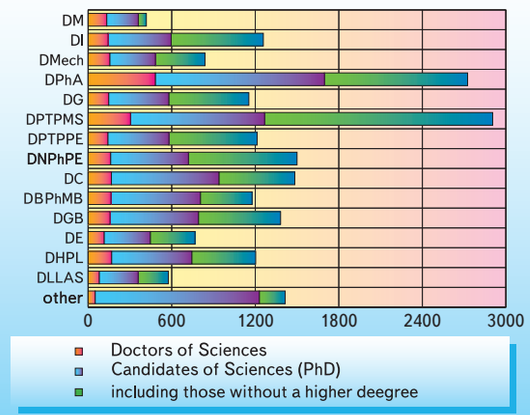
R&D employees (thousands)



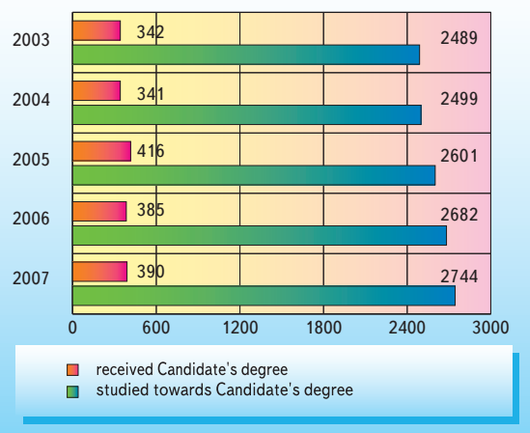
Recruitment of university graduates

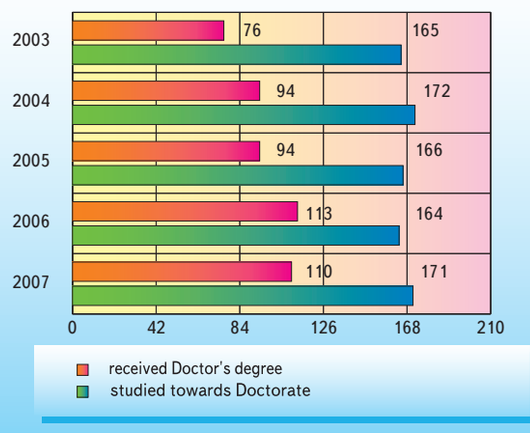


Distribution of scientists by departments



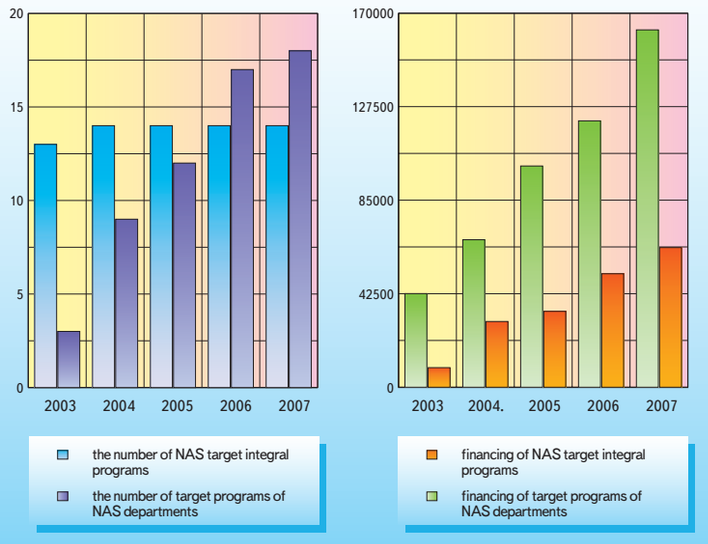
Training of research personnel



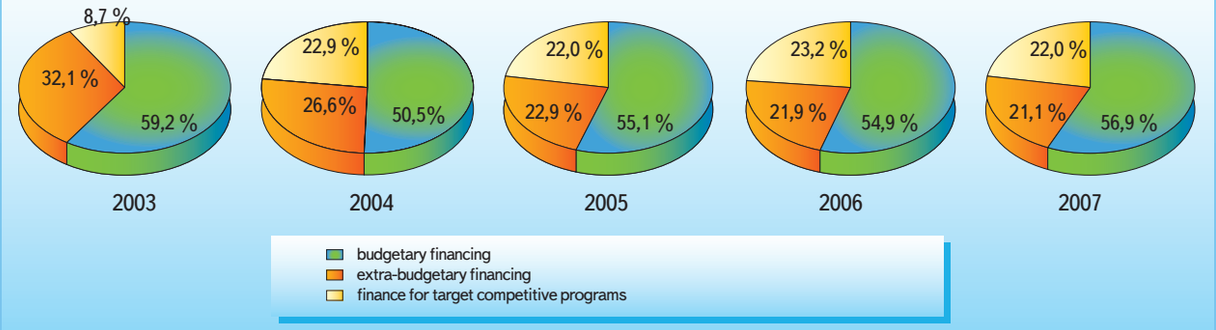


Budget	ths UAH
Total amount of expenditures	1951042,7
Basic funding from the State budget	1095001,9
Target programs finance	422895,0
Expenditures on personnel training	5666,6
Expenditures on health protection	14708,7
Expenditures on capital construction and reconstruction	6800,0
Extra-budgetary revenues	405970,5
Expenditures on wages	1245610,0
Expenditures on equipment, materials and instruments	151176,2
Expenditures on utilities	103787,5
Other expenditures	450469,0

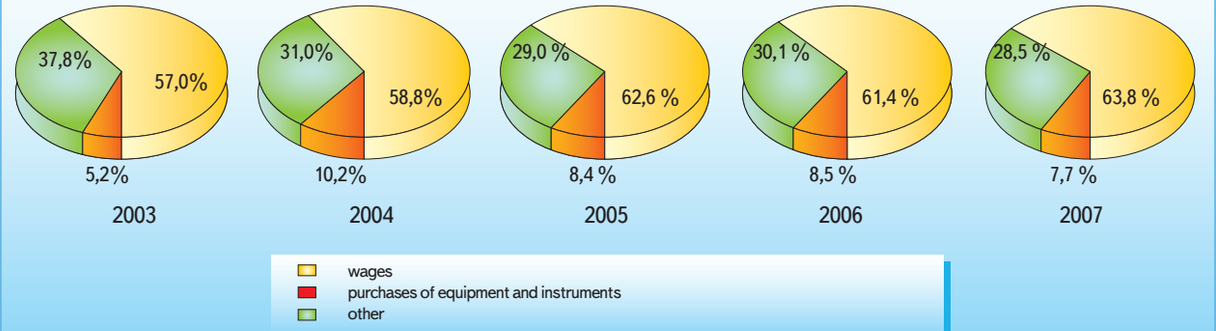
Target programs subjects



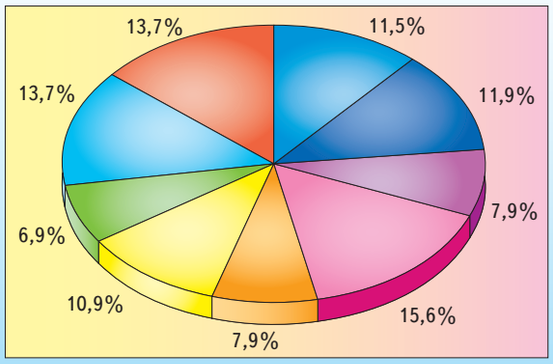
Distribution of finance by sources



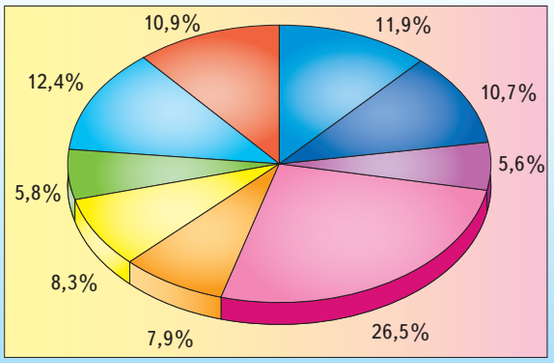
Distribution of expenditures by principal items



Distribution of basic budgetary finance

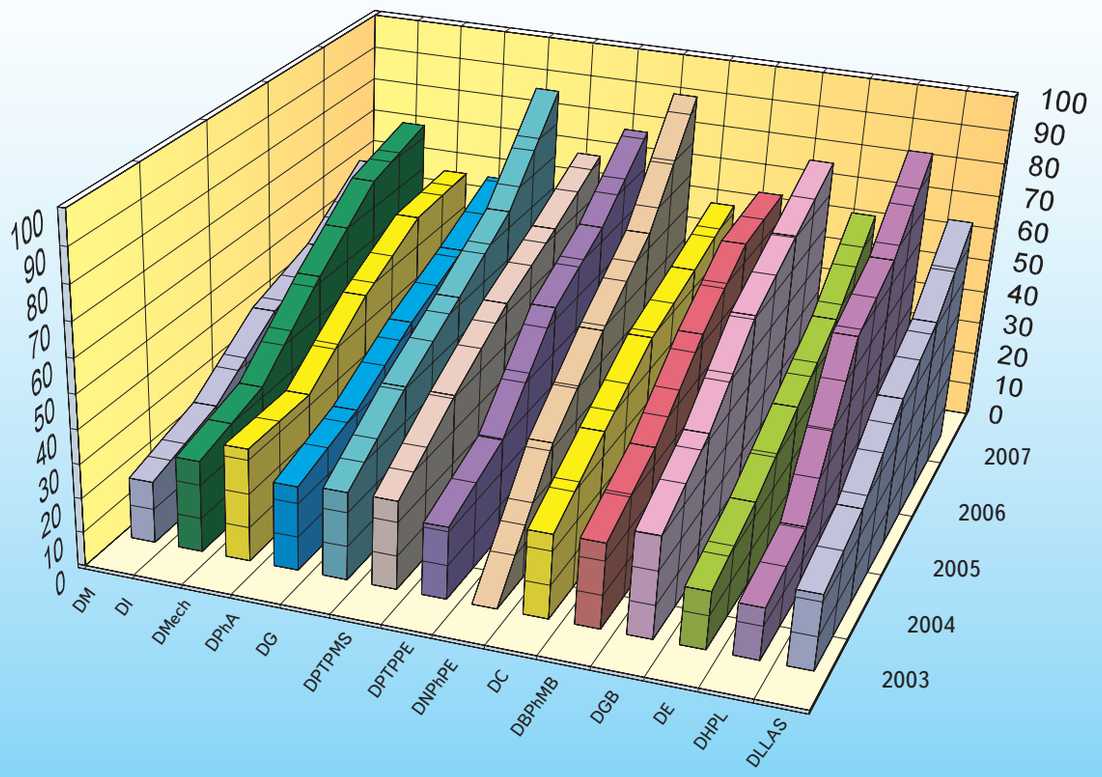


Distribution of extra-budgetary finance



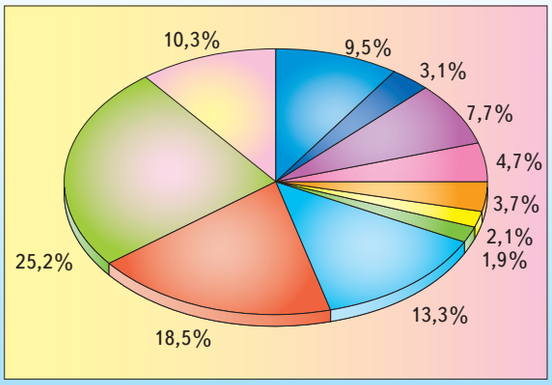
Mathematics, Mechanics, Informatics
Earth Sciences
Power Engineering
Chemistry
Social Sciences and Humanities
Physics and Astronomy
Materials Sciences
Nuclear Physics and Power Engineering
Biological Sciences

Distribution of budget finance per 1 researcher among Departments (UAH ths)

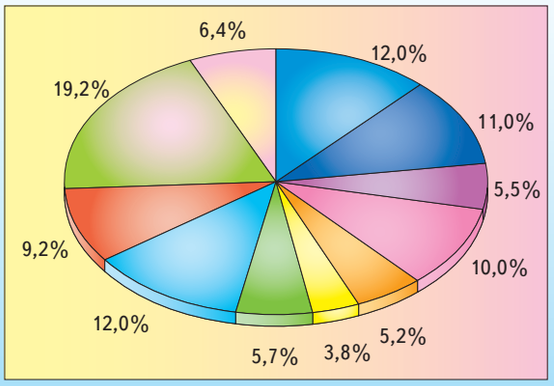


Publication of Academic Materials

Monographs

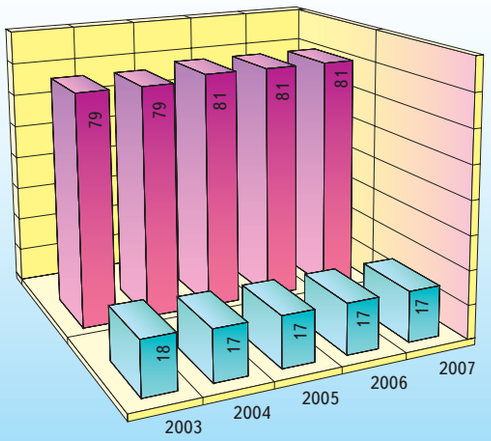


Papers



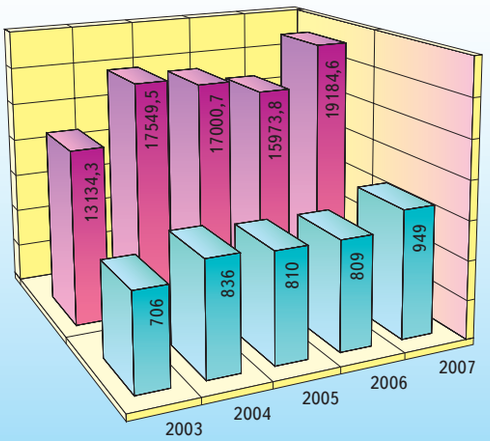
Mathematics, Mechanics, Informatics
Earth Sciences
Power Engineering
Chemistry
Economics
History, Philosophy and Law
Physics and Astronomy
Materials Sciences
Nuclear Physics and Power Engineering
Biological Sciences
Literature, Language and Art Studies

Academic Periodicals



total number of periodicals
including: the number of publications translated abroad

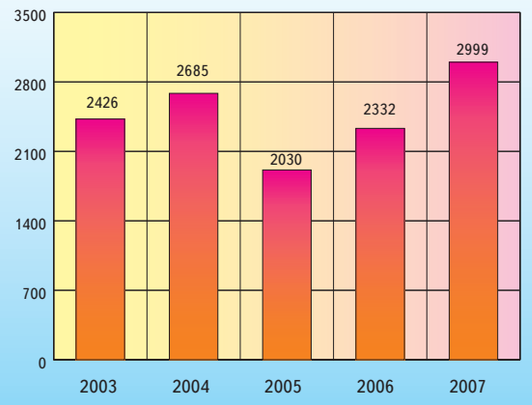
Publication of Academic Books



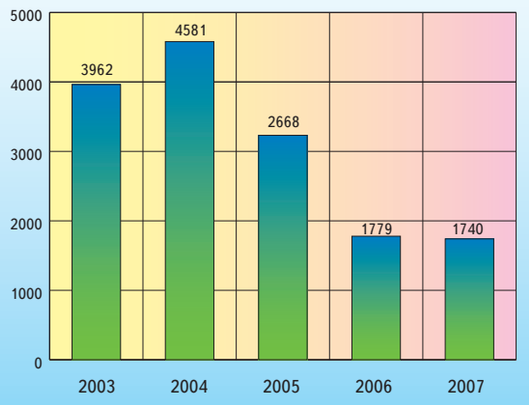
volume
the number of titles

International Contacts of the National Academy of Sciences of Ukraine with Foreign Institutions

Foreign Scientists Received in Ukraine



Ukrainian Scientists Sent on Mission Abroad



The List of the Centers for Shared Use of Scientific Equipment

Name of Centers of Joint Usage by the Scientific Equipment	NAS Institutions
Testing Machine INSTRON 8802	G. S. Pisarenko Institute for Problems of Strength
Laser Femtosecond Complex	Institute of Physics
Diagnostic of Semiconductor Materials, Structures and Devices	V. E. Lashkaryov Institute of Semiconductor Physics
NMR Spectroscopy	G. V. Kurdymov Institute for Metal Physics
Studies of magnetic moments of solids and liquids	G. V. Kurdymov Institute for Metal Physics
Studies of mechanical properties	G. V. Kurdymov Institute for Metal Physics
Scanning Probe Microscope	Institute of Magnetism under NAS and MES of Ukraine
Astronomical Spectropolarimeter	Main Astronomical Observatory
EHF Radiospectroscopy	O. Ya. Usikov Institute of Radiophysics and Electronics
Amalgamated Center for Corporate Use of the RT-22 Radiotelescope	Institute of Radio Astronomy
Integrated Physical Research Under Extreme Conditions	Donetsk O. O. Galkin Institute of Physics and Engineering
Center of Shared Use of Magnetometric Equipment	S. I. Subbotin Institute of Geophysics
Electron Microscopy and Laser Sedimentography of Geology Objects	Institute of Geological Sciences
Center of Solid Phase Mass-Spectrometry, Gas Isotopic and Microelement Analysis	M. P. Semenenko Institute of Geochemistry, Mineralogy and Ore Formation
Regional Center of Shared Use of Equipment	Marine Hydrophysical Institute
Testing Machine MTS	E. O. Paton Electric Welding Institute
Laser Interferometric Measuring Complex	E. O. Paton Electric Welding Institute
GLEEBLE	E. O. Paton Electric Welding Institute
Optical Spectrometer with Inductive Coupled Plasma	E. O. Paton Electric Welding Institute
TEM-SCAN	I. M. Frantsevich Institute of Problems of Materials Science
Scanning Electron Microscopy and Microanalysis	V. N. Bakul Institute for Superhard Materials
Laboratory of Gas Analysis in Metals and Alloys	Physical-and-Technological Institute of Metals and Alloys
Metallographic Motorized Microscope	Z. I. Nekrasov Iron & Steel Institute
Molecular and Crystal Structure of Materials	Institute for Scintillation Materials
Center for Electron Microscopy and X-Ray Microanalysis	H. V. Karpenko Physico-Mechanical Institute
Gas and Gas-Liquid Chomatography	Gas Institute
Digital Ferro-Probe Magnetometer	Scientific-and-Technical Center of Technical Facilities Magnetism
Analytical Materials Science of Nano-Structured Systems for Nuclear Power Engineering	National Science Center 'Kharkiv Institute of Physics and Technology'
Ultra Low Lewel $\alpha-\beta$-Spectrometry	Institute of Environmental Geochemistry under NAS and the MEA of PP from the Consequences of Chornobyl Catastrophe
Apparatus Complex for Determination of Porous and Structure Characteristics of Nanoparticles and Nanomaterials	L. V. Pisarzhevsky Institute of Physical Chemistry
X-ray Single-Crystal Diffractometry	Institute of Organic Chemistry
FT-IR Spectrometer 'Tensor 37'	Institute of Macromolecular Chemistry
Chromato-Mass-Spectrometry and HPLC-Mass-Spectrometry	A. V. Dumansky Institute of Colloid and Water Chemistry