

TURNING OVER CHAPTERS OF HISTORY OF THE SCIENTIFIC INSTITUTION (HISTORY OF CREATION, ACHIEVEMENTS)

The history of creation of the Institute of Agricultural Microbiology of the NAAS is closely related to with the activities of the famous Ukrainian scientist, Academician of the Ukrainian Academy of Agricultural Sciences (UAAS) Mykhailo Vasylovych Revo. M. V. Revo cherished the idea of creating the institute at the beginning of his scientific career, but the scientist began its purposeful implementation in the second half of the 50s of the past century, when the appropriate conditions were formed. In the 30s of the past century, the scientist was subjected to repression, his work was silenced for a long time, and only with the onset of the political “defrosting” was it possible to realize his plans. M. V. Revo set out his views on the creation of a new institute in memoranda: to the President of the UAAS P. A. Vlasiuk (1959) and to the First Secretary of the Central Committee of the Communist Party of Ukraine M. V. Podhornyi (1960). In his notes, Mykhailo Vasyliovych not only emphasized the expediency of establishing the institute, but also outlined its main directions of activity, tasks, and determined the directions of work.

Numerous commissions created to consider the proposals resulted in the formation of the Department of Agricultural Microbiology, Virology and Immunology (DAMVI) within the Ukrainian Scientific and Research Institute of Agriculture at UAAS (Order of the Minister of Agriculture of the USSR No. 1037 dated 22 November 1960 and Resolution of the Board of UAAS dated 29 November 1960). However, the Department practically began its activities at the end of summer of the next year, after granting it the status of a branch of the Ukrainian Scientific and Research Institute of Agriculture (Order of the Minister of Agriculture of the USSR No. 508 dated 29 August 1961). This day – 29 August 1961, is considered the official date of establishment of the Department.

DAMVI included three laboratories: agricultural microbiology, general virology and viral diseases of

farm animals and general immunology. Twenty-two persons were on the payroll of the Department. The institution was headed by the Candidate of Biology Ya. A. Holota who previously held a position of the Senior Research Fellow on Cattle and Horse Breeding at the Division of Animal Husbandry of UAAS. However, the scientific work of the team was led by Academician M. V. Revo, appointed as Deputy Director for Research. Studies of enteroviruses and L-forms of mycobacteria began to be actively conducted under the direct supervision of M. V. Revo. In other laboratories at this time the features of diplococcal and streptococcal infections were studied, which is reflected in the relevant monograph [1].

M. V. Revo understood that the creation of the Department instead of the long-awaited institute was only the beginning. The scientist focused his activities on expanding the subdivision to have a basis for its future reorganizing into a scientific and research institute. For instance, with the direct contribution of Mykhailo Vasylovych, the UAAS management intended to expand the department “by creating a Laboratory of Soil Microbiology, Bacterial”. However, the scientist died suddenly on 2 March 1962, without realizing his plan.

The team inherited the helm of M. V. Revo’s life-work. The department gradually expanded. For example, studies on soil microbiology challenges were initiated. M. H. Tiahny-Riadno, Doctor of Biology, became the Head of the Laboratory of Soil Microbiology.

In 1964, the Department was headed by an outstanding scientist, Doctor of Veterinary, Professor V. I. Rotov. V. I. Rotov’s activity was mostly devoted to the problems of prevention and control of animal tuberculosis [2, 3]. His work on serological identification of tuberculosis, new methods of prevention and treatment of animals contributed to the complete elimination of tuberculosis isolators and groups of tuberculosis animals



in farms of many regions of Ukraine. Not to exaggerate, it can be argued that at that time the main studies on these issues in Ukraine were conducted in the DAMVI. V. O. Rozhdestvenskyi, Candidate of Biology, was appointed as Deputy Director for Research. Later, Professor M. P. Mosiuk and Candidate of Agriculture V. O. Aharkov held this position.

At that time, the Department includes 8 scientific subdivisions: Laboratory of Microbiology of Zoonotic Diseases (Head – V. I. Rotov), Laboratory of Immunology (Head – K. P. Chepurov, Doctor of Veterinar, Professor), Laboratory of Virology (Head – V. A. Rozhdestvenskyi), Laboratory of Electron Microscopy (Head – M. Ya. Kurbala, Candidate of Veterinary), Laboratory of Viral Diseases of Cereals (Head – V. O. Aharkov), Laboratory of Viral Diseases of Potatoes (Head – R. N. Nikitina, Candidate of Biology, later – V. A. Marchenko, Candidate of Agriculture), Laboratory of Soil Microbiology (Head – M. F. Mosiuk, Doctor of Agriculture) and Laboratory of Feed Microbiology (Head – A. D. Semeni, Candidate of Agriculture).

In the laboratories of the institute, Roshchin's dry concentrate for feed ensiling, liquid complex leaven for corn silage, technology of enrichment of composts with useful microflora, diagnostic sera for detection of viral diseases of cultivated plants were created; the issue of field resistance of plant varieties and hybrids to viral diseases, the spread of viruses and their harmfulness on the then zoned varieties of potatoes has been studied; pathogenic strains of enteroviruses were isolated for reproduction in an experiment in order to develop methods to control diseases of enterovirus aetiology, etc. In 1965, the production of diagnostic sera for the detection of viral diseases of potatoes began.

The Ukrainian Scientific and Research Institute of Agricultural Microbiology was established on the basis of the existing Department in 1969 (Resolution of the Council of Ministers of the USSR No. 442 dated 24 July 1969 and Order of the Minister of Agriculture of the USSR No. 583 dated 22 August 1969). The institute included 10 scientific subdivisions: Agricultural Microbiology, General Virology and Viral Diseases of

Farm Animals, General Immunology, Soil Microbiology, Plant Virology, Digestion of Farm Animals, Feed Microbiology, Immunology, Virology of Farm Animals, Zoonotic Diseases of Animals.

The institute was headed by a well-known virologist Yu. M. Sheludko, Candidate of Biology. V. I. Rotov was appointed as Deputy Director for Research. Well-known virologists V. P. Romanenko and F. Yu. Kozar are involved in the work of the Institute at that time.

With the establishment of the institute, the biological features of swine enteroviruses, their role in the aetiology of diseases are actively studied. As a result of studies conducted, in 1971 enzootic encephalomyelitis (Teschen disease) of pigs was detected for the first time in the USSR. The results of these studies are reflected in the monograph [4].

In the scientific topics of the newly established institute, a significant part was devoted to the studies of the most actual questions of phytovirology. At this time, extensive studies have been conducted on production and collection plantings of potatoes, crops of lupine, soybeans, tomatoes in protected soil, state variety test plots of Polissia and Forest-Steppe zones. An extensive affection of these cultures with viral diseases has been found. Directions such as the healing of plants from viruses by the method of meristem culture, creation of weakly pathogenic strains of viruses to control viral lesions and others have being developed. Qualitative solution of the issues would be impossible without the appropriate material and technical base and staffing. These issues have been successfully resolved. Studies on the problems of phytovirology was conducted by highly qualified specialists – N. O. Sivers, Candidate of Biology, A. Ye. Rybalko, Candidate of Agriculture. Somewhat later, M. Ya. Pohorilko, M. Ye. Shevel, N. V. Shcherbyna, M. M. Zarytskyi and L. P. Kolomiets successfully passed Candidate's thesis defence. The developments of plant virologists have been protected by 15 invention certificates and have been widely used in agricultural production. At this time, Yu. M. Sheludko prepared and published a textbook "Phytovirology" [5], which was the principal one for education of students in the relevant specialty for a long time.

Especially active development of the institute started in 1972, when V. S. Sivers, Candidate of Biology, was assigned as a Director and O. O. Berestetskyi, Candidate of Biology – as a Deputy Director for Research. Building of a new laboratory complex on Malinovskyi Street started and the institute is saturated with new modern equipment, a powerful scientific team is formed. The main research areas were feed microbiology, soil microbiology, phytovirology, animal virology, animal microbiology.

During this period, studies of microbiological aspects of increasing the feed value of plant residues (cereal straw, corn cobs, etc.) are actively developing, probiotic preparation BPS-44 was created for the prevention and treatment of gastrointestinal diseases in young cattle, features of its effective use were studied. The main executors of these issues were M. Kh. Spravtsev, Candidate of Biology, S. D. Bohdan, Candidate of Agriculture, V. P. Dorozhko, H. M. Horobets, M. P. Topchii, Candidates of Veterinary.

Studies on microbiological fundamentals of forming crop rotation, important in volume and significance were conducted; together with well-known specialists in the field of agriculture, optimal crop rotations for the development of cultivated plants and the formation of soil fertility have been proposed. Strains of different pathogenicity of potato virus X, M, S, Y, PLRV, yellow bean mosaic virus, tobacco mosaic virus on tomatoes were isolated and studied. Active studies of viroids started [6]. In 1974, a new disease caused by the bacilliform virus from the rhabdovirus family was detected and studied on healthy potato varieties for the first time in Europe.

The importance of studies conducted under the leadership of O. O. Berestetskyi on certain directions of soil microbiology, in particular, the role of phytotoxic microorganisms in the emergence of such a phenomenon as soil fatigue should be particularly emphasized. Phytotoxic forms of microorganisms – micromycetes (S. P. Nadkernychnyi, Candidate of Biology), bacteria (Yu. M. Mochalov), actinomycetes (L. A. Kononiuk, Candidate of Biology) – have been invariably studied in the soils of Polissia, Forest-Steppe and Steppe zones in field crop rotations and during

cultivation of agricultural crops. The chemical nature of phytotoxic metabolites of microorganisms was studied by V. P. Patyka, Candidate of Biology, and their influence on the initial stages of organogenesis of cultivated plants – T. A. Hrab, Candidate of Agriculture.

Since 1975, when O. O. Berestetskyi held an appointment of the Director of the All-Union Institute of Agricultural Microbiology of the All-Union Academy of Agricultural sciences named after V. I. Lenin, V. I. Kanivets, Doctor of Agriculture, served as Deputy Director for Research and at the same time as Head of the largest subdivision at the institute – Department of Soil Microbiology. At this time, the above studies continued. At the same time, the issues of soil biological activity, carbon transformation, features of activation of the symbiotic nitrogen fixation process, creation of nitrification inhibitors have received significant development. The studies were conducted by scientific groups led by A. I. Kysel, V. P. Patyka, V. I. Torzhevskyi, S. P. Nadkernychnyi, Candidates of Biology, T. A. Hrab, Yu. M. Mochalov, Candidate of Agriculture.

At this time, studies of the causative agent of tuberculosis have being widely developed, diagnostic, preventive and therapeutic agents, etc. have being tested. V. I. Rotov, P. Yu. Savchenko, V. S. Kozlov, V. P. Opanasenko were among those who have actively worked on resolving these issues. The results of these works are reflected in numerous publications, as well as in monographs [7-9].

From 1981 to 1997 the institute was headed by V. P. Romanenko, Doctor of Veterinary, Professor, Academician of NAAS. F. Yu. Kozar, Candidate of Biology, worked as a Deputy for Research at that time. The main study areas were soil microbiology, virology of plants and animals, feed microbiology, animal tuberculosis.

At that time, the staff has developed methods for diagnosing swine enterovirus diseases, proposed new enzootic units – swine enterovirus gastroenteritis and enterovirus pneumonia. Nineteen previously unknown types of viruses have been discovered, 15 of which are patented. Viral vaccine against swine enzootic encephalomyelitis has been developed and put in



the manufacture. The study results were reflected in the relevant monograph [10]. The authors V. P. Romanenko, O. H. Pruss, N. V. Babych were awarded with the State Award in Science and Technology in 1989 for the development and implementation of a system of measures for the prevention and elimination of Teschen disease and the creation of a viral vaccine and diagnosticums.

In the 80s, intensive studies on certain issues of such a disease as animal tuberculosis were conducted. A collection of mycobacteria was created in the Laboratory of Animal Microbiology (headed by A. O. Bokun, Candidate of Biology, and later – by V. S. Kozlov, Candidate of Biology). Based on the analysis of epizootological parameters and the results of the studies, a “System of measures for the prevention and treatment of bovine tuberculosis” was developed. The developed method of chemoprevention with the use of tubazid was implemented in numerous farms in Ukraine, Russia, Kazakhstan and other regions of the former Soviet Union.

Since 1980, as an independent structural unit, the Laboratory of Biological Nitrogen, headed by N. M. Maltseva, Candidate of Biology, started their studies. Gas chromatographic methods for determining the activity of the nitrogen fixation process have being set up in the laboratory, and active strains of nodule bacteria have being actively selected. At the same time, at the initiative of V. V. Volkohon, the subdivision began studies on associative nitrogen fixation. At that time, isotope dilution methods (with ^{15}N) are actively used in the work, methods of activating the process of associative nitrogen fixation are developed, the composition of microbial nitrogen-fixing groups of the root zone of a number of cultivated plant species, features of introduction into agrocenoses of active strains of associative diazotrophs are studied. Significant differences and different prospects of such agronomic practice as presowing bacterization upon use for annual and perennial cultures were shown. In the late 80s – early 90s, influence of phytohormones and their synthetic analogues on the process of nitrogen fixation has being actively studied. The mechanism of positive effect of auxins and cytokinins on

the course of associative nitrogen fixation was clarified during the study. Laboratory staff participated in the publication of the monograph “New elements of bioregulation for sustainable development in agroecosystems” [11].

Since 1997, the institute is headed by V. P. Patyka, Doctor of Biology, Professor, Academician of NAAS. At his initiative, the Southern Research Station was attached to the Institute, which was part of the Institute until 2012 and conducted studies on a number of issues of soil microbiology at the sites of the South of Ukraine. Post-graduate education was started at the institute. New scientific subdivisions have being created: Laboratory of Biological Transformation of Nitrogen and Phosphorus (Chief – V. V. Volkohon, Candidate of Biology), Laboratory of Microbiomethod (Chief – S. P. Nadkernychnyi, Candidate of Biology), Laboratory of Technical Microbiology (Chief – M. Ya. Pohorilko, Candidate of Biology). Active preparation for the creation of a Collection of Beneficial Soil Microorganisms of the Institute was started. With the participation of the Institute staff, a monograph “Biological Nitrogen” [12] was prepared at this time, a monograph by P. Yu. Savchenko “Laboratory diagnosis of animal tuberculosis” [13] was published, a monograph by V. I. Kanivets “Life of the soil” [14], “Short English-Russian-Ukrainian dictionary ...” [15] were prepared.

In 2000–2003, the Director of the Institute was a well-known phytovirologist, Candidate of Biology, M. M. Zarytskyi. At this time, significant efforts were aimed at creating a Collection of Beneficial Soil Microorganisms, which acquired the status of National Heritage (Order of the Cabinet of Ministers of Ukraine No. 472-p dated 19/08/2002). The collection was formed with the active participation of Professor O. V. Nadkernychna, Candidate of Agriculture L. M. Tokmakova, Candidate of Biology T. M. Kovalevska. Today, the Collection includes 580 cultures of bacteria and microscopic fungi belonging to more than 20 genera. It combines specialized collections of microorganisms (nitrogen-fixing, phosphate-mobilizing, entomopathogenic bacteria, microorganisms-antagonists of plant pathogens,

microorganisms-producers of biologically active substances), which were formed in laboratories during the 60 years of functioning of the Institute. The collection funds also contain reference and typical strains of many known valid species of microorganisms obtained from the collections of Russia and Ukraine.

In addition to the National Collection of Beneficial Soil Microorganisms, collections of the strains of *Mycobacterium tuberculosis* (over 40 strains of bovine, human and avian species and 12 strains of atypical mycobacteria of various species), phytopathogenic viruses (over 50 strains and isolates), potato varieties recovered from viruses (over 120 varieties), as well as tesho-, enteroviruses of pigs (over 120 strains) were formed. Employees of the Institute P. Yu. Savchenko, V. S. Kozlov, H. M. Diachenko, N. O. Kravchenko, F. Yu. Kozar, L. P. Kolomiets, M. Ya. Pohorilk, O. H. Pruss, V. I. Soroka, A. O. Bokun, I. V. Demchuk took an active part in the creation of the collections.

From 2003 to 2011 the Institute was headed by V. V. Volkohon, Doctor of Agriculture, Professor. O. V. Nadkernychna, Doctor of Biology, worked as a Deputy for Research (since 2009 – S. V. Derevianko, Candidate of Biology). During this period, significant efforts of the team were aimed at developing microbial preparations of different functional orientation. Such preparations as Albobakteryn, Antymyshyn, Biohran, Diazobakteryn, Mikrogumin, Polimiksobakteryn, Ryzohumin, Khetomik have been created and registered in Ukraine. Experimental microbial preparations Agrobakteryn, Phosphoenteryn, Azokhetomik, Kladostym, Bacyloturynh, preparations for diagnostics, prevention and treatment in young cattle, pigs and poultry (BPS-L, Imunoton for immunocorrection in young animals, immunoenzymatic diagnosticums for detection of Teschen disease causative agent, inactivated vaccine against his disease), etc. were developed. Employees of the Laboratory of Virology established the fact of productive infection of potato leaf roll virus in mammalian cell cultures. Studies of economic and managerial aspects of development, implementation and application of means of biologization of agricultural production are initiated, namely: economic efficiency and pricing for

microbial preparations and veterinary drugs; intellectual property management system in a state scientific and research institution; a pool of issues of marketing, transfer of innovations and legal protection of intellectual property rights in the field of agricultural microbiology, etc.

During this period, the introduction of preparations for agriculture has being significantly expanding. The work on the implementation of scientific developments of the Institute became especially active after A. M. Moskalenko, Candidate of Economics, was appointed as a deputy Director for Marketing and Innovations. At that time, the Institute is awarded a gold medal of the Ministry of Agrarian Policy of Ukraine “For the Best scientific Development”.

The specialized scientific board for the defence of candidate's theses in the specialty “Microbiology” started its work. The works of young scientists of the Institute were awarded the Award of the President of Ukraine for Young Scientists (Ye. P. Kopylov), the Scholarship of the Cabinet of Ministers of Ukraine (T. I. Patyka, T. O. Bova, I. O. Kameneva). In 2005, publication of an interdepartmental scientific thematic collection “Agricultural Microbiology” was organized in the Institute. The collection, which is published twice a year, publishes articles in Ukrainian and English. The collection is included in the list of professional publications of Ukraine. At this time, the creative contact between the Institute's staff and scientists from Russia, Belarus, China and Germany are being actively formed. Delegations of Chernihiv scientists have repeatedly visited scientific institutions of these countries and hosted colleagues from abroad.

The expansion of studies on agricultural microbiology in Ukraine has contributed to the formation of the Scientific and Technical Program (now the NAAS Scientific Research Program) “Agricultural Microbiology”, which has been coordinated by the Institute since 2006.

The publishing activity is intensified in the Institute. In addition to the publication of scientific articles in professional journals, a number of monographs [16]–[19], catalogues [20], [21], recommendations, etc. have being published.



In 2011, Chernihiv Institute of Agricultural Manufacture and Nosivka Breeding and Experimental Station with Research Farms were attached to the Institute of Agricultural Microbiology of the NAAS. The new organization was named as “Institute of Agricultural Microbiology and Agroindustrial Manufacture of the NAAS” (Orders of the NAAS No. 174 dated 19 July 2011; No. 271 dated 28 October 2011). N. M. Buniak, Candidate of Economics, has been appointed as a Director of the Institute. S. F. Kozar, Candidate of Agriculture, Senior Research Fellow works as a Deputy for Research. A department headed by O. V. Yehorov, Candidate of Agriculture, was being established on the basis of the Chernihiv Institute of Agricultural Manufacture. The scientific researches of the Institute are supplemented by a new direction – scientific support of agroindustrial manufacture, namely – issues of the creation of new varieties and technologies for growing crops and their implementation. Well-known scientists work in the department: O. M. Berdnikov, Doctor of Agriculture, Professor, Corresponding Member of the NAAS; A. H. Bardakov, O. Yu. Lokot, V. A. Bardakov, Candidates of Agriculture and others. The institute becomes the owner of varieties of agricultural crops; primary seed production of lupine and oat varieties and introduction of original and elite seeds into agricultural production of Ukrainian enterprises is underway.

During these years, studies were initiated to create microbial preparations for canning wet rolled corn grain; a methodology was developed and an economic assessment of measures to expand the reproduction of soil fertility in Polissia was conducted; the volumes of introduction of microbial preparations for ensiling of green mass of corn and haylage of perennial grasses and alfalfa increased.

Two monographs of scientists of the institution were published abroad, namely: V. V. Volkohon “Biological transformation of nitrogen” [22] and Ye. P. Kopylov “Soil saprophytic fungi – natural regulators of growth, development and resistance of plants to pathogens” [23].

The Institute of Agricultural Microbiology and Agroindustrial Manufacture of the NAAS was estimated as the main organization of the regional center

of scientific support of agroindustrial manufacture of the Region of Chernihiv. During the same period, the Institute was entrusted with the organization of preparation and publication of the popular science journal “Chernihivshchyna Agrarian” (Agrarian Region of Chernihiv).

From 2014 to 2019, the Institute was headed by V. V. Volkohon, Doctor of Agriculture, Professor, Academician of the NAAS. At that time, the scientific divisions of the Institute carry out studies in the following scientific areas: microbiological state of agrocenoses under the influence of biotic and abiogenic factors in the technology of growing crops; features of biological transformation of nitrogen and phosphorus under different fertilizer systems (including organic); selection of active strains and creation of biological preparations on the basis of nitrogen-fixing, phosphate-mobilizing, growth-regulating microorganisms and phytopathogen antagonists; regulation of the phytohormonal state of the system “soil-microorganisms-plant” at the initial stages of plant organogenesis; the relationship between microorganisms and plant in natural and artificially created symbioses and associations; features of microbial successions during composting of organic matter; creation of technologies of controlled composting with the participation of selected microorganisms; mechanisms for implementation of the probiotic potential of microorganisms to increase the productivity of farm animals; monitoring and systems for protection of cultivated plants from viral infections. The economic direction of studies is actively developing, in particular, the need to review existing strategies for the use of mineral nitrogen fertilizers in order to improve the efficiency of agricultural land and the need to comply with soil-biological management methods (deficit-free provision of soils with organic matter, the use of fertilizers within the physiological needs of plants and the use of microbial preparations to increase the degree of assimilation of the active substance from fertilizers and optimize the pool of nutrients in the soil) as determining factors influencing the potential and effective soil fertility. The development of scientific bases for the formation and evaluation of ecological and economic efficiency

of models of organic production of agricultural products and fertilizer systems in crop rotations of organic production in Polissia is ongoing [24].

Young scientists of the Institute D. V. Krutylo (2011), I. H. Chuchvaha (2014) won the competition for the Award of the Presidium of the NAAS “For the Best Scientific Report of a Young Scientist of the NAAS on Basic and Applied Research”.

In 2014, the collection “Agricultural Microbiology” was included in the scientometric database Index Copernicus (2014).

In 2015, the specialized scientific board for the defence of candidate’s theses in the specialty 03.00.07 “Microbiology” resumed its work.

In 2016, for educational activities at the third (educational and scientific level) of higher education, the institute receives a license from the Ministry of Education and Science of Ukraine in specialty 201 – Agronomy, field of knowledge 20 – Agricultural Sciences and Food (Order of the MES No. 966 dated 11/08/2016). Training of candidates for the degree of Doctor of Philosophy is carried out according to the educational and scientific program “Agricultural Microbiology”, which is accredited by the National Agency for Quality Assurance in Higher Education.

At that time, the scientific developments of the Institute are implemented not only in different regions of Ukraine, but also abroad, in particular in the Republic of Lithuania.

At the beginning of 2019, A. M. Moskalenko, Doctor of Economics, Corresponding Member of the NAAS, Honoured Economist of Ukraine, was chosen as the Director of the Institute.

The range of scientific tasks is expanding. Scientific divisions of the Institute conduct studies in the following directions:

- microbiological state of agrocenoses under the influence of biotic and abiogenic factors in the technology of growing crops;
- features of biological transformation of nitrogen and phosphorus under different fertilizer systems (including organic);
- selection of active strains and creation of biological preparations on the basis of nitrogen-fixing,

- phosphate-mobilizing, growth-regulating microorganisms and phytopathogen antagonists;
- the relationship between microorganisms and plant in natural and artificially created symbioses and associations;
- features of microbial successions during composting of organic matter; creation of technologies of controlled composting with the participation of selected microorganisms
- mechanisms for implementation of the probiotic potential of microorganisms to increase the productivity of farm animals;
- monitoring and systems of protection of cultivated plants from viral infections;
- selection of lupine;
- economic and energy assessment of biological factors of optimization of the production process of crops;
- ecological and economic aspects of optimization of organic matter transformation processes in leached chernozem.

A. S. Kyslynska (with the team of contributors: T. V. Bulyhin, T. T. Hnatiuk, M. V. Boiko, A. S. Kyslynska) won the Award of the President of Ukraine for Young Scientists for the scientific work “Soybean diseases: diagnosis, biocontrol, prevention” (Decree of the President of Ukraine No. 903/2019 dated 13/12/2019 “On Awards of Ukraine for Young Scientists in 2019”). H. V. Tsekhmister, Candidate of Agriculture, placed third in the competition for the Award of the Presidium of the NAAS “For the Best Scientific Report of a Young Scientist of the NAAS on Basic and Applied Research”.

Since 2020, the collection “Agricultural Microbiology” is included (Order of the Ministry of Education and Science of Ukraine No. 409 dated 17/03/2020) in the Register of scientific professional publications of Ukraine (category B) by specialties: 201 – Agronomy; 202 – Plant protection and quarantine; 091 – Biology; 101 – Ecology, sciences: agricultural and biological.

In 2021, the first defences of theses were held in one-time specialized scientific boards of the NAAS IAMAM for the degree of Doctor of Philosophy in the



field of knowledge 20 “Agricultural Sciences and Food” in the specialty 201 “Agronomy” (O. M. Bilokonska, O. V. Lohosha).

The activity on introduction of science-driven products of the Institute acquires expanded scope: along with traditional cooperation with agrarians, large-scale production of scientific development of the Institute under a license agreement for the use of IP: “Method of manufacturing the microbial preparation Polimiksobakteryn – plant growth stimulator” and license agreement for the trade mark “Polimiksobakteryn” in other organizations. Due to the additional funds received, the material and technical base for scientific research is being updated, laboratory and office premises are being repaired and on-site improvements are being undertaken.

During the same period, the scientific developments and professional level of Chernihiv microbiologists are gaining more and more international recognition: in particular, studies is being commissioned by the Joint Stock Company with the Board of Directors of SNF SA (France, 2019) and GGT GmbH Global Green (Austria, 2021); contacts regarding the supply of biological preparations of the Institute to the African continent were established.

The activity of the Council of Young Scientists is intensifying. In order to attract talented young people to scientific activities, a school of young microbiologists is organized, in the work of which graduate students of local universities take part.

The scientific library is equipped with modern computer equipment and appropriate software, which has expanded the access of employees and post-graduate students of the Institute to modern scientific knowledge.

Material encouragement of the Institute’s staff for the defence of theses and publication of scientific articles is started.

Thanks to tumultuous initiative of the institute’s youth, the traditions of collective celebration of the New Year are being restored, flash mobs are being initiated on the occasion of the Vyshyvanka’s Day (a day of traditional Ukrainian clothing) and other significant events.

Today the structure of scientific divisions of the institute includes 3 scientific departments:

Agricultural Microbiology (head – V. V. Volkohon, Academician of the NAAS) with laboratories:

Plant-Microbial Interactions (chief– O. V. Nadkernychna, Doctor of Biology, Professor);

Soil Microbiology (chief – S. B. Dimova, Candidate of Agriculture);

Ecology of Soil Microorganisms (chief – I. M. Pyshchur, Candidate of Agriculture);

Physiology of Microorganisms (chief – S. F. Kozar, Doctor of Agriculture) consisting of two sectors (growth and functional activity of microorganisms) (chief– T. A. Yevtushenko, Candidate of Agriculture) and a collection of useful soil microorganisms (chief – Yu. O. Vorobei);

Virology (head – L. M. Reshotko, Candidate of Biology);

Probiotics (chief – N. O. Kravchenko, Candidate of Veterinary);

Scientific Support of Agroindustrial Manufacture (head –O. V. Yehorov, Candidate of Agriculture) with laboratories:

Agrochemistry and Soil Fertility (chief – L. V. Potapenko, Candidate of Agriculture);

Agriculture and Seed Production (chief – V. A. Bardakov, Candidate of Agriculture);

Economics, Intellectual Property, Marketing of Innovations and Arrangement of Scientific Personnel Training (acting head – O. M. Brediuk).

The work of scientific subdivisions is provided by: administrative management;

accounting group;

economic department;

subdivision of organizational support and implementation of scientific developments.

Studies at the Institute are conducted by 34 research fellows, including 6 doctors of sciences, 21 candidates of sciences and 2 doctor of philosophy. Six post-graduate students are working on thesis research.

Council of Young Scientists is actively working at the Institute, and its activity is aimed at involving young people in active scientific work. Every year the Council organizes and holds scientific conferences of

young scientists at the Institute. The conferences hold a competition for the best works with the award of nominal prizes: M. V. Revo – in the field of virology and microbiology of animals and O. O. Berestetskyi – on soil microbiology, and since 2020 – an award in the field of economics of agricultural biologization and an award for the best scientific work of practical direction.

Outstanding scientists have worked at the Institute in different years, in particular: M. V. Revo, Academician of Ukrainian Academy of Agricultural Sciences; O. O. Berestetskyi, Corresponding Member of All-Union Academy of Agricultural sciences named after V. I. Lenin; V. P. Romanenko, Academician of the NAAS; V. P. Patyka, Academician of the NAAS; O. M. Berdnikov, Corresponding Member of the NAAS; V. I. Rotov, Professor; K. P. Chepurov, Professor; A. V. Cherkasov, Professor; M. F. Masiuk, Professor; M. H. Tiahnyi-Riadno, Professor; V. I. Kanivets, Professor; L. V. Kosenko, Doctor of Biology

The most important developments of the Institute:

- probiotic preparation BPS-44 for the prevention and treatment of gastrointestinal diseases and stimulation of growth of young farm animals and poultry (V. S. Sivers);
- BPA – a bacterial preparation to increase the productivity of fodder beet and vegetable crops (Yu. M. Mochalov, V. I. Kanivets);
- bacterial preparation Polimiksobakteryn to increase the yield of sugar beets, corn, sunflower, fibre flax (L. M. Tokmakova, V. I. Kanivets);
- bacterial preparation Albobakteryn to increase the productivity of spring and winter rape, mustard (L. M. Tokmakova, V. I. Kanivets);
- industrial technology of application of microbial preparations together with protective and stimulating substances at seed plants (L. M. Tokmakova, V. I. Kanivets);
- bacterial preparation Diazobakteryn to improve the nitrogen nutrition of winter rye, buckwheat, cereals and increase their yield (V. V. Volkohon, O. V. Nadkernychna);
- biopreparation Ryzobrazyn to increase mulberry productivity (O. V. Nadkernychna, Yu. O. Vorobei, M. A. Ushakova);

- method of obtaining microbial preparations, with the optimal titre of bacterial cells and the concentration of phytohormones (V. V. Volkohon, S. B. Dimova, M. S. Komok);

- biopreparation of complex action Ryzohumin for legumes (V. V. Volkohon, S. B. Dimova, K. I. Volkohon, O. V. Nadkernychna, D. V. Krutylo);

- biopreparation of complex action Mikrogumin for spring barley (V. V. Volkohon, K. I. Volkohon);

- biopreparation of complex action Biohran for potatoes and vegetable crops (V. V. Volkohon, S. B. Dimova);

- biopreparation Bacyloturynh for plant protection against pests based on entomopathogenic bacteria strain *Bacillus thuringiensis* L-4 (S. P. Nadkernychnyi, T. I. Patyka, N. O. Mashko);

- biopreparation Khetomik based on the strain of antagonist fungi *Chaetomium cochliodes* 3250 for improvement of nutrition of plants and protection against causative agents of root diseases and stem eelworm (S. P. Nadkernychnyi);

- rodenticidal biological preparation “Antymyshyn” for control of harmful rodents on agricultural lands (V. V. Volkohon, H. M. Diachenko, N. O. Kravchenko);

- strains of nodule bacteria of different legumes, which are used as bioagents of microbial preparations (O. V. Nadkernychna, T. M. Kovalevska, D. V. Krutylo, V. P. Horban, V. S. Vorobei);

- substantiation of the role of biotic nodulation factors in the induction of nitrogen-fixing symbioses and strengthening of the process of molecular nitrogen fixation in legumes, elucidation of the nature of the biological phenomenon – spontaneous formation of nodules on mulberry roots (O. V. Nadkernychna, Yu. O. Vorobei);

- highly active strains of producing fungi of phytohormonal and antibiotic substances (S. P. Nadkernychnyi, Ye. P. Kopylov);

- Cladostym to stimulate growth and development of plants and increase crop yields based on the natural saprophytic fungus *Cladosporium sp.* 359 (S. P. Nadkernychnyi, Ye. P. Kopylov);

- Cladostym to stimulate the growth and development of plants and increase crop yields based on

the natural saprophytic fungus *Cladosporium sp.* 359 (S. P. Nadkernychnyi, Ye. P. Kopylov);

- scientific bases of formation of mycorrhiza by ascomycetes saprophytic fungi with plants (S. P. Nadkernychnyi, Ye. P. Kopylov);

- methodological principles and methods of determining ecologically acceptable doses of mineral nitrogen in technologies of growing crops (V. V. Volkohon, S. B. Dimova, K. I. Volkohon);

- justification of the ways to increase physiologically appropriate doses of nitrogen fertilizers in technologies for growing crops (V. V. Volkohon);

- justification of ecological expediency of systems of fertilization of agricultural crops by biodiagnostic parameters (V. V. Volkohon, S. B. Dimova, K. I. Volkohon);

- justification of the principles of controlled biocomposting of poultry manure; bioorganic fertilizer Biokom-T, enriched with agronomically valuable microorganisms and substances with growth-promoting action (V. V. Volkohon, S. B. Dimova, S. M. Derkach);

- method of manufacturing microbial preparations with optimized content of phytohormones (V. V. Volkohon, S. B. Dimova, M. S. Komok, K. I. Volkohon);

- features of carbon deposition depending on the sources of organic matter and fertilizer levels (V. V. Volkohon, S. B. Dimova, K. I. Volkohon);

- model of optimization of microbiological processes of nitrogen and carbon transformation (V. V. Volkohon, S. B. Dimova, K. I. Volkohon);

- a method of determining the direction of the processes of mineralization-synthesis of organic matter in the soils of agrocenoses (V. V. Volkohon, S. B. Dimova, K. I. Volkohon, O. V. Pyrih, T. Yu. Brytan);

- scientific bases of the creation of artificial symbioses of diazotrophs with cereals and legumes (O. V. Nadkernychna, O. O. Shakhovnina);

- scientific bases of formation of effective triple symbioses: “nitrogen-fixing bacteria – saprophytic fungus – plant” (O. V. Nadkernychna, Ye. P. Kopylov, A. S. Kyslynska);

- a method of assessing cereals for their ability to associative nitrogen fixation (O. V. Nadkernychna, O. O. Shakhovnina);

- determining serological and genetic diversity of soybean and bean nodule bacteria in modern agroecosystems (D. V. Krutylo);

- binary composition of *B. japonicum* strains with slow and intensive growth (*B. japonicum* 46 + KB11), which can be used as a basis for new biopreparations to increase soybean productivity, more effective than single strain preparations (D. V. Krutylo);

- description of a new disease of cucumbers in Ukraine caused by the fungus *Acremonium cucurbitacearum* and the mechanism of its phytopathogenic action (Ye. P. Kopylov, H. V. Tsekhmister);

- strain of the microorganism-antagonist *Trichoderma viride* 017, which is able to limit the spread of acremoniosis (Ye. P. Kopylov, H. V. Tsekhmister);

- features of growth of industrial strains of diazotrophs and technology of manufacturing microbial preparations on their basis (S. F. Kozar);

- efficiency of microbial preparations and their contribution to the production process of cultivated plants under different fertilizer systems, including organic (V. V. Volkohon, S. B. Dimova, K. I. Volkohon, N. P. Shtanko, N. V. Lutsenko, V. P. Sydorenko);

- substantiation of expediency of combined use of microbial preparations and mineral fertilizers in doses not exceeding the physiological optimum for plants (V. V. Volkohon);

- biopreparation Baktopaslon for potatoes (S. F. Kozar, T. A. Yevtushenko);

- biopreparation ABT for vegetable crops (S. F. Kozar, T. A. Yevtushenko);

- the way to increase growth activity of *Bradyrhizobium japonicum* (S. F. Kozar, T. A. Yevtushenko);

- a way to maintain the viability of diazotrophs at rest (S. F. Kozar, T. A. Yevtushenko);

- a way to increase the activity of diazotrophs under the action of metal nanocarboxylates (S. F. Kozar, T. A. Yevtushenko);

- techniques for optimizing biological processes in corn agrocenoses, including bacterization of seeds and treatment of vegetative plants in the phase of 3-5 or 7-9 leaves using a suspension of the bacterial preparation Polimiksobakteryn (L. M. Tokmakova, L. A. Shevchenko);

- system of measures for prevention and elimination of Teschen disease in pigs (V. P. Romanenko, O. H. Prus, N. V. Babych);
- live vaccine against Teschen disease in pigs (V. P. Romanenko, O. H. Prus);
- inactivated vaccine against Teschen disease in pigs (V. I. Soroka, S. V. Derevianko, T. O. Bova);
- kits for the diagnosis of enzootic encephalomyelitis (Teschen disease), enterovirus gastroenteritis, pneumonia and pneumoenteritis of pigs (V. P. Romanenko, O. H. Prus, N. V. Babych, O. I. Polevik, L. V. Kupnevskaya, I. M. Pinchuk, A. O. Bokun, T. O. Bova, S. V. Derevianko, V. I. Soroka, I. V. Volkova, L. V. Bozhok);
- species-specific primers for identification of tesho- and enteroviruses of pigs (S. V. Derevianko);
- system of protection of revitalized potatoes in the field (F. Yu. Kozar, M. Ye. Shevel, Yu. O. Dmytruk, M. M. Zarytskyi, N. O. Sivers, L. P. Kolomiets, O. Ye. Mamchur);
- method of vaccination of plants with weakly pathogenic strains of viruses (F. Yu. Kozar, N. O. Sivers, L. P. Kolomiets);
- enzyme-linked immunosorbent assay systems for the diagnosis of phytopathogenic viruses (Yu. M. Sheludko, F. Yu. Kozar, M. Ya. Pohorilko, M. M. Zarytskyi, N. O. Sivers, L. P. Kolomiets, I. V. Volkova, O. O. Dmytruk, L. M. Lebid, O. Ye. Mamchur);
- technology of obtaining virus-treated potato seed material (N. V. Shcherbyna, F. Yu. Kozar, V. V. Neborachko, N. V. Romanenko, I. V. Demchuk, O. M. Petrenko, L. P. Kolomiets, M. M. Zarytskyi);
- method of isolation and maintenance of potato leaf roll virus strains in mammalian cell cultures (T. O. Bova, I. V. Volkova, S. V. Derevianko);
- database of pathogens of potato viral diseases, atlas and maps of phytopathogenic viruses distributed in agrocenoses of Ukraine (L. M. Reshotko, I. V. Volkova, O. O. Dmytruk);
- diagnostic test systems for detection and identification of potato viruses in plant material (PVX, PVM, SBK, YBK) by real-time PCR (L. M. Reshotko, I. V. Volkova, O. O. Dmytruk);
- system of measures for prevention and treatment of bovine tuberculosis (A. O. Bokun);
- system of epizootic monitoring of poultry farms in terms of tuberculosis (H. M. Diachenko);
- method of accelerated serodiagnosis of bovine tuberculosis (H. M. Diachenko, N. O. Kravchenko);
- method of differentiated serodiagnosis of bovine tuberculosis (H. M. Diachenko, N. O. Kravchenko);
- antigenic test preparations for rapid diagnosis of bovine tuberculosis (H. M. Diachenko, N. O. Kravchenko);
- biopreparation Imunoton to increase resistance and for immunocorrection in young farm animals (H. M. Diachenko, N. O. Kravchenko);
- method of obtaining a symbiotic preparation based on probiotic bacteria with high metabolic activity and prebiotic substances – growth stimulants of the intestinal normal flora of animals (N. O. Kravchenko, O. V. Holovach, V. O. Ageiev, L. V. Bozhok);
- biopreparation-probiotic for the treatment and prevention of gastrointestinal diseases of young farm animals (N. O. Kravchenko, O. M. Dmytruk, L. V. Bozhok, V. O. Ageiev);
- probiotic bacillary preparation subtilis-lacto BPS-L (S. V. Derevianko, H. M. Diachenko, A. O. Bokun);
- a method of correcting the state of the antioxidant system of young cattle and pigs using a probiotic preparation (V. O. Ageiev, H. M. Diachenko, S. V. Derevianko);
- experimental sample of the preparation for ensiling green mass of corn (N. O. Kravchenko, M. H. Perederii);
- technology of biological preservation of rolled corn grain by treatment with strains of probiotic bacteria of the species *Bacillus subtilis* and lactic acid bacteria (N. O. Kravchenko, V. O. Ageiev, L. V. Bozhok);
- agroecological basis of growing sugar-bearing crops in Polissia conditions for bioethanol production (O. M. Berdnikov, L. V. Potapenko, L. M. Skachok, N. I. Horbachenko);
- agroecological basis of technologies for growing new species of bioenergy plants in Polissia for the production of solid biofuels (O. M. Berdnikov, L. V. Potapenko, L. M. Skachok, N. I. Horbachenko);

- model of regulation of processes of transformation of organic matter by means of agrotechnical techniques for the purpose of achievement of positive balance of humus (O. M. Berdnikov, L. V. Potapenko, N. I. Horbachenko);

- optimal model of technology for growing miscanthus for solid fuel taking into account the patterns of behaviour of radionuclides and heavy metals in the system “soil-plant-lysimeetric waters” in the contaminated area (O. M. Berdnikov, L. V. Potapenko, L. M. Skachok, N. I. Horbachenko);

- methods of reproducing the fertility of light sod-podzolic soils of Polissia (O. V. Yehorov);

- technology of optimal supply of soil with organic matter (O. V. Yehorov);

- scientific basis of formation and estimation of ecological and economic efficiency of models of organic agricultural production in the conditions of Polissia (Yu. M. Khalep, A. M. Moskalenko);

- methods for assessing the socio-economic efficiency of the use of means of biologization of agriculture (A. M. Moskalenko; Yu. M. Khalep);

- method for determining the ecological and economic efficiency of fertilizer systems in crop rotations of organic production in Polissia (Yu. M. Khalep, A. M. Moskalenko);

- theoretical and applied principles of functioning and development of counselling (on the example of the Region of Chernihiv) (A. M. Moskalenko; Yu. M. Khalep);

- new varieties of narrow-leaved lupine: Yulian (V. A. Bardakov, T. Ye. Sysoieva), Lokomotiv (V. A. Bardakov, A. H. Bardakov);

- new varieties of white lupine: Rapsodiia (V. A. Bardakov, A. H. Bardakov, N. P. Zhydok), Yuvilei 100 (V. A. Bardakov, T. Ye. Sysoieva, N. P. Zhydok);

- new varieties of yellow lupine: Zoloty kupol (V. A. Bardakov, A. H. Bardakov), Yarylo (V. A. Bardakov, A. H. Bardakov, N. P. Zhydok).

Study results are widely implemented in production. In particular, more than 3 million doses of Teschen disease vaccine and 3,000 sets of swine enterovirus disease diagnosticums were produced, more than 1 million vials of sera for the diagnosis of potato

viruses were sold, and over 100 potato varieties for Ukrainian farms were revitalized. A license for the production of probiotic preparation BPS-44 was sold. In the previous decade alone, microbial preparations created at the Institute were introduced on an area of over 700,000 hectares, and in the last two years this figure has grown by 260,000 hectares annually due to the production and introduction of biological products by other organizations under license agreements. The amount of funds received from the implementation of scientific developments increased from UAH 846.7 thous in 2007 to UAH 12,869.2 thous in 2020.

Thus, the efforts of several generations of scientists in Ukraine have created an important centre of agricultural microbiology and virology for science and production. The Institute celebrates its 60th anniversary with significant achievements. The fundamental studies of the team has been highly praised and widely recognized. Applied developments are actively used in agricultural production.

1. *Chepurov K. P., Cherkasova A. V. Diplococcal and streptococcal diseases in animals. K.: State publisher of agricultural literature of the USSR, 1963. 159 p.*
2. *Rotov V. I. Avian tuberculosis and measures for its control. K.: Publishing house of Ukrainian Academy of Agricultural Sciences, 1962. 220 p.*
3. *Veterinary reference guise /Edited by Prof. V. I. Rotov. K.: State agricultural publishing of the USSR, 1963. 581 p.*
4. *Romanenko V. P. Teschen disease. K.: Urozhai, 1974. 76 p.*
5. *Sheludko Yu. M. Phytovirology. K.: Vyscha shkola, 1970. 272 p.*
6. *Sheludko Yu. M., Reifman V. H. Viroids – a new class of pathogens. M.: Nauka, 1978. 88 p.*
7. *Rotov V. I., Kokurichiev P. I., Savchenko P. E. Tuberculosis in farm animals. K.: Urozhai, 1973. 384 p.*
8. *Rotov V. I. Avian tuberculosis. K.: Urozhai, 1974. 152 p.*
9. *Rotov V. I., Kokurichiev P. I., Savchenko P. E., Trach Yu. A. Tuberculosis in farm animals (Second edition, revised and enlarged). K.: Urozhai, 1978. 240 p.*
10. *Romanenko V. F. Swine infectious gastro-intestinal diseases. M.: Kolos, 1984. 158 p.*
11. *Davydova O. Ye., Veshytskyi V. A., Maltseva N. N., Volkohon V. V. et al. New elements of bioregulation for sustainable development in agroecosystems K.: Naukova dumka, 2004. 320 p.*

12. Patyka V. P., Kots S. Ya., Volkohon V. V. et al. *Biological nitrogen*. K.: Svit, 2003. 424 p.
13. Savchenko P. Ye. *Laboratory diagnosis of animal tuberculosis*. Chernihiv, 1998. 64 p.
14. Kanivets V. I. *Life of the soil*. K.: Ahrarna nauka, 1998. 132 p.
15. *Short English-Russian-Ukrainian dictionary, Russian-Ukrainian-English dictionary on biological nitrogen* / Edited by V. F. K., 1999. 173 p.
16. *Microbial preparations in crop farming. Theory and practice* / edited by V. V. Volkohon. K.: Ahrarna nauka, 2006. 312 p.
17. Volkohon V. V. *Microbiological considerations of optimization of crop nitrogen fertilization*. K.: Ahrarna nauka, 2007. 144 p.
18. *Experimental soil microbiology* / Edited by V. V. Volkohon. K.: Ahrarna nauka, 2010. 464 p.
19. *Methodology and practice of using microbial preparations in technologies of growing crops* / Edited by V. V. Volkohon. K.: Ahrarna nauka, 2011. 150 p.
20. *Catalogue of cultures of microorganisms / scientific editorial board: V. V. Volkohon, O. V. Nadkernychna, T. M. Kovalevska*. Chernihiv: Centre of Scientific, Technical and Economic Information, 2007. 45 p.
21. *Catalogue of protection documents* / Edited by V. V. Volkohon. Chernihiv: Editorial and publishing complex "Desnianska pravda", 2010. 240 p.
22. Volkohon V. V. *Biological transformation of nitrogen. The direction of processes at different levels of fertilization of crops*. Palmarium Academic publishing, 2013. 116 p.
23. Kopylov Ye. P. *Soil saprophytic fungi – natural regulators of growth, development and resistance of plants to pathogens*. Palmarium academic publishing, 2013. 104 p.
24. Moskalenko A. M. *Theoretical and methodological principles of effective use of agricultural lands of Polissia of Ukraine: monograph*. Nizhyn: Published by the private entrepreneur M. M. Lysenko, 2015. 335 p.