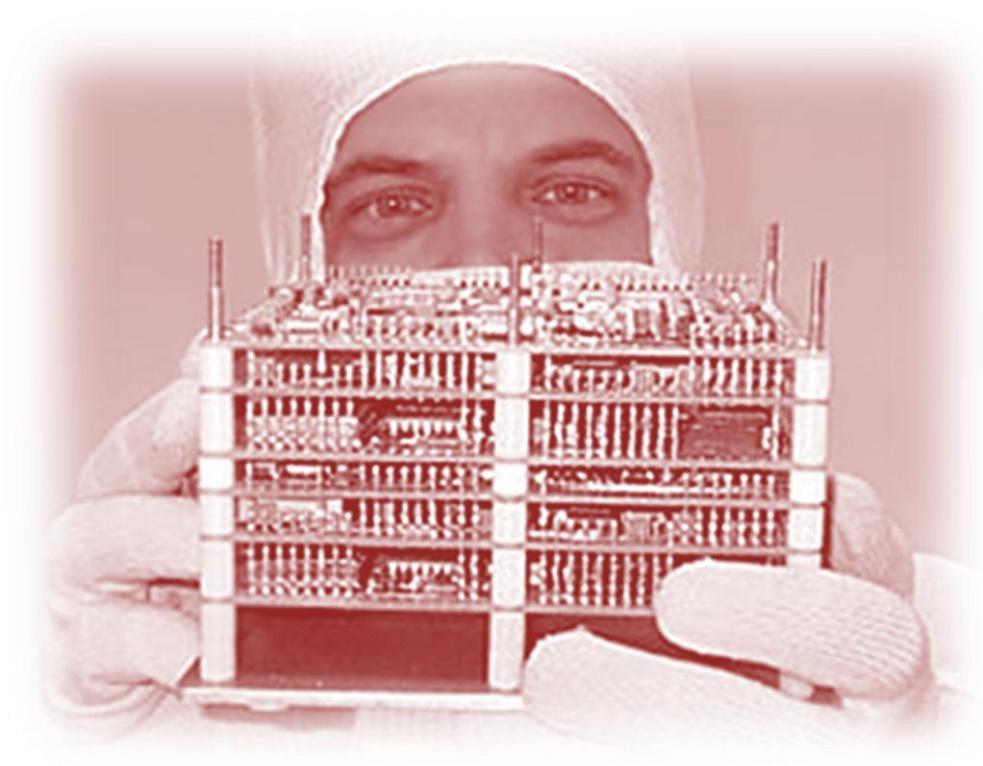




# SAS ANNUAL REPORT

2014



Slovak Academy of Sciences  
Štefánikova 49  
814 38 Bratislava



*After a voyage of the solar system that lasted more than a decade the Rosetta space probe reached its destination comet 67P/Churyumov–Gerasimenko on 8 August 2014 having travelled a distance of more than six billion kilometers.*

The Department of Space Physics Institute of Experimental Physics in Kosice was involved in the construction of the spacecraft.

## IMPRINT

The Annual Report has been compiled pursuant to the Act on the Slovak Academy of Sciences No. 133/2002 Coll. In compliance with Article 8 paragraph 7 c) thereof, the Assembly of the Slovak Academy of Sciences endorsed the Annual Report on 3. 6. 2015.

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Štefánikova 49, 814 38 Bratislava

Available in electronic form at [www.sav.sk](http://www.sav.sk)

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## **Presidium of SAS for the period 2013 – 2017**

President

prof. RNDr. JAROMÍR PASTOREK, DrSc.

Vice President for Economy

prof. RNDr. PAVOL ŠAJGALÍK, DrSc.

Vice President for Research

RNDr. EVA MAJKOVÁ, DrSc.

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PhDr. MIROSLAV LONDÁK, DrSc.

Mgr. JURAJ MARUŠIAK, PhD.

RNDr. MIROSLAV TIBOR MOROVICS, CSc.

RNDr. PAVOL SIMAN, PhD.

●  
*At an extraordinary session of the SAS Assembly on 18.12.2014, the members of the SAS Assembly voted on the proposal to recall prof. RNDr. Jaromír Pastorek, PhD. as President of SAS. The SAS Assembly submitted this mandate to the Minister of Education, Science, Research and Sports. Prof. RNDr. Jaromír Pastorek, PhD at the same time on 18. 12. 2014 renounced his membership in the Presidium of SAS*  
●

## **President/Chairpersons of the SAS Assembly**

JUDr. ZUZANA MAGUROVÁ (until 24 . 9. 2014)

RNDR. JÁN SEDLÁK, DRSC. (from 24 . 9. 2014 do 18. 12. 2014)

PROF. RNDR. KAROL MARHOLD, CSC. (from 18. 12. 2014)

## CHAPTER I

### Foreword

In 2014 the Slovak Academy of Sciences began preparing for one of the most significant changes in its history so far –the transformation of its organizations from both the budgetary and contributory perspective into a new form of public research institution (PRI), derived from a well-functioning model introduced by the Academy of Sciences of the Czech Republic. The law is stipulated by the Ministry of Education, Science, Research and Sports in cooperation with the staff of the SAS Institute of State and Law Office who worked together intensively on this law throughout the year. At the same time at SAS, particularly in the SAS Assembly, there has been some debate on amendments to the Act on SAS, which is an inherent part of the PRI legislation.

Another major blow to the academic community in 2014 was speculation on reducing the number of institutions operating at SAS. This was based on the idea of joining or merging of SAS Institutes into larger units which would have a better chance in gaining large projects from EU Structural Funds, or an even greater chance of success in Horizon 2020 projects. At the very least these units would be less vulnerable to possible changes in financing. Consideration was given to a number of variants and models for merging SAS institutes. To date none of these obtained majority support from the SAS Assembly. Discussion on this will continue in 2015.

Year 2014 was challenging for SAS also because the draft budget for the SAS for the year 2015 which was reduced by 17 per cent compared to 2014. This had a negative effect on opinion in SAS, and ultimately in society. Such a reduction of the budget would mean the release of almost 500 SAS employees. The trade unions highlighted the unsustainability of research excellence should this step be taken by SAS. This saw the birth of the " Veda chce žiť (Science wants to live)" initiative which has launched a broader discussion on the financing of science and education in Slovakia.

The end of 2014 at SAS was turbulent, culminating in an extraordinary SAS Assembly on 18. 12. 2014, at which a vote of no confidence was issued to the President of SAS. This happened for the first time in the history of the SAS.

Despite the events which dramatically affected the life of SAS, the ambition of SAS to provide quality research with an emphasis on excellence remains unchanged. In 2014 the rough construction of the University science park for biomedical research was completed and handed over as was the building for the applied research centre in Bratislava. The pavilion for the PROMATECH Research Center was completed in Košice. SAS gained two more "major projects". These are achievements for SAS and its institutions in raising funds from the EU structural funds. SAS also submitted a project for requisition of the HORIZON 2020 program called Building teaming-up Centre of Excellence for Advanced Materials application (CEMEA).

These achievements confirm that SAS has the ambition and potential to be applied in the European research area as an equal member. The infrastructure that has been built at SAV is an instrumental precondition for this effort. SAS also makes available an infrastructure that provides the potential for closer cooperation of the institutes of SAS with industrial practice as well as with the business sector.

This report documents the results achieved by SAS organizations in all areas of research. Some of these are published in leading journals such as NATURE, others produce results applicable in industrial practice, and I believe that all of them are valuable and important to society.

Pavol Šajgalík  
SAS President

## I.1. Scientific Policy

The prime objective of SAS in 2014 was to increase the quality of output and its inclusion among successful research institutions of the European Union. We focused on increasing the number of publications in high-impact magazines, publishing high-quality monographs and chapters in monographs published in foreign languages, in prestigious publishing houses. There is still an insufficient number of patents received with European or world effect.

The 11 percent of SAS employees proportion (FTE) covers 31 percent of publications and 39 percent of citation output for Slovakia. To compare output quality of SAS we used SCImago Institution Ranking and Excellence rate indicator; this is the percentage of institutions included in the set of ten percent cited publications in the relevant scientific disciplines around the world. In 2014 SAS reached 17.82, compared with the world's best organization (from over 4,800 institutions included in the indicator), which was assigned a value of 100. In the Slovak Republic the Comenius University was assigned the highest value of 20.3. For comparison: the Academy of Sciences of the Czech Republic was assigned 23.28. When comparing the frequency output of the organization (Output indicator) SAS reached a value of 3.42, while the Comenius University reached 2.2 (once again for comparison: the Czech Academy of Sciences reached a value of 9.42 for output criteria in 2014). In Slovakia SAS contributes to the largest number of publication output in the Scopus database, in the absolute number has the largest number of publications categorized to 10 percent of the most highly cited works in given fields of expertise.

Despite SAS ranking best in Slovakia in terms of scientific output, its position among the V4 countries and generally in Central and Eastern Europe is less than satisfactory. According to SCImago ranking Institutions we are lagging behind compared with other academies of science in the V4 countries, particularly in parameters of excellence, as defined above.

The Institutes of SAS were awarded seven patents in 2014, two of which were granted in the US. SAS organisations signed 21 patents in 2014, eight of which are filed as PCT (Patent Cooperation Treaty).

In 2014, the number of SAS researchers amounted to 1 535.9 (FTE), the number of internal PhD students was 492. SAS published 1415 CC publications and received 29,007 citations. 2014 saw an average of 0.92 CC publications and 18.9 citations per capita per employee.

Slovakia, including SAS has a very low success rate in obtaining grants from the European Research Council (ERC), which are among the most prestigious. Analyses show that according to the number of ERC grants obtained, some new EU Member States (Czech Republic, Poland, Hungary) are gradually approaching the level of the "European Dozen", while others, including Slovakia are still lagging behind, and this gap continues to increase. This also applies to SAS, even though the only ERC project received for the year in Slovakia was won by SAS staff.

Structural Funds have helped significantly improve Slovakia's slow progress in research infrastructure, the potential to increase the effectiveness and success of Slovakia in research within the V4 and EU has been built. In order to make full use of this potential, institutional funding should be set up derived from auditing and to strengthen competitive research funding through various APVV (Slovak Research and Development Agency) programs. SAS proposes among other things opening a sustainability program which would enable support for laboratories built from Structural funds in a competitive form. Not having a program such as this risks a large part of investment in research infrastructure for Slovakia not making the expected contribution.

At the end of 2014, SAS developed a request to the Ministry of Education, Science, Research and Sport of the Slovak Republic for SAS plan to the year 2017. In this request the conceptual changes in the structure and organization SAS were summarised. These changes are geared toward a modern, flexible, dynamic and successful SAS, with an improved position in the European Research Area, with a link to RIS3. The aim of these changes is to streamline the process of transferring knowledge into economic practice, the culmination of a greater share of "knowledge" on the final products and technologies applied in industry, not only in Slovakia but also around the world (significant increase in patents and innovative output).

An important part of SAS scientific policy is the acquisition of talented researchers from abroad. SAS acquired the SASPRO <http://www.saspro.sav.sk/> project in 2014 as part of FP7 EU-FP7 Marie Curie COFUND program. These were doctorate and researcher posts for those who have passed less than 14 years having obtained a PhD. The project scheme solidifies the extent of financial support for candidates according to EC policy.

The SASPRO project has helped to at least partially reverse the brain drain "phenomenon" from Slovakia in that it motivates Slovak scientists to return to Slovakia and offers scientists operating abroad adequate conditions for their work in their home country. This is the first project in the history of Slovakia which seeks to address the reintegration of talented researchers from abroad.

To date we have concluded the first call to which 43 candidates from around the world applied. Applicants submitted scientific projects that they plan to address with certain SAS organisations. The project includes the views and support of the appropriate organizations. The submitted projects were evaluated by independent international experts where by the quality of the project, the quality of the candidate and the quality of the host organization are evaluated.

## CHAPTER II

### Science and Research

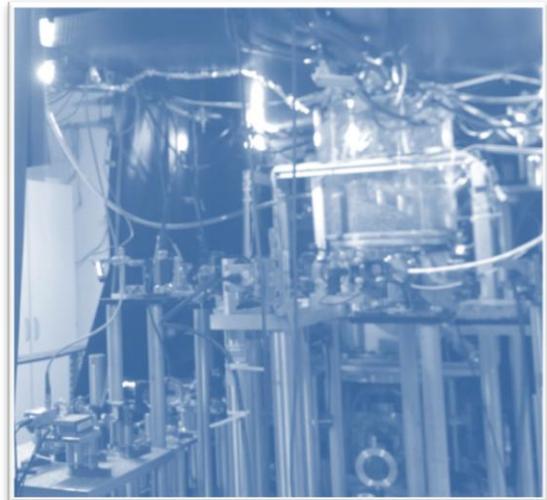
#### II.1 Most significant results of scientific work

##### SAS SECTION 1

The most important scientific results achieved by the institutes of scientific Section 1. of SAS (Physical, Space, Earth and Engineering Sciences) cover a wide range of research in physics, geophysics, in precise measurements, materials research, electronics and aerospace research. The results are divided into the areas of basic scientific knowledge, problem solving for social practice and research in international scientific projects.

In basic scientific knowledge a manipulation of atoms was modelled which was performed using an atomic force microscope on the surface of oxidized copper. The modelling of processes to create nanostructures on the surfaces using an atomic force microscope helped to understand the complex physical processes that take place at the atomic level. These contribute to the possibility of designing fundamentally new components and devices used in processes at the atomic level. Technical sciences in medical services: with the help of magnetic resonance imaging the metabolism of muscle and liver has been studied. The results showed a significant possibility of using magnetic resonance imaging in medical practice for examining the metabolism of the gastrocnemius muscle, liver disease and effect of exposure to phosphorus on the muscles as well as helping to gain more accurate diagnostics for serious diseases. A monograph by Slovak authors entitled "Modelling of Earthquake Motions: Waves and Ruptures" was published at the prestigious English publishing house Cambridge University Press. The work summarizes the basic knowledge of seismic movement and formation of cracks in the earth's core, obtained through modelling. The results of scientific discovery show that physical methods and modelling of physical processes are widely used in our lives, beginning with the processes at the atomic level, through medical applications to predicting the movement at the earth's core. In the field of applied research, complex measuring systems were developed for continuous monitoring of heel reactor vessels at the nuclear power plant in Mochovce. The use of these measurement systems will improve the operational safety of nuclear power plants. A special automotive engine mount was developed for Hyundai within the framework of a bilateral project for eliminating critical vibration on the axle. This new technology can be used after adjustment for the production of various types of auto components. In the area of electrical engineering SAS was a partner ( alongside FBH Berlin, Infineon Villach) as part of the work of the FP7 HipoSwitch project - technology transfer, a power transistor technology that was submitted and is usable for power control with low conversion loss.

Significant scientific results were also achieved in international scientific cooperation. SAS employees participated in the construction of a service system for the Rosetta space probe. They also studied the early stage of development of the Nova Delphini 2013 nova star (V339 Del). A detailed analysis of the star established that it had not developed in line with current theoretical assumptions. We also developed a unique TATRA spectrometer which was used for the implementation of the first experiment designed at CERN and implemented in Slovakia. In the experiment, nuclear reactions when radioactive elements were irradiated with an astatine laser were directly observed. Astatine radioactivity can be utilized in the treatment of malignant tumours. The results of international scientific cooperation confirm that the Slovak scientists also know how to establish themselves internationally.



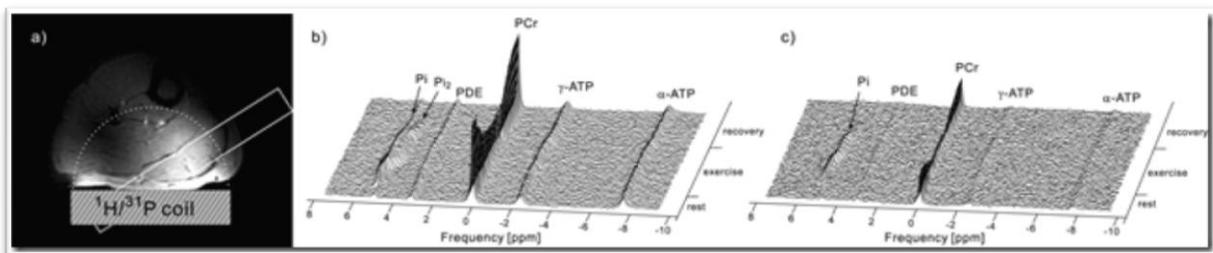
### II.1.1.1

## The investigation of muscle and liver energy metabolism using novel phosphorus MR spectroscopy and imaging localization methods

INSTITUTE OF MEASUREMENT SCIENCE SAS

RESEARCHERS: L. Valkovič, I. Frollo.

The chemical reaction rates of phosphorus energy metabolism in individual muscle groups and the liver are important markers of the pathophysiology of these organs as well as of the entire organism. New  $^{31}\text{P}$ -MRS method for precise localization of dynamic changes of phosphorus metabolites for the measurement of energy metabolism of the liver and muscles (1D-ISIS) has been developed and tested.



An *in vivo* localizer image with the depicted coil position and overlaid with localization volumes is depicted in image (a). The full line represents the proposed 1D selection for signal localization from gastrocnemius medialis muscle, and the broken line represents the approximate coil sensitivity volume, containing several muscle groups. Stack plots of the  $^{31}\text{P}$  spectra acquired during rest, exercise and subsequent recovery are shown in image (b) for the non-localized and (c) for localized acquisitions. Workload induced changes in intramyocellular pH can be quantified in  $^{31}\text{P}$ -MR spectra from chemical shift between phosphocreatine (PCr) and free inorganic phosphate (Pi). If several differently active muscles contribute to the measured signal, a splitting of the Pi resonance can be observed (b). This is not the case if the signal originates from a single muscle group (c), making muscle metabolism quantification from localized measurement much more precise.

#### PUBLICATIONS:

VALKOVIČ, L. – CHMELÍK, M. – JUST KUKUROVÁ, I. – JAKUBOVÁ, M. – KIPFELSBERGER, M. CH. – KRUMPOLEC, P. – TUŠEK JELENC, M. – BOGNER, W. – MEYERSPEER, M. – UKROPEC, J. – FROLLO, IVAN UKROPCOVÁ, B. – TRATTNIG, S. – KRŠŠÁK, M. Depth-resolved surface coil MRS (DRESS)-localized dynamic  $^{31}\text{P}$ -MRS of the exercising human gastrocnemius muscle at 7 T. In *NMR in Biomedicine*, 2014, vol. 27, no. 11, p. 1346 – 1352. ISSN 0952-3480.

VALKOVIČ, L. – GAJDOŠÍK, M. – TRAUSSNIGG, S. – WOLF, P. – CHMELÍK, M. – KIENBACHER, CH. – BOGNER, W. – KREBS, M. – TRAUNER, M. – TRATTNIG, S. – KRŠŠÁK, M. Application of localized  $^{31}\text{P}$  MRS saturation transfer at 7 T for measurement of ATP metabolism in the liver: Reproducibility and initial clinical application in patients with non-alcoholic fatty liver disease. In *European Radiology*, 2014, Vol. 24, no. 7, p. 1602 – 1609. ISSN 0938-7994.

VALKOVIČ, L. – BOGNER, W. – GAJDOŠÍK, M. – POVAŽAN, M. – JUST KUKUROVÁ, I. – KRŠŠÁK, M. – GRUBER, S. – FROLLO, I. – TRATTNIG, S. – CHMELÍK, M. One-dimensional image-selected *in vivo* spectroscopy localized phosphorus saturation transfer at 7T. In *Magnetic Resonance in Medicine*, 2014, vol. 72, no. 6, p. 1509 – 1515. ISSN 0740-3194.

# **The Finite-difference Modelling of Earthquake Motions: Waves and Ruptures**

**GEOPHYSICAL INSTITUTE, SAS**

RESEARCHERS: P. MOCZO, J. KRISTEK, M. GÁLIS, M. KRISTEKOVÁ.

This first monograph of its kind includes original textbook chapters on  
- the mathematical-physical model of seismic motion,  
- rheological models of continuum for implementation of realistic attenuation and hysteretic stress-strain relation,  
- an introduction to the finite-difference method.

This monograph presents the complete theory and computational algorithm of the method developed by the team (partial results published originally in journals), new results on optimization of the finite-difference schemes, discrete representation of material heterogeneity, initiation of rupture propagation and filtration of a slip rate.

PUBLICATION:

MOCZO, P. – KRISTEK, J. – GÁLIS, M. The Finite-difference Modelling of Earthquake Motions: Waves and Ruptures; Cambridge University Press 2014, 365 pp., ISBN 978-1-107-02881-4.

## **II.1.1.2**

### **The simulation of high-dynamic turbulent gas flow in pipelines**

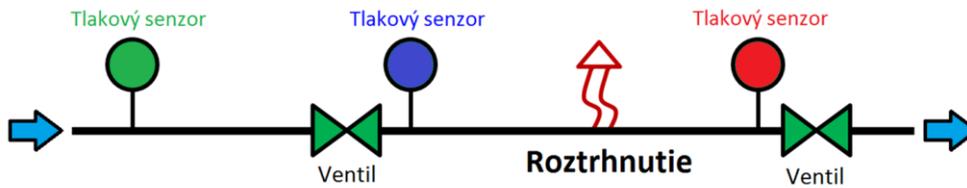
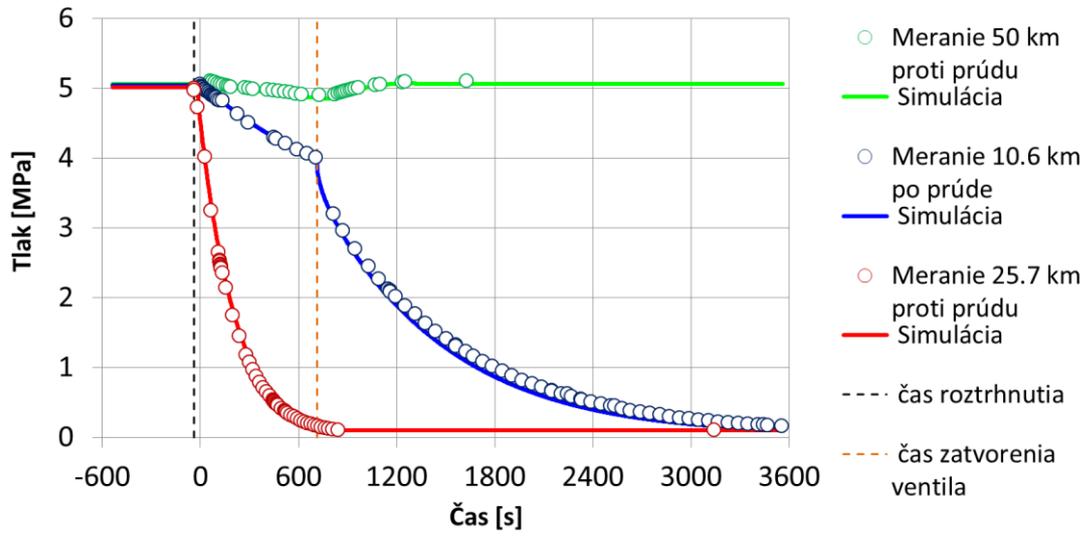
RESEARCHERS: M. Bayer, R. Hajossy, I. Mračka, K. Nemoga, P. Somora, A. Sedliak, T. Sedláková, M. Spál, P. Vadovič, T. Žáčik (leader).

Through the complete, one-dimensional system of conservation equations with terms for pipe resistance, the influence of gravity and heat transfer through the pipe wall is modelled. Numerical simulation is based on central-upwind Godunov-type scheme and was implemented using various kinds of parallelization (CPU and also GP-GPU massive parallelization).

The developed simulator is able to realistically model high-dynamic processes such as the rarefaction wave after pipeline rupture or the shock waves after opening valves. The simulator has been used for testing and development of methods for detection and localization of accidents on the distribution and transit pipelines. The results obtained have been presented at the international gas conference of the Pipeline Simulation Interest Group (PSIG).

REFERENCE: Hajossy, R., Mračka, I., Žáčik T.: Cooling of a Wire as the Model for Rupture Location. In: PSIG 2014, May 6–9, Baltimore, Maryland, USA.

### Simulácia roztrhnutia potrubia na slovenskom distribučnom plynovode



Break-down of pipeline.

## Automobile engine bracket eliminating critical axle vibrations

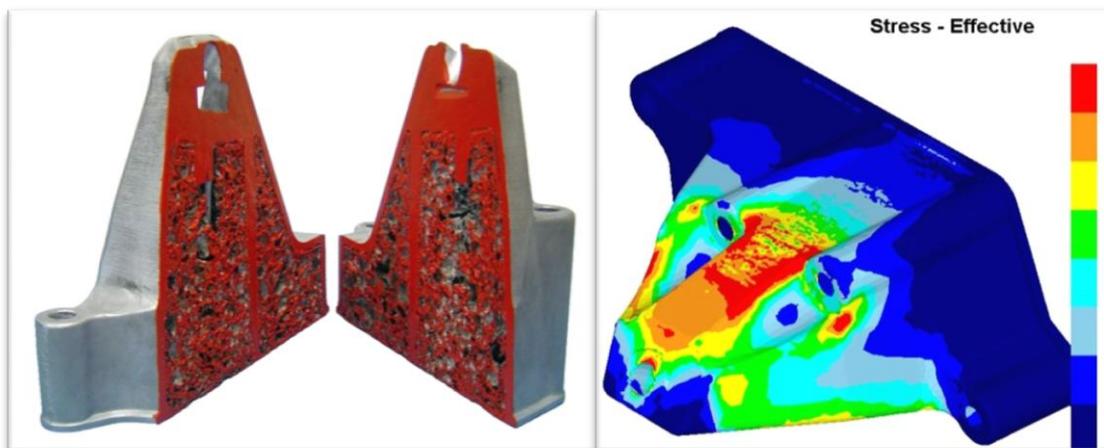
INSTITUTE OF MATERIALS AND MACHINE MECHANICS SAS

RESEARCHERS: F. Šimančík, J. Španielka, P. Tobolka, Ľ. Pavlík, P. Oslanec.

On the basis of a research contract, IMMM SAS has developed a new type of automotive engine bracket which significantly eliminates vibration transfer to car axles. On the basis of FEM calculations, the bracket was designed as a hybrid cast component in which stiffness and damping properties of aluminium foam are combined with a thin pore free surface layer cast made of aluminium alloy providing the required strength and acceptable surface finish. The prototype part was produced using novel casting technology. This enables the production of such hybrid components in one technological operation which will significantly reduce production costs in the future.

Prototype tests in real conditions following installation into the vehicle confirmed almost complete elimination of critical vibrations. Other decisive properties including component weight and fatigue strength remained on the level of original pressure die cast bracket. Furthermore, excellent agreement between the simulation predicted and experimentally measured properties has also been confirmed. This provides a good chance for successful deployment of similar components in the structure of automobile bodies.

The new technology is readily adaptable for production of different types of car components, and is not significantly limited by their complexity, size or volume of mass production in contrast with technologies currently being used. If put into practice, it could provide in addition to lower production costs, significant reduction in the total weight of the car body, without the necessity of undesired compromises in safety assurance and strength properties. Patent protection and transfer into practice are currently underway.



*Cross sectional view (marked in red) of the engine bracket tested during the development.*

*Finite element method strength calculation of the motor bracket hybrid casting. The most stressed locations of the bracket are marked in red.*

PUBLICATION:

SUPÍK, V. – YOUNG-JIN KO. Aluminium Foam for Engine Bracket Application, Firemná publikácia. HMETC GmbH, Rüsselsheim, Germany "Werkstoffe im Automobilbau – Neue Materiallösungen und Konzepte im Dialog" 5. ATZ-Fachtagung, 5. – 6. November 2014 Stuttgart.

CONTRACTOR: Hyundai Motor Europe Technical Centre GmbH, v Rüsselsheime (HMETC).

PROJECT: Bilateral project.

# Technology Transfer of Normally-off Power Switching Transistor Based on AlGaN/GaN Heterostructure

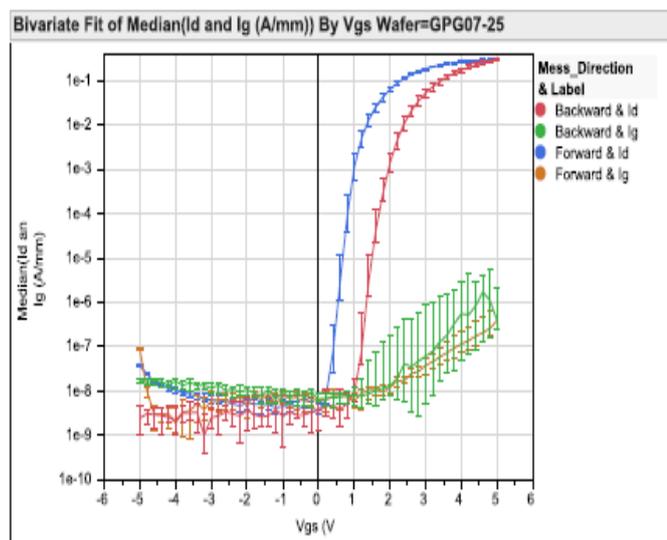
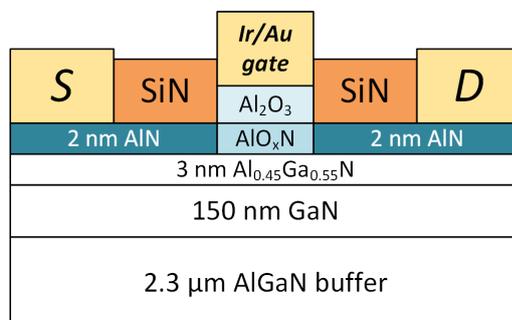
INSTITUTE OF ELECTRICAL ENGINEERING SAS

RESEARCHERS: D. Gregušová, M. Blaho, Š. Haščík, A. Seifertová, M. Ťapajna, K. Fröhlich, J. Kuzmík.

Technology transfer to Ferdinand-Braun Institute Berlin, eventually targeting industrial partner Infineon Villach as an end-user, was contracted within the 7<sup>th</sup> FP program HipoSwitch. As a member of the European consortia, a team at the SAS Institute of Electrical Engineering led by Dr. Ján Kuzmík developed a novel normally-off transistor based on AlGaN/GaN heterostructure, representing a competitive alternative to state-of-the-art Si-based technologies. These devices are intended for integration into the new high-efficiency power converters for power supplies in industrial applications such as telecom base stations. The goal was to develop the processing technology for a transistor working as a switch, capable of providing sufficiently high threshold voltage while maintaining extremely low resistivity of the device in the ON-state. Furthermore, it was necessary to analyze the breakdown mechanism in the OFF-state. Our technology features the adjustment of the threshold voltage using plasma-assisted oxidation of the semiconductor surface followed by the oxide deposition using atomic layer deposition technique. Transistors with threshold voltage of 1.6 V and current density of 0.5 A/mm were achieved in this way. The analysis of the breakdown mechanism in the OFF-state pointed to the avalanche effect and related degradation of the device interfaces. As well as the results being published in scientific journals, the industrial design was provided to the partners.

Exploratory structure with inherent oxide/semiconductor interface, 10 nm Al<sub>2</sub>O<sub>3</sub> by ALD and  $N_{dsurf} < 1.7 \times 10^{13} \text{ cm}^{-2}$ .

$I_{dmax} \sim 0.5 \text{ A/mm}$ ,  $V_{th} \geq 1 \text{ V}$ , on/off ( $V_{gs} = 0 \text{ V}$ )  $> 10^7$



## PUBLICATIONS:

GREGUŠOVÁ, D. – JURKOVIČ, M. – HAŠČÍK, Š. – BLAHO, M. – SEIFERTOVÁ, A. – FEDOR, J. – ŤAPAJNA, M. – FRÖHLICH, K. – VOGRINČIČ, J. – LIDAY, J. – DERLUYN, J. – GERMAIN, M. – KUZMÍK, J. ADJUSTMENT of threshold voltage in AlN/AlGaN/GaN high-electron mobility transistors by plasma oxidation and Al<sub>2</sub>O<sub>3</sub> atomic layer deposition overgrowth, Applied Phys. Lett. 104 (2014) 013506.

KUZMÍK, J. – JURKOVIČ, M. – GREGUŠOVÁ, D. – ŤAPAJNA, M. – BRUNNER, F. – CHO, E. M. – MENGHESSO, G. – WUERFL, J. Degradation of AlGaN/GaN high-electron mobility transistors in the current-controlled off-state breakdown, J. Applied Phys. 115 (2014) 164504.

## CONTRACTOR:

Ferdinand Braun Institute Berlin, Germany, Industrial end-user Infineon Villach, Austria.

### II.1.1.3

## Historic First Landing on a Comet

SAS ASTRONOMICAL INSTITUTE

RESEARCHERS: European Space Agency ESA, Space Technology Ireland (STIL),  
Institute of Experimental Physics SAS – Department of Space Physics  
(J. Baláž).

The Department of Space Physics IEP-SAS participated on the construction of the Rosetta critical Electronic Service System (ESS) in the frame of scientific-technical cooperation with STIL in the years 2000 and 2001. The ESS unit is a mission critical system that provided the separation of the lander Philae from the main Rosetta orbiter and also provided digital communication between them. The space probe Rosetta was launched on 2 March 2004 and travelled to the 67P/Churyumov-Gerasimenko comet over 10 years. The close encounter and orbit synchronisation with the comet was completed on 6 August 2014. The lander Philae separation and its first-ever landing on the comet surface was completed on 12 November 2014, so this date became a milestone in the history of cosmonautics. The ESS service system performed all the required operational tasks flawlessly. Based on the flight dynamics requirements, the ESS managed the Philae separation with a velocity of 19 cm/s and kept reliable data communication with Philae until the battery discharge and the lander hibernation. The science data obtained by Philae are currently being processed.

PROJECT: ESA-Rosetta.



## Laser spectroscopy and the development of the TATRA spectrometer

SAS INSTITUTE OF PHYSICS

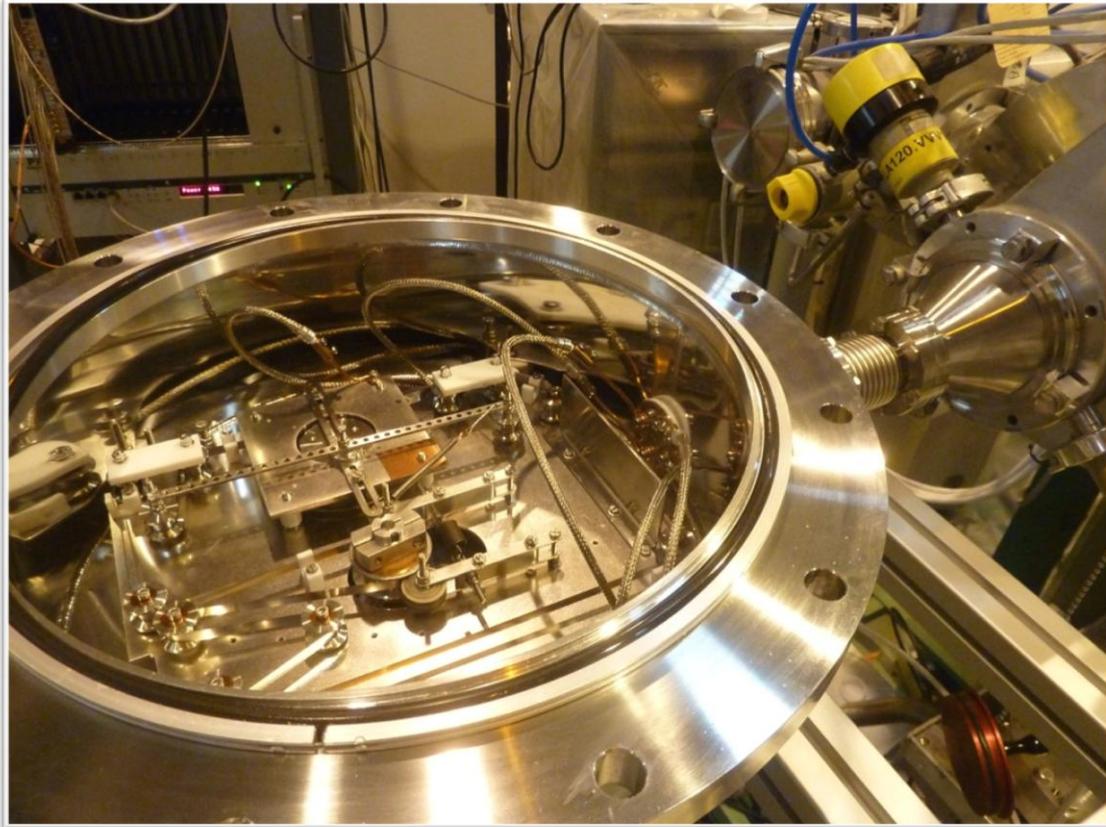
RESEARCHERS: M. Venhart (OJF), V. Matoušek, M. Veselský, J. Kliman, K. Petřík, P. Švec, P. Švec jr., D. Janičkovič, PhD students: M. Sedlák, D. Klíč.

The experimental CERN-ISOLDE facility is a leading apparatus in the field of radioactive-ion beams, which is a very progressive area of nuclear research. It is using the infrastructure of pre-accelerators of the LHC for production of beams of otherwise inaccessible isotopes. In 2013, by using technology of laser ionisation potential of the astatine was measured precisely for the first time. For a long time astatine was the last element naturally occurring on Earth with an unknown value of ionisation potential. Experimental investigation of chemical

properties of the astatine is very since the  $^{211}\text{At}$  isotope is candidate for alpha particle based tumour therapy.

In August 2014, the unique spectrometer TATRA was used in the IS521 experiment. This was the first experiment to have been proposed, defended and performed at CERN by a Slovak research group. The spectrometer allows simultaneous spectroscopy of conversion electrons and gamma rays following the beta decay of atomic nuclei. The uniqueness of the apparatus is in its ability to be operated in a high vacuum environment which sets it apart from similar models.

PUBLICATION: S. ROTHE et al. Incl. M. VENHART, Nature Communications 4 (2013) 1835.



*Spectrometer TATRA.*

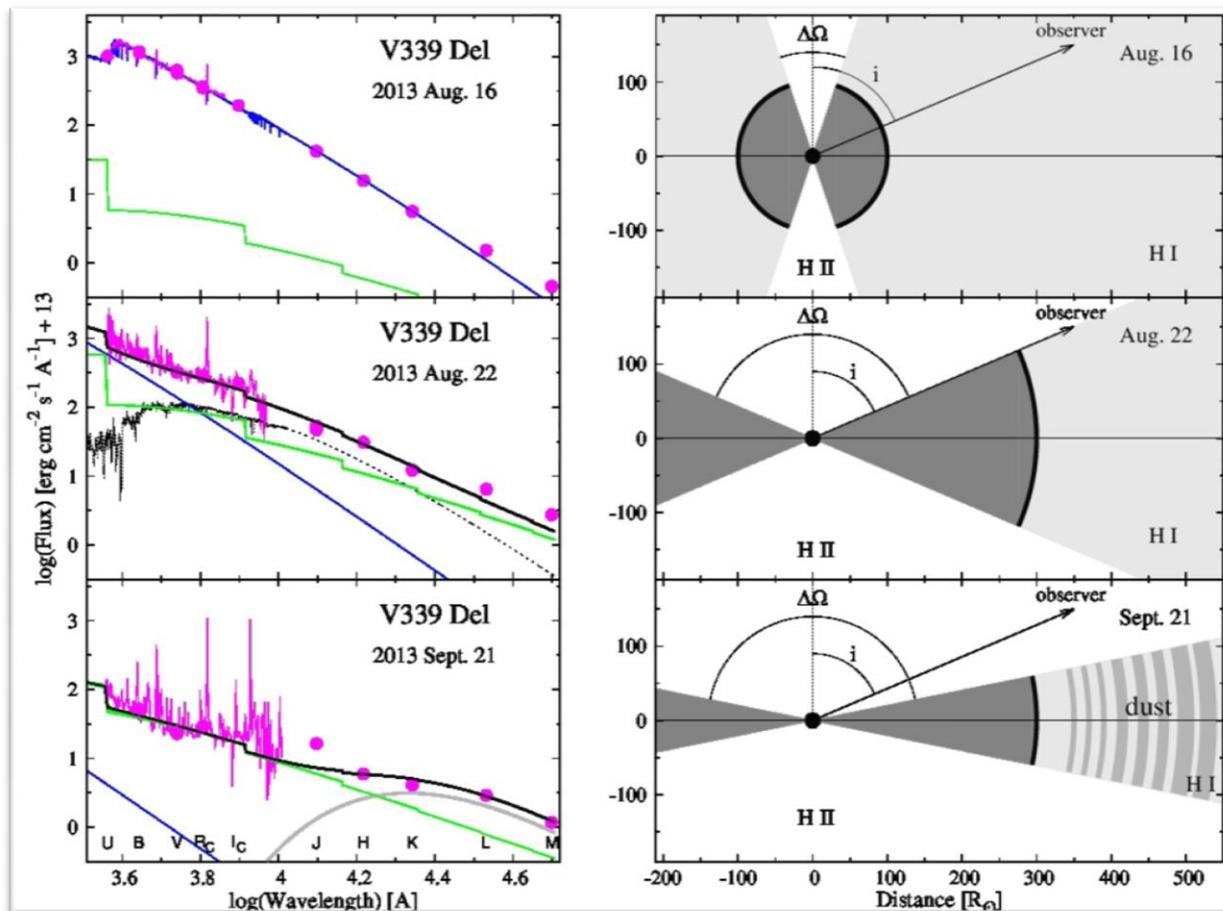
## **Early evolution of the extraordinary Nova Delphini 2013 (V339 Del)**

**SAS ASTRONOMICAL INSTITUTE**

RESEARCHER: A. Skopál

The nova phenomenon results from the explosive thermonuclear fusion of hydrogen to helium on the surface layer of a white dwarf (WD). The hydrogen-rich fuel for this process is accreted onto the WD surface from its binary companion. When the pressure at the base of the accreted layer gets its critical value, protons create helium cores liberating the light energy of  $6.3 \times 10^{11}$  Joules from 1 gram of hydrogen. Current theoretical models of the nova predict that the bolometric luminosity of some novae can exceed for a short time after

explosion the so-called Eddington luminosity, at which the light energy balances the gravitational force of the object. Nova Delphini 2013 (V339 Del) was discovered on August 14.6, 2013. Modelling the spectral energy distribution (SED) from its discovery to the first detection of X-rays (day 40) we found that the bolometric luminosity of the nova exceeded the Eddington limit by a factor of 5 to 10. The high cadence of our spectra allowed us to determine the duration of the fireball stage to August 20, when the spectrum of the nova changed dramatically. Throughout the course of one day, the maximum SED shifted to the UV domain, whereas in the optical/IR spectrum, an extreme increase of nebular radiation was observed. The corresponding emission measure of  $1\text{-}2 \times 10^{62} \text{ cm}^{-3}$  required the burning WD to generate one order of magnitude higher luminosity than its Eddington value. Our detailed analysis of the nova evolution, from a few hours after its outburst to the first detection of X-rays, showed that the nova was not evolving according to the current theoretical prediction. The unusual non-spherically symmetric ejecta of nova V339 Del and its extreme physical conditions during and after the fireball stage represent interesting new challenges for the theoretical modelling of the fascinating nova phenomenon.



Left panels show the energy distribution in the optical/near-ir spectrum of v339 del, while the right panels depict a sketch of the corresponding ionization structure of the nova. Top panels are distinctive for the fireball stage, middle panels for the transition to a harder spectrum, and the bottom panels represent evolution when the first x-rays and dust emission were indicated (details are found in figs. 2 and 9 of the original paper).

PUBLICATION:

SKOPAL, A. – DRECHSEL, H. – TARASOVA, T. N. – KATO, T. – FUJII, M. – TEYSSIER, F. – GARDE, O. – GUARRO, J. – EDLIN, J. – BUIL, CH. – ANTAO, D. – TERRY, J.-N. – LEMOULT, TH. – CHARBONNEL, S. – BOHLSSEN, T. – FAVARO, A. – GRAHAM, K. Early evolution of the extraordinary Nova Delphini 2013 (V339 Del). In *Astronomy and Astrophysics*, 2014, vol. 569, article no. A112, p. 1 – 14. ISSN 0004-6361.

## SAS SECTION 2

The results of the projects addressed in the 2nd section of Sciences Academy of Sciences which are featured as the most important results of basic scientific knowledge, problem solving for social practice and international scientific projects represent a broad spectrum of disciplines and methodological approaches.



In the field of biomedical sciences, the year 2014 brought a number of interesting results. It has been shown that the expression and function of a CA IX biomarker can be inhibited by the substance carnosine which enables carnosine to be used in antitumour therapy.

Another study paid attention to ryanodine receptors which control the calcium cycle in the cardiac muscle cells. The mutations of these receptors lead to heart arrhythmias. The atomic structure of this receptor was determined with the help of X-ray analysis. This structure is maintained in a stable status by a central helix. Up to seven critical mutations that cause arrhythmia can be found in this helix. These findings will aid in the search for therapies that can prevent the occurrence and development of pathological cardiac arrhythmias.

Interesting results of the study of model yeasts *Saccharomyces cerevisiae* and *Kluyveromyces lactis* in relation to the role of protein Pdr16 in the development of resistance to azole antimycotics, could be put to use even with opportunistic pathogenic yeasts *Candida albicans* and *Candida glabrata*.

There has been considerable success in the treatment of cancer. A suitable arrangement of treatment mediated gene therapy of human stem cells in a model of rat tumour (glioblastoma) implanted in the brain led to a complete cure for glioblastoma in a significant number of animals. The results of this preclinical study strongly support the initiation of a clinical study of the treatment of malignant brain tumours.

Metabolic syndrome (MetS) is a condition associated with hypertension and changes in redox reactions which is manifested in an increase of oxidative stress. Identifying sources of stress in the brain centres in regulating hypertension was the subject of another study that revealed that administration of pioglitazone to adult animals with MetS among other effects led to a reduction in high blood pressure.

Another significant result is the development of more efficient collection and storage of energy from renewable sources as part of the SMARTGRID project in which an energy network was built drawing on energy from the sun and the earth. Mixtures of commercially available so-called solar mixtures based on nitrates were modified in order to obtain new types of so-called luminophores based on nitrides designed for LED diodes. Their advantage is that they are more cost-effective than commercially produced LED diodes.

The results of study of the application of polymer nanocomposites suggest that the degree of dispersion of nanoparticles in the polymer matrix has an important effect on the structure and physical properties of the nanocomposites.

In the study of biodiversity and landscape one of the most important results achieved in 2014 was the preparation and publication of a Red list of groups of model organisms and forest ecosystems in the Carpathians as well as the list of invasive species in the Carpathian region. The lists which are the result of broad international cooperation are an important step

towards the coordinated protection of biodiversity in the region. Carpathian arc, one of Europe's highest mountains, and adjacent Pannonian Basin were examined in another project to monitor changes in land use and land cover in this region over the past 200 years. The region was subject to major socio-economic and political changes in this period that reflect the land use and structure of land cover. The results obtained are important for the efficient and sustainable use of biodiversity of the land in the future.

Karol Marhold

## II.1.2.1

### The structure of the human ryanodine receptor 2 in relation to cardiac arrhythmia

INSTITUTE OF MOLECULAR BIOLOGY, SAS  
INSTITUTE OF MOLECULAR PHYSIOLOGY AND GENETICS, SAS

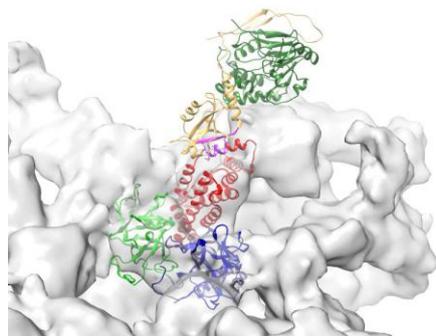
RESEARCHERS: L. Borko, V. Bauerová-Hlinková, E. Hostinová, J. Gašperík, K. Beck, F. A. Lai, A. Zahradníková, J. Ševčík.

Ryanodine receptors control calcium cycling in cardiac myocytes. Mutations of the ryanodine receptor cause cardiac arrhythmias. Our international team used X-ray structural analysis to determine the atomic structure of an important part of the human ryanodine receptor, the first three domains of the molecule. The structure is maintained in a stable state by a central helix that binds to all three domains. Seven mutations that lead to arrhythmias have been identified in this central helix. Our results help us to understand why these particular mutations cause arrhythmias. For example, the mutation at position 419 decreases the stability of the protein. Using molecular modelling, we followed the movements of the domains of the receptor that regulate the transport of calcium ions and we identified a region where the receptor interacts with the regulatory enzyme protein phosphatase I.

These results represent a step forward in understanding the molecular mechanism of pathological calcium release by ryanodine receptors. They significantly improve our understanding of the causes of cardiac arrhythmias and may eventually lead to the development of treatments that could impede the initiation and pathological development of arrhythmias.

Several European media have reported the publication of this result (e.g. [http://www.eurekaalert.org/pub\\_releases/2014-11/cu-tyh11714.php](http://www.eurekaalert.org/pub_releases/2014-11/cu-tyh11714.php)).

In Slovakia, a press conference was organized on December 11, 2014 and was met with wide interest by the media.



*A model of three domains of the studied part of hRyR2 (blue, green and red; PDB 4JKQ) placed into the electron density map of the ryanodine receptor (EMD-1606). The attachment of protein phosphatase I (dark green; PDB 3EGH) via a molecule of spinophilin (yellow; PDB 3EGH) is marked in magenta. The image illustrates the complementarity between the surfaces of the ryanodine receptor and protein phosphatase I molecules.*

PROJECTS: IMB: APVV-0628-10, VEGA 2/0131/10; IMPG: APVV-0721-10, VEGA 2/0148/14.

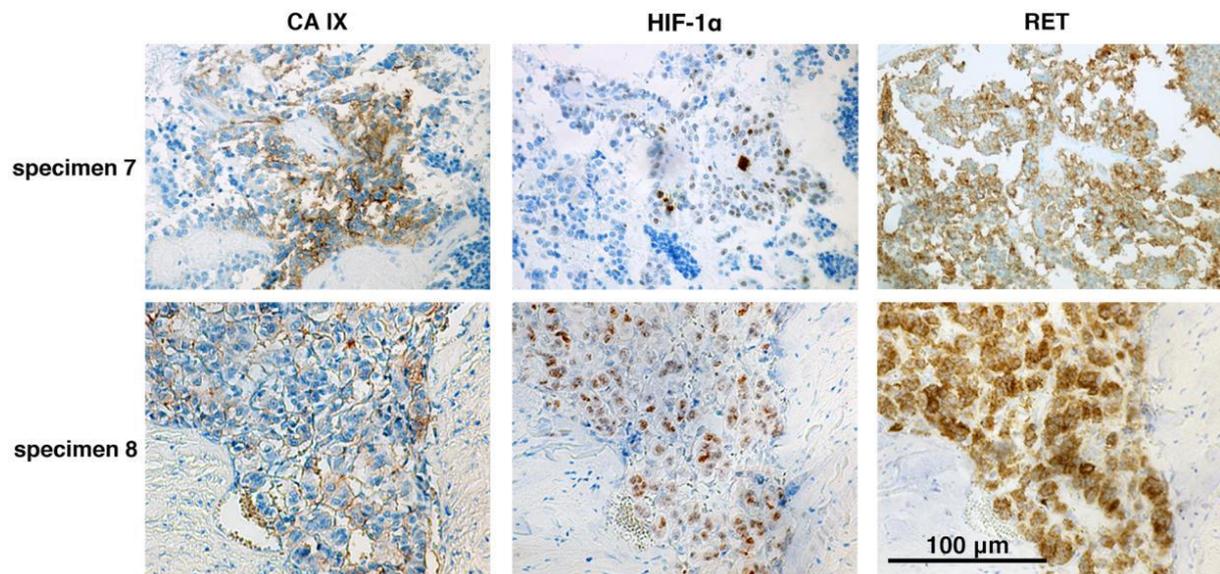
PUBLICATION: BORKO, Lubomír – BAUEROVÁ-HLINKOVÁ, Vladena – HOSTINOVÁ, Eva – GAŠPERÍK, Juraj – BECK, K – LAI, F. A. – ZAHRADNÍKOVÁ, Alexandra – ŠEVČÍK, Jozef. Structural insights into the human RyR2 N-terminal region involved in cardiac arrhythmias. In Acta Crystallographica D, 2014, vol. D70, p. 2897 – 2912  
ISSN 0907-4449.

# Elucidation of the new regulatory mechanisms of hypoxia inducible tumour marker CA IX

INSTITUTE OF VIROLOGY, SAS

Investigators: M. Takacova, V. Simko, L. Csaderova, M. Zatovicova, Z. Ditte, M. Labudova, F. Iuliano, J. Kopacek, S. Pastorekova, J. Pastorek.

As an outcome of the long-term study of the tumour biomarker CA IX focused on the elucidation of its role within tumours and its application in tumour diagnostics and therapy, in 2014 we completed and published our original results which reveal mechanisms of CA IX regulation. We showed that within thyroid cancer, CA IX expression results from oncoprotein RET activation as well as hypoxia (a state of insufficient oxygen supply) inducible factor HIF and that both these pathways cooperate during the tumour progression. We also showed in search of therapeutic approaches targeting CA IX function in tumour acidosis that the expression and function of CA IX can be inhibited via carnosine and thus, we proposed its application in anti-cancer therapy.



*Serial tissue sections from two medullary thyroid carcinomas stained with antibodies against CA IX biomarker, HIF-1α transcriptional factor, and RET oncoprotein. Brown colour confirming the expression of these tumour markers in overlapping regions points to their hypoxia-mediated local staining pattern (specimen 7) or oncogene RET-induced diffuse pattern (specimen 8).*

PROJECTS: VEGA 2/ 0152/12, APVV-0658-11, APVV-0893-11, 7FP METOXIA, ERDF 26240220062.

PUBLICATIONS:

TAKÁČOVÁ, M. – BULLOVÁ, P. – ŠIMKO, V. – ŠKVARKOVÁ, L. – POTURNAJOVÁ, M. – FEKETEOVÁ, L. – BABÁL, P. – KIVELA, A. J. – KUOPIO, T. – KOPÁČEK, J. – PASTOREK, J. – PARKKILA, S. – PASTOREKOVÁ, S. Expression pattern of carbonic anhydrase IX in medullary thyroid carcinoma supports a role for RET-mediated activation of the HIF pathway. In *American Journal of Pathology*, 2014, vol. 184, no.4, p. 953 – 965. ISSN 0002-9440.

DITTE, Z. – DITTE, P. – LABUDOVÁ, M. – ŠIMKO, V. – JULIANO, F. – ZAŤOVIČOVÁ, M. – CSÁDEROVÁ, L. – PASTOREKOVÁ, S. – PASTOREK, J. Carnosine inhibits carbonic anhydrase IX-mediated extracellular acidosis and suppresses growth of HeLa tumour xenografts. In *BMC Cancer*, 2014, vol. 14, no. 1, p. 358– 370. ISSN 1471-2407.

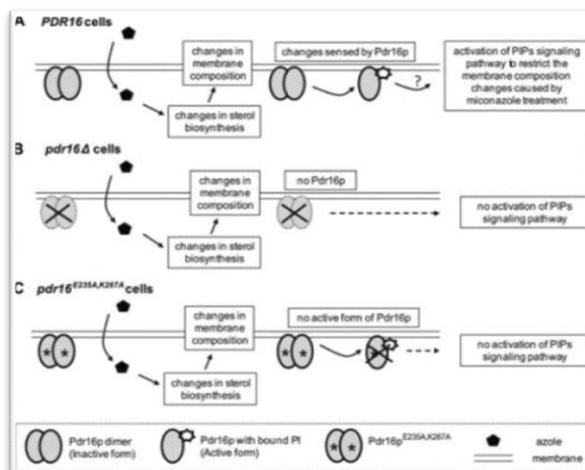
# Lipid transfer protein Pdr16 and yeast pleiotrophic drug resistance

INSTITUTE OF ANIMAL BIOCHEMISTRY AND GENETICS, SAS

RESEARCHERS: M. Balážová, E. Goffa, P. Griač, I. Hapala, R. Holič, E. Kutejová, V. Pevala, K. Poloncová, Z. Šimová, D. Tahotná.

Understanding the molecular mechanisms leading to drug resistance of yeast pathogens is essential in overcoming this resistance. Pdr16 protein (Pleiotrophic Drug Resistance 16), homologue of the phosphatidylinositol (PI) transfer protein, emerged recently as a factor of clinical resistance to antimycotics in fungal pathogens of humans. Our goal was to understand the physiological role of this protein and how it contributes to the development of drug resistance. We have found that model yeast organisms *Saccharomyces cerevisiae* and *Kluyveromyces lactis* are hypersensitive to clinically used azole and morpholine antimycotics when Pdr16 protein is non-functional or missing. The increased drug resistance is accompanied with changes in sterol composition of the plasma membrane. In addition, in contrast to *S. cerevisiae*, Pdr16 protein defective *K. lactis* yeast was hypersensitive to all tested xenobiotics and alkali metal cations. Furthermore, we have prepared Pdr16 protein unable to bind PI. This PI binding deficient Pdr16 was not able to fulfil the role of Pdr16 in protecting against azole and morpholine antifungals providing evidence that PI binding is critical for Pdr16 function in modulation of response to antifungal drugs. Interestingly, PI binding deficient Pdr16 was able to bind sterol molecules.

The results obtained allowed us to propose two mechanisms for the function of Pdr16p in providing protection against azole antifungals. Pdr16p was capable of functioning as a hypothetical sensor of membrane sterol composition or, alternatively, it could be required for effective intermembrane transport of sterols or their intermediates in the cell. We plan to verify these models in the near future. In addition, we will use the results obtained in model yeast organisms to study the role of Pdr16 protein in drug resistance of human opportunistic pathogens, yeasts *Candida albicans* a *Candida glabrata*.



*Pdr16p as a hypothetical sensor of membrane lipid composition.*

PROJECTS: VEGA 2/0077/10, 2/0058/11, 2/0180/12.

PUBLICATIONS:

ŠIMOVÁ, Z. et al. (2013), The yeast *Saccharomyces cerevisiae* Pdr16p restricts changes in ergosterol biosynthesis caused by the presence of azole antifungals. *Yeast* 30(6):229 – 241.

GOFFA, E. et al. (2014). Isolation and functional analysis of the *KLPDR16* gene. *FEMS Yeast Res.* 14(2):337 – 345.

HOLIČ, R. et al. (2014). Phosphatidylinositol binding of *Saccharomyces cerevisiae* Pdr16p represents an essential feature of this lipid transfer protein to provide protection against azole antifungals. *Biochim Biophys Acta* 1842(10):1483 – 1490.

## II.1.2.2

# Complete regression of glioblastoma by suicide prodrug gene therapy mediated by mesenchymal stem cells simulating clinical therapeutic scenario

CANCER RESEARCH INSTITUTE SAS

AUTHORS: C. Altaner , V. Altanerova, M. Cihova , K. Ondicova , B. Rychly , L. Baciak , B. Mravec

Glioblastoma multiform (GBM) is the most deadly human brain cancer. GBM with current treatment modalities is incurable. The reason for this is the highly invasive character of glioblastoma cells and by the presence of chemo- and radiotherapy resistant glioblastoma stem-like cells - cells initiating glioblastoma growth that remain unaffected by standard treatment. Over the last 12 years we developed suicide prodrug gene therapy directed to the tumour by mesenchymal stem/stromal cells engineered to express fused yeast gene cytosinedeaminaseuracilphosphoribozyl transferase. We have shown in several articles published over the past 12 years that the therapeutic modality is safe and highly efficient, being able to kill tumour cells without systemic toxicity. Rat intracerebrally grown C6 glioblastoma was used to test the efficacy of this therapy in experiments designed to simulate clinical therapeutic scenario. Intracerebrally grown glioblastoma was treated by resection and subsequently with single or repeated intracerebral inoculations of therapeutic stem cells followed by a continuous intracerebroventricular delivery of 5-fluorocytosine using an osmotic pump. Kaplan-Meier survival curves revealed that surgical resection of the tumour increased the survival time of the resected animals depending on the extent of surgical intervention. However, direct injections of therapeutic stem cells into the brain tissue surrounding the postoperative resection cavity led to a curative outcome in a significant number of treated animals. We assume that observed curative therapy of glioblastoma by stem cell-mediated prodrug gene therapy might be caused by the destruction of both tumour cells and the niche where glioblastoma initiating cells reside. Clinical trials may help to establish whether or not similar outcomes can be expected in patients.

### PROJECTS:

Therapeutic stem cells in treatment of aggressive tumours – preclinical study.

The use of human adult mesenchymal stem cells for targeted gene therapy of tumours currently cannot be satisfactorily treated by standard treatment.

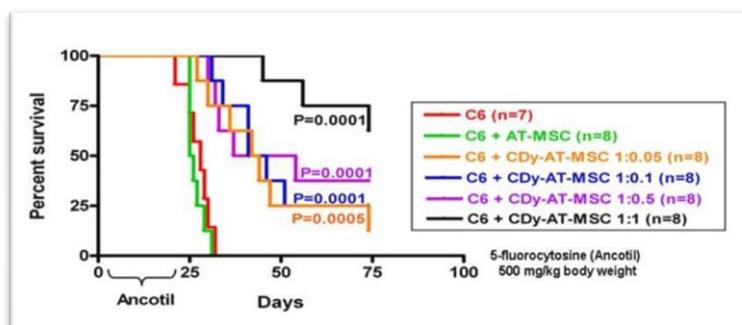
Grant support: Slovak League against Cancer.

### PUBLICATIONS:

ALTANER, Č. – ALTANEROVÁ, V. – CIHOVÁ, M. – ONDIČOVÁ, K. – RYCHLÝ, B. – BACIAK, L. – MRAVEC, B. Complete regression of glioblastoma by mesenchymal stem cells mediated prodrug gene therapy simulating clinical therapeutic scenario. In International Journal of Cancer, 2014, vol. 134, no. 6, 1458 – 1465. ISSN 1097-0215.

ALTANEROVA, V. – CIHOVA, M. – BABIC, M. – RYCHLY, B. – ONDICOVA, K. – MRAVEC, B. – ALTANER, C. Human adipose tissue-derived mesenchymal stem cells expressing yeast cytosinedeaminase::uracil phosphoribosyltransferase inhibit intracerebral rat glioblastoma. Int J Cancer. 2012; 130(10) : 2455 – 2463.

ALTANER, Č.. Prodrug Gene Therapy for Cancer Mediated by Mesenchymal Stem/ Stromal Cells Engineered to Express Yeast Cytosinedeaminase::Uracilphosphoribosyltransferase (Review). J Stem Cell Res Ther 2015, 5: 264.



# Innovative heat storage in inorganic salts and the development of novel phosphors

INSTITUTE OF INORGANIC CHEMISTRY SAS

PRINCIPAL RESEARCHERS: Z. Lenčేశ, V. Pavlík.

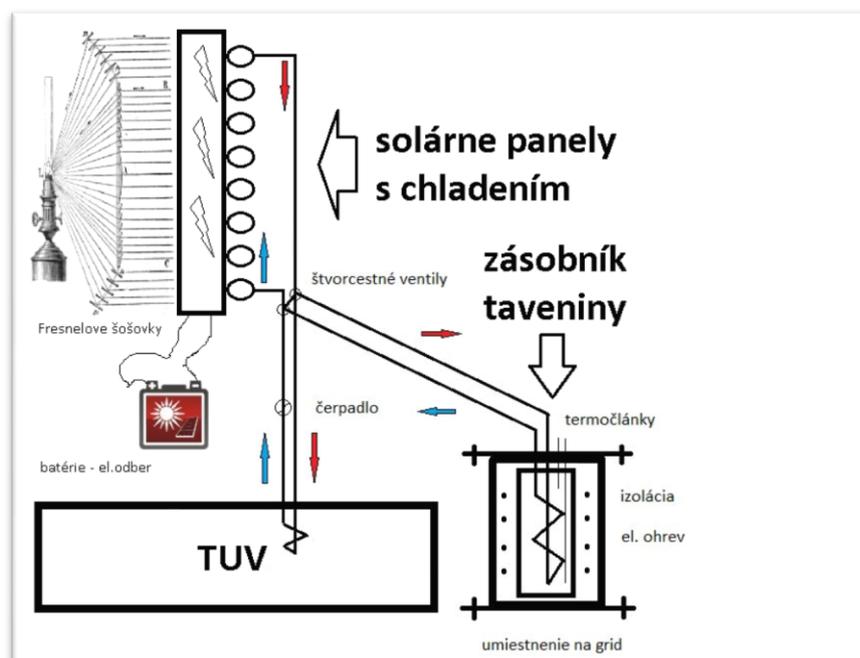
The European Strategic Plan for Energy and Technologies includes the research and development of new materials and systems for the accumulation and transport of heat energy and the compatibility of these novel thermo-materials with construction/engineering materials. The strategic plan involves a concept for more effective collection and conversion of energy from renewable sources. The Institute of Inorganic Chemistry (IIC) became involved in this type of research through the ENERGOZ project. In the framework of this project a power “smart-grid” was built which collected the energy from the Sun and the Earth. The grid is self-supplying, drawing energy from solar panels and ground gaps per the glycol-water tube-exchanger system. The SmartGrid serves as a demonstration of independent energy unit for future generation buildings. The main task of IIC was the development of a special heat-storage reservoir which can be used to heat household water or the rooms in which the grid is installed when solar energy is not available. The secondary objective was to find and characterize (e.g. physico-chemical and corrosion properties) a new heat-storing salt for this reservoir. This was achieved by modification of the various mixtures of the commercial so-called “solar salts” based on nitrates. The third objective of the project was the development of new types of nitride and oxynitride phosphors for LED applications. Their advantage in comparison to older types of phosphors is higher efficiency and efficacy, longer lifetime, higher thermal stability and reasonable pricing.

The participants of the project received the Award of the Slovak Academy of Sciences for the building of novel infrastructure for science and the building of a unique SmartGrid testing laboratory.

PUBLICATIONS:

IBRAHIM, I. – LENČEŠ, Z. – BENCO, L. – HRABALOVÁ, M. – ŠAJGALÍK, P. Cerium-doped  $\text{LaSi}_3\text{N}_5$ : Computed electronic structure and band gaps. In Journal of the European Ceramic Society, 2014, vol. 34, no. 11, p. 2705 – 2712.

IBRAHIM, I. – LENČEŠ, Z. – BENCO, L. – HRABALOVÁ, M. – ŠAJGALÍK, P. Sm-doped  $\text{LaSi}_3\text{N}_5$ : Synthesis, computed electronic structure, and band gaps. In Journal of the American Ceramic Society, 2014, vol. 97, no. 8, p. 2546 – 2551.



# Red List of model groups of animals and invasive species in the Carpathians

INSTITUTE OF FOREST ECOLOGY SAS

RESEARCHERS: A. Krištín, P. Zach, J. Kulfan.

The first Carpathian Red list of grasshoppers, crickets and birds based on current IUCN categories was compiled and summarized in cooperation with scientific and expert institutions from seven Carpathian countries (Slovakia, Czech Republic, Poland, Ukraine, Hungary, Romania, Serbia). There are 1382 known grasshopper and cricket species in Europe and of them 142 were found in the Carpathians and 61 of these were featured in the Carpathian Red List. Ten of these were categorised as endangered species (EN). Of the 773 European species of birds, 28 species were listed, 5 of which were categorized as critically endangered (CR). 40 species from the Carpathians were listed as invasive alien species. The first author coordinated data collection and analyses, writing chapters on Orthopterans<sup>[1]</sup> and birds<sup>[2]</sup> and all collected data on invasive species<sup>[3]</sup>.



*Predatory bush cricket (Saga pedo)*, type of orthopteran included in the highly endangered category of the Carpathian Red List.

(Photo: Anton Krištín)

COMMISSIONED BY: Štátna ochrana prírody SR, BioREGIO Carpathians project of European Union.

## PROJECTS:

VEGA 2/0157/11, 2/0035/13 (Ústav ekológie lesa SAV) .  
BioREGIO Carpathians project of European Union.

## PUBLICATIONS:

[1] KRIŠTÍN, A. – IORGU, I. S. Red list of grasshoppers, bush-crickets and crickets (Orthoptera) of the Carpathian mountains. In Carpathian red list of forest habitats and species Carpathian list of invasive alien species. Banská Bystrica : The State Nature Conservancy of the Slovak Republic, 2014, p. 186 – 199. ISBN 978-80-89310-81-4.

[2] PUCHALA, P. – DEMKO, M. – KRIŠTÍN, A. – SEKULIC, G. Draft Carpathian Red List of birds (Aves). In Carpathian red list of forest habitats and species Carpathian list of invasive alien species. Banská Bystrica : The State Nature Conservancy of the Slovak Republic, 2014, p. 217 – 220. ISBN 978-80-89310-81-4.

[3] GÖRNER, T. – BOTTA-DUKÁT, Z. – HELTAI, M. – FEHÉR, Z. – MÁRTON, M. – PATKÓ, L. – KUCIEL, H. – SOLARZ, W. – SZEWCZYK, M. – SCHNEIDER, E. – OLOSUTEAN, H. – BANADUC, A. – DUMBRAVA, A. – LAZAREVIĆ, P. – BAKOVIĆ, D. – ZATEZALO, A. – BRANKOVIĆ, S. – GOJDIČOVÁ, E. – KRIŠTÍN, A. – KAUTMAN, J. – VAVROVÁ, L. – URBAN, P. – ZACH, P. – KULFAN, J. – VOLOSHCHUK, M. – KOZURAK, A. – KURTIK, F. – CHUMAK, V. Draft List of invasive alien species of the Carpathian region. In Carpathian red list of forest habitats and species Carpathian list of invasive alien species. Banská Bystrica : The State Nature Conservancy of the Slovak Republic, 2014, p. 228 – 234. ISBN 978-80-89310-81-4.

### **II.1.2.3**

#### International Research

## **Changes in redox balance in neuronal hypertension connected with metabolic syndrome. The role of uncoupled NO-synthase.**

Principal researchers and main coordinators of Slovak-Taiwan project:  
Dr. Ima Dovinova / Prof. Julie Y.H. Chan.

Researchers from Slovakia:

Ima Dovinová, Miroslav Barančík, František Kristek, Soňa Čáčányiová, Štefan Zórad  
PhD. students and post-docs: Miroslava Majzúnová, Lucia Gajdošechová, Peter Bališ.

Researchers from Taiwan:

Julie YH Chan, Samuel HH Chan

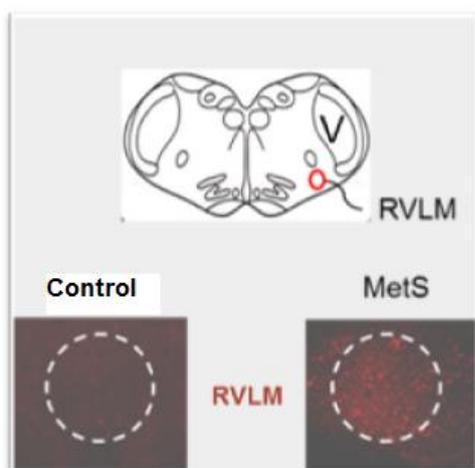
PhD. students and postdocs: Kay LH Wu, Yung- Mei Chao.

Project: SAS-NSC JRP 2010/01, international project in cooperation with Taiwan.

Metabolic syndrome (MetS) is a disease distributed worldwide. It is associated with hypertension, diabetes, alterations in lipid profile and changes in redox equilibrium that lead to oxidative stress. The present study sought to describe the mechanisms of injury and identify sources of oxidative stress in the brain centres that regulate hypertension – in the rostral ventrolateral medulla (RVLM). The experiments used adult rats fed with a high-fructose diet. This eight-week high-fructose diet lead to increased sympathetic vasomotor activity, hypertension and the development of MetS. The effect of redox-sensitive therapy using a PPAR gamma agonist – pioglitazone – was studied on this model. In adult animals we observed a decrease in sympatho-vasomotor activity and hypertension. Furthermore, the treatment improved tissue levels of reactive oxygen species and the dimer/monomer ratio of neuronal NO-synthase in brain RVLM.

PUBLICATION:

WU, Kay L.H. – CHAO, Yung-Mei – TSAY, Shioh-Jen – CHEN, Chen Hsiu – CHAN, Samuel H.H. – DOVINOVÁ, Ima – CHAN JULIE, Y.H. Role of nitric oxide synthase uncoupling at rostral ventrolateral medulla in redox-sensitive hypertension associated with metabolic syndrome. In *Hypertension*, 2014, vol. 64, no. 4, p.815-824. ISSN 0194-911X.



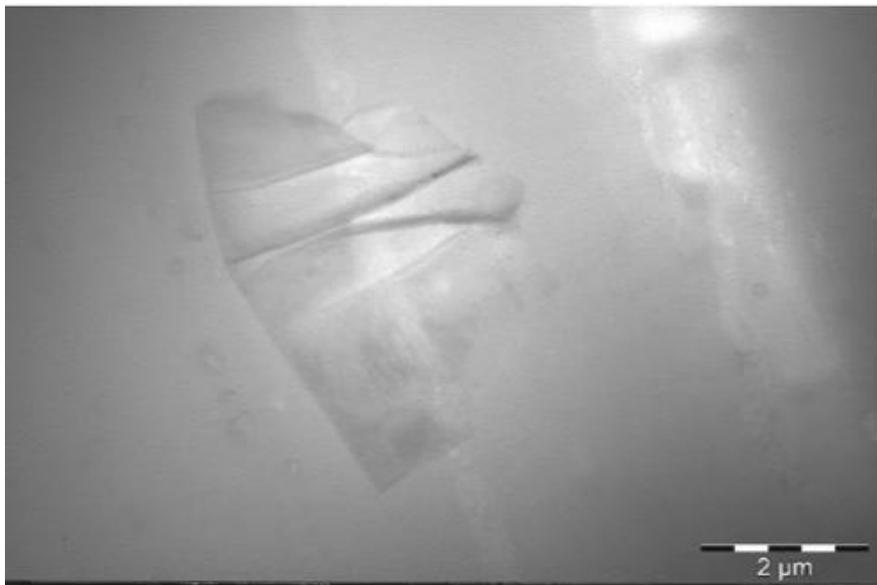
*Figure: Oxidative stress in brain RVLM - adult animals with MetS  
Figure above shows RVLM region of the brain. Figure below shows level of oxidative stress in RVLM region in control and experimental animals fed with high-fructose diet over six weeks. In animals with MetS a two times higher level of reactive oxygen species was observed in RVLM region (see Fig) together with increase of redox-sensitive excitation of sympathetic nervous system and high blood pressure.*

# The application of polymer nanocomposites

POLYMER INSTITUTE SAS

RESEARCHERS: Z. Špitalský (principal investigator), J. Mosnáček, M. Danko, M. Mičušík.

The nanocomposites based on poly(ethylene terephthalate) with expanded graphite were compared to those with functionalized graphite sheets for research of graphene low content polymer nanocomposite application in electronic devices. The results suggest that the degree of dispersion of nanoparticles in the polymer matrix has an important effect on the structure and physical properties of the nanocomposites. The presence of graphene sheets nanoparticles enhances the crystallization rate of polymer. It has been confirmed that *in situ* polymerization is the effective method for preparation nanocomposites which can avoid the agglomeration of nanoparticles in polymer matrices and improve the interfacial interaction between nanofiller and polymer matrix. The results obtained have also shown that due to the presence of functional groups on graphene oxide surface, the interaction with polymer matrix can be stronger than in the case of exfoliated graphene and matrix. The thus obtained polymer composites can be used as electrically conductive fibres in textile or as materials with barrier properties.

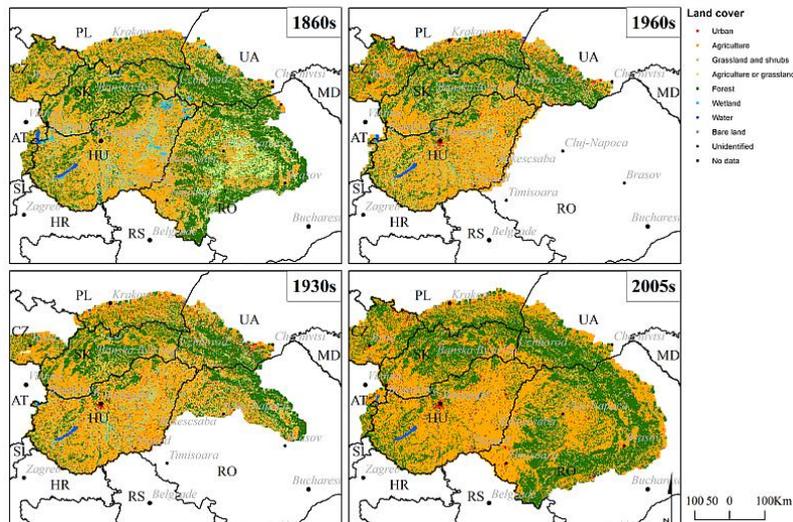


*The transmission electron microscopy picture of polymeric nanocomposite with particle of graphene*

# Research on landscape changes for National Aeronautics and Space Administration (NASA): 200 years of land use and land cover changes and their driving forces in the Carpathian Basin

INSTITUTE OF LANDSCAPE ECOLOGY, SAS

RESEARCHERS: J. Lieskovský, E. Halada, M. Mojses, M. Boltiziar, K. Kysucká.



*Changes in land use in the area of Carpathian Basin during 1860 – 2005.*

The Carpathian Basin is considered to be the backbone of Europe's biodiversity with the preserved forests, mountain and cultural landscape habitats. This region together with the adjacent Pannonian Basin experienced several major socio-economic transformations throughout the 19th and 20th centuries: World War I and the demise of the Austro-Hungarian Monarchy, World War II, the rise and fall of socialism, and the eastward expansion of the European Union, Schengen area and the monetary Eurozone. The importance of these events and processes and their impact on land cover change has been the subject of a project funded by the Land-Cover / Land Change Program of National Aeronautical and Space Agency (NASA). For the analyses of historical land use, we used military maps of the Austro-Hungarian Monarchy, interwar maps and Soviet topographical maps. The Slovakian and Moravian parts of the area were interpreted and digitized by researchers from the Institute of Landscape Ecology. Data from historical maps was combined with the LANDSAT satellite images that were processed by partners from the Department of Forest and Ecology, of the University of Wisconsin and Humbolt University in Berlin. We also contributed by data processing for verifying changes in forest cover evaluated by LANDSAT imagery, processing of socioeconomic statistics, preparation of data for meta-analysis of local studies of landscape changes. Part of the project was also an eight month post-doctoral scholarship at the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL).

PROJECT: 200 Years of Land Use and Land Cover Changes and Their Driving Forces in the Carpathian Basin in Central Europe (NASA Land-Cover and Land-Use Change Program)

RESULTS:

MUNTEANU, Catalina – KUEMMERLE, Tobias – BOLTIZIAR, Martin – BUTSIC, Van – GIMMI, Urs – HALADA, Luboš – KAIM, Dominik – KIRALY, Geza – KONKOLY-GYURO, Eva – KOZAK, Jacek – LIESKOVSKÝ, Juraj – MOJSES, Matej – MÜLLER, Daniel – OSTAFIN, Krzysztof – RADELOFF, Volker C. Forest and agricultural land change in the Carpathian region - A meta-analysis of long-term patterns and drivers of change. In Land Use Policy : The International Journal Covering All Aspects of Land Use, 2014, vol. 38, p. 685-697. ISSN 0264-8377.

### SAS SECTION 3

The Section 3 SAS institutes develop their research in three groups of scientific areas, which are the science of history, social science and humanities, and the science of art and culture.

All institutes have a highly qualified workforce and of a mature age (the average age of an employee is around 50 years). The social significance and mission of individual departments are irreplaceable not only in the long tradition of research, but mainly due to the accumulation of unique scientific resources in the form of documents, archival materials (e.g. at the SAS Institute of Ethnology, SAS Institute of Musicology et al.) or information databases (e.g. Institute of Sociology SAV) which are not to be found at any other scientific institutions in Slovakia, including universities. The strategic advantage of SAS compared to university research is also the concentration of social and human disciplines "under one roof", which creates better conditions for interdisciplinary cooperation.

The specificity of research in social sciences and humanities lies in their subject, and determines their character as well as their methodology.

These fields of science deal with artefacts and social facts, social and human relations, cultural values and institutions, linguistic meanings and their interpretations, mind concepts and ideas, social communication and human behaviour, emotions and knowledge and the search for meaning and direction of human history and civilization. This is why the results of scientific research institutes of SAS Section 3 always more or less indirectly (or even directly) affect social life and events of all times (past, present, future) and their spatial (locality, globalism) dimensions create a competency "mirror" and provide expert expression. The mission of these scientific disciplines in any modern society is not only analytical and critical but also conceptual and synthetic, which cannot be otherwise even in Slovakia. Without social sciences and humanities every state or company loses its identity, orientation and perspective.

The nature of these sciences shows that the results of their research cannot simply be measured by quantitative indicators, numbers and statistics or even in short term financial effects and economic returns. These results are reflected in particular in long-term social impact and through contribution to solving societal problems and the increase of cultural development of society. Social sciences and humanities have a great responsibility to the public for their results, which they cannot deny. However, the nature of their usefulness does not lie in material and products, patents or inventions. This area of science has always proven and demonstrated the old Aristotelian idea that "knowledge and money cannot be measured by one yardstick", or simply that "it is not just bread that sustains a man". Social, public or governmental investment in social sciences and humanities research therefore "pays off" when the research results achieved are at a level comparable to research in other countries, so as to contribute to social sciences and humanities-science knowledge on an international level. It is therefore an advantage to cultivate that knowledge on our side (contrary to countries where such knowledge is not cultivated), while contributing to theoretical and applied results of its research on the solution of practical problems and the development of society. It is undisputed that the results of the research institutes of SAS Section 3 constitute a contribution that is, albeit in a differentiated rate, that which is natural. This was no different even in 2014. The scientific output of institutions in this year in addition to works published abroad, contributed in particular to the domestic development of social sciences



and humanities and especially monographs in the field of history, ethnology, philosophy, economics, political science and the science of art and literature. Scientific monographs published abroad (8 in total) and at domestic publishing houses (118 in total) show that the focus of publications were books (in addition to expert monographs of 142 book works). A considerable part of the output consists of work in scientific journals (548 altogether), of which the vast majority were peer-reviewed (470). This is also enriched by chapters in monographs (185) and magazine articles (a total of 583, of which 90 are featured in journals registered in the so-called high-value databases such as CC). The research workers of social sciences and humanities gave 1149 lectures and reports at various scientific events, of which nearly half took place abroad (502). The overall response to their scientific work represents a total of more than nine thousand citations, of which 1,015 are featured in monitored databases WOS and SCOPUS.

In qualitative terms, the results of the SAS Section 3 for 2014 represent a good standard in the domestic context with some of the top overlays in the international context. We can build on this potential and with appropriate strategies not only just maintain it in the future but to further develop it.

*Emil Višňovský*

### II.1.3.1. Significant results in basic scientific knowledge

## 60 years of SAS history scientifically processed

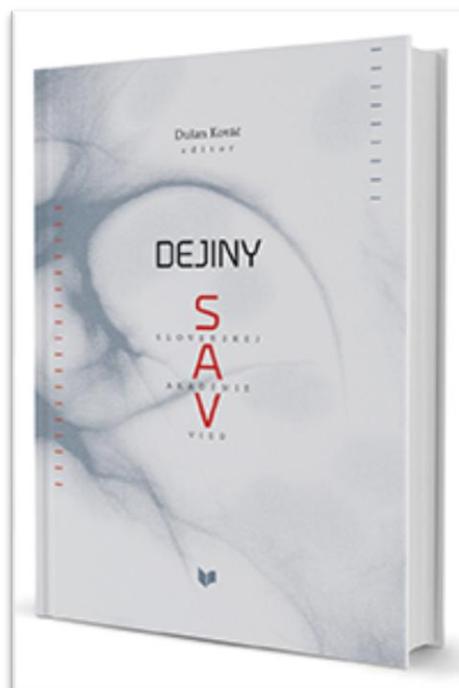
### SAS INSTITUTE OF HISTORY

RESEARCHERS: I. Gažová, J. Gubášová-Baherníková, K. Hollý, A. Hudek, L. Kamencová, J. Kláčka, D. Kováč, K. Majerová, A. Marčeková, Ľ. Nemeskürthyová, J. Pavlová.

The team of authors from the SAS Institute of History and the Central Archive of SAS led by Dusan Kovac published the first comprehensive scholarly history of the Slovak Academy of Sciences at the VEDA publishing house. This work also deals with the institutionalisation of Slovak science since the 18th century, but a significant part is devoted to the history of SAS since its founding in 1953 until 2013. The history of SAS as an institution is consistently set in the historical context with all its controversy. In correlation with the times, the possibilities and the limits within which the scientific community worked are clearly shown. In addition to the chronological and historical development great attention has been paid to thematic cross-cutting issues: the most important results of scientific research, international cooperation, financial and material equipment of SAS, etc. The work is supplemented by the most important documents on the history of SAS and image attachments.

PUBLICATION:

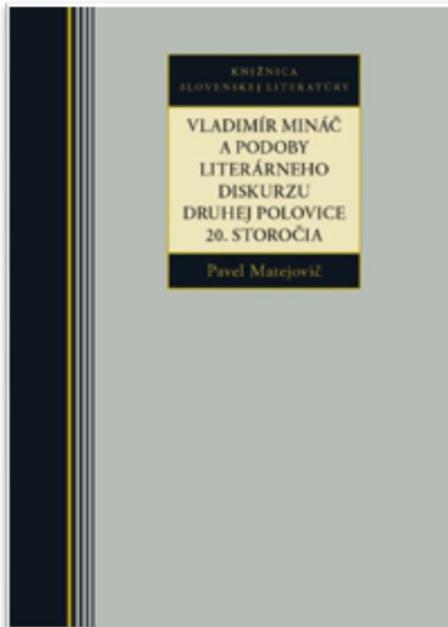
KOVÁČ, D. a kol. Dejiny Slovenskej akadémie vied. 1. vyd. Bratislava : Veda, 2014. 688 s. ISBN 978-80-224-1316-9.



## Vladimír Mináč and forms of literary discourse of the second half of the 20th century

SAS INSTITUTE OF SLOVAK LITERATURE

RESEARCHER: P. Matejovič.



The title of this monograph indicates that its content is not only a literary-historical reflection on the works of Mináč. Changes in the poetics of Mináč are in fact closely linked to the historical context that has shaped them. The author of the monograph therefore draws its attention to secondary texts on the works of Mináč through which it gives visibility to the contemporary rhetoric, role of writing and social function of the writer. With a concept designed in this way it closely relates the philosophical category of the subject as well as the forms of its transformation. This monograph mainly reflects Mináč's philosophical, aesthetic, and cultural-political views. The author also deals with autobiographical moments which are relatively well represented in his work and which were only partially received in the historical literary context. The work has the potential to also be a discussion on problems and central issues relating to the Slovak literature of the second half of the 20th century.

PUBLICATION:

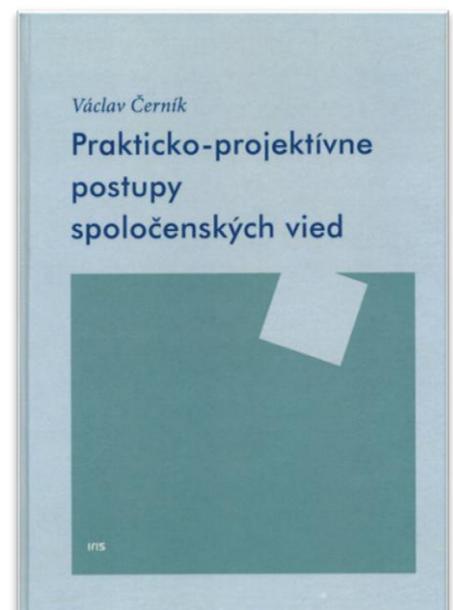
MATEJOVIČ, P.: Vladimír Mináč a podoby literárneho diskurzu druhej polovice 20. storočia. Bratislava : Kalligram – Ústav slovenskej literatúry SAV, 2014. 378 s. Knižnica slovenskej literatúry, 10. zväzok. ISBN 978-80-8101-832-9.

## The practical-projective processes of social science

SAS INSTITUTE OF PHILOSOPHY

RESEARCHERS: V. Černík.

This publication on practical-projective processes of social sciences follows the monograph 'Introduction to the Methodology of Social Sciences' (Cernik - Vicenik 2011) and empirical and theoretical processes of Social Sciences (Cernik - Vicenik 2012/2014). This is an attempt at analyzing the turnover in the method that occurs in the transition from theoretical to practical reason. The main point of focus is the issue of practical reasoning, rules, standards and normative theories, practical-projective processes, forecasting and planning, management and programming as well as the status of methodologies for practical science. It builds on the reconstruction problems of objectivity and subjectivity, truth and effectiveness, value and evaluation in social science and analysis of the verification strategies of social science. The work results in the analysis of classification, sorting and synthesizing social science, the design of comprehensive research methodology, forming of a single complex humanly decent science and the analysis of some methodological problems of ideology.



PUBLICATION: ČERNÍK, V. Prakticko-projektívne postupy spoločenských vied. Bratislava : Iris, 2014. 340 s. ISBN 978-80-8153-033-3.

### II.1.3.2. Resolution of problems for social practice

## **The scientific view of energy security of the European Union in relation to oil and gas**

**SAS INSTITUTE OF ECONOMIC RESEARCH**

**RESEARCHERS:** S. M. Obadi, M. Korček.

Today oil and gas provide for almost 60 percent of global energy needs which in the existence of geographic discrepancies among the place of their consumption and production, inevitably leads to the politicization of the flow of these fossil fuels. Despite the fact that in the 21st century the importance of renewable sources is increasing, fossil fuels remain irreplaceable for the coming decades and individual countries and economic groups are forced to reflect on this fact in the steps they take. Furthermore, the 21st century saw a series of events which had a major impact on energy security issues. The gas crisis in Europe, the tragedy in Fukushima, the development of the unconventional mining of gas and oil in the US, fluctuations in oil prices and geopolitical conflicts in the EU's eastern border, as well as the increasingly realistic environmental consequences of the use of fossil fuels which are all factors that are forcing countries to redefine their strategies for meeting the energy needs of their populations.

This publication by the SAS Institute of Economic Research analyzes the above events from multiple angles in the context of the energy *trilemma*, when the issue of energy security is perceived through the physical availability of energy, but also its economic and environmental dimensions. Theoretical standpoints and implications of standard economic concepts for energy security provide the basis for more detailed analysis of the above and a hierarchical approach. Questions and discussion arising from the global perspective, as well as from the position of the European Union and the Slovak Republic, enable one to gain a true picture of the research problems and economic implications of the events for the various stakeholders. There is also an extensive quantitative analysis and comprehensive methodological approach (calculation of the index of energy security and research of Granger causality) that provide deeper insight into research problems. The authors come to the conclusion that in the formulation of measures in the area of energy policy, it is necessary to balance the individual dimensions of energy security in order to enhance energy security in the European space.

PROJECT: VEGA 2/0009/12 – Globálna ekonomika a problém energetickej bezpečnosti: implikácie pre Európsku úniu.

OBADI, S. M. – KORČEK, M.: Energetická bezpečnosť Európskej únie so zameraním na ropu a zemný plyn: teoretické pohľady a empirické dôkazy. Bratislava: SAS Institute of Economy vo vydavateľstve Veda, 2014. 268 s. ISBN 978-80-7144-225-7.

## **Presentation of the results of the multiannual research on Košice modernism**

**SAS INSTITUTE OF ART HISTORY**

**SAS RESEARCHERS:** Z. Bartošová.

The high point of the presentation of the results of multiannual research on Košice modernism carried out at the SAS Institute of Art History was the successful exhibition of Košice modernism and its context, installed at the Slovak National Gallery in Bratislava in December 2014. Of course the exhibition in Bratislava was not mentioned in research output which took place as part of the Inter-war Košice project as the centre of art events (VEGA

2/008/12) and the European dimension of the artistic culture of Slovakia (Project EU Structural Funds). A precursor to the Bratislava exhibition was the exhibition of Kosice Modernism and its overlaps at the Gallery of Eastern Slovakia in Kosice (VÝCHODOSLOVENSKÁ GALÉRIA KOŠICE) in 2013. Co-author of the exhibition prepared by the Košice - European Capital of Culture project 2013, was independent researcher the SAS Institute of Art History Mgr. Zuzana Bartošová, PhD. In the exhibition catalogue a study was published which was of fundamental importance as a centre of Košice inter-war art events. The text was published in an English catalogue entitled 'Košice modernism and its wider context'. The exhibition has been ranked as one of the most important events of the Košice - European Capital of Culture project. The exhibition at the National Gallery was a modified reprise of the Košice exhibition and in addition to Z. Bartošová, curators Alexandra Homol'ová (SNG) and Michel Burdziński (PhD student at Warsaw University, currently on a study placement at the SAS Art History Institute) also contributed. Z. Bartošová also presented the research results of Košice modernism at the International Conference UTOPIA: EAM-2014 (The European Avant-Garde and Modernism 2014) in Helsinki, with Košice and its polyphonic artistic life.



*Anton JASUSCH/Antal JASZUSCH: Žltý mlyn, 1922. Zbierka Slovenskej národnej galérie v Bratislave. Reprofoto z katalógu výstavy.*

# Corpus of Slovak dialects

LUDOVIT STUR INSTITUTE OF LINGUISTICS SAS

RESEARCHERS: M. Šimková a kolektív SNK JÚLŠ SAV.

The Slovak National Corpus project was enriched in 2014 with an important addition, the Corpus of Slovak dialects (KN-SNK). A pilot version of the KN-SNK was prepared in March 2014, dialect version-1.0 was included in the publicly available SNK 30. 9. 2014 resources in the range of 73,855 text units. Part of the text available in this version has already been published in book form, another part was provided to the KN-SNK from the archive of dialectological department of the Ludovit Stur Institute SAS. This was a modern form of making two expansive units available within the SNK, The Slovak corpus of dialects and an electronic archive of Slovak dialects. The corpus of Slovak dialects presents a set of text data generated by the corresponding transcript of recordings and audio signals in a common format, featured programs that enable the end user to search and display necessary words and language resources in a predetermined context. The electronic archive of Slovak dialects SNK's is an extensive repository of sound recordings, their partial transcripts and other related materials in various formats.

Súbor Úpravy Zobrazit Oblíbené položky Nástroje Pomocník

 **Slovenský národný korpus**  
Jazykovedný ústav Ľ. Štúra Slovenskej akadémie vied

→English

## Korpus nářečí Slovenského národního korpusu

Korpus nářečí Slovenského národního korpusu – KN-SNK – sa začal pripravovať v oddelení SNK v roku 2013. Cieľom projektu je v prvej fáze zhromaždiť existujúce textové prepisy a nástrojmi a sprístupniť záujemcom o nářečový výskum.

Pilotná verzia KN-SNK bola pripravená v marci 2014, verzia **dialekt-1.0** bola zaradená do verejne prístupných zdrojov SNK 30. 9. 2014 v rozsahu 73 855 textových jednotiek. Časť textu dialektologického oddelenia JÚLŠ SAV.

Korpus nářečí nie je lematizovaný ani morfológicky anotovaný, vyhľadáva sa v ňom na základe konkrétneho slova (*word*) a pomocou regulárnych výrazov. Pri prepisoch sú uvedené sociálne kontexty a dá vyhľadávať prostredníctvom [NoSketch Engine](#) po [registrácii](#).

- [Textové zdroje korpusu](#)
- [Ako pracovať s korpusom](#)
  - [Metadáta o texte](#)
  - [Metadáta o informátorovi/explorátorovi](#)
  - [Ako citovať KN-SNK a jeho zdroje](#)
- [Možnosť spolupráce](#)



### II.1.3.3. Significant results of international scientific projects

## World congress of the international Gypsy Lore society 2014

### SAS INSTITUTE OF ETHNOLOGY

Main coordinator: SAS Institute of Ethnology.

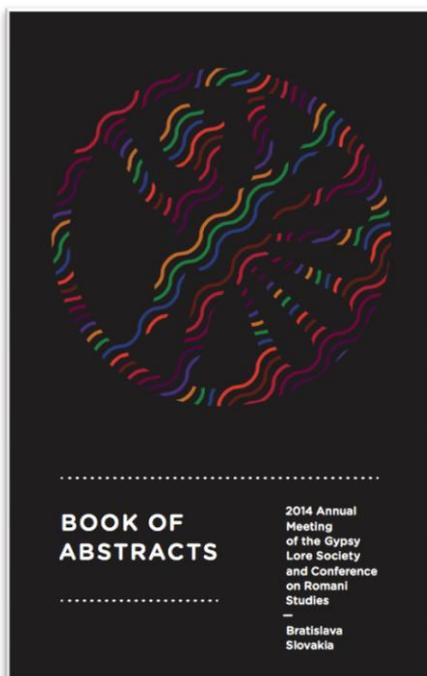
Cooperating domestic institutions: The European Commission Representation in Slovakia, Roma Institute, Faculty of Social and Economic Sciences, Slovak Society for the Study of Religion.

SK project coordinators from SAS Institute of Ethnology: T. Podolinská, T. Hrustič.

The Gypsy Lore Society (GLS) is a prestigious international organization focused on Roma studies, which was established in the year 1888 in the UK. In 2012 the GLS Committee invited the Institute of Ethnology to become the main coordinator of its World Congress. The Congress was held in Bratislava in September 2014 with the participation of a record number of 200 participants. The GLS Committee hailed the congress as the most successful scientific event in the history of the organization. Thematic panels devoted to current social problems were a new aspect of the congress program; attention was also paid to less explored topics such as European and national policies in relation to Roma, Roma political participation, education, migration of Roma groups, inclusion and integration, issues attributed to ethnicity, ethics in the collection of ethnic data, the work of churches and religious movements amongst the Roma and other groups. The conference organizers are confident that such events contribute to the deepening of knowledge and understanding of the historical, cultural and social similarities and differences of ethnic groups living for centuries on the territory of modern national states. A reviewed book of abstracts also emerged from the conference (in printed and electronic form).

The World Congress of the International Organisation Gypsy Lore Society 2014 took place in Bratislava on the premises of the Faculty of Social and Economic Sciences, Comenius University 11 - 13 9th, 2014.

<http://www.uet.sav.sk/?q=sk/gypsy-lore-society-annual-meetings-and-conferences-gypsyromani-studies>



#### PUBLICATION:

T. Podolinská, T. Hrustič (eds.), *Book of Abstracts. 2014 Annual Meeting of Gypsy Lore Society and Conference on Romani Studies*. Bratislava: Institute of Ethnology SAS, 2014. ISBN 978-80-970975-1-6, 148 s.

Online: [http://www.uet.sav.sk/files/book\\_of\\_abstracts\\_final\\_gls2014.pdf](http://www.uet.sav.sk/files/book_of_abstracts_final_gls2014.pdf).

## Jacques Copeau yesterday and today – monograph on the founder and of French theatre direction

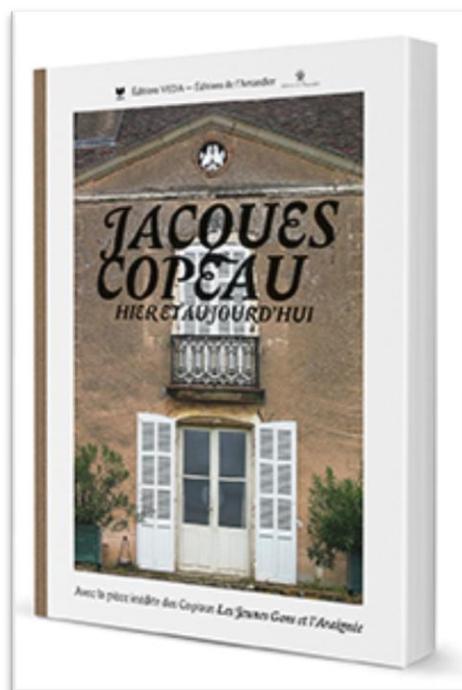
SAS INSTITUTE OF THEATRE AND FILM RESEARCH

RESEARCHER: M. Mistrík.

This publication is the result of multiannual cooperation between 17 authors from six countries and is an important scientific contribution not only for France, but for pan-European historiography and theatre. The lead author and editor M. Mistrík from the SAS Institute of Theatre and Film Research coordinated a team of French experts from the University of Paris 3 - Sorbonne Nouvelle, Université Rennes 2 as well as other artists from Italy (Università di Pisa), USA (University of Saint Joseph in Philadelphia), Japan (Waseda University), Poland (Uniwersytet Warszawski) among others. This monograph is aimed at the work of one of the founders of modern French theatre direction, Jacques Copeau (1879-1949). Apart from scientific studies it also contains published and unpublished drama by J. Copeau *Young people and spiders* which M. Mistrík discovered in the archives of the French National Library.

PUBLICATION:

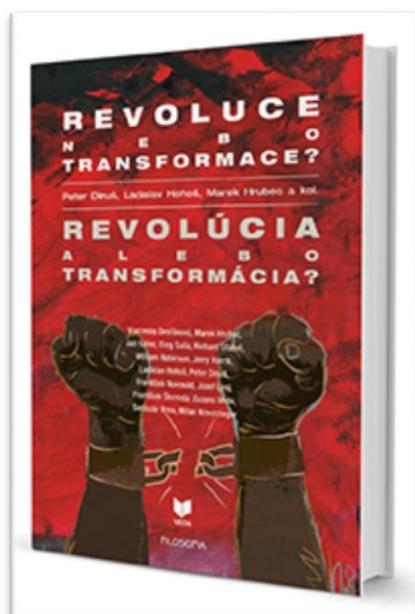
MISTRÍK, M. et al. Jacques Copeau hier et aujourd'hui (Jacques Copeau včera a dnes). Bratislava; Paríž : VEDA, vydavateľstvo SAV; Éditions de l'Amandier, 2014, 400 s.



## Revolution or transformation?

SAS INSTITUTE OF POLITICAL SCIENCES

RESEARCHERS: P. Dinuš, L. Hohoš, M. Hrubec a kol.



The twenty-fifth anniversary of the events in November 1989 provides an opportunity to reflect once again on the concepts of revolution and transformation. The social changes that have since taken place were not just one of the many common phenomena, but problematic transformation. This book seeks to bring the subject of successive and rapid, substantive and superficial, dramatic and smooth social changes in recent times and indicate possible future development trajectories. It opens transdisciplinary and interdisciplinary analysis on the border of philosophy, political science, sociology, global studies and cultural studies.

PUBLICATION:

DINUŠ, P. – HOHOŠ, L. – HRUBEC, M. a kol.: Revoluce nebo transformace? Revolúcia alebo transformácia? Bratislava – Praha: VEDA, vydavateľstvo SAV – FILOSOFIA, nakladatelství Filosofického ústavu AV ČR 2014, 288 s. ISBN 978-80-224-1371-8 (VEDA), ISBN 978-80-7007-413-8 (FILOSOFIA).

## II.2 SAS Centres of Excellence

### Centre of low temperature physics and materials research in extreme conditions – CLTP–MREC

CENTRE HEAD: prof. RNDr. Peter SAMUELY, DrSc.

HOST INSTITUTE OF THE SAS CE: Institute of Experimental Physics

COLLABORATING INSTITUTIONS: SAS Institute of Geotechnics, SAS Institute of Materials Research, Faculty of Science of Pavol Jozef Šafárik University in Košice

RESEARCH DURATION OF THE EXCELLENT PROJECT: 4. 8. 2011 – 3. 8. 2015

The laboratories and research groups at the centre continued in the development of new equipment and experimental engineering. As a major part of the Promatech research centre set up with EU structural funds, the year 2014 was crucial in building 41 new laboratories. Examples of these include a magnetically shielded laboratory, laboratory with scanning hall microscopy, an electron scanning microscopy laboratory with a focused ion beam - SEM / FIB, etc.

The centre's own research in 2014 is best documented in the 55 peer-reviewed scientific publications which arose from the support of the centre and which were published in leading journals, for example two of the works in question were published in journals with impact factors of 12 and 15. Of the scientific topics addressed at the centre, one worth mentioning is a study on superconducting properties of materials at pressures up to 320 kilobars, developing new methods for viewing the dynamics of superconducting vortices at ultralow temperatures, the synthesis of nanocrystalline materials with potential for use in biological application, the study of the mechanical properties of advanced materials at the nanoscale level, processing materials in high magnetic fields, applied research in the field of energy harvesting of small mechanical devices, the study of magnetocaloric effect, etc.

The centre operates as an open infrastructure for measurement under extreme conditions: ultra-low temperatures, high magnetic fields, high pressures and studies at nanoscale. Dozens of students are currently studying at the centre in the areas of the physics of condensed matter and materials research.

### Centre of excellence for functionalized multi-phase materials FUN-MAT

HEAD OF THE CENTRE: RNDr. Marian Krajčí, DrSc.

HOST INSTITUTE OF THE SAS CE: SAS Institute of Physics

COLLABORATING INSTITUTIONS: SAS Institute of Materials and Machine Mechanics, SAS Polymer Institute, SAS Institute of Inorganic Chemistry, Mathematics and Physics Faculty Comenius University, Faculty of Materials science and Technology STU

RESEARCH DURATION OF THE EXCELLENT PROJECT: 4. 8. 2011 – 3. 8. 2015

Based on the results obtained from analysis of Al-Mn, Al-Mo a Al-Mg rapid cooling systems, we cooperated with UMMS SAV and prepared a compacted powder composite based on atomised particles of Al(Mg). With the appropriate use of kinetic and structural knowledge of the oxidation and nitriding process during thermal processing we set conditions in-situ development of layers of MgO and Al<sub>2</sub>O<sub>3</sub> grains reinforcing Al (Mg) necessary for a significant increase in the stiffness of the composite (J. Mat. Proc. Technol., Keynote) . The combination of thermoanalytical techniques and positron annihilation spectroscopy we studied composites consisting of a nanoporous matrix (silicagel, CPG) and filling liquid (cetane, water). We identified processes in composites during their heat treatment which are fundamentally important knowledge in terms of a wider range of possibilities of practical use similar composites, for example the transport of fluids, thermal storage tanks etc. (J. Therm.

Anal. Calorim.) Furthermore, we developed an innovative plasmonic substrate for organic solar cells based on gold nanoparticles and nanorods that increase solar cell efficiency by up to 20 percent. Composites were prepared with coal nanotubes, specifically modified to achieve preferential interactions with one phase of triblock copolymers with the properties of thermoplastic elastomers. We optimized surfaces on the basis of polystyrene microspheres by vapour deposition of silver for the immobilization of the aptamers for the study of their binding properties with the help of the SERS method. Using DFT methods we focused on the study of the catalytic properties of selected (111) GaPd surfaces (J. Catalysis) and (010) GaPd<sub>2</sub> surface (J. Phys. Chem. C) for semi- hydrogenation of acetylene. We focused in particular on understanding the factors affecting the desired selectivity of the catalysts.

### Centre of Excellence for brain research - BrainCentrum

HEAD OF THE CENTRE: prof. MUDr. Michal Novák, DrSc., Dr. h. c.

HOST INSTITUTE OF THE SAS CE: Institute of Neuroimmunology

COLLABORATING INSTITUTIONS: SAS Institute of Neurobiology (NiU), SAS Institute of Experimental Endocrinology (UEE), Jessenius Faculty of medicine in Martin Comenius University (JLF UK), Faculty of Medicine Comenius University in Bratislava (LF UK), University of Veterinary Medicine and Pharmacy in Košice (UVLF), Centrum Memory

RESEARCH DURATION OF THE EXCELLENT PROJECT: 4. 8. 2011 – 3. 8. 2015

The Centre of Excellence for brain research groups together domestic academic and university workplaces involved in brain research.

In the project the Institute of Neuroimmunology aims to identify structural changes in tau protein. We found that the pattern of individual forms of pathologically modified tau protein varies slightly among patients. In the JPND project, which focused on biomarkers for Alzheimer's and Parkinson's disease – BIOMARKAPD, we joined forces with a group of selected European laboratories that test and validate new diagnostic kits. In a joint NIU and UEE project, monitoring the impact of stress on the development of neurofibrillary pathology also continued. Restraint stress caused a reduction in levels of epinephrine and norepinephrine in transgenic rats of Wistar strain, but not in the transgenic rats of the SHR strain. These results indicate the strong influence of genetic background on stress response and neurofibrillary degeneration. The Institute of Neurobiology focused on the study of molecular formulas of the various sections of spinal cord injury. Proteomic analysis showed that the damaged rostral part of spinal cord produces inflammatory markers and neurotrophic agents while in the caudal part, molecules involved in the process of necrosis were dominant. These results point to a different cell responses in the rostral and caudal parts of the spinal cord several days after traumatic injury.

Some results have been successfully published in prestigious scientific journals. The centre for brain research continues to fulfil its mission, its coordinated research activities of its members and helps to create projects aimed at research of the brain.

## Centre of excellence for studying metabolic aspects of the development, diagnosis and treatment of oncologic diseases - CEMAN

HEAD OF THE CENTRE: doc. Ing. Oľga Križanová, DrSc.

HOST INSTITUTE OF THE SAS CE: Institute of Molecular Physiology and Genetics

COLLABORATING INSTITUTIONS: SAS Institute of Virology, SAS Institute of Experimental Endocrinology, SAS Cancer Research Institute, Jessenius Faculty of medicine in Martin Comenius university

RESEARCH DURATION OF THE EXCELLENT PROJECT: 4. 8. 2011 – 3. 8. 2015

Cooperation within the CEMAN project between the SAS Institute of Molecular Physiology and Genetics, SAS Institute of Virology and the SAS Cancer Research Institute resulted in a detailed study of the mechanism of sulforaphane which acts as an antitumor agent. Sulforaphane is among the natural dietary ingredients as it is found in broccoli. Sulforaphane is capable of accumulating in tumour cells and inducing apoptosis (controlled cell death). We have shown that the short-term incubation of ovarian cancer cells with sulforaphane activated reactive oxygen forms, whereas for long term treatment with the activated transcription factor Nrf2 also increases the amount of IP<sub>3</sub> receptor type 1 (IP<sub>3</sub>R1) involved in the induction of apoptosis. IP<sub>3</sub>R1 included in sulforaphane induced apoptosis through depletion of the endoplasmic reticulum, as well as the activation of certain transcription factors in the nucleus. Nrf2 / KEAP signalling is also affected by IP<sub>3</sub>R1.

Sulforaphane also reduces the molecular response to hypoxia by reducing the levels of the HIF1 $\alpha$  protein without effecting the transcription and the stability. The influence of sulforaphane reduced regulation of pH and reduces the migration of ovarian cancer cells. These results suggest a potential to either of the combination treatment with sulforaphane either in conventional chemotherapy, natural substances, or other small molecules. The results have been summarized in two articles that will be published in 2015.

## NOREG Centre of excellence for examination of regulatory role of nitric oxide in civilization diseases NOREG

HEAD OF THE CENTRE: RNDr. Oľga Pecháňová, DrSc.

HOST INSTITUTE OF THE SAS CE: Institute of Normal and Pathological Physiology SAS

COLLABORATING INSTITUTIONS: Institute for Heart Research SAS, Institute of Neurobiology SAS, Institute of Experimental Endocrinology SAS, Medical Faculty Comenius University, Faculty of Natural Sciences Comenius University Bratislava

RESEARCH DURATION OF THE EXCELLENT PROJECT: 4. 8. 2011 – 3. 8. 2015

The aim of the Centre of excellence for examination of regulatory role of nitric oxide in civilization diseases (NOREG) is to identify common NO-regulated (patho)mechanisms which participate in the development of metabolic syndrome. At this stage of research we focused on the observing the mechanisms that lead to dysfunction of the vascular endothelium, followed by functional and structural changes of the cardiovascular system, and here we used a number of animal models of hypertension, metabolic syndrome, and social stress. Based on the findings, we conclude that the endothelial dysfunction induced by genetic disease, or pharmacologically when there is reduced nitric oxide (NO) production by endothelial NO synthase, may be the cause of high blood pressure. This conclusion also applies to some metabolic disorders, mainly hyperlipidemia. On the other hand, endothelial dysfunction of spontaneous or borderline hypertension is associated more with the overproduction of vasoconstrictory substances and appears to be independent of nitric oxide production. Oxidative stress caused by a marked production of reactive oxygen species is a major cause of endothelial dysfunction observed in models of hypertension and metabolic syndrome. The subsequent degradation of NO and reduction in its availability is, in many cases compensated with NO-independent relaxation. NO deficiency nevertheless leads to malfunctions and structural changes of the heart and blood vessels.

## Centre of Strategic Analysis – CESTA. Centre for Interdisciplinary Research and Social Strategies

HEAD OF THE CENTRE: Mgr. JUDr. Martina Lubyová, PhD.

HOST INSTITUTE OF THE SAS CE: Institute for Forecasting of SAS

COOPERATING INSTITUTIONS: Institute for Sociology SAS, Institute of Experimental Psychology SAS, Institut of Management, Slovak University of Technology in Bratislava, Faculty of Social and Economic Sciences of Comenius University

RESEARCH DURATION OF THE EXCELLENT PROJECT: 4. 8. 2011 – 31. 7. 2015

The Centre of Excellence of the Slovak Academy of Sciences CESTA (Centre for Strategic Analyses) is coordinated by Institute for Forecasting SAS. CESTA combines the expertise of several institutes of the Slovak Academy of Sciences (Institute for Forecasting SAS, Institute of Experimental Psychology SAS, Institute of Sociology SAS) and Universities (Institute of Management of the Slovak Technical University and Faculty of Social and Economic Sciences of the Comenius University). CESTA provides an interdisciplinary platform for the development of strategic decision making and modern forecasting in the fields of key importance for social development (such as demographic change and population ageing, quality of life and environment, knowledge economy, technology transfer and security).

The centre offers scientific as well as popular outputs.

In 2014 the Centre published three monographs, one article in a foreign CC journal, an article in a domestic CC journal and a large number of publications in other periodicals. As part of applied output a self-reflection survey of social and human scientists in Slovakia took place (in cooperation with the SAS Institute of World Literature) as well as the evaluation of the success of Slovakia in obtaining scientific funding from the 7th Framework Programme of the EU. A series of lectures and participation in events dedicated to the development of nanotechnology and ethical aspects of their applications also continued.

In October, CE CESTA organized a public lecture led by Professor Hans Bruyninckx - Executive Director of the European Environmental Agency. In the small conference centre at SAS and in the presence of the media, two public presentations of the monographs *Reproduction among the Roma population in Slovakia and the prognosis for population development* and *Prognosis for the development of families and households in Slovakia in 2030* also took place.

2014 saw the continued publication of the prognostic magazine Bulletin by the Institute for Forecasting that aims to fill in the gaps in terms of short-term and medium-term forecasting of selected social development indicators of the Slovak Republic. More information can be found on the CE CESTA webpage (<http://www.ce-cesta.eu>).

## Slovak History in the History of Europe. Research on European Connotations in the History of Slovakia – SDDE

HEAD OF THE CENTRE: PhDr. Dušan Kováč, DrSc.

HOST INSTITUTE OF THE SAS CE: SAS Institute of History

COLLABORATING INSTITUTIONS: Institute of Sociology SAS, Institute of Political Sciences SAS, Faculty of Philosophy, Comenius University in Bratislava, Faculty of Humanities, Matej Bel University in Banská Bystrica, Faculty of Philosophy, Pavol Jozef Šafárik University in Košice, Faculty of Philosophy and Arts, Trnava University

RESEARCH DURATION OF THE EXCELLENT PROJECT: 4. 8. 2011 – 3. 8. 2015

In 2014, members of the SDDE centre of excellence completed archival research on the topic of centers of excellence, agreed on a binding structure of the collective monograph entitled *Slovenské dejiny v dejinách Európy* (Slovak history in the history of Europe) (Dusan Kovac et al.). Proposals for lectures were sent to the World Congress of Historical Science in Jinan

(China) ], two of which were selected for the program (D. Kovac and M. Schvarc - M. Hanula). The SDDE team published five scientific monographs and 26 scientific articles in journals, collective monographs and textbooks in 2014. Foreign policy and the international context of the establishment and existence of the Slovak State in the years 1939 - 1945 were dealt with in two monographs (V. Bystrický; M. Fiamová - J. Hlavinka - M. Schvarc) and the general position of Slovakia in modern European history is dealt with in a collective monograph entitled *Slovensko v labyrinte moderných Európskych dejín* (Slovakia in the labyrinth of modern European history) (editor S. Michalek), which was done by the team of the late SDDE member, Milan Zemek. Scientific studies and articles focused on the topic of Slovak history in the history of Europe in a broad time span from the middle ages to the present.

### A history of Slovak Slavistics of 19th-20th Centuries (SlovSlav)

HEAD OF THE CENTRE: Prof. PhDr. Ján Doruľa, DrSc.

HOST INSTITUTE OF THE SAS CE: Jan Stanislav Institute of Slavistics

COLLABORATING INSTITUTIONS: Institute of Slovak Literature SAS, Faculty of Philosophy of Comenius University in Bratislava, Faculty of Education of Comenius University in Bratislava, Faculty of Philosophy University of Ss. Cyril and Methodius in Trnava, Faculty of Education of The Catholic University in Ružomberok

RESEARCH DURATION OF THE EXCELLENT PROJECT: 6. 9. 2012 – 5. 9. 2016

The planned publication of *Historický význam a odkaz diela osobností slovenského národného obrozenia* (The historical significance and reference works of figures of the Slovak national revival) (editor prof. PhDr. Ján Doruľa, PhD., Reviewer prof. Mgr. Júlia Dudášová-Kriššáková, PhD., and doc. Mgr. Mária Dobríková, PhD. Bratislava: Slavistický Jan Stanislav Institute 2014. 162 pp.). The publication contains a series of studies: Ivor Ripka, *Etymologické výskumy Jána Kollára a Pavla Jozefa Šafárika* (Etymological research on Jan Kollar and Pavol Jozef Safarik); Jana Skladaná, *Slovanský národopis Pavla Jozefa Šafárika* (Slavic ethnography of Pavol Jozef Safarik); Lenka Rišková, *K programovým básňam Pavla Jozefa Šafárika* (The programming of poems by Pavol Jozef Safarik (Loučení s Múzou a Zdání Slavomilovo)); Erika Brtáňová, *Záborského predstava národnej literatúry* (Delving into the ideas of national literature); Peter Zubko, *Jonah Záborský - kňaz nie každodenný* (Clergy not an everyday thing); John Doruľa, *Predstavy slovenských vzdelancov o jazyku a etnickej identite Slovákov v období národného obrozenia* (Thoughts of Slovak scholars on language and ethnic identity of the Slovaks during the national revival); Peter Žeňuch, *Kultúrne a spoločenské podmienky vydania päťzväzkovej Biblie pre gréckokatolíkov Mukačevskej eparchie* (The cultural and social conditions of the publication of the five volume Bible for Greek Catholics of the Eparchy of Mukacheve).

In line with the schedule for the implementation of the CE SlovSlav research program, on 8 - 9 October 2014 an international interdisciplinary scientific conference, *Ľudová próza na Slovensku v kontexte dejín slavistiky* ( Folk prose in Slovakia in the context of the history of Slavic Studies) took place at which reports prepared by members of the CE were presented: Katarína Žeňuchová *Cambelove zbierky ľudových naratívov* (Cambelová collection of folk narratives), Jana Pácalová *Codexy tisovské v rozprávkových zbierkach Pavla Dobšinského* (The Tisovsky codex in the fairytale collections of Pavol Dobšinsky), Hana Hlôšková *Dielo Jána Kalinčiaka v kontexte literárneho folklorizmu* (part of John Kalinčiaka in the context of literary folklorism) and Peter Zubko *Teologický pohľad na Dobšinského rozprávky* (The theological view of Dobšinsky fairy tales). The papers by the conference participants will be processed in the form of scientific studies and will be published in book form in 2015. 25 papers were presented at the conference and scientists from Slovakia, the Czech Republic, Russia, Belarus, Ukraine and Poland gave speeches. The thematic diversity and variety of individual performances are the result of the efforts of researchers on how complementary a scientific view is on this subject matter.

Preparatory work (transliteration, collation and redaction handwritten text) on publishing Tisovský codex B and C (J. Pácalová) also continued.

A publication due for release in 2015 was published in advance: Žeňuchová, K. : Zbierka ľudovej prózy Samuela Cambela (A collection of folk stories by Samuel Cambeis). Reviewed by Viera Gašparíková, Viera Kováčová. Bratislava: Jan Stanislav Institute of Slavistics SAS - Slovenský komitét slavistov (Slovak Committee of Slavists) 2014. 464 p.

### Castles in Slovakia (HnS). Interdisciplinary summary view on the castle phenomenon

HEAD OF THE CENTRE: prof. PhDr. Ján Lukačka, CSc.

HOST INSTITUTE OF THE SAS CE: SAS Institute of History

COLLABORATING INSTITUTIONS: Institute of Slovak Literature SAS, Institute of Musicology SAS, Institut of Geography SAS, Institute of Landscape Ecology SAS, Institute of Construction and Architecture SAS, Faculty of Philosophy of Comenius University in Bratislava, Faculty of Humanities, Matej Bel University in Banská Bystrica, Faculty of Philosophy Pavol Jozef Šafárik University in Košice, Faculty of Philosophy University Prešov  
3. 10. 2013 – 2. 10. 2017

The team of the Centre of Excellence HnS continued its activities in 2014 according to the agreed timetable. Members participated in national and international conferences devoted to the construction development of castles, archaeology or new findings on the history of castles. Three monographs were published within the CE HnS which were thematically dedicated to the organization of the royal court, and the relationship castles with extramural settlements as well as castle art. Three members of the CE HnS team were professional advisers and authors in the filming of six TV documentaries, Hľadanie stratených svetov (finding lost worlds), for Slovak television. Image and word documents are being presented on less significant episodes on the history of Slovakia in the European context. The bulk of the filming was carried out on castles not only in Slovakia but also abroad (Hungary, Austria, Italy).

## II. 3 SAS Projects

It is possible for research teams to obtain research projects supported under the national grant schemes:

### a/ VEGA

Scientific Grant Agency of the Ministry of Education, Science, Research and Sport SR (MŠVVaŠ SR), which provides a common, coordinated approach when selecting and assessing projects for basic research, addressing the institutes, universities and scientific institutions of SAS, is currently the only stable grant system for SAS and universities.

In 2014, the SAS Presidium allocated 4,516,769 Euros to the VEGA Grant which was 5 percent more than in 2013. The SAS Presidium approved the funding of 598 projects which were hosted by SAS organisations, and 55 joint projects with universities (universities are the hosting organisations).

### b/ APVV - Slovak Research and Development Agency

This state agency supports projects that are related to general calls, APVV programs and international cooperation (mobility). The main problem with this is that the calls are irregular and the fact that the current calls are focused on basic and applied research without taking into account the specificities of both of these areas.

In the second half of 2014 after a break of over a year, there was a general call for project proposals for the first half of 2015.

The Slovak Research and Development Agency supported 191 projects in 2014 which were hosted by SAS organisations. SAS organisations participated in a further 123 projects.

### c/ ASFEU/SORO

The Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic for EU Structural Funds (ASFEU) – responsible for the implementation of the Operation program Research & Development in the following areas:

- national infrastructure (through national projects),
- scientific infrastructure,
- centres of excellence support,
- applied research and development support,
- establishment support for research and development centres,
- establishment support for competence centres,
- support of university research parks and research centres.

Throughout the year 2014 several projects supported by Structural Funds concluded. All projects supported by the Structural Funds must end in the year 2015 (end of the program period). In 2014 SAS paid particular attention to the so-called big project research centres in Bratislava and Košice and university science parks in Bratislava. In addition, SAS is implementing a Research Centre Allegro project as well as a project on the vaccination program on the premises of the Šarišské Michalany company ImunaPharm. Construction inspections took place and both the research centre and university science park are being completed.

### d/ Financing of research in the commercial sector.

For some time now the SAS budget has not covered the real needs of individual organizations particularly in the areas of goods and services and in ordinary expenses. Organizations

acquire funding from external domestic sources and from foreign sources. One problem in particular that we are facing is with the operational sustainability of the new and considerably unique infrastructure obtained from EU structural funds. We therefore suggest opening a sustainability program in Slovakia (a similar one exists in the Czech Republic), which using a competition principle would allow for obtaining funding for sustaining the acquired infrastructure (operation and human resources). This funding would also include infrastructure in the process of acquisition.

## II.4 Projects supported by EU structural funds

The institutes of SAS are involved in projects of EU Structural Funds in the Operational Programme for Research and Development as well as the Operational Programme for Education.

### **Operational program for Research and Development**

The organizations of the Slovak Academy of Sciences, up to 31. 12. 2014 entered into contracts for EU Structural Funds projects along with businesses and university departments for a non-return grant in the amount of EUR 506 483 224.89. The institutes of SAS have been major partners in 80 projects. They also emerged as partners in 32 collaborative projects aimed at cooperation with the business sector and 24 projects whose principal partners are university departments. Altogether SAS organisations (together with partners from the business sector and universities) spent 262 150 567.19 euro, or 51.8 percent in the Operational Programme for Research and Development up to 31.12.2014.

In 2014, 30 projects were completed in which SAS workplaces acted as main partners or partners to businesses and university departments with a total non-return financial investment of EUR 94 475 168.83. The activities of these projects spent EUR 75 177 261.47 which means spending amounted to 79.6 percent. Overall, since the beginning of the EU SF activity, 92 projects have been completed in which SAS workplaces acted as main partners or partners to businesses and university departments, with a total non-return financial investment of 180 266 279.04, and the total amount spent in the amount of 151 639 026.91 euro, representing an allocation of 84.1 percent. Completed projects are continuing to the sustainability stage.

Five new projects began in 2014 which are due to be completed in 2015.

As part of the OPVaV-2013 / 1.1 / 02-SORO project for the modernization and building of technical infrastructure for research and development three SAS workplace were successful in acting as a principal investigators. The SAS institute of Chemistry began working on the project already in December 2013 and the other two institutes began planned activities in 2014. This is the SAS Institute of Archaeology and the project for completion of centers of excellence for research and development in the field of protection and preservation of the cultural heritage of Slovakia, with a total non-return financial investment of 2812 544.10 euro, of which 964 699.85 euro was spent up to 31.12.2014. The second project is the DiViCen – digital and video conferencing centre of the Institute of Social Sciences in Košice, with the allocated grant in the amount of 2,027 341.30 euro, of which 7 342.82 euro was spent up to 31.12.2014.

As part of the OPVaV-2013 / 2.2 / 09-RO call for the construction of university science parks and research centres, the Slovak Academy of Sciences won three projects, two of which began in 2014. This is the project for the centre for research and development of immunologically

active substances as well as the ALLEGRO Research Center. Together they entered into a contract in the amount of EUR41 210 424.98. EUR20 926.13 euro of this was spent up to 31.12.2014.

As part of the OPVaV-2013 / 4.1 / 04-SORO call for support for the transnational centers of excellence and the importance of international cooperation in the field of research (state aid scheme), the SAS Institute of Materials and Machine Mechanics was involved as a partner in the project called Centrum excelentnosti pre plazmové vysoko-produktívne spracovanie materiálov a aditívne vytváranie štruktúr (Centre of Excellence for plasma high-productive process materials and additives creating structures) that the principal investigator is a business entity - Drilling GA. The project is contracted grant totalling 2 999 967.65 euro and a total amount of 20 171.89 euro was spent up to 31.12.2014.

In 2015, the planned activities of all 44 projects with allocated grant in the amount of 326 216 945.85 Euros are due to conclude, by the end of 2014, 110511 540.28 euro was spent which represents 33.9 percent spending to date.

In 2014 Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic for EU Structural Funds did not issue any new calls. The agency reported that it intends to launch two calls in 2015 for the mobilization of excellent research teams in areas of specialization RIS3 SK, one for the Bratislava region and one for the following regions: Nitra, Trenčín, Trnava, Žilina, Banská Bystrica, Prešov and Košice. The aim will be to support the modernization, renovation and consolidation of R & D infrastructure of research institutions, as well as the implementation of high quality research activities in the run up to 2020.

### **Operational programme for education**

Five SAS organisations were involved in the call for the Operational Programme Education (OP) were involved through seven projects in which they acted as main partners. Up to 31 12 2014 they entered into a contract for non-repayable grant in the amount of 4 875 250.19 Euros and spent 2,498 894.62 which represents spending of 51.3 percent. In 2014 activities in two project concluded which were assigned 1157 659.03 euro of which the sum of 720 107.26 euro was spent, representing utilization of 62.2 percent. The project entitled the International Virtual Laboratory of Physics of advanced materials will be completed throughout the course of 2015. The researching body is the SAS Institute of Experimental Physics in Kosice. Successful completion of this project will contribute to the fulfilment of the implementation of regional innovation strategies in the Košice region.

## CHAPTER III

### Educational Activities

#### Doctoral studies and educational activities

Young adepts of science are continuously being educated at SAS organizations in doctoral studies. Fifty three SAS organisations are training students in 64 doctoral fields of study. There were 125 newly admitted doctoral students to study topics commissioned by SAS. SAS is participating in doctoral study programs at 11 universities as an external educational institution.

The number of doctoral students compared to last year has decreased. Departments at SAS had 576 PhD students altogether, including 492 doctoral students in full-time and 84 part-time. 110 candidates defended their doctoral studies. Apart from this SAS employees were the main tutors for 150 doctoral students at universities, which points to the further scientific and pedagogic capacity of SAS workplaces.

The education and scientific work of PhD students and post-doctoral students at the Academy is at a high standard of quality. SAS also supports young scientists through the Stefan Schwarz Support Fund. In 2015 13 institutes received a contribution to their wage funds for 18 Post Doc candidates.

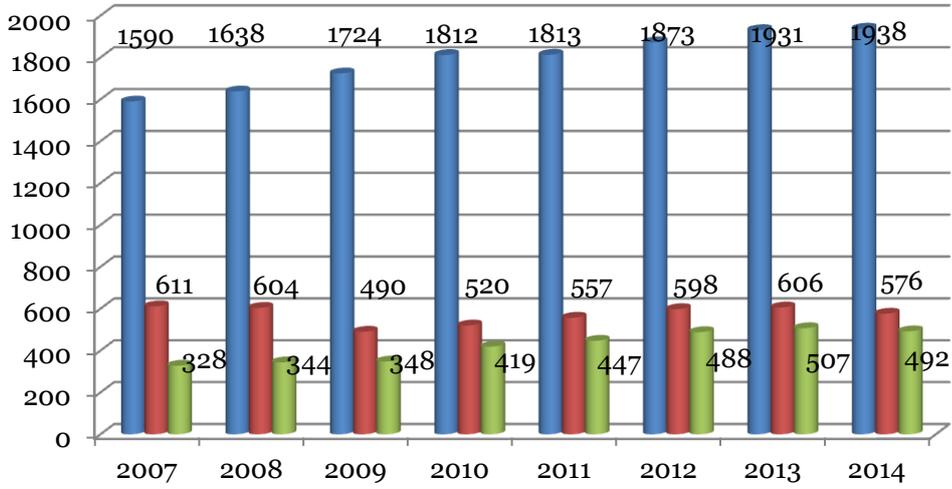
In cooperation with universities and colleges, SAS employees were mostly involved in lecturing activities at universities - 347 employees gave 13,741 hours of lectures at home and 38 employees gave 979 hours of lectures abroad, workshops and seminars were led at home by 254 employees (14,608 hours) and abroad by 28 employees (1,312 hours). An important part of the educational activity was overseeing theses (406 members of staff oversaw 1,046 theses and dissertations), 289 employees officiated over 526 dissertations and habilitation works. The role of main tutor was undertaken by 393 advisers who also trained other institutions and supervised 727 doctoral students in total.

SAS staff worked as members of commissions for PhD defence (290), the Commission for the defence of doctoral dissertations (55), and as members of committees and officiating at the inaugural or habilitation procedures at universities (84), as members of scientific boards of universities and of the boards of universities and faculties (273). In 2014 three SAS employees received the DrSc and 14 received the scientific pedagogical titles. SAS departments have 45 shared workplaces and associations aimed at making use of equipment and facilities for teaching and joint resolution of projects.

Up to 31.12.2014 there were 1,938 scientists at SAS workplaces, 269 of which were doctors of science and 1,669 PhD (full status) candidates. Compared to the previous year, the number of researchers with scientific and academic titles has increased, while 140 professors and 156 associate professors operate at SAS. According to the qualification structure of SAS, 325 leading scientists and 845 independent scientists worked at SAS.

The SAS Scientific Council awarded three Doctor of science scientific degrees in 2014. The SAS commission for assessing the scientific qualifications of employees received 121 proposals for recognition of scientific levels of qualification, 74 of which were proposals from the Slovak Academy of Sciences and 47 from the Ministry of Education (MŠ SR) and other organs of the Slovak Republic. The commission discussed 8 proposals for recognition of level I scientific qualifications and 113 proposals for level IIa scientific qualifications, 116 of which were approved and five of which were rejected. 70 SAS members of staff achieved a higher level of scientific qualification.

## Number of scientists and doctoral candidates



● scientists

● PhD students

● PhD students - fulltime

## CHAPTER IV

### SAS in the international context

The development of international cooperation is among the pillars of SAS activity. Adequate participation in various forms of international cooperation is a prerequisite for the gradual increase in the quality of research and improvement of its infrastructure. This ultimately enables acquisition of additional resources to support research in all areas.

The main pillar of international cooperation is the involvement of research teams and individuals in international projects. The centre of this is participation in EU project schemes with an emphasis on Framework EU projects. SAS scientists actively participate in the projects of the European Science Foundation (ESF), COST, NATO, CERN European Space Agency (ESA), EUREKA, UNESCO, and the International Visegrad Fund (IVF) among others. Particularly noteworthy is the involvement in the ERA-NET program which aims to connect international research at a national or regional level. It should be emphasized that the participation of research teams in ERA-NET programs is covered by SAS budgetary resources.

Another important area is the development of cooperation with scientific institutions from developed countries outside the EU through joint research projects. In 2014 cooperation with the National Science Council of Taiwan also continued which was transformed to MOST (Ministry of Science and Technology, Taiwan) at the beginning of the year, with the TUBITAK (Turkish Council for Scientific and Technological Research, Turkey) agency. Intensive negotiations with the Japan Science and Technology Agency (JST) on cooperation between JST, agencies supporting research in V4 countries and the International Visegrad Fund. The result of the negotiations was the signing of a joint Memorandum of Understanding to create conditions for the beginning of the project of cooperation between JST and V4. The first joint call for projects was scheduled for the beginning of 2015.

It is important to emphasize that SAS has developed a system supporting the participation of their teams and individuals in international projects. SAS stimulates participation of researchers from SAS organizations by increasing the budget of those organizations that successfully engage in handling multilateral international projects. Participation in the ERA-NET, ESA, as well as joint research projects with developed countries outside the EU was paid in full by SAS from its own budgetary resources. The total amount of support for participation in international projects represented an amount exceeding 1 million euro in 2014.

An important part of international cooperation is the development of mobility programs. In 2014, SAS embarked on a gradual change from supporting unspecific exchanges and visits declared common research topics to promote bilateral mobility projects aimed not just at greater efficiency and controllability of the resources used but also to increase the involvement of young researchers and PhD students. The transfer of emphasis on mobility projects foresees the gradual reconsideration of bilateral agreements with foreign partner institutions. A significant change in this area was brought by a new contract with the Academy of Sciences of the Czech Republic (AV ČR). A similar amendment with an emphasis on project collaboration was also featured in a contract with the Hungarian Academy of Sciences.

## SAS in European research

SAS is actively involved in building the cooperative area of European research per the involvement of researchers and research teams in multilateral cooperation projects, support of bilateral cooperation with partner organizations in the European Union and beyond, as well as active involvement in international scientific groupings. The main form of the involvement of research teams and individuals from SAS organizations is in international research projects supported by the European Union.

As in previous years, in 2014, projects were the focus of the 7th EU Framework program. SAS organisations handled 52 projects of FP7, as compared to nine projects in 2013 in line with expected development of FP7. SAS organisations received over 1.1 million Euro for FP7 projects. In 2014, a new EU framework program for research and innovation funding, Horizon 2020 began, which is the successor programs of FP7. SAS teams submitted a total of 67 project proposals to Horizon 2020 calls, in 2014, five of which it held the position of coordinator.

In other programs, multilateral scientific cooperation has seen significant participation by SAS in the projects of COST (European Collaboration in Science and Technology). COST is the oldest European transversal program for scientific and technological cooperation between the Member States of the EU and EFTA countries. This cooperation is taking place through the coordination of national research projects involving researchers from at least five countries. In 2014, teams from SAS organizations were involved in 81 projects particularly in the fields of medicine, chemical technology, new materials and environmental protection. An overview of COST projects is featured in Annex Table IV.2.

SAS also participated in IVF (10), ERDF (6), UNESCO (6) and ESF (5) projects. In cooperation with UNESCO, SAV participated in the International Hydrological Programme dealing Programme (IHP). SAS organisations were also represented in other major international programs such as IAEA, NATO, IEA, EUREKA, CERN etc. They participated in a total of 168 projects in multilateral scientific cooperation.

### **ERA-NET Programme**

The ERA-NET programme is a specific EU instrument for the coordination of national research programmes through national agencies for the support of science and research. ERA-NET coordination projects are proposed by a consortium of national agencies and following approval by the European Commission, they launch calls for research projects. The consortia are usually represented by the agency supporting research activities by scientists. Participation in consortia preparing the call for SAS research projects creates conditions for involving research teams in ERA-NET projects, replacing currently absent activity at national level. Support from its own budgetary resources on the one hand means competing redistribution of funding, but on the other hand presents possible limits for supporting candidates who successfully complete the International Assessment of proposals.

In 2014, SAS was a member or associated member of the consortium in several coordination projects (M-ERA.NET, Transcan, ANIHWA, NEURON II). SAS actively participated in the preparation of the ERA.NET RUS Plus program aimed at cooperation between the EU and Russia as well as the ERA-NET CONCERT programme - Japan, focused on cooperation between the EU and Japan. A summary of ERA-NET research projects is featured in Table IV.4.

## ESA projects

The European Space Agency (ESA) is an intergovernmental organization consisting of 18 member states and was established in 1975. The research of ESA is mainly focused on Earth research projects (environment monitoring, meteorology, aeronomy and geoinformatics), exploration of the solar system and on navigation and safety systems. An agreement between the Slovak Republic and ESA on the entry of Slovakia into the first of the three stages of cooperation in research and use of space for peaceful purposes which enabled its involvement in international cosmic science was signed in 2010.

IN 2014 SAS was involved in two ESA projects aimed at microgravity research, materials processing including the development of advanced alloys and material architecture suitable for use in space. As with the ERA-NET projects, SAS also supports the involvement of its research teams in ESA projects from its own budget. An overview of SAS participation in ESA projects is featured in Table IV.5.

## Cooperation with economic/ research developed countries

In 2014 joint research project programs continued (Joint Research Project - JRP), focusing on collaboration with a economic and research developed countries outside the EU. JRP programs are the result of scientific cooperation agreements which SAS concludes with non-EU institutions, with the participation of their research teams and supports from its own budget. Currently, SAS has entered into an agreement with the MOST Taiwan and Turkey TUBITAK. An important outcome of the activity of SAS is the signing of the Memorandum of Understanding between the V4 countries, IVF and JST Japan.

The cooperation with MOST Taiwan continued with seven research projects from previous calls. In 2014 the sixth joint call was launched which was open to all SAS organizations. Five proposals were submitted. The selection panel - Slovak and Taiwanese - evaluated proposals individually, then chose three projects by mutual consent. An overview of SAV-MOST projects is featured in Table IV.6.

As part of an agreement with the Turkish TUBITAK agency two types of programs are being carried out: long term mobility projects and a program of joint research projects which began in 2013. Four joint projects are being handled as part of the first call. In the second call announced in 2014, two new joint projects were supported. These projects are focused on materials research with a high potential for application assessment. An overview of projects can be found in table IV.7 .

On September 23, 2014 a Memorandum of Understanding between the Ministry of Education, Youth and Sports (Czech Republic), the National Center for Research and Development (NCBR, Poland), National Agency for Research (OTKA, Hungary), the International Visegrad Fund (IVF) and Japan Science and Technology Agency (JST, Japan) was signed in Bratislava. The Memorandum in question creates conditions for cooperation based on joint research projects between research institutions of participating countries in four different schemes (1 partner V4 - 1 partner in Japan, two partners in V4 - 1 partner in Japan, 3 V4- 1 Japan, 4 V4 - 1 Japan).

The announcement of the first call, which is thematically focused on materials for extreme use, materials for the electronics and energy harvesting and light building materials, is scheduled for the beginning of 2015.

# SAS activities in the development of international cooperation

## Activity in international scientific organisations

SAS purposefully builds relationships with international scientific institutions and structures at government level, the most important of which are the EU, UNESCO, CERN, ESA and others. It also participates in the activities of international NGOs such as ICSU, SE, ESF, ALLEA, EASAC, IAP and others. In addition to this SAS coordinates and organisationally and financially covers activities of national committees of the Slovak Republic in international scientific associations.

The **ICSU** (International Council for Science) brings together international scientific societies, but states represented scientific organizations are also members. Slovakia is represented by SAS. The ICSU is concerned with issues of scientific research and supports the handling of serious problems in the protection of the environment and the development of human society. To this end, it formulates interdisciplinary research programs providing administrative support and promoting its findings in international forums such as UNESCO and the United Nations.

**ALLEA** (All European Academies) is a federation of all European Academies of Sciences. There are currently 58 member academies from 42 countries. Its main goal is the development of European scientific policy and the coordination of scientific policy as well as the activities of the individual member academies. The vice president of ALLEA is SAS Presidium member prof. Daniela Ježová.

SAS coordinates the activities of national committees of Slovakia and pays their membership contributions to its foreign partner organizations. It also contributes to the participation of representatives of these committees in international conferences and general meetings.

In 2014 employees of SAS were members of international scientific societies, unions and national committees of the Slovak Republic and participated actively in the work of these organizations:

**EASAC** (European Academies Science Advisory Council) promotes mutual academic cooperation, and is involved in the scientific analysis of the current European problems, assesses and advises in establishing official European regulations, as well as providing a stance on topics pending with the European Commission, presenting brief reports on these topics focusing on communication with the general public.

The **ESF** (European Science Foundation) was established with the goal of achieving a high quality of scientific research in Europe. It helps member organizations to cooperate internationally in research programs in all scientific fields. ESF is gradually decreasing its activity. At the General Assembly held 27 to 28 November 2014 the termination of activity was scheduled for December 2015 in contrary to the original termination agreement to give way for the transformation of ESA into a service organisation. Due to the unclear definition of the activities of this organization and the contradiction with the original purpose of establishing ESF, the SAS Presidium decided to terminate SAS membership to ESF.

**SE** (Science Europe) is an association of financing organisations of European research and the organization and implementation of research. Science Europe promotes the common interests for funding research in Europe. It supports member organizations in their efforts to promote European research. It strengthens the European Research Area through the direct involvement of key partners. These partners are informed on the direct representation of all scientific communities and the priorities and strategies in science in Europe. SE cooperates with European universities, European Academies, European scientific organizations and the European Commission. In its activities, it takes into account the interests and opinions of researchers in all European research systems. It provides a platform for dialogue at the

European level and is working with non-European research organizations and contributing to economic development in Europe. In 2014, the focus of cooperation has focused on providing information to SE in the form of questionnaires which focused on organizational and technical matters (determining the membership fee for SAS based on the 2012-2013 budget) and to provide information on support programs for young scientists as well as the strategic priorities of SAS in science and research in the future.

### **Cooperation with academies of V4 countries**

A traditional meeting of representatives of V4 academies was held in Prague on 13 to 14 October 2014. The main topics of the meeting were a common policy and strategy in the field of science, institutional reforms, new scientific programs and national initiatives in science policy of the individual V4 countries. At the event SAS presented a History of the Slovak Academy of Sciences (*Dejiny Slovenskej akadémie vied*) monograph by the team of Slovak historian authors, led by D. Kováč. Part of the meeting featured presentations to laureates of the V4 Young Researcher Award in applied mathematics. Andrea Zemánková of the SAS Mathematical Institute received the prize. Participants at the meeting adopted a joint call of V4 academies to Slovak government and parliament representatives which highlighted the possible negative impact of the planned reduction of the SAS budget.

### **Bilateral scientific cooperation**

SAS has concluded 51 bilateral agreements on scientific cooperation with scientific institutions in 37 countries which allow the dispatch of SAS employees a total of 5,200 man-days per year. Based on these agreements attendance at professional conferences, seminars, workshops and other events took place.

Several agreements are aimed at addressing joint projects with foreign partners. SAS departments mainly addressed bilateral projects in particular with Bulgaria (BAV), Czech Republic (AV ČR), Hungary (HAS), Germany (DAAD), Poland (PAV), Russia (RALS), Italy (CNR) and Ukraine (NAVU).

In accordance with the concluded agreements 264 SAS scientists travelled abroad with 1,988 overnight stays and 246 foreign scientists arrived from abroad and spent a total of 2,120 days. An overview of inbound and outbound travel on the basis of inter-academic agreements for the year 2014 is featured in Table IV.9.

In 2014 a new agreement was signed on scientific cooperation between SAS and AS CR for the period 2015-2017, along with which an agreement to implement the protocol was also signed. The primary change in the agreement is to restrict the free quotas for exchanges and shifting emphasis to bilateral mobility projects subject to the involvement of young scientists. The first joint call approved 16 projects for the years 2015 - 2016

The preparation of new implementing protocol to the agreement on scientific cooperation between SAS and the Bulgarian Academy of Sciences for the period 2015 – 2017 was also completed and a further new agreement on project cooperation between SAS and the German Academic Exchange Service (DAAD) was signed for the period 2015-2016 as well as a new SAS - NAVU protocol for 2014 - 2016.

In countries where SAS has no MAD agreement it makes use of contacts at governmental level – cultural agreements or agreements for scientific and technical cooperation.

SAS organisations carry out the expansive part of scientific cooperation directly with partnering research institutions abroad on the basis of their own projects or joint research projects as well as possible interdepartmental agreements or cooperation.

## **Cooperation with the Academy of Sciences of the Czech Republic**

The Academy of Sciences of the Czech Republic (ASCR) holds a special place among the partners in bilateral cooperation. On 11 to 12 November 2014, a meeting of representatives of the ASCR, headed by prof. Jiří Drahoš and members of the Academic Council of the Czech Republic (prof. Vladimír Mareček, Dr. Paul Baran, Dr. Jan Šafanda, Dr. Petr Bobak, Prof. Thomas Krumlov, Dr. Hana Sychrová, prof. Jan Zima) and President of SAS prof. Pastorek, and other members of the Presidium of the SAS Assembly took place at the SAS Congress Centre in Smolenice, Slovakia. The topics addressed were international scientific cooperation, closer cooperation between SAS and ASCR on scientific research projects, experiences from various forms of financing science and research, transfer into practice, the problems of doctoral studies or the prior range of transformation of the Czech Academy of Sciences for the function of individual institutions and the quality of scientific work.

## CHAPTER V

### SAS in the context of the Slovak Republic

#### V.1. SAS research output for application in the field

##### V.1.1. The contribution of the activities of SAS to Slovakia's economical development

The basis for maintaining and enhancing the competitiveness of enterprises is the involvement and constant cooperation with research and development. The Slovak Academy of Sciences is involved in this process.

The Slovak Academy of Sciences has involved itself in European Union structural funds in the Operational Programme Research and Development and participated in 32 projects aimed at cooperation with the commercial sphere in calls relating to the state assistance scheme in which the contracted total no return grant amounted to EUR 50 663 872.40 euro. Of this amount, funds in the amount of EUR 29 851 908.71 euro were spent, representing spending of 58.92 percent.

Research projects with participation of SAS which will bring innovation and stimulate economic recovery are aimed at research and development of materials and technologies for multi-sectoral use (e.g. a 4th generation nuclear reactor), the use of the resource potential of Slovakia (magnesite, talc, zeolite), the manufacture of innovative products with high added value (synthetic sapphire, smart fabrics, new magnetic materials, organic photovoltaics). Biomedical research and application of its results are undoubtedly of major importance as is the development of electromobility and the use of cultural heritage. Individual projects should ultimately contribute to the involvement of the scientific and research structures within the EU.

##### V.1.2. Cooperation with applied and economic spheres

The Slovak Academy of Sciences continued to expand and strengthen cooperation with the applied and business sectors both in Slovakia and abroad.

The Slovak Academy of Sciences also developed scientific-research activities in the form of joint workplaces, directly linking SAS scientific organizations and private companies and non-profit organizations. We cooperated with contractual partners on 57 joint research projects at 26 common workplaces; half of these were handled with foreign entities. Financial income for SAS organizations from this activity for the year 2014 amounted to more than 800 thousand Euros.

A significant joint research and development centre was built by the Institute of Materials and Machine Mechanics in cooperation with Sapa Profily a. s. (SAPA) in Ziar nad Hronom for moulding of new materials with exceptional properties. At the joint workplace, unique sample materials are being developed moulded from a compound based on aluminium powders in conditions close to real conditions of the manufacturing process. Research activities focused in particular on the recycling of chips from machining of aluminum to construction profiles. It managed to develop a technique which is currently being put into mass production at SAPA. In addition, work continued in the development of composites for

application in solar collectors, bearing reducers and Wankel engines. Prototype profiles have also been prepared which are currently being tested in specific application.

In partnership with the Institute of Measurement Science and VUJE the measurement system to measure the tilt of a nuclear reactor for the fourth block of the nuclear power plant in Mochovce was completed in 2014. The system has been subjected to testing with the participation of the commissioning body and delivered into storage before installation at the Mochovce NPP.

The Institute of Parasitology built a joint facility in cooperation with the State Veterinary and Food Administration for parasitic zoonose diagnostics. Part of the joint workplace is the application centre for the protection of humans, animals and plants from parasites. The construction site has been launched with support from the European Regional Development Fund under the SF projects, which addresses the transfer of knowledge and technology obtained from research and development into practice. The joint workplace monitors the occurrence of trichinosis in wild animals, species specification and genotyping isolates of *Trichinella* spp. and *Echinococcus* spp. as well as diagnosis of zoonotic parasites in animals.

Intensive collaboration with the application and the business sector was also carried out in joint projects in the 7th EU Framework Programme, or further programs of international cooperation of SAS organizations. SAS organisations collaborated with more than 100 foreign companies.

In addition to research conducted at common workplaces and in international cooperation, SAS organisations provided over 70 contractual expertise, analysis and expert evaluations for use by domestic and foreign enterprises. The total financial revenue from these activities to SAS organizations amounted to almost 160,000 euro in 2014.

SAS expertly supports and where possible, financially provides for the development of patent activity in their organizations through its Office of Technology Transfer of knowledge and intellectual property SAS (SAS KTT). In 2014, SAS organisations filed 21 patent applications, of which six were abroad. Of the patent applications filed in the previous period five were granted in Slovakia and two were granted in the USA.

One of the main activities of KTT SAS was proactive communication with the application and the business sectors, pursuing and developing contacts with company representatives and popularization of results applicable in practice. KTT SAS cooperated intensively with the Centre for Scientific and Technical Information (SCSTI) and the Industrial Property Office (IPO SR). In October 2014 it won the Jána Bahýľ award for extremely valuable protected industrial solution, awarded by the IPO SK, the invention derived from the Institute of Physics entitled Snímač pomerných pretvorení ( sensor relative deformation).

In 2014, SAS worked intensively to improve technology transfer and collaboration with industry and strengthening links with industrial and economic partners in Slovakia. It drew up the program for regular contact with industrial and economic partners and began its implementation.

SAS in cooperation with other organizations organized the first annual Trans Tech Stock Exchange event in 2014 which took place in Bratislava 11 to 12 November. The event aimed to inform the industrial and business sector of the university parks and research centres on initiatives to promote technology transfer and innovation. The meeting ultimately allowed the industrialists and research and development institutions and potential to create conditions for mutually beneficial cooperation.

SAS launched a debate with industrial partners for further cooperation in research and development, particularly in connection with the amendment of Act no. 595/2003 Coll. on income tax which is aimed at supporting research and development; This amendment can

increase private sector investments in research and development and to strengthen cooperation between research organizations and the business sector. SAS believes that tax incentives will encourage industry partners to invest in research and innovation and the use of existing research and development capabilities of its SAS scientific organizations.

## **SAS in internal processes**

### **VII.1. The transformation of SAS**

A specific problem of the transformation process is to maintain the continuity of the research process in terms of following up with positive results already achieved. This refers to maintaining operating scientific teams, promoting functioning leading teams whose existence is a guarantee of quality achieved results and the training of new professionals.

The current legal situation in which the research budget organizations and contributory organizations carry out their activities presents a serious handicap to the creation of conditions for the successful implementation of the purpose for which these research organizations were established. For this reason the transformation of the organizations of the Slovak Academy of Sciences will require a new legal environment which will transform the current scientific institutes into public research institutions.

Since the creation of public research institutions as new types of legal entities primarily concerned with research, it is expected to improve opportunities for spending a greater share of resources from transnational projects and the business sector and speed up the transfer of research and development into practice. The prepared legislation creating a sui generis legal entity which will be subject to public law, and whose principal activity is research activity also involving the provision of research infrastructure. The creation of these institutions should strengthen their legal autonomy, increase their economic power and ensure public control over the results of their activities. It is expected that part of the transformation process will be the integration of existing SAS organisations to a significantly reduced number of operators. This integration is necessary because of developments in the setup of projects which may provide substantial improvement in the material conditions of the activities of organizations.

The basic principle of the proposed legislation includes the autonomy of public research institutions which will strengthen self governance, freedom of scientific research and the economic stability of future public research institutions as prerequisites for the intensification and enhancement of research and development in the Slovak Republic, of course with the observance of the necessary authority to observe and maintain focus on the purposes of establishing a public research institution, its functionality, and where there are several public research institutions, their cohesion. Granting eligibility to own property will be standardized by public research institutions in their status as full legal persons and improve public research institutions in relation to similar research institutions from abroad as well as Slovak public universities.

The Slovak Government has reaffirmed its resolve to transform research organizations into public research institutions, when on April 23, 2014 it adopted resolution no. 195/2014 approving the "National Reform Programme of the Slovak Republic in 2014", where in section 4.2.4 on Science, research and innovation confirms the transformation of the organizations of the Slovak Academy of Sciences to the new form of separate legal entities - public research institutions. The National Programme states that the transformation will remove barriers to increased cooperation with the private sector in research and

development and will therefore allow the use of private funds to finance their research activities.

The draft law on public research institutions and on amendments to certain laws was submitted to the legislative process on December 4, 2014 in accordance with the legislative program of the Government of the Slovak Republic for 2014. The transformation of organizations of the Slovak Academy of Sciences should take place on 1 January 2016.

## Annexes:

### Independent organs of SAS

#### Activities of the SAS Assembly

The SAS Assembly met seven times in 2014. In addition to this there were also sittings of the Committee of the Assembly which met eighteen times. An important role was played by the meetings of the Assembly, particularly in the process of consideration of materials on the legislation proposal for PRI and SAS legislation.

At the first meeting of the SAS Assembly the director of the SAS Institute of State and Law provided information on the materials on the transformation of SAS organizations. The chairmen of the KPT SAS working group for dealing with property and labour issues and to address the organizational structures of SAS and PRI informed members on the process of preparation at the working group level. Based on a recommendation from the committee the Assembly called for the rapid delivery of the underlying material for Intention of legislation amendment of SAS, as well as ensuring development of core theses of planned amendments of SAS documents at all levels of the organizational structure following the transformation of the SAS for the purposes of interacademic discussion.

At the subsequent meeting the Assembly took into account the material of factual intent of the legislation on PRI and approved a new plan of steps to prepare the transformation of SAS. The Assembly requested that the SAS Presidium waive the requirement to have an adequate number of PRI in every department of SAS and expressed concern at the fact that the President of SAS was in breach of the SAS Assembly resolution to submit to the Government Council for Science, Technology and Innovation held on 26. 5. 2014 informative material proposed restructuring VEGA and VEGA in accordance with RIS3 intention of a draft law on public research institutions (both SAS initiative materials). At its June meeting the SAS Assembly adopted a resolution that the Assembly endorsed the present legislative intention on the PRI in the form of one memo.

At the September meeting the council took note of information from P. Šajgalík on development of budget spending for 2014 and the prospects for the coming year. The Assembly approved the stance of the SAS Assembly on the proposed budget amount for SAS for 2015.

At an extraordinary meeting of the Committee in October 2014 the issues of the absence of working versions of the draft amendment SAS legislation were discussed and resulting intra-organizational rules and circumstances relating to submission and withdrawal from the so-called major SAS project. Members of the Committee came to the opinion capacity of the SAS Presidium to act was marked by a serious lack of communication among members of the SAS Presidium, the Committee saw great reserve in the formulation of resolutions by the SAS Presidium, as well as in their implementation towards SAS and the SAS Assembly, and that it was the responsibility of the Presidium of SAS to assess the extent to which their decisions and the extent to which the proceedings of the President in accordance with or contrary to the conditions and circumstances of their implementation.

At the meeting of the Council on 16. 12. 2014, lawyers representing The Ministry of Education, Science, Research and Sport of the Slovak Republic clarified the process of amending the legislation on SAS. After discussing the paragraph wording of the technical amendment to the act, the Assembly gave the mandate to prof. Koppelo in order for SAS put comments within the interministerial consultation .

On 18. 12. 2014 an extraordinary session was held by the Assembly, convened by the President of the Assembly at the request of 16 members of the SAS Assembly, with one single time for discussion which was the proposal for the removal of the President of SAS. F. Gömöry delivered the main reasons for dismissal of the President from office as follows: non-cooperation with SAS Assembly, persistent problems of non-compliance with SAS Assembly resolutions on the distribution of annex to the minutes of the proceedings of the SAS Presidium, the lack of basic theses amendments to SAS documents following the transformation of the SAS on PRI, the proposal of J. Pastorek regarding the reform of financing the VEGA and APVV agency, problems with the SAS budget for 2015, SAS inclusion under the reform of ESO and the lack of presentation of SAS externally. As discussions J. Pastorek responded to the objections and presented his stance on each one. The meeting of the Assembly was adjourned due to the developments and discussions with the Minister of the Interior R. Kalinak on the topic of ESO. Following the resumption of the Assembly meetings J. Pastorek was voted out as President of SAS. Subsequently, some Assembly members gave up the membership of the committee of the Assembly. After the election of a new Assembly committee and chairman of the SAS Assembly the extraordinary session concluded.

## Activities of the SAS Scientific Council

In 2014 the SAS Scientific Council functioned in the same composition as of June 2013 (chairman prof. Mgr. Jaromír Pastorek, DSc., Members of the SAS Presidium and external members: prof. Ing. Viktor Smieško, PhD., Ing. Peter Magvaši CSc., Dr.hc prof. Ing. Peter Bielik, PhD., prof. RNDr. Karol Mičieta, PhD., prof. MUDr. Ladislav Mirossay, MD., prof. Ing. Robert Redhammer, PhD., prof. Ing. Rudolf Sivák, PhD.).

The SAS Scientific Council met three times (26. 3., 27. 5., 30. 6.).

At the March meeting, members of the SAS Scientific Council evaluated proposals for members of the qualification commission and scientific advisory: the SAS Commission for assessing the scientific qualification of employees as well as chairmen, vice-chairmen and secretaries of the SAS scientific advisory. SAS Scientific Council members approved a number of SASPRO programmes as well as its statutes and rules of procedure.

The second part of the meeting of the SAS Scientific Council was also attended by invited guests Dušan Čaplovič, Minister of Education, Science, Research and Sports, Jozef Masarik, Chairman of the Presidium APVV and Pavol Holik of the MESRS SK. At this point SAS President Jaromír Pastorek and Vice-President Eva Majková presented the proposal application RIS3 for VEGA, VEGA and ASFEU projects which is intended to promote quality projects, their developmental and stable financing, as well as the possibility of requesting adequate outputs.

The President of the SAS Assembly Zuzana Magurová informed on the discussion of members of the SAS Assembly which developed through e-mail communication after consultation with the Ministry of the Interior on issues of research funding as part of rationalization measures to reform the ESO.

Members of the SAS Scientific Council discussed proposals to grant SAS awards:

- SAS International award pre prof. Dr. Ing. Pavel Cheben (Canada) or outstanding work in the field of technical sciences.
- SAS award: prof. RNDr. Vladimír Šepelák, DrSc. (SAS Institute of Geotechnics); team from the SAS Institute of Experimental Physics, Department of subnuclear physics (Ing. Jaroslav Bán, CSc., doc. RNDr. Dušan Bruncko, CSc., RNDr. Eduard Kladiva, CSc., RNDr. Michal Seman, CSc., RNDr. Pavol Strážinec, CSc.); team from the SAS

Institute of Molecular Biology, Department of gene expression (RNDr. Ján Kormanec, DrSc., Mgr. Renáta Nováková, CSc., RNDr. Dagmar Homerová, CSc., RNDr. Ľubomíra Fecková, Ing. Bronislava Řežuchová, RNDr. Beatrice Ševčíková, Renáta Kirschlová); PhDr. Miroslav Londák, DrSc. and PhDr. Slavomír Michálek, DrSc. of the SAS Institute of History.

- SAS Young scientist award: Mgr. Maríne Cihovej, PhD. Of the SAS Cancer research Institute, Mgr. Adam Hudek, PhD. of the SAS Institute of History.
- Honorary doctor of technical sciences prof. Koichi Niiharovi of the Technical University of Nagaoka (Japan).

The SAS Scientific Council awarded:

- Scientific degree of doctor of environmental science RNDr. Ferdinand Špork, CSc., Independent Scientist of the Institute of Zoology in Bratislava, based on the successful defence of the doctoral dissertation "water benthic invertebrates - their significance in categorizing and identifying disturbances in the aquatic environment" in the scientific field: 010520 – 010530 Ecology;
- Scientific degree of Doctor of Medical Sciences, MD. Richard Imrich, PhD., Senior Scientist of the Institute of Experimental Endocrinology in Bratislava, based on the successful defence of the doctoral dissertation "Interactions between neuroendocrine, metabolic and immune factors in the pathogenesis of autoimmunity" in the scientific field: 030106 Normal and Pathological Physiology;
- Scientific degree of Doctor of Medical Sciences prof. MD. Andrei Čalkovská, PhD., Department of Physiology of Jessenius Faculty of Comenius University in Martin, on the successful defence of the doctoral dissertation "Pulmonary surfactant: possibility of altering the biophysical and physiological properties" in the scientific field: 030106 Normal and Pathological Physiology.

## SAS Learned Society

In 2014, the SAS Learned Society was focused on particular issues related to the planned process of transformation of SAS, but also in the context of the government-approved RIS3 document and its implementation plan for the coming period. 2014 was also marked by the draft legislative amendments that would change the current law on SAS direct provision for membership in the SAS Learned Society from "scientists of the Academy", and thus opened the society up for a nationwide scope.

The SAS Learned Society met at two regular sessions in 2014 of the General Assembly of the SAS Learned Society and the Council of the SAS Learned Society met at the interim.

In the period before the first General Assembly of the Council analyzed ways of organizing learned societies in different countries (especially Europe) to optimize activity and improve the status of the SAS Learned Society following the legislative changes.

In Council discussions the need to strengthen the position of scientific excellence in all sectors of science and research in Slovakia resonated in particular, as did the need to comment on the establishment of a mechanism of economic support for research priorities in the Slovak Republic. The Council of the SAS Learned Society prepared a statement on the transformation of SAS. Among other points it states the following:

*"The primary cause of stagnancy in research in Slovakia compared with the developed countries of Europe, but also our closest neighbours, is its long-term underinvestment. Secondary to this is the real absence of the above which leads to a high degree of surface distribution and consequent inefficient use of resources on a global scale.*

*This approach discourages young professionals from remaining in the field of research in the Slovak Republic. It also significantly limits the research potential of the (remaining) scientific excellence of Slovakia which is intellectually capable of competing in a competitive international environment.*

*Reform of the management of research and development in the direction of improving this situation is therefore needed. Whether or not the implementation of the RIS3 action plan and the associated transformation of SAS actually lead to a significant improvement in the quality of research can only be determined in time. In fact this represents only the most basic formal setting, the function of which will depend on the setting of many other parameters which will have a crucial human factor. Experience in Slovakia indicates that it was on this that the expectations of earlier reforms in the field of research and development failed.*

*In addition to subjective factors, being under this status also underlines the lack of willingness to realistically assess the situation in the context of global competition and the often too low setting of quality criteria. With limited resources, this leads to the aforementioned high degree of surface distribution (in general) and the resulting poor quality of research.*

*Creating VVI focused on selected priorities formulated in RIS3 allowing them to bid for large projects must not prevent the development of quality scientific projects of basic research, emerging from the bottom-up system which is the basis of the healthy development of every scientific community.*

*In order for the transformation to be effective, it cannot be achieved without differentiation and fair personnel audit. From the perspective of the SAS Learned Society, a prerequisite for attaining the objectives of the transformation is to prepare the fundamental systemic*

*measures before beginning administrative restructuring. This is to ensure that resulting public research institutions are strongly motivated from the beginning to promoting top research, even while suppressing inefficient and non-perspective research groups."*

At the Annual General Meeting on 12. 5. 2014 the SAS Chairman prof. Jaromír Pastorek, PhD. informed members of the Learned Society on the current status of the transformation process in the area of management in SAS Slovakia. The General Meeting approved the above-mentioned statement and also a resolution which requires the SAS President of the Academy of Sciences to report on the activities and management of SAS the first general meeting of the Learned Society of Sciences in the current year, focusing solely on top research at SAS, research priorities and their funding.

Throughout the course of the year the Council dealt with the unfavourable situation in science, research and education. It developed a call to the members of the SAS Learned Society; expressing in its statement that in the current situation it would be necessary to develop a realistic initiative in the field of system quality improvement measures so that structural changes in the management of science yield an expected increase in research efficacy.

The Council later developed a Declaration of the SAS Learned Society on the proposed funding of science from the state budget for 2015 which was sent to government officials. It states the following:

*"Slovak science needs stable funding from competitive sources that ensure the competitiveness at least within the EU and to better draw the funds from the Horizon 2020 program. The Learned Society recognises the transformation of SAS as an opportunity which must be used for recovery and significant streamlining of research at SAS. The administrative restructuring of SAS and management of research in Slovakia itself does not make sense if effective measures to enhance the quality of real, motivating top scientists to conduct research in our research area, in favour of the development of the knowledge society and economy of Slovakia are not taken. Structural changes cannot be rendered in an organization that is not functioning experimenting with wage security, to which the planned SAS budget cuts has contributed. "*

On 27. 11. 2014 the second General Assembly was held, with an emphasis on analyzing the effectiveness of research in Slovakia and the impact of further reductions in the SAS (operating) budget. The President of the SAS Learned Society, prof. Noga gave a lecture on "Science in the Slovak Republic in the light of ranking agencies SCImago" in which he compared the development of qualitative parameters of the scientific output of the V4 countries in various areas of research for the last 15 years. He also compared the five-year development of quality parameters at six of the highest rated institutions in Slovakia (SAS, UK, STU, UPJŠ, TU Košice, SR), whereby statistically the fastest growth of quality is currently present at UK, while SAS is gradually losing its dominance.

In his analysis "prediction of outcome in the new EU countries in raising funds from Horizon 2020", Prof. Luby highlighted the fact that the volume of funds obtained from the EU significantly influences national excellence and research and development intensity. Prof. Šajgalík presented the analysis of the development budget of SAS for another decade, in particular highlighting the stagnation and decline in institutional funding in recent years which has an adverse impact on scientific productivity.

In 2014 as in every year, members of the Learned Society of SAS were actively involved in various activities to support and promote science such as interviews in the daily press, columns and articles in daily newspapers or other periodicals, appearances on TV, or in short television documentaries on science and scientific personalities. In addition to this, members also delivered popularizing lectures to the general public (Science night, the Science Centre,

children's university, accompanying events as part of the Science and Technology Week, etc.), or to events organized by ministries.

By the end of 2014 the Learned Society had 47 full members, 53 emeritus members and 10 honorary members.

## **SAS scientific societies**

In line with the structural development of SAS, with the progressive establishment of its institutions and other organizational units, a whole range of scientific societies has arisen since the 1950s. These were loosely associated with SAS, but pooled professionals and those interested in the various disciplines from universities and other areas. Their mission was to obtain specific support for the development of individual disciplines, cooperation with the scientific communities of professional scientific institutions, but also popularization and bringing research results to the general public. There are currently 53 of such scientific societies registered. Their activity covers the Council of Scientific Societies at SAS as their association chairmen. Their communication with scientific institutes and the SAS Presidium provide the SAS Commission with cooperation with scientific societies. A large part of scientific societies have a fixed agreement with the SAS institutes; on the basis of this they jointly organize scientific, professional, educational and popularization events, issues publications, periodicals, etc.

The cooperation of scientific societies with the educational sector is aimed, apart from science and research and education activities, at addressing teaching and methodological issues, organizing and sponsoring specialised olympics and other student competitions. The scientific societies of SAS also regularly participate in the activities of a nationwide week of science and technology in Slovakia (Týždňa vedy a techniky na Slovensku), as well as in the science night festival (Noc výskumníkov). Scientific societies mediate contacts of experts from SAS and other cultural institutions such as museums, as well as with the public authorities and third sector organizations. Several of these have extensive international contacts, whether through membership in transnational associations and committees or mediation and staffing cooperation in organizing international events. A range of scientific societies have particularly active working relations with Czech companies which is reflected in the regular organization of joint scientific meetings which are established throughout the existence of the former Czech-Slovakia. A persistent problem with membership of learned societies lies in the fact that transnational associations have relatively high membership fees for which companies often lack sufficient funding.

In 2014, scientific societies associated with SAS organized independently or in cooperation 214 different scientific events (conferences, seminars, symposia etc.). A significant minority of them had international participation. The number of scientific and popularizing events organized by companies was 137 which does not include separate popularisation lectures for the public. The societies issued or participated in the issuance of 19 scientific and professional publications, mostly conference proceedings. General meetings of scientific societies tend to be associated with a scientific program. Particularly relevant are those nationally organized by larger companies, at which the development priorities of a certain discipline or its future direction are covered. Most of the scientific societies issue newsletters and several professional journals and other periodicals, scientific and popularizing publications and promotional materials.

## Scientific societies associated with SAS

1. Asociácia slovenských geomorfológov (Association of Slovak Geomorphologists)
2. Jednota slovenských matematikov a fyzikov (Union of Slovak Mathematicians and Physicists)
3. Národopisná spoločnosť Slovenska (Ethnographic Society of Slovakia)
4. Slovenská akustická spoločnosť (Slovak Acoustical Society)
5. Slovenská Alzheimerova spoločnosť (Slovak Alzheimer's Society)
6. Slovenská antropologická spoločnosť (Slovak Anthropological Society)
7. Slovenská archeologická spoločnosť (Slovak Archaeological Society)
8. Slovenská astronomická spoločnosť (Slovak Astronomical Society)
9. Slovenská bioklimatologická spoločnosť (Slovak bioclimatological society)
10. Slovenská biologická spoločnosť (Slovak biological society)
11. Slovenská botanická spoločnosť (Slovak Botanical Society)
12. Slovenská dopravná spoločnosť (Slovak Transport Society)
13. Slovenská ekologická spoločnosť (Slovak Environmental Society)
14. Slovenská entomologická spoločnosť (Slovak Entomological Society)
15. Slovenská fyzikálna spoločnosť (Slovak Physics Society)
16. Slovenská geografická spoločnosť (Slovak geographical society)
17. Slovenská geologická spoločnosť (Slovak geological society)
18. Slovenská histo- a cytochemická spoločnosť (Slovak histo - and cytochemical society)
19. Slovenská historická spoločnosť (Slovak Historical Society)
20. Slovenská chemická spoločnosť (Slovak Chemistry Society)
21. Slovenská ílová spoločnosť (Slovak clay group)
22. Slovenská imunologická spoločnosť (Slovak Immunological Society)
23. Slovenská jazykovedná spoločnosť (Slovak Linguistic Society)
24. Slovenská jednota klasických filológov (Slovak society of Classical Philology)
25. Slovenská limnologická spoločnosť (Slovak Limnological Society)
26. Slovenská literárnovedná spoločnosť (Slovak literary society)
27. Slovenská meteorologická spoločnosť (Slovak meteorological society)
28. Slovenská mineralogická spoločnosť (Mineralogical Society of Slovakia)
29. Slovenská muzikologická spoločnosť (Slovak Limnological Society)
30. Slovenská mykologická spoločnosť (Slovak Mycological Society)
31. Slovenská numizmatická spoločnosť (Slovak Numismatic Society)
32. Slovenská orientalistická spoločnosť (Slovak Oriental Society)
33. Slovenská parazitologická spoločnosť (Slovak society of parasitology)
34. Slovenská pedagogická spoločnosť (Slovak pedagogical society)
35. Slovenská psychologická spoločnosť (Slovak society of psychology)
36. Slovenská sociologická spoločnosť (Slovak society of sociology)
37. Slovenská spoločnosť pre biochémiu a molekulárnu biológiu (Slovak Society for biochemistry and molecular biology)
38. Slovenská spoločnosť pre dejiny vied a techniky (Slovak Society for the history of science and technology)
39. Slovenská spoločnosť pre kybernetiku a informatiku (Slovak society for cybernetics and informatics)
40. Slovenská spoločnosť pre medzinárodné právo (Slovak society of international law)
41. Slovenská spoločnosť pre mechaniku (Slovak society for mechanics)
42. Slovenská spoločnosť pre nEurovedy (Slovak society for neuroscience)
43. Slovenská spoločnosť pre poľnohospodárske, lesnícke, potravinárske a veterinárne vedy (Slovak Society for agricultural, forestry, food and veterinary sciences)
44. Slovenská spoločnosť pre regionálnu politiku (Slovak society for regional policy)
45. Slovenská spoločnosť pre štúdium náboženstiev (Slovak society for the study of religion)
46. Slovenská štatistická a demografická spoločnosť (Slovak statistical and demographical society)
47. Slovenská teatrologická spoločnosť (Slovak theatrical society)
48. Slovenská zoologická spoločnosť (Slovak zoological society)
49. Slovenské filozofické združenie (Slovak philosophical society)
50. Slovenské združenie pre politické vedy (Slovak political science society)
51. Spoločnosť pre vedy a umenia (Slovak society for science and art)
52. Umeleckohistorická spoločnosť (Slovak art history society)
53. Vedecká spoločnosť pre náuku o kovyoch (Slovak metal science society)

## International cooperation projects

Table IV.1

Overview of SAS participation in the 7th EU Framework Programme in 2014

SAS organisations	Project title
1st SAS Department of Sciences	
SAS Astronomical Institute	Coordinated observations on three-digit prominences
SAS Astronomical Institute	Topology and physical parameters of the magnetic fields of solar filaments
SAS Astronomical Institute	SOLARNET- High-Resolution Solar Physics Network
SAS Institute of Electrical Engineering	European development of superconducting tapes: Integrating novel materials and architectures into cost effective processes for high current applications and magnets
SAS Institute of Electrical Engineering	Superconducting, reliable, lightweight, and more powerful offshore wind turbine
SAS Institute of Electrical Engineering	GaN-Based Normally-Off High Power Switching Transistors for Efficient Power Converters
SAS Institute of Physics	Simulators and Interfaces with Quantum Systems
SAS Institute of Physics	Quantum Technology for Europe
SAS Institute of Geotechnics	Water purification and soil from mixed contaminants
SAS Institute of Hydrology	Detection of Watercourse Contamination in Developing Countries Using Sensor Networks
SAS Institute of Informatics	EGI: Integrated Sustainable Pan-European Infrastructure for Researchers in Europe
SAS Institute of Informatics	Systems for data interoperability rescue units (REDIRNET)
SAS Institute of Informatics	Virtual Enterprises Networked together by Interoperable Services
SAS Institute of Informatics	Management of the Global Security of Air Traffic Services
SAS Institute of Materials and Machine Mechanics	Energy Multidisciplinary Knowledge Alliance aimed at the introduction of an Innovative Educational Programme
SAS Institute of Materials and Machine Mechanics	Micro and Nanocrystalline Silicide - Refractory Metals FGM for Materials Innovation in Transport Applications
SAS Institute of Materials Research	Innovative materials solutions for Transport, Energy and Biomedical sectors by strengthening integration and enhancing research dynamics of KMM-VIN
2nd SAS Department of Sciences	
SAS Institute of Botany	Building the European Biodiversity Observation Network
SAS Institute of Chemistry	Integrated Structural Biology Infrastructure
SAS Institute of Chemistry	Cancer diagnosis: Parallel sensing of prostate cancer biomarkers
SAS Institute of Chemistry	Electrochemical lectin and glycan biochips integrated with Nanostructures

SAS Institute of Chemistry	Microbial Resource Research Infrastructure
SAS Institute of Parasitology	Assessment and Monitoring of the Impacts of Genetically Modified Plants on Agro-Ecosystems
SAS Institute of Inorganic Chemistry	Pushing the envelope of nuclear magnetic resonance spectroscopy for paramagnetic systems. A combined experimental and theoretical approach (pNMR)
SAS Institute of Inorganic Chemistry	Nitride Materials with Functional Properties for Energy Applications
SAS Institute of Animal Biochemistry and Genetics	Animal Welfare Research in Enlarged Europe
SAS Institute of Experimental Endocrinology	Integrated Structural Biology Infrastructure
Institute of Forest Ecology SAS	Ecological Function and Biodiversity Indicators in European Soils
SAS Institute of Plant Genetics and Biotechnology	Plant adaptation to heavy metal and radioactive pollution
SAS Institute of Landscape Ecology	Operationalisation of Natural Capital and EcoSystem Services: From Concepts to Real-world Applications – OpenNESS
SAS Institute of Molecular Biology	Finding modulators of cellular and protein activity in metagenomes
SAS Institute of Molecular Physiology and Genetics	Clinical Development of Nitisinone for Alkaptonuria
SAS Polymer Institute	Molecular and atomic probed series elastomers in relation to the relaxation dynamics of broad-band dielectric spectroscopy
SAS Institute of Zoology	Biology and Control of Vector-Borne Infections in Europe
SAS Institute of Virology	European Virus Archive (EVA)
SAS Institute of Virology	Anti-tick Vaccines to Prevent Tick-borne Diseases in Europe
SAS Institute of Virology	Biomedical Engineering for Cancer and Brain Disease Diagnosis and Therapy Development
SAS Institute of Virology	Metastatic Tumours Facilitated by Hypoxic Tumour Microenvironments
SAS Institute of Virology	New Drugs Targeting Influenza Virus Polymerase
3rd SAS Department of Sciences	
SAS Institute of Economy	Employment 2025: How Multiple Transitions Will Affect the European Labour Market
SAS Institute of Economy	WWWforEurope - Welfare, Wealth and Work for Europe
SAS Institute for Research in Social Communication	Building a platform for enhanced societal research related to nuclear energy in Central and Eastern Europe
SAS Institute for Forecasting	Role of Science in Strategic Planning of Economic Growth and Sustainable Consumption: Linking Research and Public Policy-Making
SAS Institute for Forecasting	Youth Mobility: maximizing opportunities for individuals, labour markets and regions in Europe
SAS Institute for Forecasting	Lifelong Learning, Innovation, Growth and Human Capital Tracks in Europe
SAS Institute for Sociology	Media-hosted eParticipation in Slovakia

SAS Office	
SAS Office	From materials science and engineering to innovation in Europe (M-ERA.NET)
SAS Office	Animal Health and Welfare (ANIHWA)
SAS Office	ERA-Net on Transnational Cancer Research (TRANSCAN)
SAS Office	Coordination of MS/ AC S&T programmes towards and with Russia (ERA.Net RUS Plus)
SAS Office	Network of European funding for Neuroscience research (ERA-NET NEURON II)
SAS Office	Innovation and Commercialisation in the NMP thematic area INCOMERA

**Table IV.2**  
**Overview of COST projects with SAS participation in 2013**

<b>SAS organisation</b>	<b>Project title</b>
1st SAS Department of Sciences	
SAS Astronomical Institute	The origin and evolution of life on Earth and in space
SAS Astronomical Institute	Polarization as a tool to study the Solar System and beyond
SAS Institute of Electrical Engineering	Hybrid energy storage devices and systems for mobile and stationary applications
SAS Institute of Electrical Engineering	Colloidal Aspects of Nanoscience for Innovative Processes and Materials
SAS Institute of Electrical Engineering	Advanced X-ray spatial and temporal metrology
SAS Institute of Electrical Engineering	Exchange of knowledge on ionic liquids
SAS Institute of Electrical Engineering	Modern X-ray and tomography imaging methods using phase contrast
SAS Institute of Electrical Engineering, SAS Institute of Experimental Physics SAV	Nanoscale Superconductivity: Novel Functionalities through Optimized Confinement of Condensate and Fields
SAS Institute of Physics	Thermodynamics in the quantum regime
SAS Institute of Physics	Advanced X-ray spatial and temporal metrology
SAS Institute of Physics	Enhanced X-ray Tomographic Reconstruction: Experiment, Modeling, and Algorithms
SAS Institute of Physics, SAS Institute of Experimental Physics SAV	Colloidal Aspects of Nanoscience for Innovative Processes and Materials
SAS Institute of Physics	Fundamental Problems in Quantum Physics
Institute of Geography SAS	Connecting European connectivity research

SAS Institute of Experimental Physics SAV	Multifunctional Nanoparticles for Magnetic Hyperthermia and Indirect Radiation Therapy
SAS Institute of Measurement Science	European network for innovative uses of EMFs in biomedical applications
SAS Institute of Measurement Science	European Network for Hyperpolarization Physics and Methodology in NMR and MRI
SAS Institute of Measurement Science	Colour and Space in Cultural Heritage
SAS Institute of Materials Research	Electrospun Nano-fibres for bio inspired composite materials and innovative industrial applications
SAS Institute of Materials Research	Mechanical properties of materials for regenerative orthopaedic and dental medicine
SAS Institute of Materials Research	Ferroelectric and Magnetoelectric Materials
SAS Institute of Materials Research	Porous composite biomaterial substrates of the biopolymer-calcium phosphate type for regenerative medicine
SAS Institute of Construction and Architecture	<i>Loss of the Night Network</i> Initiative
2nd SAS Scientific Department	
SAS Institute of Botany	European Information System for foreign species – COST
SAS Institute of Chemistry	Colloidal Aspects of Nanoscience for Innovative Processes and Materials
SAS Institute of Chemistry	Food waste valorisation for sustainable chemicals, materials & fuels (EUBis)
SAS Institute of Chemistry	Food waste valorisation for sustainable chemicals, materials & fuels
SAS Institute of Chemistry	Mineral-improved crop production for healthy food and feed
SAS Institute of Chemistry	Systems biocatalysis
SAS Institute of Chemistry	Chemical approaches to targeting drug resistance in cancer stem cells
SAS Institute of Chemistry	Multivalent glycosystems for nanoscience – MultiGlykoNano
SAS Institute of Neurobiology, SAS Institute of Neuroimmunology	Nanomechanics of Intermediate Filament Networks
SAS Institute of Parasitology	European Network for underestimated vectors and vector-borne infections
SAS Institute of Parasitology	European Network on Taeniosis/Cysticercosis
SAS Institute of Inorganic Chemistry	Our Astro-Chemical History
SAS Institute of Inorganic Chemistry	New generation biomimetic and customized implants for bone engineering
SAS Institute of Experimental Pharmacology & Toxicology	An integrated European platform for pancreas cancer research: from basic science to clinical and public interventions for a rare disease
SAS Institute of Experimental Pharmacology & Toxicology	Chemistry of non-enzymatic protein modification – modulation of protein structure and function
SAS Institute of Experimental Pharmacology & Toxicology	An integrated European platform for pancreas cancer research: from basic science to clinical and public interventions for a rare disease

SAS Institute of Experimental Pharmacology & Toxicology	Structure-based drug design for diagnosis and treatment of neurological diseases
Institute of Forest Ecology SAS	Fraxinus dieback in Europe: elaborating guidelines and strategies for sustainable management
Institute of Forest Ecology SAS	Determining invasiveness and risk of Dothistroma
Institute of Forest Ecology SAS	Endophytes in Biotechnology and Agriculture
Institute of Forest Ecology SAS	Climate Change and Forest Mitigation and Adaptation in a Polluted Environment
Institute of Forest Ecology SAS	Studying Tree Responses to Extreme Events: a Synthesis
Institute of Forest Ecology SAS	Innovations in Climate Governance: Sources, Patterns and Effects
Institute of Forest Ecology SAS	Tourism, welfare and ecosystem services
Institute of Forest Ecology SAS	Network for sustainable ultrascale computing
Institute of Forest Ecology SAS	European Information System for Alien Species
Institute of Forest Ecology SAS	Forest Land Ownership Changes in Europe: Significance for Management And Policy
Institute of Forest Ecology SAS	Enhancing the resilience capacity of Sensitive mountain Forest ecosystems under environmental change
Institute of Forest Ecology SAS	Large-scale methane measurements on individual ruminants for genetic evaluations
Institute of Animal Physiology	Large-scale methane measurements on individual ruminants for genetic evaluations
Institute of Animal Physiology	European network on the factors affecting the gastro-intestinal microbial balance and the impact on the health status of pigs
Institute of Animal Physiology	Epigenetics and Periconception Environment - Periconception environment as an epigenomic lever for optimising food production and health in livestock
SAS Institute of Plant Genetics and Biotechnology	Green Infrastructure approach: linking environmental with social aspects in studying and managing urban forests
SAS Institute of Plant Genetics and Biotechnology	Studying tree responses to extreme events: a synthesis
SAS Institute of Plant Genetics and Biotechnology	Pathogen-informed strategies for sustainable broad-spectrum crop resistance
SAS Institute of Plant Genetics and Biotechnology	Strigolactones: biological roles and applications
SAS Institute of Plant Genetics and Biotechnology	Plant Metabolic Engineering for High Value Products
SAS Institute of Plant Genetics and Biotechnology	Biosafety of transgenic trees: improvement of scientific evidence for the development of safe plants and implementation of EU directives
SAS Institute of Plant Genetics and Biotechnology	The quest for tolerant varieties - Phenotyping at plant and cellular level
SAS Institute of Landscape	Enhancing the resilience capacity of Sensitive mountain Forest

Ecology	ecosystems under environmental change
SAS Institute of Molecular Biology	Next Generation Sequencing Data Analysis Network
SAS Institute of Molecular Biology	Understanding Movement and Mechanism in Molecular Machines
SAS Institute of Molecular Physiology and Genetics	Hypoxia Sensing, Signalling and Adaptation
SAS Institute of Molecular Physiology and Genetics	Gas transmitters: from Basic Research to Biological Applications
SAS Institute of Normal and Pathological Physiology	Gas transmitters: from Basic Research to Biological Applications
SAS Institute of Normal and Pathological Physiology	EU-ROS: The European Network on Oxidative Stress and Redox Biology Research
SAS Polymer Institute	Innovative application of regenerated wood cellulose fibers
SAS Polymer Institute	Sustainable flame retardancy for textiles and related materials based on nanoparticles substituting conventional chemicals
SAS Polymer Institute	European Scientific Network for Artificial Muscles
SAS Institute of Virology	Sustainable production of high-quality cherries for the European market
3rd SAS Department of Sciences	
SAS Institute of Archaeology	COSCH – Colour and Space in Cultural Heritage
SAS Institute of Economy	Systemic Risks, Financial Crises and Credit: the Roots, Dynamics and Consequences of the Subprime Crisis
SAS Ludovit Stur Institute of Linguistics	European Network of e-Lexicography
SAS Ludovit Stur Institute of Linguistics	Parsing and Multi-word Expressions. Towards Linguistic Precision and Computational Efficiency in NLP
SAS specialised and service institutes	
Mlyňany Arboretum of SAS	Endophytes in biotechnology and agriculture
Mlyňany Arboretum of SAS	European Information System for Alien Species

**Table IV.3**  
**Overview of international research projects at SAS in 2014 -**  
**as part of the European Science Foundation, (ESF)**

<b>SAS organisation</b>	<b>Programme title</b>
SAS Institute of Art History	Court Residences as Places of Exchange in Late Medieval and Early Modern Europe (1400-1700) - Palatium
SAS Institute of Chemistry	EGSF The Euroglycoscience Forum
Institute of Animal Physiology	European network for gastrointestinal health research
SAS Ludovit Stur Institute of Linguistics	The European Network on Word Structure. Cross-disciplinary approaches to understanding word structure in the languages of Europe (NetWords)
SAS Mathematical Institute	Geometric representations and symmetries of graphs, maps and other discrete structures with applications in science

**Table IV.4.**  
**Overview of international research projects at SAS in 2014 as part of the ERA-NET (7. RP EÚ) programme**

<b>SAS organisation</b>	<b>Project title (acronym)</b>
MNT ERA.NET II	
SAS Institute of Experimental Physics SAV	Small energy harvester based on magnetostrictive amorphous and nanocrystalline materials (STREAM)
SAS Polymer Institute	Applications of polymer nanocomposites with low content of graphene in electronic devices (APGRAPHEL)
M – ERA.NET	
SAS Institute of Physics	Surface engineering and advanced coatings for the next generation of X-ray diffractive optics ( XOPTICS)
SAS Institute of Experimental Physics SAV	Magnetically active anisotropic composite systems (MACOSYS)
SAS Polymer Institute	Multifunctional Materials for advanced Neural interfaces. (M2NEural)
SAS Institute of Materials Research SAS Institute of Inorganic Chemistry	Graphene-ceramic composites for tribological application in aqueous environments (GRACE)
SAS Institute of Materials Research	Novel explosive welded corrosion resistant clad materials for geothermal plants (ExploGuard )
KORANET	
SAS Institute of Hydrology	Estimation of Uncertainty in Rainfall Runoff Modelling, Korea, Poland, Slovakia (EURRO-KPS)

**Table IV.5**  
**Overview of international research projects at SAS as part of the ESA (European space agency) programme**

<b>SAS organisation</b>	<b>Project title</b>
SAS Institute of Experimental Physics SAV	JEM-EUSO, Extreme Universe Space Observatory Onboard Japan Experiment Module
SAS Institute of Materials and Machine Mechanics	Gravity Dependence of CET in Peritectic TiAl Alloys

**Table IV.6**  
**Joint research projects as part of bilateral scientific cooperation between SAV and MOST Taiwan in 2014**

<b>SAS organisation</b>	<b>Project title</b>
SAS Institute of Physics	Preparation and studies of nanoparticle arrays for plasmonic applications
SAS Institute of Materials and Machine Mechanics	The study and modelling of mechanical and tribological characteristics of novel ultra-finegrained Al-Al <sub>2</sub> O <sub>3</sub> composites
SAS Institute of Inorganic Chemistry	New inorganic phosphors for energy-efficient lighting sources which are free of rare earth elements.

SAS Institute of Chemistry	The development of potent and selective inhibitors of glycosyltransferases
SAS Institute of Experimental Endocrinology	Skeletal muscle as a mediator of beneficial effects of regular exercise on cognitive functions and metabolism in patients with Alzheimer's disease: the role of muscle myokines and microRNAs
SAS Institute of plant genetics and biotechnology	Studying the mechanisms of male sterility regulated DAF, genome-RING finger E3 ligase, and its use in agriculture
SAS Institute of Construction and Architecture	Applications of meshless methods in computational mechanics

**Table IV.7**  
**Overview of joint research projects as part of SAV-TÜBITAK cooperation for 2014**

SAS organisation	Project title
SAS Institute of Physics	Physically processed rapidly quenched alloys for detection of low magnetic fields
SAS Institute of Physics	Towards Low-Cost and Highly Efficient Polymer Based Organic Photovoltaics via Incorporation of Graphene and Noble Metal Nanoparticles
SAS Institute of Inorganic Chemistry	Development of ceramics composites materials for bio-applications
SAS Institute of Materials and Machine Mechanics	Investment casting of turbine blades from nickel based superalloys
SAS Institute of Materials and Machine Mechanics	Magnesium Nanocomposites for Biodegradable Medical Implants
SAS Polymer Institute	Photovoltaic and Sensor Properties of Plasma and Chemical Functionalized Graphene and Carbon Nanotubes

**Table IV.8**  
**Statement of mobility**

(received and sent within the MAD per individual country, man-days and money spent on those received)

Country	Sent		Received		Financial cost in Euro	No. of projects
	No. sent	No. Man-days	No. received	No. Man-days		
Argentina	2	24	5	72	2 766.00	5
Belgium	6	96	0	0	0	0
Bulgaria	21	150	21	165	7 846.60	19
Czech Republic	108	657	103	741	31 422.20	32
Montenegro	1	10	0	0	0	0
China	3	57	3	21	1 260.90	0
Egypt	0	0	8	176	4 887.00	0
Estonia	0	0	1	14	390.60	1
France	4	33	4	19	910.10	3
Croatia	3	20	0	0	0	0
India	0	0	1	30	813.80	0
Israel	5	57	1	4	215.00	0
Japan	1	23	1	19	891.10	1
Canada	0	0	4	18	585.30	0
Hungary	9	41	27	137	5 185.90	8
Germany	23	280	14	175	10 496.20	6

Poland	45	259	22	225	10 355.20	26
Romania	11	76	3	21	7 449.00	0
Russia	0	0	2	28	1 098.00	3
Slovenia	4	16	0	0	0	0
Serbia	0	0	3	17	1 092.20	0
Italy	10	79	6	40	1 449.20	6
Taiwan	2	12	9	94	5 933.8	2
Turkey	2	70	2	56	1 803.30	2
Ukraine	2	14	6	48	1 812.40	22
Vietnam	2	14	0	0	0	0
<b>Total</b>	<b>264</b>	<b>1988</b>	<b>246</b>	<b>2 120</b>	<b>98 663.80</b>	<b>136</b>

## SAS patent and licensing activity

Inventions registered in 2014 in patent proceedings:

In Slovakia 13  
Internationally (PCT) 8

Patents granted in 2013 for inventions registered in previous years:

In Slovakia 5  
Abroad 2

Throughout the course of 2014, SAS organisations were registered (independently of jointly with partner organisations) in patent proceedings for the following inventions:

### Domestic patent applications

Number PP 50057-2014  
Authors Michaela Sojková, Štefan Chromik  
Title Naprašovací terč na prípravu prekurzorových vrstiev vhodných na výrobu vysokoteplotných supravodičov, spôsob jeho výroby a naprašovanie (The sputtering target for the preparation of the precursor layer for the production of suitable high-temperature superconductors, and the method for producing the sputtering apparatus)  
Workplace SAS Institute of Electrical Engineering

Number PP 5045-2014  
Authors Róbert Brunner, Emil Pinčík  
Title Určovanie zmien optických hrúbok tenkých pasivovaných polovodičových vrstiev po pasivačných procedúrach (Determining changes in the optical thickness of thin semiconductor wafers following passivation procedures)  
Workplace SAS Institute of Physics

Number PP 50045-2014  
Authors Peter Švec, Peter Švec, Jr., Dušan Janičkovič, Michal Halász, Jozef Hoško  
Title Viacvrstvé pásy na báze zliatin kovov a spôsob ich výroby (Multilayer sheets based on metal alloys and their method of production)  
Workplace SAS Institute of Physics – CVTI

Number PP 50002-2014  
Authors Marián Sedlák, Dmytro Rak  
Title Spôsob merania obsahu alkánov v alkoholoch metódou nanosegregácie vo vodných roztokoch (method of measuring the content of alkanes of the alcohols by nano-segregation in aqueous solutions)

Workplace	SAS Institute of Experimental Physics SAV
Number	PP 00067-2014
Authors	Pavel Diko, Vitaliy Antal, Samuel Piovarčí
Title	YBCO supravodičov spracovaný vysokotlakovou oxidáciou (YBCO superconductors processed by high pressure oxidation)
Workplace	SAS Institute of Experimental Physics SAV
Number	PP 50072-2014
Authors	Juraj Stein
Title	Magnetický tlmič vibrácií, pracujúci na báze vírivých prúdov a jeho umiestnenie v kmitavej sústave (The magnetic vibration damper, working on eddy-currents and its location the oscillatory system)
Workplace	SAS Institute of Materials and Machine Mechanics
Number	PÚV 5014-2014
Authors	Ignác Capek
Title	Spôsob prípravy kompozitnej polymérovej subnanometrovej disperzie na báze akrylamidu (Process for the preparation of the composite polymer subnanometer dispersions based on acrylamide)
Workplace	SAS Polymer Institute
Number	PP 50017-2014
Authors	Dušan Berek, Ivan Novák, K. Munka, M. Karacsonyov,
Title	Spôsob prípravy kompozitného sorbenta na odstraňovanie kontaminantov z vôd (A process for preparing a composite sorbent for removing contaminants from water)
Workplace	SAS Polymer Institute
Number	25/14 3.1
Authors	Filip Rázga, Veronika Némethová
Title	Enhanced specificity and selectivity of antisense systems for cancer therapy: targeted inhibition of causal fusion genes
Workplace	SAS Polymer Institute
Number	26/14 3.1
Authors	Filip Rázga, Veronika Némethová
Title	Immune-inertness: Morpholino-modified surfaces of materials for in vivo biomedical applications
Workplace	SAS Polymer Institute
Number	PP 35-2013
Authors	Ján Slezák, Marko Fulop, Dušan Šiplák, Dušan Pajdlhauser, Marek Hudák, Jaroslav Mrenica
Title	Premiestniteľný modulárny ožarovací komplex (Transportable modular irradiator complex)
Workplace	Institute for Heart Research SAS – EVPÚ Nová Dubnica
Number	PP 50064-2014
Authors	Miroslav Kocifaj, M. Mego
Title	Metóda a systém pre 3D rekonštrukciu jemnej štruktúry pomocou RTG tomografie kombinovanej s elastickým rozptylom (Method and system for 3D reconstruction of the fine structure using X-ray tomography combined with elastic scattering)
Workplace	SAS Institute of Construction and Architecture – Univerzita Komenského
Number	PP 05010-2014
Authors	Miroslav Kocifaj, M. Mego
Title	Kapsula na cieleňú aplikáciu farmaceutického prostriedku v nej obsiahnutého a spôsob jeho uvoľnenia z kapsuly (Capsule for the targeted delivery of pharmaceutical composition and the process for the release of the capsule from within)
Workplace	SAS Institute of Construction and Architecture – Národný onkologický ústav Bratislava

## International applications under PCT and others

- Number PCT/SK2014/000011  
Authors Ján Kuzmík  
Title Enhancement mode III-N transistor with N-polarity and the method of preparation  
Workplace SAS Institute of Electrical Engineering  
Country: Holandsko
- Number PCT/IB2014/063665  
Authors Gabriel Vanko, Jaroslav Dzuba, Tibor Lalinský, Ivan Rýger, Martin Vallo  
Title MEMS pressure sensor with a high electron mobility transistor and a production method thereof  
Workplace SAS Institute of Electrical Engineering  
Country: EÚ
- Number PCT/SK 2014/000021  
Authors Milan Štefek, Ivana Miláčková, Marta Šoltéssová-Prnová, B. Diez-Dacal, Gozalo D Pérez-Sala.  
Title Use of 5-carboxymethyl-3-mercapto-1,2,4-triazino-[5,6-b]indoles and their pharmaceutical composition  
Workplace SAS Institute of Experimental Pharmacology & Toxicology
- Number 201404260  
Authors Peter Kopčanský, Milan Timko, Vlasta Závišová, Natália Tomašovičová, I. P. Studenjak, O.V.Kovalcuk  
Title Spôsob zvýšenia iónovej vodivosti kompozitu na báze kvapalných kryštálov (Method for increasing the ion conductivity of the composite based on liquid crystal)  
Workplace SAS Institute of Experimental Physics SAV – Univerzita Užhorod  
Country Ukrajina
- Number 201404255  
Authors Peter Kopčanský, Milan Timko, Zuzana Gažová, Katarína Šipošová, Katarína Šipošová, I. P. Studenjak, O. V. Kovalcuk  
Title Metóda pre stanovenie optimálnej koncentrácie lyzozýmu pre vytvorenie lyotropného magnetického kvapalného kryštálu (The method for determining the optimum concentration of lyozyme to create lyotropic magnetic liquid crystal)  
Workplace SAS Institute of Experimental Physics SAV – Univerzita Užhorod  
Country Ukrajina
- Number PCT/SK2014/050008  
Authors Ivan Lukáč, Branislav Husár, Csaba Kósa, Janka Fályová  
Title Method for cross-linking of polymer films  
Workplace SAS Polymer Institute
- Number PCT/SK2014/000020  
Authors Miroslav Kocifaj, M. Mego  
Title Method of isolation of circulating cells from the peripheral blood  
Workplace SAS Institute of Construction and Architecture – Univerzita Komenského  
Country EÚ
- Number PCT/SK2014/000024  
Authors Miroslav Kocifaj, Jozef Klačka, Gorden Videen  
Title Method and Apparatus for Lightning Threat Indication  
Workplace SAS Institute of Construction and Architecture – Videen Gorden – Comenius University  
Country EÚ

## Patents granted in Slovakia

Number	P 288234
Authors	Lívia Chitu, Peter Šiffalovič, Eva Majková, Matej Jergel, Štefan Luby
Title	Spôsob výroby nanočasticových monovrstiev a multivrstiev (A method for producing nanoparticle monolayers and multilayers)
Workplace	SAS Institute of Physics
Number	PP 288071
Authors	Marián Sedlák, Ľ. Koňák
Title	Polymérne nanočastice na báze homopolyméru poly (propylakrylovej kyseliny) a spôsob ich prípravy (Polymer-based nanoparticles of the homopolymer poly (propylacrylic acid), and their preparation)
Workplace	SAS Institute of Experimental Physics SAV
Number	P 288254
Authors	Milan Ferdinandy, Ján Dusza, František Lofaj, Daniel Kottfer
Title	Zariadenie na vytváranie ochranných vrstiev na vnútorných plochách rotačných telies odparovaním látky elektrickým lúčom (Apparatus for forming protective layers on the inner surfaces of rotating bodies using electric beam evaporation substances)
Workplace	SAS Institute of Materials Research
Number	P 288062
Authors	Dušan Berek
Title	Spôsob separácie viaczložkových polymérových systémov (Process for separating multicomponent polymer systems)
Workplace	SAS Polymer Institute
Number	P 288165
Authors	Dušan Berek, WEI, Yun - BEIJING, CN – WANG, Chong
Title	Spôsob prípravy a použitia poly(2-hydroxy propyl metakrylát)ovej chromatografickej fázy viazanej na silikagéli (Method of preparation and use of poly (2-hydroxy propyl methacrylate) phase chromatography bound to silica gel)
Workplace	SAS Polymer Institute

## Patents granted abroad

Number	US 08759493
Country	USA
Authors	Jan Zavada, Silvia Pastorekova, Jaromir Pastorek
Title	MN gene and protein
Workplace	SAS Institute of Virology
Number	US 08628771
Country	USA
Authors	Claudiu Supuran, Andrea Scozzafava, Silvia Pastorekova, Jaromir Pastorek
Title	CA IX-specific inhibitors
Workplace	SAS Institute of Virology

## Patents carried out abroad

Number	US 14/069,030
Country	USA
Authors	C. A. Benedict, D. M. Zajonc, I. Nemčovičová
Title	Novel crystal structure and ligand binding sites of TRAIL receptors
Workplace	(SAS Institute of Virology – bez afiliácie)

General overview of patent activity at SAS for the year 2014:

SAS Workplace	Patents submitted		Patents awarded	
	SK	Intl (PCT)	SK	Abroad
Institute of Electrical Engineering	1	2		
Institute of Physics	2		1	
Institute of Experimental Pharmacology and Toxicology		1		
Institute of Experimental Physics	2	2	1	
Institute of Materials Research			1	
Institute of Materials and Machine Mechanics	1			
Polymer Institute	4	1	2	
Institute for Heart Research	1			
Institute of Construction and Architecture	2	2		
Institute of Virology				2
<b>Total</b>	<b>13</b>	<b>8</b>	<b>5</b>	<b>2</b>

## SAS Economic Activity

### SAS Economic Activity

At year-end, the Slovak Academy of Sciences had 48 budgetary organizations and 19 subsidized organizations. Compared to 2013 there was a decline in the number of subsidized organizations. By 30. 6. 2014 the Arboretum Mlyňany contributory organization ceased to exist as it merged with the Institute of Forest Ecology with effect from 1.7.2014. In accordance with §15, section 6 of Act No. 133/2002 on the Slovak Academy of Sciences, 2 scientific organisations with a budgetary form of management, one scientific organisation with a subsidised form of management and one specialized organization with specialised subsidised organisation for entrepreneurial activities were drafted.

When spending financial resources, the valid legislation, principles in the area of individual programmes, functional and economic classification and binding functionality of its use were observed. All organisations participated in the budgetary information system of the State Treasury.

In the approved 2013 budget, the category had an itemized budget of overall revenues amounting to EUR1 970 000. Based on the budgetary measures of the Slovak Ministry of Finance, the budget of revenues for 2014 was adjusted to EUR1 770 000. In reality, the SAS budgetary organisations remitted to the state budget income account overall revenues amounting to EUR 10 746 152.

Of this budgetary revenues amounted to EUR1 843 039 and revenues from non-budgetary resources amounted to the sum of EUR 8 903 113 eur. The structure of revenues is shown in the table below:

Budget allowance	total	division	
		budgetary	non-budgetary
<b>Revenue per capita</b>	<b>10,746,152</b>	<b>1,843,039</b>	<b>8,903,113</b>
division:			
tax-free revenue	2,066,516	1,843,039	223,477
payments from services and fees	1,227,722	1,227,722	
meal allowance	223,477		223,477
finances	1,820	1,820	
rental	344,674	344,674	
other tax free	262,848	262,848	
revenue capital	5,975	5,975	
<b>grants</b>	<b>8,679,636</b>	<b>0</b>	<b>8,679,636</b>

Grants and transfers consisted of resources provided by the Slovak Research and Development Agency from the budget of the Ministry of Education of the Slovak Republic resources for programmes and projects of international cooperation, in particular for the projects of the 6th and 7th EU Framework Programme, Horizont 2020 multilateral EU projects, other multilateral projects, bilateral projects and projects of intergovernmental agreements on cooperation in the area of science and technology, resources from EU structural funds received from main partners – (i.e. subsidised organisations and public colleges) resources for cooperation with research institutes at home, resources for programmes of European territorial cooperation and revenues from gifts from domestic and foreign institutions.

In the approved 2014 budget the category had an itemized budget of overall expenses in the amount of EUR 60 796 384. During the year, the budget of overall expenses was adjusted based on budgetary measures of the Ministry of Finance of the Slovak Republic to EUR 132 784 133 . The adjustment of the budget of expenses shared an increase of EUR 84 203 987 and decrease of EUR 12 216 238 .

Increased spending was affected by budgetary measures, in particular:

- The transfer of capital expenditure and spending on projects financed by EU structural funds, including co-financing from the state budget of 2013, pursuant to § 8 of Act no. 523/2004 Coll. the Financial Regulation and public administration
- Transfer of funds from other budget chapters (credit units) to advance and interim payments purposefully designed for projects financed by EU structural funds, including co-financing from the state budget.

Reduce budget expenditure resulted mainly from budgetary measures that bound expenditure:

- Due to the application of the Constitutional Law no. 493/2011 Coll. Fiscal responsibility;
- under-execution of payments for projects financed by EU structural funds, including co-financing from the state budget;
- shift of capital expenditures and EU funds and co-financing from the state budget in 2015.

Throughout the course of the year financial measures were implemented of internal character and the reclassification of budgetary resources within SAS were addressed.

All SAS capital budgetary expenditure was allocated to programs, structured to sub-programs and elements.

The actual total expenditure amounted by 31. 12. 2014 amounted to EUR 141,677,127. The structure of total expenditure by source was as follows:

- Expenses from the state budget in the amount of EUR 58,183,094;
- Expenditure on joint SR and EU programs financed by EU structural funds, including co-financing from the state budget, adopted on the basis of budgetary measures amounting to EUR 74,591,315;
- Costs covered by funds from extra-budgetary resources in the amount of EUR 8,902,718 of which was expenditure on joint programs of the EU and the Slovak Republic adopted by the main partners amounted to EUR 997,996.

Of the overall expenses, ordinary expenses amounted to EUR 56 431 860 (of that a contribution for operation to the subsidised organisations of SAS amounted to EUR 18 777 830) and capital expenditure to EUR 1 751 235 (of which a capital contribution to subsidised organisations of SAS amounted to EUR 212 858).

The average calculated registration number of employees in the budgetary organisations was 2 006,66 persons. The average salary in 2014 amounted to EUR 935,39 of which (source 111) EUR 818,17 originated from the state budget.

The subsidised organisations of SAS achieved overall revenues in the amount of EUR 54 257 125. Of the overall revenues of subsidised organisations the contribution from the state budget represented EUR 18 990 688 eur (including: ordinary EUR 18 777 830 and capital EUR 212 858).

SAS resources, consisting mainly of earnings from the sale of services, earnings from rental of buildings, premises and objects, amounted to EUR 3 335 466. Other revenues of subsidised organisations consisted of contributions for the implementation of projects, in particular contributions from the state budget granted by the Slovak Research and Development

Agency, resources from the European Regional Development Fund including co-funding from the state budget provided from categories forming payment units and foreign grants in particular resources for the implementation of international cooperation projects (6th and 7th EU framework programme, Horizont 2020, multilateral projects within the EU, other multilateral projects, bilateral projects and projects within the framework of intergovernmental agreements in the area of science and technology).

Overall expenses of subsidised organisations amounted to EUR 55 252 258, of which ordinary expenses amounted to EUR 33 983 100 and capital expenses amounted to EUR 21 269 158.

In 2014, the average calculated registration number of employees in subsidised organisations was 1 136,70 persons. The average salary was EUR 1 110,61, EUR 796,58 of which was from the state budget (source 111)

The achieved level of average earnings for researchers in 2014 in euro (DSc., PhD., PhD.) – SAS Scientific organizations:

<b>SAS budgetary organisation</b>	<b>2014</b>
Source 111 SK	957.11
Total other sources	163.03
Total average earnings	1 120.14

<b>SAS subsidised organisation</b>	<b>2014</b>
Source 111 SK	965.07
Total other sources	356.32
Total average earnings	1 321.39