



SLOVAK ACADEMY OF SCIENCES
ANNUAL REPORT 2017



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Compiled and edited by: PhDr. Dušan Gálik, CSc.
Mgr. Andrea Nozdrovická

Translation: Celina Barber
Translation revision: PhDr. Dušan Gálik, CSc.

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Photos and images of the best results by SAS research institutes.
Other photos: Vladimír Šimiček, Stano Ščepán and SAS archive

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I. SCIENCE POLICY

The SAS Presidium elected for the 2017-2021 term aims to build a modern scientific and research institution respected both in the domestic and European research areas, producing excellent scientific results enriching the world of knowledge, contributing to raising the level of education and resolving current social and economic problems. In 2017, we have implemented a number of research quality management tools. *Institutional funding* and research support from the SAS budget chapter has been “historic” in nature. We want to secure this funding with a state contract for at least four years, respecting the “value for money” rule.

The first step on this path was the elaboration of the system of financing of SAS scientific organizations which was approved by the SAS Assembly in December 2017. The performance parameters of the scientific organizations are divided into two categories. The first category consists of results of complex accreditation, which was carried out by a system of expert assessment, peer-review and captured all aspects of the performance of the scientific organization. Comprehensive accreditation, the essence of which was the assessment of scientific organizations by the International Panel and began in 2016, was completed in 2017.

The second category consists of performance parameters that can be objectively quantified and evaluated at annual intervals on the basis of data from the annual reports of the scientific organizations. These are: funds obtained – grants for scientific projects, numbers of trained PhD students and the most important scientific publications and citations. In support of quality management, in 2017 SAS managed to raise funds with the Ministry of Finance of the Slovak Republic in excess of the approved SAS budget. For 2016–2017, the executive funding of scientific organizations for mediated performances will constitute these funds and five percent of the wage bill in 2018, representing over two million three hundred euros.

Another tool to support the quality of scientific work in 2017 was the awarding of top-level publications in three categories. These are scientific publications from the previous year in the scientific journals with the highest impact measured by the SJR (Scimago Journal Ranking) index, falling into the first percentile with the highest SJR in relevant scientific areas. In addition, these are the high-cited publications with the highest number of citations obtained during 2013–2015, which, according to the parameters of the Essential Science Indicators Web of Science, are among the so-called Highly Cited Papers. The third category was top scientific monographs published at renowned publishers. SAS has also begun with the recognition and support of individual Horizon 2020 projects that have not received funding from Brussels but received a Seal of Excellence as a recommendation for national funding. An important tool for the acquisition of talented young scientists from abroad was the project of the 7th Framework Program, SASPRO. In 2017 SAS, together with Comenius University in Bratislava and the Slovak University of Technology in Bratislava, submitted the SASPRO2 project within Horizon 2020, which unfortunately was unsuccessful. SAS will re-submit the project in 2018 and is also considering building a similar project scheme that will be designed for excellent young

researchers with a view to submit a European Research Council (ERC) project. The activities of the Academy continued as a grant agency, the only one in Slovakia, to support the participation of SAS research teams in ERA-NET projects. Projects funded by SAS along with Taiwan, South Korea and Turkey among others, also continued.

The Research and Development Agency, APVV, remains a decisive instrument of project funding for research in Slovakia and in SAS. The Academy is the most successful applicant, with SAS projects accounting for about 20 percent of the projects submitted to general challenges, with about 30 percent of them successful. In 2017, the continuity of the annual announcement of general calls was maintained. Unfortunately, the budget of the APVV could not be increased, so apart from the general call for VV 2017 no other programs, such as support of young researchers, industry cooperation etc., were announced.

SAS organizations have also made considerable efforts to run projects for EU Structural Funds calls. Unfortunately, the two calls of the Operational Program Research and Innovation, totalling €600 million, to be evaluated in 2017, have been cancelled for certain reasons by the Slovak Ministry of Education, Science, Research and Sports of the Slovak Republic. In the absence of EU structural fund projects, the share of research and development on the gross domestic product of the Slovak Republic has fallen sharply in this programming period. In 2017, the number of Horizon 2020 projects increased, but this number is still inadequate in SAS and is totally absent from successful ERC projects. The SAS presidency wants to support these efforts in the future.

In 2017, the Slovak National Council finally discussed and approved the law on public research institution. From 1 July 2018, SAS organizations will move to a new legal, organizational and economic form that should significantly increase the autonomy of organizations, strengthen pressures on quality and enable more intensive cooperation with other research and innovation bodies, including in the private sphere. This should reinforce project funding in basic and applied research. An important aspect of the further development of R&D in SAS is the formulation of vision and research priorities over a longer period. In 2018, SAS will specifically address these issues, which should also be helped by a wider debate on state-led policy, which is still lacking in the Slovak Republic. The state-run R&D programs, which, in addition to basic research, must open up research capabilities to address the most important societal challenges, must be based on such strategic documents.

Peter Samuely
SAS Vice President for Science, Research and Innovation

II. SCIENCE AND RESEARCH

II.1 Most significant results of scientific work

II.1.1 Section 1 – Physical, Space, Earth, and Engineering Sciences

Several remarkable results have been achieved in 2017 at the SAS Scientific Section 1, both in basic and applied research. Many of them are the results of international cooperation in various project schemes.

The multidisciplinary scientific team has prepared and fully characterized a binary metal alloy based on Ca-Mg, which leads to the ability to achieve targeted dissolution in the patient's body with a beneficial effect on the process of healing the surrounding tissue.

Monitoring of patients with severe head injury uses the method of recording the so-called critical value of the time course of intracranial pressure (VLT). The result of basic research is the design of three new alarm functions in evaluating VLT time slot records as a useful addition to the critical threshold method. The proposed procedure could help to uncover the emerging critical condition of patients.

Another important result of SAS is the optical detection of ground light emissions. As a result of rising light emissions from cities, industrial zones and other terrestrial sources, the sky is also visible at a distance of tens of kilometres from the source. For the first time, research has been developed and tested successfully for a model usable worldwide with the task of, for example, making the level of public lighting more efficient. This method significantly saves the costs that would be needed for aerial light emission research.

The results of long-term international SAS collaboration within the European consortium of the WaSClean project – water and soil treatment from mixed contaminants are recorded in the field of biodegradation of polyaromatic hydrocarbons in polluted areas, namely in the wider area of Kosice. SAS is actively engaged in pan-European cooperation also within the framework of global ATM. The results of the consortium have already been incorporated into air traffic control systems in the European airspace

In the development of the new generation of fast electronic components necessary in the future of telecommunication, a team is working on the possibilities of manipulation, formation and size of surface charges in the structure of GaN nitric transistors (GaN MOS)

No less significant are the results of SAS research which arise in addressing social and economic problems. We can mention the preparation of Ge-based high-performance X-ray materials, which was first implemented in cooperation with Integra TDS, p. r. o., Piešťany. Furthermore, the development of the cryodetector of the presence of impurities in the liquid helium, which can already protect the high-helium economy. Last but not least, it is worth mentioning the monitoring of soil ecosystems in the

floodplain forests of Žitný ostrov near the Gabčíkovo water works which have been going on for several years. This is an important indicator of the amount of water available for vegetation in the area.

However, 2017 brought more significant scientific achievements in the SAS Section 1, in the form of world-class publications (Nature), and contributions addressing social needs and innovation.

Pavol Siman
SAS Vice President of Scientific Section 1



II.1.1.1 Significant results of basic research

Retrieval of angular emission function from whole-city light sources

Institute of Construction and Architecture SAS

Researcher: Miroslav Kocifaj

Artificial light emitted from cities at night is known to spread over considerable distances and results in over illumination of nocturnal environments. Predicting the collective optical effects that all city lights can have on the diffuse light of a night sky is generally impossible without information on the city emission function (CEF). However, the CEF is difficult to determine due to a diverse and generally unavailable inventory of light sources and because of manifold light interactions with light-emitting or blocking constructs. The research performed by our team promises great progress in light-pollution modelling as this is the first time the indirect remote-sensing method, to retrieve the CEF from sky-brightness measurements, has been developed and successfully applied to experimental data. Angular emission function of the CEF is determined by applying an inverse operator on the first-mode radiance data. This is an entirely new technique in the field of light pollution and we believe it can revolutionize acquisition of CEFs worldwide because no aerial survey is necessary, such as that made in Berlin, Germany (Remote Sens. Environ. 126, 39-50, 2012). Aerial survey is however expensive when carried out routinely and is designed for spatial analysis of sources of light pollution, rather than for obtaining the cumulative CEF. In contrast, the technique we have developed is numerically fast, experimentally simple and cost efficient, thus having great potential for use as a CEF solver to which no competitive alternatives yet exist.

Projects: APVV-14-0017, VEGA 2/0016/16.

Outputs:

KOCIFAJ, Miroslav. Retrieval of angular emission function from whole-city light sources using night-sky brightness measurements. In *Optica*, 2017, vol. 4, no. 2, p. 255-262. (7.727 – IF2016). (2017 - Current Contents). ISSN 2334-2536.

SÁNCHEZ DE MIGUEL, A. – AUBÉ, Martin – ZAMORANO, J. – KOCIFAJ, Miroslav – ROBY, Johanne – TAPIA, C. Sky Quality Meter measurements in a colour-changing world. In *Monthly Notices of the Royal Astronomical Society*, 2017, vol. 476, p. 2966-2979. (4.961 – IF2016). (2017 – Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0035-8711

Feature clustering of intracranial pressure time series for alarm function estimation in traumatic brain injury

Institute of Measurement Science SAS

Researchers: Michal Teplan, Ivan Bajla, Roman Rosipal

When monitoring patients with severe head injuries, the so-called “critical value of time course of the intracranial pressure (VLT)” is regularly used. A more alarming situation can arise whereby medical personnel initiate an emergency procedure (protocol) to save a patient’s life. However, much more extensive information is hidden in the archived VLT records of many monitored patients. Based on the well-known VLT curves for survival and surviving patients, we have proposed a new approach to patient status monitoring that retrospectively takes into account the behaviour of VLT time records of both types of patients. For the VLT time series, we

designed several global and local flags that formed symptom vectors in the n-dimensional vector space. Using hierarchical Gaussian mixed n-dimensional model approach, we have suggested clustering (classifying) this space. Based on the availabilities of the clusters, three new alarm functions have been proposed, the optimal thresholds of which we have been looking for using ROC (Receiver Operating Characteristic) access and new efficiency rates. Cross-validation has demonstrated the potential of new alarm functions as a useful complementary tool to the critical VLT threshold method. The proposed procedure can help to uncover the emerging critical condition of the patient before the VLT exceeds the critical value. In the overall analysis of the record, we also find that the new optimal alarm function indicates the critical condition permanently. Compared to the conventional alarm, it appears that a conventional alarm indicates an increased danger only in about two-thirds of these cases. Problems of false alarms that can occur in both approaches are addressed by a new alarm function by searching for its optimal threshold using ROC analysis.

In collaboration with the Vienna Technical University (prof. Dr. Med. Walter Mauritz) and the University of Trnava (prof. I. Rusnák).

Projects: VEGA 2/0043/13, VEGA 2/0138/16, VEGA 2/0011/16, MZ 2013/56-SAV-6, APVV-0668-12, APVV-14-0875.

Outputs:

TEPLAN, M. – BAJLA, I. – ROSIPAL, R. – RUSNÁK, M.: Feature clustering of intracranial pressure time series for alarm function estimation in traumatic brain injury. *Physiological Measurement*, 2017, 38, s.2015–2043. (CC časopis, IF=2,058)

TEPLAN, M. – BAJLA, I. – ROSIPAL, R. – RUSNÁK, M.: Feature clustering of intracranial pressure time series for alarm function estimation in traumatic brain injury. *Electronic supplement of printed article ad 1*, 11 p. Available online: http://iopscience.iop.org/0967-3334/38/11/2015/media/aa8a51_Teplan_Supp.pdf

BAJLA, I. – ŠKOVIERA, R. – TEPLAN, M.: An alternative of the sliding window approach in time series clustering of intracranial pressure for patients with traumatic brain injury, In: J. Maňka, M. Tyšler, V. Witkovský, I. Frollo, (eds), MEASUREMENT 2017, *Proc. of the 11th Int. Conf. on Measurement*, Smolenice, Slovakia, May 29-31, 2017, s.47-50. Institute of Measurement Science, Slovak Academy of Sciences, Bratislava, ISBN 978–80–972629–0–7.

VALENTÍN, K. – BAJLA, I. – TEPLAN, M.: Prediction of intracranial pressure values of traumatic brain injured patients using Hierarchical Temporal Memory network. In: J. Maňka, M. Tyšler, V. Witkovský, I. Frollo, (eds), MEASUREMENT 2015, *Proc. of the 10th Int. Conf. on Measurement*, Smolenice, Slovakia, May 25-28, 2015, s.59-62. Institute of Measurement Science, Slovak Academy of Sciences, Bratislava, ISBN 978–80–969672–9–2.

TEPLAN, M. – BAJLA, I. – ROSIPAL, R. – RUSNÁK, M.: Intracranial pressure of patients after severe traumatic brain injury: a pilot study for lethality estimation from time series, *Proceedings from 6th International Conference on Biomedical Engineering YBERC*, Bratislava, Slovakia, July 2-4, 2014, 89-92, ISBN 978–80–971697–0–1.

Development of new biodegradable alloys

Institute of Materials Research SAS

Researchers: Ing. Karel Saksl, DrSc. and team

The aging population and the problem of improving the living situation of the old and disabled are causing an increasing demand for new biomaterials. Products made from such materials are most commonly used as implants, permanently inoculated into the human body, e.g. as replacement hip joints. However, there are also other clinical cases, cardiovascular diseases or fractures of small bones in which implants with temporary durability could be advantageously used. In such cases, fixation or mechanical support is required only during the healing process, after which the implants in the human body dissolve and the decomposition products even support the nutrition and regeneration of the surrounding tissue. In

recent years, considerable attention has been paid to the development and characterization of tripartite amorphous alloys (metallic glasses) based on calcium, magnesium and zinc, intended for bioresorbable orthopedic fixations. However, research in literature published so far has produced a surprising finding: there was no information on the preparation, stability, and structure of a binary amorphous Ca-Mg alloy, a precursor to all other multi-component systems.

A team of scientists composed of the staff of the Institute of Mechanical Engineering, Faculty of Mechanical Engineering, FEI TUKE, FMMR TUKE, SjF TUKE and DESY Hamburg (Germany) prepared and characterized the binary metal alloy Ca₇₂Mg₂₈ at. %.

The team managed to determine the light weight, modulus of elasticity, hydrogen storage capacity, and thermal properties: the glass transition, crystallization and melting temperatures, the enthalpy of all phase transitions, and described crystallization.

Project: VEGA 2/0021/16

Outputs:

SAKSL, K. – ĎURIŠIN, J. – BALGA, D. – MILKOVIČ, O. – BRESTOVIČ, T. – JASMINSKÁ, N. – ĎURIŠIN, M. – GIRMAN, V. – BALKO, J. – KATUNA, Y. – ŠULÍKOVÁ, M. – ŠULOŤOVÁ, K. – FEJERČÁK, M. – BOLDI, J. – BERTRAM, F.: Devitrification and hydrogen storage capacity of the eutectic Ca₇₂Mg₂₈ metallic glass. *Journal of Alloys and Compounds*, 725, 2017, s. 916-922.

II.1.1.2 Problem solving for social practice

High Performance X-Ray Optics for Small Angle X-ray Scattering (GISAXS)

Institute of Physics SAS

Researchers: Matej Jergel and team

Using ray tracing simulations based on the dynamic theory of X-ray diffraction, an original monolithic X-ray monochromator Ge (111) working on the principle of repeated asymmetric diffraction in the V-shaped channel [1] was designed in cooperation with Integra, TDS, p. r. Piešťany. The originality of the design is based on the combination of high intensity and high compression ratio of the output X-ray beam in one optical element which allows laboratory measurements of light intensity X-ray dispersion (SAXS) and high-intensity and high-resolution (GISAXS) SAXS (GISAXS) multipurpose commercial devices. This enables real-time lab measurements of real-time nanoscale processes using these methods which have so far been performed exclusively on synchrotrons. The realization of this monochromator was made possible thanks to the pilot application of a single point diamond turning method (SPDT) from infrared optics, which, we implemented the X-ray wavelength range in cooperation with Integra, TDS, p. r. o., Piešťany for the first time.

Outputs:

VÉGSŐ, K. – JERDEL, M. – ŠIFFALOVIČ, P. – MAJKOVÁ, E. – KORYTÁR, D. – ZÁPRAŽNÝ, Z. – MIKULÍK, P. – VAGOVIČ, P.: Towards High-Flux X-ray Beam Compressing Channel-Cut Monochromators, *J. Appl. Cryst.* 49 (2016), 1885-1892.

ZÁPRAŽNÝ, Z. – KORYTÁR, D. – JERDEL, M. – ŠIFFALOVIČ, P. – HALAHOVETS, Y: Nanomachining for Advanced X-ray Crystal Optics, *AIP Conf. Proc.* 1764 (2016), 020005.

Cryogenic impurity detector for liquid ^4He

Institute of Experimental Physics SAS

Researchers: Emil Gažo, Gabriel Pristáš, Slavomír Gabáni

Many low-temperature research laboratories around the world have suffered from blocking of fine-capillary tubes, which are necessary to achieve temperatures below 4.2 K. Recently, Gabal et al. [1] have shown that the physical mechanism responsible for the blockage of capillary is based upon the freezing of molecular H_2 traces present in liquid helium. Considering a molecular hydrogen trace amount of about 0.1 ppm, its detection by conventional spectroscopic methods is intricate and unreliable. The designed and built cryogenic impurity detector for liquid helium is based on accumulation of solid H_2 at the low-pressure impedance side of a capillary. The constructed detector allowed us to detect contaminated liquid helium which affected the low-temperature operation performance of several cryogenic devices at the Institute of Experimental Physics in Košice. Using this detector we can check the purity of liquid helium before it is used for cooling in cryogenic facilities. Moreover, the detector is suitable not only for hydrogen detection, but also for other impurities such as nitrogen, oxygen and water.

Soil moisture of the floodplain forest in the surroundings of the Gabčíkovo water structure

Institute of Hydrology SAS

Researchers: Ivan Mészároš, Pavol Miklánek, Veronika Bačová Mitková, Pavla Pekárová, Dana Halmová

The need to monitor soil moisture in the Danube floodplain forests is resulting from the expected vulnerability of the floodplain forests on the territory influenced by construction and operation of the large water structure. The aim is to assess the floodplain forests requirements for water in the conditions of natural and later on of influenced water regime of the inundation area. The soil moisture of the forest ecosystems was monitored all year around using the Neutron Probe System IH-II at 16 locations. The temporal and spatial (in direction to the depth of groundwater table) variability of the soil moisture was monitored and the soil water content was assessed in soil layers (0–30 cm, 0–80 cm and 0–150 cm) at individual locations. This is a very important indicator the amount of water actually available for vegetation. The first layer corresponds to the root system of the sub-canopy herbs, the second to the shrubs and the whole profile down to the depth of 150 cm is expected to be the controlling layer for the forest stands water supply. The results were delivered to the contractor Vodohospodárska výstavba, state enterprise.

II.1.1.3 Significant results of international cooperation

Study of surface charges in III-N heterostructures for preparation of GaN power switching devices

Institute of Electrical Engineering SAS

Researchers: M. Ťapajna, J. Kuzmík, D. Gregušová, R. Stoklas

International partners: Hokkaido Univ. (Japan), Silesian Univ. Technol. (Poland), Hungarian Academy of Sciences (Hungary)

Heterostructure field effect transistors (HFET) based on gallium nitride (GaN) represent a new promising technology for high-power and mixed-signal electronics. Despite ongoing industrialization of GaN electronic devices, there is still limited understanding on the formation of GaN surface charges, being vital for the device's threshold voltage adjustment. Specifically, the origin of the oxide/semiconductor interface charges in HFETs with metal-oxide-semiconductor (MOS) gate is still under debate. In our work we demonstrated several technological approaches to manipulate interface charges in GaN MOS-HFETs with gate dielectrics grown by different deposition techniques. First, we evaluated all relevant charges located at oxide/semiconductor interface that were then correlated with microstructural and chemical properties of the interface. The results show possibilities to manipulate the surface charges and indicate their origin. Such knowledge is unavoidable for development of the next-generation high-power and high-speed GaN transistors.

International programme: V4 – Japan Joint Research Projects

Project title: Highly Safe GaN Metal-Oxide-Semiconductor Transistor Switch (SAFEMOST)

Outputs:

ŤAPAJNA, M. – STOKLAS, R. – GREGUŠOVÁ, D. – GUCMANN, F. – HUŠEKOVÁ, K. – HAŠČÍK, Š. – FRÖHLICH, K. – TÓTH, L. – PÉCZ, B. – BRUNNER, F. – KUZMÍK, J. Investigation of 'surface donors' in Al₂O₃/AlGa_xN/GaN metal-oxide-semiconductor heterostructures: Correlation of electrical, structural, and chemical properties. In *Applied Surface Science*, 2017, vol. 426, p. 656-661. (3.387 – IF2016). (2017 – Current Contents). ISSN 0169-4332.

ŤAPAJNA, M. – VÁLIK, L. – GUCMANN, F. – GREGUŠOVÁ, D. – FRÖHLICH, K. – HAŠČÍK, Š. – DOBROČKA, E. – TÓTH, L. – PÉCZ, B. – KUZMÍK, J. Low-temperature atomic layer deposition-grown Al₂O₃ gate dielectric for GaN/AlGa_xN/GaN MOS HEMTs: Impact of deposition conditions on interface state density. In *Journal of Vacuum Science and Technology B: Microelectronics and Nanometer Structures*, 2017, vol. 35, 01A107. (1.573 – IF2016). (2017 – Current Contents). ISSN 1071-1023.

WaSClean – Water and Soil Clean-up from Mixed Contaminants

Institute of Geotechnics SAS

Researchers: Miroslava Václavíková, Daniel Kupka, Lucia Ivaničová, Dávid Jáger, Dominika Behunová, Anton Zubrik

Mixed contaminations involving different types of man-made chemicals create difficulties in clean-up as the toxic metals interfere with the degradation of organics. The main scope of the WaSClean project was to stimulate industry-academia collaboration within a multidisciplinary consortium across Europe and Central Asia in order to develop and scale-up a comprehensive technology for the remediation of contaminated land and water treatment from toxic metals, persistent organic pollutants and synthetic dyes.

Novel materials for water and soil clean-up were developed by incorporating Fe based nanoparticles on activated carbon matrices in such a way, that the active carbon retained its ability to remove organics and heavy metals, while the incorporated Fe-nanoparticles efficiently removed metalloids such as arsenic, chromium, etc. Advanced bioreactor for biodegradation of polyaromatic hydrocarbons from contaminated soils as well as a lab-scale electrochemical oxidation reactor for degradation of synthetic reactive dyes were developed, constructed, tested and optimized.

WaSClean project resulted in design and scale-up of an integrated multi-stage remediation technology for treatment of industrial waste waters and liquid effluents (e.g. from contaminated soils, landfill leachates, etc.), combining electrochemical oxidation reactors and advanced bioreactors.

Throughout the 4 years of the WaSClean project (coordinated by Institute of Geotechnics SAS), 36 Marie Curie Fellows contributed to the research by 75 long-term secondments (2-6 months) alongside with 8 industry and academic partners.



Vyčistenie vysoko koncentrovanej znečistenej odpadovej vody z textilného priemyslu elektrochemickou oxidáciou do environmentálne prijateľného stavu.

Project: FP7-PEOPLE-2013-IAPP-612250-WaSClean

Project coordinator: Institute of Geotechnics SAS

TAZE, C. – PANETAS, I. – KALOGIANNIS, S. – FEIDANTZIS, K. – GALLIOS, G. P. – KATRINAKI, G. – KONSTANDOPOULOS, A. G. – VÁCLAVÍKOVÁ, M. – IVANIČOVÁ, L. – KALOYIANNI, M. Toxicity assessment and comparison between two types of iron oxide nanoparticles in *Mytilus galloprovincialis*. In *Aquatic Toxicology*, 2016, vol. 172., p. 9 -20.

GALLIOS, G. P. – TOLKOU, A. K. – KATSOYIANNIS, I. A. – ŠTEFUŠOVÁ, K. – VÁCLAVÍKOVÁ, M. – DELIYANNI, E. A. Adsorption of Arsenate by Nano Scaled Activated Carbon Modified by Iron and Manganese Oxides. In *Sustainability*, 2017, vol. 9, no. 10, p. 1684.

JÁGER, D. – KUPKA, D. – VÁCLAVÍKOVÁ, M. – IVANIČOVÁ, L. – GALLIOS, G. P. Degradation of Reactive Black 5 by electrochemical oxidation. In *Chemosphere*, 2018, vol. 2, no. 10, p. 405-416.

Global ATM security management (GAMMA)

Institute of Informatics SAS

Researchers: Milan Rusko, Marian Trnka, Sakhia Darjaa, Igor Guoth, Róbert Sabo, Marián Ritomský

Partner institutions: AIRBUS (France), BOEING (USA), CiaoTech (Italy), Deutsches Zentrum für Luft- und Raumfahrt (Germany), LEONARDO (Italy), ENAV (Italy), Isdefe (Spain), Thales University (United Kingdom), RNC Avionics (United Kingdom), SEA (Italy), 42 Solutions (Netherlands), Romatsa (Romania)

This project addresses the management of global air traffic security in the European airspace of the future. A pseudo-pilot communication and flight control unit notifying users of the presence of an unauthorized person's speech has been designed, developed and implemented to the Air Traffic Management (ATM) simulator. A system for the identification of

stress in the voice of pseudo-pilots communicating with air traffic control signalling the potential occurrence of an increased level of stress in speech has been designed, developed and implemented. The proposed modules were implemented in the air traffic monitoring system in cooperation with the Deutsches Zentrum für Luftund Raumfahrt and presented at the final evaluation of the project in Rome on 22 November 2017.

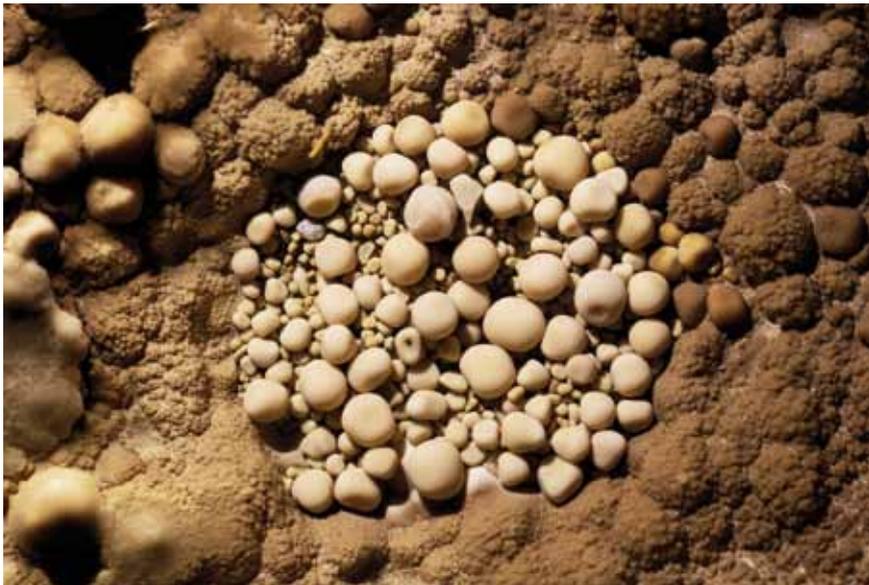
Project: FP7-SEC-2012-1

Outputs:

RUSKO, Milan – FINKE, Michael. Using speech analysis in voice communication : a new approach to improve air traffic management security. In CogInfoCom 2016 : 7th international conference on cognitive infocommunications. - Wroclaw, Poland : IEEE, 2016, proceedings, p. 181-186. ISBN 978-1-5090-2643-2. ISSN 2375-1312.

SABO, Róbert – RUSKO, Milan – RIDZIK, Andrej – RAJČÁNI, Jakub. Stress, arousal, and stress detector trained on acted speech database. In Lecture Notes in Computer Science : Speech and Computer, 2016, vol. 9811, p. 675-682. ISBN 978-3-319-43957-0. ISSN 0302-9743.

SABO, Róbert – RAJČÁNI, Jakub. Designing the database of speech under stress. In Jazykovedný časopis, 2017, roč. 68, č. 2, s. 326-336. ISSN 0021-5597.



II.1.2 Section 2 – Life, Chemical, Medical, and Environmental Sciences

The results of the projects handled at the SAS Scientific Section 2 which we present as the most significant results of basic scientific research, problem solving for social practice and international scientific projects, represent a wide range of disciplines and methodological approaches.

Several interesting findings have been gained in the area of biomedical research which can contribute to improving methods of diagnosis and treatment of various diseases in the future. The findings on the negative effect of aldosterone hormone on anxiety and depressive behaviour of patients indicate the possibility of a new approach to the treatment of psychiatric disorders by influencing the secretion of aldosterone and its effects. Further new findings are related to tauopathies, which are neurodegenerative diseases characterized by the presence of one of the forms of tau protein in intracellular spaces. The two most common tauopathies include Alzheimer's disease and progressive supranuclear palsy. The results of protein analysis, the concentration of which was significantly altered in the cerebrospinal fluid of transgenic model animals, could significantly contribute to the diagnosis of Alzheimer's disease and other tauopathies.

*A number of new findings have been gained in the study of microorganisms transfer mechanisms by ticks and the patterns of occurrence and maintenance of natural outbreaks. A particularly interesting result was the identification of the molecules in the salivary glands of the *Hyalomma excavatum*, which could be used for the preparation of anti-viral vaccines. Useful knowledge has also been obtained through the study of North American freshwater parasites. Since these parasites are potentially dangerous for humans by eating infected fish, these findings are not only part of the results of basic taxonomic and faunistic research but are also medically significant.*

Study of Nanomaterials has traditionally yielded knowledge that has a wide scope for application. This includes findings obtained from pre-clinical testing of the anti-tumour effect of arsenic tetrasulfide nanoparticles (As₄S₄, realgaru) on multiple myeloma tumor cells, a disease that is currently considered incurable. Other important findings have been gained in the field of targeted delivery of DNA and other substances such as nanoparticles, biomacromolecules in the preparation of biosensors and various nanosciences. In the field of ceramic materials it was possible to prepare dense composite materials based on Al₂O₃ or SiC with the addition of carbon nanostructures, which, unlike conventional ceramic materials, have significantly increased electrical conductivity. This property will be used for electro-spraying machine production of materials, which requires the produced material to be electrically conductive.

Bark beetles and their impact on forest ecosystems are among the most discussed issues in forestry and biodiversity conservation. Using Earth Remote Surveys, spatial simulations, and modelling of population dynamics of bark beetles based on climatic data, it has been found that the main factors affecting tree death by bark beetles are the sums of temperatures during the year and the occurrence of previous disturbances caused by wind calamities.

Public involvement in scientific research ("citizen science") is becoming more and more important. An example of possible collaboration with the public in gathering data as a basis for further research is also the gathering

of knowledge on the spread of invasive plants and animals. Active amateurs, the numbers of whom are rising in some areas of research, have the ability to track the invasive spread of organisms on a much more detailed scale than professional researchers. One example of this is the mobile application VISITOR for collecting and sharing data on the propagation of invasive plants and animals that was developed at SAS.

Karol Marhold
SAS Vice President of Scientific Section 2



II.1.2.1. Significant results of basic research

The link between aldosterone secretion with anxiety rate in allergic patients and the clinical condition of patients with depression

Institute of Experimental Endocrinologie BMC SAS

Researchers: Daniela Ježová, Nataša Hlaváčová

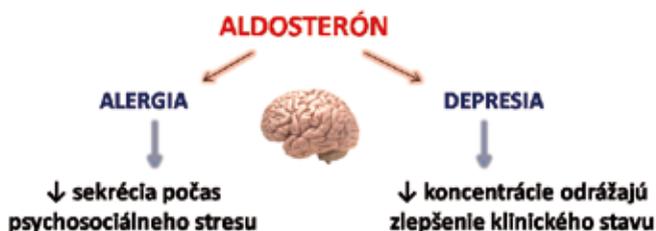
We have brought evidence that the stress hormone aldosterone has a negative impact on anxiety and depressive behaviour in animal models. The next step was a translation of this knowledge to humans under laboratory and clinical conditions. In collaboration with the Department of Psychology, Faculty of Arts CU we have revealed high trait anxiety and avoidance stress coping strategies in patients with allergies. We have demonstrated for the first time that patients with allergies show an inadequate aldosterone response during psychosocial stress compared to healthy subjects (1). We have discovered several pieces of evidence on the role of aldosterone in the pathophysiology of major depression. Our findings obtained in collaboration with the Department of Psychiatry, Faculty of Medicine CU provide evidence that salivary aldosterone concentrations reflect clinical state, treatment outcome, duration as well as severity of a depressive episode (2). Thus, modulation of aldosterone secretion represents a novel target for future treatment of mood disorders.

Projects: APVV-0496-12, VEGA 2/0057/15

Outputs:

HLAVÁČOVÁ, Nataša – SOLÁRIKOVÁ, Petra – MARKO, Martin – BREZINA, I. – JEŽOVÁ, Daniela. Blunted cortisol response to psychosocial stress in atopic patients is associated with decrease in salivary alpha-amylase and aldosterone: Focus on sex and menstrual cycle phase. In *Psychoneuroendocrinology*, 2017, vol. 78, p. 31-38. (4.788 - IF2016).

SEGEDA, Viktor – IZÁKOVÁ, Ľ. – HLAVÁČOVÁ, Nataša – BEDNAROVA, A. – JEŽOVÁ, Daniela. Aldosterone concentrations in saliva reflect the duration and severity of depressive episode in a sex dependent manner. In *Journal of Psychiatric Research*, 2017, vol. 91, p. 164-168. (4.183 - IF2016).



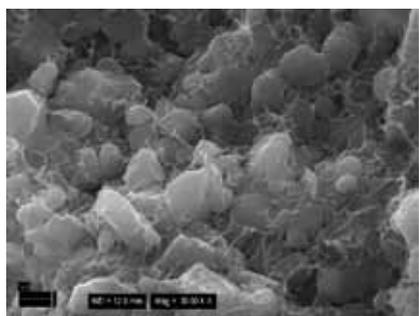
Atypical effects of hormone aldosterone in the brain.

Ceramic carbon nanostructure composites with high electrical conductivity

Institute of Inorganic Chemistry SAS

Recheachers: Ondrej Hanzel, Jaroslav Sedláček, Roman Bystrický, Valéria Bizovská, Pavol Šajgalík

Ceramic materials are electrical insulators in most cases. They are also very hard, therefore enabling them to be heavily machinable by conventional method. Electro-discharge machining is an unconventional method used for various materials and requires electrically conductive materials.



Fracture surface of composites Al₂O₃-CNT, carbon nanotubes creates conductive networks (figure on the left). Composite material placed between two electrodes heats up by passing electric current through it (figure on the right).

In order to improve electrical conductivity, dense alumina (Al₂O₃) or silicon carbide composites with addition of carbon nanostructures – carbon nanotubes (CNTs), graphene nanoplatelets were prepared using a new approach. In the case of composites Al₂O₃-CNT electrical conductivity significantly increased (about 13 order of magnitude) from 10⁻¹⁰ S/m (pure Al₂O₃) to 1748 S/m for composite with the addition of 12,5 vol. % CNTs. In the case of composites SiC-GNPs electrical conductivity increased about 5 in order of magnitude up to 1775 S/m. The improvement in electrical conductivity can be attributed to the preparation method which allowed for the preservation of the homogeneous distribution of carbon nanostructures. Carbon nanostructures formed conductive networks in ceramic matrix.

Projects: APVV-15-0469, APVV-0108-12, VEGA 2/0065/14, ERA.Net – Grace

Outputs:

- HANZEL, O. – SEDLÁK, R. – SEDLÁČEK, J. – BIZOVSKÁ, V. – BYSTRICKÝ, R. – GIRMAN, V. – KOVALČIKOVÁ, A. – DUSZA, J. – ŠAJGALÍK, P. Anisotropy of functional properties of SiC composites with GNPs, GO and in-situ formed graphene. In *Journal of the European Ceramic Society*, 2017, vol. 37, p. 3731-3739. (3.411 – IF2016). ISSN 0955-2219.
- HANZEL, O. – LOFAJ, F. – SEDLÁČEK, J. – KABÁTOVÁ, M. – KAŠIAROVÁ, M. – ŠAJGALÍK, P. Mechanical and tribological properties of alumina-MWCNTs composites sintered by rapid hot-pressing. In *Journal of the European Ceramic Society*, 2017, vol. 37, no. 15, p. 4821-4831. (3.411 – IF2016). ISSN 0955-2219.
- SINGH, M. A. – SARMA, D. K. – HANZEL, O. – SEDLÁČEK, J. – ŠAJGALÍK, P. Machinability analysis of multi walled carbon nanotubes filled alumina composites in wire electrical discharge machining process. In *Journal of the European Ceramic Society*, 2017, vol. 37, no. 9, p. 3107-3114. (3.411 – IF2016). ISSN 0955-2219.

The impact of disturbances on spruce mortality in the Tatra National Park

Institute of Forest Ecology SAS

Researchers: Pavel Mezei, Mária Potterf, Rastislav Jakuš, Miroslav Blaženec

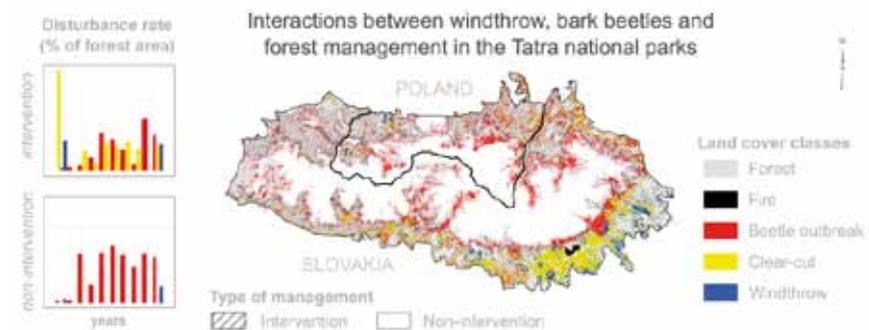
We have analysed interactions between windthrow, bark beetles and forest management in the Tatra National Park by remote sensing, agent-based modelling and simulation of bark beetle-phenology based on climate data. Our results document limited impact of logging activities in reducing beetle outbreak in neighbouring areas with intervention and non-intervention management. However, sanitation felling highly contributed to the decline of forest cover. The extent and clustering level of the windthrown trees affect the timing of beetle outbreak. Therefore, it might help to identify the most suitable windthrown locations to trigger bark beetle outbreak. The main fac-

tors affecting tree mortality per bark beetle were the combination of the sum of previous year's maximum daily temperatures, wind-caused tree mortality, and the previous year's beetle infestations. Derived disturbances maps of the High Tatra Mts., together with agent-based model of wind-bark beetle outbreak interactions are publically available as open source.

Project: APVV-0297-12

Outputs:

- MEZEI, P. – JAKUŠ, R. – PENNERSTORFER, J. – POTTERF, M. – ŠKVARENINA, J. – FERENČÍK, J. – SLIVINSKÝ, J. – BIČÁROVÁ, S. – BILČÍK, D. – BLAŽENEC, M. – NETHERER, S. Storms, temperature maxima and the Eurasian spruce bark beetle *Ips typographus*—An infernal trio in Norway spruce forests of the Central European High Tatra Mountains. In *Agricultural and Forest Meteorology*, 2017, vol. 242, p. 85-95. (3.887 – IF2016).
- MEZEI, P. – BLAŽENEC, M. – GRODZKI, W. – ŠKVARENINA, J. – JAKUŠ, R. Influence of different forest protection strategies on spruce tree mortality during a bark beetle outbreak. In *Annals of Forest Science*, 2017, vol. 74, iss. 4, article 65. (2.101 – IF2016).
- HAVAŠOVÁ, M. (POTTERF, M.) – FERENČÍK, J. – JAKUŠ, R. Interactions between windthrow, bark beetles and forest management in the Tatra national parks. In *Forest Ecology and Management*, 2017, vol. 391, p. 349-361. (3.064 – IF2016). ISSN 0378-1127.
- POTTERF, M. – BONE, Ch. Simulating bark beetle population dynamics in response to windthrow events. In *Ecological Complexity*, 2017, vol. 32, part A, p. 21-30. (1.784 – IF2016)



II.1.2.2. Problem solving for social practice

Changes of cerebrospinal fluid peptides due to tauopathy

Institute of Neuroimmunology SAS

Researchers: Petra Majerová, Peter Baráth, Alena Michalicová, Stanislav Katina, Michal Novák, Andrej Kováč

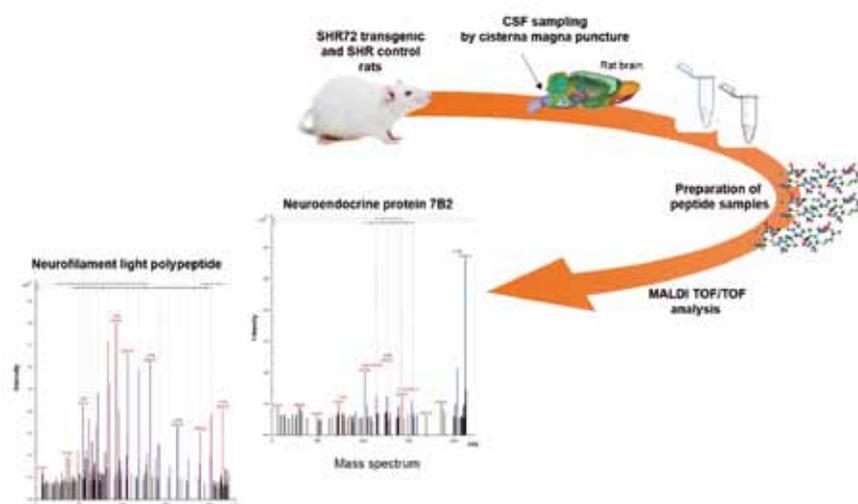
Tauopathies represent a heterogeneous group of neurodegenerative diseases. Alzheimer's disease (AD) and progressive supranuclear palsy (PSP) are two common neurodegenerative tauopathies and the most common cause of progressive brain dementia in older adults affecting more than 35 million people. Tauopathies are characterized by abnormal deposition of microtubule associated protein tau into intracellular neurofibrillary tangles composed mainly of the hyperphosphorylated form of this protein. The diagnosis of tauopathies is based on the presence of clinical features and pathological changes. There is an ongoing intensive search for biochemical diagnostic markers over the last decade, to support clinical diagnosis. Measurements of biochemical markers in CSF are increasingly used in the diagnostic process of dementia. In the present study, we used SHR72 transgenic rat model for tauopathy expressing truncated tau pro-

tein (aa 151–391/4R) to analyse the peptidomic profile of cerebrospinal fluid (CSF) by liquid chromatography – matrix assisted laser desorption/ionization mass spectrometry (LC-MALDI TOF/TOF). Out of 345 peptides we identified a total of 175 proteins. Among them, 17 proteins differed statistically significant in CSF from transgenic rats. The incidence of the following proteins was higher in CSF of transgenic rats compared to control animals: neurofilament light and medium polypeptide, apolipoprotein E, gamma-synuclein, chromogranin A, reticulon-4, secretogranin-2, calyptein-1 and -3, endothelin-3, neuroendocrine protein B72A, alpha-1-macroglobulin and augurin. Interestingly, most of the proteins identified were previously linked to AD and other tauopathies, indicating the value of transgenic animals in biomarker research.

Project: APVV-14-0547

Outputs:

MAJEROVÁ, P. – BARÁTH P. – MICHALICOVÁ, A. – KATINA S. – NOVÁK M. – KOVÁČ, A. Changes of Cerebrospinal Fluid Peptides due to Tauopathy. In *Journal of Alzheimer's Disease*, 2017, vol. 58, p. 507-512. (3.731 – IF2016).



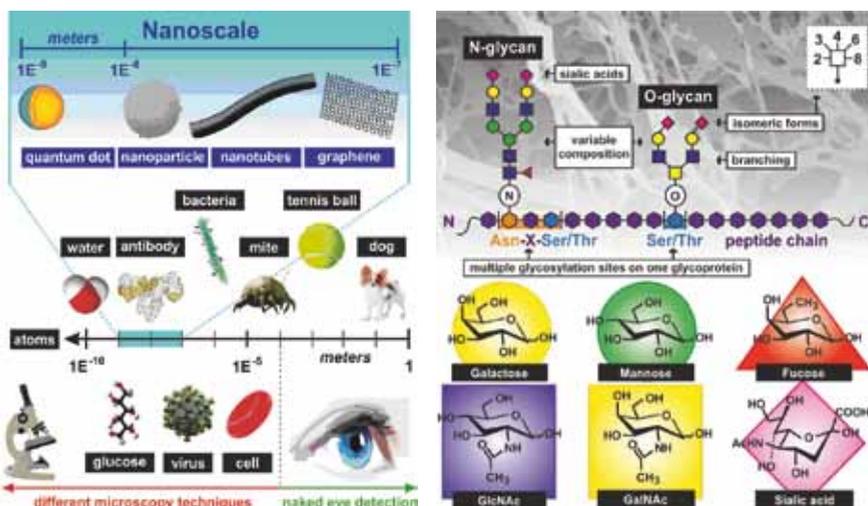
Figures 1 and 2 from Dosekova, E., et al., *Nanotechnology in Glycomics: Applications in Diagnostics, Therapy, Imaging, and Separation Processes*. In *Medicinal Research Reviews*, 2017. 37(3): p. 514-626.

The use of nanomaterials and control over the immobilization process of various molecules in nanoscale for various practical applications

Institute of Chemistry SAS

Researchers: Tomáš Bertók, Anikó Bertóková, Jaroslav Filip, Alica Vikartovská, Alena Holazová, rod. Šedivá, Ľudmila Belická, rod. Kluková, Lenka Lorencová, Dominika Damborská, rod. Pihíková, Štefan Belický, Pavel Damborský, Filip Květoň, Ján Tkáč

Immobilization of thiols containing zwitterionic moieties on gold nanoparticle surfaces was used for specific enrichment of DNA with the possibility of targeted delivery. This approach can be used for targeted DNA delivery as well as for other substances such as nanoparticles and biomacromolecules during the preparation of biosensors and different nano devices (1). Gold nanoparticle layer was used for the immobilization of antibodies for the detection of an oncomarker (2). Graphene oxide was used as a carrier



Obrazy 1 a 2 z Dosekova, E., et al., Nanotechnology in Glycomics: Applications in Diagnostics, Therapy, Imaging, and Separation Processes. In Medicinal Research Reviews, 2017. 37(3): p. 514-626.

for the preparation of a lectin biosensor (3), as well as for construction of an enzyme biocathode for biobattery preparation (4). Control over thiol or lectin immobilization in nanoscale led to the preparation of interfaces resisting non-specific interactions/adhesion of cells (5), or allowed for the investigation of lectin-biomarker interactions (6). Another process with a controlled immobilization in nanoscale was the use of antibody fragments (around 3 nm in length), which compared to the whole antibodies (around 10 nm in length) were used for much more sensitive analyte detection during a biosensor preparation (7) and the use of a controlled immobilization of Tn antigen glycan with a projected area (1 nm x 1 nm) on a nanocarrier – a human serum albumin (around 5 – 6 nm in length) for the antibody detection (8). A new type of a 2D nanomaterial MXene was used for the first time as a sensor to detect hydrogen peroxide down to one of the lowest detection limits published so far (9). Two review articles (10, 11) and one book (12) were aimed for the discussion on the use of nanomaterials for the preparation of biosensor devices, but in the glycomics for diagnostics, therapy, imaging of tissues/cells and enrichment processes.

Projects: FP7-311532, FP7-317420, APVV 0282-11 and NPRP 6-381-1-078

Outputs:

- FILIP, J. – POPELKA, A. – BERTÓK, T. – HOLAZOVÁ, A. – OSIČKA, J. – KOLLÁR, J. – ILČIKOVÁ, M. – TKÁČ, J. – KASÁK, P. pH-switchable interaction of a carboxybetaine ester-based SAM with DNA and gold nanoparticles. In *Langmuir*, 2017, vol. 33, p. 6657-6666. (3.833 – IF2016).
- JOLLY, P. – ZHURAUŠKI, P. – HAMMOND, J. L. – MIODEK, A. – LIÉBANA, S. – BERTÓK, T. – TKÁČ, J. – ESTRELA, P. Self-assembled gold nanoparticles for impedimetric and amperometric detection of a prostate cancer biomarker. In *Sensors and Actuators B: Chemical*, 2017, vol. 251, p. 637-643. (5.401 – IF2016).
- FILIP, J. – ZAVAHIR, S. – KLUKOVÁ, L. – TKÁČ, J. – KASÁK, P. Immobilization of concanavalin A lectin on a reduced graphene oxide-thionine surface by glutaraldehyde cross-linking for the construction of an impedimetric biosensor. In *Journal of Electroanalytical Chemistry*, 2017, vol. 794, p. 156-163. (3.012 – IF2016).
- FILIP, J. – ANDICSOVÁ-ECKSTEIN, A. – VIKARTOVSKÁ, A. – TKÁČ, J. Immobilization of bilirubin oxidase on graphene oxide flakes with different negative charge density for oxygen reduction. The effect of GO charge density on enzyme coverage, electron transfer rate and current density In *Biosensors and Bioelectronics*, 2017, vol. 89, p. 384-389. (7.780 – IF2016).

- SOBOLČIAK, P. – POPELKA, A. – MIČUŠÍK, M. – SLÁVIKOVÁ, M. – KRUPA, I. – MOSNÁČEK, J. – TKÁČ, J. – LACÍK, I. – KASÁK, P. Photoimmobilization of zwitterionic polymers on surfaces to reduce cell adhesion. In *Journal of Colloid and Interface Science*, 2017, vol. 500, p. 294-303. (4.233 – IF2016).
- BELICKÝ, Š. – ČERNOCKÁ, H. – BERTÓK, T. – HOLAZOVÁ, A. – RÉBLOVÁ, K. – PALEČEK, E. – TKÁČ, J. – OSTATNÁ, V. Label-free chronopotentiometric glycoprofiling of prostate specific antigen using sialic acid recognizing lectins. In *Bioelectrochemistry*, 2017, vol. 117, p. 89-94. (3.346 – IF2016).
- BELICKÝ, Š. – DAMBORSKÝ, P. – ZAPATERO-RODRÍGUEZ, J. – O'KENNEDY, R. – TKÁČ, J. Full-length antibodies versus single chain antibody fragments for a selective impedimetric lectin-based glycoprofiling of prostate specific antigen. In *Electrochimica Acta*, 2017, vol. 246, p. 399-405. (4.798 – IF2016).
- KVĚTOŇ, F. – BLŠÁKOVÁ, A. – HUSHEGYI, A. – DAMBORSKÝ, P. – BLIXT, O. – JANS-SON, B. – TKÁČ, J. Optimization of the small glycan presentation for binding a tumor-associated antibody: Application to the construction of an ultrasensitive glycan biosensor. In *Langmuir*, 2017, vol. 33, p. 2709-2716. (3.833 – IF2016).
- LORENCOVÁ, L. – BERTÓK, T. – DOŠEKOVÁ, E. – HOLAZOVÁ, A. – PAPRČKOVÁ, D. – VIKARTOVSKÁ, A. – SASINKOVÁ, V. – FILIP, J. – KASÁK, P. – JERIGOVÁ, M. – VELIČ, D. – MAHMOUD, K. A. – TKÁČ, J. Electrochemical performance of $Ti_3C_2T_x$ MXene in aqueous media: towards ultrasensitive H_2O_2 sensing. In *Electrochimica Acta*, 2017, vol. 235, p. 471-479. (4.798 – IF2016).
- DOŠEKOVÁ, E. – FILIP, J. – BERTÓK, T. – BOTH, P. – KASÁK, P. – TKÁČ, J. Nanotechnology in glycomics. Applications in diagnostics, therapy, imaging and separation processes. In *Medicinal Research Reviews*, 2017, vol. 37, p. 514-626. (8.763 – IF2016).
- DAMBORSKÁ, D. – BERTÓK, T. – DOŠEKOVÁ, E. – HOLAZOVÁ, A. – LORENCOVÁ, L. – KASÁK, P. – TKÁČ, J. Nanomaterial-based biosensors for detection of prostate specific antigen. In *Microchimica Acta*, 2017, vol. 184, p. 3049-3067. (4.580 – IF2016).
- BERTÓK, T. – BERTÓKOVÁ, A. – FILIP, J. – HOLAZOVA, A. – BELICKÝ Š. – KASÁK, P. – TKÁČ, J. *Nanobiotechnológia alebo Od lepiacej pásky k medicínskym aplikáciám*. Bratislava: VEDA, 2017, 172 s. ISBN 978-80-224-1580-4. (AAB)

VISITOR – smartphone app for collection and sharing of data on invasive plants and animals with public involvement

Institute of Botany of the Plant Sciences and Biodiversity Center SAS

Researchers: Jana Podroužková Medvecká, Ladislav Pekárik, Denisa Bazalová, Katarína Botková, Tomáš Čejka, Ivan Jarolínek, J. Májeková, Mária Šibíková, Sandra Vigiášová, Mária Zaliberová

Biological invasions, closely connected with globalization, are growing geometrically; and due to this fact, alien (especially invasive) plants and animals currently represent a growing problem. They often cause considerable economic and biodiversity losses and their monitoring is of high importance for society. The aim of this project is to acquire new knowledge on distribution, abundance and ecology of the selected alien species with involvement of the public. The participation of volunteers in monitoring and research on alien organisms not only brings new data. People also get the opportunity to participate in publicly beneficial research and get more information on this topic. For this reason, we have created the VISITOR system, where volunteers can send their findings through the smartphone app which is currently in the functional beta stage. The smartphone app is available free both for Android and IOS and download links can be found on the web atvisitor.sav.sk.

This enables involvement of various target groups, such as nature enthusiasts, fishermen, nature photographers and members of local administrative bodies and the process of exploring the local surroundings can be connected also with the educational process in schools particularly in biology classes. With an in-built smartphone camera, registered users record the occurrence of the monitored species and after filling out a simple form they send the finding to the database. Each finding is subsequently veri-

fied by an expert on the given animal or plant taxonomic group and verified findings are displayed on the map which is available to everyone on the website. The website is also a source of information on the monitored species, their descriptions and photos. New project findings and other news about these organisms will be added continuously. In future we plan further system development and adding more educational material, gamification and motivation features.

Project: COST TD 1209 – European information system for alien species



Jerusalem artichoke
(*Helianthus tuberosus*)



Screenshot of the form for new findings



Chinese sleeper
(*Perccottus glenii*)

New data on parasites of evolutionary interest and medical importance in North America

Institute of Parasitology SAS

Researcher: Mikuláš Oros

Latest reviews on the parasites of freshwater fish in North America revealed considerable gaps in knowledge on their species diversity, genetic structure, phylogeography and host specificity. In a consequence, our collaboration with the Czech and American parasitologists was primarily focused on new data acquisition targeted to the taxonomy and zoogeography of fish tapeworms using state-of-the-art methods of microscopic and molecular techniques and phylogenetic analyses. On the basis of comparative study of museum specimens along with an application of new genetic data, the taxonomic revision of two cestode genera was performed. In particular, two new species (*Promonobothrium currani* sp. n. and *P. papiliovarium* sp. n.) were recognized and newly described from freshwater fish in Mississippi and North Carolina. The tapeworm *Caryophyllaeides fennica*, commonly occurring parasite of cyprinid fish in the Palaearctic biogeographic region was reported for the first time in the endemic cyprinids from the western Nearctic. The Japanese broad tapeworm (*Diphyllobothrium nihonkaiense*) is the second most common causative agent of diphyllobothriosis in humans, which was until now detected only in the areas of the North Pacific coast of the Far East, Russia and Japan. For the first time, the tapeworm was recognized in pink salmon in south-central Alaska. Considering that this parasite has a high zoonotic potential and infects commercially im-

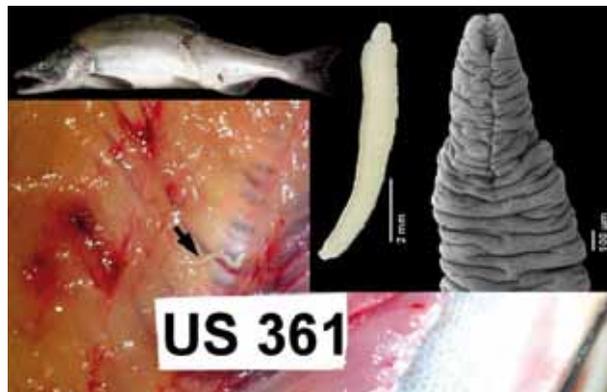
portant fish host exported all around the world, our findings are of global importance.

Projects: VEGA 2/0159/16, APVV-15-0004, APVV-0653-11

Outputs:

- OROS, M. – CHOUDHURY, A. – SCHOLZ, T. A common Eurasian fish tapeworm, *Caryophyllaeides fennica* (Cestoda) in the western North America: further evidence of amphi-Pacific vicariance in freshwater fish parasite. In *Journal of Parasitology*, 2017, vol. 103, no. 5, p. 486-496. (IF 1,326 – 2016). (Q2-Parasitology)
- KUCHTA, R. – OROS, M. – FERGUSON, J. – SCHOLZ, T. *Diphyllobothrium nihonkaiense* tapeworm larvae in salmon from North America. In *Emerging Infectious Diseases*, 2017, vol. 23, no. 2, p. 351-353. (IF 8,222 – 2016). (Q1-Parasitology)
- SCHOLZ, T. – OROS, M. Caryophyllidea van Beneden in Carus, 1863. In J. N. Caira and K. Jensen (Eds.): *Planetary Biodiversity Inventory (2008-2016): Tapeworms from vertebrate bowels of the earth*. University of Kansas, Natural History Museum, Special Publication No. 25, Lawrence, Kansas, USA, 2017, p. 47-64.

Photographs and scanning electron micrograph of the zoonotic Japanese broad tapeworm from pink salmon.



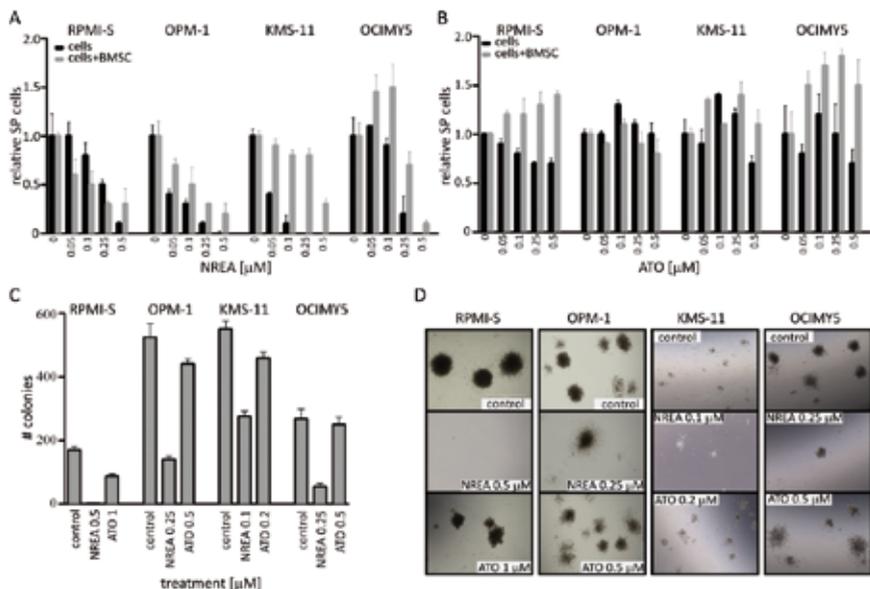
II.1.2.3. Significant results of international cooperation

Preclinical testing of the anti-tumor effect of real-gauge nanoparticles

Institute of Cancer Research BMC SAS

Researchers: Dana Cholujová, Jana Jakubíková

Multiple myeloma (MM) is a B cell malignancy characterized by clonal proliferation of plasma cells in the bone marrow. MM remains incurable despite the use of novel and conventional therapies. In this study, we demonstrated MM cell cytotoxicity triggered by realgar (As₄S₄) nanoparticles (NREA) versus Arsenic trioxide (ATO) against MM cell lines and patient cells. Both NREA and ATO showed *in vivo* anti-MM activity, resulting in significantly decreased tumor burden. The anti-MM activity of NREA and ATO is associated with apoptosis, evidenced by DNA fragmentation, depletion of mitochondrial membrane potential, cleavage of caspases and anti-apoptotic proteins. NREA induced G2/M cell cycle arrest and modulation of cell cycle regulatory proteins. Moreover, NREA induced modulation of key regulatory molecules in MM pathogenesis. Importantly, NREA, but not ATO, significantly depleted the side population (SP). SP is stem cell-like population, characterized by high clonogenicity and resistance to cancer therapy. Finally, our study showed that both NREA and ATO triggered synergistic anti-MM activity when combined with lenalidomide or melphalan. Taken together, the anti-MM activity of NREA was more potent compared



NREA decreases SP cell fraction and clonogenic potential of MM cells. CFSE-stained MM cells (RPMI-S, OPM-1, KMS-11 and OCIMY5; with higher proportion of SP cells), alone or in co-culture with BMSCs, were treated (0.05, 0.1, 0.25 and 0.5 μM ; for 72 h) with (A) NREA and (B) ATO. Representative results of three independent experiments with triplicates. (C) Effect of NREA and ATO on clonogenic potential of MM cells (with SP clonogenic potential) in vitro was evaluated by colony-forming unit/clonogenic assays. MM cells (RPMI-S, OPM-1, KMS-11 and OCIMY5; with higher proportion of SP cells) were seeded on methylcellulose, and subsequently treated with NREA and ATO. A number of RPMI-S cells were compared to respective control (untreated) cells at day 14. (D) Representative images of MM cell colonies, control (untreated) and treated by NREA and ATO at day 14. Representative results of two independent experiments.

to ATO, providing the preclinical framework for clinical trials to improve patient outcome in MM.

Projects: SASPRO 0064/01/02 (JJ), VEGA grant 2/0100/17 (JJ), VEGA grant 2/0076/17 (DC), APVV-16-0484 (JJ) a APVV-14-0103 (ZB)

Outputs:

CHOLUJOVÁ, D. – BUJŇÁKOVÁ, Z. – DUTKOVÁ, E. – HIDESHIMA, T. – GROEN, R. W. J. – MITSIADES, Constantine S. – RICHARDSON, P. G. – DORFMAN, D. – BALÁŽ, P. – ANDERSON, K. C. – JAKUBÍKOVÁ, J. Realgar nanoparticles versus ATO arsenic compounds induce in vitro and in vivo activity against multiple myeloma. In *British Journal of Haematology*, 2017, vol. 179, no. 5, p. 756-771. (5.670 – IF2016).

Transmission mechanisms of tick-borne pathogens and natural foci of infections

Institute of Zoology SAS

Collaborating foreign institutions:

- UMR BIPAR, INRA, École Nationale Vétérinaire d'Alfort, ANSES, Université Paris-Est, Maisons-Alfort, France
- University of Texas Medical Branch, Galveston, TX, United States
- University of Oxford, United Kingdom
- National Institute of Allergy and Infectious Diseases, Bethesda, MD, United States
- Fondazione Edmund Mach, San Michele all'Adige, Trento, Italy
- National Institute for Public Health and Environment, Bilthoven, Netherlands

In framework of the 7FP EDENext project and non-contracted collaborations with several foreign institutions, we explored the mechanisms of

transmission of tick-borne microorganisms and the patterns of rise and maintenance of natural foci of diseases.

In two review papers, we summarised current knowledge on the role of tick salivary gland molecules in modulation of host defence mechanisms during pathogen transmission and on interactions between ticks, viruses they transmit, and immune reactions in the host skin. We participated in the identification of salivary gland molecules from *Hyalomma excavatum* ticks that could be used for development of anti-tick vaccines. Novel are our findings on immune reactions in host skin during early phases of tick feeding and transmission of tick-borne encephalitis virus by the castor bean tick *Ixodes ricinus*. We were able to detect the presence of the virus in mononuclear phagocytes and fibroblasts of the host skin as early as 3 hours after attachment of infected ticks, and we emphasised the importance of pro-inflammatory chemokines and cytokines during virus transmission.

In collaboration with partners from Italy, we detected the presence of the tick-borne bacteria *Rickettsia raoultii* and *R. monacensis*, and of three babesia species (*Babesia venatorum*, *B. capreoli*, *B. microti*) in submountain and mountain areas of the Dolomites for the first time. We described the role of various vertebrate species (birds, rodents, ruminants) in circulation of tick-borne pathogens in natural foci in the studied area, identified the possibility of the appearance of new foci, and confirmed the key role of rodents in circulation of certain strains of the *Anaplasma phagocytophilum* bacterium.

We confirmed the infection of rodents with the *Borrelia miyamotoi* bacterium in Slovakia for the first time. We recorded double infections with *Borrelia afzelii* and *B. miyamotoi* bacteria in both *I. ricinus* ticks and rodents, and identified the importance of rodents in circulation of these bacteria in natural foci as well as the possibility of contracting double infections in humans.

Projects: FP7-261504 EDENext, EurNegVec COST Action TD1303, APVV-0274-14, APVV-0737-12

Outputs:

- ŠIMO, L. – KAZIMÍROVÁ, M. – RICHARDSON, J. – BONNET, S.I. The essential role of tick salivary glands and saliva in tick feeding and pathogen transmission. Review. *Frontiers in Cellular and Infection Microbiology*, 2017, vol. 7, article Number: 281, 23 pp. (4.300 - IF2016).
- KAZIMÍROVÁ, M. – THANGAMANI, S. – BARTÍKOVÁ, P. – HERMANCE, M. – HOLÍKOVÁ, V. – ŠTIBRÁNIOVÁ, I. – NUTTALL, P.A. Tick-borne viruses and biological processes at the tick-host-virus interface. Review. *Frontiers in Cellular and Infection Microbiology*, 2017, vol. 7, article: 339. 21 pp. (4.300 - IF2016).
- RIBEIRO, J.M.C – SLOVÁK, M. – FRANCISCETTI, I.M.B. An insight into the sialome of *Hyalomma excavatum*. *Ticks and Tick-Borne Diseases*, 2017, vol. 8, iss. 2, p. 201-207. (3.230 - IF2016).
- THANGAMANI, S. – HERMANCE, M. – SANTOS, R.I. – SLOVÁK, M. – HEINZE, D. – WIDE, S.G. – KAZIMÍROVÁ, M. Transcriptional immunoprofiling at the tick-virus-host interface during early stages of tick-borne encephalitis virus transmission. *Frontiers in Cellular and Infection Microbiology*, 2017, vol. 7, article no.: 494, 12 pp. (4.300 - IF2016).
- BARÁKOVÁ, I. – DERDÁKOVÁ, M. – SELYEMOVÁ, D. – CHVOSTÁČ, M. – ŠPITÁLSKA, E. – ROSSO, F. – COLLINI, M. – ROSÀ, R. – TAGLIAPIETRA, V. – GIRARDI, M. – RAMPONI, C. – HAUFFE, H.C. – RIZZOLI, A. Tick-borne pathogens and their reservoir hosts in northern Italy. *Ticks and Tick-Borne Diseases*, 2017, 2017 Sep 1. pii: S1877-959X(17)30014-6. doi: 10.1016/j.ttbdis.2017.08.012. (3.230 - IF2016).
- ROSSO, F. – TAGLIAPIETRA, V. – BARÁKOVÁ, I. – DERDÁKOVÁ, M. – KONEČNÝ, A. – HAUFFE, H.C. – RIZZOLI, A. Prevalence and genetic variability of *Anaplasma phagocytophilum* in wild rodents from the Italian Alps. *Parasites & Vectors*, 2017, vol. 10, article no. 293. 8 pp. (3.080 - IF2016).
- HAMŠÍKOVÁ, Z. – COIPAN, C. – MAHRÍKOVÁ, L. – MINICHOVÁ, L. – SPRONG, H. – KAZIMÍROVÁ, M. *Borrelia miyamotoi* and co-infection with *Borrelia afzelii* in *Ixodes ricinus* ticks and rodents from Slovakia. *Microbial Ecology*, 2017, vol. 73, no. 4, p. 1000-1008. (3.630 - IF2016).

II.1.3 Section 3 – Social Sciences, Humanities, Arts, and Culture

The scientific output of the SAS Section 3 scientific organizations in 2017 is comparable to that of 2016. However, notable is the increase in the number of publications in journals registered in CCC databases, by about 14 percent, and WoS CC and Scopus, where the increase was significant, up to 77 percent. The thematic diversity has persisted and in many fields we have seen a strong effort to select topics with high social applicability. A focus on topics with a presumed significant social interest was present also in the production of the Institute of Philosophy SAS. Let us mention the issue of human rights and their ambivalence, the philosophical dimension of forgiveness (in the selection of the results presented in more detail) or the Neo-Kantianism in the development of philosophical thinking in the 20th century.

Among the remarkable discoveries of the Institute of Archaeology SAS is a unique skeleton find of an important member of the Bronze Age settlement, possibly a shaman, found in Rescue Research at the Zbehy site. The Institute has successfully pursued research in the framework of Slovak-Kuwait mission on the island of Failaka in the Persian Gulf, and also research in cooperation with German experts at several localities at Vrábľe.

Among the results of the Institute of History SAS it is worth mentioning monographs from projects focusing on medieval castles and towns. Historians as well as the researchers from the Jan Stanislav Institute of Slavistics SAS have responded to the 500 years of the Reformation and other important anniversaries, including the year of Maria Therese. Another important output is a representative monograph 100 rokov časopisu Právny obzor (100 years of the journal Právny obzor) from the Institute of State and Law SAS, which is not only about the journal itself, but also about the development of legal science in Slovakia, going back to the oldest legal journal in the country.

Several monographs from the Institute of Ethnology SAS focusing, for example, on the issue of conspiracy theories, intergenerational communication, but also on methodological issues of autoethnography. The Institute's actively cooperates with several institutions from the cultural and social spheres (protection of cultural heritage, Roma status and integration, gender studies, migration issues, extremism, Holocaust, etc.) was also active. Some of these issues (attitudes towards the Roma) were also examined by the researchers of the Institute for Research in Social Communication SAS, who also dealt with the issue of the literacy of children from socio-economically disadvantaged environments, the analysis of substitute family care, behavioural characteristics and cognitive abilities of mentally handicapped children as well as various pedagogical and sociological issues. These are the works for which the interdisciplinary approach has been applied. It has also been projected into the production of the Institute of Sociology SAS, to explore the application of inclusive approaches in pedagogical work. The publishing activities of the Institute were enriched by monographs as well as foreign scholars under the 7th Framework Program and Horizon 2020 – Marie Skłodowska-Curie Actions – focusing on the issue of participative journalism and the consequences of the global financial crisis.

Issues of employment in the V4 countries and in Slovakia, as well as the early warning system by monitoring macroeconomic imbalances,

were dealt with in some works at the Institute of Economic Research SAS. Socially up-to-date and applicable social issues were also examined at the Center of Social and Psychological Science SAS: student migration, concerns about vaccination, development of ethnic relations in society, integration of the Roma into the labour market in the Danube region, innovative approaches in cross-border cooperation (see selection), lifelong education, personal and situational aspects of decision-making and others. In the works of the Institute of Political Sciences SAS, we find the subject of minority policies in Central and Eastern Europe, but also the study of the relationship between public opinion and politics.

The Institute of Art History SAS has published the first part of an extensive interdisciplinary project aimed at the research of medieval churches. The Institute of Theater and Film Sciences SAS has focused mainly on the latest period, with a focus on Slovak theater post 1989, for censorship residues in documentary film and for displaying the identity of authors in Slovak cinematography.

The selection of topics of the literary-science institutes of SAS has traditionally been broad, both in chronology and focus. From the Institute of Slovak Literature SAS, we can mention a monograph from a joint Czech-Slovak project on literary classicism, but also others focused on the Baroque period or the poetics of the text in relation to the poetics of events after 1945. The research in the Institute of World Literature SAS is markedly interdisciplinary, as reflected, for example, in the selection of monothematic themes of the *World Literature Studies* magazine, as well as in other studies. The Institute of Oriental Studies SAS published a monograph focused on the reception of German literature and philosophy in China, as well as on the modern history of the Iraqi monarchy (1918 – 1941).

The production of the Institute of Musicology SAS created a memorable representative monograph on medieval sources of church music. The Institute has extended the multidisciplinary character of its research – it cooperates with experts from natural sciences and technical disciplines in investigating the impact of microorganisms on the sound properties of organ whistles, with psychologists in musical psychology research. The Ľudovít Štúr Institute of Linguistics SAS has published several outputs from the Slovak National Corpus, but also a monograph on the role of language in social culture. Thanks to the possibilities of modern corpus linguistics, a new frequency dictionary of the Slovak language (see selection) covering a span of almost 50 years was created.

Miroslav Tibor Morovics
Vice President of SAS Scientific Section 3

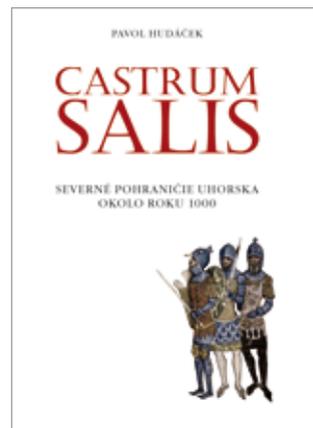


II.1.3.1 Significant results in basic scientific research

Medieval castles and towns in Slovakia

Institute of History SAS

The exploration of castles and cities, researching their function in the Medieval States, is part of the long-term research topics of the Institute of History SAS. This is evidenced by the outputs of projects completed in 2017: APVV Medieval Castles in Slovakia. Life, Culture, Society, Center of Excellence SAS Castles in Slovakia and VEGA Social and demographic development of towns in Slovakia in the Middle Ages. A key outcome of these projects is the collective monograph of Daniela Dvořák *Medieval Castles in Slovakia. Life, culture, society*, which is the result of extensive heuristics of many years in domestic and foreign archives and libraries. Apart from the parts devoted to the different aspects of the study of medieval castles, it also contains the first complete list of all medieval Slovak castles, including

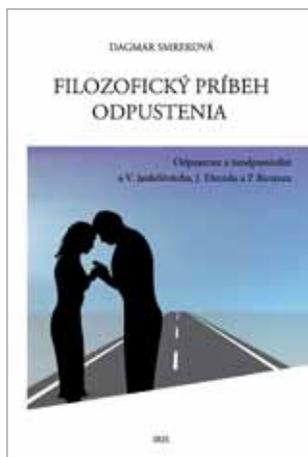


the adjacent towns and villages. This is a work which significantly shifts the state of knowledge about the phenomenon of medieval castles in Slovak and Central European medieval history. The data collected will also contribute to the widening of knowledge in other historical subdisciplines (e.g. genealogy due to the vast amount of material on the history of the noble families) but will also provide a basis for other directions of medieval research (historical demography, the environment in the Middle Ages, social composition of society, familiarity, the position of women and children in society, etc.). We also recommend other remarkable results from projects focusing on the phenomenon of medieval castles and towns, such as the monograph by the young historian Pavel Hudáček as well as the collective work edited by M. Štefánik.

- DVOŘÁKOVÁ, D. *Stredoveké hrady na Slovensku. Život, kultúra, spoločnosť*. Bratislava: Veda, vydavateľstvo SAV: Historický ústav SAV, 2017. 488 s. ISBN 978-80-224-1608-5.
- HUDÁČEK, P. *Castrum Salis: severné pohraničie Uhorska okolo roku 1000*. Bratislava: Veda, vydavateľstvo SAV: Historický ústav SAV, 2016. 477 s. ISBN 978-80-224-1535-4.
- ŠTEFÁNIK, M. (zost.). *Stredoveké mesto a jeho obyvatelia*. Bratislava: Veda, vydavateľstvo SAV: Historický ústav SAV, 2017. 352 s. ISBN 978-80-224-1609-2.

The meaning of forgiveness and human power to forgive

Institute of Philosophy SAS



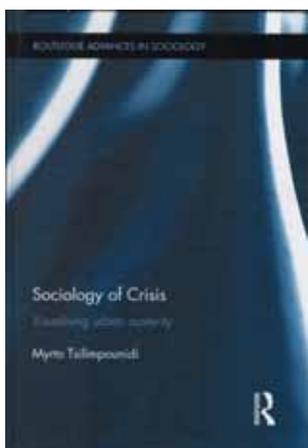
The Dagmar Smreková's monograph about forgiveness is based on the belief that forgiveness has not only religious but also its own philosophical story. The aim and purpose of the method itself is to distinguish the philosophical understanding of forgiveness from its religious / theological pontification, but also from its normal use in everyday human contact (where we often deal with meanings that only imitate true forgiveness). The advantage of philosophical optics is not only the visibility of the “stories” of forgiveness on the cross-section of the history of philosophy but, in particular, the ability to conceal in its examined sense its semantic multidimension and thus its internal contra-

dictions, ambiguities, tensions contained therein, and which question the possibility of reaching unambiguous definitions. At the same time, this attitude requires clarification of the relationship of forgiveness with the terms associated with it such as guilt, punishment, justification, reconciliation, gift, and finally encouraging confrontation of forgiveness with the unforgivable, represented absurd experience of the Holocaust. Critical reading and comparison of representative philosophical concepts leads the author to look for answers to philosophically relevant and existentially crucial questions: What is forgiveness? Where does it originate from? Are we guilty or culpable? Does forgiveness make sense in itself or relates to other goals (for example, social reconciliation)? Who has the right to forgive? How far does human power to forgive go and where are its limits? Finding answers to these and other questions is an illustrative example of the fact that philosophy can become “practical”, i.e. that supreme theoretical reflections can offer ideas useful for everyday life.

SMREKOVÁ, D. Filozofický príbeh odpustenia: odpustenie a neodpustiteľnosť u V. Jankélévitcha, J. Derrida a P. Ricœur. Recenzenti Etela Farkašová, Jozef Sivák. 1. vyd. Bratislava: Iris, 2017. 190 s. Dostupné na internete. ISBN 978-80-8200-003-3.

Social views on the global financial crisis

Institute of Sociology SAS



Myrto Tsilimpounidi, a SASPRO participant, published a remarkable monograph on the social impacts of the global financial crisis during the second year of her study placement at the Institute of Sociology SAS. The basis of the publication is the conceptualization of the global financial crisis beginning in 2008, which highlights the impact and consequences of late capitalism and its inherent part – globalization in all areas of society. In the European context, the crisis was more likely to jeopardize the stability of the entire European area than the threat on a local, regional or national scale. In her work, the author shows how sociologists

need to create new approaches to exploring dynamic changes in the social environment. The crisis is not only manifested through various statistical reports, but also in apparent bankruptcy, misery and waning reserves. This work brings a profound insight into the difficult consequences of the crisis for those living in Greece, looking at issues in wider transnational contexts to the level of the European Union.

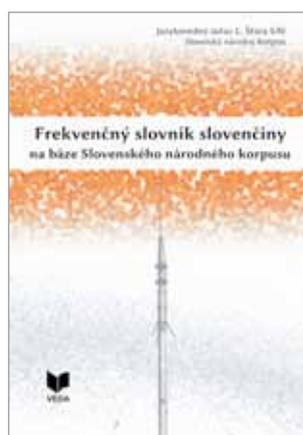
TSILIMPOUNIDI, M. *Sociology of Crisis: Visualising urban austerity*. Abingdon: Routledge, 2017. 191 p. ISBN 987-1-138-83991-5.

II.1.3.2 Problem solving for social practice

New frequency dictionary of the Slovak language

Ľudovít Štúr Institute of Linguistics SAS

The Frequency Dictionary of Slovak on the Basis of the Slovak National Corpus has emerged almost 50 years after the first edition of this type of dictionary in Slovakia (Jozef Mistrík: *Frekvencia slov v slovenčine* Bratislava: Vydavateľstvo Slovenskej akadémie vied 1969). The dictionary captures the most favoured words of contemporary Slovak, as used in the 25 years at the turn of the 20th and 21st centuries. Frequency data is based on text and language resources of the Slovak National Corpus of the Ľudovít Štúr Institute of Linguistics SAS. The source material



is the prima-7.0-frk corpus of over 250 million words and other units found in texts from 1991 to 2015, the composition of which is balanced – artistic, educational and publicised style is represented by one third of the texts. The language source, on the basis of which the words in the corpus are analysed and their occurrence in texts is explained, is the morphological database – a dictionary of the Slovak National Corpus. *The Frequency Vocabulary of the Slovak on the Basis of the Slovak National Corpus* consists of: *Dictionary of the Absolute Frequency Dictionary* (28,456 most frequently used words), *Dictionary of the Average Reduced Frequency* (28,477 of the most frequently used words), *Dictionary of Alphabet with Extended Frequency Data* (the same 28,477 of the most frequently used words) and additional frequency ranges: *Frequency list of punctuation marks*, *Frequency list of graphic symbols and digits*, *Frequency list of graphs*, *Frequency list of graphs at the beginning of words*, *Frequency list of word types*. These frequency dictionaries and lists are useful in the further computerization of the Slovak language, in the creation of dictionaries and in the study of the language in different domains

GARABÍK, R. – KMEŤOVÁ, B. – ŠIMKOVÁ, M. – ZUMRÍK, M. a kol.: *Frekvenčný slovník slovenčiny na báze Slovenského národného korpusu*. Bratislava: Veda 2017. 562 s. ISBN 978-80-224-1630-6.

Monograph on conspiracy theories

Institute of Ethnology SAS



A monograph on a topic up to date not only in our country: on conspiracy theories, which are currently the subject of concentrated interest of the scientific community, but also of the lay public, media and representatives of policy and security forces, was published at the Institute of Ethnology SAS. The publication presents one of the first more comprehensive outcomes on this topic in Slovakia. The author sees the problem primarily as a cultural phenomenon and identifies its historical and ideological contexts. At the same time, it links the existing findings of international research with examples of concrete realities of Slovak society. Conspiracy theories relate to important and sensitive spheres of social life which at the same time represent a source of group tension (issues of morality, religion, politics, the environment, natural disasters, wars, etc.).

Like many of the current stories and conspiracy theories, they can be a significant indicator of the amount of anxieties and conflicts shared in wider or narrower social groups; they can be extrapolated in a superficial manner by specific auto- and hetero-stereotypes, concepts of specific group goals and value orientations, in those ideologically most extreme positions. Their research is therefore a source of interdisciplinary useful information on contemporary society.

PANCZOVÁ, Z. Konšpiračné teórie: témy, historické kontexty a argumentačné stratégie. Recenzentky: Anna Hlôšková, Eva Krekovičová, Marína Zavacká. Bratislava: Ústav etnológie SAV; Bratislava: VEDA, 2017. 160 s. Etnologické štúdie, 29. ISBN 978-80-224-1546-0.

The effect of microscopic fungi on wooden organ whistles

Institute of Musicology SAS

It is important to understand the influence of abiotic, biotic conditions and restoration techniques to objectively assess the original sound quality of historical organs. An interdisciplinary study, based on the collaboration of authors from several SAS institutes, deals with the impact of microscopic fungi on the sound properties of wooden organ whistles after a year of operation. The work is based on the use of a large discovery of mould on a significant historical organ, whose wooden whistles had been treated with an oil paint. To carry out the research, microscopic fungi from this instrument were used, which were inoculated into experimental whistles. Abiotic conditions were set according to the analysis of the conditions directly in situ. The most important organological result of the research is that the microscopic fungi after the year of operation have had an impact on the degradation of the glue adhesive which lead to complete destruction of the glued pipe joints of the whistles. In the sample with small or no occurrence of fungi there were no significant changes in the frequency of the whistle sound or in the adhesion of the joints.

ŠTAFURA, A. – NAGY, Š. – BUČKOVÁ, M. – PUŠKÁROVÁ, A. – KRAKOVÁ, L. – ČULÍK, M. – BERONSKÁ, N. – NAGY, Š. – PANGALLO, D. The influence of microfilamentous fungi on wooden organ pipes: One year investigation. In International Biodeterioration & Biodegradation, 2017, vol. 121, p. 139-147. ISSN 0964-8305.

II.1.3.3 Significant results of international cooperation

Information provision and implementation of innovative approaches to cross-border cooperation between Slovakia and Ukraine

Center of Social and Psychological Sciences SAS

Researchers: Marian Gajdoš, Richard Filčák, Anna Kalistová, Stanislav Konečný, Alexander Mušinka, Eduard Nežinský, Zlatica Sáposová and Ivana Studená.

Project CBC01030, funded through the NFM and co-financed from the state budget of the Slovak Republic, *Information provision and implementation of innovative approaches to cross-border cooperation between Slovakia and Ukraine*, was addressed by the Center for Social and Psychological Sciences SAS between 27 May 2016 and 30 April 2017 in cooperation with partner organizations (Uzhgorod Institute for Cross-Border Cooperation, Finnmark Region Administration, Norway, ISD Slovakia, VÚC Košice and International Institute for Cross-border Analysis and Management in Uzhhorod).

On the basis of the study of forms and methods of cross-border cooperation between border territories of Norway and Russia, its organization within the Barents region, as well as the experience of the development of cross-border relations between Eastern Slovakia and the Transcarpathian region of Ukraine, the research team prepared the theoretical and methodological materials that enabled the implementation and application of positive cooperation aimed at optimization in the conditions of Slovakia. In this sense, the results in the form of articles, expertise, international conferences presentations, publication of the overall results of the project implementation, as well as advice and recommendations for the decision-making sphere and the participants, have been published in press and also electronically.

GAJDOŠ, M. – USTYCH, S. et al. The study of the experiences of the Norwegian-Russian and Slovak-Ukrainian cross-border cooperation: analyses carried out by the expert team of project CBC01030 [elektronický zdroj]. Košice : Centre of Social and Psychological Sciences of the Slovak Academy of Sciences, 2017. 1 CD-ROM. (Published also in Slovak and Ukrainian languages.)

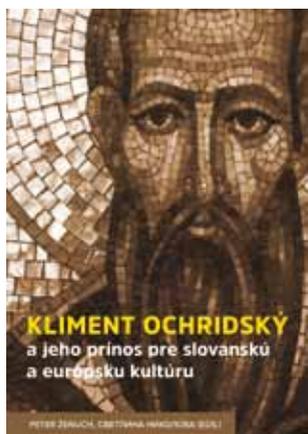
GAJDOŠ, M. – USTYČ, S. – BENCHAK, O. – BILAK, O. – FILČÁK, R. – FORDAL, L. G. – KALISTOVÁ, A. – KONEČNÝ, S. – MAZUR, S. – MIROŠNIKOV, D. – MUŠINKA, A. – NEŽINSKÝ, E. – PRYKHODKO, V. – PIASECKA-USTYČ, S. – RAFAELSEN, R. G. – SÁPOSOVÁ, Z. – STUDENÁ, I. From analyses to interventions: Innovative approach to fostering cross-border cooperation between Slovakia and Ukraine: Summary of expert analyses carried out by the expert team of project CBC01030. Košice : Centre of Social and Psychological Sciences of the Slovak Academy of Sciences, 2017. 57 s. ISBN 978-80-9726936-0-2 (Published also in Slovak and Ukrainian languages.)

GAJDOŠ, M. – USTYČ, S. – KONEČNÝ, S. – SÁPOSOVÁ, Z. – FILČÁK, R. – STUDENÁ, I. Recommendations and proposals. Košice: Centre of Social and Psychological Sciences of the Slovak Academy of Sciences, 2017. 11 p. (Published also in Slovak and Ukrainian languages.)

Clement of Ohrid and his contribution to Slavic and European culture

Jan Stanislav Institute of Slavistics SAS

ST. Climent of Ohrid is the central figure of the publication, which is based on the cooperation of Slovak, Bulgarian and other Slavic institutes. The Slovak side was represented by the Jan Stanislav Institute of Slavistics SAS. This monothematic set of studies includes the scientific contributions



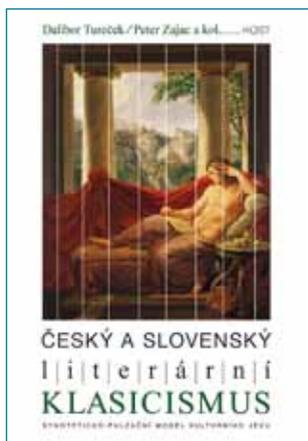
of Slovak, Bulgarian, Polish, Czech and Lithuanian colleagues, who focused on the personality and work of St. Clement of Ohrid and his translative, creative and ideological contribution to Slavic and European cultural heritage. St. Clement belonged to the disciples and collaborators of the holy brothers Cyril and Method. As a pillar of missionary activity in Great Moravia he played a decisive role in forming a Slavic Christian culture. Although the attention in the work is particularly devoted to the work and respect of St. Clement of Ohrid, his contribution to the Slovak culture is perceived primarily in the context of the Cyrillo-Methodic

missionary work and heritage, which is connected with the Byzantine-Slavic written and cultural tradition and its translations into Latin literature and culture in the Slavonic context.

ŽEŇUCH, P. – NIKOLOVA, S. (eds.): *Kliment Ochridský a jeho prínos pre slovanskú a európsku kultúru*. Bratislava – Sofia: Slavistický ústav Jána Stanislava SAV, Кирило-Методиевски научен център към БАН, Slovenský komitét slavistov, Veľvyslanectvo Bulharskej republiky v Slovenskej republike, 2017. 184 s. ISBN 978-80-89489-31-2.

Czech and Slovak literary classicism

Institute of Slovak Literature SAS



The cooperation of Czech and Slovak literary historians led to the publication of a remarkable collective monograph on Czech and Slovak literary classicism. The work is based on monographs devoted to Czech literary romanticism, Slovak literary realism and Czech and Slovak literary parnasism, which emerged as a result of the project *Discourse of Czech and Slovak Literature of the 19th Century* (funded by GAČR) in cooperation with several Czech and Slovak research institutes. The project's keystone is a methodology based, among other things, on the work of Petr Zajac, emphasizing non-linear processes in which the various

nodal points provide a balance between literary and wider cultural trends. The theoretical aspects of the approach to classicism are elaborated extensively by Prolegomena, part of Argumentum brings a summary of case studies on Czech and Slovak literary material which are chronologically sorted. Finally, the volume closes the appendix following the modification of the traditional and prestigious classicist version of the vertex (hexameter) in the context of 19th-century paranism.

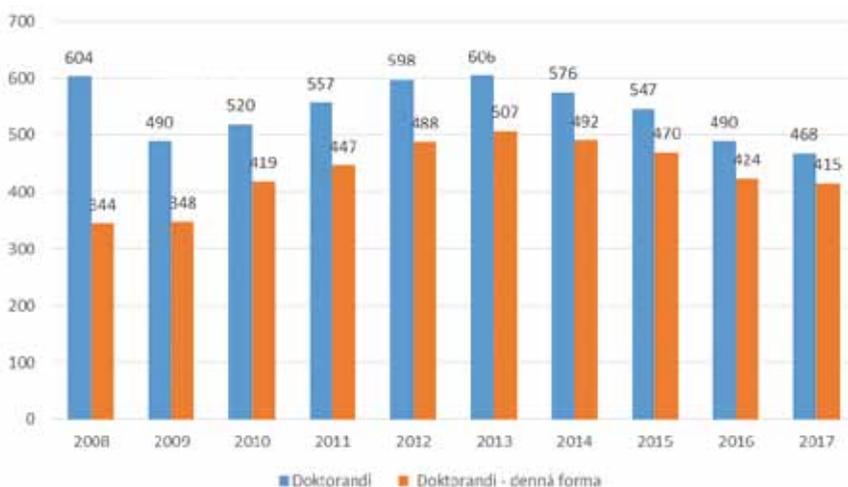
TUREČEK, D. – ZAJAC, P.: *Český a slovenský literární klasicismus: synopticko-pulzační model kulturního jevu*. Recenzenti Eva Stehlíková, Rudolf Chmel, Jiří Kudrnáč. Brno : Host, 2017. 614 s. ISBN 978-80-7577-186-5.

III. SAS IN EDUCATION

Doctoral studies and pedagogical activity

Young scientific scholars continue to successfully train at SAS organizations through PhD studies. As external educational institutions, SAS organizations are involved in conducting PhD programs at 11 universities. Pursuant to Act No. 131/2002 Coll. on Higher Education Institutions, as amended by the Slovak Ministry for Education, Science, Research and Sport, SAS organizations have been granted the right to train doctoral study programs in 46 organisations across 63 fields of study.

SAS organizations trained 468 graduate students in 2017 altogether, of which 415 doctorates were in full-time study and 53 were part time. The newly-enrolled doctoral students for study amounted to 124. The continuing trend of decline in the number of PhD students is worrying, as since 2013 the total number of PhD students has declined by 23%, with the number of full-time students dropping by 18%.



Development of the number of PhD students in the period 2008 – 2017

111 PhD students finished their study with the thesis defence. Additionally, SAS staff acted as senior trainers of 157 postgraduate students at universities, pointing to the further scientific and pedagogical capacity of SAS institutes.

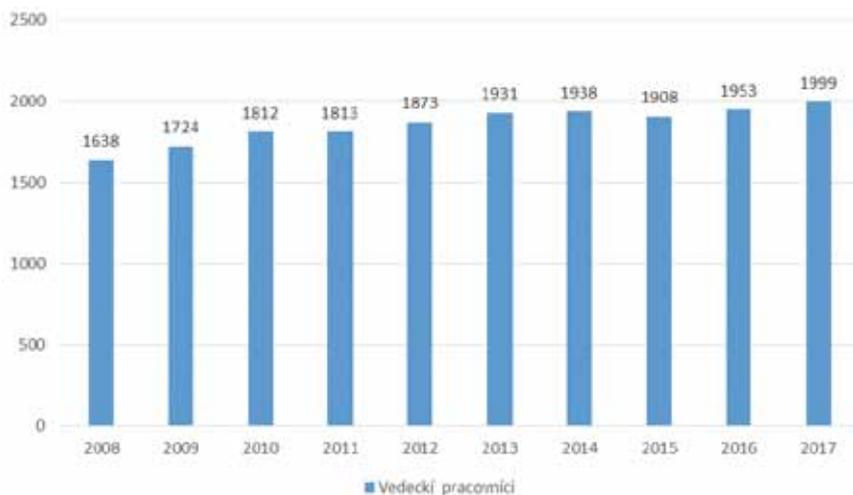
The education and scientific work of doctoral students and postdoctoral students has a high standard at SAS. SAS also supports young scientists through the *Supportive Fund of Štefan Schwarz for Creation of Postdoctoral Positions*. In 2017 a contribution to the wage fund was given to 16 institutes for 16 postdocs.

In 2017, SAS also introduced a *Compensatory Allowance for Graduate Doctoral Students* within one year of graduation, which removes the

decline in net wage after moving from PhD study to employment. This was granted to 31 postdoctoral students.

In collaboration with universities, SAS employees mostly contributed to university lecture activities – 333 employees dispatched for 12,117 hours at Slovak universities and 42 for 1,093 hours abroad, exercises and workshops were led by 235 employees (15,081 hours) in Slovakia and 22 abroad (1,722 hours). An important part of pedagogical activity is the supervising and opponent review of diploma and bachelor theses – 436 SAS employees supervised 1,032 diploma and bachelor theses, 289 employees acted as opponents of 467 dissertations and habilitation works. 376 supervisors (including supervisors for other institutions) worked in the role of chief supervisors, altogether for 625 PhD students. SAS staff worked as members of PhD defense committees (288), the Doctoral Dissertation Defense Commission (44), the members of the commissions or opponents in inaugural or habilitation proceedings at universities (90), as members of scientific councils of universities, governing boards of universities and faculties (256). In 2017 3 candidates received the scientific rank of DrSc., 16 SAS employees received a scientific-pedagogical rank. SAS institutes have 108 joint facilities with universities, focusing on teaching and joint project management.

As of 31.12.2017, 1,999 researchers worked at SAS centers and institutes, of which 251 were doctors of science and 1,748 CSc. and PhD. In comparison with the previous year, the number of researchers with scientific-pedagogical rank increased, with 138 professors and 161 associate professors. According to the qualification structure, 292 lead researchers and 926 senior researchers worked at SAS.



Development of the number of researchers in the period 2008 – 2017

The Scientific Council of SAS awarded five Doctor of Science degrees in 2017. A total of 100 proposals for the award of scientific qualification grades were submitted to the SAS Commission for Assessment of Scientific Qualifications of Employees, of which 45 were from the Slovak Academy of Sciences and 55 from the Ministry of Education, Science, Research and Sport of the Slovak Republic and other departments of the Slovak Republic. The Commission handled two proposals for the award of scientific qualification level I and 98 proposals for the award of level IIa. The commission awarded overall 97 scientific degrees; three proposals were rejected.

IV. SAS IN THE INTERNATIONAL CONTEXT

SAS is actively involved in the creation of the European Research Area. The main pillar of international cooperation is to involve research teams and individuals in international projects, mainly in EU Framework Programs, in COST, IVF, ESA, NATO, CERN and others. SAS organizations have collaborated with foreign partners on joint research, particularly in the fields of medicine, chemical engineering, new materials and environmental protection. In cooperation with UNESCO, SAS participates in the International Hydrological Program (IHP). SAS institutes have also been represented in other major international programs such as IAEA, NATO, IEA, CERN and EMPR.

IV.1 SAS in the European Research Area

In 2017, SAS continued to actively develop ERA relations in all areas of international cooperation – working in international associations, developing bilateral and multilateral cooperation on the basis of scientist exchanges, as well as project cooperation.

Activity in international scientific organisations

SAS actively and systematically builds relationships with international scientific institutions and associations, both on governmental (EU, UNESCO, CERN, ESA), and at the non-governmental (ICSU, ISSC, ALLEA, EASAC, and others) levels. In several of these organizations SAS also represents the other Slovak research institutions.

ICSU (International Council for Science) brings together international scientific societies, which represent national scientific associations, and member organizations which are national representatives. SAS represents the Slovak Republic in the ICSU. The ICSU formulates interdisciplinary research programs, provides administrative support and promotes their findings in UNESCO and/or UN international fora. A joint meeting of the ICSU and the ISSC (International Council for Social Sciences) was held in 2017, where a large majority of representatives agreed to merge the two organizations into a new organization entitled the International Council for Science.

ALLEA (All European Academies) is a federation of all European academies. At present, ALLEA has 56 member academies from 41 countries. Its objectives and goals include developing scientific policy making to improve the conditions for research work as well as increasing excellence and developing and preservation of high ethical standards in European research. In 2017 Prof. Daniela Ježová was Vice President of ALLEA.

EASAC (the European Academies Science Advisory Council) is the association of the national academies of the EU Member States. The aim is to develop mutual cooperation among academies, to create a common platform for addressing urgent issues of science and society development as well as advisory work on the preparation of documents in line with EU legislation. EASAC provides highly expert opinions on current issues, assesses European legislation, organizes seminars for European policy makers, and issues opinions on topics discussed in the European Commission.

ESA (European Space Agency) is an intergovernmental organization for space research, founded in 1974. Research focuses on environmental monitoring, meteorology, aeronautics and geoinformatics, solar research, and navigation and security systems. In 2010, an agreement was signed between the Slovak Republic and ESA on the entry of Slovakia into the first of three stages of cooperation in research and space use for peaceful purposes. SAS has been actively involved in ESA activities mainly in the fields of space science, microgravity research (cosmic biology and medicine) and material processing, including the development of advanced alloys and material architectures suitable for use in space. Four ESA projects with the participation of teams from SAS organizations were handled.

Activities of National Committees

SAS supports the activities of 22 national committees that coordinate the activities of Slovak researchers in international unions associating researchers by fields of expertise. On the basis of the activity reports of the individual SAS Committees, contributions and other expenses related to the activities of the committees in the total amount of € 41,841 were paid in 2017. A new National Sociology Committee was set up which will work at the Slovak Sociological Society.

Bilateral scientific cooperation

An important part of international cooperation and one of its quality indicators is the mutual exchange of scientists. SAS has 44 bilateral agreements on scientific cooperation with research institutions in 34 countries. Many agreements are aimed at dealing with joint projects with foreign partners. In accordance with the concluded inter-academic agreements, in the year 2017, 162 postings of SAS scientists for 1,022 days and 169 admissions of foreign scientists for a total of 1,096 days were realized. Within the framework of bilateral scientific cooperation, SAS institutes carried out projects mainly with Czech Republic (CAS – 32), Poland (PAS – 24), Ukraine (NAVU – 21), Bulgaria (BAS – 18) Hungary (HAS – 8), Germany (DAAD – 3) and Italy (CNR – 7).

Multilateral scientific cooperation

7th Framework Programme and Horizon 2020 projects

In 2017, SAS organizations participated in 60 EU Framework Programmes projects (10 in a coordinator position), of which 41 were Horizon 2020 projects and 19 were 7th EU Framework Programme projects. The SAS teams participated in the preparation of 69 Horizon 2020 project proposals, 19 of these in the position of coordinator.

One ERC project was carried out in SAS (Institute of Chemistry SAS). SAS organizations submitted 4 ERC project proposals (1 in Section 1, 2 in Section 2, 1 in Section 3), the other three participated in the preparation of ERC project proposals as partners (one in every Section).

COST projects

The COST (European Collaboration in Science and Technology) is the oldest European cross-cutting program for scientific and technical cooperation among EU Member States and the EFTA countries. Cooperation takes place through the coordination of national research projects, with projects funded at national level. In 2017 SAS organizations participated in 53 COST projects.

ERA-NET projects

The ERA-NET program is a specific EU instrument for coordinating national research programs through national agencies. SAS is the only Slovak organization active in the development of ERA-NET programs. Under Horizon 2020, the ERA-NET program runs under the COFUND scheme, which means that part of the funds spent by the agencies on project management (up to 30% depending on the consortium agreement) will be reimbursed from EU funds. The participation of SAS in coordination projects enables teams from SAS organizations to participate in the execution of research projects. In 2017 SAS was a member of 23 ERA-NET co-ordination projects, of which 14 were in the COFUND scheme. The SAS teams were involved in 14 research projects in ERA-NET in 2017.

Other projects

Other programs with the participation of SAS organizations include the International Visegrad Fund (IVF) with 13 projects with SAS participation, and UNESCO (6 projects). In cooperation with UNESCO, SAS participated in the International Hydrological Program (IHP). SAS institutes have been also active in other major international programs such as IAEA, NATO, IEA, CERN and EMPR.

IV.2 Cooperation with economically/research developed countries

Taiwan

Under the bilateral scientific cooperation agreement between SAS and MOST Taiwan, SAS organisations run 8 research projects with Taiwanese partners. In 2017, the 9th call for research projects for 2018-2020 was launched in SAS – MOST JRP. The topic of the call was not specified and was open to all SAS organizations. Five project proposals were submitted under the published call. After evaluation on the Slovak and Taiwanese sides, two projects have been selected for funding.

Turkey

SAS has a cooperation with Turkey based on an agreement with TÜBİTAK (The Scientific and Technological Research Council of Turkey). Under the agreement with this institution, there are 2 types of projects:

- **Mobility support projects.** Project application can be made continuously throughout the year. Currently, two projects are being addressed.
- **Joint Research Projects Program (JRP).** 5 projects have been run within this program. The 5th common call was announced to support 2 projects scheduled to start in June 2018.

Japan

In 2017, three projects continued on the basis of the Memorandum on Scientific and Technological Cooperation among the Visegrad Group (International Visegrad Fund, Ministry of Education, Youth and Sports of the Czech Republic, National Center for Research and Development of Poland, Slovak Academy of Sciences), and Japan (Japan Science and Technology Agency), signed in 2014. The aim of the memorandum is to intensify the cooperation of researchers from the V4 countries with Japan.

Republic of Korea

In 2017, the first joint call in Korea – the V4 Joint Research Project, was evaluated. Out of the total number of 18 project proposals submitted (of which SAS participated in 10), 3 have been approved for funding, all including the participation of SAS.

Singapore

In Smolenice, on March 14, 2017, in the presence of the Minister of Education, Science, Research and Sport of the Slovak Republic Prof. Peter Plavčan and president of SAS Prof. Pavol Šajgalík an international workshop was organised by the Slovak Academy of Sciences with three prominent scientific institutions from Singapore: National University of Singapore, Nanyang Technological University and A* STAR Agency for Science, Technology and Research. The four-day workshop was attended by leading experts from various scientific disciplines, as well as representatives of scientific and university institutions from Singapore. The facilitator of the conference was the Vice President of the Slovak Academy of Sciences, Dr. Eva Majková. The aim of the workshop was to initiate scientific contacts among the advanced institutions from Singapore and the Slovak Academy of Sciences and to look for possibilities and forms of future cooperation. One of them is the mutual exchange of doctoral students. This would initially consist of shorter stays ranging from one week to a month. Within workshop there was also a discussion on economic and industrial cooperation, as well as on how to properly set up the grant scheme for project funding, particularly in terms of their evaluation. A Memorandum of Understanding between SAS and A * STAR was signed in June 2017.

IV.3 SAS activities for the development of international cooperation

V4 Academies cooperation

On September 26 – 27, 2017, a meeting of representatives of the V4 Academies of Sciences was held in Warsaw at the Polish Academy of Sciences. At the meeting, in addition to the presidents and representatives of the V4 Academies, the President of the Austrian Academy of Sciences, Prof. Anton Zeilinger was also in attendance. President of SAS Prof. Pavol Šajgalík presented the results of the international evaluation of SAS organizations. An important point of the meeting was the discussion on the extension of cooperation between the V4 Academies of Sciences and the Austrian Academy of Sciences. Further topics of discussion were focused on cooperation between academies and universities, as well as on the cooperation of Central European countries in the preparation of the new 9th EU Framework Program.

Slovak laureate of the V4 Young Researcher Award was Tomáš Smolek from the Institute of Neuroimmunology SAS for his excellent results achieved in the field of biomedicine.

Cooperation with the Czech Academy of Sciences

As a part of the cooperation between SAS and the Czech Academy of Sciences, 32 bilateral mobility projects were underway, 16 for the period 2015 – 2017 and 16 for the period 2016 – 2017. In March 2017, a new call for project proposals within the framework of the academic agreement between the Academies for the years 2018 – 2020 was announced. The call was closed on 31 May 2017. Of the 32 projects submitted, 20 projects have been approved for support.

During the year, the Scientific Cooperation Agreement between the Slovak Academy of Sciences and the Czech Academy of Sciences was updated, which, together with the Implementation Protocol, will be signed at the meeting of representatives of academies in the Czech Republic at the beginning of 2018.

V. SAS IN INTERNAL PROCESSES

V.1 Transformation of SAS

The law, for which SAS had been waiting for more than two years, was finally approved by the Government of the Slovak Republic on May 24, 2017 and discussed and approved by the National Council of the Slovak Republic on September 7, 2017. The law comes into force on January 1, 2018 and the transformation of SAS organizations into a new legal and economic form will be effective as of 1 July 2017. SAS organizations will transform from state budget / contributing organizations to public research institutions. This change is essential and although Law 243/2017 Coll. is universal and valid for all state budget research institutes and units, SAS is a pilot institution within the Slovak Republic, and the first to make use of the law.

During 2017, a lot of preparatory work was carried out in SAS on the transition of SAS organizations to the new legal form. The SAS Commission on Transformation and SAS Legislative Commission started to work on the regulations needed for individual research institutions. They also set a minimum number of researchers and prepared a recommendation for new public research institutions in view of the need to set up proper supervising and governing boards and scientific council. There have been adjustments in real estate management of the SAS organizations location, and so on. The year 2017 was filled with intensive preparatory work for the smoothest transition of SAS organizations into a new legal form. In 2017, several new centers were created and applications for their creation were submitted with effect from January 1, 2018. As of this date, the number of SAS scientific organizations decreased from the original 57 to 46. This process of bringing together and merging research institutes and their conversion to research centers was conditioned by consideration of the viability of the institutes. In each particular case the merging process was based on a voluntary association of research teams with a view to find an appropriate combination of sustainable research directions. The process of creating larger, more viable entities within SAS is not yet complete and will continue in the coming period.

V.2 SAS Accreditation 2016

In 2017, the process of evaluating SAS organizations was finalized. Members of the international metapanel met in January at the Smolenice Congress Center, where they harmonized the results of the evaluation of the three panels by SAS sections and institutes. The metapanel was made up of Professor Marja Makarow, at that time Vice Chair of the Academy of Finland, Swedish Physicist Professor Pär Omling, Estonian Biologist Pro-

fessor Toivo Maimets, Croatian Professor of Linguistics Milena Žic-Fuchs, specialist in Cultural History of Religion in Europe Professor Sijbolt Noord from Holland and Professor John Wood, expert in material engineering from the United Kingdom of Great Britain and Northern Ireland.

As up to 52.6 percent of the evaluated institutions were placed in category B (see the table), the metapanel proposed a division of category B and creation of subcategory B+. The experts initially assigned 3 institutes from each section to B+. However, this evaluation was not adopted by the SAS Assembly, so the final classification approved consisted of four categories:

- A. Research is internationally leading within the European context. The institute has demonstrated important contributions to the field and is considered an international player in Europe.
- B. Research is visible at European level. The institute has made valuable contributions in the field in Europe.
- C. Research is solid and has contributed to the knowledge in the field at European level. The institute is nationally visible.
- D. Research is not solid or is repetitive, or it is flawed in the scientific or technical approaches.

Results of the evaluation of the SAS research organisations for the period 2012 – 2015 by the international panel of experts

Category	A	B	C	D
Section 1	0	11	4	0
Section 2	1	9	9	3
Section 3	1	10	7	2
Total	2 (3.5 %)	30 (52.6 %)	20 (35.1 %)	5 (8.8 %)

The final task of the metapanel was the preparation of the final report. The report presented the Slovak research area with an explanation of the methodology of the international evaluation. The essential part of this was the General Recommendation – for SAS, institutes and also ministries.

On February 23, 2017, a SAS press conference was held at the premises of the SAS Office on the results of the evaluation, attended by the then Minister of Education, Science, Research and Sport of the Slovak Republic, Prof. Peter Plavčan, Deputy Prime Minister and Minister of Finance of the Slovak Republic Ing. Peter Kažimír and a number of media representatives. Representatives of the international evaluation metapanel, headed by the chairwoman Prof. Marja Makarow from Finland informed the media and the public on the results of the evaluation which aired on TA3. Chair of the expert panel Prof. Marja Makarow highlighted the potential of SAS and two institutions which are at a top level in Europe – the **Polymer Institute SAS** and the **Institute of Ethnology SAS**. A further nine institutes far exceed the European average, so at least 11 of our institutions are at the forefront of the European Research Area. International experts see plenty of positives in our scientific work. Most apparent is the fact that we have a lot of excellent young motivated scientists. The metapanel members also presented some general recommendations from the evaluators, including the emphasis on closer cooperation with universities and the Ministry of Education, Science, Research and Sports of the Slovak Republic. The summary report also includes recommendations for institutional management, long-term strategic planning, and highlighting multidisciplinary research. Among other things, the experts also appreciated the merging of some SAS institutes into larger units, but with the emphasis on the need

for their reorganization. One of the recommendations is also to develop a national research strategy in Slovakia.

At the press conference, the SAS approach and the results of its independent international evaluation were commended by Deputy Prime Minister and Minister of Finance of the Slovak Republic Peter Kažimír, who confirmed that in cooperation with the Ministry of Education, Research and Sport of the Slovak Republic there will be an increase in resources for the best institutes by one million one hundred thousand euro to support excellence and top research. This amount was promised for 2017 and for another three years, but it was actually depleted in 2017.

After finalizing the summary metapanel report, SAS institutes received time for comments, or feedback. Several institutes sent explanations, and 18 appealed. After the experts' assessment for the individual panels, the results were dealt with by an extraordinary meeting of the SAS Presidium. The Presidium took into account some of the arguments of the evaluated subjects and in eight cases adjusted the final evaluation in partial indicators, for one institution the double overall rating was corrected into a single joint result. The overall categorization of SAS organizations was left to the Panel of International Experts in light of the proposed evaluation results.

Following the end of the evaluation process, the SAS research organizations developed their research strategies and action plans for the subsequent period taking into account the recommendations of international experts. These are beginning to be fulfilled and implemented, as is also demonstrated by the adoption of a decision on performance financing.

The historically first independent evaluation of the academy by foreign experts with the ambition to acquire a professional, correct and objective view of the current state and visions of science in Slovakia, is gradually yielding results. It has helped to identify possible weaker spots in international competitiveness, while at the same time making better use of the strengths of our work and research.

SAS has met the commitment to the Government in signing the Stabilization Treaty in summer of 2016. This provides a stable budget of at least €60 million annually until 2018. Top quality identification is for SAS a way for better financing in the future. The evaluation process is the first step in



Metapanel members at Smolenice, from the left: J. Wood, P. Omling, M. Makarow, S. Noorda, M. Žic Fuchs and T. Maimets

the innovative perception of the quality of science and research in Slovakia, transcending our local criteria and approximating them to the European scene. In this context, it also increases the credibility of the academy in international context and may help not only our talented researchers to leave Slovakia, but, on the contrary, to gradually attract top researchers from abroad.

The evaluation of SAS organisations has its limits and it is necessary to search for a joint assessment with universities according to international standards in order to allocate financial resources in line with performance and results. In the near future, it is also necessary to focus on the evaluation of research groups.

V.3 Evaluation of specialized and service organizations

In 2017, the evaluation of the SAS specialized and service organizations was carried out. The evaluation of these organizations was last done in 2007. On the basis of the approved *Principles of Regular Evaluation of SAS Specialized and Service Organizations for the Period 2008 – 2016*, SAS created the Accreditation Commission (AC), which consisted of an external evaluator and a member of the SAS Presidium. One of the members of the AC was also a correspondent for the evaluated unit. The correspondent was also responsible for the preparatory phase, i.e., checking the content of the surveyed organization's questionnaire.

The attendance assessment consisted of a presentation by the Statutory of the organization evaluated, presentation of the evaluation and the plenary debate, as well as a site visit in some cases.

The evaluation included an assessment of the basic conditions for the organization's activities (including personnel and finance), the activities of the organization with emphasis on projects, outputs as well as professional and service activities of a permanent nature and an outline of the organization's activities for the next period.

The following organisations were evaluated:

- Veda Publishing House SAS,
- Computing Center SAS,
- Technical and Economic Administration of Social Sciences Institutes SAS,
- Encyclopaedic Institute SAS,
- Congress Centre Smolenice SAS,
- Technical and Economic Administration of SAS Institutes Košice,
- Central Archive of SAS,
- Central Library SAS.

The invited specialists for a given type of specialized organization served as external experts. Our colleagues from the Czech Academy of Sciences helped us significantly. All of the discussions were on economic issues and the further functioning of the workplaces in the context of the transition to public research organisations.

A comprehensive view of the activities and results of the specialized and service departments was summarized in the final report, which in-

cluded an assessment of the following factors: basic conditions for the organization's activities, financial provision (expenses, wages and others), activity of the organization in the evaluation period including SWOT analysis and outline of activities of organizations for a further period, and, in conclusion, an overall evaluation and recommendations, including comments, objections to the organization's activities, and specific tasks the organization must perform in time for further regular evaluations.

All evaluated units succeeded in the overall rating and received a rating of a good organization. As there was no need for appeal, the SAS Presidium issued a certificate of classification to all organizations rated.

The Accreditation Commission has drawn up recommendations for each evaluated unit to be continuously monitored in 2018.



VI. LIST OF ORGANIZATIONS AS OF 31 DECEMBER 2017

Section 1: Physical, Space, Earth, and Engineering Sciences

Earth and Space Sciences

Institute of Astronomy SAS
Earth Science Institute SAS
Institute of Geography SAS
Institute of Hydrology SAS

Mathematical and Physical Sciences

Centre for Advanced Material Application SAS
Institute of Experimental Physics SAS
Institute of Physics SAS
Mathematical Institute SAS

Engineering Sciences

Institute of Construction and Architecture SAS
Institute of Electrical Engineering SAS
Institute of Geotechnics SAS
Institute of Informatics SAS
Institute of Materials and Machine Mechanics SAS
Institute of Materials Research SAS
Institute of Measurement Science SAS

Section 2: Life, Chemical, Medical, and Environmental Sciences prírode a chemických vedách

Medical Sciences

Biomedical Research Center SAS
Institute of Experimental Pharmacology and Toxicology SAS
Institute for Heart Research SAS
Institute of Neurobiology SAS
Institute of Neuroimmunology SAS
Institute of Normal and Pathological Physiology SAS

Biological and Chemical Sciences

Centre of Biosciences SAS
Institute of Chemistry SAS
Institute of Inorganic Chemistry SAS
Institute of Molecular Biology SAS
Institute of Zoology SAS
Polymer Institute SAS

Agricultural and Veterinary Sciences

Institute of Animal Fyziology SAS
Institute of Forest Ecology SAS

Institute of Landscape Ecology SAS
Institute of Parasitology SAS
Plant Science and Biodiversity Center SAS

Section 3: Social Sciences, Humanities, Arts, and Culture

Historical Sciences

Institute of Archaeology SAS
Institute of Ethnology SAS
Institute of History SAS

Humanities and Social Sciences

Centre for Social and Psychological Sciences SAS
Institute for Research in Social Communication SAS
Institute for Sociology SAS
Institute of Economic Research SAS
Institute of Philosophy SAS
Institute of Political Sciences SAS
Institute of State and Law SAS

Arts and Culture

Institute of Art History SAS
Institute of Musicology SAS
Institute of Oriental Studies SAS
Institute of Slovak Literature SAS
Institute of Theatre and Film Research SAS
Institute of World Literature SAS
Jan Stanislava Institute of Slavistics SAS
Ludovít Štur Institute of Linguistics SAS

Specialized Units

Central Archive of SAS
Central Library SAS
Computing Center SAS
Encyclopaedic Institute SAS
Veda Publishing House SAS

Servis Units

Congress Centre Smolenice SAS
Technical and Economic Administration of SAS Institutes Košice
Technical and Economic Administration of Social Sciences Institutes SAS