NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF ARMENIA

R E P O R T
ON MAJOR RESEARCH OUTCOMES
FOR 2017

DIVISION OF MATHEMATICAL AND TECHNICAL SCIENCES

Academician-Secretary – academician L.Aghalovyan
Scientific Secretary – L.Martirosyan

The Division of Mathematical and Technical Sciences includes the Institutes of Mathematics, Mechanics, for Informatics and Automation Problems, as well as the Department of Hydromechanics and Vibrotechnics.

The Division includes 14 academicians, 9 corresponding members, 28 foreign members, 5 honorary doctors, as well as 2 honorary members.

During the reporting year 3 general meetings of the Division were held.

At the annual general meeting held on 10 February the candidacy of cand. (phys.-math.) V.Sahakyan for the vacancy of the director of the Institute for Informatics and Automation Problems was discussed and approved.

At the annual general meeting held on 16 March L.Aghalovyan`s report "On the main scientific and scientific-and-organizational results of the Division for the 2016 year" was approved. Scientific reports of cand. (phys.-math.) R.Barkhudaryan (Institute of Mathematics), cand.(geol.) S.Hayroyan (Institute of Mechanics), cand.(tech.) G.Karapetyan (Institute for Informatics and Automation Problems), as well as foreign members of NAS RA A.Manzhirov (RF) and A.Seyranian (RF) were presented at the meeting.

At the annual general meeting held on 29 March the candidacy of DSc(phys.-math.). V.Hakobyan for the vacancy of the director of the Institute of Mechanics was discussed and approved.

11 meetings of the Bureau of the Division were held. The following issues were considered and approved: the reports of the institutions of the Division for the year 2017, including the programs of basic funding; the working plan of the Division for 2017 year; the number of the postgraduate vacancies and their distribution among the Institutes for 2017-2018 academic year; the results of admission to the postgraduate school, research advisers and scientific topics of the postgraduate students; the decision project of the general meeting for the reporting year; applications on maintaining of scientific objects of national value for 2018 on state target programs, as well as staffs of the editorial boards of journals “Proceedings of NAS RA. Mathematics” and “Proceedings of NAS RA. Mechanics”. The elections of the editor-in-chief of the scientific journal “Proceedings of NAS RA. Mechanics” were held. DSc (phys.-math.). V.Hakobyan was elected as the editor-in-chief of the journal “Proceedings of NAS RA. Mechanics”.

The rating process of the productivity of the institutions of the Division, the main results of the scientific organizations of the Division, the results of the international and local conferences, organized by the Division Institutes, possible interdisciplinary investigation between institutions of the Division, issues on provision and on the results of the scientific trips as well as some other scientific-and-organizational issues were discussed.

The following scientific journals are published on the Division specialities: “Proceedings of NAS RA. Mathematics” (6 numbers), “Proceedings of NAS RA. Mechanics” (4 numbers), “Proceedings of NAS RA. Technical Sciences” (4 numbers), “Mathematical Problems of Computer Science” (2 numbers), as well as the electronic “Armenian mathematical journal” (2 numbers).

229 scientific articles (including 91 abroad) and 9 conference abstracts (including 4 abroad) were published in 2017 by the researchers of the Institutes of the Division, as well as 4 monographs (including 2 abroad), 2 collections of scientific articles and 3 tutorials.

The Institutes of the Division have organized 2 international scientific conferences.

1 Doctoral and 6 Candidates dissertations were defended by the researches of the Institutes. 5 Candidate`s dissertations were defended at the Scientific Councils of the Institutes of the Division.

5 projects on international grants have been implemented in the Institutes of Division (Institute for Informatics and Automation Problems).

In December of the reporting year annual report meetings of the Institutes were held, the reports of the Institutes for 2017 year were discussed and approved.

Institute of Mathematics

Major achievements

Quadrature surfaces with two and more phases have been defined and studied. Several results related to the existence, regularity and qualitative properties for these surfaces have been proved. Moreover, it has been shown that three or more junction points cannot appear (Sup.: acad. A.Nersessian, A.Arakelian).

Institute of Mechanics

Major achievements

In order to minimize the influence of external factors on the accuracy of assessments of processes occurring within lithospheric plates and blocks of the earth, in general, measuring instruments (tiltmeters, deformographs) tend to be laid at some depth from the outer surface of the package in seismology. For a laminated packet of plates the corresponding three-dimensional problem of the theory of elasticity has been solved, when the measurement data are taken from the surface of the ***k***-th layer of the packet (Sup.: acad. L.Aghalovyan, V.Tagvoryan).

Outcomes of applied developments

Based on the experimentally obtained data a new physical geological model (calculation scheme) of landslide dangerous slope stability evaluation has been stated for the influence of dynamic (seismic) force on it:

- for semisolid ($0<I_L<0.25$) and tight-plastic ($0.25<I_L<0.5$) consistency soils, when $\tau_0 / \tau_{f,st} <0.7$ and $f<12$ Hz (τ_0 -shear stress, $\tau_{f,st}$ -standard shear strength of soil, f -vibration frequency of shear stress) it is recommended to substitute the value of seismic inertia force for some calculation scheme; when $\tau_0 / \tau_{f,st} >0.7$ and $f<12$ Hz- the value of soil shear strength is defined as a result of dynamic experience;
- for light-plastic and fluid-plastic ($I_L>0.5$) consistency soils, in spite of the values $\tau_0 / \tau_{f,st}$ and *f,* in the above-mentioned calculation scheme it is recommended to substitute the value of soil shear strength defined as a result of dynamic experience (Sup**:** DSc(tech.) K.Karapetyan, DSc (geol.) S.Hayroyan, E.Manukyan).

Institute for Informatics and Automation Problems

Major achievments

All balanced bipartite even pancyclic orgraphs have been described with given conditions (Sup.: cand.(phys.-math.) I.Karapetyan).

Outcomes of applied developments

Multifunctional infocommunicational system UNIMail has been designed to replace a number of individual infocommunication user services on the basis of network and sms technologies (MailInformer, Websms, Mail2sms) which are currently being used in the ASNET computer network. In accordance with the project the basic application software of the system has been created, the test operation of the launch version UNIMail has been started. The UNIMail system has been presented as

a stand-alone multifunctional infocommunication resource intended for informational support of Webmail users by the operative transfer to the mobile phone of the recipient of selective sms notifications about incoming emails, providing possibility of remote transfer of sms from the Internet to the region where the UNIMail server is located and a number of other applications (Sup.: DSc(tech.) A.Nanasyan).

An automated driver guidance system has been developed, which includes the following components: (1) Detection or traffic lane lines; (2) Estimation of vehicle position on the road based on the lines in camera view; (3) Lane departure warning system; (4) Lane keeping assistance system; (5) Camera view calibration and correction to the perpendicular (bird eye) view for additional calculation.

A database for collecting user-specific data has been developed based on MS SQL Server, which was integrated into the SoloLearn system. Currently the system stores data of approx. 7.5 million users, including their avatar images. A machine-learning system based on deep neural networks has been developed, which is working on the collected user data. The purpose of the system is: a)to suggest specific and personalized content to the users of the system based on their activity data, b) to recognize the faces of the users from their avatar images (Sup.: DSc(phys.-math.) H.Sarukhanyan).

The recently created system for analyzing and virtual restoration of distorted images has been improved. Now it is applicable to color images (Sup.: DSc(tech.) D.Asatryan).

A software package is being developed for importing and efficient usage of semantic data represented in RDF format in cloud environment. Experiments for biological data have been held (Sup.: cand. (phys.-math.) V.Sahakyan).

Additional mechanisms of Web sites and Web servers protection have been developed and implemented. An extended test version of the scientific publications system ASNET-AM (https://pubs.asnet.am) - https://mutq.asnet.am has been developed and implemented. The system works using the WebSSO mechanism and provides a section of personal documents with the following functions: splitting own search results for publications, uploading own publications from the computer, and by URL. Other services are also integrated into the system, such as ASNET-AM Handipum (https://handipum.asnet.am) and ASNET-AM Drive (https://drive.asnet.am). Software updates have been developed and implemented in the ASNET-AM network increasing the level of security of Email and DNS Services (Sup.: cand.(tech.) A.Petrosyan).

Department of Hydromechanics and Vibrotechnics

Major achievments

Cavitation occurs in the flow of fluid around the surface of the hydraulic structure, pump blades, turbines, propellers, etc. For a real liquid it arises as a result of a local decrease in pressure below the critical pressure, that is, below the saturated vapor pressure of this liquid at a given temperature. Both hydrodynamic cavitation, which arises from the reduction of pressure from large local velocities in the flow of a dropping liquid, and acoustic cavitation resulting from a decrease in pressure as a result of the passage of acoustic waves through the liquid, are accompanied by the appearance of shocks causing large pressures in the liquid mechanically destroying the streamlined bodies and leading to a decrease in the efficiency of the hydraulic installation. The negative effects of a condensate pump impaired by cavitation erosion on the efficiency of a dual-loop nuclear power plant of the ВВЭР-440 type as a whole have been investigated.

To eliminate cavitation erosion in the working parts of the hydraulic installation the system is designed so that at all its points the fluid pressure is greater than the evaporation pressure. To prevent cavitation in condensate pumps they must be installed with a certain support in relation to the condenser. In most cases, due to the limited space, the provision of the necessary support is difficult. The proposed method radically eliminates the occurrence of both hydrodynamic and acoustic cavitation phenomena in the cavities of condensate pumps. This is achieved by the use of effectively functionalizing stabilizers of wave and oscillatory processes, which smooth out the pulsations of pressure and fluid flow (Sup.: cand.(tech.) G.Avetisyan).

Outcomes of applied developments

The stabilizers of pressure and flow pulsations have been developed to eliminate cavitation phenomena in condensate pump installations of nuclear power plants of the type ВВЭР-400.

Based on the similarity theory, the hydrodynamic process occurring in the condenser-condensate pump-deaerator circuit is simulated, the main criterion is the Reynolds number. In the pipeline of the experimental bench after the pulsator, a pressure oscillation of the liquid is generated having an amplitude-frequency characteristic identical to the amplitude-frequency characteristic of the pressure oscillations of the condensate in the discharge part of the pipeline after the condensate pump of the type КСД-230-115/3.

Based on the results of experimental studies the theory of calculating the design parameters of the stabilizer of wave and oscillatory processes has been corrected.

With optimal selection of the stabilizer parameters it is possible to attain 95% quenching of the pressure pulsations, which allows to eliminate the cavitational erosion of the impeller and the condensate pump casing, thereby significantly increasing the efficiency of the station as a whole (Sup.: cand.(tech.) G.Avetisyan).

DIVISION OF PHYSICS AND ASTROPHYSICS

Academician-Secretary – academician R.Kostanyan
Scientific Secretary – N. Davidyan

The Division of Physics and Astrophysics includes the Byurakan Astrophysical Observatory after V. Ambartsumian, the Institute for Physical Research, the Institute of Applied Problems of Physics, the Institute of Radiophysics and Electronics, the International Center for Relativistic Astrophysics Network –Armenia and "Galaktika" CJSC.

The Division includes 10 academicians, 13 corresponding members and 30 foreign members.

During the reporting year 3 general meetings were held.

At the annual general meeting held on March 16 the academician-secretary of the Division R.Kostanyan presented the main results of the scientific and organizational activities of the Division for 2016. Scientific reports were made by NAS RA foreign members A.Sedrakian (Germany), S.Avakyan (RF), M.Kazaryan (RF), R.Mirzoyan (Germany), DSc(phis.-math.) R.Drampyan, DSc(phis.-math.) V.Qocharyan, academician A.Gulyan, DSc (tech.) H.Pirumyan, Kh.Manaseryan and DSc(phis-math.) N.Sahakyan.

During the general meetings on March 31 and April 6 the Division submitted for approval the following candidacies for the vacancies of the directors of the Division Institutes: DSc(phis.-math.) T.Zakaryan (IRPE), DSc(phis-.math.) A.Mikaelyan (BAO after V.Ambartsumyan), corresponding member A.Papoyan (IPR) and corresponding member A.Mkrtchyan (IAPP).

During the sessions of the Bureaus of the Division the following issues were discussed and approved: the applications of the subdivisions for "Maintenance and Development Projects for the Base Financing Infrastructure of the Scientific and Technological Activity" for the year of 2018, the staff of the editorial board of the journal "Astrophysics". DSc(phis.math.) A.Nikoghosyan's candidacy was proposed for the vacancy of the editor of the journal "Astrophysics".

Academicians R.Martirosyan and A.Mkrtchyan were awarded with the 1st degree Order for "Services to the Motherland." Corresponing member H.Matevosyan was awarded with the honorable title of "Honoured Science Worker". Corresponding member A.Papoyan was awarded with the title of Honorary Doctorate of the Armenian-Russian University. DSc(phis-math.) A.Mikaelyan, the director of the Byurakan Astrophysical Observatory after V. Ambartsumyan, was awarded with Tigran the Great Medal of the International Knighthood Academy of Security.

During the reporting year a number of national and international scientific events has been held, international cooperation in the scientific organizations of the Division has expanded, new agreements have been signed, cooperation between scientific and educational institutions has been ongoing.

The evaluation process of the activities of the Division's subdivisions has been organized.

During the year the Division has conducted 9 Bureau sessions with participation of the Directors of the Institutes. The issues discussed were particularly related to the enhancement of the efficiency of scientific works, assessment of organizations' work performance, instructions for increasing the effectiveness of scientific and organisational activities of the Institutes.

5 employees of institutions of the Division got their PhDs.

Institutions of the Division have received 8 licenses. 209 articles (including 130 abroad), 112 theses (45), 2 monographs (1) and 5 manuals have been published.

In December of the reporting year annual reporting meetings were held in the scientific organizations of the Division, the reports on scientific and organizational activity in 2017 were discussed and approved. Publishing Board of the "National Academy of Sciences of RA: Physics" journal has been discussed and approved.

The Division publishes the following scientific journals: "Proceedings of NAS RA. Physics", "Astrophysics" and the electronic "Armenian Journal of Physics".

Byurakan Astrophysical Observatory after V.Ambartsumyan

Major achievements

On the basis of the near and middle infrared photometric data in the young stellar object UKIDSS J185318.36 + 012454.5 a powerful outburst, which exceeds 5 magnitudes, has been detected. Based on photometric data the star UKIDSS J185318.36 + 012454.5 has been classified as a young stellar object with an 0/I evolutionary class. With respect to the type of the outburst the stellar object can be classified as an object of the MNor type (Sup.: cand.(phys.-math.) E.Nikoghosyan).

Based on the spectral data of SDSS DR7-DR8-DR9 survey for the first time for 779 Markaryan galaxies a homogeneous spectral classification has been carried out, which makes it possible to refine spectral classes and subclasses for a significant number of galaxies and carry out their further statistical research (Sup.:cand.(phys.-math.) A.Mickaelian).

It has been shown for the first time that in the early and late spiral galaxies supernovas (SNs) with Ia type are almost twice closer to the disk of the parent galaxy than SNs with a core collapse (Sup.: cand.(phys.-math.) A.Hakobyan).

It has been shown that as a result of the "Burma effect" in the center of active galaxies, magnetic fields can be formed both under the conditions of matter outflow and accretion. Moreover, in both cases the moments of the formed dipole magnetic field has a different orientation from the moments of rotation of the galaxies. These circumstances make it possible in principle to determine which process is the main one: the outflow of matter or accretion (Sup.: cand.(phys.-math.) R.Andreasyan).

The non-linear problem of transmission and reflection of radiant energy in the one-dimensional finite geometrical thickness medium with isotropic scattering has been solved using the method of “linear images”. Mathematically accurately presented and analytical, from the point of view of the solution, the inverse problem of determining the luminosity function and the light curves of irregular variable stars in aggregates has been studied (Sup.: cand.(phys.-math.) H.Pikichyan).

Based on the principle of expanding of the Universe on a small scale, and taking into account that the dark matter responsible for the expansion of the Universe interacts with ordinary baryonic matter, it has been concluded that in the process of this interaction the internal energy of all baryonic objects increase. As a result the stability of all objects, including the nuclei of atoms, is reduced which is expressed by a decrease in the binding energy. Decreasing of the binding energy leads to an increase in mass. This solves the paradox, why on a much smaller scale the Universe did not locate in the region with the Schwarzschild radius (Sup.: cand.(phys.-math.) H.Harutyunian).

A new carbon dwarf which is located at a distance of 100 kpc has been found. In the spectrum of this object the Hα emission has been observed (Sup.: cand.(phys.-math.) K.Gigoyan).

Outcomes of applied developments

At the joint Armenian-Russian station 370000 measurements have been performed altogether and 610 orbits of artificial satellites have been restored during 190 observational nights (Sup.: cand.(phys.-math.) H.Harutyunian).

Institute for Physical Research

Major achievements

A new theoretical approach has been developed for quantum network based on single-atom-cavity system, which provides higher efficiency and information capacity than the previously known schemes due to the causality of the photon and the atomic quantum states. Quantum information is recorded as a superposition state of the atom trapped in an optical cavity, which is mapped to the superposition of the cavity photons when external field is applied. This reliable and efficient scheme allows effective distribution of entanglement over large distances in the quantum network (Sup.: DSc(phys.-math.) Yu.Malakyan).

While exciting Rb vapor on the hyperfine structure of D_2 line by a linearly polarized light, orthogonally polarized radiation has been recorded in the transmission spectrum for certain values of

laser intensity at zero magnetic field for the ^{85}Rb and ^{87}Rb V-type cyclic transitions. Based on the threshold behavior of the process and the absence of signal for the □-type transitions, the phenomenon has been explained by the population inversion due to the Zeeman pumping (Sup.: corr. member A.Papoyan).

Parameters of resistive switching of capacitor structures having bipolar and unipolar energy-independent memory (RRAM) properties based on monolayer donor (n-ZnO1Li), acceptor (p-ZnO10Li) and two-layer ZnO10Li/n-ZnO1Li (p-n transition) films, as well as on dielectric La_2O_3 films have been defined depending on the electrode material (LaB_6, Au, Ag, Pt, FTO, Si (p), Si (n)). Multi-layer 3D structures can be made from this type of materials, which will allow creation of terrabyte memory devices (Sup.: cand.(phys.-math.) Y.Kafadaryan).

Outcomes of applied developments

A method for optical measurement of temperatures based on the temperature dependence of the most intense emission lines and the ratio of the absorption coefficients of excited Stark sublevels of crystals activated with the ions of rare-earth elements has been proposed. In different crystals, the operating temperature range and the average sensitivity of the sensors have been determined. It has been shown, in particular, that for cristals $Y_3Al_5O_{12}$: Yb^{3+} the first method is applicable in the field of creogenous temperatures (40-130^{o}K), and the second method - in the region of high temperatures (500-1000^{o}K)(Sup.: acad. R.Kostanyan).

A new method for the formation of metallic microstructures has been proposed and implemented based on the adsorption of atoms on crystalline substrate and simultaneous control of photo-stimulated desorption of atoms by spatially modulated non-diffracting light. The experiments have been performed in sodium and rubidium cells on a sapphire substrate illuminated by a Bessel beam of 532 nm wavelength and 2 W/cm^{-2} intensity. Obtained thin metallic layers with submicrometric structure are applicable for optical and photonic devices (Sup.: DSc(phys.-math.) R.Drampyan).

A new method for measuring the density of low-dimensional currents of photo- and thermal-conductivity in thin films has been proposed and developed, which allows to simultaneously check the electrical conductivity of the thin films and determine the size of the conductive cluster in the granulated films. Thin films of ZnO doped with Li, Ga, Ag mixtures have been prepared, the influence of the mixtures (donor Ga and acceptor Ag) has been studied. The influence of granular size and crystalline structure on the conductivity has been investigated (Sup.: cand.(phys.-math.) R.Hovsepyan).

Based on the measurments of temporal parameters of scintillation it has been shown that for the YAG:Ca,Ca crystals the coactivation reduces the probability of the recombination processes in scintillation. The coactivation aimed at the realization of $Ce^{3+}\rightarrow Ce^{4+}$ transition allows to control the growth time of the scintillation, which is important for the required high temporal resolution. Unlike garnets, the light yield of scintillation in YAP:Ce,Ca crystals is reduced due to the overlap of the emission and absorption bands (Sup.: DSc(phys.-math.) A.Petrosyan).

Institute of Applied Problems of Physics

Major achievements

It has been theoretically shown that it is possible to control the magnetic permeability (μ) and the dielectric constant (ε) values by the acoustic fields of micron wavelength, which enables to obtain meta-materials of new class (Sup.: acad. A.Mkrtchyan).

Studies have been carried on for the creation of media with various relative density and degrees of ordering from refractory metals and other materials by the method of iono-plasma fragmentation in acousto-plasma environment, during which for the first time a new method of spraying that can have a vast implementation in micro electronics, instrument making, mechanical engineering and in the other areas has been developed and created (Sup.: corr. member A.Mkrtchyan).

It has been experimentally shown that the point temperature gradient perpendicularly applied to the $(10\bar{1}1)$ atomic planes of quartz single crystal results in the change of spatial-time characteristic of the reflected X-ray beam and in particular the two-dimensional focusing of the reflected beam (Sup.: cand.(phys.-math.) V.Kocharyan).

Outcomes of applied developments

Electronic equipment has been developed in the medium with layered structure made on the basis of plates of poly-cluster diamond and aluminum nitride, on the basis of surface acoustic waves. A new class accumulator model of thermal neutrons which can be used for developing new equipment in the areas of condensed matter physics, medicine, etc. has been developed (Sup.: acad. A.Mkrtchyan).

A new super sensitive method has been developed and created with the application of the effects of acousto-physics for registration super weak acoustic echoes emerging from the interaction of electromagnetic waves with natural, artificial and biological objects with resonance characteristics (Sup.: corr. member A.Mkrtchyan).

On the basis of a newly synthesized refractory matter detectors-transformers for the beams of visible and invisible range have been developed and created (Sup.: cand.(phys.-math.) V.Nalbandyan).

Institute of Radiophysics and Electronics

Major achievements

A new type of a non refractive microlens has been proposed. Lens represents a cubic shape dielectric slab with characteristic dimension of $2\mathscr{l}$ and dielectric permittivity $\mathscr{l} \leq 2$. It has been shown, both theoretically and experimentally, that the proposed microlens owns focusing behavior like a single zone Fresnel-type diffraction lens ensuring the increase of intensity by 10-13 dB in the focal spot. The proposed lens can be widely applied both in optic and microwave ranges (Sup.: corr.member A.Hakhoumian).

Mixed hardware-software real-time precise and reliable tools for matching the exciting generator with plasma chamber have been developed. The design involves innovative solutions in the fields of digital signal processing and scientific instruments (Sup.: cand.(phys.-math.) T.Zakaryan).

Investigations have been performed to analyze the dependence of the laser beam induced photocurrent on the coordinate of the illumination center in two-dimensional p-n-p structures grown by molecular-beam epitaxy, and the conditions under which this dependence is linear have been clarified. Due to the high coordinate sensitivity of the system even 1 nm displacement is possible to be measured (Sup.: corr.member S.Petrosyan).

The Sb/InSb Schottky contacts have been realized by pulsed laser deposition on n-InSb substrates in <111> crystal orientation, exhibiting high photosensitivity in the 2-5 μm wavelength range when the thicknesses of semitransparent Sb film are in nanometric scale. The interpretation for the shape of volt-ampere characteristics gained due to the presence of intermediate oxide layer sandwiched between the metal and the semiconductor and boundary surface states has been presented (Sup.: A.Khachatryan).

Based on very general assumptions and without reference to any particular model an approach has been presented that allows to solve easily the problem of time evolution of initial perturbation at the development of a streaming instability in dissipative plasma. The approach is valid independently on the type of the instability (e.g. electron beam instability of Cherenkov type, cyclotron type, beam instability in periodical structure etc). (Sup.: DSc(phys.-math.) E.Rostomyan).

Outcomes of applied developments

The dependence of the nanocrystalline structure of glass-crystalline perlite substrates on the technological modes of synthesis and the composition of the raw material has been studied. Scanning electron microscope (SEM) measurements have shown that the average size of nanocrystals depends

significantly on the temperature and duration of the crystallization process, as a result the ratio of the crystalline and glassy phases, as well as the micro-hardness and the ballistic resistance of the substance significantly change (Sup.: corr. member S.Petrosyan).

The work on obtaining enriched distilled water ions and silver nanoparticles by laser ablation has been continued and the dependence of the density of nanoparticles on temperature and time of vibration has been studied. Microbiological studies of water enriched with ions and nanoparticles of water have been conducted (Sup.: cand.(phys.-math.) R.Khachatryan)

On the base of the results from regular radio-astronomical observations (2007-2015) conducted in the scientific polygon "Saravand" the character of yearly average changes of radio-emission intensity, as well as the validity of the periodicity of flux changes of radio source Cassiopeia A have been discussed. It has been shown that during the given period the intensity of the radio-emission Cassiopeia A decreased approximately with the yearly average speed of 0.55%, but the results of the yearly average of the period 2007-2015 have shown a curve with weaker, approximately 2.7-3 years period's change.

Based on the results of long-term regular observations at the Byurakan radiointerferometer operating at a frequency of 72 MHz, in view of the results of studies of other known authors, a hypothetical probabilistic curve has been constructed that effectively isolates seismogenic anomalies from other disturbances, based on the duration of their manifestation, and its approximating analytical expression has been obtained. The daily values of seismic coefficients of the detected anomalies and seismic activity of a vast region around the observation point have been obtained. Correlation relations between the above-mentioned coefficients have been investigated (Sup.: DSc(tech.) H.Piroumyan).

The work of artificial neural networks (ANN) has been described with the purpose of further development of the algorithm for solving the problem of automatic recognition of modulations.. The automatic modulation recognition is a very important task for telecommunication systems, since it is vital for the demodulator to know the exact type of the received signal modulation (Sup.: acad. A.Ghulyan).

Theoretical studies aimed at substantiating the efficiency of a dual frequency, multi-polarization, combined active-passive microwave remote sensing of the sea surface, bare soil and vegetation cover for assessing the main characteristics of the probed surfaces and for unambiguous detection and recognition of anomalous formations formed on these surfaces have been carried out.

Works have been carried out to validate, confirm and assert the International Patent Application of A.Arakelyan entitled "An automated wide-ranging anti-hail protection method and a network". Patents of the European Community, the USA, Canada and the RF have already been acquired (Sup.: DSc(phys.-math.) A.Arakelyan).

ICRAnet Armenia

Major achievements

Timing analysis of gamma-ray emission from bright blazars detected by Fermi LAT has been carried out. The blazars gamma-ray light curves from 2008 to 2017 have been calculated using adaptive binning method which allows to find the shortest time scales for their variability (Sup.: cand.(phys.-math.) N.Sahakyan).

DIVISION OF NATURAL SCIENCES

Academician-Secretary – corresponding member R.Aroutiounian
Scientific Secretary – S.Atshemyan

The Division includes the Scientific and Production Centre (SPC) "Armbiotechnology", the Scientific Centre of Zoology and Hydroecology, the Institute of Botany after A.Takhtajian, the Centre for Ecological-Noosphere Studies, the Institute of Biochemistry after H.Buniatyan, the Institute of Hydroponics after G.Davtyan, the Institute of Molecular Biology, the Institute of Physiology after L.Orbeli.

The Division includes 8 academicians, 11 corresponding members, 27 foreign members as well as 12 honorary doctors.

2 general meetings, 28 Bureau meetings of the Division were held during the reporting year.

At the annual meeting of the Division held on 16 March the report of the academician-secretary R. Aroutiounian on the scientific and scientific-organizational activities of the Division in 2016 was heard. The issues obstructing the activities of the Institutes of the Division, such as the law of purchases, minimal base salary, the absence of specialized councils in the SCC for interdisciplinary dissertations, the limitation for the scientist with the right to participate only in one council, were discussed. The following proposals were made: to change the name of the Division, to rename the Institute of Botany to the Institute of Botany after A.Takhtajian, to develop a project for the improvement of the Botanical Garden, if necessary cooperating with the funds, to expand cooperation with higher educational institutions. It was proposed to conduct the elections of academicians and corresponding members in the Division with the concept of 2/3, and conduct the election at the general meeting with the concept of 50% + 1, as in this case the risk factor dicreases.

The scientific reports of the following leading scientists of the Division were heard: cand.(biol.) A.Nersesyan "Creation of a seed bank as an effective method of preserving the flora of Armenia", cand.(food sci.) D.Pipoyan "Assessment of risks of fresh fruits and vegetables grown in the mining areas of the RA", cand.(biol.) Z.Gharabekyan "Perspectives of the development of tissue engineering in Armenia", cand.(biol.) R.Zakharyan "The role of genetic factors in the development of schizophrenia", NAS RA foreign member A.Bazian (RF) "Emotionally saturated cognitive brain map".

At the 29 meetings of Bureau the following reports were discussed and approved: the 2017 working plan of the Division; the reports of the Institutions of the Division on 2016 and 2017 base funding, on the maintenance and development of the infrastructure, on the maintenance of the scientific objects of national importance and scientific and scientific-technical state projects of target programs; the applications for the positions of postgraduate studies and doctoral candidacy for 2017-2018; the applications of the Institutes for new appliances; the reports of the Institutes on the scientific-organizational activity in 2017. To the post of directors were re-elected: acad. A.Saghyan (the Scientific and Production Centre "Armbiotechnology"), DSc(biol.) B.Gabrielyan (the Scientific Center of Zoology and Hydroecology), corr.member J.Vardanyan (the Institute of Botany after A.Takhtajian), DSc(biol.) N.Ayvazyan (the Institute of Physiology after L.Orbeli), DSc(biol.) S.Chailyan (the Institute of Biochemistry after H.Buniatyan), cand.(biol.) Kh.Mayrapetyan (the Institute of Hydroponics Problems after G.Davtyan).

During the reporting period the evaluation of functional effectiveness of the Institutes was carried out, and based on the results, a project of activities was developed which should be implemented during 2018.

The reports of the directors of the Institutes of the Division on the scientific and organizational activities in 2017 were discussed at the on-site meetings of Bureau.

The travel expenses for scientific visits of researchers from the Division Institutes were discussed and 24 travel grants were provided from the NAS RA funds preappointed for the scientific visits.

The Division has organized round tables on the topics "Applied aspects of biodiversity conservation in Armenia" and "Applied problems of Biomedicine" (jointly with YSMU after M. Heratsi), seminars on Bioinformatics and "Cell technologies in modern biology" (jointly with the Institute of Physiology after L.Orbeli). Jointly with the Institute of Botany the ceremony of renaming the institute to the Institute of Botany after A.Takhtadzhyan was organized, as well as tree planting,

dedicated to the founding of the "Friendship Park". The Institutes of the Division have organized a number of anniversary events, such as International Conferences dedicated to the 135th anniversary of academician L.Orbeli, the 110th anniversary of academician H.Bunyatyan, the 70th anniversary of the founding of the Institute of Hydroponics Problems after G.Davtyan, as well as a seminar dedicated to the memory of NAS RA corresponding member A.Boyajyan.

15 local and international events were organized by the Institutes of the Division including seminars, conferences, scientific expeditions, a total of 1112 participants, 152 of which were from abroad.

379 articles (196 – in foreign journals) and 151 abstracts (81 – in materials of foreign conferences), 4 monographs, 4 educational tutorials and 3 patents were published by the Institutes of the Division.

20 candidates' dissertations were defended by the researchers from the Institutes at 5 specialized councils of the Division.

Institute of Botany after A.Takhtajian

Major achievements

As a result of biotaxonomical investigations of the flora of Armenia 2 new for the science taxa have been revealed and described: *Campanula tridentata* subsp. *zangezurica* (*Campanulaceae*), distributed in Armenia (Zangezur) and Northern Iran, and *Fritillaria tunievii* (*Liliaceae*) from Central Armenia (Urts ridge). As a result of rechecking of herbarium material it has been found that the latter is distributed in other floristic regions of Armenia and SW Anatolia as well. By long-term observations in nature 2 new for Armenia species have been revealed: *Sorbus orbiculata* (*Rosaceae*), earlier described as *S.umbellata* var. *orbiculata,* and *Scilla otschiauriae* (*Hyacinthaceae*). For the flora of Artzakh a new for science species *Crataegus artzachensis* Gabrielian et Sargsyan has been described (Sup.: DSc (biol.) M.Oganesian).

Centre for Ecological-Noosphere Studies

Major achievements

Assessment has been done of aflatoxin B1-caused health risk resulting from consumption of grains in the city of Yerevan. Consumption of rice, buckwheat, wheat and corn has been surveyed. It has been indicated that carcinogenic risk from aflatoxin B1 exceeds a toxicological threshold set by the Science Committee for Food Safety by 1.5 times (Sup.: cand.(food sci.) D.Pipoyan).

Outcomes of applied developments

In the frames of an agreement concuded with the Zangezoor Copper-Molybdenum Plant works have been continued aimed at implementation of a monitoring program for determining physico-chemical indices of concentrations of heavy metals, xantogenates and oil products in wasterwater from the Artsvanic water reservoir and riverwaters in rural community of Syunik and towns of Kajaran and Kapan (Sup.: DSc(geol.-min.) A.Saghatelyan).

In the frames of a complex fish farming development and the Sevan trout population restoration program under financial support of "The Sevan Trout" CJSC works have been continued on constructing a system of remote monitoring of Lake Sevan water quality. Through decipherment of satellite images of medium- and high resolution LANDSAT 8 OLI and Sentinel 2 models of decipherment of water temperature, total biomass and total suspended matter in water have been developed (Sup.: cand.(geol.) Sh.Asmaryan).

By order of the ANPP works have been continued aimed at water sampling from influent flows, determining biological and chemical oxygen demand and oil products (Sup.: cand.(biol.) G.Tepanosyan).

Under a contract with the ANPP, with a purpose of maintaining water chemical regime of the chemical workshop norms for specific discharges of chemical reagents – sulfuric acid and sodium

hydroxide – have been developed. A production quality control has been implemented for ionites, percentage of sulfuric acid and sodium hydroxide, quality of inlet water to be treated and treated water, acidity, alkalinity, hardness, carbon dioxide, silicates. By results of lab and theoretical studies norms for specific discharges of sulfuric acid and sodium hydroxide have been calculated. A Regime Map optimal for the given technological regime has been developed (Sup.: DSc (tech.) G.Babayan).

In the frames of works designated for assessment of chemical risks from foodstuffs available in Yerevan food markets and some trade outlets field works have been implemented and fruits and vegetables including those of doubtful origin have been sampled. In apple, lemon, pepper and tomato samples the content of a pesticide – endosulfane- chlorine organic insecticide that has an acute and chronic effect on human organism has been detected.

Identification of ice-cream widely realized at trade outlets in Yerevan has been done. As a result, cases of ice-cream adulteration by vegetable fat and presence of trans-isomers in it have been revealed.

Works have been continued on sanitary and hygienic risk assessment in Yerevan food markets, in the frames of which it has been indicated that at outlets for animal-origin products and particularly at Market N1 the quantity of pavilions operating within a high-risk zone has reduced to 50% vs. earlier 80%, that of pavilions within a low-risk zone remaining unchanged – 20% (Sup.: cand.(food sci.) D.Pipoyan).

In 2017 the UNESCO Chair supported the process "Education for Sustainable Development" by its activities and contributed to integration of three components of science (education, research, innovation) on national and regional levels (Sup.: cand.(biol.) G.Poghosyan).

A popular science newspaper "Most (the Bridge)" continued to be published (Sup.: DSc (geol.-min.) A.Saghatelyan).

Scientific Centre of Zoology and Hydroecology

Major achievements

For inclusion into IUCN Red List of Threatened Species the list of 29 Armenian insect species together with their fact sheets have been prepared and submitted to IUCN Species Survival Commission. From Armenia one new species of scarab beetles has been described. For the first time for Armenia a dangerous invasive species of harlequin ladybird *Harmonia axyridis* has been reported. For the first time in Armenia 21 species of the family Histeridae have been reported, 9 of them are new for the fauna of Transcaucasia. In the framework of international co-operation one new subgenus and 7 new species of jewel-beetles have been described (Sup.: cand.(biol.) M.Kalashyan).

22 species of gallflies have been revealed, one of them is new, 1 genus and 4 species are new for Armenian fauna (Sup.: cand.(biol.) L.Mirumyan).

For the first time karyotypes of 4 species of scarab beetles and 5 species of periodical cicadas have been described. DNA study for phylogenetic analysis has been carried out on some beetles from Armenia, including: chrysomelid *Bromius obscurus* (genes COI, ITS2), ground-beetle *Procerus scabrosus fallettianus* (COI, ITS2), 5 species of chaffers Cetoniinae (COI, 28S) (Sup.: cand.(biol.) G.Karagyan)

The studies on molecular-genetic analysis of flukes have been carried out, interspecific cross-hybridization between species *Fasciola hepatica* and *F.gigantica* has been revealed (Sup.: cand.(biol.) S.Aghayan, cand.(biol.) H.Gevorgyan).

Trends in development of several Armenian aquatic ecosystems have been studied and the main factors that disrupt their balance have been identified.

The seasonal studies have been carried out at 142 stations of Lake Sevan in order to identify the features of the vertical and horizontal zoning of Lake Sevan and clarify the boundaries of hipolimnion. Studies have shown that the positive processes in the lake ecosystem are continuing. Boundaries of hypolimnion having a protective value for the lake have been greatly expanded. The oxygen deficiency in the bottom layers was not recorded even in the period of summer stratification.

For the first time complex studies of the biodiversity of the hydrobionts in the Marmarik tributary of the Hrazdan River has been performed, and water quality has been assessed. According to the surveyed hydrobiological data, the waters of the Marmarik tributary were classified as "clean - fairly

clean", while the saprobity was varied "from β-oligosaprobic to β-mesosaprobic" (Sup.: DSc(biol.) B.Gabrielyan).

Outcomes of applied developments

The parasite species composition of sheep, poultry, rabbits and fish has been studied.

The dicrocoelium, fasciola, echinococci and gastrointestinal nematode infection level has been determined for sheep. Chicken have been infected by *Heterakidae* and *Ascaris*. Fish have been infected by *Monogenea*, *Trematoda* and *Cestoda*. Rabbits have been infected by *Eimeria* and *Passalurus.* The circulation paths have been identified for helminths, particularly for causative agents of sheep fasciolosis, dicroceliosis in biocoenosis of Marmarik region and adjacent territories. The freshwater mollusk species composition has been identified as well as their contamination by fasciola larval forms. The Ixodidae tick species composition has been studied. The duration of tick parasitizing the livestock has been determined and the infection extension and intention rates have been calculated as well for these regions (Sup.: acad. S.Movsesyan).

In wild and cultivated plants in coastal zone of Marmarik and Hrazdan rivers works on revealing and studying of parasitic and virus carrier nematodes have been carried out. Eight species of parasitic nematodes have been found (Sup.: cand.(biol.) R.Mkrtchyan).

5 species of predatory Phytoseiidae mites from 4 genera have been revealed.

Insecticide activity of some essential oils and poisonous plants against pests has been studied. Prospectives of their implementation in biological pest control have been analysed (Sup.: DSc(biol.) K.Dilbaryan).

On the territories impacted by the construction and earthwork at the Amulsar mine unnoticed decreasion of population number of brown bear and budger has been revealed. Some minor changes of species composition of ground-nesting birds have been registered. Due to decrease of wetland areas decline of number of amphibians has been registered as well. Relocation works for three snake species included into Red book of RA have been carried out (Sup.: cand.(biol.) M.Ghasabyan, cand.(biol.) A.Aghasyan).

As a result of ichthyological studies conducted in Lake Sevan a notable increase in fish stocks has been recorded. The total fish stock in the lake was 2,280 tons, in which the share of whitefish was 2216 tons. The commercial stock of whitefish was 554 tons. As a result of uncontrolled catching, a recovery equivalent to commercial stocks has not occurred. To restore commercial stocks of whitefish it is proposed to strengthen oversight over the protection of spawning, prespawning fish school and fish population replenishment.

The current state of impacts of the construction and earthwork carried out at the Amulsar mine on the Rivers Arpa, Darb, Vorotan has been assessed as well. Studies have shown that as a result of ongoing work no negative impacts have been recorded yet on the aforementioned river ecosystems.

Qualitative and quantitative analysis of the indicators of biocenosis components of the impact of the SHPPs, constructed on the Arpa River and its tributaries Herher and Yeghegis, has shown that Shannon-Wiener specific variety index of the bottom fauna is more accurate and sensitive to assess the impact of SHPPs on river systems (Sup.: DSc(biol.) B.Gabrielyan).

Studies of populations of two-fingered crayfish of Lake Sevan has shown that in comparison to the previous year the commercial stocks of two-fingered crayfish have sharply decreased from 4,500 tons to 2,600 tons. The latter is a consequence of commercial size violation. As a result of catching carried out by the Chinese coagulating and spiraling crayfish gear, the population is losing the possibility of replenishment and restoration. In order to prevent the reduction of the commercial stocks of the crayfish in Lake Sevan the proposals for effective management of crayfish stocks and for revision of crayfish gear have been developed and submitted to the Ministry of Nature Protection of the Republic of Armenia. The admissible catching of crayfish for 2018 has been set at 500 tons (Sup.: cand.(biol.) E.Ghukasyan).

Institute of Biochemistry after H.Buniatyan

Major achievements

Studies for identification of new peptides with application of high performance liquid chromatography (HPLC) and mass spectrometry have been continued. The structure of these peptides has been confirmed and their synthesis has been performed. The effect of galarmin, (synthesized on Fmoc amino acids) on the mice inoculated with the Ascite Ehrlich carcinoma has been studied *in vitro* (in cooperation with the University of Miami, USA). Studies have been also carried out to find the mechanisms of galarmin effect, by application of cytostatic (antiproliferative) and/or cytotoxic (apoptotic) mechanisms, and the results obtained have demonstrated mainly the cytotoxic effect of galarmin.

By using antiserum against galarmin the galarmin immunopositive nuclei have been immunohistochemically revealed in the tumor cells of the control samples, which allows to suggest the possible synthesis of the endogenous galarmin in the cancer cells and its role in anti-cancer process. In order to reveal the mechanisms of proline-rich peptides galarmin, Gx-NH2 effect, their interaction with the dimer of the extracellular domain of the human epithelial growth factor receptor (EGFR), the catalytic domain of the same receptor, the dimer of human superoxide dismutase and the monomer of the same enzyme AutoDock Vina software has been applied to calculate the energy of interaction (Sup.: DSc(biol.) S.Chailyan).

Adenosine deaminase and dipeptidyl peptidases activities at various pathologies have been studied. The obtained results evidence that high adenosine deaminase activity of synovial fluids at rheumatoid arthritis is due to the accumulation of small isoform of the enzyme. It is citrullinated and can be considered as a new autoantigen (Sup.: DSc(biol.) S.Mardanyan).

A number of lectins have been applied to detect bacteria. As an optical sensor in this case, anisotropic silver nanoparticles have been used. The system has shown its effectiveness in detecting both the Gram positive and Gram negative bacteria. A hybrid silver-quantum dot system has been used in immune assays for sensitive protein detection (Sup.: cand.(biol.) V.Gasparyan).

Outcomes of applied developments

The studies of the effect of different peptides with application of high performance liquid chromatography and mass spectrometry, and synthesis of peptides based on Fmoc amino acids, has allowed the development and production of cromatographic columns (Sup.: DSc(biol.) S.Chailyan).

The chemical composition and antioxidant qualities of ethanol extracts of grape, sorrel and leaves of pistacia, melitot, rose petals and pellicles of walnut kernel have been studied. It has been revealed that application of these plants suppresses growth of the Ascite Ehrlich carcinoma cells, and their extracts and some of their elements can be suggested as an additional source for prevention of cancer, neurodegeneration and diabetes. The studies of physico-chemical qualities of dipeptidyl peptidase IV and adenosine deaminase have contributed to creation of diagnostics collections of some deceases by means of investigated enzymes (tuberculosis, rheumatoid arthritis), and decrease of symptoms of some deceases (daibetes, cancer, neurodegeration) by means of natural and synthetic inhibitors (Sup.: DSc(biol.) S.Mardanyan).

The nanoparticles of gold, silver, quantum dots sensitized with biomolecules (antibodies, antigenes, lectines) due to their unique optical features, represent nanosensors containing both recognition and signal transformation components. This allows their practical application in highly sensitive definition of any compounds. Particularly, the lectin sensibilised nanoparticles can be used in biological systems for identification of different bacteria with application of a non-instrumental method (paper-based sensors) (Sup.: cand.(biol.) V.Gasparyan).

Scientific and Production Centre "Armbiotechnology"

Major achievements

It has been shown for the first time that cultured milk products, which are fermented by cold-sensitive strains of lactic acid bacteria (LAB), retain their qualitative characteristics with long-term storage in the refrigerator (Sup.: DSc(biol.) H.Hovhannesyan).

From the milk of donkey cultures of LAB have been isolated, metabolic products of which have high antimicrobial properties against pathogenic molds and bacteria. The most promising strains of LAB have been selected for further introduction into production ((Sup.: cand.(biol.) F.Tkhruni).

More than 370 strains of LAB have been screened to detect β-galactosidase activity. Of these, 25 crops - active producers have been selected. The growth of strains at different temperatures, pH, NaCl concentrations, as well as the ability to metabolize carbohydrates, resist bile and the action of antibiotics have been studied (Sup.: cand.(biol.) K.Chitchyan).

The effect of synthetic peptides on the growth of bacteria of the *Pseudomonas* genus, resistant to β-lactam antibiotics, has been studied. It has been shown that *P.aeruginosa* MDC B-9254 and MDC B-9268 strains contain plasmids by which the resistance to ampicillin is transmitted. It has been assumed that these plasmids contain genes encoding β-lactamases. It has been found that β-lactamase of the *P. aeruginosa* MDC strain B-9254 is not inhibited by clavulonic acid. It has been shown that synthetic peptides glycyl-(*S*)-propargyl glycine and (*S*)-β-[4-allyl-3-(pyridin-3'-yl)-5-thioxo-1,2,4-triazol-1-yl]-α-alaninyl-alanyl-glycyl-(*S*)-β-[4-allyl-3-(pyridin-3'-yl)-5-thioxo-1,2,4-triazol-1-yl]-α-alanine are able to inhibit the growth of ampicillin-resistant strains of *P.aeruginosa* 9254 and *P.aeruginosa* MDC B-9268 (Sup.: cand.(biol.) N.Hovhannesyan).

A wasteless technology for transferring salts of basic amino acids into a zwitterionic form using an electromembrane method has been developed. For the transformation process in 2- and 4-chamber electrodialysers, the value of the limiting current density, the optimal concentration of amino acids, the specific energy consumption, the order of the exchange reaction, and the rate constant of the reaction have been determined. The method allows obtaining target products at low energy and chemical reagents consumption (Sup.: DSc(chem.) A.Aghajanyan).

The microbiological method for producing D-lysine from DL-lysine racemate in laboratory fermenters has been developed. Due to the proposed method the concentration of D-lysine in the culture liquid reaches 30-35g/l with 3.0-4.0 g/l of accompanying substances. Based on the developed technology it is possible to reproduce and establish small-scale production of D-lysine (Sup.: cand.(tech.) A.Vardanyan).

The results of physical, chemical and microbiological investigations have shown that active oxidative processes occur in an abandoned Kavart mine. A correlation between the intensity of these processes and the total quantity and species composition of mineral decomposing bacteria has been observed.

It has been revealed that the inhibition of iron oxidation by copper ions has a competitive nature. The increase of substrate concentration will allow to overcome the inhibitory effect of copper on the growth and oxidation activity of *Leptospirillum* sp. str. 64 and *Acidithiobacillus* sp. str.13Zn. It has been determined that while growing bacteria form biofilm consisting of extracellular polymeric substances (EPS) which significantly increases the resistance of bacterial cells to heavy metals (Sup.: DSc(biol.) N.Vardanyan).

The synthesis of 5-aminolevulinic acid by cultures of purple non-sulfur photosynthetic bacteria has been studied. It has been shown that the mutant E10 of *Rhodobacter capsulatus* synthesizes the greatest amount of 5-ALA-179 mg/l during 24 hours (Sup.: cand.(vet.) V.Goginyan).

The enzymes (glycosyltransferase, inulinase) isolated from active producer strains have been purified by affinity chromatography to an electrophoretically homogeneous state. Some biochemical properties of immobilized inulinase have been studied under conditions of high substrate concentration in order to obtain oligosaccharides from starch and inulin (Sup.: cand.(biol.) V.Ghochikyan).

4 new β-isobutylphenyl- or sec-butylphenyl substituted optically active (ee > 95%) derivatives of α-aminopropionic acid with potential antipyretic properties for the first time have been synthesized in DMF medium by the asymmetric C-alkylation of Ni^{II}-(*S*)-2-FBPB-Gly, Ni^{II}-(*R*)-2-FBPB-Gly, Ni^{II}-

(*S*)-2-FBPB-(*S*)-Ala and Ni^{II}-(*R*)-2-FBPB-(*R*)-Ala complexes by *p*-isobutylphenyl bromomethane and sec-butylphenyl bromomethane. The universal method for their producing has been developed (Sup.: DSc(chem.) S.Dadayan).

Optically pure (*S*)-α-amino acids saturated with acetylenic bonds have been synthesized. Their initial amino acid synthons have been obtained, further investigated in the Glaser heterocoupling reactions. The structure and the absolute configuration of the obtained enantiomerically enriched amino acids have been studied and characterized (Sup.: cand.(chem.) A.Mkrtchyan).

New peptide inhibitors of the collagenase enzyme have been obtained using non-protein amino acids (Sup.: cand.(chem.) Yu.Danghyan).

To clone genes of enterobacterial aspartate- and aromatic aminotransferases with broad substrate specificity, characterization of recombinant enzymes, and technologization of the most promising recombinant enzymes, two pairs of primers have been created from the complete sequence of the *Pectobacterium carotovorum* genome. On the basis of 10 DNA samples isolated from bacteria, 5 pairs of recombinant strains have been obtained. From the aspartic and aromatic aminotransferases of one of these strains immobilized forms have been obtained, which were characterized by temperature and pH optima (Sup.: cand.(biol.) A.Hambardzumyan).

The newly constructed strain *Brevibacterium flavum* HKN contains recombinant plasmids pARGBS (provides a high level of L-arginine synthesis by the presence of the heterologous gene *argB Geobacillus stearothermophilus*) and pARGGT (carries the homologous gene *argG Corynebacterium glutamicum,* encoding the enzyme arginine succinate synthetase). Studies of their segregation and structural instability have shown that the recombinant plasmid pARGBS has 100%, and pARGGT - 80% stability.

The fermentation conditions ensuring the biosynthesis of L-arginine 33 g/l in the recombinant strain *Br. flavum* HKN have been optimized (Sup.: cand.(biol.) A.Hovsepyan).

The properties of the isolated soluble polysaccharide synthesized by the new iron- and sulfur-oxidizing chemolithotrophic bacterium *Acidithiobacillus* sp. 13Zn have been studied. The previously developed method for isolating the extracellular colloidal polysaccharide has been modified taking into account the peculiarities of the culture. It has been determined by HPLC that the bacterium under study synthesizes a homogeneous colloid exopolysaccharide. Methodological approaches for the study of biological, chemical and physical properties of the isolated polysaccharide have been developed. Methodological approaches for screening cyclofructan producers and their quantitative determination by spectrophotometry using appropriate computer programs have been developed as well (Sup.: cand.(biol.) L.Markosyan).

Field trials of 32 strains of entomopathogenic bacteria *Bacillus thuringiensis* against the insect pest lacewort (*Euproctis chrysorrhoea L.*) have been performed. Two active strains that cause 100% mortality of larvae within 24 hours have been selected. These cultures can be proposed for effective control of harmful insects.

The maintenance, storage and study of a collection of microorganisms containing about 13,000 strains are under way (Sup.: cand.(biol.) H.Zargaryan).

Using *Brevibacterium flavum* strain-producers the technology for L-alanine biosynthesis in the "Biostat-S" bioreactor has been developed. With combined application of optimized technological parameters it has become possible to reduce the duration of the process, to increase the yield of the target amino acid and to reduce the amount of concomitant amino acids. It has been shown that the initial *Br.flavum* AA5 strain in the laboratory bioreactor in 58 h synthesizes up to 51.5 g/l of L-alanine, while *Br.flavum* GL18 synthesizes 62.8 g/l of L-alanine (Sup.: cand.(biol.) G.Avetisova).

The influence of the Australian and local strains of *Bradyrhizobium japonicum* on the efficiency of 10 selection soybean varieties (Rusa, Melpomena, Danko, Bereginya, Vasilkovskaya) obtained from the Institute of Genetics and Selection (Odessa, Ukraine) has been studied in the field conditions. It has been shown that the yield of the indicated varieties is by 16-36% higher than that of non-inoculated plants (Sup.: cand.(biol.) V.Hakobyan).

The possibility of using the optically active non-protein amino acids, synthesized in the SPC "Armbiotechnology" NAS RA, as structural analogues of L-valine in genetic-selection works has been studied. A collection of 32 analog-resistant mutant of *B. flavum* V9 and *B. flavum* V12 producing

strains has been created which shows about 12% increase in the activity of valine synthesis (Sup.: cand.(biol.) A.Chakhalyan).

Outcomes of applied developments

The production and realization on the European market («Iris Biotech», «Acros Organics») of a number of optically active non-protein amino acids of medical, pharmaceutical and diagnostic importance has been continued (Sup.: acad. A.Saghyan).

The production of cultured dairy product "Narine" based on lactic acid bacteria *Lactobacillus acidophilus* INMIA B-9602 (ACT 173-2015) has been continued. At the same time, the production of fruit "Narine" with addition of manufactured in the Center natural syrups of apricot, peach and black mulberry has been set up. The products are sold in the leading pharmacy chains, supermarkets and a number of maternity hospitals in Yerevan (Sup.: acad. A.Saghyan, R.Hairapetyan).

The production of complex biofertilizers "Ecobiofeed" and "Ecobiofeed+" for the needs of agriculture has been continued. During the reporting period more than 2 tons of biopreparations realized in various farms of the Republic of Armenia have been produced (Sup.: acad. A.Saghyan, cand.(biol.) G.Avetisova).

The serial production of drugs, demanded on the medicinal market of RA (hydrogen peroxide 3% and 30%, boric acid, magnesia sulfate, potassium permanganate, ammonium aqueous solution, castor oil, glycerin, etc.) has been continued. On a contractual basis, these preparations are being sold in the wholesale network "Natali-Farm", "Vaga-Farm", "Farm Dom", "Uni-Farm", "Sanus", "Armpharmacy", "Alta", etc. (Sup.: acad. A.Saghyan, cand. (chem.) G.Hovsepyan).

The production of new vegetable oils from seeds, stones and fruits of various plants (buckthorn, flax, sesame, grapes, milk thistle, apricot, peach, etc.) for food and cosmetic purposes has been set up (Sup.: acad. A.Saghyan, DSc (chem.) S.Dadayan).

In order to obtain new products of functional nutrition, selected associations of lactic acid bacteria, isolated from different samples of fermented milk products, have been tested in the "Artsakh Kat" plant (Sup.: cand.(biol.) F.Tkhruni).

Institute of Molecular Biology

Major achievements

Data on complete mitochondrial genomes of 206 modern Armenians and 52 ancient DNA samples from present-day Armenia and Artsakh have been deposited into GenBank. Compared with other populations of the region lowest genetic distance in this dataset is between modern Armenians and the ancient individuals which strongly favor a genetic continuity model of the inhabitants of the eastern areas of the Armenian Highland at least since the Neolithic (Sup.: DSc(biol.) L.Yepiskoposyan).

The genome wide association studies have shown that Armenian population is characterized by high frequency of the treatment efficacy modulation polymorphisms in the genes of the molecular targets (dopamine and serotonin receptors), metabolic enzymes (cytochrome P450) and transporters (COMT) of antipsychotics. Further studies have shown that 2 polymorphisms (rs4436578 in *DRD2* gene and rs6314 in *HTR2A* gene) and one haplotype are associated with schizophrenia. Moreover, the correlation of the disease duration and the age of the first episode of schizophrenia with these genetic variants have been demonstrated (Sup.:cand(biol.) A.Arakelyan).

Outcomes of applied developments

A TMM software package for transcriptome based assessment of the activities of telomere maintenance mechanisms has been developed. This software in particular will facilitate development of new anticancer agents targeting telomeres in cancers (Sup.: cand.(biol.) A.Arakelyan).

The *VvMybA1* gene allelic polymorphism has been studied in the Armenian grape cultivars, which is important for the quantity of anthocyanin – crucial determinant of the grape quality. The wine grape varieties which are homozygous by functional alleles and accumulate high content of

anthocyanin in berries have been determined and can be used for high quality wine production. The prototypes of genetic passports of the grapevine varieties of the Armenian National Grapevine Collection have been developed (Sup.: cand.(biol.) K.Margaryan).

Two nucleoside compounds (aUY11 and cm1UY11) have been shown to possess potent, dose-dependent inhibitory effect on ASFV infection in Vero cells. The strongest antiviral effect is observed when aUY11 and cm1UY11 are added at early stages of infection. Furthermore, cm1UY11 inhibits the synthesis of early and late viral proteins. The inhibitory effect of the compounds studied on ASFV infection in porcine alveolar macrophages has been confirmed (Sup.: DSc(biol.) Z.Karalyan).

Institute of Hydroponics Problems after G.Davtyan

Major achievements

For the first time some varieties of cultivated soybean (*Glycine max* (L.) MERR.) have been introduced into the hydroponic culture (Majesta, Menua, Korado). It has been found that in soilless culture it is possible to get 80-110 g soybean seeds from one plant, in which the content of raw protein fluctuates between 34-39, and fats - within 22-26 %. There were no significant differences between raw protein and fat content in beans of soil and hydroponic plants.

The standardization of mountain germander (*Teucrium polium* L.) has been implemented by apigenin, according to which in hydroponic and wild dry raw materials the sum of flavonoids is almost identical, and the soil control 2 times concedes the other two variants. *T. polium*'s stocks in Voghjaberd have been determined which makes up to 5.6 kg/100m^2.

The saplings of *Juniperus virginiana* L. with the height of 13-15 cm and trunk diameter of 1-1.5 mm have provided 100 % survival rate when planting in volcanic slag substrate. At the end of the vegetation period their height is 35 cm, and the trunk diameter is 4 mm. It has been found out that in Dilijan forest zone during 4-5 years from 1m^2 hydroponicums it is possible to obtain 45-50 high quality saplings of box (Buxus L.) which have mighty root system and 40-50 cm height.

The highest growth indices -0.93 and 1.68 for leaf and stem callus of *Ginkgo biloba* L. have been observed with the use of phytohormones 0.5 mg/L of α-NAA, 0.5 mg/L of 2.4-D and 1.0 mg/L of BAP. Intensive growth and viability of callus culture of *Picea pungens* L. are provided at the 0.5 mg/L optimal concentration of BAP and 2.4-D or α-NAA and 2.4-D. In open-air hydroponics, essential oil content of *Pelargonium roseum* Willd. (0.2 %) and *Lavandula angustifolia* L. (2.2 %) was respectively 1.7 and 1.6 times as high as soil control.

The radiomonitoring researches have shown that the herbs of ANPP territory agrocenosis with their total β-activity exceed the same objects of Ashtarak (1.1-1.4 times) and IHP territory (1.1-1.5 times), which proves the technical influences of ANPP on biosphere. Moreover, the share of most dangerous artificial radionuclides of ANPP territory (^{90}Sr, ^{137}Cs) made the herbs total β-activity 2.3-3.2, Ashtarak territory 2.1-3.1, IHP territory 1.8-2.9 % (Sup.: corr. member S.Mayrapetyan).

Outcomes of applied developments

The biotechnology of curly cabbage hydroponic growth has been developed (Sup.: corr. member S.Mayrapetyan).

The vertical tower module of plants hydroponic growth has been designed and tested for the first time, where 3 varieties (Albion, Monterey and Sweet Eve) of remontant strawberry have been grown (Sup.: cand.(biol.) A.Tadevosyan).

Proposals to sell decorative tree-shrub tree saplings, obtained in the result of developing hydroponics cultivation biotechnology (nearly 5000) have been sent to Municipality of Yerevan and other interested organizations with the aim of signing contracts (Sup.: cand.(biol.) A.Hovsepyan).

In tissue culture laboratory the *in vitro* collection of plants has been preserved (clove 17 varieties (*Dianthus caryophyllus* L.), potatoes 14 varieties (*Solanum tuberosum* L.), medicinal asparagus (*Asparagus officinalis* L. (Mary Washington), kalanchoe (*Kalanchoe pinnata* Lam. (Pers.) and etc) (Sup.: DSc(biol.) E.Sargsyan).

The agro-technical and phytotechnological recommendations for *Lycium barbarum* L. have been developed (Sup.: DSc (agric.) M.Babakhanyan).

The RA Patent “Polymer-inorganic slurry of cesium radioactive nuclides and the mode of its reception” has been registered (Sup.: cand.(biol.) A.Tadevosyan).

Cooperation agreements have been signed with chairs of “Biochemistry, Microbiology and Biotechnology” and “Botany and Mycology” at YSU Faculty of Biology, in order to conduct joint scientific researches, to hold Bachelor's, Master's and PhD students' internships and prepare cadres; with the Scientific Center of Vegetable and Industrial Crops of MA RA, in order to conduct joint scientific researches, and commercialization of a number of precious and rare plants' seeds, seedlings and row material (Sup.: cand.(biol.) Kh.Mayrapetyan).

Institute of Physiology after L.Orbeli

Major achievements

Studies have been continued to create a repository of mesenchymal stem cells (MSC) from adipose tissue. The growth properties of AdMSC cultured with human serum have been tested, and the influence of serum on the viability and rate of reproduction of AdMSC has been investigated. Preliminary results have shown that human serum can be an alternative to fetal bovine serum. Training and improvement of practical skills in isolating mesenchymal stem cells from different source fats allow us to confirm the presence of a high level of pluripotent mesenchymal cells in the cell culture (Sup.: cand.(biol.) Z.Karabekyan).

Evaluation of the correlation of NADP oxidase activity and synaptic plasticity in the central nervous system in type II diabetes and phytoterapy has been performed to justify the prospects for the development of multi-purpose phytopreparations from native raw materials. The antioxidant activity of Stevia rebaudiana leaves and Goji berry fruits in the central nervous system is accomplished through selective stabilization, which enhances the possibilities of antioxidant therapy (Sup.: DSc(biol.) V.Chavushyan-Papyan).

On the rotenon model of Parkinson's disease in rats, it has been shown that curcumin has a regulatory effect on the change in bioelectrical activity of neurons in the hypocampus-substancia nigra loop. As a result of morphohistochemical studies the neuroprotective effect of curcumin has been determined due to the survival of the cellular structures. Intraperitoneal administration of curcumin significantly reduces rotenon-induced neurotoxicity and death of hippocampal and substancia nigra neurons. After treatment with curcumin in the rotenone-affected group of rats restoration of motor reactions to rearing and other behavioral disorders has been found (Sup.: DSc(biol.) V.Sargsyan).

As a result of immunization of rabbits an antidote has been obtained from the venom poisoning of the snake Macrovipera lebetina obtusa, and several types of testing by various experimental in vivo and in vitro approaches have been performed to evaluate the effectiveness of the serum (Sup.: DSc(biol.) N.Ayvazyan).

Outcomes of applied developments

For the first time the integrated modified system of psycho-physiological definition of the types of athletes’ character with application of polygraph has been developed adapted to the specifics of the sport. Complex psycho-physiological survey using a polygraph allows us to identify individual biological features, functional disorders of the nervous system and to form positive psychophysical mobilization readiness of athletes. Cooperation of polygraph registration of nonspecific physiological reactions of the organism with a psycho-physiological definition of the types of athletes’ character serves as a universal means of decoding subconscious nonverbal elements of the psyche of athletes (Sup.: cand.(biol.) A.Khachunts).

DIVISION OF CHEMISTRY AND EARTH SCIENCE

Academician-Secretary – academician L.Tavadyan
Scientific Secretary – cand.(techn.) L.Gasparyan

The Division includes the Scientific Technological Center of Organic and Pharmaceutical Chemistry, the Institute of Chemical Physics, the Institute of General and Inorganic Chemistry, the Institute of Geological Sciences, the Institute of Geophysics and Engineering Seismology after A.Nazarov.

The division includes 9 academicians, 6 corresponding members and 21 foreign members of NAS RA.

2 general meetings of the Division were held during the reporting year.

At the annual meeting of the Division held on 16 March the reports of the academician-secretary, academician L.Tavadyan, directors of the research institutes, as well as foreign members of NAS RA of the Division, related to their scientific activities and achievements in 2016 were discussed.

At the general meeting held on 10 March the candidacy of Kh. Meliksetyan, cand.(geol.), for the vacancy of the director of the Institute of Geological Sciences was heard, approved and was submitted to the discussion of the Presidium NAS RA.

At the General meeting of Bureau held on 14 April the candidacy of L.Sahakyan, cand.(geol.), was discussed and appointed for the vacancy of the deputy director of the Institute of Geological Sciences.

At the meeting of Bureau held on 11 May applications of maintenances and development project of the scientific and technical activity, basic funding infrastructure applications of scientific organizations of the Division for 2018 have been discussed, as well as the new staff of the Academic Council of the Institute of Geological Sciences was discussed and approved.

Corresponding member R.Melkonyan's condidacy as the editor-in-chief of the journal of "Proceeding of NAS RA. Earth Sciences" was discussed and approved at the meeting of Bureau held on 30 October.

The business plan "The modernization of the production of the Scientific Technological Center of Organic and Pharmaceutical Chemistry" was worked out and submitted to the government by the Division with Scientific Technological Center of Organic and Pharmaceutical Chemistry.

13 meetings of the Division were held within the year where scientific and organizational problems were systematically discussed.

Working plan and distribution of postgraduate studies of the Division, annual reports of the Division and Institutes, reports of scientific and technical activity and Basic funding of Institutes for 2017 were discussed and approved at the meetings of Bureau.

4 researchers of the institutes of the Division were on academic trips in Russia, Germany and other countries for the purpose of joint research, as well as for participation in international conferences and symposia.

The Division jointly with the Institute of Geological Sciences NAS RA organized the 42nd International commission on the history of geological sciences (INHIGEO)" with participation of 75 scientists, including 45 foreign participants, and the 5th IGSP 630 international conference and field workshop "Permian and Triassic integrated stratigraphy and climatic, environmental and biotic extremes" with participation of 34 scientists, including 25 foreign participants, was organized as well; jointly with the Institute of General and Inorganic Chemistry V International conference on "Chemistry and chemical technologies" dedicated to the 60th anniversary of the Institute of General and Inorganic Chemistry after M.Manvelyan with participation of 150 scientists, including 58 foreign participants from Russia, Ukraine and other countries was organized. Jointly with the Institute of Geophysics and Engineering Seismology after A.Nazarov the Division organized III International Conference of Young Scientists on "Actual problems of geophysics, engineering seismology and seismically stable construction" with participation of 100 scientists, including 20 foreign participants.

385 articles (209 in local and 176 in foreign journals), 70 abstracts (32 at local and 38 at foreign conferences), 7 monographs were published by the Institutes of the Division, 3 patents RA were received.

Three Candidates' and one Doctor's dissertations were defended in 2017.

The Division has taken part in the works of annual meetings of the Institutes and in the discussion of scientific results.

Institute of Chemical Physics after A.Nalbandyan

Major achievements

It has been revealed that in the reaction of carbon dioxide conversion of methane the decrease in particle size of the catalyst, prepared from the nanopowders of tungsten carbide (WC), produced by the plasmomechanical method leads to significant increase in the catalyst activity and the degree of methane conversion (Sup.: DSc(chem.) S.Arsentiev).

Reduction of copper from oxide oily wastes has been realized under combustion mode using additions of a strong oxidizer (Sup.: corr. member S.Kharatyan).

Outcomes of applied developments

Tests have been carried out in the CJSC "Disinfection Center" of MH RA, in the reference-laboratory of SNCO "National Tuberculosis Center" of the MH RA, as well as in production companies of food processing (fish, meat products, fruit juices) for optimizing the activator's composition of the disinfectant "Bioxil-2" and revealing its bactericidal activity. In all the tests high efficiency of the disinfectant "Bioxil-2" has been confirmed (Sup.: acad. L.Tavadyan, cand.(chem..) L.Nersesyan).

A single-stage technological process on processing of oxide oily wastes of copper wire production into high-purity (more than 99%) copper powder has been developed under combustion mode (Sup.: corr. member S.Kharatyan).

On the basis of hydride cycle method new technological processes of single-stage, wasteless and environmentally safe production of the titanium aluminide, $TiAl_3$, and the most widespread alloy of titanium, Ti4V6Al have been developed. These technologies differ from conventional by efficiency, simplicity, low energy consumption and productivity (Sup.: DSc(tech.) S.Dolukhanyan).

A new technology for processing of tail spoils of Kadjaran Copper-molybdenum Concentrating Mill, aimed at extracting copper-, molybdenum- and iron-containing components, has been tested using an aggregated laboratory installation (Sup.: cand.(tech.) K.Hakobyan).

Scientific Technological Center of Organic and Pharmaceutical Chemistry

Major achievements

Several pharmaceutical and physiological properties of N-benzoyl-DL-valin dimethylaminoethyliodine methylatecompound have been studied. In particular, a) study of anticholinesterase activity has been performed, b) acute toxicity of compound has been determined (LD_{100}-350mg/kg, LD_{50}-mg/kg, DL0 -50mg/kg). Neurophysiological study demonstrates that under the influence of this compound neurodegenerative processes in the long term memory region of the brain have been inhibited. Neurodegeneration of this region is linked to Alzheimer's disease, which implies that this compound may have therapeutic effect in prevention of this disease (Sup.: corr.member V.Topuzyan)**.**

Outcomes of applied developments

Flavonoidal compounds in the wastes of grape processing have been investigated. Spectrophotometric methods of Antioxidant(antiradical) activity determination and quantitative definition for that compounds have been developed and tested (Sup.: DSc(chem.) V.Mnatsakanyan).

A method of separation of albumin and serum proteins by Capillary Zone Electrophoresis (CZE) has been developed and optimized. This method can be used in the practice of diagnosing, preventing and treatment of the liver cirrhosis (Sup.: cand.(biol.) G.Gasparyan).

Institute of General and Inorganic Chemistry after M.Manvelyan

Major achievements

Thermoregulation coatings (TRC) of new compounds based on zirconium and zinc silicates have been developed for space machines. A principally new approach to the synthesis of target materials via hydrothermal-microwave method allowing to produce radiation-resistant pigments with improved features for TRC has been developed. These findings enable to use Armenia's mountainous rocks such as perlite, diatomite and quartzite as a raw material. The synthesized coatings were tested at Alikhanyan National Laboratory under the conditions of modeling space environment (Sup.: cand.(tech.) V.Baghramyan).

Fusible nitrate glasses resistant to crystallization within the narrow range of transformation temperatures have been developed. The mechanism of contact interaction in the systems (diamond – metal – oxide – nitrate glass) in the range of glasses thermodynamic instability has been established to develop composite materials (including diamond-containing abrasive ones) for the treatment of diamond polycrystals and monocrystals. New variants of technological treatment processes (grinding, polishing) for diamond polycrystals and monocrystals have been justified (Sup.: DSc(tech.) N.Knyazyan).

Outcomes of applied developments

Within the frame of the project "The technology of complex chemical processing for serpentinous ultrabasic rocks" a pilot plant has been constructed and a number of experiments have been carried out for the production of bischofite $MgCl_2 \cdot 6H_2O$ from the above mentioned rocks existing in occurrences of Armenia. It has been shown that the developed technology can be applied for the industrial-scale production of bischofite and silica (Sup.: cand.(tech.) N.Zulumyan).

The extraction of copper from oxidized copper minerals by flotation has been investigated and the productive technology principles have been suggested (Sup.: cand.(tech.) A.Hovsepyan).

Institute of Geological Sciences

Major achievements

As a result of stratigraphic and petrologic researches it has been shown that shamiram-byurakan ignimbrite is a subtype of artik ignimbrite. The obtained data show that the above mentioned ignimbrites and yerevan-leninakan ignimbrites are a result of different eruption phases of volcanic activity of Aragats (Sup.: cand.(geol.) Kh.Meliksetian).

Microbial, carbonate dome constructions from Martakert region (NE Artsakh) are characterized by a dark, micritic peloidal fabric with no internal lamination and are therefore classified as thrombolites and are unique geological monuments (Sup.: cand.(geol.) L.Sahakyan).

The carried out complex underwater and surface tectonic studies allow to explore the presence of the Noratus-Qanagegh under water fault segment in Lake Sevan, under the modern lake deposits based on the spatial distribution of the underwater springs and gas emissions (Sup.: DSc(geol.) A.Avagyan).

Perspective areas have been distinguished within the territory of Dastakert-2 ore field. Steeply dipping gold-bearing zones have been opened, in which the grade of minerals corresponds to the economic viability (Sup.: cand.(geol.) A.Hovhannisyan).

Outcomes of applied developments

A new type of phosphorus fertilizer has been created by enrichment, which by its qualitative criteria (the amount of P_2O_5 absorption by plants) is an analog of double superphosphate used in industry (Sup.: DSc (geol.-min.) T.Avagyan).

Considering the strong earthquake as momentary slips on the Earth surface, the initial velocity of the non-homogeneous soil top-layer particles' transverse seismic fluctuations on the surface of earth depending on the predictable earthquake magnitude has been determined through theoretical examinations. The values of the ground velocities established by the developed method are compared with their values on the MSK-64 seismic scale, which shows a sufficient correlation for earthquakes with magnitudes $6.0 \leq M \leq 9.0$. With the joint efforts of the RA Government, World Bank, and "Applied Technology Council" American organization, the normative-instructive document "A guidebook of school building reconstruction and new school building planning in the RA" has been elaborated (Sup.: acad. E.Khachiyan).

An examination of the Cellular Seismology method and its applicability in the RA bigger basins territory for the purposes of examining the earthquakes or explosions has been carried out (Sup.: cand. (phys.-math.) L.Sargsyan).

A prototype of multi-functional modern electrical prospecting multichannel measuring equipment "VECTOR-GEO" has been developed and created. Due to its functional features it can be widely used in research electrical survey. The proposed complex can be useful for effective mastering of educational and practical material on the laboratory courses "Petroelectric studies of samples and models of rocks and ores" and "Physical modeling - Electrical prospecting workshop" (Sup.: DSc (phys.-math.) A.Matevosyan).

Software for automated landslide monitoring has been completed and tested. The software currently operates in the monitoring system first implemented in Armenia. A model for rockfalls hazard assessment has been developed using data on rockfalls in Lori marz (Sup.: cand.(geol.-min.) A.Avagyan).

Institute of Geophysics and Engineering Seismology after A.Nazarov

Major achievements

A probabilistic and deterministic map at a scale of 1:500 000 has been compiled for seismic hazard assessment on the territory of the RA expressed by the values of the maximum ground accelerations (Sup.: cand. (phys.-math.) V.Grigoryan).

It has been shown that the problems of the rigidly clamped beam with two ends and the cantilever beam under kinematic excitation are similar to the problems of current distribution in two-wire and single-wire lines, respectively. A new table of analogies between elastic (mechanical) and electrical quantities has been compiled. Based on the analogy between the propagation of elastic waves in a cantilever beam and currents in a long line a system of differential equations has been recorded for the first time for "electric current", similar to the system of equations for purely shear oscillations. It has been shown how from the recorded first equation of the system it is possible to obtain Ohm's law for an electric current. Further on the analogy from the first equation, for purely shear oscillations it has been shown that the internal friction mechanism is similar to Ohm's law (Sup.: corr. member S.Hovhannisyan).

A serial production of mobile and stationary measuring and control water level meters in wells and boreholes has been organized on the experimental-production base of the Institute highly demanded on the market of the Republic of Armenia and successfully applied in various sectors of the national economy (Sup.: cand.(geol.) J.Karapetyan).

Outcomes of applied developments

An automated, control and measuring system of water level meters in wells and boreholes has been designed, manufactured and introduced.

An automated monitoring and measuring monitoring network has been created to monitor the water level in piezometric wells on the Geghartalich reservoir dam (Sup.: cand.(geol.) J.Karapetyan).

As a result of the systematic analysis of a complex of geophysical, geological-tectonic, seismological, geodetic data, a three-dimensional structural-dynamic model of the earth's crust of the Kaps reservoir territory has been compiled at the scale of 1:200 000, serving as a seismotectonic basis for the seismic hazard map compilation aimed to assess the seismic effect on the reservoir dam (Sup.: cand. (geol.-min.) H.Hovhannisyan).

Based on the results of complex geophysical studies of the designed Kaps reservoir «Kumayri» irrigation tunnel the direction, length of the tunnel and geotechnical condition have been identified, and the engineering-geological and hydro-geological conditions of the new tunnel route have been assessed (Sup.: R.Gasparyan).

For recording vertical oscillations a seismic sensor has been developed and tested (Sup.: A.Gasparyan).

A remote seismic protection system has been developed and introduced for monitoring and safe operation of strategically important facilities (Sup.: S.Shahparonyan).

DIVISION OF ARMENOLOGY AND SOCIAL SCIENCES

Academician - Secretary - academician Yu.Suvaryan
Scientific secretary - cand.(philosophy) H.Kocharyan

The Division consists of the Institute of History, the Institute of Economics after M.Kotanyan, the Institute of Philosophy, Sociology and Law, the Institute of Language after H.Acharyan, the Institute of Literature after M.Abeghyan, the Institute of Oriental Studies, the Institute of Archaeology and Ethnography, the Institute of Arts, the Armenian Genocide Museum-Institute, Shirak Centre for Armenian Studies, "Armenian Encyclopedia. Publishing house". All Armenian foundation for financing Armenian Studies acts in the frames of the Division.

The Division includes 7 academicians and 18 corresponding members.

In 2017 three general meetings of the Division were held.

At the general meeting on 22 February the report of the corresponding member P.Avetisyan "On the results of investigations of the newly discovered archaeological sites (new data, new methods and new concepts)" was considered. The candidatures of academician R.Safrastyan and corresponding member P.Avetisyan were recommended for the vacancy positions of the directors of the Institute of Oriental Studies and the Institute of Archaeology and Ethnography.

At the annual general meeting of the Division on March 28 the report of the academician-secretary Yu.Suvaryan "The main results of scientific and scientific-organizational activities of the Division in 2016" was discussed and approved. Scientific reports on "Literary Studies in the system of Social Sciences" (acad. S.Sarinyan), "History of Armenia – the state of publication and about new solutions of some fundamental bases of the historiography" (acad. A.Melkonyan), "Kurdish issue and its validity" (DSc (hist.) V.Bayburdyan) were heard.

At the general meeting on April 18 the scientific report of the academician G.Poghosyan on "The methods of investigation of the electorate behavior in sociology" was heard. The candidature of the corresponding member V.Harutyunyan for the vacancy position of the director of the Institute of Economics after M. Kotanyan was recommended.

During the current year 13 Bureau meetings were held.

The following points were considered and approved: the working plan of the Division, the applications of the projects on keeping and development of infrastructure of based financing during 2017 scientific and scientific-technical activities, on preservation of scientific objects of national value, on the state special purposed projects, as well as current reports on the mentioned procedures during 2016; applications for 2017 post-graduate studies; the applications of the projects on keeping and development of infrastructure of based financing during 2018 scientific and scientific-technical activities, on preservation of scientific objects having national value, the 2017 program of the annual general meeting of the Division; the staff of the scientific council of the Institutes of Oriental Studies, Archaeology and Ethnography, Economics after M. Kotanyan, Language after H.Acharyan;

organizing committee of the International Conference dedicated to the 300th anniversary of the establishment of the Mkhitarist Congregation in Venice; meeting schedule of the annual reporting sessions of the scientific organizations of the Division. The following points were heard and discussed: the problems of organizing attestations and competitions within the scientific organizations of the Division and the issues of organizing structures for their scientific management; realization of common scientific project with Academy of Social Sciences of China; cooperation with Hrant Dink International Foundation; presenting a program related with the events dedicated to the 75th anniversary of the establishment of the NAS RA; as well as issues related to the celebrations of the 90th jubilees of academicians H.Gevorgyan and V.Barkhudaryan and other scientific and organizational issues.

The Division organized an International Conference dedicated to the 300th anniversary of the establishment of the Mkhitarist Congregation in Venice.

At the meetings of Bureaus the issues on the organization of the assessment of the effectiveness of scientific organizations, the conclusions of the assessment subcommittees, assessment results and other issues of the Division were heard and discussed.

The Bureau discussed and developed events related to the celebrations of the 100 jubilees of the Republic of Armenia and May heroic battles in 2018.

Based on the decision of the Bureau the fillowing candidatures of chief editors of the scientific journals were recommended: corresponding member P.Avetisyan (Bulletin of Social Sciences), corresponding member A.Kharatyan (Journal of Armenian Studies), DSc (hist.) A.Kosyan (Fundamental Armenology).

At the meeting of the Bureau on 20 December reports on scientific and scientific-organizational activities of the Division Bureau and scientific organizations were considered and approved.

During 2017 three volumes of the “Historical-Philological Journal”, the “Journal of Armenian Studies” and the “Bulletin of Social Sciences” each, as well as two volumes of the English online journal “Fundamental Armenology” were published.

1056 articles (230 in foreign journals), 160 abstracts (119 in local and 41 in foreign conferences), 101 monographs, 12 tutorials were published by the Institutes of the Division.

Institute of History

Major achievements

The 2nd volume of “The History of the Armenian Periodicals” (ed. A.Kharatyan, L.Gevorgyan), which covers the history of the Armenian newspapers and magazines in the period of 1900-1922, has been published. The volume reveals the intellectual, cultural and spiritual direction of the Press of the period. The history and contents of Armenian newspapers and magazines, for the most part, have been introduced for the first time.

Within the framework of the theme "The Armenian Statehood from the Ancient Times to 1918" (Sup.: acad. A.Melkonyan) the history of the Akhtamar Catholicosate has been studied from the time of its foundation until the collapse (1113-1895). It has been presented that after the emigration from the country of the nobility of the Vaspurakan Kingdom, which became the victim of the attacks of the Seljuk Turks and the treacherous policy of the Byzantine Empire, the common people and the clergy who served him remained in place. The representatives of the younger branches of Artsruni – the Khedenekyans, who had not left their homeland, having fortified themselves in the castle of Amuk, on the island of Akhtamar and in the coastal villages of Lake Van, retained their semi-independent authority, including spiritual and ecclesiastical powers. The Akhtamar Monastery and the surrounding educational centers became the leading units of Armenian culture and science.

The historical demography of the late 19th century and early 20th century in the Kharberd province of Western Armenia has been studied. The issues of the number of the Armenian population of the province and the history of the Armenian Genocide have been considered. The issue of the involvement of the Armenian population in the economic life and demographic processes of the province, in particular, the emigration to the United States, has been touched upon. An attempt has been done to calculate the approximate number of the Armenian population of Kharberd in 1915 on the basis of analysis and comparison of various sources.

Institute of Archaeology and Ethnography

Major achievements

As a result of excavations of the new site Lernagog 1 and study of corresponding materials, an ancient settlement dated to the 8-7th millennia BC has been revealed and researched, the settlement introduces the culture of the Early Holocene pre-ceramic Neolithic (PPNB/C) period. In the mentioned period the cultural facts (stationary settlements, domestication of animals and cereals, formation of crafts, etc.) typical to agriculturers and cattle-breeders gradually spread all over the Near East from the core zones of formation of agricultural societies. Before that the chronological border of the appearance of early agricultural societies in the territory of contemporary Armenia had been represented by settlements related to the first half of the 6th millennium BC and there were no sources which could enable the study of social-cultural developments occurred in the previous time span. The results and new data from the excavations carried out in the frames of the Armenian-Japanese collaboration are an important contribution to the sphere of understanding the mechanisms of formation of the first agricultural societies in the Near East, as well as to studies related to the area of their spreading. These works evidence the existence of a new centre with parameters typical to the core zone of "Neolithic revolution" in the regions to the north of the river Araxes (Sup.: A.Petrosyan, M.Arimura).

Outcomes of applied developments

A database concerning the people exiled from Armenia on 14 of June, 1949 has been created and placed in the site (http://www.armeniatotalitaris.ru/). A reference book on the exiled people in Soviet Armenia in the period of politic violence of the USSR - the two volumes of the "Book of memory" with data on approximately 23.000 people has been prepared for publication (Sup.: cand.(hist.) H.Kharatyan).

According to the circular convention signed with the Smithsonian institution, a great number of ethnographic field works have been carried out in Tavush, Lori, Shirak and Syunik regions of RA. The opportunities of development of cultural, rural and ethnic tourism in Armenia have been attested, analyzed and rated by the realized and current studies. On the basis of the study results strategic and current projects of development of tourism in Armenia will be made (Sup.: DSc(hist.) H.Marutyan, cand.(hist.) G.Shagoyan, cand. (hist.) A.Tadevosyan).

Owing to the means granted by the embassy of the USA the works of the first phase of museumification of the cave Areni 1 as an object of tourism (fencing, organization of lighting, construction of a passageway and an ancillary building, making and placing of information boards) have been finished (Sup.: B.Gasparyan).

Analytic and field research works have been carried out towards the elaboration of the project of participation of Armenia in the anual festival "FolkLife 2018, Washington D.C." (Sup.:corr. memb. L.Abrahamyan, cand.(hist.) S.Mkrtchyan, R.Tsaturyan).

Series of lectures on migration consisted of 20 parts have been prepared to be produced and put in the scientific-educational site www.boon.am. The lectures are dedicated to theories of migration, to contemporary problems and challenges of migration politics in Armenia and in the world (Sup.: cand.(hist.) A.Poghosyan).

The application "Kochari, traditional group dance" elaborated in the Institute has been included in the UNESCO non-material cultural heritage list (Sup.: R.Tsaturyan).

All the series of books, theses of reports of published during 1974-2010 by the Institute (in general 23 492 pages) have been digitalized.

900 units of finds having historical-cultural great values (objects made of bronze, iron, glass, bone, stone) have been reconstructed and prepared for museumification.

Institute of Oriental Studies

Major achievements

Within the framework of the program “Armenia and the Problems of Political, Social, Cultural and Ethnic History of Turkey, Iran, Caucasia and Arabic Countries of Mashriq” (Sup.: acad. R.Safrastyan) one of the most important achievements is the study of the history of the conflict in the Near East, in particular in Syria, as well as the study of the history of the Alawi community of Syria and sunni-shia contradictions in the context of “Arab spring”. The subject matters of the study are the issues of the confessional peculiarities of the Alawi community of Syria, the problems of establishing the military and political authority of Alawites in 1970-2000 - during the reign of Hafez al-Assad, the role of Alawites in the developments of domestic politics. The study and coverage of the activity of the Alawi community in Syria's military and security field was particularly important. The issue has been also highlighted in terms of evaluating and studying the root causes of the war in Syria today.

Within the framework of the program “Eastern Sources of the Ancient, Medieval and New Period about Armenia and the Armenians” (Sup.: cand.(hist.) R.Ghazaryan) publishing in English Persian sources of the late medieval and new period is of great significance. 450 Persian manuscripts have been presented: they have a great importance for the study of the history of Armenia and neighboring countries in the 16^{th}-19^{th} centuries.

Institute of Language after R. Acharyan

Major achievements

In the framework of the topic “Issues in General-Comparative and Applied Linguistics” (Sup.: DSc (phil.) V.Hambardzumyan) a number of projects in applied linguistics has been developed and implemented, the projects are aimed at the use of modern technologies in internet-based linguistic research on the one hand, and successful functioning of Armenian as an internet language on the other hand. The project “Armenian Electronic Concordance” is ready to be launched in a separate website, and it will provide a large web-based electronic database of resources with a compact flexible search engine and an extensive coverage for the academic community with an option of continuous upload of works in old, middle and modern Armenian languages.

The absence of modern literary Western Armenian grammar discription makes it urgent to commence activities targeted at the regulation of the Western Armenian language. Taking this into consideration, varieties of literary Western Armenian, that exist in different communities of the Armenian Diaspora, and some controversial issues have been thoroughly investigated within the topic “Problems of Research and Regulation for Modern Eastern Armenian and Western Armenian Languages” (Sup.: cand.(phil.) N. Sargsyan) as a result of which the canonical forms of the parts of speech in Western Armenian have been determined and the grammatical regularities have been systematically presented. Meanwhile, applied stylistic differences, free and equivalent linguistic phenomena, conversational and non-acceptable foreign variants and dogmatic/indisputable misconceptions have been distinguished in multiple linguistic and grammatical formations. The research outcomes are summarized in the book “Grammar of the Western Armenian Language (Norms and Problems) Book A” authored by A.Cholakyan.

Considerable work has been done within the framework of the topic "Study of Armenian Dialects" (Sup.: DSc(phil.) V.Katvalyan) to study the dialectal units currently functioning in the territory of the Republic of Armenia. Collection of audio and video dialect material from all the settlements of the Kotayk Region has been completed, a large amount of dialect material has been stored that needs to be studied and which will be presented together with the material collected within the project "Dialectological Atlas of the Armenian Language" (DAAL) in a separate website by the "Armenian Dialect" project and with a matching software programme. By the results of live subdialect research in the Kotayk Region it has been recorded that the dialect of Van is not entirely lost. Among the dialects of Mush, Sasun, Diadin, Karin a subdialect of Van is also functioning in the RA.

Outcomes of applied developments

In the framework of the theme “Issues of research and normalization of the modern East Armenian and Western Armenian languages” (Sup.: cand. (phil.) N.Sargsyan) dictionaries, not only for the professional framework, but also for the public interest, have been compiled and published ("New Words", "Spelling Dictionary of Proper Names", "Dictionary of Armenian Equivalents for Unnecessary Loanwords"), a guidebook ("Armenian Language Guide") on language regulation has been drafted.

The website Hamabarbar.am (Sup.: DSc(phil.) L.Hovsepyan) is ready to be launched where a huge database of electronic co-resources will greatly enable to search and use material needed for linguistic research with a wide-range comprehensive information available.

Institute of Literature after M.Abeghyan

Major achievements

Within the scope of the theme “History and theory of the Armenian literature” (Sup.:DSc(phil.) V.Devrikyan) a research has been carried out in the context of the Assyrian-Byzantine traditions of the first centuries of Christianity. The Armenian versions and editions of the traditions have been outlined beginning from the legends about Abgar till the stories connected with Constantinus the Great. The question has been considered which of the above-mentioned versions of traditions were widespread in the Armenian environment and what types of re-editions took place conditioned with the national and ecclesiastical factors.

On the basis of the extracts from the travelogues of the 17-18th centuries European travelers related to Armenia characterizations of Armenia and the Armenian nation given by those authors have been presented. In the research the Armenian national traditions, mentioned in the travelogues, have become a specific object of analysis in the aspect of whether each of these traditions were previously recorded in the preceding period of Armenian literature and by other travelers, or it is the first recording of that time. It also reveals the similarities and differences of the versions of the same traditions in the records of other authors.

Institute of Philosophy, Sociology and Law

Major achievements

The important results of the project “Historical-philosophical, socio-political and legal studies of the Armenian reality research” (Sup.: acad.G.Poghosyan) supported through base funding in the reporting year of 2017 were reflected in four scholarly directions, *viz*. philosophy, sociology, law and political science.

Findings of the sociological research of many years that dealt with migration have been summarized and provided grounds for important research conclusions regarding a new phenomenon that emerged in the Republic of Armenia, *viz*. depopulation processes. Having profoundly described the root causes, scope and further trends of depopulation, the Institute`s researchers at the same time outlined ways and methods for preventing and eliminating this dangerous phenomenon that poses a threat to the country’s security. The scientific results and proposed recommendations have been published in a collective monograph (G.Poghosyan, I.Arakelyan and V.Osipov. Migration and Depopulation in Armenia. Yerevan: Limoosh publishers, 2017, 200 pages) and sent to all interested governmental organizations and public entities in the country.

The main research findings have been summed up also in prestigious «СОТИС» (*SOTIS*) journal which is published in Moscow, its №1 (81), 2017 issue consists entirely of the research articles submitted by the Institute’s research staff.

For the seventh consecutive year a republican science conference “Philosophy in the Present-Day World” was held in the Institute on the occasion of the World Philosophy Day established by UNESCO. Proceedings of the conference were published as a separate collection of research articles (Editor-in-chief : acad. G.Poghosyan).

Outcomes of applied developments

In 2017 the research activities that have focused on the current socio-political climate and migration processes in the Republic of Armenia, in particular in the circumstances of membership in the Eurasian Economic Union, were continued. Since early 2017, sociological studies of the parliamentary elections have been conducted in the country in the context of transition to a parliamentary system of government in Armenia. The sociological studies were organized and conducted jointly with the well-known international *Gallup/Baltic Survey* organization.

Institute of Economics after M. Kotanyan

Major achievements

Within the scope of the project "Issues on Increasing the Effectiveness of the Performance of Tax and Customs Authorities in the Republic of Armenia" (Sup.: corr. member V.Harutyunyan) possible issues and the degree of uncertainty with respect to the corresponding consequences associated with the accession to the Eurasian Economic Union (EAEU) have been identified by addressing the specifics of organizing the activities of the tax and customs authorities in the EAEU member and non-member states and legislative and administrative measures that are to be introduced and complied with the EAEU membership requirements. Based on the research results and the detailed study of the experience of other nations the optimal approaches to increasing the efficacy of the performance of both tax and customs authorities have been identified by stressing the need for optimizing the organizational chart and introducing new or making changes in the existing rules governing the conducts of tax and customs authorities.

Within the scope of the project "Issues on Ensuring Sustainable Economic Growth in the Republic of Armenia and Approaches to Address Them" (Sup.: DSc (econom.) A.Bayadyan) it has been shown that improvement of the socioeconomic state in the Republic of Armenia is possible in the case of the formation of the regional industrial complex, the development of various branches of the processing industry, the creation of intra-industry and inter-industry production links in marzes. In order to increase GDP, it is necessary to improve the export infrastructure, in particular, special attention should be paid to the difficulties arising in the transport process from Armenia or to Armenia, and to attach importance to efforts to promote exports towards high-quality and non-perishable goods and the accelerated depreciation mechanism in the part income tax.

Outcomes of applied developments

Within the scope of the project "Issues on Increasing the Effectiveness of the Performance of Tax and Customs Authorities in the Republic of Armenia" (Sup.: corr.member V.Harutyunyan) the issues on improving the activities of tax and customs authorities that could seriously affect the progress of the economy have been studied; theoretical and methodological approaches to improving the efficacy of the tax administration have been investigated; regional integration impact on the tax and customs system has been explored; and possible approaches to the radical transformation of the conduct of the customs and tax servants based on the study of the international best practices have been examined.

Within the scope of the project "Issues on Promotion of Widespread Use of Alternative Energy Sources in the Republic of Armenia" (Sup.: cand.(econom.) H.Markosyan) based on the results of the study it has been proposed to allow the use of the accelerated depreciation in the renewable energy sector, and to define a guaranteed margin between the pay-back price and the sale of the power for the power accumulating stations in order to promote the construction of private nested power capacities; the mechanisms to promote the activities of independent solar energy stations that operate without a license have been elaborated based on the generated power selling price scale and capacities built on the borrowed resources to be compensated in the form of income tax in case of the natural person for loan interest payments as an option; the efficacy of introducing "Green Certificates" and the need for operating hydro-accumulating capacities have been justified.

Within the scope of the project "Promoting Domestic Investment and FDI as a Tool for Ensuring Sustainable Economic Growth in the Republic of Armenia" (Sup.: cand. (econom.) L.Sargsyan) based on the analysis findings it has been demonstrated that the respective measures are needed to be undertaken with respect to getting construction permits, electricity, protecting minority investors, paying taxes, enforcing contracts in order to improve the nation's ranking according to the Doing Business Index methodology. Based on the assessment of the investment risk and potential of Armenia it has been identified that the following indicators are of great concern: FDI inflow, GDP per capita, poverty rate, and taxes paid by the businesses.

Within the scope of the project "Interplay of Military and the Arms Industry with Innovations and the Economic Growth in the Small Open Economies" (Sup.: cand. (econom.) G.Harutyunyan), based on the successful country cases of small open economies (Israel, South Korea, Singapore) that reported significant economic growth by nurturing the military industry, a modified path and/or approach to that type of economic growth has been proposed for Armenia. In order to develop the military industry a new structure of inter-science cooperation has been introduced and it has been proposed to make it as a basis of the contemporary policy aimed at developing the science in the Republic of Armenia.

Within the scope of the project "Design and Introduction of New Approaches to Improving the Socio–Demographic Situation in the Republic of Armenia" (Sup.: cand.(econom.) A.Zatikyan) an assessment methodology for identifying the most attractive countries from the view point of labor migrants has been introduced with proposing a respective conceptual model.

Within the scope of the project "Identification of Possibilities for Positioning of the Armenian Companies and their Implementation in the Context of Integration into the Value Chains of the Transnational Corporations" (Sup.: cand.(econom.) A.Makaryan) it has been identified that in order to ensure higher growth rates of the Armenian wearing apparel industry it is required to promote the exports of commodity group 62 (articles of apparel and clothing accessories, not knitted or crocheted) both with respect to outsourced contract exports placed by foreign brand names and locally manufactured items by local producers in the Russian and other EAEU member states. Based on the analysis findings the importance of manufacturing generic drugs has been justified in the case of the pharmaceutical products.

Institute of Art

Major achievements

Within the framework of the program "A comprehensive study of Armenian art" (Sup.: corr. member A.Aghasyan) for the first time in the history of domestic theater studies a comprehensive research has been carried out on formation, specifics and trends of ballet art of Armenia in XX – early XXI century, exemplified by the oeuvre of Armenian choreographers.

Within the system of Armenian arts and culture, ballet is a historically new phenomenon, stemming from both All-European and genuine Armenian national experience, these accounting for some of its specific features. The subject of the research has been viewed from the perspective of generally accepted canonicity of scenic dance, with a further insight into the problem of its primacy, basing on old and medieval Armenian evidences. The household and ritual origin of the dance has been interpreted as a theatrical expression of national temperament and features. Immanent links with ballet art of the new times have been unveiled.

The history of Armenian ballet has been narrated in accordance with the phases of its evolution and improvement – from scenic dance up to modern ballet of European model. The differences and interpenetration of oriental and European details have been juxtaposed with the differences and likeness of Eastern Armenian and Western Armenian cultures. The interpenetration of the latter may be dated back to the post-1920s, and to a large extent related to the opening of the National Opera and Ballet Theater in Yerevan.

The paper thoroughly and professionally analyzes the performances staged by Armenian ballet-masters. The productions are subdivided into three groups: adaptation of classics, interpretation of the

former experience and staging of new scores. A major role here is given to national themes which have served as a basis for independent quests of shape.

Armenian Genocide Museum-Institute

Major achievements

Within the framework of the project "Study of the History and Historiography of the Armenian Genocide" (Sup.: DSc (hist.) H.Demoyan) the Armenian Genocide Museum-Institute (AGMI) has prepared and presented five temporary exhibitions: "Time of Mantashyants: Armenian Business Life in XIX-XX centuries", "Aurora Mardiganyan", "From Genocide to Reestablishment of Independence", "Armenian Genocide Memorial Complex -50 ", "Images of the Armenian Kings and Queens in the European and Armenian paintings of XVII-XX centuries".

AGMI has continued its research of the primary sources of the history of the Armenian Genocide, as well as the demography of Western Armenia. R. Tatoyan's monograph entitled "The Armenian Population of Bitlis Province of Western Armenia on the Eve of the Armenian Genocide (an attempt of comparative analysis of statistical sources)" has been prepared for publication.

Shirak Centre for Armenian Studies

Major achievements

Within the framework of the program “Shirak’s archaeological and historical-ethnographical studies-2” (Sup.: DSc(phil.) S.Hayrapetyan) fixed cradle like tombstones covered with carvings as well as a new place which, according to the data of archaeological survey, dates back to antique period have been discovered in Shirak region in the territory of Jrapi village, on the bank cistern of Akhurian. Fortifications have been discovered on the left and right banks of the Akhurian with cyclops, castles with uncemented walls in Poqr Sepasar, Jrapi, Zorakert and Jradzor, all fortresses near the bank of the Akhurian have been taken into account and mapped.

The topographies of tribal countries /Virtirukhi Katarza, Lusha, Buzunia and Kulia/ occupying the Akhurian basin in II-I BC millennium have been verified and those toponymies have received scientific etymology by the evidence of their Indo-European bases.

Some verifications of historiological nature have been connected with the Armenian royal list of an Unknown historian where as a consequence of Medieval careless pen there are textual omissions and even some displacements of separate passages.

Works have been carried out on the ashough traditions of Kars, relations of Kars-Alexandrapol which until now has not been studied in the Armenian ashough study.

Armenian encyclopedia. Publishing house

Major achievements

Editorial work has been carried out on the 2nd volume of the "Encyclopedic Dictionary".

National Bureau of Expertise SNPO

Major achievements

During the accounting period the National Bureau of Expertises (NBE) participated in the VII St. Petersburg International Legal Forum (RF) and in the first session of the Interstate Technical Committee 545 "Forensic Science" – "Problems of Standardization in Forensic Science Activity". The forum included a number of discussions on essential issues which faced expert organizations, especially standardization of forensic science activity as one of the mechanisms of ensuring formation of uniform scientific and methodical approach to implementation of forensic production; the role of standardization in the international accreditation of forensic science laboratories; the activity of Interstate Technical Committee on standardization (ITC 545) "Forensic science" as an instrument of

creation of the Eurasian forensic science space; the discussion of standardization experience at the international accreditation of the forensic science organizations; the discussion of features of the national legislation on standardization at implementation of forensic science activity on the Eurasian space; the harmonization of requirements of legal proceedings and development of interstate and national standards in the field of forensic examination: opportunities and restrictions.

A three-day scientific workshop entitled "DNA sequencing technologies and their application in practice" took place in Yerevan, held in Armenia for the first time. The main purpose was to develop one of the topical directions of the scientific field in the Republic of Armenia, namely genetic research and forensic genetic expertise. The workshop brought together genetics from Japan, Sweden, Denmark and Georgia, who together with the leading scientists of the institutes of the National Academy of Sciences of Armenia discussed problems of development of DNA technologies. This important scientific event provided an opportunity to establish professional/working relations with similar international partner organizations.

Within NATO's "Science for Peace Project. EAP. SFPP 984597, Solid state gas sensors against security and military threats", a database of a number of organic components, corresponding to primary and secondary standards, have been implemented on "Agilent 7820A" gas-chromatograph. For the gas samples of a number of organic compounds of this device, the boundaries of detection of researchable samples are calculated using calibration curve. Within the framework of the same project, a series of tests of standard and researchable gas samples were carried out using 6 gas test samples using the Drager X-am 7000 gas analyzer. The research conducted within this project will make it possible to have organic and inorganic based sensors in NATO Military System, which in their turn will give opportunity to detect and neutralize quickly the used chemical poisoning signals (for example, sarin, soman, tabun, etc.).

Since 2015 the National Bureau of Expertises jointly with the Center of Medical Genetics and Primary Health Care has been continuing the scientific and research work on the project entitled "Molecular pathogenesis of mitochondrial OXPHOS diseases" A-2151 funded by the International Science and Technology Center (ISTC). A study of influence of nuclear and mitochondrial genetic variations in mitochondrial OXPHOS diseases was conducted within the framework of the project. Aiming to solve the problems encountered, works on genomic DNA extraction of cell cultures of skin biopsy taken from a selected patient group were carried out. The extracted DNA was subjected to quantitative analyses, then complete sequencing of the selected group in the University of Copenhagen was done in order to detect nuclear DNA changes. In order to confirm the presence or absence of pathogenic mutations, the results of DNA-sequencing have already been studied by the program participants in Armenia. At the present stage of summarizing the results, it has been found that some patients have nuclear pathogen mutations, the presence of which confirm another diagnosis. A decision has been made that the patients, who didn't have any genetic mutations as a result of nuclear genome sequencing, will already continue to be examined for detection of mitochondrial genome mutations. It is planned to finish the mitochondrial genome studies, as well as to perform functional study of cells in the selected group of patients after genetic diagnosis of mitochondrial OXPHOS disease.

The organization has been actively continuing participation in the works of the European Network of Forensic Science Institutes (ENFSI): in 2017 the staff of the organization took part in the seminar on "One day, One topic" organized by Paint and Glass Working Group in Wiesbaden, Germany and in the first working meeting of Best Practice Manual Subcommittee established by ENFSI Drugs Working Group, which took place in Copenhagen, Denmark. In the course of the cooperation the organization is carrying out works on processing, locating and introducing the current methodological manuals (Best Practice Manual) applied in the EU expert field within ''Monopoly 2012'' project.

The organization employees took part in the following international conferences: "Forensic examination of synthetic drugs discovered in the Republic of Armenia in 2013-2016, including synthetic cannabinoids contained in herbal cigarette blends" (Vienna), International conference on "Heroin Smuggling" organized by European Union Agency for Law Enforcement Training (CEPOL), "Aspects of Forensic Chemical Expertise of Heroin Illicit Trafficking" (drug trafficking towards Iran-Armenia-Georgia-the European Union) (Bucharest), the 13th International forensic symposium on

"Biometric and Facial Identification" (Bratislava) and the International Scientific Conference on "Psychological Impact as a Criterion for Evaluating Reliability/Unreliability" (Moscow).

For the first time in Armenia, the introduction of the new methodology of dendrochronology in the field of forensic expertise has been launched by the department of soil and biological origins expertises, which will allow to clarify the limitation of extraction of trees, issues related to the illegal deforestation of its identification, the family of tree species, the exact age of the tree, the year and the month of the tree/group of trees pruned, the time difference of pruned trees, the identification of the origin of pruned trees, if the samples presented for expertise are the pieces of the same tree species, etc.. Within this framework the department has begun carrying out work via "LINTAB" LTM06 produced by German RINNTECH and TSAP-Win Software. The application of this device and the software in forensic expertise will make it possible to substantially expand the relevance of the expertise in this field and to minimize the impact of the human factor.

Scientific and research work for analyzing general crime, study of the causes and conditions of its separate types and implementation of relevant preventive measures with competent authorities of the Nagorno-Karabakh Republic was continued.

The cooperation with forensic centers of Russia, Ukraine, Moldova, Belarus, Kazakhstan and Georgia was continued.

Outcomes of applied developments

Within the law of criminal procedure operating in the RA, the organization has conducted expertises in 28 forensic directions with around 129 forensic subtypes and technological directions.

It is important to note that the certification body for twofold purpose and military purpose goods and technologies (products) of the organization accredited by "National Accreditation Body" SNPO also continued its activities corresponding to ISO/ IEC 17065-2013.

In the course of 2017 a considerable amount of work was done in the organization with a view to successfully implement the international accreditation of the forensic subdivisions of the organization through a national or international (European or American) authorized body within a short period of time. For that purpose, it should be also mentioned that in 2017 a number of activities in 3 areas (drugs, metals and alloys, paint and lacquer coatings) directed to international accreditation have been conducted in the Physical Technical Examinations and Chemical Expertises Department in accordance with ISO /IEC 17025:2005 standard requirements.