



Pavol Jozef Šafárik University in Košice  
Faculty of Science

# CHANGING THE WORLD WITH SCIENCE



**CHANGING THE WORLD WITH SCIENCE**

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## FOREWORD

Dear friends,

since its foundation in 1963 the Faculty of Science has undergone substantial development and has become an important pillar in the field of natural sciences in Slovakia – in physics, chemistry, biology, mathematics, computer science, geography, whether in research, academic instruction or teachers training.

The Faculty is enjoying a good reputation within Slovakia as well as internationally. Its quality is acknowledged by successful graduates who are becoming leaders in their respective fields not only in the academic sphere, but also in the industry, research and education. Until today the Faculty has provided academic education to more than 8 000 graduates, enrolling about 200 freshmen every year.

In this publication you will find a sum of information concerning the history of the Faculty, the prominent personalities who have contributed to its advancement, as well as its current offer of study programmes and scientific activities. This brochure aims to shed light on the life and work at our Faculty, its being an asset to the scientific communities, the society and the future of Slovakia.



The Senior Management of the Faculty of Science  
of Pavol Jozef Šafárik University in Košice:

**doc. RNDr. Roman Soták, PhD.**

**doc. RNDr. Andrea Straková Fedorková, PhD.**

**prof. RNDr. Gabriel Semanišin, PhD.**

**doc. RNDr. Marián Kireš, PhD.**

**doc. Mgr. Michal Gallay, PhD.**



## THE FOUNDING SPARK

The establishment of the Faculty on 1 March 1963 was urged by the social needs of the East Slovakian region, which was undergoing a rapid industrial and cultural development, but was missing a complex scientific and research base. That was manifested by the lack of qualified teachers and experts in the field of natural sciences that were necessary to educate new generations and foster research and education in the region dominated by the metallurgical and chemical industries.

Exceptional contribution to the foundation of the Faculty is due to its first dean, professor **Vladimír Hajko** (\*1920, +2011), who gave the Faculty a solid organization foundation and also set the key trends of its development persisting till this day. The Faculty's birth was influenced positively by the gratuitous help of the Technical University (former VŠT) in Košice and the Faculty of Medicine UPJŠ in Košice. Their generous approach as well as the aid from the Ministry of Education and extraordinary effort of the Faculty's first Dean allowed the newly-established Faculty to open the four fundamental study branches – biology, physics, chemistry and mathematics. 54 students of teachers' training in these study branches enrolled in the first academic year.

The first management of the Faculty succeeded in attracting to Košice top experts experienced in both research and international cooperation, such as: prof. Daniel-Szabó, prof. Dubinský, prof. Kolbenheyer, prof. Hajko for physics, prof. Praslička, the Ahlers spouses for biology, prof. Matherny, MUDr. Barna, prof. Podhradský for chemistry, prof. Palaj

and prof. Jucovič for mathematics, to mention only a few of such outstanding personalities, although their list could be much more extensive. Thanks to these personalities the Faculty has been able to produce the quality research in a symbiosis with the quality instruction since its very beginning.

A gradually growing number of staff, students and departments necessitated the reorganization of the structure of the Faculty in the end of the second millennium in order to increase the efficiency of the management and coordination of the Faculty's operation. In 2002 there were established institutes to subsume the activities of particular departments and communication with the Faculty's management.

Read more about the development and milestones of the Faculty of Science on the website:



You can also listen to an audio recording of the discussion about the Faculty's development on the Radio Regina RTVS of 28 February 2023 – hosting the current Faculty's Dean Roman Soták, the former Dean Alexander Feher and our successful young scientist Andrea Straková Fedorková.



The outstanding figures that significantly contributed to the advancement of the Faculty and its respective scientific fields are devoted with a gallery displayed next to the Administration Office of the Faculty. This will enable generations to come to see the faces of those who have laid the foundations of the Faculty of Science UPJŠ in Košice.





# FACULTY TODAY

Structurally, the Faculty currently consists of 6 institutes. Creative research and educational activities are rendered by more than 200 employees supported by a hundred of other staff from the IT sector, administration and maintenance. The Faculty provides education to almost a thousand of students every year.

The Faculty is pulsing with life in the three centres. The main complex of buildings is localized in the campus surrounded by Moyzesova, Šrobárova, and Kostlivého streets, in the vicinity of the historic core of the City of Košice. They are housing the UPJŠ Rector's Office, the Dean's Office of the Faculty of Science, the Institute of Chemistry and the Institute of Biology and Ecology.

In the premises located at Jesenná 5 and Park Angelinum 9 streets there is a seat of the Institute of Physics, the Institute of Mathematics, the Institute of Computer Science and the Institute of Geography. Here is also situated a specialized workplace of the Faculty, the Centre of Applied Computer Science, which ensures the reliability of computer and communication devices as well as the Internet networks.



**FACULTY OF SCIENCE**  
PAVOL JOZEF ŠAFÁRIK  
UNIVERSITY IN KOŠICE



**INSTITUTE  
OF CHEMISTRY**



**INSTITUTE OF BIOLOGY  
AND ECOLOGY**



**INSTITUTE  
OF PHYSICS**



**INSTITUTE  
OF MATHEMATICS**



**INSTITUTE OF COMPUTER  
SCIENCE**



**INSTITUTE  
OF GEOGRAPHY**

The third centre is located in the premises of the Botanical Garden UPJŠ in Košice, situated at Mánesova street 23, seating three Departments of the Institute of Biology and Ecology.

You can follow a reportage on the 60th anniversary of the Faculty of Science which was celebrated in 2023 and its current studies on the RTVS channel Regina TV broadcast of 17 May 2023.





# SCIENCE CHANGES THE WORLD

Since its origin, the Faculty of Science UPJŠ in Košice has focused on the fostering of its scientific-research activities and their immediate interconnection with the education of undergraduates. Nowadays, the Faculty is a modern research institution with an excellent tradition in raising quality experts and teachers in the respective fields of natural sciences. This substantially contributes to the positive ranking of UPJŠ in Košice.

Our research is flexibly responding to the calls of our times, but, at the same time, we derive from the long-term tradition of research topics developed at respective workplaces – in the fields of physics, chemistry, biology, ecology, geography, mathematics and computer science. Our research projects focus mainly on the understanding of the fundamental natural processes, but we also bring solutions relevant for the practise in the form of patents, analyses, consultation services and trainings. The research outcomes are published preferably in internationally recognized scientific journals, prestigious in the respective fields.

We are thankful for our achievements to both the staff and the top infrastructure which the Faculty of Science has built in the previous decade from the funds of the European Union. It is still a challenge for us to maintain the continuity of the quality work of our staff and the excellent condition of our research facilities.


The most significant scientific research outcomes are published in the section entitled "Sciences Change the World":



Our research is presented to the public, on an ongoing basis, in a TV show "Science and Technology /VAT/" in cooperation with RTVS Slovakia:







In the following chapters we will provide some more details concerning the specialization of the respective study branches of the Faculty of Science in terms of the study programmes and research and career opportunities on offer.

# PHYSICS

The study branches in physics have deep roots at the Faculty of Science in Košice, currently they are fostered by 5 workplaces of the Institute of Physics. Excellent international research results and education in the field of physics are the fundamental pillars of the Faculty. This quality is strengthened by the long-term close cooperation with the Institute of Experimental Physics of the Slovak Academy of Sciences, as well as centres for particles acceleration – in Switzerland (CERN) and in Germany (European XFEL, DESY). The Faculty's research facilities in physics include more than thirty specialized laboratories. The research activities are focused on magnetism, low temperature physics, nanotechnologies, nuclear and particles physics, biophysics, theoretical physics, astrophysics and theory of physics teacher's training.



In biophysics we research into mechanisms of photodynamic therapy and development of a potential treatment of cancer on the molecular and cellular levels. We also develop methods of detection of trace amounts of chemical compounds in solutions and examine interactions of biomacromolecules with medications.

In the physics of condensed matter the research is focused on the properties of modern magnetic materials, including nanocrystals, and on the study of nanoparticles for biomedical and catalytical applications.

The very low temperature physics research concentrates on a complex observation of magnetic and superconducting nanostructures, molecular nanomagnets and their potential in the area of quantum computer technologies. An accredited Top Research Team 'Quantum Magnetism and Nanophysics (QMAGNA)' is working at the Institute in this field.

In the nuclear and subnuclear physics the research is focused on ultrarelativistic collisions of heavy ions, spin effects in small nucleon systems and use of nuclear radiation in medicine.

In the theoretical physics we are expanding the theory of condensed substances and statistical methods for the analysis of phase transitions and critical phenomena in materials, including description of their magnetic and elastic properties.

The research in astrophysics concentrates on the study of physical processes in interacting variable stars.

The theory of physics teacher's training is elaborated in the area of new interactive methods and instruction strategies for elementary and secondary schools and universities.







# CHEMISTRY

Chemistry is one of the traditional study branches offered by the Faculty of Sciences that is currently developed at 7 workplaces of the Institute of Chemistry. The quality of the research and education in the field of chemistry has been endorsed, in the recent years, by several laureates and nominees of national science awards. Several publications of our chemists rank as the most cited in international databases for the given year.

In the field of analytical chemistry, we specialize in developing methods suitable for automation and miniaturisation of analytical measurements in compliance with the principles of environmentally-friendly chemistry and for their application in the analysis of biological samples, pharmaceutical preparations, food and water and for enantioselective separation of biologically active analytes.

The research in the field of inorganic chemistry focuses on the complex compounds displaying anti-tumour, antimicrobial and toxic effects. We also examine their molecular and low-dimensional magnetism and develop porous materials on the basis of silica and MOF-type compounds (metal-organic frameworks), suitable, for example, for the storage of hydrogen or other gases. The TRIANGEL Top Research Team has been accredited at the Institute to specialize in this area.

In the field of physical chemistry, we have been very successful especially in the development of lithium-sulphur (Li-S) batteries which research result-

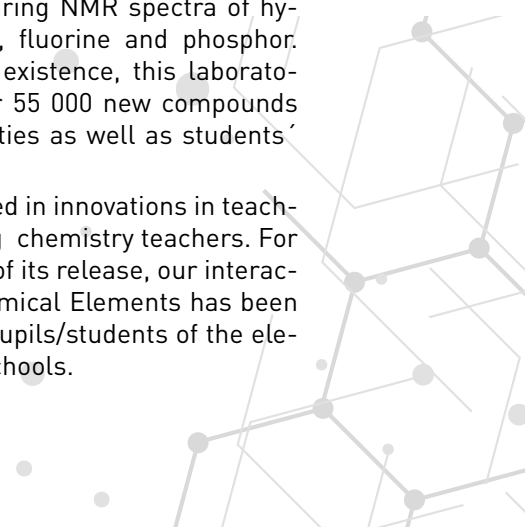
ed in two patents. During the COVID-19 pandemics we proposed electrochemical sensors for detection of viruses. We are developing degradable biomaterials, nanomaterials for medicine, and also new catalysts, for example, for hydrogen production.

Our biochemical research is specializing in the structural stability of biomacromolecules, especially proteins and nucleic acids. Currently we focus on an interaction of medications with nucleic acids that aid in clarifying their primary effect on the molecular level.

In the field of organic chemistry, we are concerned with a targeted and effective synthesis of sphingolipid structures and analogues of indole phytoalexins with antiproliferative/cytotoxic profile, amino-saccharides as inhibitors of glycosidases, and multifunctional compounds on the basis of tacrine, acridine, coumarin and quinoline with an expected effect against the Alzheimer disease.

The spectroscopic determination of structures and properties of chemical compounds is conducted in a specialized Laboratory of Nuclear Magnetic Resonance (NMR) by measuring NMR spectra of hydrogen, carbon, nitrogen, fluorine and phosphorus. For half a century of its existence, this laboratory has characterised over 55 000 new compounds within the research activities as well as students' final theses.

We have long been engaged in innovations in teaching chemistry and training chemistry teachers. For example, in the first year of its release, our interactive Periodic Table of Chemical Elements has been seen by more than 8000 pupils/students of the elementary and secondary schools.







# BIOLOGY AND ECOLOGY

pfupjs



pfupjs



Přírodovědecká fakulta UPJŠ



For the past 60 years, the biological research of the Faculty has expanded to split into various sub-branches, and today it is coordinated by the Institute of Biology and Ecology at 8 workplaces. The research has a heavy interdisciplinary outreach especially into chemistry, physics and medicine. We collect new information also thanks to the top laboratory equipment allowing histological and immunofluorescent procedures, confocal electron microscopy as well as molecular-biological analysis.

In the field of cell biology we are concerned with experimental oncology and influence of hypericin, skyrin, and photodynamic therapy on multiple drug resistance of tumours. We develop personalized medicine aiming to set up DNA-RNA nanoparticles that get activated only in tumour cells. Another line of research is focused on the development of an RNA aptamer specific to SARS-CoV-2 spike protein. We examine development processes in the spinal cord and when it is injured. Another research topic are in vivo pharmacokinetic analyses of selected substances.

In genetics we focus on the regulation of biosynthesis of secondary metabolites in the representatives of the *Hypericum* plant species. We examine gene associations with antitumour effects of these

substances. We concentrate on the understanding of the generation of secondary metabolites in the plant tissues and cells, including those that are genetically modified. Bioactive substances for biomedical applications are examined by the accredited BIOACTIVE Top Research Team.

Physiology of animal species is oriented on the examination of brain structures influenced by neurodegenerative diseases, depression, and brain tumours. We have clarified the potential of various substances which are chemically conditioning the origination of tumours, and explained immunologic, metabolic and hormonal effects of selected



chemo-preventive substances. In ethology we deal with ectoparasites in reptiles and the role of reptiles in the reservoirs of pathogens.

The Faculty's new specialization is microbiology where we focus on the bacteria living in extreme environmental conditions, such as hot springs or waters with high concentration of salts and acids. We have identified a lot of extremophile bacteria, that have been unknown to science, which have interesting properties that may be useful in biotechnology. We also examine the spread of genes of antibiotic resistance in the environment outside hospitals.

The botanical research specializes on the impact of ultraviolet radiation on the physiological and biochemical processes in the cells of cyanobacteria, algae, lichens and bryophytes in diverse geographic environments, including polar areas. We isolate new bioactive substances, such as secondary metabolites that may be utilized in the production of medications. Precious results have been acquired in the field of plant evolution, biosystematics and plant physiology.

The zoological research deals with the population of water and soil invertebrates, flying insects and vertebrates. This research is focused on diversity and ecology of arthropods of the Western Carpathians karst areas, and we discovered several new spe-



cies. We examine the changes in the soil fauna of the spruce forest hit by the wind calamity. Significant results have been achieved in the research of the populations of newts, frogs, and bats and their adaptation to urban environments.

We are also advancing didactic methods of education in biology and we are incorporating our experience into the training of biology teachers.



matematika.upjs



matematika.upjs



# MATHEMATICS

The research tradition in mathematics dates back to the early days of our Faculty when the research foundations were laid down in algebra, geometry, and mathematical analysis. Nowadays it continues under the auspices of the Institute of Mathematics operating in 4 divisions dealing with a wide range of research topics.

In the area of mathematical analysis, set theory, and topology theory, the research is focused on aggregations, especially non-additive measures and integrals, which are useful in the image processing and lots of other applications. The research is concerned with theoretical questions of time-frequency analysis as well as modelling of discrete and continuous, deterministic, and stochastic dynamic systems. In cooperation with the Mathematical Institute of the Slovak Academy of Sciences in Košice the set-theo-

rem topology is being elaborated, including the application of the set theory in the real analysis.

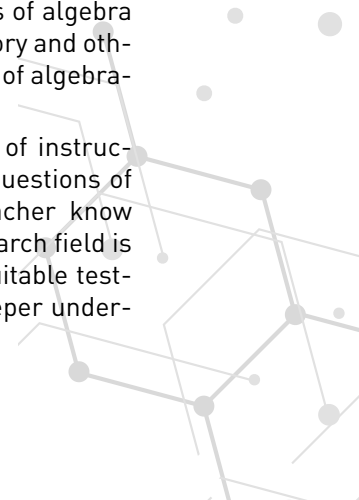
The research in statistics is focused on stochastic processes and their application, multi-dimensional linear models, modelling of dependences in multi-dimensional models, time series predictions, and application of statistics in medicine and mathematical economics.

In the field of game theory attention is focused mainly on the cooperative models with non-transferrable utilities which have several practical applications in searching for kidney donors, assigning graduates to work positions or study places.

The research in graph theory is focused mainly on the colouring and structure of graphs, topological theory of graphs, graph cycles, application of graph theory and evaluated graphs. The Košice Group of Discrete Mathematics is operating at the Institute accredited as KOSDIM Top Research Team.

The algebra research concentrates on the arranged structures and universal algebra which generalizes the knowledge obtained in various areas of algebra (group theory, linear algebra, lattice theory and others), and it examines general properties of algebraic systems with finitary operations.

The research in the field of the theory of instruction in mathematics is focused on the questions of what should a good mathematical teacher know and how s/he may learn it. Another research field is formative evaluation, identification of suitable testing methods which could result in a deeper understanding in mathematics.



# COMPUTER SCIENCE AND DATA ANALYSIS

UstavInformatikyUPJS  uinf.sk 

Research in computer science is conducted at the Institute of Computer Science, which encompasses three departments and was organically formed from the previous Institute of Mathematical Sciences.

Capitalizing on emerging trends, our focus has shifted towards artificial intelligence (AI) in data analysis. We are dedicated to advancing AI methodologies, particularly in machine learning and neural networks. Our developments include healthcare applications such as diagnostic ECG record classification, predicting surgical interventions, and automating report control. Additionally, we're enhancing AI techniques for textual analysis, understanding content and relationships within texts. This includes applications for anomaly and plagiarism detection, language modeling for chatbots, sentiment analysis of texts, and generating literary content.

In cybernetics and information security, our research is centred on addressing security threats, including the detection and prediction of security attacks, modelling attacker behaviour, and designing traps for attackers. Our innovations contribute to systems for detecting and analysing network security awareness.

We're also exploring formal conceptual analysis and the application of fuzzy sets to uncover latent meanings in heterogeneous and incomplete data sets. This research has led to developments in recommendation systems, quantum computing, and the teaching of mathematics.



In the realm of neurocognition, our studies delve into how the brain processes complex auditory and visual stimuli in noisy environments. This research has practical applications in enhancing hearing aids, auditory displays, human-computer interaction, and virtual reality technologies.

In the fields of automata, formal languages, and graph theory, our focus is on the descriptive and computational complexity of automata and algorithms. We work on effective automata representations for programming languages, analyzing complexity in automata, language operations, and developing time-efficient algorithms.

Our research in indoor navigation and localization aims to enhance the accuracy of smartphone positioning by Bayes filters, camera imagery, sensor data, and wireless network signals.



# GEOGRAPHY

ustavgeografie



geography\_kosice



Košice Geography

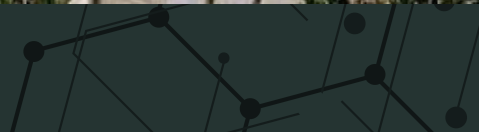


Geography is our youngest field which has been developed for over two decades at the Institute of Geography. The research is focused on development and applications of geographic information systems, methods of geoinformatics, and open-source remote exploration of Earth. The development of methods of geospatial modelling has solid grounds being focused on the solar radiation, photovoltaic potential, overheating of towns, soil erosion, and shallow surface flow of water. The Institute of Geography owns a unique technology for the land survey by terrestrial laser scanning and unmanned aerial vehicles (UAV) with a laser scanner of multispectral, hyperspectral and thermal camera, including the related computer technology and software.

Thanks to these technologies we are also able to continue elaborating our own original scientific topics, such as the geomorphological development of caves and karst areas, urban heat islands, paleogeography and minerals, structure of the country and its transformation under the influence of the use of renewable energy resources, transformation of industry and agriculture, migration and dynamics of residents. We also develop a 3D geospatial visualisation and interaction with geographical data in the form of Touch GIS, virtual reality and 3D print, especially to increase the attractiveness of geography instruction at schools and dissemination of the public awareness concerning the positives of the geospatial modelling.







## DIDACTICS OF SCIENCE SUBJECTS



Prírodovedecká fakulta UPJŠ

Our institutes host specialized teams of academic staff who focus on various educational aspects of teaching the science. These include researching the effectiveness of teaching methods and strategies, training aspiring teachers, supporting ongoing professional development for educators, nurturing talented youth, and promoting science education. This multifaceted approach ensures a dynamic and impactful contribution to the field of education. Within the international grant cooperation (such projects as the 7th FP: Establish, Sails, Erasmus: FunThink, AleMP), we are introducing new trends into the education in Slovakia, which are successfully enhanced by national educational projects (IT Academy, DVUI, MVP). These trends include, in particular, research-oriented education focusing on the fostering of sciences literacy, computational literacy, functional thinking, utilization of tools of

formative evaluation of pupil skills, and conceptual understanding.

Within the framework of digital transformation of education, we work on the implementation of a national strategy that we propose, we educate and support school digital coordinators, network stakeholders in education, we realize and evaluate standardized Selfie surveys at schools, navigate digital excellence action plans at schools, and we are active in participating in the specialization advancement of teachers within the European DigCompEdu framework.

We are engaged in preparing a design of school science laboratories in the Future Classroom Lab fashion, creating educational activities, training teachers and verifying innovative instruction methods (mixed and reversed instruction, IBSE, STEM education) in such inspiring educational environment.

## PROJECTS

Maintaining high standards in research and education is directly linked to adequate funding. We routinely seek support from domestic subsidy agencies like VEGA, KEGA, and APVV, where we achieve very good results. However, our aspirations extend beyond these boundaries, aiming for international funding sources that offer significantly larger budgets than domestic agencies can provide. The competition for these funds is intense, and success hinges on long-term, robust scientific work, as well as the development of both infrastructure and human capital. In recent years,

we have successfully participated in various projects financed by international funds, serving either as the lead beneficiary or as a collaborative partner:

**MHz – Tomoscopy (Horizon Europe, EIC Pathfinder)** is a project in which our Institute of Physics participates as a partner of a wider consortium. The project is aimed to build the first multi-projection hard X-ray scanning microscope capable of capturing images of fast phenomena in 3D by direct observation of objects dynamics, such as atoms and molecules that are not observable by other imaging methods and so far have been accessible only to theoretical simulations and speculations.

**InnoChange (Horizon Europe, EIT's HEI Initiative)** is a project of the Institute of Computer Science of the Faculty of Science UPJŠ in which it operates as a consortium partner. It is concerned with increasing the business and innovation capacity of university institutions and improving the integration of these institutions into the innovation ecosystems in the Central and East Europe. The project connects universities from various innovation environments.

**CasProt (Horizon 2020, Twining)** is a project which is pursued by the Institute of Physics of the Faculty of Science UPJŠ and the Technology and Innovation Park UPJŠ. Its aim is to enhance the scientific capacity and improve the UPJŠ's research profile in the area of biophysics of proteins thanks to the intensive cooperation with the Technical University of Munich and the University of Zurich. This project will also instigate the high-tech development and will advance the innovation potential of our University with an expected impact on the region of East Slovakia as well as Slovakia as a whole.

**UrbanHIST (Horizon 2020, MCSA-ITN)** was a multidisciplinary research and educational program implemented by four universities and various partner organizations as a European Joint Doctorate (EJD). Its objective was to develop and sustainably support a shared understanding of 20th-century urbanism in Europe. The Institute of Geography from the Faculty of Science at UPJŠ was actively involved in this initiative.

**ALT (Horizon 2020, MSCA-RISE)** focused on researching the human brain in relation to adaptation and learning while listening to information in noisy and distracting environments. This project, conducted by the Institute of Informatics, provided new insights into the neural structures and cognitive processes of learning, crucial in everyday situations. A notable outcome includes mobile phone brain training games designed to enhance the auditory abilities of both individuals with normal hearing and those with hearing impairments.

Among the cross-border cooperation projects supported by the European Regional Development Fund, notable ones include EFUSE, GeoSES, and TOKAJGIS. We were also successful in securing contracts from the European Space Agency (ESA).

The NANOVIIR, iCoTS, OPENMED, and BioPickmol projects, co-financed by the European Structural and Investment Funds, have been instrumental in enhancing our infrastructure. These initiatives have enabled us to construct new facilities, renovate buildings, and develop innovative technologies, including virus detection sensors, advanced electro-batteries, and novel analytical procedures in chemistry, physics, and biophysics. Additionally, the comprehensive IT Academy project has revolutionized the didactics of science, mathematics, and computer science. This project has introduced new educational methodologies, learning materials, and has provided comprehensive training for teachers in elementary and secondary schools.

## TOP RESEARCH TEAMS

The Accreditation Agency of the Slovak Republic identified 4 Top Research Teams operating at our Faculty:

- Quantum Magnetism and Nanophysics (QMAGNA),
- Bioactive Substances for Biomedical Applications (Bioaktiv),
- Inorganic Materials (TRIANGEL),
- Košice Group of Discrete Mathematics (KOSDIM).





## UNIVERSITY SCIENCE PARKS

In the past decade, the Faculty has embraced the opportunity to contribute to the development of three university science parks (UVP) in Košice. These parks are dedicated to transferring knowledge and technology into practical applications and fostering entrepreneurial activities. We are involved in the UVP Medipark, which specializes in medicine, biophysics, and biochemistry, and the UVP Technicom, which concentrates on knowledge and computer science technologies. Additionally, we are engaged in research at the Promatech Research Centre, focusing on advanced ma-



terials. These initiatives represent our commitment to bridging academia and industry, driving innovation in these critical fields.

## INTERNATIONAL COOPERATION

As one of its priorities, the Faculty supports its young scientists, interdisciplinary research and cooperation with foreign partners. By means of intergovernmental agreements we are members of international collaborations, such as DESY (Deutsches Elektronen Synchrotron) and XFEL (European X-ray Free Electron Laser) in Hamburg, Germany, CERN LHC (Large Hadron Collider), Geneva, Switzerland, and JINR (Joint Institute for Nuclear Research) Dubna, Russia. Over twenty agreements with foreign universities and research workplaces, including, inter alia, Ilmenau University of Technology (Germany), University of Lodz (Poland), University of Florida (USA), Kharkiv National University (Ukraine), Uppsalla University (Sweden), bring about the real results and inspiration for further research. The ERASMUS+ Programme plays a crucial role in facilitating networking and the exchange of knowledge across European academic and research institutions for our staff.

## PATENTS AND UTILITY DESIGNS

The outcome of our research has resulted in the registration of several patents in the field of chemistry, biomedicine and physics. They include, for example, a patent for new catalysts for organic synthesis, batteries, sensors for virus detection and nanomaterials.

## EXPERT CONSULTANCY AND COLLABORATIVE PARTNERSHIPS

Within our research and development we have contracts with several firms and state institutions, such as Tepelné hospodárstvo Košice (Heat Management of Košice), Chemko Strážske (chemical industry), VSL Software (software design), Správa slovenských jaskýň (Management of Slovak Caves), NOVISOFT, Louis Pasteur University Hospital in Košice. We have considerably contributed to the preparation of CO<sub>2</sub> emission balances for the City of Košice as well as the preparation of an urban plan and a civil defence plan for Košice. We have conducted training for the employees of T-Systems, U.S. Steel, the Self-government region of Košice in data analysis and geoinformatics.

# STUDY WITH A PERSPECTIVE

Enthusiasm of researchers and teachers of the Faculty of Science has been shaping the personalities and professionalism of our graduates. Along with the employment of top research infrastructure in the instruction, the zeal of our staff is one of the key factors of our graduates having excellent prospects to find placements especially in research, industry, education as well as commerce. The portfolio of science studies have been extended in course of decades of the Faculty's development and today it includes such fields as physics, biology, chemistry, mathematics, computer science, geography and their teacher's training, with interdisciplinary fields progressing as well: biophysics, biochemistry, geoinformatics, data analysis and artificial intelligence.

Our students can opt for their favourable specialization on all the three academic levels of study. Since their number is lower than it is at other universities, we are able to work with them on an individual basis. They can also get employed at our Faculty as assisting staff and thereby participate in our research directly.

The flexibility of study is ensured by an offer of interdisciplinary studies in two sciences fields or one sciences subject in combination with another subject from humanities. At the master's level students can decide to continue only in a single preferred major, or they can pursue interdisciplinary studies aiming to become a teacher of the two of the fields.

It is our priority to motivate the best, most ambitious and strong-minded graduates from master's study programmes to pursue their academic careers in the PhD studies. PhD students bring new energy and represent an active force for the life of the Institutes and Departments. They obtain a four-year scholarship to actively participate in the education and benefit from new and original scientific results in research. They acquire the skills of presentation and defence of their academic results in front of the the international scientific community. Finally, they become experts in their fields and have no problem to find job positions at home or abroad.

A detailed offer and description of study programmes along with the subjects taught are available here:

<https://studijne-programy.upjs.sk/>



Our research focus in particular areas of sciences is naturally reflected in the study possibilities that we offer to our prospective students. Thanks to the synergy of research and education, our graduates are well prepared for the practise, they can easily find placements and employments in their respective specializations. The factors that contribute to

these positive trends are the real-life experience with modern technologies already during their studies, focus on the sound self-study and collegial cooperation with their teachers. The current study options and possibilities of finding placements in respective branches will be summarised in the following text.



## PHYSICS

Bc.	Mgr.	PhD.	STUDY PROGRAMME
•	•	•	biophysics
•	•	•	physics
•			interdisciplinary study of physics in combination with another sciences or humanities subject
	•		physics education in combination with another sciences or humanities subject
	•	•	physics of condensed matter
		•	progressive materials
		•	physics education

Graduates in physics study programmes are equipped with comprehensive competences and are experienced in practical physical experimenting, computer modelling of processes and theoretical work. They have deep knowledge and skills that are critical in the sphere of high-tech production and research, logical and exact thinking, they have experimental as well as programming skills, and are capable of working as team members. This synergy of the competences of our physicists and biophysicists equips them with a competitive advantage compared to less demanding study fields. Graduates easily find their job positions at home as well as abroad in the companies' departments engaged in the research and development of sensors, nanoparticles, magnetic, quantum and other smart materials, machinery, medications, and banks. They are in-demand also at radiology departments

of hospitals. They work for the centres of particles accelerators, such as CERN, XFEL, research institutions, universities, and astronomic observatories. Many of them are courageous enough to open their own start-ups, they are successful in business and launching technological innovations.

## CHEMISTRY

Bc.	Mgr.	PhD.	STUDY PROGRAMME
•			chemistry
•			interdisciplinary study of chemistry in combination with another sciences or humanities subject
	•		didactics of chemistry in combination with another sciences or humanities subject
	•	•	analytical chemistry
	•	•	inorganic chemistry
	•	•	biochemistry
	•	•	physical chemistry
	•	•	organic chemistry

Graduates from our chemistry study programmes find a wide range of placement possibilities. They



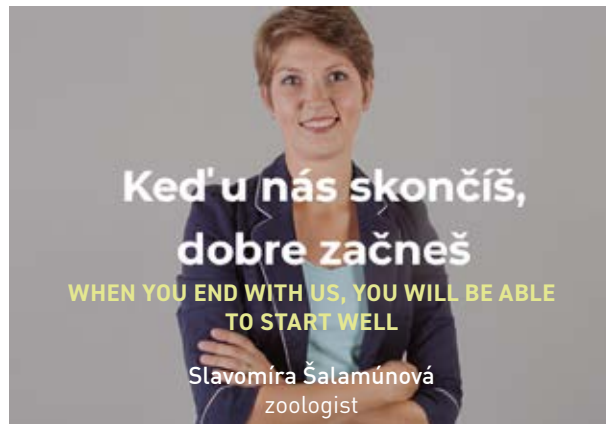
guarantee the precise analysis and synthesis of substances and deep knowledge of both the theory and experimental work in the area of pharmacy, cosmetics, agriculture, food industry, manufacture and characterization of materials, thanks to which they operate at research workplaces of the Slovak Academy of Sciences and universities in Slovakia as well as abroad. They are employed by biochemical laboratories in hospitals, water management companies, control, testing and diagnostic firms, or analytical laboratories of water filter plants and wastewater treatment facilities or agricultural firms. They can also work as forensic analysts with the police. Their placements in generation and storage of energy in relation to electrical batteries and hydrogen is becoming a rising trend.



## BIOLOGY AND ECOLOGY

Bc.	Mgr.	PhD.	STUDY PROGRAMME
•			biology
•			interdisciplinary study of biology in combination with another sciences or humanities subject
	•		didactics of biology in combination with another sciences or humanities subject
	•		botany and plant physiology
	•		genetics and molecular cytology
	•		zoology and animal physiology
		•	molecular cytology and genetics
		•	zoology and animal physiology
		•	plant physiology

Graduates from biology- and ecology-oriented study programmes make up a wide range of specialists



working as analysts in microbiological, genetical, biochemical, veterinary and hygiene laboratories and in research and development of pharmaceuticals, assisted reproduction and physiology of plants and animals. They are able to determine heritability and examine genomes, assess the effect of medications as well as the impact of the external environment on the phenomena occurring inside organisms. They are able to manage, protect and utilize the environment, but also grow agricultural plants and ornamental plants. They are in demand in research institutions as well as universities.



## MATHEMATICS

Bc.	Mgr.	PhD.	STUDY PROGRAMME
•			mathematics
•	•		economic and financial mathematics
•			interdisciplinary study of mathematics in combination with another sciences or humanities subject
	•		didactics of mathematics in combination with another sciences or humanities subject
	•		managerial mathematics
		•	applied mathematics
		•	discrete mathematics
		•	theory and practice in teaching mathematics

Graduates in mathematics have deep knowledge in the theory of mathematics and statistics thanks to which they can find placements wherever data analysis is at the table and the requirement is to determine the formal procedure for an analysis and the modelling of a development of various types of data. They usually lead analytical teams in banks and insurance companies, financial institutions, state-owned and commercial firms. They create and tailor products to fit both their employers as well as clients. Their capabilities of formalizing practical problems in the software environment ensure their universal placements.

## COMPUTER SCIENCE AND DATA ANALYSIS

Bc.	Mgr.	PhD.	STUDY PROGRAMME
•	•	•	informatics
•	•		data science and artificial intelligence
•			applied informatics
•			interdisciplinary study of informatics in combination with another sciences or humanities subject
	•		didactics of informatics in combination with another science or humanities subject

Computer science graduates from UPJŠ in Košice are capable of utilizing their skills of formalizing the assigned tasks. Therefore, they are commonly hired to design the software solutions that graduates from other universities learn to handle. They solve problems concerning the effective processing



of data of varied origin (chemical, biological, medical, literary, legislative, imaging), employing modern technologies of machine learning/teaching, and they are highly competent in the area of information and cybernetic security. It is quite common that they establish start-ups and are in charge of IT departments of supranational companies. They find their placements on the labour market immediately after the completion of their studies, and not rarely already during their studies.

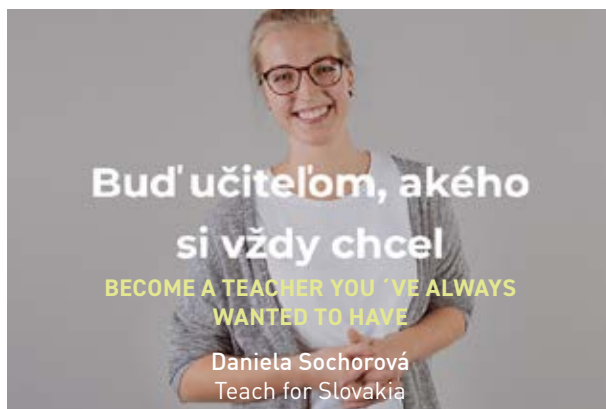


## GEOGRAPHY AND GEOINFORMATICS

Bc.	Mgr.	PhD.	STUDY PROGRAMME
•			geography and geoinformatics
•			interdisciplinary study of geography in combination with another sciences or humanities subject
	•		geography teacher's training in combination with another sciences or humanities subject
	•		geography and geoinformatics
		•	geoinformatics and remote sensing

Graduates in geography study programmes are fully competent to analyse interactions between the countryside and the human society, to design solutions to problems in the municipalities or regions by means of geoinformatics technologies, including the field work. Since vast majority of decisions is currently taking place on the ground of the data obtained at a particular place and at a certain point in time, the experience of our geographers with data assessment makes them highly competitive at the labour market. This being said, our graduates find their placements in companies managing transportation of raw materials, road traffic network and energy distribution, at the level of state and public administration, in urban planning, geodetic firms, mobile operators and in precise agriculture. They can work as geographic information systems experts, GIS analysts, cartographers or specialists for the processing of images from satellites, airplanes and drones.





Bc.	Mgr.	PhD.	STUDY PROGRAMME
			<ul style="list-style-type: none"> <li>interdisciplinary study of physics, chemistry, biology, geography, mathematics, or computer science in combination with another sciences or humanities subject</li> </ul>
			<ul style="list-style-type: none"> <li>teacher's training in physics, chemistry, biology, geography, mathematics, or computer science in combination with another sciences or humanities subject</li> </ul>
			<ul style="list-style-type: none"> <li>physics education</li> </ul>
			<ul style="list-style-type: none"> <li>theory and practice in mathematics teaching</li> </ul>

Graduates from our teacher education programs are well-equipped to bring modern, immersive teaching techniques to primary and secondary schools, grounded in their deep understanding of dual-major subjects. These graduates often become integral members of school administrations, lead specialized extracurricular activities, and develop innovative teaching methods. They find themselves highly sought after in the education sector, particularly in high-demand areas like physics, mathematics, and computer science, where there is a notable shortage of qualified teachers.

Moreover, our teacher training graduates are consistently among the most favored educators in schools. They have a unique ability to inspire and motivate their students about their subjects, pre-

## TEACHING EDUCATION PROGRAMME

Bachelor students aspiring to become teachers have the option to pursue an interdisciplinary study mode, combining two majors. At the master's level, they have the flexibility to either continue their teacher training or specialize in just one of their two chosen subjects. Doctoral study provides an opportunity to delve into research in the didactics of physics or mathematics, focusing on theory of education. Additionally, for those seeking to broaden their teaching qualifications, we offer a 5-semester specialized program in subjects such as physics, geography, computer science, and mathematics.



paring them for various extracurricular competitions where they frequently achieve top results. This holistic approach to teaching not only educates but also actively engages students, making learning a more dynamic and fulfilling experience.

# WHY TO STUDY WITH US?

## QUALITY SCIENCE = QUALITY STUDY

As a research university, we take pride in generating valuable insights for society. The high scientific quality of our work is evidenced by publications in prestigious journals, a testament to our robust domestic and international collaborations and involvement in numerous research projects. This research excellence enables us to offer contemporary natural science studies and teacher training programs, combined with other subjects, across all three academic levels.

Our students have the unique opportunity to engage directly in research and gain experience as part of the assisting staff. Moreover, our relatively smaller student body allows us to provide personalized, individual tutoring, ensuring a more focused and supportive educational experience. This approach not only enriches their learning journey but also fosters a deeper understanding and practical application of their studies.

## LESS IS SOMETIMES MORE

The relatively small size of our faculty comparing to others offers a unique advantage: the ability to know almost every student personally and promptly address any adaptation or personal challenges they may face. Students particularly value working in smaller groups, having personal consultations with thesis supervisors, and receiving support in their research activities and internships. Such experiences at the faculty level enhance students' research skills, as they often participate in research projects



during their studies.

We also encourage academic excellence and sports by awarding scholarships for academic achievement and motivation in their respective fields. Building strong, friendly relationships with students begins from their first year, through informal three-day retreats outside Košice. These gatherings not only facilitate student bonding but also provide an opportunity for us to introduce the university's operations and outline their study journey.

## EXPERIENCE FROM ABROAD

Thanks to the diverse study opportunities available across Europe, students at UPJŠ in Košice can readily gain international experience. We actively support our students in pursuing education and internships abroad. For instance, through the Erasmus+ program, our students can benefit from partnerships with over 100 institutions, allowing them to participate in exchange programs during or even





after their studies. In certain disciplines, they have the option to enroll in international double degree programs, offered in collaboration with partner universities in Spain, France, Sweden, the Czech Republic, Poland, and Ukraine. Additionally, we encourage participation in summer schools and workshops.

Another valuable aspect of our campus life is the daily interaction with over a hundred international students and staff members who have joined our faculty as part of their career development. This multicultural environment enriches the educational experience for our domestic students, broadening their perspectives and fostering a global outlook.



## STUDENTS ACTIVITIES

We greatly value proactive students, many of who are involved in the Students Council. Faculty supports their efforts in organizing entertaining and meaningful activities, such as November freshmen matriculation ball, evening quizzes, publishing of the “Prímes” magazine. Academic staff and students jointly celebrate the Science Days regularly organized with Student Council in April. The students also organize charity events, blood donations, and in promotional activities for the university. Beyond these activities, our students also excel in university sports clubs across hockey, football, basketball, and e-sports, demonstrating their diverse talents and team spirit.



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## ACCOMMODATION AND DINING FACILITIES

Our students have access to comfortable living arrangements in dormitories situated at Medická Street 4 and 6, and Popradská Street 66 and 76, offering a total of 1,755 spaces. The Faculty of Science primarily houses its students in the Medická Street complexes, which feature amenities like a dining hall, buffet, social areas, and sports fields, all conveniently located on campus. These dormitories are ideally positioned close to faculty buildings and the city center, providing easy access to a variety of cultural, social, and sports activities, as well as excellent transportation links to other faculties.

The university offers catering services at multiple locations, staffed by a team of over 50 professionals



who work in four state-of-the-art kitchens and two food distribution centers. These facilities, located at Medická 4, Moyzesova 9, Tr. SNP 1, and Jesenná 5, with distribution points at Mánesova and Popradská Street, are dedicated to preparing high-quality, delicious meals for our students, staff, and visitors.

Our commitment to sustainability and healthy eating is demonstrated through our participation in the “Green Dining Room” project, in collaboration with the Slovak Vegan Society. This initiative is part of the wider “Meatless Monday” movement, encouraging the consumption of plant-based foods over meat and animal products at least once a week, preferably on Mondays.

Additionally, the Minerva building at Moyzesova Street 9 houses a new café, offering a contemporary and inviting space for students and the public to unwind and socialize between lectures. This café enhances the vibrant campus life, providing a perfect spot for relaxation and engagement.

Details about accommodation and dining facilities:



## KOŠICE: A VIBRANT HUB FOR LEARNING AND LIVING

Košice is an unparalleled destination, offering the ideal setting to begin and establish a life. This vibrant city is home to over 220,000 people, with thousands more commuting for work. It stands as a city of youth, with four universities educating over 20,000 students from 50 countries worldwide. At UPJŠ, approximately 7,000 students enroll each year, with around 1,000 at the Faculty of Science.

Thanks to its perfect size, Košice combines the convenience of proximity with the affordability of a smaller city. Between lectures, students can enjoy a stroll in the historic city center, savoring coffee or street food. They can also choose from an array of cultural events. Opportunities abound for work, entertainment, and self-actualization. The Košice IT Valley, encompassing 50 companies in the IT, high-tech, and creative industries, including start-ups

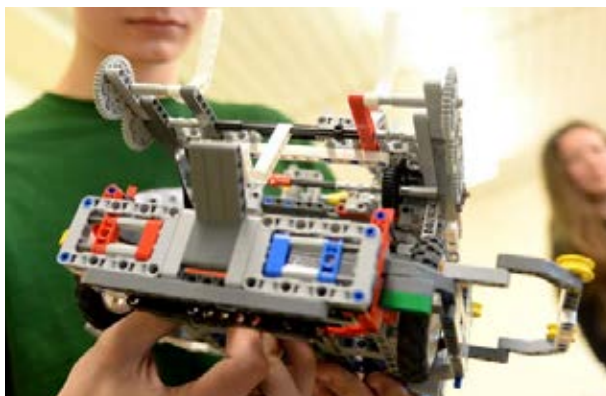


and global business giants, makes Košice not just a place to study, but a vibrant community to grow professionally and personally.

## COMMITTED TO COMUNITY

### WE SUPPORT TALENTED PUPILS AND STUDENTS

Due to our long-term work with talented youths, the Faculty was assigned a title 'European Talent Point'. The Faculty often becomes a place of regional and national rounds of Olympiads in individual subjects. The Faculty's staff operate as presidents of regional commissions and members of national commissions of Olympiads in respective subjects



and of Tournaments of Young Physicists. We organize regular meetings concerned with solving competition assignments and preparing advanced rounds of competitions, providing consultations and professional tutorials for research theses submitted to the competition known as Students' Research Activities (SOČ), where we also provide our laboratories in which pupils/students solve research issues under the supervision of our staff.

The Faculty hosts regional rounds of the competitions of scientific-technical projects known as AMAVET, IQ Olympiads, Tournament of Young Physicists, Physical Charge, First Lego League, and Botanikiad. In the UPJŠ historic aula we conduct award ceremonies where we appraise winners of the Olympiads as well as teachers who have devote their time to supervision of pupils/students.

In the field of nuclear physics, we have participated in the programme of International Particle Physics Masterclasses, within which students of secondary schools become, for one day, members of the scientific teams of physicists at some of 80 universities around the world and get acquainted with solving current problems of the global research.



## PARTNER SCHOOLS

The Faculty maintains a partnerships with 13 secondary schools in the Košice and Prešov regions. These partnerships are aimed to popularize the sciences among students of these schools, including a possibility to make use of the laboratories and professional consultations in the context of Olympiads in the respective subjects and other competitions. Through the Club of Schools Headmasters, we regularly meet with members of the management of secondary grammar schools and secondary vocational schools of East Slovakia to discuss the current needs of the education of pupils/students and teachers, and changes in the education legislation.

## WE ARE GOING PUBLIC

The Faculty engages in numerous events, either as a participant or even an organizer, aiming to advertise itself and the results of its research among the general public, to promote science and the study programmes on its offer. We can meet at the following lectures, interactive exhibitions and entertaining events:

SEPTEMBER • European Researchers´ Night

- Slovakia TechEXPO Košice  
– a professional fair

DECEMBER • The Nobel Prizes in Focus

- lectures

OCTOBER, FEBRUARY • Doors Open Day

MARCH • Kill Boredom with Science

- a programme during written A-level tests

- Other Journeys – a travellers´ festival, other than usual

APRIL • HackKošice

- an international hackathon organized by the Major League Hacking

- Days of Natural Sciences
- Students´ Scientific Conference
- Students´ Pranks Conference ŠTRK

## NONGOVERNMENTAL ASSOCIATION – “OZ PRÍRODOVEDEC” (NATURAL SCIENTIST)

For over 20 years the OZ Prírodovedec is a venue to support teaching and scientific activities at our Faculty, to implement developmental projects for the support of talented students and their mobilities abroad, to organize events and foster traditions of the profession.



MAY • Try a Day of an University Student

- a programme during oral A-level examinations

JULY • Children´ s University

- a daily camp for children

### THROUGHOUT THE YEAR:

- Teachers´ Clubs – professional events for teachers of sciences subjects,
- Educational Fairs: ProEduco, Gaudeamus, Which University is Right for You, University Fair at the Pavol Horov Secondary Grammar School in Michalovce,
- Data Days activities for prospective students of mathematics, computer science and data analysis,
- Science Tearoom – lectures about the research at the Faculty whose list is available here:





## GRADUATES AND GOLDEN GRADUATION CEREMONY

It has been over 8,000 graduates so far that have left the gates of the Faculty to join the profession. Annually, it is usually a total 120 of them at the three levels of academic study.

The 60-year tradition of the UPJŠ's education and research in sciences has become manifest in the Slovak society by hundreds of quality teachers, professionals, researchers, managing leaders or businessmen. We would like to keep in touch with our graduates, therefore after their graduation we create opportunities for them to register via the Alumni Space portal.



In 2017 we had an opportunity to conduct the first Golden Graduation Ceremony to which the Faculty's graduates were invited after 50 years that had passed from their university graduation, as the first graduates left their alma mater in 1967.

If you are not a member, yet, join at:





# AWARDS

The quality of the Faculty's research and education is endorsed by independent appraisals of our employees. We are very proud of our laureates and we are aware that their success is backed by the teams of other colleagues and students standing behind them. All of them together are a positive, motivating example for others. In the previous years, the quality of our research and education have been underlined by several nominations and laureates of awards within the ESET Science Awards, the Researcher of the Year, The Slovak Woman of the Year, L'Oréal – UNESCO Women in Science. Not a few publications in the field of chemistry, physics, and mathematics rank with the first percent of the publications that are most-cited in the given year in the Web of Science, the so called 'Highly Cited' category.



## **ESET Science Award 2023**

prof. RNDr. Katarína Cechlárová, DrSc.,  
matematician, finalist in the category "Outstanding  
Personality of University Education".

## **ESET Science Award 2022**

doc. RNDr. Miroslav Almáši, PhD.,  
chemist, laureate of the award "Outstanding Slovak  
Scientist under the Age of 35",

prof. RNDr. Renáta Oriňaková, DrSc.,  
chemist, finalist in the category "Outstanding  
Personality of University Education".

## **ESET Science Award 2021**

RNDr. Martin Gmitra, PhD., physicist, finalist in the  
category "Outstanding Slovak Scientist",

RNDr. Ivana Šišoláková, PhD.,  
chemist, finalist in the category "Outstanding Slovak  
Scientist under the Age of 35".

### ESET Science Award 2020

prof. RNDr. Vladimír Zeleňák, DrSc.,  
chemist, finalist in the category  
“Outstanding University Teacher”.

### Science and Technology Award 2021

The scientific team of the EDEVIR project of prof.  
RNDr. Renáta Oriňaková, DrSc., from the Institute  
of Chemistry of the Faculty of Science UPJŠ, in the  
category “scientific-technology team”.

### Scientist of the Year of the Slovak Republic 2018

prof. RNDr. Vladimír Zeleňák, DrSc.,  
chemist, prize laureate.

### Science Promoter 2019

doc. RNDr. Marián Kireš, PhD.,  
didactitian of physics, prize laureate.



### L'Oréal - UNESCO Women in Science 2019

RNDr. Vlasta Demečková, PhD.,  
microbiologist, prize laureate.

### L'Oréal - UNESCO Women in Science 2018

doc. RNDr. Andrea Straková Fedorková, PhD.,  
chemist, prize laureate.

### Slovak Woman of the Year 2019

prof. RNDr. Renáta Oriňaková, DrSc.,  
chemist, finalist in the category Science and Research.

# OUR VISION

The vision for the future of our university hinges on its internationalization. This strategic direction stems from the growing trend among high school students to pursue studies beyond their local regions, the declining population of local residents, and the limited state funding for science and education. Our goal is to attract high-quality student candidates and top-tier professionals, while also encouraging our staff to gain international experience and leverage international funding opportunities to enhance our scientific and technical infrastructure.

To achieve this, we are inspired by both domestic and international university models, focusing on offering courses appealing to an international audience, primarily in English, and pursuing external funding sources such as Horizon Europe, ERC, INTERREG, NATO, ESA, CERN, and XFEL grants. Significant progress has been made in this direction, but there is still much to accomplish.

Critical to this effort is the alignment between the leadership of Pavol Jozef Šafárik University in Košice and its faculties. Our shared objective is to create a motivating work environment that not only benefits the university but also contributes positively to the development of the region and society at large.

## CONTACT US

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Dean's Office of Faculty of Science  
UPJŠ in Košice

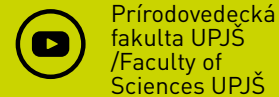
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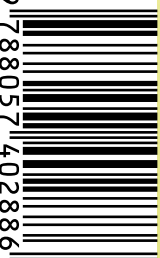




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