



STEPHAN ANGELOFF INSTITUTE OF MICROBIOLOGY

MEMBER OF THE BULGARIAN ACADEMY OF SCIENCES

MEMBER OF THE PASTEUR NETWORK

ANNUAL REPORT 2022

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OUR MISSION



Prof. Penka Petrova
Director of the Stephan
Angeloff Institute of
Microbiology

„Our mission is to popularize microbiological research in Bulgaria and carry out scientific research in areas important to society.

Our priority is to support the career development of all researchers with high potential.”

The mission of the Stephan Angeloff Institute of Microbiology is to address national and global challenges in health and climate change and to contribute to problem-solving with innovation, research, and collaboration in microbiology, virology, immunology, and biotechnology.

Priorities

In microbiological research

- To consolidate research in the field of microbiology in Bulgaria by discovering and describing the diversity of non-pathogenic and pathogenic microorganisms.
- To identify food microbial contamination.
- To identify the mechanism of antibiotic resistance.
- To find a solution for soil pollution by studying the physiological response of microorganisms to heavy metals, phenol, and oil products.
- To identify sustainable anaerobic systems for efficient energy production.

In health research

- To find solutions for maintaining a healthy microbiome with pre-, pro-, and post-biotics.
- To design novel therapeutic approaches to vaccination and to study the effect of new drugs on cancer, infectious and autoimmune diseases, acute and chronic conditions, and aging. To put forth new diagnostic tools for immunotherapy and disease pathogenesis.
- To identify new natural inhibitors with antiviral and antibacterial activity, and novel approaches to escape anti-microbial resistance and biofilm formation.



IN SERVICE TO OUR SOCIETY

We would like to contribute and help our society to overcome societal and national challenges with expertise, theoretical and practical knowledge and through collaborative and multidisciplinary research.

WE ADJUST OUR RESEARCH ACTIVITY TO NATIONAL PRIORITIES

We adjust our activity according to the National Strategy for Scientific Research Development in Bulgaria in 2017-2030. The National Priorities are:

- large-scale, rapid, and long-term development and modernization of research infrastructure;
- cutting-edge research innovation and technologies;
- improving the research ranking of Bulgarian scientists;
- increasing public trust in research and innovation;
- providing opportunities for young people to develop research careers.



WE ADJUST OUR RESEARCH ACTIVITY TO EU PRIORITIES

We focus our activity on the priorities of "Horizon Europe" 2021-2027. We perform investigations on the following topics:

- Health and quality of life;
- Prevention, early diagnosis, and therapy;
- Green, blue, and eco-technologies;
- Biotechnology and eco-foods;
- Environmental protection;
- Environmental monitoring;
- Utilization of raw materials and bioresources;
- Purifying and waste-free technologies.



WE ALIGN OUR RESEARCH WITH THE STRATEGY OF THE BULGARIAN ACADEMY OF SCIENCES

We value and align our strategy with the policy of the Bulgarian Academy of Sciences in:

- Human resources;
- Infrastructure;
- Balance in scientific research - fundamental and applied;
- Regional strategy for research development.



WE ADJUST OUR PRIORITIES TO THE PRIORITIES OF THE PASTEUR NETWORK

The role of the Pasteur Network is to help improve public health by dealing with infectious agents, through:

- biomedical research;
- public health activities;
- education;
- innovation and technology transfer.



The activities are performed through sustainable development and building up local capabilities while respecting human rights and the environment.

OUR STRUCTURE

Total employees: 163 persons

Governing body: 4 persons

Administrative body: 23 persons

- Human Resources
- Accounting
- Public Relations
- IT Maintenance

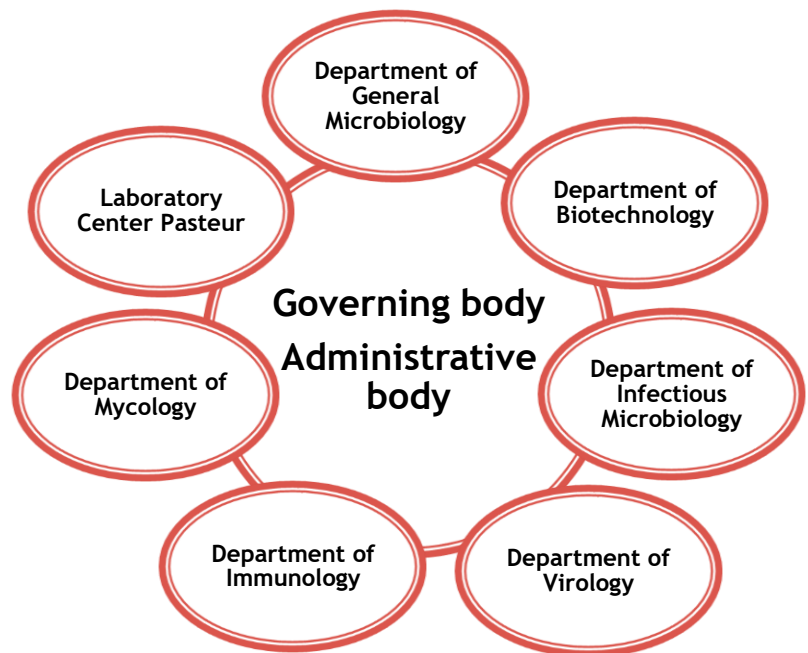
Scientific staff: 120 persons

- Departments
- Laboratory Center Pasteur

Library: 1 person

Service units: 15 persons

- Cell Culture Medium Lab
- Fermentation Lab
- Animal Facility
- Technical Service Unit



CONTROL

CONTROL OF RESEARCH AND EDUCATION ACTIVITY

Scientific council: 20 members

- Control over Institute's mission and research goals

International Scientific Council:

11 members, Control over Research Excellence

Governing body of Bulgarian Academy of Sciences (BAS):

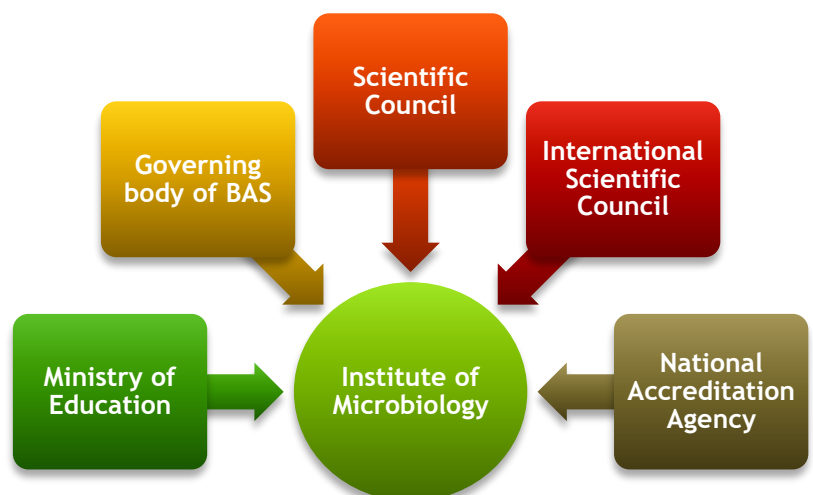
Control over Financial policy, Human resources, and Career development

Bulgarian Ministry of Education:

Control over National Regulations and Priorities in Science and Education

National Accreditation Agency:

Control over the Quality of Education



RESEARCH IN ACTION

"I believe in innovation and that the way you get innovation is you fund research and you learn the basic facts."

-Bill Gates



ЕВРОПЕЙСКИ СЪЮЗ
ЕВРОПЕЙСКИ ФОНД ЗА
РЕГИОНАЛНО РАЗВИТИЕ



POLICY-DRIVEN RESEARCH IN BULGARIA

The European Regional Development Fund (ERDF) and the Cohesion Fund (CF) support the economic social and territorial cohesion of the European Union. They contribute to reducing the disparities that still exist between European regions and countries. The European Social Fund + (ESF+) supports the implementation of the principles of the European Pillar of Social Rights.

According to the draft Regulation of Common Provisions for the 2021-2027 programming period, the ERDF, the ESF+, the Cohesion Fund, and the EMFF will support five policy objectives:

Policy objective 1: Smarter Europe by promoting innovative and smart economic transition (CP1);

Policy objective 2: A greener, low-carbon Europe by promoting a clean and fair energy transition, green and blue investments, circular economy, climate change adaptation, and risk prevention and management (CP2);

Policy objective 3: A better connected Europe by improving ICT mobility and regional connectivity (CP3);

Policy objective 4: A more social Europe – realizing the European Pillar of Social Rights (CP4);

Policy objective 5: Europe closer to citizens by promoting the sustainable and integrated development of urban, rural, and coastal areas and local initiatives (CP5).

CENTERS OF COMPETENCE - PART OF POLICY CP1 AND CP2

Project BG05M2OP001-1.002-0001 „Basic, translational and clinical research in the field of infections and infectious immunology“

PI for Institute of Microbiology: Prof. Andrey Tchorbanov

<https://sf.mon.bg/?go=projects&p=detail&projectsId=43>

Project BG05M2OP001-1.002-0019 „Clean technologies for a sustainable environment - water, waste, energy for a circular economy“ (Clean&Circle) for the construction and development of a Competence Centre

PI for Institute of Microbiology: Prof. Hristo Najdenski

https://cleantech.bg/en/project/centre-for-competence/#pll_switcher



The program builds the capacity and knowledge in leading priority areas "Food security, sustainable agriculture and forestry, marine and inland water research and the bio-economy" under the European Union Framework for Research and Innovation "Horizon 2020"



Bulgaria, with its unique climatic and ecological niches, offers an amazing variety of plant and animal species extracts containing less toxic and better tolerated biologically active compounds than synthetic ones....

„Up to BGN 3.000 per month can be received by young researchers in Bulgarian higher schools and scientific organizations“.

-Ministry of Education's news portal

EU PROJECTS

PlantaSYST H2020 Widespread 2014-1 Teaming
Establishment of a Center of Plant Systems Biology and Biotechnology (CPSBB) in Plovdiv, Bulgaria

PI for the Institute of Microbiology: Prof. Milen Georgiev

<https://plantasyst.eu/>

NATIONAL PROGRAMS

The National Scientific Program "Healthy Foods for a Strong Bioeconomy and Quality of Life" (NNP-FOOD)

PI for the Institute of Microbiology: Prof. Hristo Najdenski

<https://www.agriacad.bg/bg/science-and-education/programs/nnphrani-2>

The National Program "Healthy Foods for a Strong Bioeconomy and Quality of Life" (NNP-FOOD) has as its main goal to create adapted modern models and technologies for the production of healthy foods for a strong regional bio-economy and to improve the quality of life of the population of the Republic of Bulgaria.

The national scientific program "Innovative low-toxic biologically active agents for precision medicine" (BioActivMed)

PI for the Institute of Microbiology: Prof. Hristo Najdenski

<http://bioactivemed-nrp.com/>

The National Program "Innovative low-toxic biologically active agents for precision medicine" aims to conduct fundamental and applied scientific research on the discovery and development of new biologically active substances derived from Bulgarian natural sources and to investigate their application as remedies to overcome multidrug resistance.

The national program "Young scientists and postdoctoral fellows - 2". The program aims to attract, retain and develop highly qualified young scientists and postdoctoral fellows, thus ensuring a qualitative reproduction of the human potential for research work in Bulgaria.

PI for the Institute of Microbiology: Prof. Penka Petrova, Assoc. Prof. Ekaterina Krumova

Submitted proposals: 9 young scientists, 2 postdocs
Approved proposals: 4 young scientists, 2 postdocs

<https://web.mon.bg/bg/101021>

COLLABORATION FOR EXCELLENCE

RESEARCH NETWORKS

The overlap allows for common ground, while the respective areas of expertise cover a greater “surface area” of the possible knowledge brought to bear on a specific question.

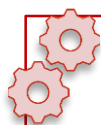
-Joel G. Sprunger



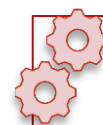
IPIN - Institute Pasteur International Network



OCUVAC - Center of Ocular Inflammation and Infection



MED-VET-NET - Network for Prevention and Control of Zoonoses



FLAG ERA - DeGraph - Bacterial degradation of GRMs



Global Initiative to Promote the Study of Fungal Biodiversity



Global Mountain Biodiversity Assessment



FATE - Fight Against Tuberculosis

COST ACTIONS

Open to all science and technology fields, including new and emerging fields; COST Actions offer an inclusive, pan-European environment for individuals of all levels of seniority to grow their professional research networks and boost their careers.....



COST Action CA18101
SOURDOugh biotechnology network towards novel, healthier and sustainable food and bioprocesses



COST Action CA1713
Implementing nature based solutions for creating a resourceful circular city



Cost Action CA18127
International Nucleome Consortium



COST Action CA21164
Towards an improvement in diagnostics and treatment strategies for TB control (ADVANCE-TB)



COST Action CA20121
Bench to bedside transition for pharmacological regulation of NRF2 in noncommunicable diseases



COST Action CA21145
European Network for diagnosis and treatment of antibiotic-resistant bacterial infections (EURESTOP)

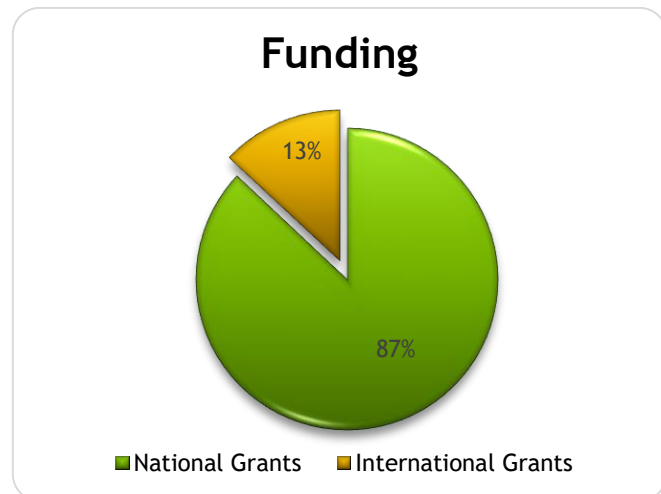
FUNDING IN NUMBERS

GRANTS

National Funding: 67 grants

- Bulgarian National Science Fund: 42 projects, 5 funded in 2022
- Other funding at the national level: 27

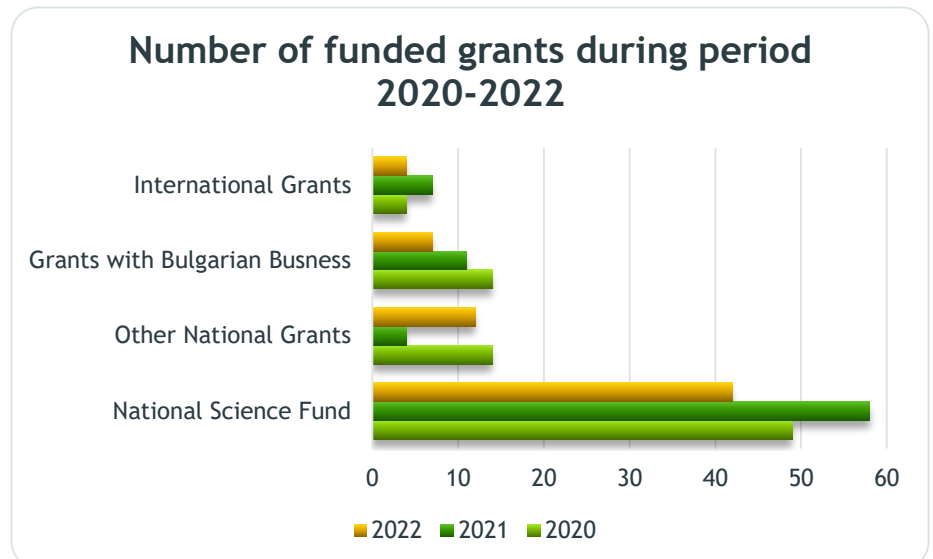
International Funding: 10 grants



TRENDS IN FUNDING

Project > 150 000 BGN: 18

Project < 150 000 BGN: 53



FINANCIAL POLICY

At the national level our research is needed and part of the resilience plan.

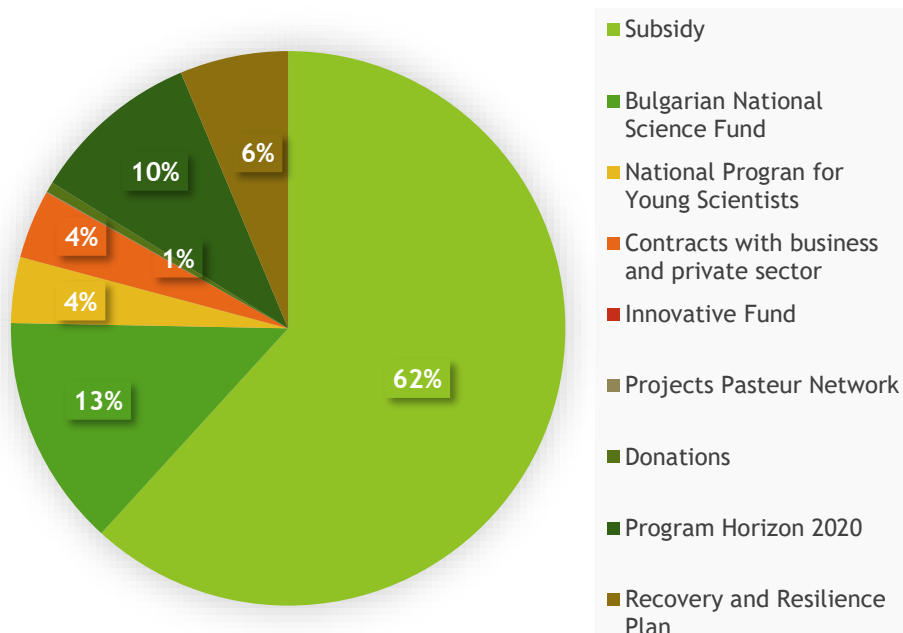
National Plan For Recovery And Sustainability Of The Republic Of Bulgaria

The Recovery and Resilience Facility is part of the Next Generation EU (2021-2024) instrument of the Recovery and Resilience Plan (RSP). To program the funds, Member States prepare National Recovery and Resilience Plans as an annex to their National Reform Programmes. The main objective of the PVA is to facilitate economic and social recovery from the crisis caused by the COVID-19 pandemic. In the pursuit of this goal, a set of measures and reforms have been grouped to make a significant contribution to the recovery of the economy's growth potential and to develop it by ensuring resistance to negative external impacts.

62% of the income in the Institute is due to a subsidy that covers salary and 50% of utilities to sustain our infrastructure.

Our Institute received 6% of its total budget as co-funding from The National Plan for Recovery.

Incomes in 2022

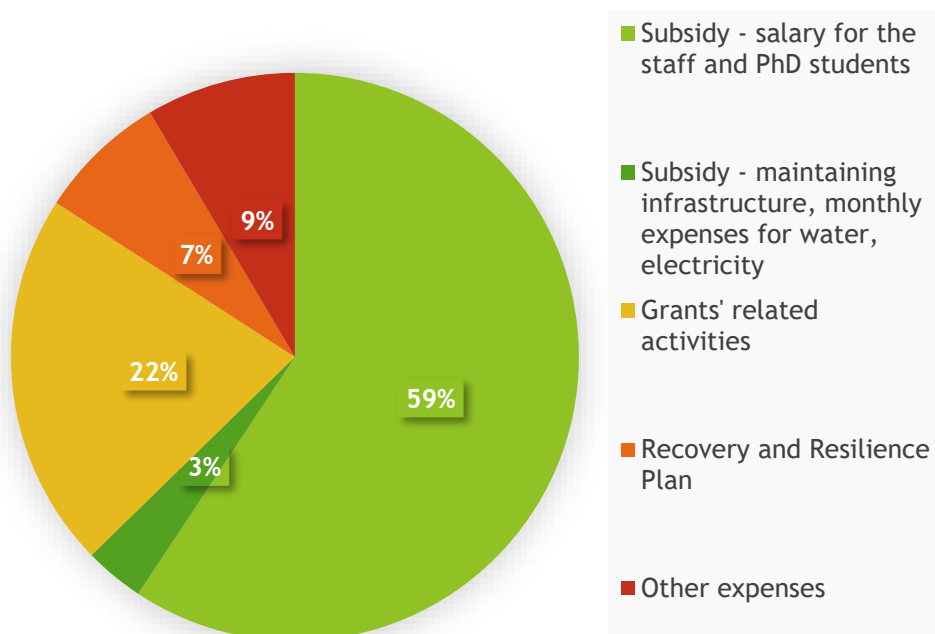


| INCOME | Amount in BGN |
|--|------------------|
| Subsidy | 3 543 076 |
| National Science Fund Grants | 776 664 |
| National Program for Young Scientists | 220 216 |
| Contracts with business and private sector | 229 236 |
| Innovative Fund | 1 186 |
| Projects Pasteur Network | 1 956 |
| Donations | 34 500 |
| Program Horizon 2020 | 566 811 |
| Recovery and Resilience Plan | 362 529 |
| Total | 5 736 174 |

| EXPENSES | Amount in BGN |
|--|------------------|
| Subsidy - salary for the staff and PhD students | 3 350 271 |
| Subsidy- 50% for utilities to sustain the infrastructure | 192 024 |
| Grants' related activities - consumables, new devices | 1 210 213 |
| Recovery and Resilience Plan | 415 426 |
| Other Expenses | 481 388 |
| Total | 5 649 322 |

Our Institute spends 59% of the subsidy for staff salary and only 3% to maintain infrastructure. Most of the expenses were related to Grants' specific research activities.

Expenses in 2022



RESEARCH ACTIVITIES IN NUMBERS

PUBLISHED ARTICLES

Published articles: 157

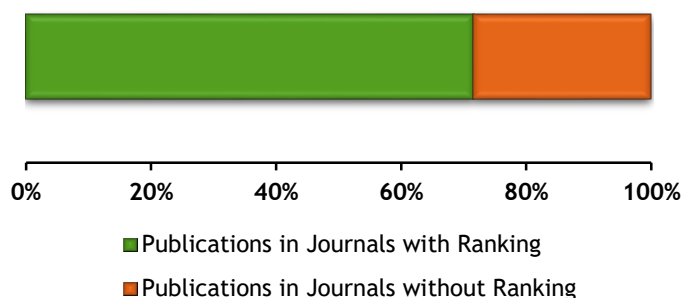
Publications in
Scopus/Web of
Science Database: 113

Other publications: 44

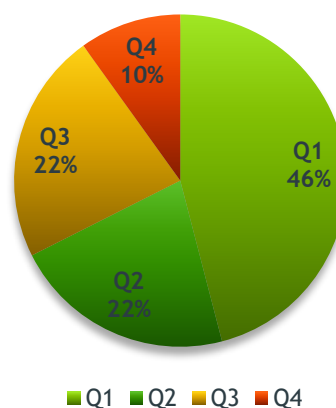
*Q - Quartile rankings
upon Journal Citation
Report

72% of published
articles in 2022 are in
Journals with a
Ranking

Published articles in 2022



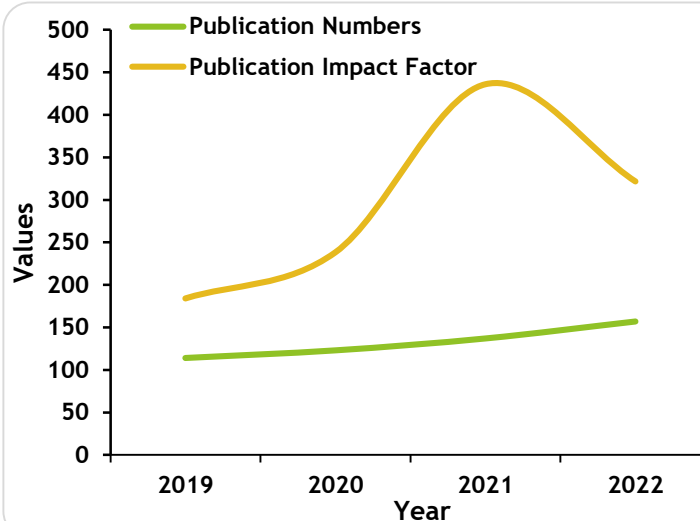
Published articles with Ranking in 2022



46% of published
articles are in a
category of the
Highest Ranked
Journals

The number of
published articles
increased 1.3 times
compared to 2019.

The quality of
published articles
raised 1.75 times
compared to 2019.



CITATIONS

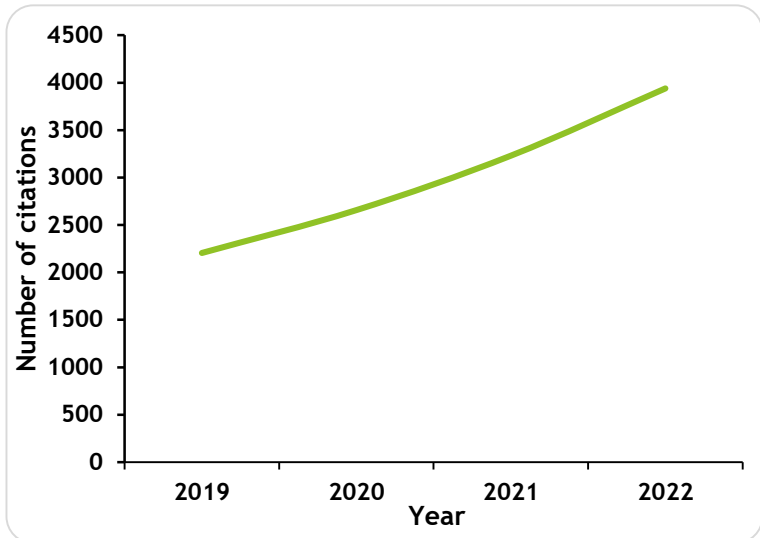
Total citations: 3939

**Citations in
Scopus/Web of
Science Database:
3425**

**Citations in Other
Sources: 514**

Cited articles: 818

**The number of
citations increased
1.78 times
compared to 2019.**



SCIENTIFIC CONFERENCES

**We want to get to
know other people
and use the benefit
and opportunity at
each conference for
networking.**



WHAT WE HAVE ACHIEVED IN 2022...

Department of General Microbiology

Head:

Prof. Penka Petrova, PhD, DSc

Tel.: +359 2 979 31 79

E-mail:

pepipetrova@yahoo.com

Laboratories:

- Cellular Microbiology
- Microbial Genetics
- Microbial Biochemistry
- Extremophilic Microorganisms

Department of Biotechnology

Head:

Prof. Lyudmila Kabaivanova, PhD

Tel.: +359 2 979 31 67

E-mail:

lkabaivanova@yahoo.com

Laboratories:

- Metabolomics
- Cell Biosystems
- Bioremediation and biofuel

Department of Infectious Microbiology

Head: Professor Hristo

Najdenski, DVM, DSc,

Corresponding Member of BAS

Tel.: +359 2 979 31 61

E-mail: hnajdenski@abv.bg,

hnajdenski@gmail.com

Laboratories:

- Bacterial Virulence, Resistance and New Antimicrobial Agents
- Molecular Biology of Mycobacteria

1. We boost research in microbiology

- We studied the nutritional value and food safety of microbial enzymes, vitamins, exopolysaccharides, probiotics, prebiotics, postbiotics, or antimicrobial compounds.
- We identified specific probiotic strains with anti-infectious and immunostimulatory activity.
- We used a biotechnological approach to produce valuable low-molecular weight compounds (butanediol, butanol, organic acids) through the valorization of agricultural waste and the utilization of renewable natural resources.
- We investigated a novel therapeutic strategy to target the escape mechanisms of bacterial biofilm formation and antimicrobial resistance.
- We optimized ecological technologies based on microbial degradation or transformation

2. We create new platforms for plant biotechnology research

- We create a biotechnological platform to study plant-derived metabolites.
- We used a biotechnology approach to culture endemic medicinal plants.
- We used innovative methodologies like genomics, transcriptomics, proteomics and metabolomics to investigate the potential of plants in pharmacy, medicine, industry and agriculture.
- We discovered the method for detoxification of water ecosystems by algae.

3. We elevate the research in Infectious Microbiology

- We identified foodborne pathogens in agricultural farms, food products (meat, milk, etc.), drinking, natural and waste waters, soils and treatment plants.
- We determined antimicrobial resistance in bacterial isolates from various sources.
- We developed modern PCR based methods for identification of food-borne pathogens, including digital droplet PCR and loop mediated isothermal DNA amplification
- We performed screening of plant and microalgae extracts, fractions and biologically active substances, microbial metabolites, synthetic compounds and nanoscale systems loaded with active ingredients with antimicrobial and/or antineoplastic activity for the prevention of infectious diseases, chemoprevention and control of multidrug resistance in infectious and antineoplastic chemotherapy.

- Cytotoxicity and Signal Transduction
- Ecology of Pathogenic Bacteria

- We investigated the virulence mechanisms in bacterial pathogens and the pathogenesis and carcinogenesis in conditions of bacterial colonization.
- We performed toxicology analyses of new drug candidates and nutritional supplements with antimicrobial and/or antineoplastic activity.
- We discovered the genetic diversity and genealogy of *Mycobacterium caprae* strains isolated from goats of different Bulgarian geographic regions.

Department of Immunology

Head: Prof. Andrey Tchorbanov, PhD

Tel.: +359 2 979 63 57

E-mail:

tchorban@microbio.bas.bg

Laboratories:

- Experimental Immunology
- Experimental Immunotherapy
- Infectious Immunology and Inflammation

4. We investigate the pathological mechanisms of immune response

- We designed new vaccines against SARS-CoV2.
- We studied novel therapeutic approaches to target osteoarthritis.
- We exploited murine and humanized model of melanoma to study novel anti-tumor vaccine.
- We studied the effect of saffron extract in a murine model of osteoarthritis.
- We investigated the role of folate in murine and human lupus models.
- We developed specific protein-engineered molecules for therapy in Hashimoto's models and dust allergy.
- We showed fertility loss and complications in spontaneous and induced lupus models.
- We investigated how flu infections affect the host epitranscriptome in arthritic conditions.
- We studied how epigenetic and metabolic modifications by pharmacological agents promote discrete fine-tuning of neutrophil function.
- We discovered a new paradigm and diagnostic algorithm to study the repertoire of natural IgM antibodies.

Department of Mycology

Head: Assoc. prof. Ekaterina Krumova, PhD

Tel.: +359 2 979 31 26

E-mail:

e_krumova@microbio.bas.bg

Laboratories:

- Biodiversity and Molecular Biology of Micromycetes
- Metabolism and its Regulation In Micromycetes

5. We strive to be a leader in fungal research in Bulgaria

- We studied the cellular response against oxidative stress induced by various stimuli.
- We investigated the mycetes biodiversity in extreme habitats - habitats with high and low temperatures, habitats polluted with heavy metals, habitats with increased salinity.
- We isolated endophytic fungi and their potential in biotransformation processes.
- We studied filamentous fungi as producers of biologically active substances and enzymes, incl. temperature-sensitive enzymes.
- We purified and characterized enzymes produced by filamentous fungi.
- We investigated the antifungal activity of various natural and synthetic substances.
- We discover the role of filamentous fungi in the degradation process of cellulose-containing waste.

Department of Virology

Head: Assoc. Prof. Ivanka

Nikolova, PhD

Tel.: +359 2 979 31 09

E-mail:

inikolova@microbio.bas.bg

6. We extensively study the biology of viruses and efficacy of novel antiviral therapies

- We studied how Bi-polar ionizers for air and surface purification affect various human viruses.
- We performed screening for antiviral and virucidal effects of various chemically synthesized substances or plant-derived metabolites.

Laboratories:

- Experimental Chemotherapy of Enteroviral Infections
 - Experimental Chemotherapy of Influenza
 - DNA Viruses and Oncolytic Viruses
 - Biological Response Modifiers and Pathogenesis of Viral Infections
-

EDUCATION AND TEACHING



National Evaluation and Accreditation Agency

The mission of NEAA is to encourage higher education institutions in assuring and enhancing the quality of education they offer by sustaining high academic standards and good education traditions in Bulgaria.

Ph.D. students graduate by fulfilling the common credit system of the Bulgarian Academy of Sciences to ensure high research quality.....

The career center at the Bulgarian Academy of Sciences helps Ph.D. students to plan their research steps....

<http://edu.bas.bg/career-centre.html>



We help Bulgarian Universities to consolidate and increase their education capacity.

We devoted 1660 hours to training students.

Accreditation to train Ph.D. students: 4 research fields:

- Microbiology
- Immunology
- Virology
- Biotechnology

Ph.D. students: 15

Ph.D. credit system: 2 components

1. Education program: min 130 credits

- Common specialization courses: 2 courses
- Individual education: 2 exams
- Common education courses in English and Computer Science

2. Credits for individual research activity: min 70 credits

- Published articles
- Participation in conferences and schools
- Participation in projects
- Other research activities

Total credits: min 250 credits

National Programs to support students and young scientists

- National program "Young scientists and postdoctoral fellows - 2" - 6 persons
- The national program „Evropeiski Praktiki“ - training of more than 20 master and bachelor students

The Teaching activity of the Scientific Staff

- Lectures: 19 Methodological Programs
- Courses: 2 Specialization Courses
- Practical training: 21 Training Courses in our Labs
- Seminars: 1 Research Seminar

We provide our expertise in education to:

- Sofia University St. Kliment Ohridski
- Plovdiv University Paisii Hilendarski
- New Bulgarian University - Sofia
- South-West University - Blagoevgrad
- University of Food Technology (UHT) - Plovdiv

EXPERT ACTIVITIES



- We are members of 35 Research Organizations.
- We are Editorial Board members in 48 Journals.
- We took a part in 20 Expert Committees consolidating opinions to solve society challenges.

TOP RESEARCH ARTICLES AND HIGHLIGHTS

IN GENERAL MICROBIOLOGY

The researchers from the Laboratory of Microbial Genetics have characterized a novel β -galactosidase of *Lactobacillus bulgaricus* and described the complex role of Lactic Acid Bacteria in food detoxification.

Arsov, A., Ivanov, I., Tsigoriyna, L., Petrov, K., Petrova, P. In Vitro Production of Galactooligosaccharides by a Novel β -Galactosidase of *Lactobacillus bulgaricus*. Int. J. Mol. Sci., 23, 22, MDPI, 2022, ISSN:1422-0067, DOI:10.3390/ijms232214308, 14308. SJR (Scopus):1.18, JCR-IF (Web of Science):6.208.

Petrova P., Arsov A., Tsvetanova, F., Parvanova-Mancheva, T., Vasileva, E., Tsigoriyna, L., Petrov, K. The Complex Role of Lactic Acid Bacteria in Food Detoxification. Nutrients, 14, 10, MDPI, 2022, ISSN:2072-6643, DOI:10.3390/nu14102038, 2038. SJR (Scopus):1.287, JCR-IF (Web of Science):6.706.

IN INFECTIOUS MICROBIOLOGY

In collaboration, researchers from the Department of Infekctious Microbiology have been undertaken research activities to evaluate the pharmacological potential of microalgal and plant extracts, micellar curcumin and alkylphosphocholines using a wide variety of in vitro and in vivo tests. Advantageous hydrogels for staphylococcal skin infections loaded with nanoencapsulated oregano oil have been developed as well.

Zaharieva, M.M., Dimitrova, L.L., Philipov, S., Nikolova, I., Vilhelmov, a N., Grozdanov, P., Nikolova, N., Popova, M., Bankova, V., Konstantinov, S.M., Zheleva-Dimitrova, D., Najdenski, H. In Vitro Antineoplastic and Antiviral Activity and In Vivo Toxicity of *Geum urbanum* L. Extracts. Molecules, 27, 1, MDPI, 2022, ISSN:1420-3049, DOI:10.3390/molecules27010245, 245. SJR (Scopus):0.705, JCR-IF (Web of Science):4.927, Q1

Zaharieva, M.M., Kaleva, M., Kroumov, A., Slavkova, M., Benbassat, N., Yoncheva, K., Najdenski, H. Advantageous Combinations of Nanoencapsulated Oregano Oil with Selected Antibiotics for Skin Treatment. Pharmaceutics, 14, 12, MDPI, 2022, ISSN:1999-4923, DOI:https://doi.org/10.3390/pharmaceutics14122773, 2773. JCR-IF (Web of Science):6.525, Q1

Zaharieva, M.M., Zheleva-Dimitrova, D., Rusinova-Videva, S., Ilieva, Y., Brachkova, A., Balabanova, V., Gevrenova, R., Kim, T.C., Kaleva, M., Georgieva, M., Mileva, M., Yoncheva, K.,

Benbassat, N., Najdenski, H., Kroumov, A.D. Antimicrobial and Antioxidant Potential of *Scenedesmus obliquus* Microalgae in the Context of Integral Biorefinery Concept. *Molecules*, 27, 2, MDPI, 2022, ISSN:14203049, DOI:<https://doi.org/10.3390/molecules27020519>, 519. JCR-IF (Web of Science):4.927, Q1

Trochopoulos, A.G.X., Ilieva, Y., Kroumov, A.D., Dimitrova, L.L., Pencheva-El Tibi, I., Philipov, S., Berger, M.R., Najdenski, H.M., Yoncheva, K., Konstantinov, S.M., Zaharieva, M.M. Micellar Curcumin Substantially Increases the Antineoplastic Activity of the Alkylphosphocholine Erufosine against TWIST1 Positive Cutaneous T Cell Lymphoma Cell Lines. *Pharmaceutics*, 14, 12, MDPI, 2022, ISSN:1999-4923, DOI:10.3390/pharmaceutics14122688, 2688. SJR (Scopus):0.92, JCR-IF (Web of Science):6.525, Q1

More articles published in 2022 are available at <https://www.scopus.com/authid/detail.uri?authorId=7003868608>

Highlights in Infectious Microbiology

The Stephan Angeloff Institute of Microbiology researchers have shown novel insight into the transmission and phylogeography of *Mycobacterium bovis* and *M. caprae* in Bulgaria and described novel sulfonyl hydrazone derivatives as potential anti-tuberculosis agents.

Valcheva, V., Perea, C., Savova-Lalkovska, T., Dimitrova, A., Radulski, L., Mokrousov, I., Marinov, K., Najdenski H., Bonovska M. *Mycobacterium bovis* and *M. caprae* in Bulgaria: insight into transmission and phylogeography gained through whole-genome sequencing. *BMC Veterinary Research*, 18, 1, BMC, 2022, ISSN:17466148, DOI:<https://doi.org/10.1186/s12917-022-03249-w>, 148-159. SJR (Scopus):0.65, JCR-IF (Web of Science):2.792.

Valcheva, V., Simeonova, R., Mileva, M., Philipov, S., Petrova, R., Dimitrov, S., Angelova, V. T. In Vivo Toxicity, Redox-Modulating Capacity and Intestinal Permeability of Novel Aroylhydrazone Derivatives as Anti-Tuberculosis Agents. *Pharmaceutics*, 2022. 15(1), 79. SJR (Scopus):0.92, JCR-IF (Web of Science):6.525, Q1

Angelova, V. T., Pencheva, T., Vassilev, N., K-Yovkova, E., Mihaylova, R., Petrov, B., Valcheva, V. Development of New Antimycobacterial Sulfonyl Hydrazones and 4-Methyl-1, 2, 3-thiadiazole-Based Hydrazone Derivatives. *Antibiotics*, 2022. 11(5), 562.

Mokrousov, Igor, Slavchev, Ivaylo, Solovieva, Natalya, Dogonadze, Marine, Vyazovaya, Anna, Valcheva, Violeta, Masharsky, Aleksey, Belopolskaya, Olesya, Dimitrov, Simeon, Zhuravlev, Viacheslav, Portugal, Isabel, Perdigão, João, Dobrikov, Georgi. Molecular Insight into *Mycobacterium tuberculosis* Resistance to Nitrofuranyl Amides Gained through Metagenomics-like Analysis of Spontaneous Mutants. *Pharmaceutics*, 15, 9, MDPI, 2022, ISSN:1424-8247, DOI:10.3390/ph15091136, 1136-1152. SJR (Scopus):0.851, JCR-IF (Web of Science):5.215.

More articles published in 2022 are available at <https://www.scopus.com/authid/detail.uri?authorId=14061470900>

IN IMMUNOLOGY

Researchers from the Department of Immunology at the Stephan Angeloff Institute of Microbiology have shown the restriction of the global IgM Repertoire in antiphospholipid syndrome and described the potential of the characterized repertoire for immunodiagnostics.

Highlights in Immunology

Researchers from the Department of Immunology designed a novel vaccine, which combines hemocyanins from the marine snail *Rapana thomasiana* (RtH) and the terrestrial snail *Helix aspersa* (HaH) as carrier-proteins and a ganglioside mimotope GD3P4 peptide-conjugated vaccine, and showed its efficacy in a preclinical murine melanoma model. They also showed the therapeutic potential of chimeric protein molecules in Hashimoto's Thyroiditis Patients.

Pashova, S., Balabanski, L., Elmadjian, G., Savov, A., Stoyanova, E., Shivarov, V., Petrov, P., Pashov, A.D. Restriction of the Global IgM Repertoire in Antiphospholipid Syndrome. *Frontiers in Immunology*, 13, Frontiers, 2022, ISSN:16643224, DOI:10.3389/fimmu.2022.865232, 865232. JCR-IF (Web of Science):8.8.

Emiliya Stoyanova, Nikolina Mihaylova, Nikola Ralchev, Petya Ganova, Silviya Bradyanova, Iliyan Manoylov, Yuliana Raynova, Krassimira Idakieva, Andrey Tchorbanov. Antitumor Properties of Epitope-Specific Engineered Vaccine in Murine Model of Melanoma. *Marine Drugs*, 20, 6, MDPI, 2022, ISSN:16603397, DOI:10.3390/md20060392, 392. SJR (Scopus):0.794, JCR-IF (Web of Science):6.085 Q1.

Nikola Ralchev Ralchev, Aleksandar Mishel Markovski, Inna Angelova Yankova, Iliyan Konstantinov Manoylov, Irini Atanas Doytchinova, Nikolina Mihaylova Mihaylova, Alexander Dimitrov Shinkov, Andrey Ivanov Tchorbanov. Selective Silencing of Disease-Associated B Lymphocytes from Hashimoto's Thyroiditis Patients by Chimeric Protein Molecules. *International Journal of Molecular Sciences*, 23, 23, MDPI, 2022, ISSN:1422-0067, DOI:https://doi.org/10.3390/ijms232315083, 15083. SJR (Scopus):1.18, JCR-IF (Web of Science):6.208

IN BIOTECHNOLOGY

The researchers have described the mechanism of betulinic acid in lipid accumulation and validated the compound's potential in obesity management. The same group has studied the anti-adipogenic activity of maackiain and ononin in human adipocyte differentiation.

Savova, M., Todorova, M.N., Apostolov, A.G., Yahubyan, G.T., Georgiev, M.I. Betulinic acid counteracts the lipid accumulation in *Caenorhabditis elegans* by modulation of *nhr-49* expression. *Biomedicine and Pharmacotherapy*, 156, Elsevier, 2022, ISSN:1950-6007, DOI:10.1016/j.biopha.2022.113862, 113862. JCR-IF (Web of Science):7.419 Q1.

Mladenova, S.G., Savova, M.S., Marchev, A.S., Ferrante, C., Orlando, G., Wabitsch, M., Georgiev, M.I. Anti-adipogenic activity of maackiain and ononin is mediated via inhibition of PPAR γ in human adipocytes. *Biomedicine and Pharmacotherapy*, 149, Elsevier, 2022, ISSN:1950-6007, DOI:10.1016/j.biopha.2022.112908, 112908. JCR-IF (Web of Science):7.419 Q1.

Highlights in Biotechnology

In collaboration, researchers from the Laboratory of Metabolomics discussed the genetic basis for metabolomic divergence and ecotype differentiation and delineated the role of novel important transcription factors in plant biosynthesis. Several research activities have been undertaken to identify the antiviral and antibacterial activity of Bulgarian medicinal extracts.

Highlights in Biotechnology

Researchers from the Cell Biosystems Lab studied the relationships between the primary and secondary metabolite profiles, induction of genetic instability and biosynthetic potential of plant *in vitro* systems undergoing different levels of cell differentiation.

Chen, C., Liu, F., Zhang, K., Niu, X., Zhao, H., Liu, Q., Georgiev, M.I., Xu, X., Zhang, X., Zhou M.. MeJA-responsive bHLH transcription factor LjbHLH7 regulates cyanogenic glucoside biosynthesis in *Lotus japonicus*. *Journal of Experimental Botany*, 73, 8, Oxford University Press, 2022, ISSN:1460-2431, DOI:10.1093/jxb/erac026, 2650-2665. JCR-IF (Web of Science):7.378 Q1

Ding, M., He, Y., Zhang, K., Li, J., Shi, Y., Zhao, M., Meng, Y., Georgiev, M.I., Zhou, M.. JA-induced FtBPM3 accumulation promotes FtERF-EAR3 degradation and rutin biosynthesis in Tartary buckwheat. *Plant Journal*, 111, 2, Wiley, 2022, ISSN:1365-313X, DOI:10.1111/tpj.15800, 323-334. JCR-IF (Web of Science):7.091 Q1,

He, M., He, Y., Zhang, K., Lu, X., Zhang, X., Gao, B., Fan, Y., Zhao, H., Jha, R., Huda, M.N., Tang, Y., Wang, J., Yang, W., Yan, M., Cheng, J., Ruan, J., Dulloo, E., Zhang, Z., Georgiev, M.I., Chapman, M., Zhou, M.. Comparison of buckwheat genomes reveals the genetic basis of metabolomic divergence and ecotype differentiation. *New Phytologist*, 235, 5, Wiley, 2022, ISSN:1469-8137, DOI:10.1111/nph.18306, 1927-1943. JCR-IF (Web of Science):10.323 Q1.

Krasteva, Gergana, Berkov, Strahil, Pavlov, Atanas, Georgiev, Vasil. Metabolite Profiling of *Gardenia jasminoides* Ellis In Vitro Cultures with Different Levels of Differentiation. *Molecules*, 27, 24, MDPI, 2022, ISSN:1420-3049, DOI:https://doi.org/10.3390/molecules27248906, 8906. SJR (Scopus):0.71, JCR-IF (Web of Science):4.927 Q1.

PROOF OF CONCEPT INTERNATIONAL PROJECTS

| | |
|---|--|
| PI: Prof. Andrey Tchorbanov | VacciNanoCor: Generation of Humanized NSG transfer mouse model for coronavirus SARS-CoV-2 vaccine testing. Institut Pasteur International Network, 2020-2022 |
| PI: Assist. Prof. Milena Leseva | m6A_RAIIV: The lung epitranscriptome and chromatin accessibility landscape in rheumatoid arthritis complicated by the flu. Institut Pasteur International Network, 2020-2023 |
| CoPI: Prof. Svetla Danova | JINR Nuclear Regulatory Agency (NRA): Effect of ionizing radiation on probiotic strains of bacteria and yeast. International Institute for Nuclear Research Dubna, 2021 - 2022 |
| CoPI: Prof. Hristo Najdenski, DVM, DSc | Technology model for microbial degradation of cellulose containing wastes in life support system for manned space flights, contract No 4000126327/18/NL/SC - 09.01.2019, 2019-2021 |
| CoPI: Assist. Prof. Diliانا Simeonova | FLAG-ERA: DeGraph - Bacterial degradation of GRMs. Universite de Strasbourg, CNRS, Helmholtz-Institut Freiberg für Ressourcenttechnologie, 2021-2024 |

ACIP PROJECTS

PASTEUR NETWORK

- **ACIP VacciNanoCor 2020-2022:** Generation of Humanized NSG transfer mouse model for coronavirus SARS-CoV-2 vaccine testing. PI: Assoc. Prof. Andrey Tchorbanov, Institute of Microbiology, Sofia, Bulgaria.
- **ACIP m6A_RAIIV 2020-2023:** The lung epitranscriptome and chromatin accessibility landscape in rheumatoid arthritis complicated by the flu. PI: Milena Leseva, CoPI: Dr. M. Hasan, Institute Pasteur-Paris, France, CoPI: C. Barbezange, Sciensano, Belgium.
- **ACIP/A-05_13, 2013-2015:** Viral Antigen Targeting by Genetically Engineered Chimeric Molecules, PI: Assoc. Prof. Andrey Tchorbanov, Institute of Microbiology, Sofia, Bulgaria.
- **ACIP A-07-2012, 2012-2014:** Therapeutic potential of modified IgM and IgG preparations in inflammatory respiratory syndrome and sepsis. PI: Prof. Tchavdar Vasilev, Institute of Microbiology, Sofia, Bulgaria.
- **ACIP/A05_11, 2011-2013:** The role of neutrophils and NK cells in the development of collagenase-induced osteoarthritis, PI: Assoc. Prof. Petya Dimitrova, Institute of Microbiology, Sofia, CoPI: Prof. Angela Santoni, University La Sapienza, Rome, CoPI: Crina Stavaru, Cantacuzino Institute, Bucharest.
- **ACIP A-08-2010, 2010-2013:** Role of migrating birds and their feeding ticks on the dissemination of some medically important zoonotic pathogens along the East-European flyway. PI: Prof. Hristo Najdenski, CoPI:

- Prof. Elizabeth Carniel, Institut Pasteur-Paris, CoPI: Nikolay Tokarevich, Saint-Petersburg Pasteur Institute ACIP A/7/2005, 2005-2007, Macrophage dependent immunoprotective action of *Candida albicans* DNA, PI: Prof. Nina Ivanovska, Institute of Microbiology, Sofia, CoPI: Prof. Dr. Jean-Mark Cavaillon, Institute Pasteur, Paris, CoPI: Prof. Dr. Aurora Salageanu, Cantacuzino Institute, Bucharest.

PTR PROJECTS

PASTEUR NETWORK

- PTR-43-16: 2017-2018: The Role of ExoY nucleotidyl cyclase toxin in *Pseudomonas aeruginosa* infections” (1917-1918), PI: Prof. U. Mechold, Institute Pasteur, Paris; Co-PI Institute of Microbiology: Assoc. Prof. Stoyanka Stoitsova.
- PTR 519-22: 2023 -2024: Uncovering hidden antimicrobial resistance reservoirs and dynamics in the gut microbiota of undersampled human populations, PI: Dr Gregorio Iraola, Institut Pasteur in Montevideo; Co-PI Institute of Microbiology: Prof. Svetla Danova.

TRAVEL GRANTS

PASTEUR NETWORK

2008: Lora Simeonova - Vaccinology course, Institut Pasteur, Paris (course)

2013: Maya Hadjieva - 6th HKU Pasteur Immunology Course, Hong Kong (travel grant)

2013: Lora Simeonova - 11th International Virology Course on Influenza and Viral Zoonoses, Institut Pasteur Hong Kong (travel grant)

2014: Violeta Valtcheva - International Scientific Symposium Institut Pasteur International Network (2014), Institute Pasteur, Paris

2015: Nikola Kerekov - Vaccinology course, Institut Pasteur, Paris (course)

2018: Violeta Valtcheva - Introduction to Molecular Phylogenetics - Institut Pasteur Hong Kong (course)

2016: 3rd Institut Pasteur International Network Symposium "From Basic Sciences to Biomarkers & Tools in Global Health"

2017: Violeta Valtcheva - Transgenic technologies in modeling the human diseases - principles and technologies, Hellenic Institute Pasteur, Athens (course)

2018: Violeta Valtcheva - 2nd St. Petersburg Symposium on Tuberculosis and Mycobacteria: Molecular Approach, St. Petersburg Pasteur Institute (travel grant)

2019: Violeta Valtcheva - Next generation sequencing and bioinformatic tools for *M. tuberculosis* drug resistance detection and epidemiological analysis, St. Petersburg Pasteur Institute.

2021: Iliyan Manoylov - Calmette and Yersin Grant - Vaccinology course, Institute Pasteur, Paris.

INTERNSHIP

PASTEUR NETWORK

2015: Rositsa Tropcheva - Calmette and Yersin Grant, 2 months, Hellenic Institut Pasteur, Athens;

2019: Iliyan Manoylov - Calmette and Yersin Grant - Regulatory course for project designers (rodents and lagomorphs), Institute Pasteur, Paris

2022: Iliyan Manoylov - Calmette and Yersin Grant, 1 month, Animalerie Centrale, Institute Pasteur, Paris.

PLATFORMS: USE AS A PUBLIC HEALTH TOOLS

PLATFORM: PROKARYOTES AND EUKARYOTES IN HEALTH AND DISEASES

Probiotics and postbiotics v/s microbiome - nutrition-health Expertise:

- probiotics from different ecological niches
- mode of action of lactic acid bacteria and postbiotics
- new functional foods related to the beneficial bacteria in traditional fermented dairy products and sourdough
- novel bio-therapeutic potential

Analysis:

- human microbiome - biodiversity of lactobacilli from vaginal samples and breast milk;
- probiotic potential and beneficial effects

Contact persons:

Department of General Microbiology

Prof. Svetla Danova: stdanova@yahoo.com

Development of new functional foods based on prebiotics

Expertise:

- Biodiversity and probiotic potential of Bulgarian yogurt strains
- Galactooligosaccharides production by *Lactobacillus bulgaricus*

Analysis:

- Selection of bacterial strains displaying hydrolase activities (B-fructosidase, B-galactosidase, cellulase, levanase)
- Metagenomics of Bulgarian LAB fermented foods

Contact persons:

Department of General Microbiology

Prof. Penka Petrova: ppetrova@microbio.bas.bg

Development of novel foods, food supplements and cosmeceuticals based on cellular agriculture by using plant *in vitro* systems

Expertise:

- Development, characterization and cultivation of plant *in vitro* systems with different levels of differentiation;

- Optimization, analyses, downstream processing and standardization of plant biomass with improved qualities;
- Bioreactor cultivation, scale-up and production of target bioactive metabolites by using plant *in vitro* systems;
- Development of nutraceuticals based on plant *in vitro* systems.

Contact persons:

Department of Biotechnology

Assoc. Prof. Vasil Georgiev: vasgeorgiev@gmail.com

PLATFORM: WHOLE ORGANISM DISEASE MODELS

Murine models use and refinement for evaluation of immune response and drug efficacy

Expertise:

- Experimental models of acute inflammation
 - LPS-induced inflammation and shock (lung, kidney, and liver injury)
 - Zymosan-induced inflammation and multiple organ dysfunction syndrome
 - Polymicrobial sepsis model (cecal ligation and puncture, CLP)
 - Carrageenan-induced and zymosan-induced paw inflammation
- Models of rheumatoid arthritis (RA)
 - Collagen antibody-induced arthritis
 - Zymosan-induced arthritis
- Models of osteoarthritis (OA)
 - Collagenase-induced OA
 - Surgical model of anterior cruciate ligament transection
 - Ovariectomy - post-menopausal model

Analyses:

- Clinical evaluation
- Phenotyping, homing, and distribution of immune cells - flow cytometry
- Cell functional analysis - flow cytometry, In cell kits
- Histology - knee/ankle joints, lung, liver, kidney
- Immunohistochemistry for catabolic and metabolic pathways
- MMPs, cytokines, chemokines

Contact persons:

Department of Immunology

Assoc. Prof. Petya Dimitrova: petya_dimitrova@web.de

Assoc. Prof. Nikolina Mihailova: mihaylova_n@microbio.bas.bg

PLATFORM: SCREENING, CHEMICAL BIOLOGY, CHEMICAL LIBRARIES

Biodiversity of extremophilic microorganisms - archaea, bacteria and fungi, and investigation of their biosynthetic potential.

Expertise:

- The characterization of microbial diversity in extreme niches is carried out by applying modern and classical molecular and microbiological methods.
- The investigations provide new information on the microbial biodiversity in these habitats, as well as their biotechnological potential.

Analyses:

- isolation of microorganism strains from temperate and extreme environments.
- taxonomical identification of isolated strains
- investigation of the biotechnological potential of microorganisms

Contact persons:

Department of Mycology

Prof. Margarita Kambourova: margikam@microbio.bas.bg

Assoc. Prof. Ekaterina Krumova: e_krumova@microbio.bas.bg

Natural and synthetic products as a drug lead and screening for anti-viral, anti-microbial, anti-tumor and anti-inflammatory activity

Comprehensive plant metabolite profiling

Expertise:

- Production of pharmaceutically valuable plant molecules.
- Unraveling the regulatory codes and metabolic pathways that govern plant development, stress physiology and production of valuable metabolites.

Analysis:

- Collection of medicinal and aromatic plants
- Isolation and structure elucidation
 - 1H NMR or 13C NMR spectroscopy
 - 2D NMR spectroscopy (J-resolved; 1H-1H COSY; TOCSY; 1H-13C HMBC; HSQC)
 - 3D NMR spectroscopy (HSQC-TOCSY)
- Data processing
 - Metabolomics and metabolite profiling (In-house database)
 - Bucketing (AMIX, MestReNova)
 - Multivariate data analysis (SIMCA-P)

Contact persons:

Department of Biotechnology

Prof. Milen Georgiev: milengeorgiev@gbg.bg

Large-scale screening for antiviral activity

Expertise:

Viruses: entero-, toga-, flavi-, orthomyxo-, paramyxo-, rhabdo-, adeno-, herpes, poxviruses.

Analyses:

- Anti-viral activity
- Mode of action
- Combination of applications
- New approaches for alternative applications
- Resistance
- Biological response modifiers
- Double-blind study (adenovirus)

Contact persons:

Department of Virology and Laboratory Center Pasteur

Acad. Angel Galabov: galabov@microbio.bas.bg
Assoc. Prof. Ivanka Nikolova: vanianik@mail.bg
Assoc. Prof. Neli Vilhelmova: nelivili@gmail.com
Assistant Professor Lora Simeonova: losimeonova@gmail.com
Assistant Professor Peter Grozdanov: grozdanov@microbio.bas.bg

Screening for drug effects on immune cell functions

Expertise:

- Multi-parametric analysis of immune cell function.
- Anti-inflammatory activity of novel drugs.

Analysis:

- JAK kinase inhibitors
- Anti-proliferating drugs
- HDAC inhibitors
- Sirtuin activators
- NRF2 activators
- Modifiers of neutrophil functions
- Modifiers of bone cell functions
- Modifiers of B-cell functions
- Methylation agents - folic acid

Contact persons:

Department of Immunology
Prof. Andrey Tchorbanov - tchorban@microbio.bas.bg
Assoc. Prof. Petya Dimitrova - petya_dimitrova@web.de
Assoc. Prof. Nikolina Mihailova: mihaylova_n@microbio.bas.bg

Analysis of the antibody repertoire in its complete diversity

Expertise:

- Diagnostic tool for evaluation of IgM repertoire.
- The implication in glioblastoma multiforme, non-tumor patients, lung cancer brain metastasis, and breast cancer metastasis.
- Topological data analysis for biological big data.

Analysis:

- Design of mimotope-based repertoire profiles.
- Defining predictors based on repertoire profiles.
- Data processing implementing machine learning techniques.

Contact persons:

Department of Immunology
Assoc. Prof. Anastas Pashov - a_pashov@microbio.bas.bg

Screening for anti-microbial activity (antibacterial and antifungal) of natural and synthetic products

Expertise:

- Defining antimicrobial activity of novel drugs extracts and compounds thereof.
- Defining antimicrobial activity of proteins and antibodies.
- Defining antimicrobial activity of nano-formulations with new or existing compounds, incl. clinically approved chemotherapeutics and antibiotics.
- Exploring the mechanisms of action of extracts and compounds (bioactive and synthetic) in comparison with known clinically applied chemical structures.

Analysis:

- Implementation of microbiological approaches for determination of MIC, CFU counts, MBC.
- Biochemical approaches for enzyme activity and investigation of interference with the quorum sensing system of sensitive bacteria.
- Molecular-biology approaches for evaluation of the effects of active compounds and extracts on the bacterial quorum sensing system.
- Microscopic approaches for evaluation of the effects of active extracts and/or compounds on the bacterial cell wall.

Contacts:

Department of Infectious Microbiology

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Assoc. Prof. Maya Zaharieva: zaharieva26@yahoo.com

Assoc. Prof. Violeta Valcheva: violeta_valcheva@mail.bg

Department of Mycology

Assoc. prof. Ekaterina Krumova: e_krumova@microbio.bas.bg

Department of General Microbiology

Assoc. Prof. Tsvetelina Paunova-Krasteva: pauny@abv.bg

Assist. Prof. Rumyana Eneva: rum_eneva@abv.bg

Screening for antineoplastic activity

Expertise:

- Evaluation of the antineoplastic activity of plant extracts, compounds thereof, synthetic chemical structures and microbial products on tumor cell lines originating from tissues that are in contact with the environment and suggest the involvement of bacterial infections in the disease. pathogenesis: effects on cell growth and proliferation
- Evaluation of mechanisms of action of active plant extracts, compounds thereof, synthetic chemical structures, and microbial products in terms of:
 - effects on induction of programmed cell death;
 - influence on the cell cycle and signal transduction;
 - epigenetic modulation potential.

Analysis:

- Pathomorphological evaluation of cytopathic effects on treated cell lines.
- Determination of median inhibitory concentrations and in vitro cytotoxicity based on biochemical methods for cell proliferation and cytotoxicity.
- Evaluation of clonogenicity and genotoxicity.
- Biochemical evaluation, fluorescent methods and immunoassays of apoptosis induction, and determination of apoptosis and other types of cell death.
- Implementation of PCR-based molecular biology methods (real-time PCR, digital droplet PCR) for evaluation of effects on gene activation and/or silencing.
- Epigenetic approaches for determination of epigenetic DNA modulation as a consequence of exposure to test substances.

Contacts:

Department of Infectious Microbiology

Assoc. Prof. Maya Zaharieva: zaharieva26@yahoo.com

Investigations of cell's oxidative stress events**Expertise:**

Investigations of oxidative stress events in eukaryotic cells: Assay of stress biomarkers and evaluation of the antioxidant activity.

Analysis:

- Determination of stress biomarkers in cells
- Determination of antioxidant activity

Contacts:

Department of Mycology

Assoc. Prof. Ekaterina Krumova: e_krumova@microbio.bas.bg

Studying molecular epidemiology and evolutionary genetics for mycobacteria**Expertise:**

- Molecular epidemiology and evolutionary genetics for mycobacteria, including species from *Mycobacterium tuberculosis* complex.
- Genomic bioinformatic tools for analysis of mycobacteria.
- Screening of new molecular markers for drug resistance in mycobacteria.

Analysis:

- Molecular genetic and population structure analysis of *Mycobacterium tuberculosis*.
- Molecular phylogeny and bioinformatic analysis of mycobacteria.
- Evaluation of new molecular markers for drug resistance in mycobacteria.

Contact persons:

Department of Infectious Microbiology

Assoc. Prof. Violeta Valcheva: violeta_valcheva@mail.bg

PLATFORM: IMAGING TECHNIQUES**Morphology of microorganisms and electron microscopy****Expertise:**

- Biofilms - structure, development and control.
- In situ interaction of bacteria with cultured cells.
- Ultrastructure and cytochemistry of microorganisms from diverse phylogenetic groups - viruses, prokaryotes (bacteria, actinomycetes) and eukaryotes (yeasts, fungi).

Analysis:

- Transmission electron microscopy: processing and sectioning of resin-embedded samples, negative staining.
- Immunocytochemistry - immuno-gold labeling of ultrathin sections and negatively stained samples.
- Scanning electron microscopy.

**PLATFORM:
ANTIMICROBIAL
RESISTANCE**

Contacts:

Department of General Microbiology
Assoc. Prof. Tsvetelina Paunova-Krasteva: paunyt@abv.bg

Antimicrobial resistance in agricultural areas in the light of the one health concept

Expertise:

- Biodiversity of pathogenic bacterial strains in animals and environment, incl. farms, farm lagoons, water sources, and agricultural fields around farms.
- Resistance pattern in pathogenic and non-pathogenic bacterial species in agricultural areas (collaboration with Hellenic IP (Greece)).
- Types of resistance - biochemical, genetically determined, etc.
- Genes of resistance - chromosomal and R plasmids, pharmacological groups of antibiotics involved.
- Possibilities for transmission of resistance carriers between non-pathogenic and pathogenic bacterial species within bacterial communities in agricultural areas.

Analysis:

- Identification of pathogenic bacteria - according to microbiological ISO standards, biochemically (Phoenix BD system), with PCR-based techniques (conventional, real-time PCR and digital droplet PCR) and LAMP assay.
- AST testing using microbiological approaches recommended by EUCAST.
- biochemically (Phoenix BD system).
- Agar-diffusion test for determination of zone inhibition (automates counter SCAN1200).
- Genetic analysis of resistance carriers collaboration with ILVO (Melle, Belgium).
- Determination of genes of resistance (R plasmids or chromosomal located) - PCR-based techniques (conventional, real-time PCR and digital droplet PCR), LAMP assay.
- Determination of point mutations (existing and new) which could be related to antibiotic resistance - digital droplet PCR and NGS.
- Screening for antibiotic residuals in samples from agricultural areas using chemical analytical methods such as HPLC and mass spectrometry.

Contacts:

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