

**THE NATIONAL ACADEMY OF SCIENCES
OF THE REPUBLIC OF ARMENIA**

**R E P O R T
ON MAJOR RESEARCH OUTCOMES
FOR 2025**

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Divisions of Sciences,
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INTRODUCTION

In 1943, pursuant to a resolution of the Council of Ministers of the Armenian SSR, the Academy of Sciences of the Armenian SSR was established on the basis of the Armenian Branch of the USSR Academy of Sciences. In the early years following the proclamation of independence of Armenia, it was renamed the National Academy of Sciences of the Republic of Armenia (hereinafter referred to as NAS RA). One year thereafter, NAS RA was granted the status of official adviser to the Government of the Republic of Armenia. In 2011, the National Assembly of the Republic of Armenia adopted the Law “On the National Academy of Sciences of the Republic of Armenia.”

As the supreme scientific institution of the Armenian nation, the Academy has gone through a challenging yet productive path over more than eight decades, achieving significant scientific results and earning international recognition. In its capacity as the principal coordinating body for scientific research within the Republic, the National Academy of Sciences conducts fundamental and applied research in almost all fields of science, in accordance with international standards. The Academy has made a substantial contribution to strengthening national defense capabilities, advancing economic development and the healthcare system, exploring new energy sources, and increasing public awareness of science and education.

In 2025, the National Academy of Sciences continued to advance successfully in numerous fields of science and technology, maintaining effective collaboration with academies, universities, scientific, technological, and innovation centers, as well as governmental and private-sector organizations in various countries. Institutions and research groups within NAS RA actively participated in international grant programs and in competitive scientific projects announced by the Committee of Higher Education and Science of the Republic of Armenia, winning 244 grants.

During the same year, the number of scientific articles authored by NAS RA researchers and indexed in international scientific citation databases exceeded the previous year’s output by approximately 26%. In coordination with their affiliated organizations, departments of NAS RA organized 59 international scientific conferences, and, with the direct support of the NAS RA Presidium, 581 scientific missions by NAS RA researchers were carried out.

The professional problem-oriented councils of NAS RA were active, convening a series of substantive discussions on issues including biodiversity, food security, environmental protection, and related fields. These discussions were attended by leading scientists, representatives of governmental institutions, and members of the private sector.

In 2025, the second NAS Prize award ceremony was held. In the categories of fundamental and applied research, prizes were awarded to six research teams in the fields of physical-mathematical and technical sciences, chemistry, life and Earth sciences, Armenian studies and social sciences, and medicine (sponsors: “Martin Star” LLC and “Liquor” CJSC).

On October 9, 2025, the President of the Republic of Armenia signed the new Law of the Republic of Armenia “On Higher Education and Science,” pursuant to which NAS RA is a non-profit organization. The principal mission of Academy is to conduct expert evaluation of infrastructures funded by the Government of the Republic of Armenia on a baseline basis, as well as of certain scientific programs and the progress/results of their implementation and reporting; to promote the popularization of science; to participate in the training of scientific personnel; and to carry out publishing, library, and other functions. The main operational units of the Academy will be specialized expert commissions and problem-oriented councils.

The leadership of NAS RA, in cooperation with the authorized body, has developed the new Statute of NAS RA, which has been approved by the Government of the Republic of Armenia. In accordance with the Law, following approval of the Statute, elections of associate/corresponding and foreign members of NAS RA will be held. The leadership of the Academy has drafted and submitted for approval by the authorized body the procedures for conducting the elections and the criteria applicable to candidates. After the elections, the General Assembly of the Academy will be convened, which will elect the Presidium and the Scientific Council. Subsequently, the election of the Academy’s executive leadership, as well as the approval of its new structure, staffing schedule, and financial budget, are planned.

Taking into consideration the importance of science for the development and progress of Armenia, as well as the pivotal role of the Academy within the overall scientific and educational system of the country, the leadership of NAS RA expresses its readiness to continue its mission under the new status for the advancement of scientific progress of the nation, economic development, and the strengthening of national defense capabilities.

President of NAS RA, academician Ashot S. Saghyan

DIVISION OF MATHEMATICAL AND TECHNICAL SCIENCES

Academician-Secretary – academician L. Aghalovyan
Assistant to the Academician-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 8 academicians, 6 corresponding members, 24 foreign members, 5 honorary doctors.

During the reporting year 1 general meetings of the Division was held.

At the annual general meeting held on April 22, the report of L. Aghalovyan "On the main scientific and scientific-and-organizational results of the Division for the 2024 year" was discussed and approved. Scientific reports of DSc (phys.-math.) A. Dgrbashyan (Institute of Mathematics), cand.(phys.-math.) M. Mikilyan (Institute of Mechanics), as well as cand. (phys.-math.) S. Darbinyan (Institute for Informatics and Automation Problems) were presented at the meeting.

24 meetings of the Bureau were held. The following issues were discussed and approved: the working plan of the Division for 2025; the number of postgraduate vacancies and their distribution among the Institutes for 2025-2026 academic year; the results of admission to the postgraduate school, research advisers and scientific topics of the postgraduate students; applications for admission of postgraduate school for the 2026-2027 academic year. There were discussed: applications for the programs of basic financing of scientific and scientific-technical activities; applications for scientific and scientific-and-technical state target program for 2025; applications of the Institutes of the Division for funding for the purchase necessary equipment, applications of the scientific trips, candidacies for the position of deputy director and scientific secretary of the Institute of Mechanics as well as report on the scientific and scientific-organizational activities of the Institute of Mathematics.

The staff of the new Scientific Council of the Institute of Mathematics were approved. The candidacy of DSc (phys.-math.), prof. R. Aramyan for the vacancy of the director of the Institute of Mathematics was discussed. R.Aramyan was elected the director of the Institute of Mathematics.

The main results of the activity of scientific organization of the Division for 2025, as well as other scientific-organizational issues.

The following scientific journals are published on the Division specialities: "Proceedings of NAS RA - Mathematics" (6 issues), "Proceedings of NAS RA- Mechanics" (4 issues), "Proceedings of NAS RA and NPUA (series of technical sciences)" (4 issues), "Mathematical Problems of Computer Science" (2 issues), as well as the electronic "Armenian mathematical journal".

2 monograph (abroad), 230 scientific articles: 158 in the peer-reviewed journals (117 Wos/Scopus) and 72 in the conference proceedings (15 abroad), 47 theses (31 abroad) were published in 2025 by the researchers of the Institutes of the Division.

The Institutes of the Division have organized 7 international and republic scientific conferences (5 international). Projects on international 3 grants have been implemented in the Institutes of Division (Institute for Informatics and Automation Problems).

5 Candidates' dissertations were defended at the Scientific Councils of the Institutes of the Division (Institute of Mathematics-2; Institute of Mechanics-1; Institute for Informatics and Automation Problems -2).

In December 2025, annual report meetings of the Institutes were held, the reports of the Institutes for 2025 were discussed and approved. At these meetings the academician-secretary of the Division was present and had a speech.

Institute of Mathematics

Major Achievements

By extending the concept of the class of Gibbs random fields, the foundations of a general theory of Gibbs random fields have been established. This became possible due to the proposed purely probabilistic definition of a Gibbs random field, without reference to any physical concepts. The classical definition (by Dobrushin, Lanford, and Ruelle) is not used in the proposed theory. At the same

time, the related existence theorem is regarded as the main tool for constructing Gibbs random fields. Results from mathematical statistical physics are incorporated into the developing theory of Gibbs random fields as an important (if not the most important) part. It should be noted that the corresponding theory has a structure accepted in the theory of random processes. An efficient criterion has also been proposed for determining when a random field is non-Gibbsian, based on a system involving the filtration of conditional distributions of the embedded random field (Sup.: corr.-memb.B. Nahapetyan).

It is known that the Funk transform (FT) is invertible in the class of even (symmetric) continuous functions defined on the 2-dimensional spherical surface. An additional condition was obtained for reconstructing an arbitrary function (which may be non-even) — the weighted Funk transform (used to reconstruct an odd function). The invertibility of the so-called two-data Funk transform is examined. The transform consists of the classical FT and a weighted FT. An iterative inversion formula is presented. For the class of even (symmetric) continuous functions, this inversion formula represents a new solution to the classical problem, which is more stable than the classical solution, according to the reviewer, who considered this work to be a significant contribution to integral geometry. Such inversion formulas are of theoretical importance in the theory of convexity, integral geometry, and spherical tomography (Sup.: DSc(phys.-math.) R. Aramyan).

Outcomes of applied developments

A hyperplane is a non-invertibility set for the spherical Radon transform (SRT) in $\mathbb{R}^d$. However, it is possible to reconstruct a compactly supported function located on one side of the hyperplane using the values of SRT on spheres centered on the hyperplane. For reconstruction of an arbitrary function (with possibly non-compact support) using SRT on spheres centered on the plane, an additional condition was found — a weighted SRT — for reconstructing odd functions with respect to the hyperplane. The inversion of the two-data spherical Radon transform is considered. An inversion formula is presented, using local spherical integrals to reconstruct the unknown function. This formula generalizes the inversion formula for SRT for functions supported on one side of the plane, previously obtained by the same author. Such inversions have theoretical significance in many branches of mathematics and form the mathematical foundation of modern imaging techniques, such as thermoacoustic and photoacoustic tomography, radar imaging, geophysics, and several others. The obtained inversion formula may expand the applicability of tomography (Sup.: DSc(phys.-math.) R. Aramyan).

A method was proposed for identifying and separating programs operating in cloud infrastructures using log-data and machine learning techniques.

A method was proposed for detecting and explaining faults in cloud programs based on processing program traces.

The application of interpretable machine learning methods for fault detection and explanation was studied.

A method was proposed for cleaning cloud infrastructures from non-functioning yet resource-consuming components.

The application of large language models for identifying trends of typical failures and proactive mitigation was studied.

The diagnostic capabilities of monolithic software systems using machine learning were studied. (Sup.: cand. (phys.-math.) A. Poghosyan)

Institute of Mechanics

Major Achievements

For plates with a plane of elastic symmetry (13 elasticity coefficients), the new class of spatial mixed boundary value problems has been solved, for which the classical and refined theories for plates are not applicable (Sup: DSc(phys.-math.) M. Aghalovyan).

Outcomes of applied developments

The designed wing frame of an unmanned aerial vehicle (UAV), possessing comparatively high and controllable mechanical properties while maintaining the same mass, which was submitted to the

Intellectual Property Agency of the Ministry of Economy of the Republic of Armenia for the purpose of obtaining a patent for an invention, was recognized as innovative by the noted agency and registered as an invention (Patent N382Y, “Wing frame of an unmanned aerial vehicle”) (Sup: DSc(tech.) K. Karapetyan).

Institute for Informatics and Automation Problems

Major Achievements

Consider a partially ordered set $(P(n, 3), \leq)$, where $P(n, 3)$ consists of triples of increasing elements of the set $[n]$, and $\leq$ is a component-wise partial order on $P(n, 3)$. An algorithm has been developed that partitions $P(n, 3)$ into the minimum number of disjoint symmetric chains. Such chains are used to recognize monotone binary functions defined on $P(n, 3)$. These functions, in their turn, are important because they can generate degree sequences of 3-uniform hypergraphs (which is known to be an NP-hard problem). Also, the possibility of applying reinforcement learning for recognizing monotone Boolean functions is investigated. All the main components of reinforcement learning have been developed: environment, agent, policy, etc., as well as algorithms for performing the necessary transformations of structural data and calculating rewards, costs, and other parameters of the algorithm (Sup.: corr. memb. L.Aslanyan).

Outcomes of applied developments

During the reporting year, the UAV swarm management platform developed under Grant 21AG-1B052 was significantly enhanced, evolving into a cross-platform system with real-time simulation and visualization. An interactive simulation environment was introduced, enabling testing and validation of multi-UAV behavior, movement, communication, and mission progress. A live interactive map was integrated, allowing operators to work with real-world geographic data, define mission nodes, assign drone roles, and set objectives, bringing mission planning closer to real deployment. Telemetry reception was improved by eliminating external antennas and using onboard communication modules. In addition, a prototype vision-based navigation system was developed, enabling UAV position stabilization in the absence of satellite navigation signals (Sup. DSc (tech.) S.Poghosyan).

An experimental device has been created to study the properties of quantum halo that arise around physical objects with changing entropy immersed in space. A large number of experiments have been conducted using the device, which are currently in the processing stage. It has been proven that this method allows one to obtain information in real time from physical bodies with the above properties, which is very promising for the development of new subtle quantum technologies (Sup. DSc (phys.-math.) A.Gevorkyan).

In this research, machine learning is used to efficiently analyze the complex structure of hybrid perovskites suitable for solar panels and to predict their band gap energy. Random Forest and Gradient Boosting models demonstrated the best performance, enabling the identification of promising compositions (1.2–2.0 eV), which were later validated through DFT and experimental synthesis. The combined ML–DFT–experimental approach applied in this work represents one of the most comprehensive analyses of organic–inorganic halide perovskites, covering their structure, stability, and electronic properties (cand.(tech.) V.Avetisyan).

A speaker diarization system has been developed, which, using the similarity distance indicators between vector representations of speech segments, iteratively refines the boundaries of speakers, detects new speakers and dynamically updates the hypothesis. The main innovation is the integration of a module for distinguishing overlapping segments, which assigns labels of the same time segment to multiple speakers. The system achieves an error rate of up to 8.03% on the VoxConverse collection (Sup.:cand.(tech.) C.Ghukasyan).

A statistical model of earthquake precursor processes was studied and developed by comparing seismological data and the periodicities of Earth's rotation around the Sun and the rotation of the Earth and Moon around a common barycenter. A statistical analysis of key seismicity indicators was conducted for areas in Italy, Greece, Turkey, Armenia, and Iran. The study revealed a correlation

between the diurnal and semidiurnal periods of seismic activity and the dominant mechanism of large earthquakes in the regions (Sup.:cand.(geol.) A.Kazarian).

A network traffic analyzer (ntopng) was developed and installed. Zabbix and Grafana monitoring and management systems for a high-performance computing system were developed and implemented, regulating the operation of several software packages, including Chessify, ACF, and SLURM (Sup.: cand.(tech.) R. Tadevosyan).

An experimental platform, AICon, was created to conduct experiments on diffusion, embedding, and avatar generation using local computing resources. Chatbots based on BERT were developed for the automated processing of scientific queries. An experimental Armenian-language chat assistant was created using the OpenAI Assistants API. A study was conducted on methods for fine-tuning OpenAI models to solve problems specific to the Armenian language. A DMTCP checkpointing system was developed using the Aznavour high-performance computing system with an integrated SLURM scheduler (Sup.: cand.(tech.) Gyurjyan).

The development and pilot implementation in a network environment of a new centralized system for storing e-mail and identification data was completed (Sup.: cand.(tech.) G. Petrosyan).

Department of Hydromechanics and Vibrotechnics

Major achievements

The fundamentally new stabilizer for fluctuations of pressure and consumption of liquid and gas has been developed (Patent of RA N 650Y) (cand. (tech.) G. Avetisyan).

Outcomes of applied developments

The wind power plant with capacity of 20 kW and vertical-axis wind turbine was designed, manufactured and installed. It was connected to the “Electric Networks of Armenia” system (RA patent N 650Y) (Sup.: A. Simonyan).

DIVISION OF PHYSICS AND ASTROPHYSICS
Academician-Secretary – academician R. Kostanyan
Assistant to the Academician-Secretary – N. Davidyan

The Division consists of the Byurakan Astrophysical Observatory after V. Ambartsumian (BAO), the Institute of Physical Research (IPR), the Institute of Radiophysics and Electronics (IRPhE), the Institute of Applied Problems of Physics (IAPP) and the International Center for Relativistic Astrophysics Network - Armenia (ICRANET).

The Division includes 3 academicians, 10 corresponding members and 22 foreign members.

During the reporting year, 3 general meetings of the Division and 17 Bureau sessions were held. Constant communication was established with the Division organizations to discuss and solve numerous current issues.

At the annual general meeting of the Division, held on April 22, the report “On the Main results of Scientific and organizational activities of the Division for 2024” by the Academician-Secretary of the Division, academician R. Kostanyan was presented and approved.

At the meetings of the Bureau the applications for basic financing of scientific and technical activities “Preservation and development of infrastructures”, admission to postgraduate studies, business trips (5 applications) were discussed and approved, an expert opinion on letters from government agencies and responses to applicants were given.

The Presidium of NAS RA approved the candidacy of the editor-in-chief of the journal “Astrophysics”. The new editorial board consisting of renowned foreign scientists was elected. The publishing agreement with Springer Nature Switzerland was signed.

The new staff of the Scientific Council of the IPR was approved. At the joint meeting of the institutes of the Division, CJSC “Geocosmos” MHTI of RA, CJSC “Bazumk” and the Investment Council of NAS RA the topic “Armenian satellite: past, present and future” was discussed as well as the importance of coordinating of works in this area, the need of joint works and mutual beneficial cooperation between the organizations of Divisions of NAS RA were emphasized.

The issues of increasing the efficiency of scientific works, expanding the applied researches and evaluating the work of scientific organizations were constantly discussed.

The institutes of the Division organized 7 republican and 23 international conferences, new agreements were signed, collaboration with other branches of science and education was in progress. Key elements of the Institutes’ 2025 development strategy for the upcoming years were discussed and approved. With the aim of developing cooperation between the institutes of the Division and foreign countries the directors of the institutes organized scientific discussions (4 seminars) with foreign leaders (5 seminars).

In December, annual general meetings were held in the scientific organizations of the Division, where the reports on scientific and scientific-organizational activities for 2025 were discussed and approved, later they were approved by Bureau session of the Division.

5 Candidates’ dissertation were defended by the researchers of Institutes of the Division.

The Institutes of the Division received 3 author licenses (1 international), 7 monographs (2 abroad), 233 articles in the pre-reviewed journals (175 Scopus/WoS) and in conference proceedings 33 (13 abroad), 214 theses (48 abroad) were published.

The following scientific journals are published on the Division specialties: “Proceedings of NAS RA. Physics” (imp.f. 0.5, 4 issues), “Astrophysics” (imp.f. 0.7, 4 issues) and the electronic “Armenian Journal of Physics” (4 issues).

Byurakan Astrophysical Observatory after V. Ambartsumyan

Major achievements

A detailed study of blazars exhibiting X-ray emission has been carried out. During the work, a cross-identification was performed between the known blazar catalog (BZCAT) and data obtained from various X-ray satellites (ROSAT, Chandra, XMM-Newton, Swift, INTEGRAL). As a result, 1,535 identified sources were obtained. In the course of the study, we calculated the optical and X-ray

fluxes, luminosities, absolute magnitudes, and spectral indices for all of them. Using X-ray–optical luminosity ratios, color–color diagrams, and the other derived data, an attempt was made to determine their characteristics and identify differences between them (Sup.: cand.(phys.-math.) A. Mickaelian).

A large number of new C–CH, C–N, and other carbon stars have been discovered in the DFBS survey in the Galactic halo, at heights of 8 kpc and above from the Galactic plane. The confirmation of their spectral classes was performed using the Gaia DR3 database. Some of the newly identified CH stars exhibit radial velocities exceeding –500 km/s. A substantial number of blue star-like objects (about 1200) with strong ultraviolet excess have also been discovered, as well as many emission objects (about 250, including both stars and galaxies). It was found that, in the case of stars, a significant fraction are binary systems (Sup.: cand. (phys.-math.) A. Mickaelian).

The methods of the kinetic Boltzmann theory were used to study the coefficients of electrical conductivity, thermal conductivity and thermoelectric power of the inner crust of a magnetized neutron star in the liquid state of plasma, considering the scattering of electrons on ions and free neutrons. The electrical conductivity of the outer crust of the star was studied in the hot regime, where the contribution of the positron component of the plasma becomes important. It was shown that the role of positrons is important already at temperatures above 1 MeV. The coefficient of the thermoelectric power of hot quark matter in strongly coupled regime was calculated, using the method of Kubo's formulas. Two scientific papers were published during the year, and four drafts are currently under preparation (Sup.: DSc(phys.-math.) A. Sedrakyan).

During the reporting year, we continued the research work within the frames of our extensive program devoted to changes in line spectra formed in scattering and absorbing media under the influence of non-stationary energy sources. Particular attention was paid to the values of the average residence time of photons in optically active media. For the first time, relatively simple formulas were derived for these values, with use of Ambartsumian's the well-known results regarding the average number of scattering events as well as on the result we obtained in 1986 concerning the relationship between absorption in a continuous spectrum and the desired average value of the residence time of photons in the medium. Neumann expansions were constructed, which allow us to form an idea on the behavior of quantities under study not only in the case when radiative equilibrium occurs in the medium, but also when it is not established. In addition, various average values were calculated, relating not only to reflected and transmitted fluxes, but also to the flux subjected to thermalization in the medium. The so-called PDF (Probability Density Function) and CDF (Cumulative Distribution Function) distributions were obtained, which determine the chronometry of the quantities under study (Sup.: DSc(phys.-math.) A. Nikoghossian).

The theory of Master space-Teleparallel Supergravity $\overline{MSp}$ -TSG is proposed as a local extension of the recent theory of global MSp-SUSY. Within the framework of the local $\overline{MSp}$ -TSG theory, the physics of “accelerated motion and inertia effects” was studied. This extensive paper covers the following three theories: “The MS-Supergravity”, “The MS-Teleparallel Supergravity”, “A general deformation of MS and inertial effects” (Sup.: DSc(phys.-math.) G. Ter-Kazarian).

Outcomes of applied developments

Work continues on the creation of a new software package and new methods of processing observational material. The automatic processing package (pipe line) is also being improved, which allows to process the scientific images obtained during the whole night, using many additional images (bias, flat-field, dark etc.) (Sup.: DSc(phys.-math.) T. Magakian).

During the year, over 493,400 measurements were taken at the Armenian-Russian station during 230 observing nights and the orbits were restored for 430 artificial Earth satellites (Sup.: cand.(phys.-math.) H. Harutyunian).

Institute for Physical Research

Major achievements

For the first time, the Cs $6S_{1/2} \rightarrow 7P_{3/2}$ transition at 456 nm in atomic vapor layers of an optical nanocell was investigated in the presence of sub-Doppler resonances. At an atomic vapor layer thickness of $\ell = \lambda/2 \approx 230$ nm, Dicke narrowing of spectral lines is recorded, accompanied by a red frequency shift of atomic transitions, which is attributed to atom-nanocell surface interactions. For a thickness of $\ell \approx 460$ nm, the obtained resonances have a linewidth of <20 MHz, located at the frequencies of atomic transitions. These narrow resonances are of interest for high-resolution spectroscopy and instrumentation and can serve as convenient frequency markers. (Supervisor: D. Sarkisyan, Dr. Sci. (Phys.-Math.)).

A spatial scanning technique for the optical imaging of strongly scattering objects was investigated, based on the spatially selective registration of ballistic photons arising from modulated (pulsed) laser radiation. The registration system counts the number of transmitted pulses at any pixel, forming a grayscale image. By selecting the modulation mode, it is possible to record a real analog image or outline the contours of image features without the need for software image processing. The developed system was tested on a model scattering object (a stack of paper) and a biological object (a human hand). (Supervisor: A. Papoyan, corr. member of NAS RA).

A new time-dependent two-state quantum model is presented, describing level crossing in a system under the influence of a laser field with constant amplitude. In this configuration, which is a four-parameter generalization of the Demkov-Kunike second three-parameter level-crossing model, the frequency detuning varies within a limited range, and the resonance crossing occurs asymmetrically with respect to the crossing point. The general solution of the problem can be written as a linear combination of two independent Clausen generalized hypergeometric functions with arbitrary constant coefficients, each of which can be represented as an irreducible linear combination of two ordinary hypergeometric functions. The asymptotics of the solution with respect to quasi-energies are analyzed, and the probability of the final transition is calculated for the case when the system starts from the first quasi-energy state. (Supervisor: A. Ishkhanyan, corr. member of NAS RA).

Outcomes of applied developments

Mirrorless lasing was recorded in a backward laser radiation configuration when dilute rubidium vapor is excited by linearly polarized continuous laser radiation scanned in the frequency range of the resonances of Rb D2 line hyperfine transitions. The dependence of the backward laser signal on the frequency and power of the input radiation, as well as on the B-field applied along the linear polarization of the input light, was investigated. Potential applications of the obtained results for remote monitoring of magnetic fields were discussed. (Supervisor: A. Papoyan, corr. member of NAS RA).

With support of the Armenian "PSI" tech company and in close cooperation with the L. Orbeli Institute of Physiology of NAS RA and the Research Institute of Physics of YSU, the design, fabrication, operation, and parameter optimization of a "hydrophone" (SFCO-hydrophone) operating on the basis of a single-layer flat-coil-oscillator were carried out during 2025. Using the new "hydrophone," the movement of the Danio rerio fish (zebrafish) was studied to reveal and analyze the behavior of the fish's movements. These and similar fish are currently widely used in physiology, pharmacology, and also translational medicine. (Supervisor: S. Gevorgyan, Dr. Sci. (Phys.-Math.)).

A field-effect transistor based on a zinc oxide semiconductor with an n-type ferroelectric channel has been developed. A ZnO:Li film, exhibiting properties of a low-conductivity ferroelectric semiconductor, was used as the channel. Measurements of the static characteristics of the transistors and the information writing and reading processes were performed. These results can be applied to create a manipulation field-effect transistor. (Supervisor: R. Hovsepyan, PhD (Phys.-Math.)).

Electrode systems for supercapacitors have been manufactured based on Co₂O₃-C (cobalt oxide - carbon) nanocomposites. Their volt-ampere characteristics have been studied using the three-electrode method, and the specific capacity has been estimated depending on the concentration of

cobalt oxide in the carbon matrix. The highest value achieved was 100 F/g (Sup.: cand.(phys.-math.) A. Manukyan).

Institute of Applied problems of Physics

Major achievements

At the TB21 radiation line at the DESY research center, resonant transition radiation of electrons with energies of 800–2500 MeV in the energy range of 10–200 keV was studied from two targets consisting of twenty 10- μm -thick aluminum foils separated by 100- μm -thick layers (air in one case, Teflon in the other). It was shown that for the air target, the experimental results coincide with theoretical estimates with sufficient accuracy, whereas for the Teflon target, the energy peak of the resonant transition radiation shifts to a higher energy range (Sup.: cand. (phys.-math.) V.R. Kocharyan).

The radiation generated by an electron circulating around a ball of a dispersive matter is theoretically investigated. It was shown that a dispersion law can be chosen such that "resonant" radiation is observed not at a single harmonic (as in the case of a non-dispersive dielectric ball), but simultaneously at several neighboring harmonics (Sup.: DSc (phys.-math.) L. Sh. Grigoryan).

The linear, nonlinear, and exciton absorptions of CdSe nanosheets was studied in the presence of axial and planar electric fields. The linear, nonlinear, and exciton absorption coefficients were calculated, and the resonance frequencies of the corresponding transitions were determined (Sup.: DSc (phys.-math.) H. Sarkisyan).

Outcomes of applied developments

Research was conducted to improve the technology for producing spherical ammonium perchlorate crystals. Mainly, the dependence of the production of spherical crystals of appropriate sizes from an ammonium perchlorate solution in a reactor on the stirring speed and other parameters was studied.

An optimal technology was developed for producing spherical ammonium perchlorate crystals of medium (50–160 μm) and large (160–315 μm) sizes. These can be used as the main component for the production of mixed solid rocket propellant. (Sup.: corr. member A.H. Mkrtchyan).

Fundamental research was conducted in the framework of synthesis of new types of multicomponent media that can be applied in various fields of science and technology. In particular, the temperature dependence of ammonium perchlorate solubility was studied. For the first time, a constant magnetic field was used in the technology for producing spherical crystals, significantly reducing their formation time. (Sup.: cand. (chemical.) S.V. Barseghyan):

A device for linear (one-dimensional) magnification of an X-ray diffraction image has been developed and manufactured (Sup.: DSc (tech.) H. Drmeyan).

A new type of X-ray spectrometer has been developed, that has high resolution and is suitable for use in X-ray spectrometry, in particular for the accurate determination and recording of characteristic X-ray spectra of materials (Sup.: cand. (phys.-math.) V.R. Kocharyan).

An interferometer in the GHz-THz frequency range has been developed and manufactured, enabling spectral analysis of radiation in this range. A new X-ray microtomograph has been developed and assembled, enabling three-dimensional imaging of material inhomogeneities with a resolution of up to 4-5 μm (Sup.: cand. (phys.-math.) V.V. Margaryan).

The optical, temporal, thermal, radiation, and other properties of a number of new corundum crystals were studied not only in the UV range, but also in the vacuum ultraviolet (VUV) and infrared (IR) ranges. The results showed that corundum crystals can be used as light converters to create sensitive detectors in the aforementioned wavelength ranges (Sup.: J.G. Vardanyan).

Institute of Radiophysics and Electronics

Major achievements

The superwideband (2-40) GHz antenna for radiation of electromagnetic waves with radial polarization has been developed and investigated. The coefficient of reflection in the range (1-40) GHz, as well as the polarization distribution in the radiated bunch and guide diagram on the range (9-11) GHz have been measured. The coefficient of refraction in the range 9-11 GHz does not exceed 0,1, the width of guide diagram near 10 GHz is 15% them (Sup.: cand. (phys.-math.) A. Makaryan).

In the special type of periodic photonic cristalls the strong dependence of transition radiation of crossing relativistic particles was observed on the Bruster angle. This fact makes possible the use of these cristalls as the detectors of such particles. The new theoretical approach has been suggested for investigation of antireflectivity, which does the matter for increase of effectivity of solar elements (Sup.: DSc(phys.-math.) J. Gevorkyan).

The stekhiometric composition of CdS thin films was investigated by the use of scanning electronic microscope It was shown that Cd/S ratio in those films changes from 0.39 up to 0.7, and they contain the spheric grains of the size 124 – 132 nm. The investigations show that such films are perspective for solar elements (Sup.: cand. (phys.-math.) A. Musaelyan).

A high-speed rangefinder for short distances /0.2 m -4.0 m/ has been developed. The rangefinder works based on the following principle: a narrow beam of amplitude-modulated infrared (IR) radiation is emitted from the rangefinder, which is directed towards the target. The rangefinder detects the target almost instantly when the target appears in the field of view of the rangefinder receiver. It is intended for installation on devices moving at speeds exceeding a certain speed (Sup.: K. Mirzoyan).

Outcomes of applied developments

Signal frequency multipliers, specifically varicaps and microwave multiplier diodes based on five-fold frequency doubling circuits (up to 3 GHz), were studied, and their tuning was developed and implemented (Sup.: K. Dadalyan).

Scanning electron and atomic force microscopy were used to study the influence of laser power, wavelength, substrate temperature and target-to-substrate distance on the formation of CdTe thin films by pulsed laser deposition. These films are intended as window layers for InSb/CdTe heterojunction infrared photodetectors. It is revealed that thin films deposited using laser radiation wavelengths of 600 and 1200 nm, as well as at substrate temperatures of 100–300 °C, have a cubic crystalline structure with unit cell parameters close to the theoretical value. The thickness of the polycrystalline CdTe films was found to vary in the range of 248–421 nm, depending on the laser power and the target-to-substrate distance (Sup.: corr.memb. S. Petrosyan).

An electronic system for controlling the operation of both internal combustion and electric engines has been developed and researched, the essence of which is as follows: A thin conductor is wrapped around one of the electric wires feeding the engine (without damaging the insulator), which serves as a sensor for the information signal. Signal, induced in the sensor are transmitted to an operational amplifier, and then to a decoding and decision-making device. The result can be displayed on a dashboard, monitor, or other display device. It can also be transmitted via a radio transmitter and the engine can be controlled remotely. The Armenian patent N 961 Y, as of 17.01.2025 is obtained (Sup.: K.Mirzoyan).

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A method has been developed for producing silver nanoparticles measuring 20-70 nm in size in distilled water. Laser ablation was performed using the first ($\lambda = 1.06 \mu$) and second ($\lambda = 0.53 \mu$) harmonics of a YAG:Nd laser. The first harmonic detaches particles measuring 200-1000 nm from a silver target. These nanoparticles are subsequently disintegrated into smaller particles measuring 20-70 nm under the influence of the second laser harmonic. A method has been developed for producing

nanoparticles of organic substances in aqueous solutions for biological research (Sup.: cand. (phys.-math.) R.Khachatryan).

X-ray diffraction and optical microscopy studies of the structural properties of all-inorganic polycrystalline perovskite thin films of CsPbBr₃ was conducted. The effect of thermal annealing of the deposited films on their phase composition, microstructure, morphology was investigated. The relationship between the average grain and crystallites (subgrain) sizes in the films, as well as the degree of crystallographic texturing under various annealing conditions was analyzed (Sup.: L.Matevosyan).

ICRANet Armenia

Major achievements

A new neural-network–based modeling framework was developed that makes hadronic and hybrid modeling of blazar emission computationally feasible. The method replaces time-consuming numerical simulations with a trained neural network that accurately reproduces both electromagnetic and neutrino emission, enabling fast and systematic exploration of complex physical parameter spaces. This removes a long-standing computational limitation and opens the way to multimessenger modeling of blazars with full statistical parameter inference (Sup.: DSc(phys.-math.) N. Sahakyan).

DIVISION OF NATURAL SCIENCES
Academician-Secretary – corresponding member R. Aroutiounian
Assistant to the Academician-Secretary – A. Minasyan

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 6 academicians, 7 corresponding members, 27 foreign members as well as 12 honorary doctors.

1 general meeting, 22 Bureau meetings of the Division, 8 reporting meetings of the scientific institutes were held during the reporting year.

At the annual meeting of the Division the main fundamental and applied results of the Institutes were discussed.

At the 22 meetings of Bureau the following reports were discussed and approved: the 2025 working plan of the Division; the reports of the institutions of the Division on 2024 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 2025-2026; the applications of the Institutes for new appliances, applications on funding the scientific business trips. At the meeting of Bureau of the Division, a candidate for the vacant position of director of the H. Buniatyan Institute of Biochemistry was also discussed, which was submitted for approval to the Presidium of the National Academy of Sciences. PhD in Biology A. Antonyan was appointed director of the H. Buniatyan Institute of Biochemistry of the NAS RA.

The Division held a meeting of the "Problem Council on Biodiversity and Biosafety" to discuss biodiversity conservation in the context of challenges facing the construction and mining industries.

As a result of discussions at the meetings of the tender commission of NAS RA, the institutes of the division were provided with financing for the purchase of necessary equipment.

Bureau has approved 16 funding applications for scientific business trips.

36 local and international events were organized by the Institutes of the Division including seminars, conferences, scientific expeditions, a total of 2049 participants, 405 of which were from abroad.

The institutions of the Division presented their results in the pavilions of the scientific festival "Science Week".

352 articles in peer-reviewed journals (316 Scopus/WoS) and 24 conference proceedings (21 abroad), 179 theses (120 abroad), 7 monographs (abroad), 4 educational tutorials were published by the Institutes of the Division, 2 patents of RA were obtained.

Three PhD dissertations were defended by the researchers from the Institutes at three specialized councils of the Division.

One Doctoral and ten Candidate's dissertations were defended by the researchers from the Institutes of the Division, five of which were defended at four specialized councils of the Division.

The Division's institutions implemented 32 grant programs with international funding.

Institute of Botany after A. Takhtajyan

Major achievements

A new Oligocene fossil site, Dilijan-4, has been discovered in Dilijan National Park, and a new Miocene site, Mushakan-3, has been discovered in the vicinity of Mushakan village. Fossil algae of the genera Botryococcus, Pediastrum, Spirogyra, Cosmarium, Mougeotia, Cymbella, Eunotia, Epithemia, Ulnaria, Gomphonema, Neidium, Pinnularia, and Cocconeis, as well as cyanobacteria of the genus Gloeotrichia, have been discovered for the first time in samples collected from Lake Sevan

peatlands. In Vayots Dzor Province, spores of fossil higher plants have been discovered and studied for the first time from Devonian strata dating approximately 370 million years (supervisor D.Sc. I. Gabrielyan).

For the first time for the flora of Armenia, priority generic and species names of the family Crassulaceae have been adopted based on the latest taxonomic classification. The genera *Hylotelephium*, *Phedimus*, *Prometheum*, *Petrosedum*, and *Chaloupkaea* are accepted. It has been established that in Armenia the family Crassulaceae is represented by eight genera. A new identification key for the species has been developed (supervisor Dr. M. Sargsyan).

Taxonomic studies of mosses growing in Armenia have been resumed, as a result of which 13 new species have been identified for the Aragats massif (supervisor Dr. A. Achoyan)

A palynomorphological study of the new endemic species *Iris sisianica* Zubov & Bondarenko from the subgenus *Hermodactyloides* has been conducted for the first time in Armenia. A significant similarity with another species of this subgenus, *I. reticulata* M.Bieb., growing in Armenia, has been confirmed, both in terms of the pollen aperture type (zonasulcate) and the type of exine sculpture (irregularly reticulate). The main differences between the species are slightly larger pollen grain sizes and the larger lumina size of the reticulate exine sculpture in *I. sisianica* (supervisor D.Sc. A. Hayrapetyan).

A karyological and molecular-genetic study was conducted on representatives of the genus *Zingeria* in the flora of Armenia, characterized by varying ploidy levels: *Zingeria biebersteiniana* ($2n=4$), *Z. trichopoda*, *Z. pisidica* ($2n=8$), and *Z. kochii* ($2n=12$). Our data show that *Z. biebersteiniana* has a major ribotype that coincides with a minor fraction found in *Z. kochii*. *Z. trichopoda* possesses two major ribotypes: one related to *Z. biebersteiniana*, and another shared with *Poa diaphora* (subtribe *Poinae*). The presence of ribotypes in *Z. trichopoda* identical to those in *Z. biebersteiniana* may be explained by the phenomenon of distant introgressive hybridization. In *Z. kochii*, two major ribotypes were identified: one is shared with the main ribotype of *Z. pisidica*, and the other is related to *Colpodium versicolor*. Our findings offer a revised perspective on the phylogenetic relationships within this group of low-chromosome grasses (supervisor Dr. A. Ghukasyan).

A taxonomic study of the *Pyrus* section of the genus *Pyrus* L. (Rosaceae) of the flora of Armenia was conducted. It was established that this section includes the following ten species and one variety: *P. caucasica* Fed., *P. communis* L., *P. demetrii* Heideman, *P. grossheimii* Fed., *P. hyrcana* Fed., *P. hyrcana* var. *yeghegisi* Akopian, *P. ketzkhovellii* Kuth., *P. sosnovskyi* Fed., *P. tamamschianae* Fed., *P. turcomanica* Maleev and *P. vsevolodii* Heideman. Morphological descriptions of the species, an identification key for their determination, as well as data on their geographic distribution, habitats, phenology, endemism, synonyms and taxonomic notes are provided (supervisor D.Sc. J. Akopian).

It has been established that the flora of Armenia contains 139 endemic species and subspecies of vascular plants from 27 families and 69 genera. The families Rosaceae, Asteraceae, Poaceae, and Fabaceae are the richest in endemics, as well the genera *Pyrus* and *Astragalus*. Most endemic taxa are neoendemic and are confined to floristic regions belonging to the Ancient Mediterranean subkingdom of flora. They grow primarily in arid ecosystems. In more humid ecosystems, most endemics are paleoendemics. Most of them are confined to regions of the Boreal subkingdom of flora. Centers of endemic species accumulation have been identified in Armenia that require special attention for biodiversity conservation (supervisor D.Sc. G. Fayvush).

The international online herbarium platform JACQ contains data on 600 lichen species and 60 fungal species. Three new fungal species for Armenia have been identified—*Onygena equina*, *Panaeolus plantaginiformis*, and *Tuber* aff. *iranicum*—and the rare species *Battarreia phalloides* has been rediscovered (supervisor Dr. A. Gasparyan).

For the first time, measurements of CH₄ emissions, stable water isotopes, and CDOM were conducted for a number of small alpine lakes in Armenia. All data were digitized, analyzed, and integrated into a geoportal based on the NextGIS platform, providing eight information layers, including hydrochemistry, isotopic composition, methane emissions, nutrients, and meteorological variables. The creation of a comprehensive database and interactive geoportal provides broad access to historical and new data (supervisor Dr. I. Fedorova).

Centre of Ecological-Noosphere Studies

Major achievements

Generalization of results of long-term radioecological studies conducted in the Aragats massif has indicated that by the contents of naturally occurring radionuclides (Ra-226, Th-232, K-40) the soils are background. This is proved by a steady increase in radionuclide activity from topsoils to deeper horizons, low values of geoaccumulation index for all radionuclides ($I_{geo} < 0$) as well as the ratio of predominant naturally occurring elements Th/Ra (3,89). The major share in formation of a dose and carcinogenic risk for humans determined by radionuclides in the Aragats massif soils belongs to Th-232, for biota - to Ra-226. As recorded, bottom sediments of rivers rising in the Aragats massif have high activity of naturally occurring radionuclides in high-mountain fast-flowing parts of rivers and relatively low activity in low-lying regions (<2000 m a.s.l.), which is due to changes in hydrodynamic conditions (sup.: c.b.s. O.Belyaeva).

The work was summarized on methodical approaches for evaluating several morphological, physical and biological characteristics (water level, ice cover, algal bloom) of the ecological status of Lake Sevan based on optical indicators of satellite-based remote sensing (shoreline, temperature of water surface, ice cover, ice regime, chlorophyll-a content of water, and harmful algal bloom). Due to the elaborated methodical approaches, the satellite-based remote sensing as a mandatory component was included in a novel complex system of state monitoring of Lake Sevan (sup.: c.g.s. Sh. Asmaryan).

Outcomes of applied developments

Based on the analyses and generalization of long-term radioecological studies of agricultural lands, assessment was done of basic (background) activity levels of naturally occurring radionuclides in soils of individual localities. The resulting data may be used in follow-up radioecological studies of the environment to assess a zero-background on new nuclear construction sites (sup.: c.b.s. O.Belyaeva).

In some samples of animal-based foods (beef, lamb meat, pork, chicken, milk, honey) produced in the RA tetracycline residues do not determine public health risks associated with dietary exposure. The assessment of risk of potentially toxic elements (Cu, Mo, Pb, As) to Armenia's adult consumers of domestic polyflower honey has indicated that the estimated daily intakes of potentially toxic elements are considerably lower vs. reference health values set by the European Food Safety Authority and thus there is no probability of health risks determined by chronic exposure. The dietary survey data obtained from Yerevan's adult population and concerning their kitchen salt consumption habits and consumption of target high-salt products (cheese, basturma and sudjukh, jerks, smoked and salted fish, lahmadjo, pickles, salty peas, salty pistachios and peanuts, salty sunflower seeds, tomato juice) have indicated that adding salt into cooked meals is habitual to 27,4% of respondents, while 13.1% of them salt the meal without tasting it. Lab examinations of high-salt foods (dairy products, meat products, flour-based products, tinned vegetables, processed legumes, sauces) have indicated that highest in salt are basturma and sudjukh. A comparatively high salt content has cheese and cheese products, followed by salty sunflower seeds, potato and sausage pastries, salty sticks and crackers, boiled and smoked sausage products, pizza, lavash, bread, salted cucumbers and marinated vegetables.

The results obtained will underlay the assessment of daily intake of kitchen salt in the population's diet. The assessment was done of daily intake of sugar in the adult population's diet as a result of consuming high-sugar foods. The results have shown that the largest share in the average daily intake of sugar belongs to chocolate and chocolate-containing sweets followed by confections

and soda drinks. As a result of high-sugar food consumption, the average daily intake of sugar in the diet of 25.3% of consumers exceeds the level (50g/day) recommended by the World Health Organization (sup.: d.f.s. (Italy) D. Pipoyan).

In the frames of basic and contract-based work, based on the elaborated methodical approaches to land cover classification using aerospace data, mapping was done of buildings and non-differentiated uncontrolled waste in the eastern portion of Yerevan in the total area of 275ha through deciphering drone-based optical images with the application of ML models (MLP, SVM), and digital 3D-models of the relief and surface were constructed. On this basis calculations were done of the volumes of non-differentiated uncontrolled debris and buildings in the given area (sup.: c.g.s. Sh. Asmaryan).

Scientific Centre of Zoology and Hydroecology

Major achievements

14 new species to science have been revealed, including 11 beetle species (Coleoptera), 1 mantis species (Mantodea), and 2 butterfly species (Lepidoptera). In addition, 93 species new to the fauna of Armenia have been recorded, comprising 6 beetle species, 40 fly species (Diptera), 4 thrips species (Thysanoptera), 2 butterfly species, 8 terrestrial tardigrade species (Tardigrada), 30 spider species (Aranei), and 3 pseudoscorpion species (Pseudoscorpiones) (PhD M. Kalashian, PhD N. Zarikyan).

The results of the craniological study indicate clear craniological differences between subfossil dogs and subfossil and modern wolves, as well as the significantly larger size of the subfossil wolves discovered at the Mets Sepasar sanctuary (PhD A. Gyonjyan).

A large number of parasites belonging to the family Diplostomatidae were detected in the Armenian gull; these parasites cause blindness in fish and inflict significant damage (PhD M. Vardanyan).

For the first time in Armenia, using molecular genetic methods, the zoonotic cestode *Echinococcus multilocularis* and a previously unrecorded species of ked *Hippobosca longipennis* were identified in stray dogs. In addition, a novel haplotype of the blood parasite *Haemoproteus* was identified in leaf warblers for the first time (PhD S. Aghayan).

For the first time in Armenia, the meiosis characteristics in birds were studied – specifically, the process of genome elimination in 3 species of the genus *Phylloscopus*. The properties of germline-restricted chromosomes, which are eliminated from somatic cells but retained in germ cells, were studied (PhD V. Spangenberg).

The value of several ecosystem services provided by the landscapes of the Republic of Armenia for regulating and maintaining the water balance has been determined. A species new to science has been recorded in the caddisfly fauna (PhD V. Asatryan).

Four important aggregation sites for waterfowl have been identified (PhD S. Hakobyan).

In the river ecosystems of the Lake Sevan catchment basin, a noticeably elevated level of mercury contamination was observed in the mouth section of the Sotk River, exceeding the minimum basin concentration by 9.4 times in water and 3.6 times in bottom sediments, while the average value was exceeded by 3.6 and 2.6 times, respectively (PhD G. Gevorgyan).

As of early October 2025, the total stock of whitefish in Lake Sevan amounted to 3592 tonnes, silver crucian carp – 21 tonnes, and Sevan trout – 138 tonnes (PhD N. Barseghyan).

Outcomes of applied developments

Within the framework of a contract signed with the Ministry of Environment of the Republic of Armenia, works continued on the assessment of biological resources:

- The status of populations of animal species serving as the main hunting targets was assessed, resulting in the provision of allowable hunting quotas and hunting periods for the 2025–2026 hunting season to the Ministry of Environment (PhD M. Ghasabyan).

- The spatiotemporal and vertical distribution of the quantitative and qualitative characteristics of phytoplankton and zooplankton communities, as well as the species composition and distribution of benthic macroinvertebrates and macrophytes, was assessed (PhD G. Gevorgyan).

As of early October 2025, the commercial stock of whitefish amounted to 1373.9 tonnes. Taking into account the existing problems of population replenishment and significant commercial pressure, the proposed whitefish fishing quota for 2026 is set as 40% of the commercial stock, or approximately 550 tonnes. In 2026, whitefish fishing is proposed to be permitted starting from February 1. The low abundance of fish species in rivers flowing into Lake Sevan is attributed to currently unfavorable habitat conditions, including seasonal water abstraction, contamination from household activities, alterations of river channels, and other factors (PhD N. Barseghyan).

Within the framework of an agreement with the Caucasus Nature Fund (CNF), insect monitoring was carried out in Armenia's nature protected areas, and materials were collected from 9 protected areas (PhD M. Kalashian).

A scientific application for citizens has been developed to enable participation in monitoring river ecosystems (PhD V. Asatryan, PhD M. Dallakyan).

Within the scope of the applied studies, laboratory synthesis of the multi-epitope chimeric *Toxoplasma gondii* protein was carried out, its immunogenicity was evaluated in BALB/c mice, and in vitro studies of the antitoxoplasma activity of local plant extracts were conducted. The results obtained provide an applied foundation for the development of new preventive and therapeutic approaches (PhD S. Aghayan).

A method for freezing animal reproductive cells, spermatocytes, and oocytes without using ultra-low temperatures has been developed. This technology allows for long-term storage of cell suspensions at -18°C with the ability to defrost and prepare high-quality specimens. This technology is important for research on rare, endangered animals or clinical patients, where multiple rounds of testing are required (PhD V. Spangenberg).

Institute of Biochemistry after H.Buniatyan

Major achievements

The activities of glutaminase, DPPIV, ALT, AST and creatinine were assessed in blood plasma and homogenates of brain, liver, kidney and pancreas in experimental STZ diabetes infected rat model. Compound C₂₀H₂₀N₂O₄ exhibited the greatest hypoglycemic effect in rat model of experimental STZ diabetes among seven GABA derivatives synthesized at STCOPC, reducing blood glucose levels by 3.8 times. Among the chemical compounds synthesized in STCOPC, two compounds effectively inhibited ADA1. Their interactions with the enzyme were characterized using optical, fluorescence and docking methods. In the aponeurotic tissue of patients with Dupuytren's contracture (DC), ADA1 and ADA2 activity is 7 times higher. High DPPIV and DPPII activity has been recorded, which has not been detected in healthy tissue. ADA1 activity is the highest in severe DC, while DPPIV and DPPII activities are highest in moderate DC. The IC₅₀ values for inhibition of ADA activity by water and ethanol extracts of *Anthriscus cerefolium* were 0.5±0.23 and 0.4±0.27 mg/ml, respectively. The mild ADA inhibitory effect demonstrated by the plant implies its possible use as an anti-inflammatory agent. (A. Antonyan, cand.b.s.).

Studies of changes in the blood coagulation system under conditions of chronic Cd poisoning and the effect of an amino acid mixture (GACT, glutamine, β-alanine, and ethanolamine-O-sulfate) as a result have continued. This poisoning increases blood clotting by 30%, most of which falls on the extrinsic coagulation pathway, since FXII, activating the intrinsic blood clotting pathway, is activated very weakly after poisoning, by 6.2%. In case of 2- and partially 3-fold intraperitoneal injection of the amino acid mixture, the biochemical and morphological changes occurring in the blood coincide with the data obtained after the previously performed single intravenous injection. In case of 5-fold injection, internal bleeding begins in rats, indicating its dose-conditioned anticoagulant activity (Z. Paronyan, cand.b.s.).

A method for non-covalent complexation of serum albumin (SA) molecules with cationic and anionic porphyrins has been developed. Cationic porphyrins form weak complexes with SA (0.2-0.3 porphyrin molecules per 1 SA molecule) and formation time varies from 24 to 72 hours in darkness at 6-8°C. The SA molecule with an anionic photosensitizer (PS) forms significantly better complexes with the SA molecule than with cationic PS. Complex formation time is 48 hours in darkness at 6-8°C. A method for separating the complex from unbound components on an aluminum oxide (Al₂O₃) column has been developed (G. Gyulkhandanyan, cand.b.s.).

Outcomes of applied developments

ADA and DPPIV can be considered as target enzymes to avoid surgical intervention of Dupuytren's patients by using inhibitors of these enzymes in medicine. Fresh extract of *Anthriscus cerefolium* stimulates the growth of *L. rhamnosus* bacteria 5-10 times compared to the probiotic added to the medium. It exhibits antimicrobial activity against *E. coli* and *Staphylococcus aureus* using the diffusion method (A. Antonyan, cand.b.s.).

Research has been conducted to create paper sensors for detection of any bacterial infection. Lectins conjugated to gold nanoparticles are used as universal proteins that produce a colored circle in the presence of bacteria. The sensitivity of the method significantly exceeds the values typical for infections detected in biological fluids. Potential prophylactic measures to prevent tumor development include natural antibodies to carbohydrates in human blood plasma, which can be injected into human risk groups. An unconventional method of affinity purification of these antibodies was applied using milk glycoproteins, which bind with the carrier through a protein moiety, leaving the carbohydrate components free. This approach, unlike classical methods of covalent attachment of sugars, preserves the native structure of carbohydrates and prevents possible disruption of antigen determinants (V. Gasparyan, cand.b.s.).

The antimicrobial properties of low-molecular peptides (bacteriocins) synthesized by five probiotics: *Lactobacillus acidophilus*, *L. rhamnosus*, *L. bulgaricus*, *Streptococcus thermophilus*, *Bifidobacterium bifidum* against various pathogens *Escherichia coli*, *Staphylococcus aureus* and *Klebsiella pneumoniae*, *Candida albicans* have been studied. These peptides have been separated using HPLC, which may imply their use as antibiotic substitutes and organic preservatives in the food industry. The antibacterial and antifungal properties of several organic compounds synthesized at the STCOPHCH of NAS RA have been studied. Substances with pronounced antimicrobial properties against various pathogenic microorganisms have been selected (R. Madoyan, cand.b.s.).

Scientific and Production Centre “Armbiotechnology”

Major achievements

A probiotic strain *Bifidobacterium longum* ssp. *longum*, characteristic of the human gut microbiota, was isolated from neonatal meconium. The genome of the strain was sequenced, after which the culture was deposited under the number MDC 11247. Based on this strain, a consortium of bifidobacteria and lactic acid bacteria was developed for creating the biologically active supplement “Bifinarin” (supervisor: PhD in Biology V. Bagiyanyan).

The α -amylase gene of the strain *Bacillus amyloliquefaciens* MDC1974 was amplified by PCR from genomic DNA using the primer pair amy1974_pBE-S_NdeI_sig_F (GCCGGTGCACATATGgtaaattgcacgctgatgcagta) and amy1974_pBE-S_XbaI_R (ATGGTGATGTCTAGAAAttattctgaacataaatggagacggacc) and then cloned into the shuttle vector pBE-S using Gibson assembly. A recombinant strain *B. subtilis* RIK1285_amy1974, expressing α -amylase from *B. amyloliquefaciens*, was obtained. Under optimized conditions, the strain produced α -amylase with an activity of ~2000 U/mL in the fermentation medium. Efficient methods for enzyme extraction and stabilization were developed (supervisor: PhD in Biology A. Ambartsumyan).

It was demonstrated that under bioreactor conditions, the producer strain *Phaffia rhodozyma* MAS8 achieved a maximal astaxanthin yield of 4.5 g/L, under optimized fermentation parameters: the use of filtered brewery waste as a nutrient medium, temperature of 28 °C, pH 4.5, aeration at 0.8 volumes of air per volume of medium per minute, and process duration of 120 h. Methods for the extraction and identification of astaxanthin were developed, and its chromatographic and spectral characteristics were performed (supervisor: PhD in Biology A. Ovsepyan).

The genome of the clinical strain *Pseudomonas aeruginosa* 80 was found to contain virulence factor genes *LasB*, *lasI*, *lasR*, and *aprA*, which are absent in the collection strain *P. aeruginosa* MDC5249. New inhibitors of *Clostridium histolyticum* collagenase were identified: F-moc-leucyl-allylglycine (IC_{50} = 2.38 mM), F-moc-isoleucyl-allylglycine (IC_{50} = 2.68 mM), and (S)-allylglycine. These compounds were shown not to affect the activity of serine proteases (trypsin, proteinase K), nor to alter the total extracellular protease activity of *P. aeruginosa* (supervisor: PhD in Biology N. Oganesyan).

The synthesis of L-tryptophan under various conditions was studied using a previously obtained genetically selected strain *Br. flavum* C18 (m-FP-r, 5-FT-r, 5-MT-r), resistant to structural analogues m-fluorophenylalanine, 5-fluorotryptophan, and 5-methyltryptophan. The highest L-tryptophan titer (up to 8.0 g/L) was recorded at the end of the process in a fermentation medium containing 15% sucrose, 5% (NH₄)₂SO₄, after 96 h (supervisors: PhD in Biology V.Kochikyan).

Osmotolerant bacterial strains were identified that are capable of fixing up to 40 µg/mL of molecular nitrogen and synthesizing up to 20 µg/mL of auxin, while maintaining a high cell titer (1×10⁸–10¹⁰ CFU/mL) under unfavorable conditions for 6 months (supervisors: PhD in Biology V. Kochikyan).

A method of gas chromatography was developed and validated for qualitative and quantitative identification of persistent organic pollutants, particularly chlorinated pesticides. This method is suitable for qualitative and quantitative analysis of α-BHC, β-BHC, γ-BHC, Aldrin, 2,4-DDE, 4,4-DDE, 2,4-DDD, 4,4-DDD, 2,4-DDT, 4,4-DDT, Dieldrin, and Endosulfan in various matrices (supervisor: PhD in Chemistry A.Tsatryan).

A comparative analysis of the fatty acid composition of cornelian cherry seeds was performed. A technology for producing extracts with pronounced anti-hemorrhoidal activity was developed. Samples of rectal suppositories were produced, whose physicochemical parameters meet the established requirements for preparations of this type (supervisor: Doctor of Chemical Sciences S.Dadayan).

During co-cultivation of probiotic strains of lactic acid bacteria from the genera *Lactobacillus* and *Enterococcus*, mutual influences of synthesized metabolites (exopolysaccharides, EPS, and bacteriocins, BCN) were demonstrated. *Enterococcus* strains showed higher levels of EPS and BCN synthesis compared with *Lactobacillus*. Combined use of purified metabolites resulted in a 30–90% reduction in antimicrobial activity, depending on the type and concentration of EPS. The results emphasize the need to consider metabolite interactions when selecting strains for co-cultivation to develop complex functional preparations (supervisor: PhD in Biology F. Tkhruni).

Out of 47 isolated lactic acid bacteria (LAB), six were identified as cultures with high proteolytic activity. Based on morphophysiological characteristics and API-test analyses, the strains were classified as *Lactobacillus delbrueckii*, *L. plantarum*, *L. salivarius*, *Lactocaseibacillus rhamnosus*, *Lactococcus lactis*, and *Streptococcus thermophilus*. Fermented dairy products based on these strains exhibited high physicochemical and organoleptic qualities. Their consortia can be recommended as starter cultures for producing new fermented dairy products (supervisor: PhD in Biology L. Danielyan).

The sorption behavior of cyanobacteria *Nostoc* PCC 7413 and 8109 toward Cu²⁺ and Ni²⁺ was investigated. *Nostoc* PCC 7413 demonstrated high tolerance and long-term sorption of Ni²⁺, whereas Cu²⁺ quickly caused desorption and toxic cell destruction. *Nostoc* PCC 8109 sorbed Ni²⁺ only at early stages and low concentrations, followed by desorption. Comparison showed that Ni²⁺ is retained significantly more stable than Cu²⁺, and that sorption efficiency and tolerance differ between strains, with *Nostoc* PCC 7413 showing superior performance (supervisor: PhD in Veterinary Sciences V. Goginyan).

The genetic affiliation of active symbiotic nitrogen-fixing bacteria in biopreparations was identified and confirmed through sterile vegetation experiments (supervisor: researcher S.Harutyunyan).

The tolerance and adaptation mechanisms of leaching bacteria to NaCl were studied, and minimum inhibitory concentrations were determined. It was shown that gradual increases in salt concentration during cultivation enhance microbial tolerance. Adaptation of *Sulfobacillus thermosulfidooxidans* 41 to high NaCl concentrations increased Cu extraction from chalcopyrite by 5–8 times. Maximum copper extraction was observed at 0.4M NaCl, a level close to seawater salinity (supervisor: PhD in Biology A. Vardanyan).

Ultrasonic homogenization methods were developed for obtaining water-alcohol tinctures of red clover and narrow-leaved fireweed, significantly reducing the extraction period and enabling the production of tinctures with high concentrations of biologically active compounds (supervisor: PhD in Chemistry G. Ovsepyan).

Studies were carried out on the synthesis of new non-proteinogenic amino acids using substituent propargylglycine complexes in Mannich reactions. New peptides based on these amino acids were

synthesized. As a result of preliminary computer modeling, peptides were selected for obtaining potentially biologically active compounds (supervisor: PhD in Chemistry A. Mkrtchyan). Using Suzuki cross-coupling reactions, new non-proteinogenic amino acids were synthesized. Some of these amino acids were incorporated into peptide chains, resulting in new potentially biologically and pharmacologically active peptides (supervisor: PhD in Chemistry Z. Mardian).

Outcomes of applied developments

Developed Technical Specifications (TS AM 39377914.9418–2025) and registered the EAEU Declaration of Conformity No. AM-008/SB.-1609-2025 for the production of the powdered fermented dairy product “Bioargin”, based on strains of lactic acid bacteria (supervisor: PhD in Biology F. Tkhruni).

Institute of Molecular Biology

Major achievements

For the first time in Armenia, genotyping of the grapevine pest Phylloxera was conducted, accompanied by monitoring of infested areas. More than 100 new genotypes were collected and sequenced (Sup.: cand(biol.) K. Margaryan).

Outcomes of applied developments

The PocketMaster tool has been developed, which is a flexible and automated tool for the analysis, clustering, and interpretation of protein pockets. Due to its capabilities, PocketMaster can serve as a valuable tool in the early stages of drug development, where careful and accurate protein evaluation is required (Sup.: DSc (biol.) K. Nazaryan).

A software package tsantsR for microbiome meta-analysis has been developed, which, based on a provided metagenomic database, constructs a network representing the bacterial composition. The package clusters the nodes of the network and predicts their functional potential using KEGG pathway and disease annotations (Sup.: N. Vardazaryan).

Institute of Hydroponics Problems after G.Davtyan

Major achievements

For the first time, a wild edible plant, curly dock (*Rumex crispus* L.) has been introduced into hydroponic and soil cultures, and in aquaponics. It has been found that in hydroponics it is possible to produce up to 27.4 kg yield of fresh curly dock per 1m², which outperforms soil culture by 6.0 times and aquaponics by 3.8 times. In their turn, aquaponic plants surpassed soil ones by 1.6 times in fresh yield. Over a single growing season, each hydroponic plant formed 410 leaves which outperformed soil and aquaponic plants by 3.4 and 1.8 times, respectively. It has been established that during the growing season aquaponic plants stood out by the maximum content of vitamin C, surpassing hydroponic and soil-grown plants by 1.3 and 1.2 times. Meanwhile, growing conditions do not significantly affect β -carotene content. Hydroponic plants surpassed the soil and aquaponic plants in the content of extractive substances, total phenols and crude protein by 1.1, 1.1 and 1.1-1.3 times, respectively, and were inferior to them in content of flavonoids and tannins by 1.3 and 1.3-1.4 times, respectively. The impact of the growing media on the level of photosynthetic pigments in leaves was also revealed: the minimum content of chlorophylls (a+b) and carotenoids was observed in plants grown in soil, while hydroponics and aeroponics provided the highest content of photosynthetic pigments.

In in vitro culture, a concentration of 1 mg/L BAP in 0.5MS nutrient medium promoted the formation of 5-6 microshoots in meristem explants of drumstick tree (*Moringa oleifera* Lam.), and in the case of cultivated saffron (*Crocus sativus* L.), a concentration of 40 g/L sucrose and 3 mg/L BAP promoted the development of microcorms weighing an average of 389 mg. Under phytotron climate

chamber conditions, hydroponic systems Ebb&Flow, Deep Water, and drip irrigation were tested for growing saffron, where the maximum number of flowers (3-4 flowers/plant) and air-dried yield of stigma (8-9.5 mg/plant) were obtained from the corms treated with 60 ml/L of gibberellic acid.

It was found that the plant raw materials of some edible plants (dock, amaranth (*Amaranthus*), common bean (*Phaseolus vulgaris* L.), majoran (*Origanum majorana* L.), pepper (*Capsicum annuum* L.), lupine (*Lupinus albus* L.)) and medicinal plants (common chicory (*Cichorium intybus* L.), bushy lessertia (*Lessertia frutescens* L.), prickly eleutherococcus (*Eleutherococcus senticosus* (Rupr. and Maxim)), great burdock (*Arctium lappa* L.), small-flowered basil (*Ocimum tenuiflorum* L.)) cultivated in hydroponic and soil conditions in the territory of the IHP in the Ararat Valley (technogenic impact zone of the ANPP with 30 km radius) are radioecologically safe, since their total β -radioactivity complies with the radioecological safety standards established by the World Health Organization (<1000 Bq/kg). Hereby, in hydroponics the gross β -radioactivity of edible plants fluctuates between 60-360 Bq/kg, and that of medicinal plants between 100-550 Bq/kg (Chief: Associated Member of NAS RA S.Mairapetyan).

Outcomes of applied developments

The National Body for Standards and Metrology CJSC has registered the technical specifications for "Moringa oleifera Lam. Leaves, Biologically Active Supplement" TS AM 10012903.9371-2025 (Chief: PhD Kh.Mayrapetyan).

For the first time, wild edible plants *Rumex crispus* L. and *Astrodaucus orientalis* (L.) Drude were introduced into hydroponic culture (Chief: PhD A.Tadevosyan).

A small-scale experiment on curly rhubarb was performed in outdoor hydroponics (Chief: PhD A.Tadevosyan).

More than 600 saplings of different tree-shrubs (sycamore, oak, sophora, juniper, thuja, privet, catalpa, silk tree, judea tree, fraxinus) produced as a result of scientific experiments were realized for about 1.1 million drams. About 40 saplings of sophora were donated to 2 completely renovated schools for benevolent purposes (Chief: A.Ghahramanyan).

Institute of Physiology after L.Orbeli

Major achievements

Plastic transformations of the membrane of erythrocytes of 4 different human blood groups under the influence of gyurza (*Macrovipera lebetina obtusa*) poison were studied with the help of atomic force microscopy, and force parameters were calculated. It has been shown for the first time that B antigen of the third blood group contributes to more serious damage to the membrane of erythrocytes under the influence of hemolytic poison. The prototype of the antidote obtained at the institute was tested on 17 cases of gyurza bites in dogs as part of preclinical studies, in 15 of which the animals' health was completely restored (N. Ayvazyan, Dr. Sci.). A hyperspectral imaging method has been developed that allows for visualization of radiofrequency ablation of the myocardium directly during surgery, which will reduce the frequency of unsuccessful attempts to ablate atrial fibrillation. The development of skin substitutes continues, the process of obtaining type I collagen is being optimized, and the properties of the scaffolds are being evaluated (N. Sarvazyan, Ph.D). Research was conducted to identify physiological correlates of various human emotional states based on the analysis of multimodal physiological indicators. A new algorithm for detecting high-frequency EEG oscillations was developed, which is important for localizing epileptic foci (A. Khachunts, Ph.D). Alcohol directly affects nerve cells, causing neurodegeneration and subsequent cognitive and behavioral impairments. The pharmacological intervention studied was the hepatoprotector with a peptide component, Molixan, and the peptide drug, Semax, which served as a control group. To evaluate the effectiveness of Molixan on the morphofunctional state of the brain and liver of animals with acute, severe ethanol poisoning, histochemical and morphometric studies were conducted. Molixan demonstrates high efficacy in treating central nervous system and liver dysfunction, and also acts as a neuroprotective agent, preventing or slowing brain tissue damage and promoting nerve cell regeneration (M. Danielyan, PhD).

Outcomes of applied developments

24SUEq-INSTPHYSIOL-0041 «MP160 System with evoked response amplifier, reusable electrodes, and haptic stimulator». From RA MESCS HSC. The multi-channel MP 160 data acquisition system in combination with AcqKnowledge 6.0 software is used to record pain-related evoked potentials in rats under conditions of electrical stimulation and administration of venoms or essential oils (local paw injection and intraperitoneal route). Signals are filtered, averaged, and analyzed to determine N and P peak amplitudes and latencies using a predefined sampling rate, allowing objective evaluation of the analgesic efficacy of the tested compounds. (A. Voskanyan, PhD).

«Wearable Multidimensional Biomedical Data Collection System». From funded by PMI Science Armenia and the EIF A prototype of a wearable device for collecting multidimensional biomedical data was designed and assembled. The device includes heart rate, skin temperature, skin conductance, and motion sensors, is controlled by an ESP32 microcontroller, and transmits sensor data to a newly developed smartphone application for further analysis (A. Sargsyan, PhD).

25AA-1F064 «4D and 5D Hyperspectral Characterization of Biological Objects with Emphasis on Medical Applications». From RA MESCS HSC. The project investigated the effectiveness of multidimensional hyperspectral data over conventional three-dimensional data. The project is now in the process of adding a fourth dimension, around the design of a symmetric light source (N.Chilingaryan).

25AA-1F080 «Innovative Skin Grafts: Local, Sustainable, Effective». From RA MESCS HSC. The research activities focused on developing collagen-based skin substitutes for the treatment of burn injuries. Experimental work was carried out to optimize the extraction of Type I collagen from bovine tendon using both acidic and enzymatic extraction methods, followed by comprehensive biochemical characterization to assess purity. In parallel, preparatory steps for the subsequent experimental phase were completed, including the procurement of essential reagents and consumables required for cell culture studies. (A. Avetisyan).

HORIZON Europe NAR-SAR IPH 101087403. Development and design of a programmable device for pulsed field ablation (PFA). An autoencoder-based methodology has been developed to detect the most informative excitation-emission layers in ME-HSI hyperspectral imaging data, providing significant dimensionality reduction while maintaining high analytical accuracy. The developed method will enable visualization of radiofrequency ablation of the myocardium directly during surgery, reducing the incidence of unsuccessful atrial fibrillation ablation. Spectral changes caused by a collagen bond-strengthening agent were detected using ME-HSI. Machine learning methods were simultaneously used to determine the optimal framework parameters. A convolutional autoencoder architecture was developed that enables the analysis of 4D multi-excitation hyperspectral data with full preservation of the spatial-spectral structure. This model provides robust and meaningful undirected clustering and serves as the basis for automated interpretation of ME-HSI data. 4D hyperspectral imaging has been tested for differentiation of nerves and ligaments (in a cow model) and for identification of lichen species under UV excitation and visible light (N. Sarvazyan, Ph.D).

DIVISION OF CHEMISTRY AND EARTH SCIENCE
Acting Academician-Secretary – corr. member A.Ishkhanyan
Scientific Secretary – cand. (tech.) L.Gasparyan

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

The Division includes 4 academicians, 5 corresponding members and 16 foreign members.

1 general meeting, 16 meetings of the Bureau were held during the reporting year.

At the annual general meeting of the Division held on April 22 the reports of the acting Academician-Secretary, corresponding member A.Ishkhanyan, directors of the Institutes, as well as leading scientists, related to their scientific activities and achievements in 2024 were discussed.

At the meetings of the Bureau the following issues were discussed and approved: applications for the programs of basic financing of scientific and scientific-and-technical activity: "Preservation and development of infrastructure" and for state target programs for 2026; working plan for 2025; distribution of full-time and part-time postgraduate free places of NAS RA for 2026/2027; applications for purchase of the equipment in the scope of the program on "Maintenance, rearmament of scientific equipment, purchase of substances for scientific research, fulfillment of unforeseen urgent expenses of the Institutes of NAS RA" for 2025.

The issues of conferring honorary doctorates to the Director of the Institute of Geophysics of the People's Republic of China, Secretary General of the Asian Seismological Commission, Doctor of Sciences, Professor Li Li, and to the Faculty of Pharmacy of the Aristotle University of Thessaloniki (Greece), Professor Athena Geronikaki were discussed and recommended.

80 researchers (10 of which were financed by NAS RA) of the institutes of the Division were sent to academic trips to Russia, Germany, Estonia, Hungary, Kotayk region of RA and other countries for the purpose of joint research, as well as for participation in international conferences and symposia.

The reports on the scientific and technical activity of the Institutes on the program "Preservation and development of infrastructure" of the basic funding and state target programs for 2024 were discussed and approved.

249 in the peer-reviewed journals (190 Scopus/WoS) and 20 in the conference proceedings (13 abroad), 192 theses (150 abroad), 2 patents were obtained.

Five Candidates' dissertations were defended in 2025.

The Division actively took part in the discussion of the scientific results of the Institutes during the annual meetings of these organizations.

Scientific Technological Centre of Organic and Pharmaceutical Chemistry

Major achievements

Activation by hydrogen atom transfer (HAT) offers an alternative opportunity to selectively activate the aliphatic C–H bonds with the lowest bond dissociation energy (BDE). A subclass of photocatalysis referred to as "visible light-induced transition metal (TM) catalysis", has emerged as a distinctive synthetic tool that allows TMs to serve a dual role: capturing light energy and driving catalytic transformations (Scientific Leader: PhD R. Hakobyan).

Outcomes of applied developments

An active collaboration was established with the Martiros Saryan House-Museum, resulting in the first comprehensive investigation of the pigment composition of paintings by the renowned Armenian artist Martiros Saryan using Raman spectroscopy. The study examined selected paintings created between 1909 and 1948, including "Morning in Stavrino", "Arabian Dancer", "Caravan", "Yerevan Zangu River" and "Kirovakan".

Analysis of the Raman spectral data revealed that Saryan's palette comprises a wide range of inorganic and mineral pigments, such as ultramarine blue, cobalt blue, emerald green, cobalt green, celadonite green, cadmium yellow, chrome yellow, Venetian red, yellow ocher, red ocher, lead white,

zinc white, and calcium carbonate. In addition, metal carboxylates and oxalates-identified as degradation products of the paint layers-were detected. These findings provide significant insight into Saryan's painting techniques, and they offer valuable information for the conservation and restoration of his works (Scientific Leader: PhD A. Hovhannisyan).

Institute of Chemical Physics after A. Nalbandyan

Major achievements

By combining machine learning and finite element methods, the temperature-dependent nonlinear optical rectification coefficient in GaAs/AlGaAs tetrapod quantum dots has been obtained for the first time using a hybrid approach (head: DrSc D. Hayrapetyan).

Ultraviolet excitation of dibenzophenanthroline results in a strong 600 nm emission from benzene excimer, due to energy transfer from phenanthroline moiety to the benzene dimer (head: DrSc G. Gurzadyan).

Outcomes of applied developments

The potential of ultra-high-temperature carbides (TaC, HfC) for the development of high-performance energetic materials has been revealed. It has been shown that the amount of heat released during their oxidation is comparable to that of well-known thermite systems (head: Prof. S. Kharatyan).

Under rapid heating conditions, at using the high-speed temperature scanner device, single-step synthesis of the widely used permanent magnetic material Nd₂Fe₁₄B was performed, whereas conventional methods require multistage processes involving complex equipment.

A high-entropy FeNiMnAlCu alloy was synthesized by the solution combustion synthesis method, containing certain amount of a high-entropy oxide. By subjecting the obtained product to spark plasma sintering it was possible to eliminate the oxide and to obtain an almost pure FeNiMnAlCu alloy with a face-centered cubic crystal lattice, suitable for application as a soft magnetic material (head: PhD S. Aydinyan).

A hydroxyapatite-titanium personalized cranial implant with a laminate structure was manufactured using 3D printing technology. The researches have shown that the implant with a laminate structure exhibits the necessary bioactivity, thermal conductivity characteristic for bone, and stable mechanical properties (head: PhD M. Aghayan).

Institute of General and Inorganic Chemistry after M.Manvelyan

Major achievements

New radiation-resistant and radiation-protective vitreous, glass-crystalline and composite materials with improved properties and high density values of 4.8–6.2 g/cm³ have been developed. Conducted radiation and absorption studies of the developed materials (γ -radiation 0.5–1.25 MeV and fast neutrons 15–50 MeV). According to the data of the linear radiation intensity attenuation coefficient, the synthesized materials are characterized by a high ability to attenuate gamma radiation and are resistant to fast neutron radiation (137Cs with an energy of 661.7 keV and ⁶⁰Co with an energy of 1173 and 1333 keV were used as radiation sources) (Doctor of Sci. Engineer. N. Knyazyan).

On the basis of the properties of hydrosilica gel obtained from iron-magnesium dunite serpentines (Mg(Fe)₆[Si₄O₁₀](OH)₈, as well as the activity of amorphous ZnO, the system SiO₂(gel)–NaOH–ZnO–CoCl₂–H₂O was studied, and under mild conditions, cobalt-doped willemite of various colors was synthesized. It is shown that when zinc oxide is introduced instead of zinc salts, the consumption of NaOH is significantly reduced (Doctor of Sci. Chem. N. Zulumyan).

A waste-free method of obtaining fertilizers from local, non-traditional raw materials has been developed. Sisian diatoms and serpentinites RA. The physical and chemical properties of the obtained fertilizers were studied and their effectiveness was confirmed.

The influence of cement mixing methods, targeted additives and different types of fillers on the strength and structure of cement is investigated (PhD in engineer. K. Grigoryan).

Outcomes of applied developments

On the basis of new fluorine-containing phosphate systems $P_2O_5-Al_2O_3-0.8MeO/0.2MeF_2(Me-Mg,Ca)$, low-melting glasses and glass-crystalline materials were synthesized. Developed glasses with high values of microhardness (480-540 kg/mm²), which can be used in medicine as bone implants (Doctor of Sci. (Engineering) N. Knyazyan).

A froth flotation process for sulfides obtained from oxidized copper, lead, and zinc minerals has been developed. The consumption of reagents required for flotation enrichment has been determined. Concentrates (Cu, Pb, Mo, Zn) obtained using the developed technology comply with current standards (Doctor of Science (Engineering) K. Davityan, PhD).

A microwave (MW) method has been developed for producing complex raw material of yttrium aluminosilicate glass from solutions of $Y(NO_3)_3 - Al_2(SO_4)_3 - Na_2O \cdot nSiO_2$ salts. The processes of melting the complex glass batch (YAS) under conventional and microwave heating, as well as the physicochemical properties of the glasses, were studied. A comparison of synthesis and melting processes using conventional and microwave methods confirmed the advantages of the microwave method: a 2–3-fold reduction in synthesis time, a decrease in melting temperature by 100–150 °C, and a 5–6-fold reduction in melting time (PhD in engineering V. Baghramyan).

Institute of Geological Sciences

Major achievements

Based on data obtained from the modern seismic network of the Institute of Geological Sciences of National Academy of Sciences of the Republic of Armenia, it has been shown that the Afar plume (a deep mantle flow) extending from East Africa and the southern part of the Red Sea is moving northward, spreading not only to the Arabian Peninsula and Western Anatolia, where it is expressed in OIB-type volcanism, but also reaching the Armenian Highland. Here it heats and melts the lithospheric mantle enriched by previous subductions, causing widespread post-collisional volcanism in the region (leader: Dr.Sci. Kh. Meliksetian).

Outcomes of applied developments

The specific features of the problem of predicting the magnitude of displacements and accelerations of the Earth's surface during strong earthquakes on a heterogeneous (multilayer) foundation are identified. It is shown that, in the case of a heterogeneous foundation, compared to an equivalent homogeneous one, a significant increase in acceleration occurs, depending on the degree of heterogeneity, differences in the strength of the layers (or the shear strain propagation velocities V_s), and their thicknesses. When replacing a heterogeneous foundation with a homogeneous one, accelerations on the Earth's surface are 1.3–1.6 times greater. A comparison of predicted accelerations for 18 two-layer foundations revealed that this effect is associated with significant differences in the eigenfunctions of the heterogeneous foundation, their vibration modes, and frequency spectra compared to the corresponding characteristics of a homogeneous foundation (headed by Academician E. Khachiyani).

Detailed geophysical surveys have been completed and are ongoing to accurately identify seepage risk zones, assess their nature and intensity, and develop targeted seepage control solutions for the Aparan and Azat reservoirs of the Republic of Armenia. Electrical resistivity tomography (ERT), two-dimensional ground-penetrating radar (2D GPR), and seismic exploration using multichannel analysis of seismic surface waves (2D MASW) and seismic refraction tomography (2D SRT) were used. Preliminary data revealed areas of filtration risk, but the results are considered very preliminary as the research is ongoing (headed by M. Gevorgyan, PhD).

Institute of Geophysics and Engineering Seismology after A. Nazarov

Major achievements

A comprehensive seismic geodynamic network and data collection and processing center has been created, the center is the only one in the region in terms of its technical equipment and instrumental recording methods, meeting strict international standards (head Dr. J. Karapetyan).

A study was conducted of the extremely rare process of anomalous activation of weak and moderate earthquakes in February 2025 in the central Aegean volcanic zone, based on recordings from automated seismic geodynamic stations operating within the framework of the Armenian-Chinese cooperation. Analysis of instrumental records and focal mechanisms revealed the complex volcano-tectonic structure of the study area, which represented the subduction zone of the African macroplate and the Aegean mesoplate. A hypothesis is advanced, that this process simultaneously reflects the short-term pulsation of the magma chamber of the underwater, active, currently dormant Columbo volcano and excitation along the entire length of the Santorini-Amargosa underwater volcanic-tectonic lineament (head Dr. E. Geodakyan).

A new methodology for calculating synthetic accelerograms based on normative spectral curves was developed. The proposed methodology enables the approximation of synthetic accelerograms of strong earthquakes for various regions of the Republic of Armenia. This approach improves the accuracy of strong motion assessments compared to traditional dynamic curves used in regulatory documents, which lack a direct empirical basis. The developed accelerograms can be used in seismic engineering analysis, adequate seismic hazard assessment, and the improvement of seismic design standards. The proposed methodology was developed for Armenian seismic codes, but the latter is sufficiently flexible and can be adapted to other international standards (head Dr. J. Karapetyan).

Outcomes of applied developments

A horizontal pendulum sensor was developed and manufactured to provide a natural oscillation period of 5s (0.2 Hz) (head A. Gasparyan).

Developed and manufactured a low-frequency generator for oscillating platforms. The generator is assembled using modern electronic components, ensuring high reliability. The operating range is divided into 52 divisions and is adjusted based on the division indication on the main indicator (head M. Mihranyan).

Calibration work was performed on a vertical vibration platform, and tables were compiled to improve measurement accuracy. The speed sensor, located on the platform, allows measuring the platform's oscillation amplitude in an operating range of 0.08÷1.6 mm at a speed of 0.01 m/s. To simplify further calculations, tables based on the sensor readings and frequency dependence were compiled (head A. Gasparyan).

DIVISION OF ARMENOLOGY AND SOCIAL SCIENCES

Academician-Secretary – academician Yu.Suvaryan

Assistant to the Academician-Secretary – A.Melkumyan

The Division of Armenian Studies and Social Sciences comprises Institutes of History; Oriental Studies; Art; Archaeology and Ethnography; Institute of Economics after M. Kotanyan; Institute of Language after H. Acharyan; Institute of Literature after M. Abeghyan; Institutes of Philosophy, Sociology and Law; Shirak Center for Armenian Studies; and the “Armenian Encyclopedia” Publishing House.

The Division includes 5 academicians and 13 corresponding members of the National Academy of Sciences of the Republic of Armenia (NAS RA).

In 2025, one general meeting of the Division was convened. At the annual General Assembly held on 22 April 2025, the report by Yu. M. Suvaryan, Academician-Secretary of the Division, entitled “The Main Results of the Scientific and Organizational Activities of the Division of Armenian Studies and Social Sciences in 2025,” was presented, discussed and approved.

As part of the Assembly, a series of scholarly presentations was delivered, including: “Interpretation of Key Issues in the Formation of the Armenian People and the Emergence of the First Armenian Statehood in the ‘First Volume of the History of Armenia’ by A. A. Melkonyan, Academician of NAS RA, and A. A. Bobokhyan, Doctor of Historical Sciences; “Recent Scientific Results of Archaeological Research” by P. S. Avetisyan, Corresponding Member of NAS RA; “The Poetry of Avetik Isahakyan: Methodology and Relevance” by A. V. Isahakyan, Doctor of Philological Sciences; “Armenian Political Thought: History and Contemporary Relevance” by E. H. Ordukhanyan, Candidate of Political Sciences.

With the active participation of the Division, several international academic events were organized in cooperation with partner institutions, including:

- the International Conference Dedicated to the 100th Anniversary of the Birth of Academician S. Abrahamyan, co-organized with Institute of Language after H. Acharyan, Armenian State Pedagogical University after Kh. Abovyan, and H. Tumanyan State University of Vanadzor (Yerevan, 19 May 2025);

- the International Academic Conference “East–West: Cultural Mediators (Literature, Music, Dance, Theatre, Painting, Graphics, Architecture, Sculpture, Cinema)”, jointly organized with the M. Abeghyan Institute of Literature of NAS RA, the M. Gorky Institute of World Literature of the Russian Academy of Sciences, and the National Library of Armenia (Yerevan, 25–27 September, 2025);

- the International Conference “Avetik Isahakyan – 150”, organized in cooperation with M. Abeghyan Institute of Literature of NAS RA, Institute of World Literature of the Russian Academy of Sciences after M. Gorky, the Faculty of Armenian Philology of Yerevan State University, the Mekhitarist Congregation, the House-Museum after Avetik Isahakyan, and the Fundamental Library of NAS RA (Yerevan–Gyumri, 22–25 October, 2025).

During the reporting year, thirteen meetings of the Division Bureau were held. These meetings addressed and approved the Divisions’s 2025 work plan; applications submitted by research institutions concerning the maintenance and development of infrastructure supporting basic funding for scientific and scientific-technical activities; and proposals related to state-targeted programs. The Bureau also reviewed interim reports for 2025 on infrastructure development programs, applications for postgraduate (aspirantura) admission quotas, the progress of layout and typesetting of Book One of Volume One of the *History of Armenia*, measures aimed at enhancing the effectiveness of research institutions, the internationalization of academic journals, and other research and organizational issues. At the meeting held on 11 December, the annual reports on the scientific and research-organizational activities of the Division Bureau and affiliated institutions were discussed and approved.

At the Bureau meetings of 20 May and 12 August 2025, the candidacies for director proposed by the General Assemblies of the academic staff of the Institutes of Philosophy, Sociology and Law, and of Archaeology and Ethnography, respectively, were reviewed and approved. The approved candidates were Dr. E. H. Ordukhanyan and Dr. A. A. Bobokhyan.

The Specialized Problem Council on Terminological Issues of NAS RA examined and adopted decisions on the “Rules of Practical Transliteration of the Armenian Language,” the “Principles of

Armenianization of Technical Terms and the Use of Certain Terms,” and “Armenian Equivalents for Five Widely Used Public-Sphere Terms.” These decisions were submitted to the Ministry of Education, Science, Culture and Sports of the Republic of Armenia for endorsement and subsequent application in written and oral communication.

In 2025, three issues each of the journals Historical-Philological Journal, Journal of Armenian Studies, and Herald of Social Sciences were published, along with two issues of the English-language electronic journal Fundamental Armenology. Institute of Language after H. Acharyan published one issue each of Language and Linguistics and Jahukyan Readings. Institute of Literature after M. Abeghyan released two issues of Literary Studies, while Institute of Arts published two issues of Art Studies.

Researchers affiliated with the Division’s institutions published 118 monographs (11 abroad), 22 textbooks and manuals, and 1027 articles, including 707 in peer-reviewed academic journals (200 Scopus/WoS) and 320 in conference proceedings (101 abroad). In addition, 214 theses were published (99 abroad).

Overall, 21 international and 18 national conferences were held during the reporting period.

Institute of History

Major achievements

Within the framework of the topic “Problems of Armenian statehood from ancient times to 1918” (headed by Academician of the National Academy of Sciences of the Republic of Armenia A. Melkonyan), based on a broad source base, the history of the formation and activities of the Transcaucasian Sejm, the proclamation of Transcaucasia as an independent republic and the process of Transcaucasia’s secession from Russia, the formation of the independent republics of Georgia, Azerbaijan and Armenia are covered.

Outcomes of applied developments

The works published by the institute, in addition to their scientific and theoretical significance, also have considerable practical and applied value. They can serve as a foundation for new historical research, be used in the reworking of other topics, and also be applied in the revision and teaching of textbooks on “Armenian History”, “World History”, “History of Neighboring Countries” and other related subjects.

The rich factual material presented in the works is also important for exposing the anti-scientific and fabricated viewpoints in historiography.

Institute of Oriental Studies

Major achievements

The scientific programs implemented by the Institute of Oriental Studies of NAS RA during the reporting year have created a comprehensive scientific framework that adds new quality and analytical depth to the study of the region's historical, cultural, political, and social processes.

The Institute's scholars have made significant progress in internationalising various topics in Armenian and Oriental studies through specialised articles and the publication of scientific works in highly reputable journals. Notably, the monographs by L. Hovsepyan and A. Tonoyan stand out. The article “Sustaining Contractual Identity, Ontological (In)Security, and Azerbaijan's Policy toward Armenia after the 2020 Nagorno-Karabakh War” (2025, Vol. 36, No. 3209), co-authored by Tonoyan and published in the journal "Small Wars & Insurgencies" (Scopus, Q1), provides a theoretical framework justifying the persistence of anti-Armenian and irredentist narratives following the 2020 Nagorno-Karabakh War within the context of security theory. The article argues that the prospect of peace intensifies the ontological anxieties of the Azerbaijani ruling elite, as the enduring “enemy image” of Armenians remains a central element of Azerbaijani identity and nation-building. Published as open access in 2025, the article has garnered over 4,000 views and downloads as of the latest update.

During the year, the article “The Eurasian Region at the Axis of Russian-Turkish Competition,” co-authored by Grigor Vardanyan, Senior Researcher in the Arab Countries Department, and published in *TRAMES: A Journal of the Humanities and Social Sciences* (2025, 29(79/74), 4, 371–press), received high acclaim. The article provides an in-depth analysis of the dynamics of Russian-Turkish competition following the collapse of the Soviet Union. It explores the fundamental nature of regional contradictions and their impact on military-political processes in the South Caucasus and the Middle East. Alongside these achievements, significant international scientific cooperation was also pursued during the year. Within the framework of the 2021 cooperation agreement with the Institute of Russian, East European, and Central Asian Studies of the Chinese Academy of Social Sciences, several high-level events took place in 2025. Notably, an international conference of the Congress of the Institute of Oriental Studies and the Chinese Academy of Social Sciences was organized in Yerevan on November 25. Subsequent meetings are planned for 2026 in China, including an international conference focused on ongoing changes in the Caucasus.

The end of the reporting year also featured the international conference “South Caucasus-2025” (November 14, 2025), organized through a joint initiative by the Institute of Oriental Studies of the RA NAS and the Armenian branch of the Friedrich Ebert Foundation. The workshop analyzed the Ukrainian crisis, the resulting shifts in international relations, and their impact on geopolitical dynamics in the South Caucasus, highlighting the relative shift in regional power due to the strengthening of Azerbaijan's position. An important conclusion was the observed tendency to balance and diversify Armenia's foreign policy amid deepening cooperation with Asian partners.

The publication of the inaugural issue of the journal “Bulletin of the Institute of Oriental Studies” represents a significant achievement. Articles published in English by both Armenian and international authors aim to promote and globalise Oriental studies. Concurrently, systematic efforts are underway to enhance the journal's global visibility and secure its inclusion in leading scholarly databases.

Outcomes of applied developments

Within the framework of the program “Eastern Sources of the Ancient, Medieval, and Modern Periods about Armenia and the Armenians: Armenia and the Problems of Political, Social, Cultural, and Ethnic History of Turkey, Iran, Caucasus, and Arabia” (led by PhD, Assoc. Prof. G. Iskandaryan), several critical scientific studies were conducted in 2025. These include monographs, books, and articles that have received significant international recognition. Among the monographs, “The Nine Pillars of the Governance System of the Islamic Republic of Iran” by the Head of the Iran Department, G. Iskandaryan, is particularly noteworthy. It offers an in-depth, systematic, and comprehensive analysis of the structure of Iranian state governance, revealing the interconnected roles of the fundamental institutions that ensure the effective functioning of the country's multi-layered government mechanisms. This study complements the work of the Institute's leading researcher, V. Bayburdyan, whose “Iran: Geographical Reference Book” presents the geography, history, state structure, and key features of public life in Iran. Together, these works, prepared by two leading specialists from the Iran Department, provide a nuanced understanding of Iran and make a significant contribution to advancing Iranian studies at the Institute. Another essential scientific achievement is the work of M. Balayan: “Artsakh: Endangered Heritage” and “Residences of the Aghvan Catholicosate,” which summarise and systematise source data on the historical, administrative, and spiritual centres of Artsakh and the Armenian Aghvan Catholicosate. These contributions are vital to the study and preservation of Artsakh's historical and cultural heritage. One of the most significant results obtained with base funding is the monograph by A. Harutyunyan, “The Emergence of the Azerbaijani State and the Problem of the Ethnogenesis of Azerbaijanis,” which addresses the main issues surrounding the formation of the Azerbaijani state and the ethnogenesis of the Azerbaijani people. Another notable work is H. Stepanyan's “Baronian's Newly Discovered Turkish Novels in Armenian,” which makes a significant contribution to Armenian literature and linguistic heritage.

Among the most important results obtained with base funding in the reporting year are the research published in the journals of the Institute of International Relations. In particular, the article

“Azerbaijan–Syria Relations. Shaping the Fluctuations and Turning Points (1992–2025)”¹ by Pashayan A., Gevorgyan G., Vardanyan G., which analyses the development of relations between Azerbaijan and Syria, Baku’s ambitions to form a “middle power”, its interdependence with Turkey, and the impact of regional political changes on Armenia-Syria relations.

Another significant contribution is L. Hovsepyan's article, “Beyond the Islamic State and Kurdish Threat: The Broader Aspects of Turkey’s Military Involvement in the Syrian Crisis (Q2)”, which analyses the domestic, identity, and ideological factors influencing Turkey's military involvement in Syria, as well as the ambitions and motives of the ruling elite.

L. Harutyunyan’s article, “The Abraham Accords and Normalisation between Arab Countries and Israel: The Impact of the Gaza-Israeli War of 2023, on political developments in the Middle East, also considers their potential effects on Armenia.

Junior researchers from the Turkey Department contributed the article “Turkey’s Military Cooperation with Post-Soviet Turkic States: New Vector of Erdoganism in Regional Integration Projects” by V. Torosyan and T. Aghamalyan, which presents the ideology of Erdoganism and concludes that Turkey aims to establish regional military unity through the export of militarisation.

Other important project outcomes include articles focused on the political and socio-legal systems of Armenian history, particularly during the ancient and medieval periods. These works address issues such as state formation in the Armenian Highlands, the socio-legal status of Armenian feudal classes, and the relations between the Armenian provinces of Eastern Armenia and the Mongols. The study of these issues was addressed in their research by the institute's employees: R. Ghazaryan, G. Mkhitaryan and M. Balayan.

Institute of Archaeology and Ethnography

Major achievements

In the reporting year, the results of fieldwork and laboratory analyses conducted within the sub-project “Excavations and Study of Archaeological Sources of Prehistoric and Ancient Armenia” (supervised by A. Bobokhyan) were published in high-impact international journals and academic volumes. Significant progress was achieved, particularly in the study of Armenia’s urban landscape during the Urartian period. Excavations at the site Shamiram uncovered fortified structures and other architectural elements dating to the Urartian period, offering valuable insights into the regional policies of the Van kings (led by V. Melikyan).

Noteworthy achievements were also made in the study of medieval Armenia. Two previously unknown early medieval churches were unearthed; one in the Kecharis monastic complex and another within the Kapan citadel. New data on monastic economies were obtained through investigations at the Spitak monastery in Lanjanist and Shativank in Vayots dzor. Of special significance is the discovery at Shativank of a concealed assemblage of more than one hundred rare utilitarian and liturgical items, which illuminates important aspects of the monastery’s material culture and its external connections (excavations led by D. Mirijanyan, H. Badalyan, G.M. Sargsyan and D. Davtyan).

Significant progress was achieved in the field of Genocide Studies. The anthropological analysis of a century-long process of Genocide remembrance, presented in the monograph “Commemorating the Armenian Genocide” (published in both English and Armenian), provides a vital link between academic discourse and public memory. Notably, the English edition has been published in a Web of Science platform publishing house, a development that substantially enhances the global visibility and understanding of Armenian perspectives on the Genocide (author: H. Marutyan).

Important achievements were also recorded in the historical and cultural study on Artsakh, particularly in the area of cultural heritage (the publication of the monograph “Tigranakert in Artsakh” edited by H. Petrosyan, the analysis of the Second Artsakh War (the monograph “Conflict, Space and Transnationalism: An Ethnography of the Second Nagorno-Karabakh War” by A. Hakobyan and M. Molika, published in the Web of Science platform publishing house), as well as related historical,

¹ Pashayan A., Gevorgyan G., Vardanyan G., Azerbaijan-Syria Relations. Shaping the Fluctuations and Turning Points (1992-2025), М., “Международные процессы”, 2025.

cultural, and socio-political issues, and the broader process of internationalization (led by H. Kharatyan, M. Galstyan).

Outcomes of applied developments

The “Applied Anthropology” research group has carried out a range of research and analytical programs focused on the preservation and transformation of ethnic, religious, linguistic, and social group identities, as well as their social, political, cultural, and ideological bases (Dr. H. Kharatyan).

The Institute actively participates in various initiatives aimed at promoting science, including open lectures at different institutions, the “Days of European Archaeology” (June 13-15), programs on Public Radio and Public Television, and the preparation and editing of applications for the inclusion of historical and cultural monuments of the Republic of Armenia (Tirinkatar, Areni, Artashat etc.) in the UNESCO World Cultural Heritage preliminary and main lists.

During the year, the Archive received a substantial number of archaeological, ethnographic, and folklore materials, including complete author archives, field research and excavation reports, and documents spanning the 20th-21st centuries.

Shirak Centre for Armenian Studies

Major achievements

Within the framework of "Archaeological and Historical-Ethnographic Studies of Shirak-3" (Sup.: cand.(hist.) A.Hayrapetyan) excavations continued at the site of the Bronze-Iron Age fortified settlement of Jradzor. The materials unearthed provide compelling evidence that the fortress's defensive system underwent repeated reconstruction over time. Evidence of reuse during the medieval period is indisputable. The masonry has been found to contain Byzantine anonymous cross-shaped bricks, medieval glazed ceramics, and remains of tints. The presence of an Urartian temple, along with clear traces of medieval reuse, indicates a close intertwinement of religious, administrative, and military functions in this region. Consequently, Jradzor can be conceptualised as a regional power base, where military and economic systems converged along communication routes extending northwards from the Ararat Plain.

In 2025, in the southern part of the village of Jradzor in the Shirak region, on the right bank of the Akhurian River, newly discovered caves No. 1 and No. 2 were explored, which were found during the construction of the Kaps Reservoir. No archaeological cultural layer was identified in Cave No. 1. Within the confines of Cave No. 2, an excavation site was meticulously delineated, subdivided into squares measuring 3×3 m, and excavations were conducted in layers, accompanied by comprehensive stratigraphic recording, documentation, and photography of the finds in situ. A total of 101 ceramic fragments were unearthed, comprising shards of a clay jug buried in the ground, pieces of wavy and glazed ceramics, and animal bone remains preserved inside the jug. The material evidence unearthed provides insights into the nature of the settlement and the economic utilisation of the site, thereby enabling its contextualisation within the broader framework of medieval reuse of the Dzradzor fortress.

A comparative analysis was conducted of the countries mentioned by Herodotus (c.). The geographical entities referred to as Eastern Pactica, Bactria, and Western Pactica. Etymological analysis has shown that the name Eastern Pactica is derived from the Sanskrit word paktha, meaning "five," and the name Bactria, like its double zari-aspa, has a "horse" character. With regard to the appellation 'Western or Armenian Pactica', it is not a local – nor, it should be added, Armenian – toponymic designation. The term is derived from the Indo-European root pahrt-, signifying "agreement" or "union", and corresponds to the name of the federative state of Urartu.

Institute of Language after H.Acharyan

Major achievements

Within the framework of the project "Study of Armenian Dialects" (supervised by Dr. V. Katvalyan), particular significance was attached to the commencement of work on the "Dialectological

Atlas of the Armenian Language," as well as the preparation and publication of Issue "A," dedicated to the Gegharkunik region (authored by V. Katvalyan). For the first time in Armenian reality, a regional dialectological atlas has been published, including approximately 70 isoglosses, 2 general maps, and 65 isogloss maps covering about ninety settlements. Each map is accompanied by commentaries regarding the manifestation of isoglosses both in dialectal Armenian as a whole and in the local sub-dialects of the region. The work is presented in two languages—Armenian and English—which will enable foreign researchers to familiarize themselves with and utilize the presented material.

Within the framework of the project "Issues of Historical Development of the Armenian Language" (supervised by G. Mkhitarian, Ph.D. in Philology), the work titled "Manuscript Dictionaries titled 'Andes Banasteghcats' (13th–18th centuries)" was completed. Sixty-three manuscript variants of these medieval dictionaries, preserved at the Mesrop Mashtots Matenadaran, were studied. These dictionaries represent valuable collections that authentically reflect the linguistic situation of their time, particularly lexical realities; the material they contain has been introduced into scientific circulation for the first time and subjected to a comprehensive analysis (from both philological and linguistic perspectives).

In comparison with textual examples of Armenian bibliography, the work provides a detailed examination of word-meaning changes and neologisms found in the manuscripts, while also identifying and investigating dialectal features, loanwords, and foreign forms.

Within the framework of the project "Issues of General, Comparative, and Applied Linguistics" (supervised by Dr V. Hambartsumyan), the monograph "Essays on the History of the Literary Armenian Language" was completed. It covers key issues in the history of the literary Armenian language, the resolution of which is crucial for forming a new and more concrete understanding of the historical and cultural distinctive development of our language and of the society that speaks it. The work is a philological and linguistic study that addresses selected linguistic materials from the ancient, medieval, and modern periods of the written era, which have remained unexamined until now.

Outcomes of applied developments

Within the framework of the project "Issues in the Study and Standardization of the Modern Eastern and Western Armenian Languages" (supervised by T. Asoyan, PhD in Philology), Issue IX of the publication "New Words" was released, documenting words not attested in explanatory dictionaries or dictionaries of neologisms. A textbook titled "General Linguistics: A Guide to Practical Classes" was also published, aimed at supporting students' independent work and developing their practical skills. The manual may be useful for anyone interested in general linguistics and Armenian linguistics.

A work titled "Issues of Lexicology, Grammar, and Stylistics of the Modern Armenian Language" has been published, devoted to matters of standardization and the stylistic features of the contemporary Armenian language.

Within the framework of the project "Issues of General, Comparative, and Applied Linguistics" (supervised by Dr V. Ambartsumyan), a scientific-practical model titled "From the Subconscious to Language Awareness and Communication: A Three-Stage Labyrinth" was developed and implemented. It was presented at the event "Psychological Vernissage: Expo-25." The model made it possible to obtain multifaceted data on linguistic cognition, internal communicative dynamics, and the awareness of perceptual processes.

In collaboration between the Institute of Language and the Research Center of Psychology of YSU, a book titled "The Psycholinguistic Application of the Fairy Tale" was published. It presents psycholinguistic approaches and methods of creative psychology in the field of fairy-tale therapy, as well as the nature and key aspects of psychological work carried out through the medium of the fairy tale.

A book titled "Directory of Institute of Language After H. Acharyan - 2024" presenting the bibliographic lists of scientific works published by the researchers of the Institute in 2025 and the general content of the publications (in Armenian, English, and Russian), has been published.

Institute of Literature after M.Abeghyan

Major achievements

Within the framework of the topic «History and Theory of Armenian Literature» (headed by PhD H. Vorskanyan), the book Isaakyan A. V., Avetik Isaakyan, A Scholarly Biography, Book Two, 1901–1912, Y., Edit Pert, 2025, 490 pp., has been published, covering an important period of the poet's life and work - the first decade of the twentieth century. The book is based on documentary and bibliographic materials: letters, diaries, memoirs, articles, and the family archive, some of which are introduced into scholarly circulation for the first time.

A monograph by P.A. Demirchyan, Yeghia Temirchipashyan: Life and Work, or: "I Must Always Be a Man in Search of a Path", Y., WUA Publishing, 2025, 600 pp., has been published. It represents the first attempt at a comprehensive analysis of the writer's life and work. The study presents the period of Ye. Temirchipashyan's life, the urgent problems of that stage of national and social development, as well as the author's theoretical and practical response to them.

A monograph by S.S. Abramyan, Henrik Edoyan: "Speech Is My Support", Y., Armav, 2025, 213 pp., has been published. The research is based on the half-century literary heritage of the eminent poet Henrik Edoyan. The author evaluates and interprets the artistic system of Edoyan's poetry and its aesthetic concept, analyzing the process of formation and its stages of completion, and defining the poet's place and role in the literary-historical context of contemporary Armenian and world poetry.

A monograph by S.S. Abramyan, Akob Movses: Poet and Aesthete, Y., Zangak, 2025, 216 pp., has been published. It is dedicated to the literary heritage and evaluation of one of the significant names of modern Armenian poetry, Akob Movses. For the first time, the poet's work has become the subject of a comprehensive study in Armenian literary scholarship.

The book Nikol Aghbalyan, Collected Works in Seven Volumes, Volume One: History of Armenian Literature, Y., Lusakn, 2025, 820 pp. (texts prepared by G. Ananyan and A. Manukyan; annotations and glossary of names compiled by A. Manukyan), with a foreword by A. Manukyan ("Nikol Aghbalyan: The Tireless Worker of Armenian Thought", pp. 5–50), has been published.

The book Charents Ye., Collected Works in 13 Volumes, Volume 2: Poems and Ballads. 1915–1931, Y., Antares, 2025, 476 pp. (text and notes prepared by A. Nikoghosyan), has been published. It restores the unnecessary corrections made in the previous edition and expands the notes and textual variants.

The book Hovhannes Tumanyan, Complete Works, Volume 6 (reprint), Y., Edit Pert, 2025, 1024 pp., prepared for publication by the Tumanyan Studies Group, has been published. It includes H. Tumanyan's publicistic and critical articles (1887–1912).

In scholarly journals included in international databases, 20 articles have been published, contributing to the internationalization of the research conducted at the Institute.

Outcomes of applied developments

Makaryan, A.A., Jrbashyan, A.E., Seyranyan, L.B., Armenian Literature 12, Ministry of Education, Science, and Technology of the Republic of Armenia (Yerevan, Edit Print, 2025, 144 pages). "Armenian Literature 12" is a school textbook for the 12th grade of secondary school. It consists of two thematic sections: "Man, Nature, Technology" and "Modern Armenian Literature and Armenian Diaspora Literature." The material included in the textbook pertains to Armenian literature of the second half of the 20th century and the period of independence. The thematic sections include the best works of Armenian classics, as well as contemporary Armenian writers and Armenian writers of the Diaspora. Among the main authors studied are Amo Saghyan, Vahagn Davtyan, Zakhrat, Hrant Matevosyan, and Levon Khechoyan. The textbook also includes selected examples of contemporary literature from the works of Aghasi Ayvazyan, Hovhannes Melkonyan, Razmik Davoyan, Armen Martirosyan, and Hrach Sarukhan. Armenian Diaspora literature is represented by selected works by Hakob Mndzuri, Mushegh Ishkhan, and Roper Khatchetchyan. Materials describing the lives and general features of the works of these authors are accessible via QR codes. Additional materials from the works of renowned writers Vardges Petrosyan and Aghasi Ayvazyan are also included; they are also located under QR codes.

Nikoghosyan, A.G., Vardanyan, A.V., "Literature 9," a textbook for the 9th grade of comprehensive schools (Bishop, Antares Publishing House, 2025, 176 pages). Guaranteed by the Ministry of Education, Science, Culture, and Sport of the Republic of Armenia. A circulation of 37,500 copies. The textbook contains chapters on 5th-century Armenian literature, Mesrop Mashtots and the invention of writing, the epic poem "The Daredevils of Sassoun," and the ayren, as well as biographies and a number of works by Movses Khorenatsi, Pavstos Buzand, Koryun, Grigor Narekatsi, Nerses Shnorhali, Frik, Sayat-Nova, Mikael Nalbandian, Rafael Patkanyan, and Derenik Demirchyan. These chapters expand students' understanding and literary knowledge of concepts such as historiography, poetry, psalm, riddles, ayren, myths, epic song, epos, comedy, and more.

Institute of Economics after M.Kotanyan

Major achievements

Within the framework of theme "Introducing the concept of the circular economy model as a necessity for increasing food security in RA" (supervisor: Ph.D in Economics, Associate Professor M.G. Manucharyan):

- A number of advantages of the circular economy, as opposed to the linear economy, have been substantiated, which have operational significance both at the strategic and micro- and macroeconomic levels, which determines the need to introduce a circular economy model in the agricultural sector.
- The problems of the circular economy and the linear economy, the economic opportunities of circular economy business models, waste management have been analyzed, and the advantages of introducing the circular economy concept from the perspective of increasing food security have been substantiated.

Within the framework of theme "Science development strategy as the most important prerequisite for sustainable development of the RA economy and ensuring security" (supervisor: Ph.D in Economics E. A. Hakobyan):

- The prerequisites for the development of science in the Republic of Armenia (the inherited heritage and the current state) were analyzed.
- The application of international experience in the development of the state science strategy was studied, on the basis of which recommendations for the development of the science strategy were formulated, as well as the indicators describing the effectiveness of science in the Republic of Armenia and the countries of the region were studied.

Outcomes of applied developments

Within the framework of theme "Introducing the concept of the circular economy model as a necessity for increasing food security in RA" (supervisor: Ph.D in Economics, Associate Professor M.G. Manucharyan) the following priorities were distinguished, namely:

The increasing scale of organic waste leads to serious socio-economic and environmental problems.

- Environmental consequences - If we assume that in the Republic of Armenia in 2024 about 55-60% of solid household waste will be organic waste (350.3-380.1 thousand tons), then in the case of unmanaged landfills, methane emissions will amount to 11.9-12.9 thousand tons, which is equivalent to 321.3-374.1 Gg CO₂ (the global warming potential of methane over a 100-year period is 27.0-29.8 times higher than carbon dioxide). In the case of waste management (composting, anaerobic digestion), emissions can be reduced.

- Economic consequences – Food losses and waste also include the cost of water, land, fertilizers, energy, and labor resources. For example, in 2023, total wheat losses amounted to 45.6 thousand tons, which, under the conditions of the average actual yield (19.6 qt/ha), could have been obtained from 23.3 thousand ha. In grain-growing regions, 2500-2700 cubic meters of water are required to irrigate 1 ha of wheat. That is, the loss of 45.6 thousand tons of wheat in 2023 led to the loss of 58250-62910 thousand cubic meters of water.

No matter how different the countries of the world are, they all face the problem of environmental protection, and according to their economic level, they have a similar structure of waste. This commonality and specificity will allow the application of already tested and economically

justified solutions in other countries. The application of the rich and well-founded foreign experience of the circular economy in our republic will allow us to reduce rapidly growing waste pools, provide companies with additional profits, and play a significant role in the social development of the community.

Within the framework of theme " Science development strategy as the most important prerequisite for sustainable development of the RA economy and ensuring security" (supervisor: Ph.D in Economics E. A. Hakobyan) the following priority has been identified:

A widely accepted indicator in international practice for assessing the effectiveness of science financing is the GERD indicator (Gross domestic expenditure on R&D), which expresses the ratio of a given country's annual R&D expenditures to the country's gross domestic product (GDP) in percentage terms. International experience shows that high GERD indicators (4-5% and more) combined with the active participation of the business sector lead to the development of high-tech industry and economic prosperity, while in the Republic of Armenia, the low involvement of the private sector in R&D activities hinders the commercialization of innovations and the modernization of industry. Science should be closely linked to the economy, work together to quickly apply the results of scientific research and bring innovations to fruition, which will make the sector attractive for young people.

Institute of Philosophy, Sociology and Law

Major achievements

The Institute of Philosophy, Sociology and Law NAS RA, within the scope of the topic "Philosophical, socio-political and legal issues of the Armenian society (history and modernity)" (headed by PhD in Political Science E. Ordukhanyan) has conducted research in four scientific directions: philosophy, sociology, law and political science.

During the reporting period the most important results of the Institute's include the study of the theory and history of Armenian philosophy, modern legal historical and theoretical problems, key geopolitical processes and civilizational problems occurring in the Republic of Armenia and the South Caucasus region, as well as the study of new social and political realities and challenges in Armenian society.

Among the obtained results, it is important to highlight:

- The study of the spiritual activities of Nerses Shnorhali and the political concept of Nerses Lambronatsi (Doctor of Philosophy, Professor R.A. Mirumyan, Candidate of Philosophy, Associate Professor L.S. Sarvazyan).

- Study of the features of historical memory and historical identity (Academician, Doctor of Sociology, Professor G.A. Poghosyan).

- The study of historical and contemporary problems of the evolutionary development of legal concepts, issues of the evolutionary development of theoretical and conceptual approaches to law and legal understanding (Doctor of Law, Professor G.H. Safaryan, PhD in Law, A.V. Shuquryan).

- The formation of a new balance of power in the South Caucasus, the study of Armenian-French military ties (PhD in Political Science, Associate professor E.H. Ordukhanyan, Hayk Sukiasyan, Doctor of Political Sciences, Professor L.Gh. Shirinyan, PhD in History H.V. Nazaryan).

During the reporting period, the most important scientific results obtained at the Institute were published in monographs, as well as in the form of articles in journals included in the list of scientific periodicals acceptable for the HESC RA and in scientific periodicals included in the prominent international scientometric databases WoS and Scopus.

Efficient work was also carried out in the direction of strengthening the international relations of the Institute.

Outcomes of applied developments

During the reporting period, the applied results of the Institute are as follows:

- The Director of the Institute, PhD in Political Science, Associate Professor E. Ordukhanyan as expert of the Advisory Committee of the Council of Europe Convention for the Protection of National Minorities and the Head of the Research Group “Internationalization of Law and Comparative Legal Studies” PhD in Law D. Hakobyan as expert of the UN Working Group on the Rights of Rural People and Persons Living in Rural Areas continued their activities in these organizations.

- Based on the obtained scientific results, some researchers of the Political Studies Department, the Research Group on Political Culture, Democratization and European Integration Studies, and the Research Group on Internationalization of Law and Comparative Legal Studies regularly present their analyses and proposals regarding the organization of the legal and political life of the state in the public expert-analytical platforms.

- In order to popularize the Institute and its fundamental scientific directions, a new series of scientific lectures in format of Podcast were filmed, which were widely spread on the Facebook page and YouTube channel of the Institute.

- In terms of international cooperation, within the framework of the memorandum signed with the Foreign Policy Community of Indonesia, the Institute, as a co-organizer, participated in the Global Town Hall 2025 international forum entitled “The Future We Need.”

The POLITNOMOS. Journal of Political and Legal Studies (editor-in-chief: PhD in political science, associate professor E.H. Ordukhanyan) English scientific journal (serial numbers: Volume 2, No. 2, Volume 3, No. 1, Volume 3, No. 2) after being included in the international scientometric databases such as Google Scholar, Semantic Scholar, Crossref, Scispace, Yubetsu Shibata, was submitted for the indexation in the international scientometric database Scopus and it has already passed the validation phase.

Institute of Arts

Major achievements

Within the framework of the basic project “Complex Study of Armenian Art” (head A. Asatryan, D. Arts), the work on the study of contemporary art continued.

For the first time, a comprehensive study has been conducted on the activities of the first symphony orchestra organized in Armenia – the National Philharmonic Orchestra of Armenia in the 21st century. Based on a study of archival documents and materials stored in the NFOA archive, presents the orchestra's concert activities in Armenia and abroad between 2000 and 2025. The orchestra has made a significant contribution to the musical life of the Republic of Armenia and to the popularization of Armenian classical and contemporary symphonic and vocal-symphonic music. The results of this study are published in the preface to the Chronicle of the NFOA's activities and presented at an international scientific conference (Minsk). Soon, as part of the NFOA's 100th anniversary and with financial support from MONKS, they will be summarized in a monograph by A. Asatryan.

For the first time, a comprehensive study of the work of composer Ruben Sargsyan has been carried out (head L. Yernjakyan, D. Arts). The musical world and artistic individuality of the composer are presented, and the stylistic and aesthetic origins of Ruben Sargsyan's polygenre works are examined in the light of various artistic trends in contemporary music. The results of the study are published in L. Yernjakyan's monograph “The World of Ruben Sargsyan: Composer and Time” (in Armenian).

As part of a study of modern and contemporary Armenian visual arts, the first Armenian literary and art illustrated magazine Araks (St. Petersburg, 1887-1898) – articles, reports, and publications – about 19th-century Armenian masters of fine art, and the role of this periodical in covering and popularizing their work has been identified (head – corresponding member A. Aghasyan). The results of the study are published in A. Agasyan's monograph “Armenian Fine Arts on the «Araks» magazine (St. Petersburg, 1887-1898)” (in Armenian).

As part of the study of ancient Armenian art, the iconography of the fine and decorative arts of the Kingdom of Van (Urartu, 9th-6th centuries BC), the artistic decoration of Urartian seals, and issues of spatial construction in Urartian fine arts were examined (head G. Poghosyan, PhD in Art History). The results of the study are reflected in 2 articles (“Symbolic interpretation of the ritual scene on the gold medallion from Toprak-Kale” and “The depiction of Halo in the artistic design of Urartian medallions”) by G. Poghosyan published in the scientific journals “Journal of Ancient History and Archaeology” (Q1, Romania) and “History, Archaeology, and Ethnography of the Caucasus” (Q1, Russia), as well as in her reports at international scientific conferences.

Outcomes of applied developments

Within the framework of the basic project “Complex Study of Armenian Art” (head A. Asatryan, D. Arts) and publication of the spiritual legacy of Armenian classics as part of it, the work on the 2nd edition of Komitas’s oeuvre commenced, and the 2nd volume came out, which includes Komitas’s choir songs.

The textbooks for “Music” subject taught in the 4th and 11th grades of secondary schools were published (head T. Shakhkulyan, PhD in Arts).

4 issues of the illustrated popular-science art magazine “Roslin” came out: the 2024 winter issue, and the 2025 spring, summer and autumn issues (editor of the Art section A. Asatryan, D. Arts); most of the articles are authored by NAS RA Institute of Arts researchers.

The radio program series “Identity” of the Ararat Patriarchal Diocese of the Armenian Apostolic Holy Church, broadcast on the Public Radio of Armenia with the participation of NAS RA Institute of Arts specialists, aims to popularize the results of art studies.

International Scientific-Educational Center

Major achievements

During the reporting year, the processes aimed at the internationalisation of the International Scientific-Educational Centre of the National Academy of Sciences (ISEC NAS RA) continued. Collaborative ties with partner organisations were expanded, and new international mobility programs were introduced. Specifically, 11 international and external cooperation agreements, memoranda, and contracts were signed with various universities, scientific organisations, and other institutions.

In the reporting year, ISEC NAS RA received funding under the European Commission's Erasmus+ Capacity Building in Higher Education (CBHE) program for the implementation of the project “EUBridge: Strengthening Higher Education for European Project Management in Armenia,” following the results of the Erasmus+ capacity-building competitions. This is the first time that ISEC NAS RA has acted as project coordinator within the framework of this Erasmus+ action. The EUBridge project aims to develop the capacity of Armenian universities in the field of European program development and management. The project aims to fill the gap in structured training and practical skills by creating an innovative curriculum, a pilot Academy for European Project Management, and simulation training modules. Within the framework of the Armenia-Spain-Italy partnership, the project aims to introduce the best European practices into the Armenian higher education system. Plans include developing high-quality teaching materials and an interactive digital platform that supports both face-to-face and distance learning. This will enable university staff, researchers, and students to acquire practical knowledge in the design, management, and implementation of European programs.

In the World University Rankings, ISEC NAS RA ranked 305th out of 422 participating institutions, with a total score of 5241 points, placing it within the medium-to-high performance category. The ranking results of ISEC NAS RA are available at the following link: <https://ranking.heranking.com/2025/isec.am>. The official rating certificate awarded to the Centre, along with the institutional activity report, can be accessed via the following link: https://drive.google.com/file/d/1FI6c11CVCds7XVqSgiN6FsF-ILRYFZrU/view?usp=drive_link.

Recognising the strategic importance of internationalisation and external cooperation in higher education, the Centre has developed professionally oriented academic programs leading to double degrees. Pursuant to Order No. 51-N of the Minister of Education, Science, Culture, and Sports of the Republic of Armenia, dated 16 June 2025, “On the Procedure for Ensuring the Quality of Modular Programs of Additional Education,” a modular additional education program entitled “School of Guides” was developed and formally approved by the authorised body. The program has been implemented and operational since November 2025.

ISEC NAS RA has continued the publication of the “Katchar” Scientific Periodical, which is included in the list of scientific journals recommended by the Supreme Certifying Committee (SCC) of Armenia, as well as the Popular Science Magazine “In the World of Science”. In the reporting year, the scientific periodical “Katchar” was renamed the public science journal “Katchar/Academy”, and the journal's website was revamped entirely in accordance with the requirements of the Armenian Academic Research Computer Network. In the reporting year, the faculty of ISEC NAS RA published one textbook, one monograph, and 46 scientific articles, 8 of which appeared in scientific journals indexed in the “Scopus” and “Web of Science” databases.

Outcomes of applied developments

Software updates and checks, including antivirus programs, were carried out in the computer classrooms at ISEC NAS RA. An online admissions platform for NAS RA was launched. Routine updates were made to the video conferencing software environment on the distance learning platform installed at the Centre (<https://conference.isec.am/>), and the necessary security and software packages were updated accordingly. The Moodle-based distance learning platform installed at ISEC was updated. The distance-learning room, equipped with the necessary technical equipment, has been reopened.

The administrative and teaching staff of ISEC NAS RA were sent on business trips to Spain, France, Bulgaria, Italy, Croatia, Belgium, Germany, Montenegro, the Netherlands, Georgia, the USA,

the UAE, and Serbia, where they participated in national and international professional development programs, conferences, youth forums, and scientific symposiums.

As part of the Erasmus+ program, the Centre has implemented exchange programs for students, faculty, and administrative staff with 10 European universities.

During the current academic year, guest lectures at the Centre were delivered by faculty members from St. Cyril and St. Methodius University of Veliko Tarnovo (Bulgaria), the National Education Commission University of Krakow (Poland), the University of Lille (France), the Higher School of Economics (Russia), and the University of Washington (USA).

During the current academic year, within the framework of the Erasmus+ International Credit Mobility programme, students of ISEC NAS RA pursued studies at the International Telematic University (Italy), St. Cyril and St. Methodius University of Veliko Tarnovo (Bulgaria), the University of Lille (France), as well as the Universities of Tuscia, Bologna, and Federico II of Naples (Italy).

Based on the outcomes of the development and implementation of educational programs, all academic departments of the Centre conducted comprehensive reviews and enhancements of their professional education programs. This process encompassed revisions to intended learning outcomes, teaching and learning methodologies, assessment strategies, and student assignments, with the objective of ensuring alignment with contemporary academic standards and quality assurance requirements.

Building on prior experience and in accordance with established regulatory provisions, comprehensive evaluative studies were conducted to assess the quality and effectiveness of educational programs, graduate outcomes, and internships organised by ISEC NAS RA, as well as the overall quality of instruction at the Centre. Internal quality monitoring was systematically implemented across all departments, and the Centre's expert review group conducted on-site evaluations to verify and assess departmental processes. As a result, 95% ISEC's professional education programs underwent rigorous internal audits, ensuring alignment with contemporary academic standards and best practices.

To further strengthen professional competencies and employability, a series of courses, seminars, and masterclasses was organised for both academic staff and students. Open lectures were delivered by representatives of target employers and distinguished industry professionals, providing insights into current labour market trends. In addition, career guidance visits were arranged with organisations relevant to their professional development, enabling students and graduates to gain practical exposure and enhance their career readiness.

National Bureau of Expertise SNPO

Major achievements

The Organization has continued publishing the scientific periodical "Armenian Journal of Forensic Expertise and Criminalistics". The 13th and 14th issues of the periodical were published, which included a total of 42 peer-reviewed articles.

In November, an extended three-day joint meeting of the European Network of Forensic Science Institutes (ENFSI) was held for the first time in Armenia by the decision of the highest body of ENFSI, the Board, which was initiated and organized by the Organization as a permanent representative of ENFSI and full member of ENFSI. The 30th anniversary joint meeting was attended by leading forensic institutions of the European Union, members of the Board and Secretariat of the European Network of Forensic Science Institutes (ENFSI), chairs of standing committees, heads of ENFSI Expert Working Groups (EWGs), as well as other representatives of the forensic field from France, Germany, Switzerland, the Netherlands, the United Kingdom, Austria, Croatia, Greece, Poland, and other European countries. The event served as a new impetus for the continuous science-based development and capacity building of the forensic field, as well as for the introduction of modern technologies and new methodologies.

The Organization also held a conference entitled "Current Issues of the Forensic Field and Development Prospects", dedicated to the 21st anniversary of the establishment of the National Bureau of Expertises. During the conference, the scientific work was discussed and summarized, the scientific

novelties obtained as a result of the conducted research were presented, newly developed methodological approaches were introduced, and the experts also shared the advanced results achieved, which is of great importance for the knowledge-based development of the country's forensic field.

The experts of the Organization's relevant subdivisions also participated in conferences, symposiums, workshops, qualification tests and other ongoing activities conducted by the respective working groups of the European Network of Forensic Science Institutes (ENFSI), thereby ensuring their professional engagement in a modern scientific and methodological working environment.

Seven experts of the Organization, specializing in materials science, trace expertise, toxicology, audio recording, and DNA expertise, participated in international professional testing (Professional test) aimed at assessing professional knowledge and skills in the forensic field and obtained positive results. The primary purpose of the testing was to ensure a comprehensive and objective assessment of professional competence of the experts, which makes it possible, on a scientifically substantiated basis, to evaluate the compliance of their knowledge, skills, abilities, and overall professional level with the requirements of the positions they hold.

In certain areas, new research methods and methodologies have been developed and implemented, and, through their application, various research activities have been initiated, ensuring scientifically substantiated results. In this regard, the methodology was applied in the field of toxicological examinations, developed and published jointly with the Association of Specialists in Chemical Toxicology and Forensic Chemical Analysis of the Russian Federation, as well as a methodology was jointly developed in the field of commodity examinations with the Scientific and Practical Center of the State Forensic Examination Committee of the Republic of Belarus.

The participation of the Organization's experts in CEPOL exchange program of the European Union Agency for Law Enforcement Training (CEPOL) was resumed.

Outcomes of applied developments

Within the framework of the state procurement contract for the provision of services for the needs of the state in the accounting period, 13254 forensic expertise has already been carried out, with a total value of 783189.0 thousand AMD.

The Organization's units have also conducted 149 expertise / 414 objects examined / within the framework of civil proceedings, 41 expertise / 82 object examined / within the framework of administrative proceedings, 2 expertise / 2 objects examined / based on bankruptcy court decisions, 83 expertise / 610 objects examined / within the framework of the state procurement contract "Provision of services for state needs N<Q-T-UUÖQ&-25/6" with the RA Prosecutor's Office (on cases of illicit enrichment), as well as 1120 expertise / 1262 objects examined / based on contracts concluded with individuals and legal entities within the framework of civil legal relations.

STATE TARGET PROGRAMS

National Cloud Infrastructure for Open Science

Coordinator V.Sahakyan, cand. (phys.-math.), Institute for Informatics and Automation Problems

The is aimed at addressing fundamental and applied research challenges in the natural sciences, including hydrometeorology, environmental protection, seismology, biology, and medical genetics, while simultaneously developing cloud and computing infrastructure through the effective use of the technical capabilities of the national research electronic infrastructure.

The program was implemented with the participation of leading specialists from the Institute of Informatics and Automation Problems of NAS RA, the Institute of Geophysics and Engineering Seismology named after A. Nazarov (YES), the Institute of Physiology named after L. A. Orbeli, the Institute of Molecular Biology, and the Ministry of Environment of the Republic of Armenia. Within the framework of the program, extensive research was carried out across several natural science domains.

Meteorology: In the field of meteorology, a comprehensive assessment and analysis of the intensity of drought conditions across the territory of Armenia were conducted, taking into account climate warming trends observed over recent decades and their impact on regional hydrometeorological conditions. The frequency of extreme climate indices in recent decades observed in Armenia was analysed, trends in their variability were identified, and projected future changes were assessed using climate models. An assessment of drought conditions for the territory of Armenia was carried out using satellite multispectral images and data (CMORPH and IMERG).

Environmental Protection: Studies of harmful substances emitted into the atmosphere were carried out using modern models.

Seismology: Geodynamic modelling was carried out aimed at developing a predictive system for the activation of active tectonic faults and developing an express instrumental monitoring system to assess the degree of vulnerability of buildings.

Biology: In biology, molecular modelling of a previously developed lipid bilayer–transmembrane integrin complex was continued, with the obtustatin protein incorporated and simulations extended over longer time intervals. These studies were carried out using the high-performance computing resources of the Aznavour supercomputer, which made it possible to perform long-duration and computationally intensive simulations.

Medical genetics: In the field of medical genetics, work was carried out on the collection of open-access data, models, and scientific publications, followed by their processing, quality control, and compliance verification. The curated resources were subsequently integrated into the ArmLifeBank platform to ensure the availability of a structured, accessible, and searchable database.

To ensure optimal infrastructure provision and the development of new services, significant efforts were devoted:

Modern lightweight virtualization tools were developed for cloud and HPC environments, based on the Apptainer/Singularity tools. A comparative analysis of lightweight virtualization technologies was performed on the Aznavour supercomputer, proving their high efficiency, security and portability.

Specialized computing environments were deployed to support machine learning tasks, including Transformer, LSTM, and Mamba models, as well as parallel computing using Python and Julia and distributed data processing with Dask.

The impact of RDMA-based memory pooling on computing performance was also investigated, with particular emphasis on its role in accelerating parallel computations and improving the efficient use of computing resources.

A mechanism was developed for integrating cloud and high-performance storage systems, resulting in a scalable, efficient, and secure integrated cloud–HPC platform for big data analysis and machine learning applications.

The scientific results obtained during the implementation of the State Target Program were published in 15 scientific articles.

The outcomes of the program were presented at a working scientific conference held on December 20, 2025, which was attended by more than 40 specialists from relevant scientific fields.

Evaluating micro nutrient consumption in the RA and scientific-methodological support required for public awareness

Coordinator L.V. Sahakyan, c.g.s., Director of the Center for Ecological-Noosphere Studies NAS RA

The goal of the Program “Evaluating micro nutrient consumption in the RA and scientific-methodological support required for public awareness” is to evaluate the current status of micro-nutrients consumption in Armenia and provide a scientific-methodological basis for developing the effective population nutrition improvement strategies. The Program goal and anticipated results are agreed with the Ministry of Economy RA and aim to address state needs. The work performed in the accounting period was designed to study the best international practices in the assessment of micro nutrients and dietary reference values as well as the assessment of dietary iron consumption by the population. By the method of a total dietary study over 382 subsamples of food stuffs consumed in the RA underwent pretreatment (in compliance with dietary habits of the population) and 146 products were analysed for iron contents by a Thermo Scientific iCAP 7400 ICP-OES analyser. Based on resulting data and individual food consumption databases produced by the Ecocenter, assessment was done of iron consumption levels.

The outcomes of the Program have an essential applied value and enable the implementation of the event “Assessing micro elements content in foods” included in the “Action Plan for a Food Safety System Development Strategy for 2022-2026”.

Development of radiation-resistant and protective from laser location glassy and composite materials

Coordinator N.Knyazyan, DSc(tech.), Institute of General and Inorganic Chemistry after M.Manvelyan

The presented topic was carried out at the IGIC of NAS RA in collaboration with the Environmental Monitoring Laboratory of the ANPP. The aim of this work is to investigate and develop new glassy and composite materials with improved radiation resistance and protection against laser detection.

Studies were continued on the glass-forming regions based on the main glass-forming oxides B_2O_3 and SiO_2 in the systems $ZnO/CdO/PbO-B_2O_3/Bi_2O_3-Al_2O_3-SiO_2$ and $CaO/SrO/BaO-B_2O_3/Bi_2O_3-Al_2O_3-SiO_2$, on the ranges of glasses stable against crystallization, the composition of crystalline phases and their crystallization fields, as well as on the radiation stability of the synthesized glasses under γ -radiation and fast neutron irradiation. New radiation-resistant and radiation-shielding glassy, glass-ceramic, and composite materials with improved properties and high-density values of $4.8-6.2 \text{ g/cm}^3$ have been developed.

Studies of γ -ray irradiation and absorption in the energy range of $0.5-1.25 \text{ MeV}$ and fast neutrons in the range of $15-50 \text{ MeV}$ were carried out at the Nuclear Power Plant Environmental Monitoring Laboratory. Based on the linear attenuation coefficient data, the synthesized materials exhibit a high gamma-ray attenuation capability (radiation sources used were ^{137}Cs with energy 661.7 keV and ^{60}Co with energies of 1173 and 1333 keV). Analysis of the obtained data showed that at energies of 661.7 , 1173 , and 1333 keV the samples have high μ coefficients. A decrease in the μ coefficient is also observed with increasing photon energy.

Studies were conducted on the absorption of fast neutrons by the developed materials. To investigate the radiation effects, the samples were placed in containers with fast neutron sources and irradiated for 32 days. It was found that the developed materials are stable under fast neutron irradiation during the specified period. The reduction in neutron flux intensity was calculated using the summed effective nuclear cross sections of the constituent elements.

Development of a New Geological Map of Armenia at a Scale of 1:200000

Coordinator Kh. Meliksetian, Dr.Sci., Institute of Geological Sciences

During the reporting period, a unified database was created summarizing data on volcanic and intrusive rocks for the purpose of compiling a new geological map at a scale of 1:200,000 in the appropriate format. The database includes both new data collected from literature sources and radiometric dating data obtained in recent years using Ar-Ar, K-Ar, and U-Pb isotope methods. Systematization and cross-correlation of these data allowed for a better understanding of the age relationships of igneous complexes, a revision of the stratigraphic position of individual volcanic and intrusive units, and their spatial relationships. Based on the resulting database, an updated geochronological scale was compiled. This serves as the chronological basis for geological mapping at a scale of 1:200,000 and provides a clearer and more scientifically sound representation of the stages of magmatic development in the region.

173 geological maps of various scales (including 1:200,000, 1:100,000, and 1:50,000) were georeferenced in the GIS system and converted to a unified coordinate system. Simultaneously, layers of administrative boundaries, settlements, roads, water bodies, and mountain peaks of the Republic of Armenia were created in the GIS, which will serve as the topographic basis for compiling the new map.

As part of the project, fieldwork was conducted to clarify the boundaries of lava flows, the locations of volcanic and intrusive bodies, and their sampling. Petrographic and chemical-analytical studies were conducted, resulting in a refinement of the composition and nomenclature of rocks. At the same time, the Middle Jurassic sedimentary layers and the index species of fossils preserved in them in the Tavush region were studied, which are of great importance for correcting the dating of these layers.