Main Results

B. E. Paton, President of the Academy

Further economic growth in the country, measures of the state support to science had a positive impact on the activities of the National Academy of Sciences (NAS) of Ukraine in 2002.

Extra allocations from the State budget enabled us to design and start implementing special-purpose programs in the major spheres of natural sciences, social and humanitarian research, in accordance with the top-priority areas of science and technology approved by a special law of Ukraine.

Last year, academy scientists achieved a number of new world-level results in certain areas of mathematics, information science, mechanics, physics and life sciences. I would like to put a special emphasis on the fast development of research in such highly relevant advanced areas as intelligent information technologies, nanophysics and nanostructural materials, soft-matter physics, sensorics, molecular and cell biology.

In the field of socio-humanitarian research, numerous major basic studies of the issues of socioeconomic, political, cultural and ethno-national development of the society were carried out. In particular, strategic priorities of innovative backup to the sustainable development were set, economic, organizational and legal issues were worked out, with a view to forming an efficient state policy in the regions. Significant results were achieved in scholarly backup to the national-and-cultural revival of Ukraine.

In total, last year Academy scholars published over 720 academic books, 447 monographic writings and 280 collected scholarly works among them. Leading foreign publishers issued 43 monographs, this is 10 more than in 2001.

Fruitful work of the Academy scholars was duly appreciated by the state. In 2002, 99 researchers of the NAS of Ukraine were given high state awards, honorary titles, were awarded state prizes and government decorations. For outstanding services to the development of Ukrainian science they were given: 2 Orders of Yaroslav the Wise, V degree; 1 Order of Yaroslav the Wise, IV degree; 3 Orders ‘For Distinguished Services’, II degree; 11 Orders ‘For Distinguished Services’, III degree; 3 Orders of Princess Olga, III degree, 15 researchers were awarded the title ‘Honoured Worker in Science and Technology of Ukraine’ and 2 Academy workers won other honorary titles.

16 scholars of NAS of Ukraine, as well as teams of two research institutions — those of the Institute of Political and Ethno-National Studies and the I. M. Frantsevich Institute of Materials Science Problems — were awarded with the Honorary Diplomas of the Cabinet of Ministers of Ukraine, 46 researchers won NAS of Ukraine prizes named after outstanding scholars.

As in the previous years, the Academy did major research to ensure scholarly backup to achieving priority national goals. Thus, jointly with specialists of other agencies, our scientists continued to work out the ‘Energy strategy of Ukraine out to 2030 and a more distant future’. A large-scale All-Ukraine monitoring of public opinion concerning current developments in socioeconomic and political spheres was started. Academy scientists made a significant contribution to studying the status of technological and natural safety in Ukraine and participated in discussing the issue at the meeting of the Council of National Security and Defense. Efforts of numerous Academy institutions will be aimed at improving the efficiency of the state system of environment monitoring through using advanced information technologies, telecommunication systems and devices for remote Earth probing.

Here I should add that current issues of social and economic development of Ukraine largely predetermined further reformation of the network of the Academy institutions. New institutions and those reorganized last year include the Institute for Physics of Mining Processes, the Institute of Coal Power Technologies, the Institute of Demography and Social Studies.

A great deal of attention was given to scientific backup to basic industries of the economy. I'll give but a few examples. Scientific principles of liquid-slag recycling in melting and ladle treatment of metal melts were worked out and a respective procedure was suggested. Such a restructuring of technological processes in producing iron and steel melts can pay its way in a year. Republic of Crimea commercialized the first in Ukraine pilot module of 'Sivashsky-1'geothermal heat-and-power plant. New high-yield winter wheat varieties 'Columbia' and 'Podolianka' were produced for agribusiness of Ukraine, a new mutant variety of winter wheat 'Smuhlianka' gave a yield of 114 metric centners per hectare, which is a historic record in this country.

In general, innovative activities of NAS institutions have become more active. Scientists, jointly with production workers, were implementing a number of hi-tech projects aimed at obtaining new composite, polymer and chemical materials, developing intelligent hard- and software means of recognizing language signals and images, increasing occluded-methane production etc. Extensive efforts were directed toward a wider use of efficient plant-growth regulators and the first domestic pesticide in agriculture.

A new impetus was given to the activities of technoparks (R&D facilities pools) organized at, and with participation of, leading science institutions of the Academy. One has to point out that today technoparks are actually the only efficient innovative mechanism in Ukraine. And given the preservation of the special regime of their activities, they will be able to both ensure innovative breakthroughs in hi-tech areas and cope with another task — provision of investment to science.

Academy's contribution to implementing the state R&D and innovative policies at the regional level grew substantially. To implement decisions of the last-year General meeting of the Academy, the Advisory council on future development of the regions of Ukraine was set up under NAS Presidium, and special academic sections on those issues were organized in all regional science centers. They have already started operating in the Western, Donetsk and North-East Science Centers.

Fruitful cooperation of the Academy with the Kyiv City State Administration continued, its objective being R&D and innovative development of the capital. Last year, in conformity with a Presidential Decree, a large-scale experiment on implementing the Program of R&D development of Donetsk oblast up to 2020 was started. Academy scientists took an active part in it. They also started to work out similar programs for Dnipropetrovsk, Zaporizha and Dniprodzerzhinsk. Since last year, Southern Science Center has been working on the program of developing infrastructure and business activities on Zmiiny Island and the continental shelf.

A further impetus was given to inter-academy collaboration, which was carried out both multilaterally and bilaterally. In the framework of the year of Ukraine in the Russian Federation, the collaboration of this Academy with institutions of the Russian Academy of Sciences became more extensive. Of great significance for further improving ties between the two academies was a joint session of RAS Presidium and NAS Presidium held in Moscow. It heard a number of academic presentations of Ukrainian and Russian scholars on relevant issues of the present-day science and outlined prospects of further development of collaboration.

Last year, the Agreement on collaboration with the National Academy of Sciences of Belarus and the List of joint research projects (areas) was signed in Kyiv. To carry out fundamental research in astrophysics, we signed the Agreement on joint exploitation and development of observation base on Maidanak Mountain with the Academy of Sciences of Republic of Uzbekistan.

NAS of Ukraine made an important contribution to preparing and holding the Conference of representatives of the national academies of sciences of the member states of the Organization of the Black Sea Economic Cooperation (Athens, Greece, April 15-17, 2002). The conference set up the Council of the Presidents of the national academies of sciences of BSEC member states, whose first meeting was held late in 2002 in Kyiv and was hosted by our Academy.

The previous year was an important landmark in the further improvement of the interaction of Academy scholars with educationalists. A joint session of NAS Presidium and the Board of the Ministry of Education and Science (MES) was held. Taking into account its results, we signed the Agreement on collaboration between NAS of Ukraine and MES of Ukraine, approved the list of activities aimed at further development of collaboration in 2002-2007, identified priority areas of interaction between regional science centers and respective councils of university presidents in

implementing regional science and R&D policies. One should also emphasize here that in 2002 NAS research institutions and schools of higher learning signed more than 100 cooperation agreements. Over 1200 highly qualified academy researchers were involved in teaching in the education system. Departments of special-purpose training of KPI National Technical University of Ukraine and T. Shevchenko Kyiv National University were working successfully.

NAS of Ukraine has always focused attention on recruiting talented youth to its research institutions. A number of respective Academy proposals were implemented in the Presidential Decree No 315 of April 9, 2002 'On further measures toward supporting young researchers'. In particular, this decree set up annual grants of the President of Ukraine in support of young researchers. To raise the prestige of NAS scholarships for young researchers, they will be doubled.

These and other measures taken by the Academy somewhat improved the situation with reinforcing its institutions with young researchers. In 2000-2002, the Academy saw a small, but both absolute and relative increase in the number of young researchers (those under 35). Certain positive shifts remained in NAS post-graduate studies, in particular, the higher competition for admission and the number of students. Yet, one has to admit that we failed to achieve a distinct improvement here. What is needed is further concentration of efforts, primarily those of the state, at an integrated approach to the problem. Of utmost importance is the involvement of the possibilities of big business, which we see, in particular, in the Russian Federation.

Another critical problem for the Academy still is the extremely unsatisfactory state of its experimental research facilities and, first and foremost, their provision with up-to-date science equipment. In this connection one has to point out that over last year budget financing for wages and scholarships was allocated on time and in full. The plan of financing other expenditures was met at 36,5% (the finance shortfall amounted to Hr 59,3 mn). Due to this fact, NAS institutions actually could not purchase necessary materials, chemicals and equipment. The absence of addressed finance also resulted in postponing the organization of advanced-equipment pools jointly with MES of Ukraine.

One has also to point out that the extremely meager logistics made important scholarly expeditions virtually impossible. The fact that financing of projects by the State basic research foundation was practically suspended last year also had a very negative impact on the development of numerous research areas. The situation is to be changed in any possible way.

Activities of NAS General Meeting and Presidium. Dev elopment of International Ties

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

In the year under review, NAS of Ukraine focused its activities on developing advanced areas of science and technology, working out recommendations and proposals aimed at meeting current challenges of state formation, building up positive tendencies in the economy, resolving pressing social problems.

The annual session of NAS General Meeting, held on April 5, 2002, was an important event. It was attended by the Prime-Minister of Ukraine, high dignitaries of Verkhovna Rada, Presidential Administration, Cabinet of Ministers of Ukraine, other high-profile workers of state administration bodies, representatives of research institutions, mass media, public organizations. The session listened to the report of NAS academician B. E. Paton, the President of the Academy, on NAS of Ukraine activities in 2001 and main trends of its further work. The report, speech of the Prime Minister of Ukraine, presentations of the General Meeting's participants emphasized that the Academy assigned top priority to the development of basic research, scientific backup to the fuel-and- power sector and agribusiness, determination of the operating condition and residual service life of potentially hazardous facilities, as well as to their safe operation. The session of the General Meeting discussed and approved amendments and additions to the new version of NAS Statute. Winners of the prizes commemorating outstanding Ukrainian scholars and of the awards for young scholars and students were given diplomas for their achievements in research work.

On January 16, 2002 and November 14, 2002, celebration sessions of NAS General Meeting were held to mark the 50th anniversary of producing the first in Ukraine and Continental Europe electronic computer MESM and commemorate the 100th anniversary of academician S. O. Lebedev, a prominent scientist in computers. Numerous representatives of academic community, including guests from CIS and other foreign countries attended the sessions.

NAS Presidium traditionally attached great significance to developing fundamental research in natural, technical sciences and in the socio-humanitarian sphere. It discussed presentations covering the present status and prospects of developing information technologies in Ukraine; operation of the URAN system; furthering research into nanostructural materials in NAS institutions; regional aspects of global climate changes; prospects of studying corrosion and anti-corrosion protection of metal facilities in Ukraine; the status and prospects of laser techniques in eye investigations; development and commercialization of an advanced domestic chemical substance for increasing the output of agricultural crops; the family cancer syndrome and a new philosophy of preventing malignant tumors, issues of Ukraine's existence in the world civilization system; scientific basics of dividing economic authorization and responsibility between the central and regional administration bodies; Ukrainian population migration: its motivations, intentions and causes; studies of ethno-cultural processes in the frontier areas of Ukraine.

NAS Presidium gave significant attention to the problem of scientific substantiation of the construction project of the deep-water shipping Danube-Black sea waterway. It was pointed out that the canal construction through the absolute-preservation zone (the Bystre estuary) of the Danube Biosphere Reserve under the UNESCO aegis is unacceptable and against regulatory and legal norms of the national legislation of Ukraine and its international commitments to UNESCO. NAS Presidium approved a proposal for the necessity to discuss alternative projects.

A joint meeting of NAS Presidium and Ministry of Science and Education Board raised issues of their further collaboration in 2002-2007. Among major achievements of their joint activities in the past, the meeting emphasized extensive efforts towards developing a legal framework badly needed by both researchers and educationalists. Due to their fruitful interaction, a number of important legislative and regulative acts have been adopted, which define basic principles of functioning of science and education and are aimed at a significant rise in the status of scholar in the society.

In 2002, 15 NAS institutions presented reports on their research and research-organization activities.

On the eve of the 16th anniversary of the Chernobyl Accident, NAS Presidium pointed out at its meeting that the impacts of the gravest technological and environmental disaster of the XX century still have their effect on human lives. Ukraine has made a difficult decision on closing down the Chernobyl power plant and made a commitment to transform the plant and the adjacent territory into an environment-friendly zone, as well as took on the bulk of the respective work.

NAS of Ukraine carried on efforts to upgrade the network of its research institutions. A resolution was adopted to organize the Institute of Demography and Social Studies and the Institute of Scintillation Materials. The Institute of Food Chemistry and Technology under NAS and the Ministry of Agrarian Policy of Ukraine was incorporated into NAS Department of General Biology; a number of new joint ventures were set up.

NAS Presidium also kept in view publishing activities. In particular, it adjusted the schedule of preparing and publishing the III, IV and V volumes of «The History of the Ukrainian Culture», listened to the information on issuing the I volume of the «Encyclopedia of the Present-Day Ukraine», approved editors-in-chief of the «Ukrainian Physical Journal», journals «Advances in Metal Physics» and «Metal Physics and Cutting-Edge Technologies».

As in the previous years, the Academy gave significant attention to the cooperation of NAS institutions with Kyiv-based organizations and Ukrainian regions. E. g., a public joint session of the Kyiv City State Administration and NAS Presidium discussed the level of implementation the Agreement and Program on Cooperation in 2001-2002 and signed a joint resolution on the issue. NAS Presidium considered problems of implementing 'The Program of R&D development of Donetsk oblast out to 2020'. A Council on cooperation of the National Academy of Sciences of Ukraine with Ukrainian regions was set up under NAS Presidium.

NAS Presidium and Presidium Bureau made a number of decisions on transferring NAS housing stock and integral property complexes to local communities. Special attention was given to finalizing the offset payments of NAS budget-financed institutions for electric power, heat, natural gas, as well as to measures towards preparing institutions and organizations to the winter season, ensuring reliability and safety of exploiting buildings, facilities and engineering networks, eliminating emergencies.

NAS Presidium discussed current issues of the International Association of Academies of Sciences (IAAS) activities. In particular, information was presented on the Dushanbe meeting of IAAS Council, attended by delegations of academies of sciences of Belarus, Armenia, Georgia, Kirghizstan, Russia, Tadjikistan, Ukraine and two IAAS associate members — Joint Institute for Nuclear Research (Dubna) and Russian Humanitarian Research Foundation.

A significant role in the international collaboration was played by further development of joint research with the Russian Academy of Sciences. To this end, a public joint meeting of RAS Presidium and NAS of Ukraine Presidium was held in Moscow in May, which was concerned with the Year of Ukraine in the Russian Federation. RAS academician Yu. S. Osipov, NAS academician B. E. Paton and leading scholars of the two countries made speeches and presentations.

Actions were taken towards promoting an active involvement of NAS researchers into international projects of the Sixth Framework Program of the European Commission. They are based on the experience of NAS bilateral collaboration with EU member states and interest to the partnership on the part of research organizations of Austria, Poland and Turkey. The opportunities of NAS institutions and individual scholars to participate in this program have improved due to the Agreement on Cooperation in Science and Technologies concluded by Ukraine and the European Community.

NAS Presidium listened at its meeting to the information on the status and progress of

collaboration of NAS scientists with the European Organization for Nuclear Research (CERN) and identified actions to be taken to ensure involvement of NAS institutions in the activities of the abovementioned organization.

Inviting prospects for further development of regional international collaboration are opened up by joint efforts of the Black Sea Economic Cooperation (BSEC) member states. In this connection, information was heard concerning the meeting of the Council of the Presidents of the respective national academies, held at NAS of Ukraine in Kyiv on December 9-10, 2002. The meeting was attended by 10 delegations of the academies of sciences: those of Armenia, Azerbaijan, Bulgaria, Georgia, Greece, Moldova, Romania, Russia, Turkey and Ukraine. NAS Presidium also approved a decision on the development of NAS interaction with the International Center of Black Sea Studies.

Significant attention was given to the participation of NAS scientists in UNESCO programs. In particular, Kyiv hosted an international UNESCO workshop ‘Using information technologies and distant education to train and upgrade teachers: trends, policies and strategies’, which discussed pressing issues of education improvement.

A major step towards furthering cooperation in science between Ukraine and Macedonia, in particular, planning and implementing joint research programs in the humanitarian sphere, was made by NAS exhibition held in the Macedonian Academy of Sciences during the Days of Ukrainian science in Macedonia.

Scientific Backup to the Development of Fuel-and-Power Industry of Ukraine

A. K. Shidlovsky,
Vice-President of the Academy

Fuel-and-power industry is a major element of the Ukrainian economy.

It is the situation in the fuel-and-power sector (FPS) that determines the development of industry, agriculture, provision of services, municipal sector of Ukraine, and in the final analysis — the level of society development and quality of life in this country.

International and domestic experience has shown that successful use of market model of economy regulation, and of FPS in particular, is only possible if there is an efficient system of its R&D, technological, legal and regulative backup.

Power engineering is not merely a material- and power-intensive branch with long investment cycle, but first and foremost, it is an intellect- and research-intensive one. Its successful functioning requires the use of state-of-the-art achievements of science and technology.

In spite of the recent difficulties, we have obtained certain results, which could form the basis for further development of the fuel-and-power industry of Ukraine and solutions of some urgent FPS problems.

Projections of the demand for fuel-and-power resources in the economy and social sphere have been prepared for consecutive five-year periods out to 2030. General fuel-and-power balances, as well as those for different fuel types, have been developed, with account being taken of the possible development of fuel resource bases and minimization of energy imports.

A software complex to calculate emergency regimes in complex power grids was developed and commercialized in Dniprovska and Pivnichna power systems.

A pilot microprocessor system for locating damage in DC contact networks of direct current was put into operation at the Donetsk railways. It ensures a quick finding and clearing of the fault.

A study of intensive coil firing was carried out at Darnitska heat-and-power station power boilers, with a view to a substantial reduction in the amounts of natural gas and fuel oil spent for jet firing. It was found that installation of the gas-fuel equipment developed at NAS Institute of Gas instead of the available one would ensure a considerable reduction in the subsidiary-fuel consumption, an improvement of clinker separation and a decrease in fuel content in light ashes and clinker.

A method of integrated thermal processing of coal-concentration by-products, of peat, of agricultural waste was developed to produce generator gas and liquid fuel. A first draft of State program of using sludge and coal-concentration dry waste for firing in heat-and-power stations was worked out, which relied on the results obtained and took into account the resource base of the waste products.

50 automatic electric bolts with piezo-drivers were designed and commissioned at food industry enterprises, which allowed a significant improvement in the performance of dosage equipment for liquid and dry substances, improvement in fire-security and increase in energy efficiency of such enterprises.

Technologies to intensify gas extraction at inefficient gas wells were developed, to ensure a 3-4-fold increase in the productivity of gas, gas-condensate and oil wells due to active methods of stimulating oil- and gas layers.

A satellite technology of prospecting oil- and gas-bearing regions on the sea shelf and continental regions was developed, whose application ensures a 2.5-3-fold rise in the cost-

effectiveness of prospecting.

The Ukrainian National Energy Program out to 2010 and State Integrated Program of Energy Saving were developed and adopted; Energy strategy of Ukraine out to 2030 and further perspective is being completed. These documents are important regulatory guidelines for activities of state institutions in power engineering and energy saving.

Yet, it may be generally considered that there is a need for further improvement in scientific backup to the operation and development of FPC. Primarily, it concerns the organization of scientific backup to national, state and industrial energy programs.

To revive and develop research, technological and production potential of the power sector, an adequate level of functioning and development is to be ensured for energy research (including that at the Academy) and, above all, for its rational financing. Both budget finance and extra funds from various sources are to be raised for top-priority projects.

Lately, the problem of providing the power sector of Ukraine with skilled personnel has become especially acute.

Thus, power sector, as the society in general, is faced with numerous challenges.

All of them are to be resolved jointly, since one problem left unsolved stalls a search of effective solutions to the others.

«Green chemistry» and Advanced Technologies

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

In the XX century, chemical industry grew at an increased rate, and the total growth in products of oil refining as well as the basic and fine chemical synthesis industry has exceeded the volumes of chemical products in all the previous human history by several orders of magnitude. Naturally, such rapid growth in chemical production, due to imperfect technological processes used, has led to a sharp growth in the amount of gaseous emissions into the atmosphere, discharge of liquid and solid wastes that can gravely endanger human environment.

The concern of the scientific community for the problem of environmental protection has become particularly apparent in numerous new branches of environmental science, whose object of study is the impact of industrial production on ecosystems, as well as designing methods for disposal and decontamination of industrial waste. Practical implementation of this task requires enormous financial and material resources.

A more sophisticated approach to solving this problem is to search for solutions, whose basic difference is that they rather than trying to fight the effects are aimed at preventing the causes provoking the unfavorable environmental changes. A promising approach in these terms is to search for advanced processes and technologies which are primarily aimed at preventing (or drastically reducing) environmental pollution by cutting the volumes of chemical industry waste and their toxicity, using harmless substances (or substances safer than those currently used) as the starting materials and semi-products.

Such an approach began to be intensively developed in economically developed countries in the 1990-s and it acquired the somewhat unusual name of «green chemistry». It is based on a clear distinction from other environmentalist concepts aimed, as a rule, at eliminating of already existing negative impact of human technological activities.

One of the fundamental principles of «green chemistry» is that it is simpler and more cost-effective to prevent formation of waste in the process of chemical production rather than dispose of and recycle them later. To achieve «green chemistry» goals, it is of crucial importance to use new approaches to chemical products preparation and to develop whole new technologies on their basis. The basic current approaches are as follows:

designing and producing alternative catalysts and developing novel chemical processes with their application;

using new media for chemical reactions, in particular, bi-phase catalytic systems, ionic liquids or supercritical liquids;

conducting solvent-free reactions using alternative activation methods (e. g. microwave radiation, mechanic-and-chemical and ultrasonic activation etc.);

replacing currently used industrial reagents, catalysts and solvents with safe ones;

microbiologic and enzymatic methods for chemical products preparation, etc.

The «green chemistry» is currently in a state of explosive growth and development. The Royal Chemical Society in the UK publishes a specialized international scientific journal «Green Chemistry»; the American Chemical Society has established the Green Chemistry Institute with 23 local branches all over the world; the U. S. Presidential Green Chemistry Award was instituted seven years ago; the International Union of Pure and Applied Chemistry (IUPAC) in recent years has regularly held symposia and meetings on «green chemistry». Studies on some highlights in

«green chemistry» have also been carried out at numerous institutions of the National Academy of Sciences and higher educational centers of Ukraine. Among those are projects on developing alternative catalysts, solid-phase inorganic synthesis, inter-phase catalysis, studying physical-and-chemical fundamentals of the effect of physical factors on chemical reactions etc. A number of institutes of the Departments of Chemistry, Physical-and-Technical Problems of Materials Science, Physics and Astronomy are involved in solving those problems. Still, the scope of these works and in some cases their scientific level do not fully meet up-to-date requirements of the science progress. In this connection, more attention must be given to the activities of research teams engaged in this sphere, to increasing the number of such teams, alongside with diversifying and refining the subjects of their research. Of high scientific relevance is the issue of coordinating research efforts in «green chemistry», organizing meetings, symposia, conferences, educational programs in this sphere. No doubt, the introduction of chapters or even special courses dealing with concepts, principles and methodology of «green chemistry» to the schedules of chemical sciences courses in schools of higher learning would be very timely. Actually, it should make an impact on graduating students' skills in designing novel environment-friendly chemical processes and advanced technologies meeting the challenges of the XXI century.

Socio-Humanitarian Studies: Contribution to Scientific Backup of Innovative Development of Ukraine

I. F. Kuras,
Vice-President of the Academy

In 2002, scholars of NAS Section of Social and Humanitarian Studies aimed their efforts at profound analysis of current social-and-economic, social-and-political and spiritual-and-cultural processes, ensuring their reliable forecasting, scholarly substantiation of improving the innovation culture in the society as an important leverage for Ukraine's way to dynamic development.

Significant results were achieved in working out theoretical fundamentals of the state innovation policy, models, ways and mechanisms of innovative progress of the economy; studying economic, organizational and juridical problems of forming efficient state regional policy. The theoretical results mentioned have become the basis for designing prospective programs of social-and-economic development of Kyiv and Donetsk regions.

NAS of Ukraine scholars in the fields of politics and law substantiated ways to improve interaction of legislative, executive and judicial powers, optimize state administration in reforming the political system, worked out, approbated and ensured scholarly and advisory backup of draft laws in Verkhovna Rada committees, the Cabinet of Ministers of Ukraine and various ministries, in particular, the Law of Ukraine 'On the Cabinet of Ministers of Ukraine'.

Provision of a large-scale sociological monitoring of public opinion on pressing issues of social-and- political life of Ukraine plays a significant role in ensuring political, social-and-economic and cultural transformations, in forming high political culture of the society. Our scholars prepared a number of substantiated proposals and recommendations aimed at improving the social policy of the state, ensuring the Ukrainian society stabilization, lowering the level of social tensions and political confrontation, neutralizing sources of inter-ethnic, inter-confessional and inter-regional contradictions.

Results obtained in the sphere of social, political and cultural aspects of information science, computer linguistics, expansion of Ukrainian-language information space became the basis for Academy institutions' participation in working out of the draft Concept of state information policy in Ukraine, creation of a new series of Ukrainian dictionaries, their software version in particular, and developing domestic science-information resources.

A special place in the activities of socio-humanitarian institutes belongs to introducing their research results to the practice of education and culture sphere. NAS scholars have made a significant contribution to working out a draft State standards of basic and secondary education, numerous learning schedules, textbooks and learning manuals for secondary and higher schools. NAS institutions give substantial assistance to the development of museums and reserves, preservation of historical and nature landmarks, publishing and information activities.

Of great significance for the development of socio-cultural innovations in Ukraine is the research done by Academy institutes into the issues of raising the role of humanitarian factors in the present-day social development, preserving and updating the cultural, spiritual heritage of the Ukrainian people under new historical conditions.

Trying to meet pressing society needs for scholarly innovations, NAS institutions concerned with socio-humanitarian studies are becoming increasingly involved in the process of obtaining and commercializing research-intensive products that are a present-day competitive commodity, of

supporting and backing up top-priority tasks. Such approaches provide for deep transformation of the research activities themselves.

A joint session of the NAS Section of Social and Humanitarian Studies, the Ministry of Education and Science of Ukraine, academies of pedagogical and juridical sciences was held in 2002. It discussed issues of developing innovative activities in social, educational and cultural spheres, raising the researcher's innovation culture in the conditions of forming information society in Ukraine. The session played an important role in identifying future research objectives, as well as transition ways to new progressive modes of organizing the research process and active introduction of research-and-development results to the practical activities of state-power bodies, education and culture institutions. It directed our scholars toward searching for new forms and methods of efficient use of the creative potential of socio-humanitarian studies in the interests of economic, social, spiritual-and-cultural progress of the Ukrainian society.

Mathematics

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

In 2002, doing fundamental research, scientists of the institutions under NAS Mathematics Department obtained crucially new results in advanced fields of mathematical science.

Specialists in algebra started the theory of locally scalar representations of knapsacks in the Hilbert spaces, which establishes a close relation between certain sections of algebra and functional analysis.

In geometry and topology, the formula of the asymptotic parallelepiped volume for the case of isometric imbedding of three-dimensional Lobachevsky space in five-dimensional Euclidean space was produced. Final results for the global structure of Hopf's hypersurfaces in complex spaces of constant holomorphic curvature were obtained, as well as those in Sasabian spaces of j-constant curvature. A topological classification of functions with isolated singularity on surfaces was obtained.

In the field of the function theory, investigation was carried on into problems related to estimating the norms of derivatives for periodic and non-periodic functions given both on the whole axis and in its certain interval. Precise estimates in a class of one-sided approximations of functions by absolutely continuous functions were made. A new theorem about conformal differentiability of quasi-conformal mappings was proved.

In the area of functional analysis, the Pascal measure was constructed in the space of generalized functions, as well as the field of Jacobian operators for which this measure is spectral. The corresponding analysis was proposed for the Pascal white noise, which is the analogue of the classical white noise.

In the field of differential equations, the problem of asymptotic decomposition of a singularly perturbed system of linear differential equations in the complicated bifurcation point of the system coefficients was solved. For operator equations in the Hilbert space, precise asymptotic estimates for the error of approximate solutions obtained by the least-square method were derived. A degree theory was constructed for densely defined nonlinear operators, which are perturbations of a multi-valued maximal monotone operator; its applications to the solvability of variational inequalities and differential inclusions for nonlinear elliptic and parabolic equations were obtained. Conditions were determined of the unique solvability of boundary-value problems with data on the whole boundary for weakly nonlinear hyperbolic systems and linear systems with partial differential equations, which are not solvable with respect to a higher derivative in time.

The Poisson approximation of additive processes was constructed in the field of probability and mathematical statistics theory. Large-deviation theorems were proved for the logarithm of similarity relation in the scheme of distinguishing models in financial mathematics, which include the fractional Brownian motion with different volatile coefficients. Qualitative characteristics of the solutions of stochastic equations with local times were studied. Limit theorems were substantiated, and asymptotic behaviour of solutions as time tends to infinity was found.

In the field of the mathematical problems of mechanics, the conditions of gyroscopic forces predomination in non-conservative dynamic systems were investigated and the sufficient conditions of stability were obtained. The invariant form of the nonlinear equations for the motion of a solid body with a cylindrical cavity partially filled with liquid was suggested on the basis of the mechanical-analogy principles in the dynamics of liquid-containing solids. Passive-stabilization conditions were determined for the pendulum system of a particular form, and the correlation between system parameters was found, which ensures a «quick» damping of the oscillations. A

procedure to investigate steady-state dynamic processes in elastic bodies with spatial thin-walled rigid and elastic inhomogeneities was worked out via reducing the corresponding three-dimensional mechanical problems to the boundary integral equations with the Helmholtz-potential kernel.

In the field of mathematical modeling and applied mathematics, a two-sided numerically analytical method to solve boundary problems at semi-axis was developed for the second-order ordinary differential equations with a singularity in coefficients. An analytical solution was obtained for the problem of detecting the plastic-zone boundary on the plane of rock contact with the coal-bed weakened by prismatic underground workings in the case of finite hollows number. Conditions of the Hopf bifurcation initiation were found and the nature of branching of spatially heterogeneous solutions to the system of interconnected reaction-diffusion equations with cubic non-linearity was investigated.

In 2002, the Department analyzed the status and prospects of mathematical research and teaching mathematics at higher and secondary schools in Ukraine. Department's institutions held 16 international scientific conferences, workshops and schools, attended by scientists from the FSU and other countries.

Information Science

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

In 2002, on the basis of the results of fundamental and applied research, institutions of the Information Science Department developed an ellipsoid-method modification, which under minimization of highly extended convex functions provides the convergence rate several times higher than the ellipsoid method itself.

A solution to a discrete differential-game analogue was obtained, which is important both for the theory and practice in the case when measuring the pursued state vector is obstructed, depending on the distance between the two players.

A philosophy was worked out to produce possible scenarios of the development and functioning of complicated systems with different inherent characteristics. It was based on the system development of mathematical and software support for the Delphi quality-analysis method, taking into account mutual effects, relations, essential uncertainties and different risk stages and levels.

A solution was found to the applied game problem concerning soft landing of a moveable object for second-order systems with friction, where the classical Pontryagin condition does not apply and phase limitations are present.

Also developed was a formalized representation of the integration technologies within the framework of interaction between intelligent networks and distributed systems.

Models were constructed to be used for optimal control of multi-component distributed systems described by correct and conditionally correct boundary-value problems for second-order elliptical equations with conjugation conditions and for fourth-order ordinary differential equations with different controls and observations. Optimal-control existence theorems were proved.

The RADA-3 system was developed on the basis of advanced information technologies and later put into operation. It is used for providing information services to the deputies of Verkhovna Rada of Ukraine.

In the area of software quality assessment and provision, the core quality-engineering knowledge was described and a set of scientific and methodological papers was produced, where software life-cycle processes are presented.

Principles were proposed to produce systems for optical recording of different versatile high-distribution structures in polar and Cartesian coordinate systems.

A unique mathematical apparatus was elaborated and used to theoretically prove the existence of critical values of information incompleteness indices for the first time ever. They define the conditions of changes in the model structure (complicacy).

The methodological role of information science and the possibilities to use it in various research activities were determined.

Conditions were found for existence of optimal non-randomized Markovian strategies and their uniqueness. Markovian and semi-Markovian models were built to control storages with general-form loss functions in an infinite time interval.

The structure of a special-purpose agent was designed for a multi-level multi-agent decision-making preparation system, with agent technologies being used here. For purposes of discrete optimization, an adaptive algorithm was developed. It can be used as an efficient tool in shortening the heuristic directed search, when non-formalized problems are solved.

Scientific and methodological basics were worked out to identify information policy and minimize information damage under global transformations of information systems.

A hardware-software system was produced, intended for recognizing a human face and objects through the use of visual information and visual image databases. Besides, a hardware-software

system for controlling a robot with gestures was developed.

Methods and means were created to provide hardware and software support for multi-cluster architecture in intelligent solving machines. The structure of the intelligent interface for the user of such a machine was designed for supporting the dialogue with a database in a natural language, including the structure and body of the electronic English-Russian dictionary that contains over 1 mn words and word combinations. A pilot design of the two-cluster and four-processor system was produced for experimental research.

A stamp manufacturing technology was developed for producing CD copies, using inorganic photo-resists. The resolution provided is from 0.2 - 0.3 mcm.

Pilot versions of electronic multimedia-based manuals and self-study handbooks of physics, mathematics, biology and chemistry were developed. They are intended for higher-school applicants or remote-training systems.

Mechanics

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

In 2002 scientists of the Mechanics Department of NAS of Ukraine obtained a number of new important results.

The dependence of the strength of plates with a boundary crack on the local instability under tension was studied experimentally.

On the basis of the numerical methods developed, patterns of elastic wave propagation in the layered composite material with initial stresses were investigated.

Using the methods advanced, research was done into the stressed state and dynamic characteristics of inhomogeneous non-circular cylindrical shells and plates in classic, refined and 3D formulations.

The equations of arbitrary loading processes on any flat trajectories were proposed, with account being taken of the kind of the material stressed state and the technique of investigating the stress-strain state of shells and bodies of revolution.

A local-wave approach to investigating shock interaction of two similar elastic bodies was worked out. An approach to investigate nonlinear bending waves in cylindrical shells under interaction with moving liquid was suggested.

At the stage of designing the 'Tsyklon-4'carrier-rocket technical shape, mathematical modeling of longitudinal vibrations of the carrier-rocket as a multivariate nonlinear time-dependent system was done, and a theoretical prediction of space-ships dynamic responses (space-vehicles longitudinal vibro-accelerations) in the process of their launching into operational orbits was made.

The possibility was substantiated and basic principles determined of producing versatile vibro-protective modules with quasi-zero stiffness at the operative part of the static characteristic for units of space, automobile and tractor vehicles.

A methodology was developed and a numerical-experimental solution obtained for the problem of evaluating the deterioration rate for power characteristics of spaceship solar batteries under the influence of integrated factors of space and near-satellite environment during continued service (10 years) in geo-stationary and hyper-elliptical orbits.

As a result of analytical studies of equations of motion of railway vehicles on bogies with frictional dampers, a phenomenon of jamming was found, which is accompanied by a many-fold increase in interaction forces between bogie elements, reducing the bogie service-time.

Investigations were done into the patterns of the impact of Mode I cracks on natural frequencies and damping capacity of rectangular plates and the degree of distortion of their vibration harmonicity in principal and superharmonic resonance.

On the basis of a complex of analytical-and-numerical investigations and with the use of the perturbation method, an algorithm was developed to determine the spectrum of natural vibrations of a generalized discrete model for a regular mechanical system of the bladed assembly type with violated symmetry, with account being taken of their aerodynamic coupling. An analogy of such an effect of coupling and frequency distortion of single-type elements on the patterns of the resonance wave-shaping in the system was determined.

A law of movement of loose-environment particles in a horizontal stream of compressed air was found, which was recognized as a science discovery and registered by the International association of discoveries under № 197.

In accordance with the Decree of the Cabinet of Ministers of Ukraine of 27. 09. 2000 № 1463 'On the development of industrial methane extraction from coal deposits of Donbas', for the first time in Ukraine, an American technology of hydrofracture of sandstones in well drilling from

surface chinks was adapted for Donbas conditions jointly with SE AFS, with a view to intensifying metane extraction.

A design philosophy and practical recommendations concerning control of dynamic performances of multi-element piezo-active radiating systems were developed.

Refined was the theoretical model of the combined action of buoyancy forces due to a heated or cooled moving wall and viscous effects on formation of vortex structures in finite domain.

A mathematical model for the processes of turbulent transfer of the non-conservative mixture in temperature-stratified medium was worked out, intended for forecasting the level of air pollution.

Numerical models were produced to estimate stability and stress-strain state of inhomogeneous rock and soil slopes, with account being taken of filtration forces and different medium phases.

A new approach to the theory of parametric oscillations of Hamiltonian systems was suggested, which allows the proofs of the basic theorems of the theory itself to be simplified and a number of new results to be obtained.

Physics and Astronomy

A. G. Naumovets,
Academician-Secretary of the Department

In 2002, scientists of the Department focused their efforts on gaining new basic knowledge in topical fields of physics and astronomy, the development of advanced technologies based on this knowledge and on training a young generation of researchers.

So, the most stringent limitation available on the mass of the Majorana neutrino - <mv> J 0,2 eV - was established in the Solotvyn Subterranean Laboratory of NAS Institute for Nuclear Research.

The reliability of the determination of the shift in the embrittlement critical temperature versus fast-neutron fluence was substantially improved for the base metal and the welds of the reactor vessels of Khmelnytsky and South-Ukrainian nuclear power plants.

It was found that the nanocystalline state in iron resulting from intense plastic deformation can be used as a basis for novel methods to improve the performance of iron-based alloys.

Experimental and theoretical studies of the «memory» effects in biological macromolecules showed that these phenomena are associated with the residual strain conserved in the macromolecule after each elementary cycle of functioning. Optoelectronic sensors were demonstrated to be useful for non-invasive monitoring of variations in oxygen saturation of arterial blood.

With the UTR-2 radiotelescope and a new multichannel device with a record sensitivity, a series of new interstellar spectral lines was detected: a-type hydrogen lines, carbon lines of b- and g-types, as well as new lines which are not identified as yet.

In 2002, the Department institutions launched a target program of basic research, planned for 2002-2006. 79 projects under the program cover priority areas of physics and astronomy, with a special emphasis on nanophysics and nanoelectronics. A permanent Kyiv-city workshop on these important subjects was initiated in 2002 at NAS Institute for Semiconductor Physics. A special meeting of NAS Press-Club and the Ukrainian National Association of Journalists, concerned with nanotechnologies, was organized jointly with chemists, medical and materials scientists.

The institutions of the Department received 157 international grants in 2002.

Issues of training physicists and astronomers at universities and secondary schools were discussed at the General Meeting of the Department in the December of 2002. A number of measures were planned to assist schools in teaching natural sciences. In particular, the Research and Educational Centre will be organized using the facilities of NAS N. N. Bogolyubov Institute of Theoretical Physics and the Kyiv Natural Sciences Lycee №145.

In 2002, the Division of the Physical-and-Technical Problems of Mining, which functioned under NAS O. O. Galkin Physico-Technical Institute in Donetsk, was reorganised into NAS Institute of Physics of Mining Processes, its strategic task being the improvement of mining safety.

The works carried out with the contribution of Department's scientists were awarded two 2002 State Prizes of Ukraine in Science and Technology, the President of Ukraine Prize for young scholars, and the Prize of the Presidents of the Academies of Sciences of Ukraine, Belarus and Moldova. Academician V. V. Yeremenko received the order 'For Services', and Drs. V. P. Churilov and Yu. M. Yampolsky the titles of 'Honoured Worker in Science and Technology of Ukraine'. NAS corresponding member V. M. Loktev was elected a member of the European Academy of Sciences, Arts and Humanities. Dr. M. I. Gorenstein won the A. von Humboldt Prize (Germany). NAS corresponding member O. B. Shpenyk was awarded the Daniel Feier Medal of the World Council of Hungarian Professors. Dr. V. G. Gavrilyuk won the title Doctor Honoris Causa of the

Helsinki Technical University.

Of the Department's unresolved problems, that of preserving research personnel grows increasingly threatening. It becomes especially acute due to massive retiring of highly skilled scientists, while many active researchers of the medium generation are working abroad, and university graduates are unwilling to join academy institutions because of low salaries, lack of up-to-date equipment and housing problems. This endangers the very existence of our science schools. Research activities are also severely stalled by the scarce finance for subscriptions to academic periodicals, infrastructure maintenance and electronic communications. Thus, under such conditions, the Department's scientists have to work hard and purposefully to complete the scheduled investigations, which are of great importance for this country.

Geosciences

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

In the year under review, a joint session of the Earth Sciences Department Bureau and the State Geological Service of Ukraine was held. It was concerned with improving the scientific basis and methodological provision of regional geological research (RGR). Taking into account the utmost importance of this research for the state, the need for a highly informative, well-based multi-purpose geological basis in the shape of 1: 200000 State geological map, a decision was made to set up the Inter-agency research-and-methodology center for coordinating RGR in Ukraine, which would involve leading specialists of the Department.

NAS academician V.I.Starostenko, Academician-Secretary of the Department, made a presentation 'On implementing the state policy in mineral resource management' at a meeting of Verkhovna Rada Committee on nature management and elimination of Chernobyl accident impacts.

A number of institutions, functioning under the Earth Sciences Department and the General Biology Department, participated in working out the integrated state program of further development of infrastructure and economic activities on Zmiyiny island and the continental shelf, which was approved by the Cabinet of Ministers in the May of 2002.

Jointly with leading marine institutes and centers of the Mediterranean - Black-sea countries, under the EU MEDAR-MEDATLAS II project, a high-level up-to-date information product was developed. It includes a database and atlas of basic hydrophysical and hydrochemical characteristics of the Black and Mediterranean seas and is a component of the European information system of marine conditions coverage.

An integrated analysis of the current situation in managing radioactive tailings (RAT) of the 1st, 2nd and 3rd power units of the Chernobyl NPP, as well as 'Shelter' facility, was carried out. Main areas of improving the existing system of RAT management were identified and 'The integrated program of RAT management at the stage of Chernobyl NPP decommissioning and transforming the 'Shelter' facility into an environment-friendly system' was developed.

For the first time in Ukraine, an integrated technique for mapping thermal and atmospheric-and-geochemical anomalies was used to forecast carbohydrate traps in water areas of the Azov and Black seas. Promising areas for further exploration were suggested.

Updating and generalization of geochronological and isotope-and-geochemical data on significant rare-earth deposits of the Ukrainian shield was made in compliance with current research and methodology requirements, a pattern of stages in ore-formation development was found.

Using the geodynamic analysis, promising non-anticlinal oil and gas reservoirs were discovered on the Volyn-Podillya margin of the East European platform. Morphological structures of reef genesis were found in the Silurian complex, and stratigraphically and disjunctively screened traps were identified in the Cambrian complex.

Under the national program 'Minimization of Chernobyl accident up to 2010', a concept of geological environment migratory heterogeneity and existence of zones with abnormally fast migration of substances, radionuclides in particular, was developed. Hydrogeological and migratory models were verified for pilot areas in the Chernobyl exclusion zone.

Geochemical studies of the natural environment (soil, water, vegetation) were carried out in major state natural and biospheric reserves of Ukraine. The research was aimed at obtaining ecological-and-geochemical criteria for assessing ecological stability of landscapes, migration and formation of mobile toxic metals in the soils of various landscapes, as well as at studying sorption-stripping processes in the soil-solution-plant system.

Under the state research program in the Antarctic and on Ukrainian ‘Vernadsky’ Antarctic station, islands and the water area of the Argentinean Archipelago and the Bellingshausen Sea, topographic and geodetic survey and marine depth measurements were carried out, resulting in a series of mappings of various features of the sea-bed relief. A model was developed and factors determined concerning organic contamination distribution from the air to various constituents of Antarctic environment.

Researchers published «Space for Ukraine» atlas — Atlas of Thematically Interpreted Images of Ukraine’s Territory Acquired in the Frame of Ukrainian-Russian ‘Okean-O’ Program and Space Missions, which will promote achievements of the Ukrainian science internationally.

In the near future, institutions under the Department of Earth Sciences will choose areas for their fundamental and applied research from the top-priority problem for Ukraine — increasing the mineral resource base of the country as a whole.

Physical and Technical Problems of Materials Science

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

In 2002, scientists of the Department of Physical-and-Technical Problems of Materials Science of NAS of Ukraine obtained a number of important research results in priority areas of the present-day materials science.

The mechanism of determining residual stresses in welded structures, based on the use of a short-time pulse of current, was studied and validated experimentally. The procedure suggested opens up wide opportunities for non-destructive in citu diagnostics of welded structures during fabrication and service.

Investigations were carried out towards development of welding consumables with ultra-low hydrogen content. Patterns of hydrogen interaction with spot and three-dimensional defects in the structure of steels were discovered. Priority types of traps were determined; they are intended for preventing hydrogen embrittlement in welding of steels.

For the first time ever, integrated studies of the process of diamond nano-particles transformation into the so-called carbon ‘onions’ of about 5-nm size and 600 m2/g specific surface were made. Using advanced methods of structural and spectroscopic analysis, the inheritance of morphology and sizes of carbon ‘onions’, specifics of their Raman spectra and p-electrons energy distribution were determined. High hydrogen-sorption ability of the carbon ‘onions’ at the level of 11 wt. % H2 was found for the first time. The results obtained are of great importance for studying the physical nature of the new cluster and nano-structural forms of carbon, as well as for further development of radically new materials — hydrogen accumulators with significantly improved hydrogen-sorption performances.

Diagrams of electrochemical resistance and corrosion crack resistance of welded joints of the ‘anti-corrosion surfacing — hull steel’ type were plotted, which are basic for evaluating their residual life and developing methods to prevent corrosion-mechanical damage under continued service conditions. An analytical relation for evaluating corrosion-fatigue life of T-shaped welded joints was found and validated experimentally. It incorporates the values of applied cyclic stresses, the length of corrosion-fatigue cracks, number of loading cycles, maximum corrosion current and electrochemical dissolution constants.

A new method to determine elasticity modulus of materials during nano-hardness investigations was developed, which involves a preliminary determination of the blunting radius at the apex of the Berkovich indenter with the use of reference materials and a subsequent calculation of the sample elasticity modulus, using the Hertz’s equation. The method could significantly improve the accuracy of measurements in nano-indenting up to the 20-nm depth.

To up-grade technological processes of producing melts of cast iron and steel with a view to resource saving in the integrated metallurgical production, a scheme of liquid-slag multiple use in melting and ladle treatment of metal melts was proposed. Scientific principles of designing this arrangement were developed. The respective feasibility study showed that this design could pay off during the very first year of the facility operation.

Basic properties of semiconductor scintillators based on isovalently-alloyed crystals of zinc selenide were studied: their X-ray, cathode luminescence, radiation stability and optical-electronic properties.

A thermoelectrically new technology of transition layers formation was developed — that of thermoelectric metal material and materials with a programmed non-homogeneity — via detonation

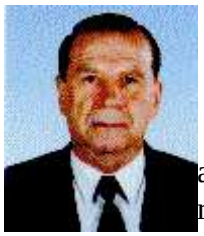
spraying. On its basis, multi-layered anti-diffusion commutation structures with thermally-damping sublayers were produced. High efficiency of the structures produced was confirmed by cyclic and service studies of cascade thermoelectrical energy converters.

Patterns of physical-and-chemical transformations in non-fluxed low-silicon (1-3 % SiO_2) magnesia pellets and high-silicon (6. 5 -13% SiO_2) partially-fluxed pellets were determined. A procedure for quantitative evaluation of distribution of pellets and agglomerate particles over distributor positions, as well as methods of loading-mode adjustment were developed and commercialized at blast furnace No. 9 of 'Krivorizhstal' metallurgical plant. They provided a 1,5-2% increase in the rate of gas utilization, an 11 kg drop in coke consumption per ton of cast iron, a 2. 5-time decrease in the frequency of tuyere burning and furnace idle time.

The Presidium of NAS of Ukraine adopted a decision concerning the reorganization of the 'Institute of Single Crystals' R&D concern of NAS of Ukraine into an R&D complex and the organization of NAS Institute of scintillation materials as its integral part.

In 2002, four works done with contribution of Department's researchers were awarded with the State Prizes of Ukraine in Science and Technology. Seven scientists became the winners.

Physical and Technical Problems of Power Engineering



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

In 2002, research activities of the institutions of NAS Department of Physical-and-Technical Problems of Power Engineering were aimed at solving the most relevant and important problems of Power Engineering, at developing efficient technologies and state-of-the-art equipment.

In accordance with the President of Ukraine decree ‘On Developing Energy Strategy of Ukraine out to 2030’, leading experts of the Department carried out research concerning forecasts of the Ukrainian Fuel-and-Power Complex development.

Scientists of the Department investigated nano-processes of deformation and failure in heterogeneous dispersed biological systems during rotor-pulse and thermal-moisture processing.

A method for solving geometrical reverse thermal-conductivity problems to locate thermal sources in arbitrary areas was developed, taking into account temperature-field limitations. New approaches were found to mathematical modeling of convective heat transfer by laminar forced convection in tubes and channels of complex slits, with allowance being made for the initial thermal region.

Theoretical research into transition and steady-state regimes in the series oscillator with reverse commutator in the capacitance (inductor) circuit were developed further, new criteria were worked out to evaluate the duration of transition regimes in circuits with commutator, with account being taken both of the circuit and commutator parameters, as well as of the mode of its switching into the circuit.

Methods to analyze dynamic regimes related to transient regimes in generator circuits and power grids, which result from unexpected short-circuiting processes, were worked out.

A method, algorithm and software were developed to solve a bound problem of non-stationary aerodynamics and elastic oscillations of bladed devices, concerning three-dimensional hyper-sound ideal-gas flows through a stage of axial-flow turbine.

An approach and software for long-term forecasts concerning development of mining industry of Ukraine were worked out, that take into account both the reduction in the number of facilities (closing down) and their increase (construction of new mines and upgrading of the operating ones). A mathematical model of investment activities in mining industry was produced.

Designs of and calculation methods for fire-boxes of low-power water-heat boilers and steam boilers were developed, with a view to their switching to burning high-ash coal in the fluidized-bed technology.

A system for monitoring emergency processes at the oblenergo level was constructed (‘Poltavoblenergo’ Ltd.).

Control systems of gas-diesel power generators with changeable firing dose of the diesel fuel were designed jointly with a German company ‘Heitzman’, and the production of fuel equipment for converting autonomous power stations of 50 - 800 kWt power to operation on simultaneous oil gas, natural gas and biogas was organized.

A computerized system for monitoring vibrations in turbine engines was put to operation at the Zaporizska heat-and-power plant. It improved the efficiency and reliability of the power station operation.

An atlas «Ukrainian Geothermal Energy Resources and Technology of their Application» was published.

Proceeding from the importance of developing high-efficiency environment-friendly coal technology for the Ukrainian economy, NAS R&D Coal Power-Technology Center that operated under NAS of Ukraine and the Fuel-and-Power Ministry was transformed into the Institute of Coal Technology under NAS and the Fuel-and-Power Ministry of Ukraine.

The 'Institute of Engineering Thermophysics' technopark was created using the facilities of NAS Institute of Engineering Thermophysics.

Chemistry

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

Research in chemistry is carried out at 12 Institutes and their 2 subsidiaries by more than a thousand of highly skilled scientists, 11 academicians and 20 corresponding members of the National Academy of Sciences of Ukraine, 173 doctors of science and 758 candidates of science among them.

In 2002, attention of the scientists of the Institutions of NAS Department of Chemistry was focused on furthering fundamental research in advanced areas of chemistry, developing priority technologies on its basis, as well as on improving research-organizational activities, stabilizing the research work-force and training a new generation of scientific workers.

A number of major works in priority areas of present-day chemistry, aimed at developing new high technologies, were performed:

- a method to synthesize Ge nanoformations with specified parameters in Si matrix was developed, that allows zonal structure in the Si-Ge quantum conversion to be varied. Jointly with NAS Institute of Physics, a first observation of dimensional quantification of Ge nanocrystals on Si (100) was made, using the field-emission method;
- an original sol-gel technology to produce spherical granulated zirconium dioxide at a pilot facility was developed and tested for the first time. It can be used as a basis for manufacturing state-of-the-art varieties of sorbents, catalysts and superacids;
- basic patterns of the effect of the halogen nature in acylic group on electrochemically activated introduction of carbon dioxide into halogen anhydrides of aromatic acids were found. By varying the halogen nature, this allows selective control of the process to obtain different products (acids, aldehydes, diketones etc.), in particular, commercially important a-oxocarbonic acids with ~ 90% output;
- a convenient method to synthesize cryptands containing carbamide and tiocarbamide groups was developed. Based on the study of chelating properties of the cryptands obtained, a Cu2+-selective electrode was produced;
- a new hitherto unknown phenomenon was experimentally found and investigated for the first time, namely, the nanocluster catalysis of disproportioning free radicals by synthetic analogues of bacterial ferredoxines (Fe4S4-cluster). It provides whole new opportunities in developing advanced nanostabilizers of oxidation of biological and organic materials;
- an integrated technology to purify and desalinate waste water of domestic garbage dump was developed. It provides for utilization of all water-treatment products and production of water that complies with all standards for water discharge into surface water basins.

The testimony to a high level of scientific research done by chemists of the Department is organization and hosting of numerous international conferences, symposiums, congresses and other scientific gatherings: the III Ukrainian Congress on electrochemistry; a science session ‘New functional inorganic substances, materials, coatings’; an international symposium on organic chemistry to commemorate the 100th anniversary of academician O. V. Kirsanov; «Vibrotechnology-2002» international conference, an international conference ‘Partition surface of phases against pollution’.

NAS corresponding member A. F. Popov, V. A. Saviolova, Yu. S. Simanenko, researchers of L. M. Litvinenko Institute of Physico-Organic Chemistry, were awarded with NAS O. I. Brodsky prize for a cycle of scientific works ‘Supernucleophylic systems for splitting ecotoxicants-neurotoxicants’.

The President of Ukraine prize for young researchers of the National Academy of Sciences of

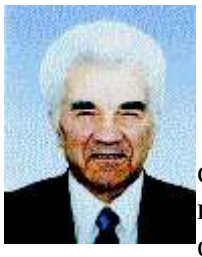
Ukraine went to O. V. Shvets, Z. V. Smila from NAS L. V. Pisarzhevsky Institute of Physical Chemistry and L. K. Patrilyak and R. V. Likhniovsky from NAS Institute of Bioorganic Chemistry and Petroleum Chemistry for a cycle of scientific works 'Development and study of zeolites (molecular sieves), catalysts and composition materials on their basis'.

I. P. Gerasimyuk, I. M. Duchno and C. A. Kopyl, employees of NAS Institute of Sorption and Problems of Endoecology were awarded with NAS of Ukraine Prize for young scientists for their study 'Synthesis, sorption, electrochemical and catalytic properties of new forms of active carbon'.

G. O. Kachkovsky, a student of T. Shevchenko Kyiv National University, won NAS of Ukraine Prize for university students for the work 'Synthesis of oxystyryle series dyes on the basis of calix[4]arenes for producing chemisensors'.

O. V. Klimchuk, a researcher of NAS Institute of Organic Chemistry, was awarded with NAS Chemistry Department L. M. Markowsky Prize for young scientists for the work 'Synthesis of phosphorylated calixarens — basic components of extraction systems for handling waste of nuclear power industry'.

Molecular Biology, Biochemistry, Experimental and Clinical Physiology



G. Kh. Matsuka,
Academician-Secretary of the Department

In 2002, fundamental research concerned with further studies of physical-and-chemical basics of biological systems organization was conducted. Due to the research done, new data in various fields of biological and medical science were obtained.

The O. O. Bohomolets Institute of Physiology and the International Center of Molecular Physiology obtained new data on molecular mechanisms of excitatory and inhibitory synaptic transmissions in different types of brain nerve cells, the mechanisms of plastic changes in these processes upon the continued activity of some intercellular structures, as well as their disturbance in experimental models of pathologic states — hypoxia, epilepsy, diabetes. Changes in the interactions of ionic channels, mitochondria and endoplasmic reticullum during the malfunction of sensor neurons of rats after experimental excitations of painful syndrome were found for the first time ever. The investigations were carried out jointly with scientists from the US State University and a German university.

At the O. V. Palladin Institute of Biochemistry, highly specific antibodies for diphtheria and whooping cough were obtained. The conjugates of these antibodies with peroxidase and biotin were synthesized. The possibility of their use for detecting respective toxins was shown, with a view to diphtheria and whooping cough diagnostics.

Experimental methods of studying streptokinase and a2-antiplasmine effect on the homeostasis system were developed, which keep promise for further fibrinolytics use as well as for investigating molecular mechanisms of pathogenesis of complicated streptococc infections.

At the D. K. Zabolotny Institute of Microbiology and Virology, significant attention was given to fundamental research, which is important for further developments in biotechnology. Thus, resistivity and adaptability of some industrially important yeast to unfavourable conditions was studied, the aim being their use in various climatic zones. Restriction maps of different types of lactic acid bacteria were constructed due to studies of their molecular structures, which allow them to be used rationally in dairy industry.

At the Institute of Molecular Biology and Genetics, pioneer data were obtained on the reduction of main cytoplasmic chaperone Hsp70 expression in cardiomyocites of myocard affected with dilative cardiomyopathy resulting in anomalous forms of major cardiac proteins. Researchers developed the concept of automated multi-sensor arrays, using advanced mathematical apparatus. On this basis, they proposed laboratory biosensor prototypes for detecting organophosphate, carbamate and triazine pesticides.

At the R. Ye. Kavetsky Institute of Experimental Pathology, Oncology and Radiobiology, the mechanism of functioning of a new CD 150 receptors subfamily, which switches signal cascades, depending on their association with adaptor peptides working as molecular switchers, was determined for lymphoid and dendritic cells. The results obtained serve as background for developing approaches to, and methods of, regulating these cascades in tumor cells.

At the Institute of Cryobiology and Cryomedicine, techniques of cryoconservation of early-phase human embryos were developed. Slow cooling under 1,2-propanole protective atmosphere was shown to be the optimal cryoconservation method for early-stage human embryos. Research into cell processes at low temperatures gave rise to new cryoconservation procedures for early-stage human embryos, which use protective biologicaly active substances.

Fundamental medical research carried out by scientists at institutions, functioning under the Academy of Medical Science of Ukraine and other ministries and agencies, also led to substantial results. In particular, medical scientists developed new diagnostics, methods of treatment and prevention of dangerous human diseases. Special emphasis was laid on studying such human diseases as cancer, cardiovascular, immune-system diseases etc. It was proved that current aggravation of various diseases results from the negative impact of the Chernobyl disaster, increased integrated effect of industrial air pollution on human organism. Studied were peculiarities of these factors effects on organisms of mother and child, the elderly etc. The results obtained allowed new approaches to be developed to prevent further negative impact of these factors on human organism.

In 2002, many scientists of the Department were awarded for their achievements in biology and medicine. State Prizes in Science and Technology were awarded to researchers of NAS Institute of Cryobiology and Cryomedicine, the Institute of Occupational Medicine (AMS) and of D. Halitsky Lviv State Medical University.

General Biology

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

Research institutions of the Department of General Biology study a wide range of problems in priority areas of the present-day basic life science. A special emphasis is placed on sub-cellular and cellular organization of biological systems, genetic and cell engineering, plant and animal phylogeny, studying flora and fauna, general aspects of biological diversity, rational use of natural resources and preservation of live nature, as well as plant genetics and selection. Simultaneously, they are meeting challenges of natural reserves issues, organizing ecological corridors, monitoring the condition of plant and animal life in various regions of Ukraine and furthering environmental studies.

In the area of physical and chemical fundamentals of biological systems organization, our specialists started research into regulatory and signal systems of the plant organism that mediate stress factors effects and form respective adaptive response in the system of physiological and biochemical reactions and morphogenesis. A system character of the plant response to unfavourable environmental impacts, such as droughts, low temperatures, ionizing or ultraviolet radiation was found. The mechanism of inducing cell DNA repair in response to the action of genotoxic agents was revealed. New data were obtained to elucidate the mechanism of microgravitation and weightlessness effect on biological systems at various levels of organization: from perceiving the gravitational stimulus by sub-scellular structures to changes in the ‘source-sink’ ratio in the multi-cellular plant as a whole. Significant progress was achieved in studying fine adjustments of the photosynthetic apparatus, regulatory effect of phytohormones and formation of plant resistance to phytopathogens. New approaches were used in studying insect locomotion.

The development of research into radiobiological effects of radionuclide pollution of the Ukraine territory, caused by the Chernobyl accident, helped identify radiation-induced genome instability as a cause of various negative remote impacts of irradiation.

Research related to biotechnological issues of genetic and cell engineering was extended. Transgenic plants of various plant families were produced. Some promising transgenic forms of plants resistant to certain herbicides were found. The efficiency of plant genetic transformation through the use of genetically modified plastids was substantiated. Phenotypic variability of cell hybrids caused by nuclear genome, plastome and recombinant mitochondria was proved. A technique was developed to use plants as ‘incubators’ for synthesizing pharmaceutical preparations of the protein nature, coded by genes included in virus DNA. Yet, studies were carried out to outline biosafety requirements for using transgenic plants in industry.

New species of hormogonic algae, lichens, fungi, mollusks, fish and mammals, as well as numerous genera of invertebrates, were discovered. Plant, fungus, lichen and animal species new to Ukraine were found. New cosmopolitan species were found in the water areas of the Black Sea and the Sea of Azov, and their negative impact on the populations of valuable food fishes was shown. Some regions of the Black Sea with especially rich biodiversity of benthos fauna and diatomic flora were located.

Research into the biodiversity in Ukraine, as before, was concerned with a wide range of fauna and flora issues and covered all diverse ecosystems characteristic of Ukraine. A gentaxonomic description of forest biodiversity in some regions of Ukraine was given and their synphytosozoologic assessments were made. The principles of compiling the «Green Book», recognized by numerous European countries, were worked out. Much attention was given to studying beneficial entomofauna in Ukraine, in particular, to insect pollinators of plants and species, which could prove to be useful in biological methods of controlling slugs and insects harmful to

plant growing, horticulture and forestry.

Results of environment studies became the basis for generalizing information on biogeochemical migration of heavy metals and radionuclides along trophic chains in different natural and man-made ecosystems, as well as for determining population effects due to changing environmental situation. Sensitive biosystems intended for monitoring ecological quality of the environment were produced.

Significant efforts of scientists of the Department of General Biology were aimed at obtaining results of immediate value for agribusiness. Among them was the production of preparations with adaptive and phytohormone action, new types of fertilizers, as well as new methods of agricultural crop selection.

Combining theoretical research with the desire to search for new insights into the nature of functioning of biological systems at different levels of organization — from cells to populations and complex biocenoses — in order to solve practical problems of preserving the biodiversity, developing biotechnologies, methods of controlling biological processes in the best interests of mankind will remain the basic principles in the activities of the Department of General Biology.

Economics

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

During the year under review, the efforts of the researchers of the Economics Department were focused on solving important and urgent science problems. In particular, they were concerned with producing an efficient mechanism of economic restructuring and its institutional basis; re-orientation of the financial system to increase the possibilities of financial institutions in providing investments and resources for the real sector; assessing the R&D potential and elaborating, on this basis, an efficient innovative- and investment-based development model supported by qualitatively new technological foundations; substantiating the guidelines to improve the efficiency of the agrarian reform and identifying strategic directions and mechanisms of the post-reform development of Ukraine's agribusiness; designing up-to-date welfare systems; justifying the incentive role of wages in increasing labor productivity; overcoming the demographic crisis impact.

Our scientists analyzed the tendencies of globalization in the economic development and Ukraine's integration to EU, worked out strategic priorities in innovation back-up for sustainable economic growth.

The Department's institutions elaborated a medium-term strategy of efficient development of Ukraine, in particular, strategies for the transition from the current exogenously-dependent transformation model to the basically endogenously-oriented one, which would be aimed at implementing the innovative model of economic development. Scenario-based medium-term forecasts of Ukraine's socio-economic development were produced; on their basis an estimate of the overall economic situation was made, and positive and negative trends in its development, bottlenecks and growth points were revealed.

The Department conducted an integrated study concerning the Strategy of Ukraine's cooperation with NATO. A research project on 'Frontier migrations in CIS: Ukraine - Russia - Belarus - Moldova' was completed. Researchers prepared a feasibility study for setting up the Institute of Demography and Social Research in NAS of Ukraine, organized in compliance with the respective Decree of the Cabinet of Ministers and Resolution of NAS Presidium.

The Department's institutions developed a concept of the mechanism for implementing regional policy under the formation of a new socio-economic environment in this country, which is oriented towards active government's regional policy and consolidation of the regions' own socio-economic potential.

The Department determined priorities for the development of productive forces in Ukraine and its regions, developed a concept and strategy of sustainable development and allocation of productive forces in Ukraine and its regions for a long-term perspective, elaborated a concept for sustainable development of work-force potential; assessed prospects for the formation of labor resources and validated forecasted development trends in this country's labor market out to 2015. A Scheme (forecast) of the development and allocation of Ukraine's economic complex out to 2015 was also produced.

Within the Verkhovna Rada's working group on analyzing and preparing new versions of Ukraine's Civil and Economic Codes, considerable work was done concerning their finalization with regard to proposals and remarks made by the President of Ukraine. A new version of Ukraine's Economic Code was prepared, which is to be presented for consideration by the next Verkhovna Rada session.

In the year under review, the activities of the scientists of NAS Economics Department were duly appreciated. NAS corresponding member B. V. Burkinsky was awarded the Order for Public

Service, III degree. NAS academician V. M. Heyets was awarded the title of Honorary Worker in Science and Technology. NAS academician M. I. Dolishny won a Diploma of the Cabinet of Ministers of Ukraine. NAS academician V. K. Mamutov was awarded with NAS Presidium Honorary Diploma, Honorary Badge of the Donetsk Oblast Rada and the title of the Honorary Citizen of Donetsk.

In 2002, for their research project 'Economic Security of Ukraine', NAS academicians V. M. Heyets, Yu. M. Pakhomov and S. I. Pirozhkov were awarded the State Prize of Ukraine in Science and Technology. NAS corresponding member O. I. Amosha and doctor of economic sciences O. F. Novikova won NAS Tuhan-Baranovsky Prize for a series of writings on social orientation of the economy. Several young scientists received scholarships of the President of Ukraine and NAS of Ukraine.

In the near future, the efforts of researchers of the Economics Department will be directed primarily towards research into theoretical issues concerning socio-economic processes of further reformation of the economy, development of scientific basics for the strategy of economic growth and increasing the competitiveness of the national economy in the global environment, as well as working out the fundamentals of industrial, monetary, financial and taxation policies as the major instruments of the state regulation of the economy.

History, Philosophy and Law

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

In 2002, scholars of the Department carried out fundamental research into topical issues of socio-economic, political, ethno-national and cultural development of the present-day Ukrainian society, into the role and importance of historical traditions, problems of shaping qualitatively new political culture, civil society, as well as prospects of new, mutually beneficial Ukraine's relations with foreign countries.

NAS Institute of Sociology, headed by NAS corresponding member V. M. Vorona, carried out a monitoring of public opinion concerning relevant issues of socio-economic and political development, studied social implications of reformation in economic, political and state administration spheres. It published monographs «Ukraine — 2002. Monitoring of Social Change» (by NAS corresponding member V. M. Vorona and Ye. I. Holovakha), «Great Migration of Peoples: Repatriates, Refugees, Labour Immigrants» (M. O. Shulha).

NAS V. M. Koretsky Institute of State and Law, headed by NAS academician Yu. S. Shemshuchenko, did research into the functioning of the Ukrainian state administration system and problems of its upgrading at the stage of administrative reform implementation. Published were monographic writings: «Intellectual Property in Ukraine: Problems of Theory and Practice» (editor-in-chief — NAS academician Yu. S. Shemshuchenko), «Issues of Ukrainian Constitution Implementation» (editor-in-chief — V. F. Pohorilko, «Interests and Power» (by NAS academician V. F. Sirenko).

Scholars of NAS Institute of Political and Ethno-National Research, headed by NAS academician I. F. Kuras, investigated general trends and peculiarities of formation and development of political system and civil society in Ukraine. The 1st volume of the six-volume edition «Political History of Ukraine. XX Century» (by NAS academician I. F. Kuras, Yu. A. Levenets, L. P. Nagorna, M. S. Karmazina) was published.

NAS Institute of the History of Ukraine published «Halytsko-Volynsky Chronicle»(by NAS academician V. A. Smoliy, NAS corresponding member M. F. Kotliar). The institute issued monographs: «History of Diplomacy in South-West Rus» (by NAS corresponding member M. F. Kotliar), «Political Terror and Terrorism in Ukraine. XIX-XX Centuries: Historical Essays» (by NAS academician V. A. Smoliy, NAS corresponding member V. M. Lytvyn, O. P. Reyent, S. V. Kulchytsky). NAS corresponding member V. M. Lytvyn published a monograph «Formation and Development of Democratic-Type State Power in Ukraine».

NAS H. S. Skovoroda Institute of Philosophy issued such monographs: «Collisions of Anthropological Speculations» (by V. H. Tabachkovsky, N. V. Hamitov, H. P. Kovadlo), «Philosophical Encyclopedic Dictionary» (editor-in-chief — NAS academician V. I. Shynkaruk), «Philosophical Dictionary of Sociological Terms», a textbook «History of Philosophy» (by NAS academician V. H. Kremin, NAS corresponding member L. V. Hubersky).

V. I. Vernadsky National Library of Ukraine, headed by NAS academician O. S. Onyschenko, published the 5th volume of the «National Bibliography of Ukraine» (by V. Yu. Omelchuk), a 2-volume memorial anthology «Born by Ukraine» (V. S. Chyshko, V. I. Popyk, M. D. Khodorovsky), a guide-book «Personal Archive Funds in V. I. Vernadsky National Library Institute of Manuscripts» (editor-in-chief — L. A. Dubrovina) and prepared the 4th and 5th volumes of documentary «History of the National Academy of Sciences of Ukraine» (1934 - 1941; editor-in-chief — NAS academician O. S. Onyschenko).

NAS M. S. Hrushevsky Institute of Ukrainian Archeography and Source Studies prepared and published the 1st volume of the 50-volume edition of M. S. Hrushevsky collected works (NAS

corresponding member P.S. Sokhan, O. V. Todiychuk, O. O. Mavrin), the 1st volume of D. Yavornytsky's complete writings.

NAS Institute of Archaeology issued a monograph by NAS corresponding member V. D. Baran and Ya. V. Baran «Origins of the Ukrainian People». NAS academician P. P. Tolochko published a monograph «Yaroslav the Wise». A work by NAS corresponding member S. D. Kryzhytsky and N. O. Leipunska «Olviya» was published in France.

Achievements of the Department's leading scientists were highly appreciated. NAS academician P. P. Tolochko, NAS corresponding member S. D. Kryzhytsky and NAS Institute of Archaeology workers G. Yu. Ivakin, D. N. Kozak, V. O. Kruts, O. P. Motsia, V. Yu. Murzin, V. V. Otroschenko, A. S. Rusiayeva, V. N. Stanok were awarded with the State Prize of Ukraine in Science and Technology for their three-volume work «Early History of Ukraine» and monograph «Ethnic History of Early Ukraine». S. I. Bilokon was awarded with the T. Shevchenko National Prize of Ukraine.

V. I. Yevintov was decorated with the Order of Academic Palms of France. The Order 'For Service' of III degree was awarded to NAS corresponding member V. I. Semchyk and M. I. Mykhalchenko, and the Order of Princess Olga of III degree — to Ya. M. Shevchenko.

Philological Studies, Art Criticism, Ethnology

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

As before, in the year under review scholars of the Department carried on their research efforts aimed at fundamental and applied issues of the development of literature, language, art criticism, traditional folk culture, computer linguistics, as well as at meeting major challenges of providing academic back-up to the national and cultural revival of Ukraine, unbiased and objective description of various stages in the past development of the Ukrainian spiritual culture and its status at the beginning of the XXI century.

Despite well-known difficulties with publishing the works completed, the practical results of implementing the abovementioned tasks are demonstrated by the publication of 102 collective and individual writings, including 57 monographic collected works, 11 academic textbooks for higher schools, 22 reference books and dictionaries, 12 academically prepared and commented belles-lettres texts, over 1200 publications by the Department's scholars in collected academic works and scholarly periodicals.

A high level of the research done at the Department is testified by awarding the 2002 State Prize of Ukraine in architecture to V. I. Tymofiyenko for his writing «Architects of Ukraine of the Late XVIII — Early XX Centuries: a Biographic Reference Book», NAS of Ukraine O. O. Potebnia Prize to T. B. Lukinova for her work «Numerals in Slavic Languages»(a Comparative and Historical Study)», NAS of Ukraine F. M. Kolessa Prize to ethnologist R. Ya. Kis for the work «The Finale of the Third Rome (Russian Messianic Idea at the Turn of the Millennium)»and M. V. Lysenko Prize to arts scholar V. V. Kuzik for a series of academic and popular works on Dmitro and Levko Revutskys.

Literature scholars of the Department continued their studies in literature theory, history of the Ukrainian and world literatures, current functioning of belles-lettres, as well as preparation of encyclopedic and academic publications of artistic heritage. A number of fundamental works were published: «The Word and the Fate» (by NAS academician M. H. Zhulinsky), «At the Turning Point: Literature Studies and Articles» (by NAS corresponding member O. V. Mishanych), «History of the XX Century American Literature» (by T. N. Denisova), «Theory of Literature»(by S. D. Pavlychko), «Modern as a Field of Experiment»(by V. I. Kostiuk and V. I. Denysenko), a Program in Literature for 5-11 years of secondary schools. A 3-volume «Chronicle of I. Franko's Life and Work»» was compiled, as well as the register of the 5-volume «I. Franko Encyclopedia».

To implement the President of Ukraine Decree 'On the development of the national dictionary base», linguists of the Department produced and commercialized a unique version of the automated lexicological file of the Ukrainian language with over 25 mn word-usage entries. A number of new-generation Ukrainian dictionaries were published, alongside with such basic works as «His Word Reflects Eternity (The Language of T. Shevchenko's Writings)» and «The History of the Ukrainian Literary Language» (both by NAS academician V. M. Rusanivsky), «Problems of Ukrainian Orthography of XX — Early XXI Centuries» (by NAS corresponding member V. V. Nimchuk).

On the basis of research into diversified phenomena of traditional folk culture, scholars of art, folklore and ethnology issued 45 collective and individual works: «Transmission of Folklore Tradition» (by S. Yo. Hrytsa), «Ukrainian National Opera»(by Yu. O. Stanishevsky), «Ukrainian Folk Woodcraft of XVI-XX Centuries (by M. Ye. Stankevych), «Origins of the Ukrainian People» (by V. D. Baran and Ya. V. Baran) and a number of collected scholarly works. New periodicals were started: «Academic Proceedings of Culture Studies Workshop» and «Studies in Art». Folkloristic and ethnographical expeditions to 9 oblasts of Ukraine and Republic of Moldova were

organized.

Important research-organization activities of the Department were aimed at developing new scholarly concepts, projects and programs of the national scale — such as the Plan of activities towards commemorating I. Franko 150-th anniversary, approved by NAS Presidium, working out programs to study ethno-cultural processes on the Ukrainian frontiers, scholarly back-up to publishing «Ukrainian Dictionaries» series, «I. Franko Encyclopedia» and a 5-volume «History of the Ukrainian Culture», at organizing 29 international and all-Ukrainian conferences. The most prominent among those events was the V International Congress of Ukrainian Studies in Chernivtsi, attended by 730 leading scholars of 24 countries of the world. The Congress elected H. A. Skrypnik, the Director of the M. T. Rylsky Institute of Art, Folklore Studies and Ethnology, the President of the International Association of Ukrainian Studies.

To ensure favourable organizational conditions for developing fundamental and applied research of ceramics in Ukraine, the Department of ceramics studies was set up at NAS Institute of Ethnic Studies, and to improve research coordination and develop national dictionary base the Academic Council on ‘Information. Language. Intelligence’ was organized under NAS Presidium.

Activities towards Environment Preservation and Sustainable Development

P.G. Kostyuk,
Member of the Academy Presidium

In accordance with NAS Presidium Resolution 'On the Scientific Basics of Sustainable Development in Ukraine' of April 15, 1998, research efforts were aimed at elaborating scientific foundations of the national strategy and philosophy of environment preservation and sustainable development, as well as at further development of relevant regional strategies. In this respect, major importance was attached to preserving and restoring the environment in Ukrainian regions under a high technological load, to the rational use of natural resources, elaborating the scientific basics and principles of integrated environment monitoring, to the study of processes and changes in the environment under the impact of anthropogenic factors. Significant attention was given to elaborating scientific fundamentals of the optimization of species and landscape ecosystems diversity, as well as to substantiating further development and improvement of the national ecological network, the network of biosphere reserves in particular.

Research was done towards developing advanced technologies and technological systems intended for resource and energy conservation, the use of renewable energy sources, utilization of industrial waste and a drastic reduction in negative impacts on the environment.

Effective results were obtained in elaborating scientific and expert conclusions concerning legal, social, economic and ecological aspects of a possible construction of a major Danube-Black Sea navigation canal through the Ukrainian part of the Danube delta. The abovementioned data were sent to the state authorities, relevant ministries and institutions of Ukraine, UNESCO-MAB Secretariat.

Academic and methodological supervision and co-ordination of the research activities was ensured by NAS Academic Council on Environment and Sustainable Development and the National Committee of Ukraine on 'Man and Biosphere' UNESCO Program (NC MAB Ukraine).

Quite a number of activities towards preparing the 5-th All-European Conference of the Ecology Ministers 'Environment for Europe' were carried out. The philosophy of the Target Integrated Anti-Landslide Program, amendments and proposals to the draft decree of the President of Ukraine 'On Sustainable Development of the Mountain Regions of Ukraine' were suggested.

Proposals towards the Draft Final Document of the World Summit on Sustainable Development (Johannesburg, 26 August - 4 September 2002) were prepared, as well as materials on setting up a joint NAS and the Donetsk Oblast State Administration 'Eco-Ukraine' R&D facilities pool, whose priority tasks were approved at the meeting of NAS Presidium.

NAS Presidium also discussed the issue 'On Scientific Basics of Ukraine's National Report on Implementing «Agenda XXI» within the «Rio+10» context'.

In the sphere of international cooperation, pursuant to the decisions of the UNESCO Seville Conference (March 1995) and the 17th session of the International Coordinating Council on the UNESCO 'Man and the Biosphere' Program (March 2002), research efforts were aimed at further development of the national network of biosphere reserves in trans-border regions. In particular, UNESCO-MAB gave approval to our proposals on starting UNESCO Shatskiy biosphere reserve. Nomination forms with the proposals concerning the organization of 'Western Polissia' trans-border biosphere reserve (Poland / Ukraine) on the basis of the Ukrainian Shatskiy biosphere

reserve and Polish ‘Western Polissia’ biosphere reserve were prepared and sent to UNESCO-MAB Advisory Bureau for consideration.

Ukrainian scientists contributed to an international (Poland/ Ukraine/ Belarus) workshop on organizing the abovementioned reserve (February 2002, Poland), an international workshop on developing the ‘Trans-Border East European Model of Regional Environmental Polissia Network: Belarus - Ukraine - Poland’ project, an action plan for its integration to the European environmental network (May 2002, Belarus), and to the ‘EuroMAB-2002’ international conference (October 2002, Italy).

In the near future, scientific efforts will be directed towards implementing the basic provisions of the documents of the World Summit on Sustainable Development (Johannesburg). In the context of these documents, elaborating social, economic, legal and technological aspects of the environmental preservation and sustainable development of Ukraine, the scientific basics of the National Strategy of Ukraine’s transition to the principles of sustainable social and economic development should become a major task for Ukrainian scientists.

Particular attention should be given to developing alternative and renewable energy sources and effective systems of their use, scientific basics of system (integrated) monitoring of Ukraine’s environment in compliance with the European standards.

Publishing Activities

Ya.S. Yatskiv,
Member of the Academy Presidium

In the year under review, academic community celebrated the anniversary of the 'Naukova Dumka' Publishing House, which dates back to the Editorial-and-Publishing Council of the Academy of Sciences of Ukraine set up in 1922 and headed by academician A. Yu. Krymsky. From the very first days of its existence, the main task of 'Naukova Dumka' has been the publication of fundamental academic studies, specialized reference books and dictionaries.

Last year 'Naukova Dumka' issued 66 books and journals (1476. 8 apiaries, 128. 4 thousand copies). Much attention was given to implementing the 'Academic Book' project, started in 2001. In 2002, 12 books were published under this project, among them were: «Civilization Models of the Present» by academician Yu. M. Pakhomov et al., «Catalysis. Homogeneous Catalysis Mechanisms and Heterogeneous Catalyses» by academician V. V. Honcharuk et al. Besides, 19 manuscripts were prepared for publication within the framework of the project.

The publication of the book «Academician Boris Paton — a Lifelong Work» by B. M. Malynovsky became a notable event in the academic life of Ukraine. The book covers 40 years during which B. E. Paton has held the post of the President of the National Academy of Sciences of Ukraine, and his activities are described on the background of the formation, development and complicated life of the Academy itself.

In compliance with a decree of President L. D. Kuchma, 'Naukova Dumka' Publishers, jointly with NAS T. H. Shevchenko Institute of Literature, made ready for the press the literary heritage of Taras Shevchenko — the first six volumes of the 12-volume academic edition of complete works. Only Volume 2 was published in 2002, however, because of insufficient budget financing. The same fate befell the complete academic 12-volume edition of the works by O. T. Honchar — only Volume1 out of the first five volumes prepared for the press was issued (in 2001).

NAS institutions published over 720 scholarly books in 2002, 447 monographs and 280 collections of academic writings among them.

At present, Ukrainian scholars widely use opportunities of publishing the results of their research achievements in various publishing houses. Outside 'Naukova Dumka' they published 241 monographs (4700 guars).

One should specially note the studies of Ukrainian scholars, issued by leading foreign publishers. In all, 43 monographs (over 840 guars) by Ukrainian scientists were published abroad, among them: «Space: Technologies, Materials Technology, Equipment» edited by NAS academician B. E. Paton ('Taylor & Francis', London), «Random Perturbation Methods with Applications in Science and Engineering» by NAS academician A. V. Skorokhod et al. (Springer Verlag), «Molten Salts: from Fundamentals to Applications» by NAS academician S. V. Volkov et al. (Kluwer Academic Publishers).

The amount of literature published by academic institutions at their own publishing facilities is steadily growing. At present this is the least expensive way of publishing academic studies, but, unfortunately, the quality of printing is not sufficient. In 2002, NAS institutes published 136 monographs (over 2300 guars) at their own printing facilities.

Current studies are published in 77 academic journals and nearly 50 serial editions of the NAS; 18 journals are translated into English by foreign publishers, 24 journals have their own web-sites.

The volume of the publications by the 'Academperiodika' Publishing House continues to grow. It is concerned, primarily, with NAS periodicals: 79 issues of 16 journals and 6 issues of collected papers were published in 2002 (37900 copies in all). In addition, 'Academperiodica' also published 25 monographs (nearly 550 quires, 20500 copies). Among them was the first book of 4-volume

monograph «Actinides in Self-Organizing System» by NAS academician A. P. Shpak et al. and «Vectorial Expansions in the Spatial Theory of Elasticity» by NAS corresponding member A. F. Ulitko.

Further development of the publishing activities of the National Academy of Sciences of Ukraine requires a closer cooperation among its publishers, revival of book-selling network and improvements in the operation of the 'Academkniha' shops, in particular. While the publication of academic books has been growing in recent years, the market of scholarly editions is completely lacking in the country.

In the year under review, the Editorial-and-Publishing Council of NAS of Ukraine focused its attention on the preparation of legal framework for NAS publishing activities, on adapting the experience of other countries in book-publishing, upgrading academic editions in Ukraine, as well as wider distribution of academic publications in electronic media, with a view to the integration of the Ukrainian science into the world research system.

List of International Events to be Held by NAS Institutions in 2003

TITLE	PLACE	TIME	MAIN CO-ORGANIZERS
II-nd Scientific Conference «Differential Equations and Nonlinear Oscillations»	Chernivtsy	August	Inst. of Mathematics
Summer Workshopr «Stochastic Dynamic Systems»	Sudak, the Crimea	May-June	Inst. of Mathematics
III-rd Conference on the Analytical Theory of Numbers and Spatial Mosaics, commemorating H. Voronov	Kyiv	September	Inst. of Mathematics
V-th Conference «Symmetry in Nonlinear Mathematical Physics»	Kyiv	June	Inst. of Mathematics
Theory of Potential and Free Flows	Kyiv	May-June	Inst. of Mathematics, International Mathematical Centre
III-rd Ukrainian-Polish Symposium INTERPOR «Conjugate Physical Fields in Porous Materials»	Brukhovychi, Lviv oblast	May	Centre of Mathematical Modelling of the Ya. S. Pidstryhach Inst. of Applied Problems of Mechanics and Mathematics
II-nd Ukrainian-Polish Symposium «Informative-Mathematical Modelling of Complex Systems». MIMUZ - 2003	Brukhovychi, Lviv oblast	September	Centre of Mathematical Modelling of the Ya. S. Pidstryhach Inst. of Applied Problems of Mechanics and Mathematics
VI-th Scientific Conference «Mathematical Problems of Mechanics of Non-homogeneous Structures », dedicated to the 75-th Anniversary of Academician Ja.Pidstrygach and to the 25-th Anniversary of the Institute Foundation	Lviv	May	Ya. S. Pidstryhach Inst. of Applied Problems of Mechanics and Mathematics
International Algebraic Conference	Lviv	August	Ya. S. Pidstryhach Inst. of Applied Problems of Mechanics and Mathematics
Direct and Inverse Problems of Electromagnetic and Acoustic Wave Theory, DIPED – 2003	Lviv	September	Ya. S. Pidstryhach Inst. of Applied Problems of Mechanics and Mathematics
Current Problems of Innovation Development	Alushta, the Crimea	September	Centre for Scientific and Technological Potential and Science History Studies

International Symposium on Sciences Science and Scientific and Technical Prognostication	Kyiv	May-June	Centre for Scientific and Technological Potential and Science History Studies
History of Computer Techniques in Ukraine	Kyiv	May-June	Centre for Scientific and Technological Potential and Science History Studies
High Technologies	Kyiv	September	Inst. of Machines and Systems
Module Technologies and Constructions in the Mechanical Engineering	Kyiv	October	Inst. of Machines and Systems
Mechanical Engineering and Technosphere in XXI Century	Kyiv	September	Inst. of Machines and Systems
VII-th Congress of Motor Engineers	Alushta, the Crimea	September	Inst. of Machines and Systems
Humans and Space	Dnipropetrovsk	June 8-15	Inst. of Technical Mechanics
IV-th Symposium on Tribo-Fatigue	Ternopil	September 23-27	Inst. of Problems of Strength
III-rd East European Conference on the Engineering Problems of Wind Effects	Kyiv	May 21 - 25	Inst. of Hydromechanics
Nonlinear Optics of Liquid and Photorefractive Crystals	the Crimea	September 30 - October 4	Inst. of Physics
Present- Day Problems of Semiconductor Physics	Truskavets, Lviv oblast	June	Inst. of Physics
Electronic Processes in Organic Materials	Lviv	June 3-8	Inst. of Physics
XI-th International Symposium "Advanced Display Technologies"	the Crimea	September 8-12	Inst. of Semiconductor Physics
Optoelectronic Information and Power Technologies	Vinnytsya	April	Inst. of Semiconductor Physics
Optoelectronic and Hybrid Optics/Digital Systems for Image Processing	Kyiv	May 14-17	Inst. of Semiconductor Physics
Scientific Problems of Optics and Advanced Materials Science	Kyiv	October 24-26	Inst. of Semiconductor Physics
Mathematical Methods in Electromagnetic Theory	Kyiv	September 10-13	Inst. of Radiophysics and Electronics
High Pressures - 2002: Fundamental and Applied Aspects	Donetsk	October	Donetsk Physical-Technical Inst.
"Inverse Problems and Nonlinear Equations", dedicated to the 80-th Anniversary of V.Marchenko	Kharkiv	August 9 - September 20	Inst. of Low Temperature Physics and Engineering
Microscopic Quantum Effects. (Shubnikov Readings, dedicated to the 100-th Anniversary of L.Shubnikov)	Kharkiv	October 1 - 6	Inst. of Low Temperature Physics and Engineering

Training Courses for Workers of Nuclear Enterprises of Ukraine and CIS Countries	Kyiv	11 sessions during the Year	Scientific Centre "lnst. of Nuclear Research"
Systems for Scientific and Technical Control of Environment	Katsyveli, the Crimea	September 16-22	Marine Hydrophysical Inst.
Fundamental and Applied Problems of Monitoring and Forecasting Natural Disasters	Sevastopol	September 16 - 22	Marine Hydrophysical Inst.
Resources of Natural Waters of the Carpathian Region	Lviv	April	Inst. of Geology and Geochemistry of Combustible Minerals
Trend in the Development of Nature and Society in Ukraine and Neighbouring States (XX-XXI Centuries)	Kyiv	June 5 - 7	Inst. of Geography
Metallogenesis of the Precambrian Shields	Kyiv	February	Inst. of Geochemistry, Mineralogy and Ore Formation
New Problems of the Advanced Structure Chemistry	Kharkiv	September	STC "Inst. of Single Crystals"
Thin Films in Optics and Electronics	Kharkiv	April	STC "Inst. of Single Crystals"
Diamond and Related-Materials Films	Kharkiv	April	STC "Inst. of Single Crystals"
Wacuum Technologies and Equipment	Kharkiv	April	STC "Inst. of Single Crystals"
Present-Day Problems of Mechanics and Physical Chemistry of Cutting Processes, Abrasive Treatment and Surface Plastic Deforming, dedicated to the 100-th Anniversary of Prof. Rosenberg	Kyiv	May	Inst. of Super-Hard Materials
Scientific-and-Technical Conference dedicated to the 100-th Anniversary of Academician O. Chekmaryov	Dnipropetrovsk	September	Inst. of Ferrous Metallurgy
X-th International Forum on Thermoelectricity	Chernivtsi	June	Inst. of Thermoelectricity
Materials and Coatings in Extreme Conditions	Katsyveli, the Crimea	September 16 - 20	Inst. of Materials Science Problems
Materials Science at the Turn of the Century	Kyiv	November 4-8	Inst. of Materials Science Problems
VI-th Conference "Problems of Corrosion and Anticorrosion Protection of Construction Materials «Corrosion-2002»	Lviv	June 4-6	Physical Mechanical Inst.
VII-th International Scientific-and-Technical Conference «LEOTEST-2001»	Slavske, Lviv oblast	March 5-6	Physical Mechanical Inst.

III-rd International Conference "Equipment and Technologies of Thermal Treatment in Mechanical Engineering"	Kharkiv	September	Inst. of Gas
Alternative Power Engineering in XXI Century	the Crimea	September	Inst. of Engineering Thermophysics
I-st Ukrainian Conference on Power Utilization of Biomass	Kyiv	September - October	Inst. of Engineering Thermophysics
Problems and Ways of Improving Coal Power Engineering	Kyiv	December	Coal Energy Technology Centre
Power Electronics and Power-Efficiency (PEPE-2002)	Alushta, the Crimea	September	Inst. of Electrodynamics
Problems of Present-Day Electrical Engineering (PMEE-2002)	Kyiv	June	Inst. of Electrodynamics
Symposium dedicated to the 100-th Anniversary of Academician O. Kirsanov	Kyiv	August	Inst. of Organic Chemistry
VII-th Ukrainian-Polish Symposium "Theoretical and Experimental Research of the Surface Phenomena and their Application"	Lublin, Poland	September	Inst. of Colloid Chemistry and Water Chemistry
I-st Congress of the Ukrainian Physiological Society	Vinnytsya	May	Inst. of Physiology
IV-th Parnas Conference on Biochemistry Problems	Wroclaw, Poland	I-st decade of October	Inst. of Cell Biology
Conference dedicated to the 30-th Anniversary of Cryobiology and Cryomedicine Development in Ukraine	Kharkiv	III-rd decade of April	Inst. of Cryobiology and Cryomedicine Problems
Problems of Oncogenetics: Scientific and Applied Aspects	Kyiv	April 10 - 11	Inst. of Experimental Pathology, Oncology and Radiobiology
VIII-th Congress of the Ukrainian Biochemistry Society	Chernivtsi	October 1 - 3	Inst. of Biochemistry
Present-Day Problems of Zoology	Kyiv	April	Inst. of Zoology
Ecological and Biological Research on Natural Territories and Territories Changed by Anthropogenesis	Kryvy Rih	May 12 - 15	Kryvy Rih Botanical Gardens
Anthfopization and Settlements Surrounding: Flora and Vegetaiton	Kostrino, Uzhgorod	May 16 - 18	Inst. of Botany
Problems of Saving Biovariety and Development of Mountainous Regions	Lviv	September	State Museum of Natural History
Humans and Mountains	Rahiv, Zakar-patska oblast	September	Inst. of Ecology of the Carpathians
Ecological Problems of Studies and Saving of Biotic Variety	Lviv	October	Inst. of Ecology of the Carpathians
The Lower Danube	Odesa	March 19-20	Inst. of Biology of Southern

			Seas
The Mechanism of Implementation of Regional Policy under Conditions of Formation of National Economy	Lviv	II quarter	Inst. of Regional Research
Development of Trans-Border Cooperation in Ukraine	Lviv	II half-year	Inst. of Regional Research
Bread Products	Odesa	IV quarter	Inst. of Market Problems Economics and Ecology Research
Problems of Foreign Investment Involvement for Development of Regions Economy	Odesa	May	Inst. of Market Problems Economics and Ecology Research
Significance of the Sociological Science in the Development of Ukrainian Society	Kyiv	I-st half-year	Inst. of Sociology
Professional Image of the Librarian of the Information Society	Kyiv	October	V. Vernadsky National Library of Ukraine
Jewish History and Culture in the Countries of Central and Eastern Europe	Kyiv	August	V. Vernadsky National Library of Ukraine
VI-th A. Krymsky Oriental Readings	Kyiv	June	Inst. of Oriental Studies
III-rd Bosporus Readings	Kerch, the Crimea	May	Inst. of Oriental Studies
Religion Freedom: Legal Provision and Realities of Confirmation	Kyiv	October	Division of Religion Studies of the Inst. of Philosophy
Religion Studies as Science and Educational Discipline	Kyiv	April	Division of Religion Studies of the Inst. of Philosophy
History of Religion in Ukraine	Lviv	October	Division of Religion Studies of the Inst. of Philosophy
Philosophical and Methodological Culture of Scientist: Problems and Reality	Kyiv	October 25-26	Centre of Humanitarian Education
Vyacheslav Lypynsky (1882 - 1931) - Founder of Conservative Trend in Ukrainian Political and Historical Ideals	Kyiv	September	Inst. of Ukrainian Archaeography and Source Studies, Inst. of European Studies
On the Way from the Varangians to the Greeks: Lower Dnieper Territories and Problem of the Great Border	Zaporizhzhya	October	Inst. of Ukrainian Archaeography and Source Studies, Inst. of European Studies, Inst. of European Studies
Ukraine - Russia: Historiographical Process of the Last 10 Years	Chernihiv	August	Inst. of European Studies
Ukrainian-Polish Relations and Problems of the State Development	Lutsk	May	Inst. of European Studies

Jubilee Conference dedicated to the 280-th Anniversary of H. Skovoroda	Kyiv	December	Inst. of Philosophy
V-th International Congress of Ukrainian Studies	Chernivtsi	August	Inst. of Literature
Ukraine at the Turn of Millennium: Ethnos, Nation, Culture	Kyiv	May	Inst. of Art Studies, Folklore and Ethnology
The 80-th Anniversary of the F. Vovk Department of Anthropology and Ethnology (AUAS)	Kyiv	April	Inst. of Art Studies, Folklore and Ethnology
Theoretical and Methodological Basis of the Present-Day Dialectology	Zhytomyr	October 4-6	Inst. of the Ukrainian Language
Terminological Council	Kyiv - Lviv	twice a year	Inst. of the Ukrainian Language
International Conference dedicated to the 200-th Anniversary of V. Dahl	Kyiv	February	Inst. of Linguistics