

CEITEC

Central European Institute of Technology
BRNO | CZECH REPUBLIC**NEWSLETTER**

Dear CEITEC Friends,

For the start of 2014 we have again seen good progress. CEITEC was awarded an ERA Chair under the EU's Seventh Framework Programme (FP7) which is designed to attract top academics to organizations such as CEITEC. In particular the ERA Chair call is intended to recruit and establish an excellent international scientist with their research team to Brno, in the areas of cell systems and imaging that bridges the fields of chemistry or physics. The Czech National funding scheme for the continuation of support for CEITEC is planned to be released shortly. As we have performed exceptionally well during the current financing scheme, the new scheme will demand a shift towards increased international grant funding. In preparation for this change, which would go into effect in the beginning of 2016, we have continued to provide support for the Horizon2020

in the form of informational workshops, and have created stimulus incentives to encourage international collaborations. In this period we have also launched our international CEITEC PhD School covering the fields of Advanced Materials and Nanosciences, and Life Sciences under one umbrella format, and we are open to receive applications. We see the CEITEC PhD programmes as an integral part of our organisation that can create a bridge for multidisciplinary science, but also as a means to develop future great scientists. In this newsletter, you should find additional information about our recent publications and awards, the new cooperative agreement with EU-Life, and news regarding some of the high-level visits that we have received. Again, we appreciate your continued support and interest in CEITEC.

Very best,
Markus Dettenhofer

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16 SELECTED RECENT PUBLICATIONS

Advanced Nanotechnologies and Microtechnologies
Advanced Materials
Structural Biology
Genomics and Proteomics of Plant Systems
Molecular Medicine
Brain and Mind Research
Molecular Veterinary Medicine




GRANTS

CEITEC Gains Another Top Scientist Thanks to the Prestigious European Grant

Masaryk University is the only institution in the Czech Republic to win a prestigious European grant from the "ERA Chairs" programme. Financial support to the tune of EUR 2.2 million makes it possible to take on a top-class scientist who, with their research team, will expand our understanding in the fields of chemical and cell biology. Of the 111 projects looking for support, only 11 were successful.

Thanks to the grant from the European Commission an international tender was announced for a top scientist to fill the ERA Chair. With their research team, over a period of four and a half years they will thus be able to carry out research in the fields of chemical and cell biology and at the same time raise the scientific level of the whole institution.

Precisely the fields of chemical and cell biology have been identified as being of strategic importance for the further development of CEITEC and Masaryk University as a whole. The future ERA Chair will represent the area of research focusing on exploration of cellular systems by advanced imaging methods and their manipulation by means of small organic molecules and/or state-of-the-art physical methods.

The job advertisement was already published in *Nature*. Applications should be submitted by April 30, 2014. Information and updates regarding the ERA Chair position are available at www.era-chair.eu. 



CEITEC Researches Have Been Granted Marie-Curie Fellowships



Dr. Peter J. Lukavsky

Dr. Lukavsky, who has led the [RNA-based Regulation of Gene Expression](#) research group of the Structural Biology programme at CEITEC since October 2012, was co-supported in establishing his own group through the Marie-Curie CIG (Career Integration Grant) funded by the European Commission. The topic of his project is the study of aberrant splicing of CFTR Exon 9. Before Dr. Lukavsky moved to Brno, he worked at top-class institutions such as ETH Zurich, the University of Cambridge and Stanford University.



Dr. Alexander Petrov

Dr. Petrov joined the [Biomolecular NMR Spectroscopy](#) research group under the supervision of Dr. Konstantinos Tripsianes in 2013. Afterwards, he applied for a prestigious grant for researchers coming from countries outside Europe, the Marie-Curie IIF (International Incoming Fellowship), funded by the European Commission. As his proposal was evaluated as one of the 14% that were successful, Dr. Petrov can perform his research at CEITEC for an extra two years from October 2014. His previous career was oriented toward the development of new methods for the selection of synthetic DNA ligands-aptamers at York University in Toronto, Canada, where he got his PhD in 2012. The topic of his current work is structural and kinetic studies of the XPF/ERCC1-DNA complex for drug discovery.




COOPERATION

CEITEC Joins an Elite Group of European Research Institutions



CEITEC has become a member of the **EU-LIFE** consortium, made up of the thirteen best European research institutes in the life sciences. The founding of EU-LIFE has been in preparation since the beginning of 2013 and officially the process was concluded with the signing of the founding agreement at the end of January 2014. CEITEC is thus one of the founders of EU-LIFE and is the only research organisation from the new member states of the EU to join this group.

The members of EU-LIFE are currently implementing more than 60 significant projects coordinated within the EU and have between them 79 grants from the European Research Council (ERC), generally recognised within the EU as a sign of excellent research.

Participation in international scientific organisations such as EU-LIFE is essential for research institutes from the perspective of using the possibility of Horizon 2020 European programmes, which support strategic partnerships in research. 



CEITEC – EMBL Research Cooperation Workshop


A delegation of CEITEC scientists visited their counterparts at **EMBL** (The European Molecular Biology Laboratory) in Heidelberg on 19–21 March 2014. The visit was a follow-up to an administrative visit in December 2013.

The scientific delegation was composed of group leaders as well as junior researchers, postdocs and PhD students from four CEITEC research programmes – Advanced Nanotechnologies and Microtechnologies, Structural Biology, Genomics and Proteomics of Plant Systems and Molecular Medicine. The main objectives of the visit were to establish and to strengthen research collaboration on a research group level, engaging the younger generation of scientists and encouraging interdisciplinarity. Part of the programme was also laboratory and core facility visits.



CEITEC scientists and their counterparts from EMBL

Apart from the scientific programme general information about EMBL was presented by Iain Mattaj, EMBL Director General. The importance of the training of PhD students was emphasized during the presentation about the EMBL PhD programme, delivered by Helke Hillebrand, Academic Coordinator and Dean of Graduate Studies. In addition, the Euro-Biolmaging project was introduced by Jan Ellenberg, Head of the Cell Biology and Biophysics Unit.

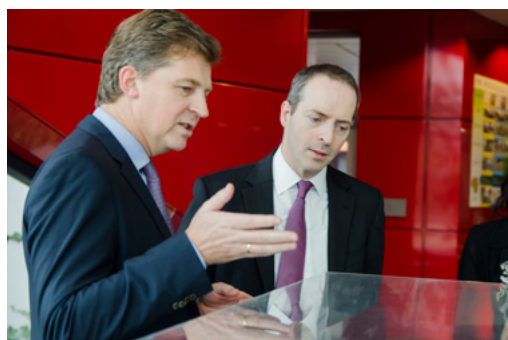
The visit received contribution from the SYLICA project (contract No. 286154, 7th Framework Programme) which supports the capacity building activities and international strategic partnership of CEITEC. 



British Minister of State for Trade and Investment, Lord Livingston, Visits CEITEC

As a part of a business mission to Central Europe, the British Minister of State for Trade and Investment, Lord Livingston, visited the CEITEC MU laboratories with the most powerful nuclear magnetic resonance (NMR) spectrometer in Central and Eastern Europe. During his visit he discussed possible cooperation with CEITEC Executive director Markus Dettenhofer and Masaryk University Vice-Rector for Development, Martin Bareš.

CEITEC already has ongoing collaboration with several prominent universities in the UK, as well as a formalized memorandum with Imperial College in the area of nanotechnology. This important visit underscored the interests of the UK in research and development in Central Europe, in which CEITEC has been recognized as an important player.



Lord Livingstone's visit to CEITEC MU

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Canadian Ambassador Otto Jelinek Met CEITEC and Masaryk University Representatives



Ambassador **Otto Jelinek** signing the Masaryk University Memory Book, © Eva Dejmková

Canadian Ambassador Otto Jelinek and his delegation met representatives of Masaryk University and CEITEC management on the occasion of his first official visit to Brno on March 6, 2014.

The ambassador, accompanied by his team responsible for trade, investment, science and technology, discussed further collaboration with MU Vice-Rector for strategy Ivan Malý, CEITEC Executive director Markus Dettenhofer and CEITEC MU director Jaroslav Koča. The presentation of CEITEC life sciences and medical research fields was included in the programme as well as an excursion to the Josef Dadok National NMR Centre.

The visit of Mr. Jelinek was a follow-up to CEITEC's mission to Canada in 2012. 

AWARDS

Award for Outstanding Achievement in Development of Clinical Medicine Given to prof. Šárka Pospíšilová Team




Šárka Pospíšilová
Molecular Medicine
research programme
coordinator

Prof. Šárka Pospíšilová, Dr. Jitka Malčíková, Dr. Martin Trbušek and the team of their international collaborators won the Award of the Dean of the Medical faculty MU for outstanding achievement in the development of clinical medicine for their publication "*ERIC recommendations on TP53 mutation analysis in chronic lymphocytic leukemia*" in the prestigious journal *Leukemia*.

The research of all three scientists from the CEITEC programme **Molecular Medicine** is focused on the study of genetic modifications that lead to different types of

leukaemia. The awarded publication presents the results of many years' efforts in the study of the role of the tumour suppressor in leukaemia cells that at the end led to new exciting findings about the *P53* oncogene. It has been shown that patients with chronic lymphocytic leukaemia (CLL) with defects in the *TP53* gene have a significantly worse prognosis, poor response and reduced overall survival with standard treatment approaches.

Thanks to long-term collaboration with the European Research Initiative for CLL (ERIC) prof. Šárka Pospíšilová started this international initiative to establish recommendations for researchers and clinicians on how, when and in which patients to perform mutational analyses of the *P53* oncogene. These recommendations have a direct impact in clinical practice, significantly improve prognosis and diagnosis of patients with chronic lymphocytic leukaemia and enable the application of more effective personalized therapy. 

OTHER INTERESTING NEWS

International CEITEC PhD School Opens Two Doctoral Programmes

CEITEC PhD School is an innovative, interdisciplinary, fast-growing, and internationally-oriented PhD School based on a strategic partnership of leading universities and research institutes in the region that are part of the CEITEC research centre. Thanks to their cooperation the CEITEC PhD School offers access to state-of-the-art infrastructure and training in an interdisciplinary scientific community.

The aim of the CEITEC PhD School is to provide students from around the world with an opportunity to get an education in contemporary scientific disciplines – with the standards of excellent foreign scientific institutions – in the inspiring environment of the city of Brno that has been long established as a city of science and biotechnology.

CEITEC PhD School in a Nutshell

- An innovative approach to education using the long-standing experience of partner institutions
- The support of interdisciplinary projects
- Above standard staffing and state-of-the-art infrastructure
- Communication in English
- Training in socio-managerial competences
- Above standard scholarship
- Quality mentoring provided by educators with international experience
- Equal conditions for admission
- “Welcome Services” for foreign students (including a free Czech course)
- Social activities for all students
- 4 year PhD programme

Study programmes and fields of study

Life Sciences

- Structural Biology
- Bio-omics

Advanced Materials and Nanosciences

- Advanced Nanotechnologies and Microtechnologies
- Advanced Materials

APPLICATION DEADLINES

- Life Sciences - **April 30, 2014**
- Advanced Materials and Nanosciences - **May 31, 2014**

THERE ARE BETTER WAYS TO MAKE THE WORLD A BETTER PLACE

Further information: www.ceitec.eu/phd | phd@ceitec.cz



Open Access to CEITEC Core Facilities Launched for 2014

CEITEC core facilities launched a new call for projects for CEITEC open access. The aim of this call is to open up CEITEC core facilities, hosted by Masaryk University and the Brno University of Technology, to external users with interesting scientific projects from all over the world. In the framework of the CEITEC open access project, use of CEITEC facilities is free of charge for participating researchers from the academic institutions. The costs of access are covered by the Ministry of Education, Youth and Sports of the Czech Republic.

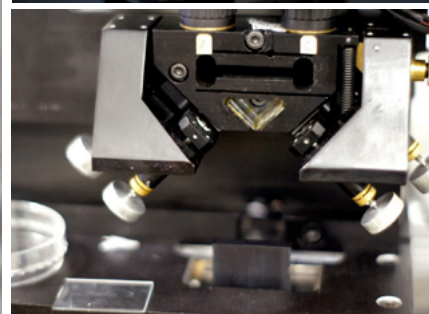
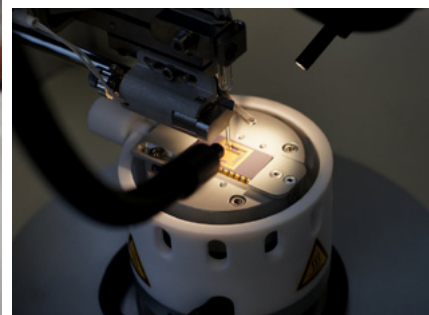
This is a continuous call (i.e. immediately after receipt of a project proposal it is submitted to a peer review process and, if positively evaluated, the laboratory time and services needed are allocated). The final deadline for projects to be implemented in 2014 is October 31, 2014. Projects may be realized until the end of 2014.



MINISTRY OF EDUCATION,
YOUTH AND SPORTS

The **CEITEC – Open Access Project**, ID number LM2011020, is funded by the Ministry of Education, Youth and Sports of the Czech Republic under the activity "Projects of major infrastructures for research, development and innovations".

Find out more about Open Access [HERE](#)



EVENTS INVITATIONS

★ **Prof. Sebastian Díaz de la Torre**

CIITEC - IPN, Mexico

Topic 1: **Concise History of Mexico and IPN**

Topic 2: **Processing and Sintering of Advanced Composite Powder Materials**

WHEN: 1/4/2014, 14:00 – 16:00

WHERE: audience hall P6, Faculty of Mechanical Engineering, Technická 10, Brno

More information can be found [HERE](#)

★ **Massimo Celino, PhD**

ENEA, Italy

Topic: **Molecular modelling design of new materials to understand and optimize their properties**

WHEN: 1/4/2014, 16:00 – 18:00

WHERE: audience hall P6, Faculty of Mechanical Engineering, Technická 10, Brno

More information can be found [HERE](#)

★ **Quantitative Phase Imaging, Techniques and Applications**

Thematic sessions:

Techniques, applications and interpretation of quantitative phase imaging

Confirmed participants:

Gabriel Popescu, Daniel Zícha, Graham Dunn, Alan Boyde, Pierre Marquet, Pavel Hozák

WHEN: 14 – 16/4/2014

WHERE: Brno University of Technology, Technická 10, Brno

More information and registration can be found [HERE](#)

★ **Betty Tijms, PhD**

VU University Medical Center, Alzheimer Center and Department of Neurology, Amsterdam, The Netherlands

Topic: **Graph theory and its application to Alzheimer's disease**

WHEN: 15/4/2014 from 15:30

WHERE: St. Anne's University Hospital, Department of Neurology, Pekařská 53, Brno

More information can be found [HERE](#)

 **Prof. Masamichi Yoshimura**

Toyota Technological Institute, Japan

Topic: **Structural Control of Graphite-Capped, Vertically Aligned MWCNT Arrays**

WHEN: 15/4/2014, 14:00 – 16:00

WHERE: audience hall P6, Faculty of Mechanical Engineering, Technická 10, Brno

More information can be found [HERE](#)

 **Prof. Guang-Ling Song**

ORNL National Lab, USA

Topic: **Corrosion and prevention of Mg alloys**

WHEN: 15/4/2014 16:00 – 18:00

WHERE: audience hall P6, Faculty of Mechanical Engineering, Technická 10, Brno

More information can be found [HERE](#)

 **Prof. Sergey Krasikov**

Ural Branch of the Russian Academy of Sciences, Russia

Topic: **Peculiarities of the phase formation at separate and joint metallothermic reduction of the titan, zirconium, nickel and molybdenum from oxides**

WHEN: 15/4/2014 18:00 – 20:00

WHERE: audience hall P6, Faculty of Mechanical Engineering, Technická 10, Brno

More information can be found [HERE](#)

 **Ivana Konvalinka, PhD**

Technical University of Denmark, Section for Cognitive Systems, Department of Applied Mathematics and Computer Science

Topic: **The two brain approach: How can mutually interacting brains teach us something about social interaction**

WHEN: 17/4/2014 from 15:00

WHERE: INBIT building, Conference room, Kamenice 34, Brno

More information can be found [HERE](#)

**Martin Jínek, PhD**

Department of Biochemistry, ETH Zurich

Structural Biology Seminar Series; topic to be announced

WHEN: 24/4/2014 from 14:00

WHERE: seminar room 1.32, building A11, University Campus Bohunice, Brno

More information can be found [HERE](#)

**Integrated Approaches to Structural Biology**

Confirmed participants:

Jerome Boisbouvier, Simon Bullock, Kay Grunewald, Anne Imberty, Michael Lindberg, Bernhard Spingler, Dmitri Svergun, Peter Tompa

WHEN: 15/5/2014 from 9:00

WHERE: Augustinian Abbey in Brno

More information and registration can be found [HERE](#)

**Prof. Steven Rapsack**

Department of Neurology, University of Arizona, Tucson, USA

Topic: **Neural systems for processing identity, emotion and social information in faces**

WHEN: 23/5/2014

WHERE: St. Anne's University Hospital, Department of Neurology, Pekařská 53, Brno

SAVE THE DATE !

**CEITEC Annual Conference: Frontiers in Life and Materials Sciences**

WHEN: 21– 24/10/2014

WHERE: Brno, Czech Republic

More information will be available on CEITEC website

INTERVIEW WITH CEITEC SCIENTIST

Dr. Hana Hughes

Research Group – **Advanced Ceramic Materials** | Research Programme – **Advanced Materials**

Dr. Hughes, you are an ideal example of a scientist who has managed to apply your scientific work in collaboration with the commercial sector and, what's more, gone into business yourself. In what research field do you work? From where did you take the courage to enter into your first commercial project?

I've always been very business-oriented and I set up my first company when I was 18, and a second in 1998 in the UK. I've never seen starting a commercial project as something requiring courage, but rather as a necessity, to use the results of research and development and commercialise new technologies and products for the betterment of the organization and society. I thus find it very motivating to work between the scientific and commercial environments.

Given my business orientation and interest in materials science, I am particularly excited in multidisciplinary projects which encompass both life and materials sciences. I strongly believe that this field has strong commercial potential and includes many interesting projects which I believe can be brought from the purely academic environment to a successful business enterprise. Throughout my time in the UK I always worked on the edge of academia and business, and all my activities were industry driven. I held a senior management role in the spinout company Applied Functional Materials which focussed on medical ultrasound. This company is typical example of business which exploited technology developed in an academic environment, technology which is unique and which can be applied as a platform technology for a wide range of commercial applications, from medical devices to NDT and beyond.

Currently I am working in CEITEC as a Marie Curie Research Fellow funded by the SoMoPro scheme, and I am investigating fabrication routes for novel sensors and actuators using new non-toxic, environmentally friendly materials. Potential applications encompass medical imaging and devices, energy generation and the monitoring of industrial systems.



Hana Hughes with her colleagues Aleš Matoušek and Pavel Tofel

“ My SoMoPro project deals with studying and developing new applications using microtechnologies and ceramic materials. At the conclusion of the project I would like to transfer the results to the commercial sphere.

You lived in England for quite a long time, how actually did you end up going abroad? And when, and above all why, did you decide to remain in Birmingham?

Yes, I spent 14 years in Britain. I went to England to learn English, which I saw as crucial for further career progression. I never intended to remain there long-term, it was rather that Britain offered me excellent conditions for my professional development, and I am very grateful for the opportunities and prospects that it gave me. The beginning was pretty difficult and I struggled for a year and a half to secure my first permanent employment. I was also very fortunate to gain recognition from my employer in the form of sponsorship of my PhD studies in addition to a grant from the UK Government Science funding body. I have worked in various parts of central Britain, including Wales, and eventually I ended up in Birmingham. All my British positions were commercial, mostly directed toward industrial research and development and later in business development, spinout management and investment.

What were your reasons for returning to Brno?

I come from the small town of Ivančice, just outside of Brno, thus Brno and South Moravia were always where I returned to when I came back to the Czech Republic, and South Moravia is place which is close to my heart. I've always had an urge to return, and perhaps to share the experience I gained in the UK. I learned from local newspapers about CEITEC as a new project trying to take a different approach how to implementing science and their desire to attract experienced scientists from abroad. I met with, among others, the then director of CEITEC and he got me interested enough that I wanted to give it a try. However, I did not realise just how different the British and Czech environments are. On my return I felt, and still feel, like a foreigner in my own country. I expect things to work a certain way and then I find out that it is not like that at all. Compared to the British system the Czech one is out of kilter and trying to find its way. However it is hardly surprising given the Czech Republic's political history, which has taken its toll, and continues to have an influence. If you live within the system you are not that much aware of it, and the possibilities of other countries are heard about only through the media or from friends. Experiencing it yourself is something impossible to describe.

Dr. Hana Hughes studied Geology at Masaryk University in Brno and graduated with Bachelors and Masters degrees. She moved to the UK in 1997 and, after a period working as an environmental consultant, she was recruited by Filtronic Comtek Plc, a company developing new materials for mobile telecommunications applications. Filtronic Comtek sponsored her to study for a PhD in materials science at the prestigious Manchester University investigating the structure and dielectric properties of materials developed for microwave filters for 3G mobile systems. The results of her study were published in high impact journals such as Applied Physics Letters and highlighted in Nature Physics. After completion of her doctorate she continued working in the commercial sector initially for Morgan Electroceramics as a Materials Specialist and thereafter in the high-tech spinout company Applied Functional Materials Ltd. as Technical Business Manager. She was responsible for leading the development of techniques for the microfabrication of ceramic piezoelectric composite devices for high frequency ultrasound transducers; and managed and co-ordinated both internal and external collaborative projects. She was also responsible for commercial activities and the successful investment by a syndicate of private and governmental investors.

Since February 2012 Hana has been working in CEITEC BUT in the Advanced Ceramic Materials research group, with the main aim to establish international collaborative activities and start new research streams in the area of functional materials and devices.

You gained financing for your work in Brno via the SoMoPro project. What is it about and how did it ease your project of returning to the Czech Republic? What further possibilities does the SoMoPro project give you?

SoMoPro is a project that is co-financed by the South Moravian Region and the EU. The aim is first of all to attract foreign scientists, or as the case may be, to help

Czech scientists to return from abroad. My SoMoPro project is called MILEPEDE and deals with studying and developing new applications using microtechnologies and ceramic materials. It involves the expansion and improvement of the technology which I managed in Great Britain. At the conclusion of the project I would like to transfer the results to the commercial sphere. I believe that the commercialisation of this technology will have a positive impact on the economy of the South Moravian Region as well as the creation of jobs. This will open up many future opportunities, especially in medical applications, energy harvesting and sensors.

You have returned to Brno with your whole family, including your two little daughters. Have your children encountered language or cultural barriers? Is returning as simple as it seems for a “mum”?

We are an Anglo-Czech family. At home we speak English, as my husband is British and speaks little Czech, but I try to speak Czech with our children, so my daughters (5 and 6) now speak fluent Czech and English. Their Czech is quite ‘interesting’, given that you can hear an English accent, and for the moment I would say that Czech is their second language. Both of my daughters

attend a Czech nursery school and, apart from sleeping regime in the middle of the day, they enjoy it. From my side it’s a bit more difficult as the nursery closes at 3.30pm each day and, without the help of my mum, I would be unable to work in Brno. This is a problem that most working parents in the Czech Republic have to solve.

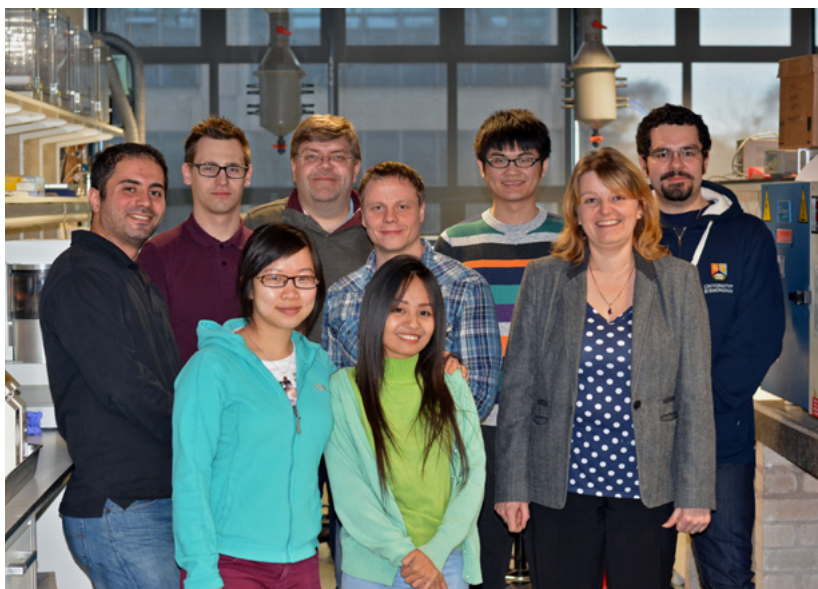
This year I went with my older daughter to enrol for the first year of primary school, and during enrolment the school expressed reservations, given that their teachers do not have experience with children that are fully bilingual. They were unsure how my children would be accepted into a group of monolingual Czech kids – and they recommended that I look for a private school giving them greater ‘space’. I was left with no choice but to enrol them with an international Montessori school – a daily trip of about 60 km!

After my experience with Britain, the situation for Czech mothers appears a lot simpler, and also financially a lot better than in Britain. Maternity leave in Britain is only 52 weeks and not fully paid. Nursery schools are available, but very expensive, so it is not unusual that one partner’s salary pays only for the nursery school. On the

other hand the nursery is open till 6.30 pm which is positive for career development and that the child gets used to being in a group of other children and adults from a very young age.

Returning to your work. How do you work with the young PhD Students and scientists at BUT? Do they have other opportunities than you did when you started? Do they make use of them?

I have had the chance to meet people from all over the world, and I recognise that people are the same everywhere. Each of us has something to offer, but it is important to treat every individual according to their abilities and needs. In that way we can achieve the best



Hana Hughes (first row, on the far right) with international PhD students and postdocs

possible results and maximum productivity. I enjoy working and meeting with students, scientists and people in general at BUT, and the university has given them an excellent knowledge base, in my opinion better than that commonly taught in Britain. Frequently, however, I encounter Czech students/scientists who know very well the rule or mathematical formula, but are completely unable to apply it, or be able to 'sell' it or transfer it to different discipline or problem. This is something that the Czech educational system is still 'learning'. We have to teach our students and scientists to promote their ideas, give them more space, and leave them with more of a sense of success and recognition. The system needs to be changed, starting from primary school through to the university level. Among our PhD students a basic difference can be seen between those that actively cooperate with foreign partners or have gone on placements, and those who have not. As I have experienced, if our postgrads and young scientists get the chance, and mainly the time, to find their feet and acclimatise, they are able to match and even outperform their foreign peers. But they have to get the chance and make use of it.

I've heard that you are able to enthuse your students and show them different levels and possibilities of cooperation abroad. How do you do it? Wherein lies the difference?

After my experience abroad I am a strong believer in the influence of environment and a personal approach on productivity. At the same time a power of strong functioning collective and opportunities for self-realisation gives enthusiasm to students and scientists in general. When talking to people working on the project I always ask questions of the type "And how would you do it? What do you think will be the best approach to achieve the results?" I always try to give people around me space so that they associate themselves with the work they do, and where possible I help with the guidance. I try to give them the self-confidence not be afraid to admit when there is something they do not know, and to realise that sometimes they can learn a lot more from mistakes than from successful experiments. In the Czech Republic I still come across the very opposite approach, where people are scared to admit that they do not know something.

I would really like our students and scientists to have the opportunity, and mainly the motivation, to take part in long foreign placements, where they could work on a variety of projects and then pass on the experience gained.

Foreign cooperation works in both directions. For students and scientists from the UK for example, cooperation with a Czech universities and academia in general is attractive. Among other things it opens up the opportunity to apply for Europe-wide grants such as Horizon 2020. The important thing is to open up communication and the chance to discuss areas of common interest, even projects which are very disruptive and multidisciplinary.

A big difference between the Czech and foreign scientific environments is multiculturalism. Abroad it is completely normal for a research group to bring together people of different nationalities. Such an international group has a great advantage in their varied perspectives on the solution of scientific questions, resulting from the differing approaches of scientists from various cultures. I try to show all this to people around me, and give them opportunities to experience it for themselves. I believe that they appreciate the opportunities. I get a lot of satisfaction from the fact that they are interested in travelling and participating in international projects.

What are your plans for the future? Do you have any dream projects for which you want to gain funding, or do you rather look for ways to realise the commercial potential of the results of your work?

My current position in CEITEC is my first purely academic university-based role. All the others that I have held were of commercial nature, or working on the edge of academia and industry. I truly believe in scientific projects with applications in mind.

My future plans are therefore directly linked to my interest in business and commerce. In my professional field I would like to succeed in the development of the technology that I am currently working on in CEITEC – the microfabrication of functional ceramics – and to see commercial use of this technology. There is still a great deal of work for me to do to achieve this!

Thank you for the interview.

SELECTED RECENT PUBLICATIONS

ADVANCED NANOTECHNOLOGIES AND MICRITECHNOLOGIES

□ PLOS One

Metallothionein – Immunohistochemical Cancer Biomarker: A Meta-Analysis.

Gumulec J., Raudenska M., Adam V., Kizek R., Masarik M.

Research Group: Smart Nanodevices

Summary: Metallothionein (MT) has been extensively investigated as a molecular marker of various types of cancer. In spite of the fact that numerous reviews have been published in this field, no meta-analytical approach has been performed. Therefore, results of to-date immunohistochemistry-based studies were summarized using meta-analysis in this review. Web of science, PubMed, Embase and CENTRAL databases were searched (up to April 30, 2013) and the eligibility of individual studies and heterogeneity among the studies was assessed. Random and fixed effects model meta analysis was employed depending on the heterogeneity, and publication bias was evaluated using funnel plots and Egger's tests. A total of 77 studies were included with 8,015 tissue samples (4,631 cases and 3,384 controls). A significantly positive association between MT staining and tumors (vs. healthy tissues) was observed in head and neck (odds ratio, OR 9.95; 95% CI 5.82–17.03) and ovarian tumors (OR 7.83; 1.09–56.29), and a negative association was ascertained in liver

tumors (OR 0.10; 0.03–0.30). No significant associations were identified in breast, colorectal, prostate, thyroid, stomach, bladder, kidney, gallbladder, and uterine cancers and in melanoma. While no associations were identified between MT and tumor staging, a positive association was identified with the tumor grade (OR 1.58; 1.08–2.30). In particular, strong associations were observed in breast, ovarian, uterine and prostate cancers. Borderline significant association of metastatic status and MT staining were determined (OR 1.59; 1.03–2.46), particularly in esophageal cancer. Additionally, a significant association between the patient prognosis and MT staining was also demonstrated (hazard ratio 2.04; 1.47–2.81). However, a high degree of inconsistency was observed in several tumor types, including colorectal, kidney and prostate cancer. Despite the ambiguity in some tumor types, conclusive results are provided in the tumors of head and neck, ovary and liver and in relation to the tumor grade and patient survival.

□ NANO LETTERS

Atomic-Scale Observation of Multiconformational Binding and Energy Level Alignment of Ruthenium-Based Photosensitizers on TiO₂ Anatase.

Kley C., Dette C., Rinke G., Patrick C., **Čechal J.**, Jung S., Baur M., Dürr M., Rauschenbach S., Giustino F., Stepanow S., Kern K.

Research Group: Fabrication and Characterisation of Nanostructures

Summary: Dye-sensitized solar cells constitute a promising approach to sustainable and low-cost solar energy conversion. Their overall efficiency crucially depends on the effective coupling of the photosensitizers to the photoelectrode and the details of the dye's energy levels at the interface. Despite great efforts, the specific binding of prototypical ruthenium-based dyes to TiO₂, their potential supramolecular interaction, and the interrelation between adsorption geometry and electron injection efficiency lack experimental evidence. Here we demonstrate multiconformati-

onal adsorption and energy level alignment of single N3 dyes on TiO₂ anatase (101) revealed by scanning tunnelling microscopy and spectroscopy. The distinctly bound molecules show significant variations of their excited state levels associated with different driving forces for photoelectron injection. These findings emphasize the critical role of the interfacial coupling and suggest that further designs of dye sensitized solar cells should target a higher selectivity in the dye-substrate binding conformations in order to ensure efficient electron injection from all photosensitizers.

ADVANCED MATERIALS

☐ Carbohydrate Polymers

Preparation, characterization and cytotoxicity of schizophyllan/silver nanoparticle composite.

Abdel-Mohsen A., Abdel-Rahman R., Fouda M., **Vojtová L.**, **Uhrová L.**, Hassan A., Al-Deyab S., El-Shamy I., **Jančář J.**

Research Group: Advanced Polymers and Composites

Summary: Silver nanoparticles (Ag-NPs) have been successfully prepared with a simple and “green” chemical reduction method. Triple helical schizophyllan (SPG) was used for the first time as reducing and stabilizing agents. The effect of temperature, silver nitrate/schizophyllan concentrations, pH of the reactions medium and the reaction time were investigated. The obtained schizophyllan/Ag-NP was characterized by UV-vis spectroscopy, TEM, DLS, X-ray diffraction, TGA, and ATR-FTIR.

The results revealed that, Ag-NPs attached to SPG through a strong non-covalent interaction, leading to good dispersion of Ag-NPs with a diameter of 6 nm within the biopolymer matrix. By increasing the pH of the reaction medium, the triple helical structure of SPG was partially broken. The SPG/AgNP nanocomposite was non-toxic for mouse fibroblast line (NIH-3T3) and human keratinocyte cell line (HaCaT).

STRUCTURAL BIOLOGY

☐ PLOS One

A Soluble Fucose-Specific Lectin from Aspergillus fumigatus Conidia - Structure, Specificity and Possible Role in Fungal Pathogenicity

Houser J., **Komarek J.**, **Kostlanova N.**, Cioci G., Varrot A., Kerr S.C., Lahmann M., Balloy V., Fahy J.V., Chignard M., Imberty A., **Wimmerova M.**

Research Group: Glycobiology

Summary: *Aspergillus fumigatus* is an important allergen and opportunistic pathogen. Similarly to many other pathogens, it is able to produce lectins that may be involved in the host-pathogen interaction. We focused on the lectin AFL, which was prepared in recombinant form and characterized. Its binding properties were studied using hemagglutination and glycan array analysis. We determined the specificity of the lectin towards l-fucose and fucosylated oligosaccharides, including α 1-6 linked core-fucose, which is an important marker for cancerogenesis. Other biologically relevant saccharides such as sialic acid, d-mannose or d-galactose were not bound. Blood group epitopes of the ABH and Lewis systems were recognized, Le^Y being the preferred ligand among others. To provide a correlation between the observed functional characteristics and structural basis, AFL was crystallized in a complex with

methyl- α , L-selenofucoside and its structure was solved using the SAD method. Six binding sites, each with different compositions, were identified per monomer and significant differences from the homologous AAL lectin were found. Structure-derived peptides were utilized to prepare anti-AFL polyclonal antibodies, which suggested the presence of AFL on the *Aspergillus* conidia, confirming its expression *in vivo*. Stimulation of human bronchial cells by AFL led to IL-8 production in a dose-dependent manner. AFL thus probably contributes to the inflammatory response observed upon the exposure of a patient to *A. fumigatus*. The combination of affinity to human epithelial epitopes, production by conidia and pro-inflammatory activity is remarkable and shows that AFL might be an important virulence factor involved in an early stage of *A. fumigatus* infection.

Journal of Chemical Theory and Computation

Mechanism of Spin–Orbit Effects on the Ligand NMR Chemical Shift in Transition-Metal Complexes: Linking NMR to EPR.

Vícha J., Straka M., Munzarová M.L., Marek R.

Research Group: Biomolecular NMR Spectroscopy

Summary: Relativistic effects play an essential role in understanding the nuclear magnetic resonance (NMR) chemical shifts in heavy-atom compounds. Particularly interesting from the chemical point of view are the relativistic effects due to heavy atom (HA) on the NMR chemical shifts of the nearby light atoms (LA), referred to as the HALA effects. The effect of Spin–Orbit (SO) interaction originating from HA on the nuclear magnetic shielding at a neighboring LA, σ^{SO} , is explored here in detail for a series of d^6 complexes of iridium. Unlike the previous findings, the trends in σ^{SO} observed in this study can be fully explained neither in terms of the s-character of the HA–LA bonding nor by trends in the energy differences between occupied and virtual molecular orbitals (MOs). Rather, the σ^{SO} contribution to the total NMR shielding is found to be modulated by the d-orbital participation of the heavy atom (Ir) in the occupied and virtual spin–orbit *active* MOs, i.e., those which con-

tribute significantly to the σ^{SO} . The correlation between the d-character of σ^{SO} -active MOs and the size of the corresponding SO contribution to the nuclear magnetic shielding constant at LA is so tight that the magnitude of σ^{SO} can be predicted in a given class of compounds on the basis of d-orbital character of relevant MO with relative error smaller than 15%. This correspondence is supported by an analogy between the perturbation theory expressions for the spin–orbit induced NMR σ -tensor and those for the EPR g-tensor as well as the A-tensor of the ligand. This correlation is demonstrated on a series of d^5 complexes of iridium. Thus, known qualitative relationships between electronic structure and EPR parameters can be newly applied to reproduce, predict, and understand the SO-induced contributions to NMR shielding constants of light atoms in heavy-atom compounds.

GENOMICS AND PROTEOMICS OF PLANT SYSTEMS

Lab on Chip

Detection of electrochemiluminescence from floating metal platelets in suspension.

Jusková P., Neučil P., Manz A., Foret F.

Research Group: Bioanalytical Instrumentation

Summary: Generation of electrochemiluminescence (ECL) signal, based on square shaped gold electrodes with a size of 50 μm positioned inside a fused silica capillary was observed with a PMT detector. The ECL was generated using electric pulses with duration in the

range from 100 ms to 5 s and an electrical field strength from 300 V/cm to 500 V/cm. It was demonstrated that the electrochemical reaction with detectable optical output can be produced using freely moving and thus disposable electrodes inside 75 μm channels.

☐ Plant Journal

Telomere repeat binding proteins are functional components of Arabidopsis telomeres and interact with telomerase.

Procházková Schrupfová P., Vychodilová I., Dvořáčková M., Majerská J., Dokládál L., Schořová S., Fajkus J.

Research Group: Chromatin Molecular Complexes

Summary: Although telomere-binding proteins constitute an essential part of telomeres, *in vivo* data indicating the existence of a protective structure similar to mammalian shelterin complex in plants are limited. Partial characterization of a number of candidate proteins has not identified true components of plant shelterin or elucidated their functional mechanisms. Telomere repeat binding (TRB) proteins from *Arabidopsis thaliana* bind plant telomeric repeats through a Myb domain of the telobox type *in vitro*, and have been shown to in-

teract with POT1b (Protection of telomeres 1). Here we demonstrate co-localization of TRB1 protein with telomeres *in situ* using fluorescence microscopy, as well as *in vivo* interaction using chromatin immunoprecipitation. Classification of the TRB1 protein as a component of plant telomeres is further confirmed by the observation of shortening of telomeres in *trb1* mutants. Moreover, TRB proteins physically interact with plant telomerase catalytic subunits. These findings integrate TRB proteins into the telomeric interactome of *A. thaliana*.

MOLECULAR MEDICINE

☐ Journal of Immunology

Age-Related Decrease in TCR Repertoire Diversity Measured with Deep and Normalized Sequence Profiling.

Britanova O.V., Putintseva E.V., Shugay M., Merzlyak E.M., Turchaninova M.A., Staroverov D.B., Bolotin D.A., Lukyanov S., Bogdanova E.A., Mamedov I.Z., Lebedev Y.B., **Chudakov D.M.**

Research Group: Adaptive Immunity

Summary: The decrease of TCR diversity with aging has never been studied by direct methods. In this study, we combined high-throughput Illumina sequencing with unique cDNA molecular identifier technology to achieve deep and precisely normalized profiling of TCR β repertoires in 39 healthy donors aged 6-90 y. We demonstrate that TCR β diversity per 10^6 T cells decreases roughly linearly with age, with significant reduction already apparent by age 40. The percentage of naive T cells showed a strong correlation with measured TCR diversity and decreased linearly up to age 70. Remarkably,

the oldest group (average age 82 y) was characterized by a higher percentage of naive CD4⁺ T cells, lower abundance of expanded clones, and increased TCR diversity compared with the previous age group (average age 62 y), suggesting the influence of age selection and association of these three related parameters with longevity. Interestingly, cross-analysis of individual TCR β repertoires revealed a set >10,000 of the most representative public TCR β clonotypes, whose abundance among the top 100,000 clones correlated with TCR diversity and decreased with aging.

□ Human Mutation

TP53 Mutation Analysis in Clinical Practice: Lessons From Chronic Lymphocytic Leukemia.

Malcikova J., Pavlova S., Kozubik K.S., **Pospíšilová S.**

Research Group: Molecular Genomics

Summary: In leukemia, *TP53* mutations are not frequent but clearly associate with impaired survival and therapy response. Here, we describe the biological and clinical consequences of *TP53* dysfunction as well as the methodical aspects of *TP53* analysis in chronic lymphocytic leukemia (CLL). In CLL, *TP53* defects are routinely analyzed as part of disease prognostication. Deletions of *TP53* locus (17p) have been uniformly detected using I-FISH for several years. Since monoallelic mutations have also been shown to have negative prognostic impact, it is recommended to examine both *TP53* mutati-

ons and deletions. Several methods are used to detect *TP53* mutations, and next-generation sequencing (NGS) is becoming a convenient option for routine analysis. Besides this, ultradeep NGS permits the detection of minor clones carrying *TP53* mutations, even below 1%. The prognostic impact of minor *TP53*-defective subclones is currently unknown, nevertheless they unequivocally bear the risk of being selected by therapy. Prospective studies assessing the consequences of carrying such clones are in progress.

BRAIN AND MIND RESEARCH

□ Schizophrenia Research

A detailed analysis of the effect of repetitive transcranial magnetic stimulation on negative symptoms of schizophrenia: a double-blind trial.

Prikryl R., Ustohal L., Prikrylova Kucerova H., Kasperek T., Venclikova S., **Vrzalova M., Ceskova E.**

Research Groups: Applied Neuroscience (main author) & Behavioural and Social Neuroscience

Objective: The aim of the study was to assess the effect of rTMS not only on the general severity of negative schizophrenia symptoms, but also particularly on their individual domains, such as affective flattening or blunting, alogia, avolition or apathy, anhedonia, and impaired attention.

Methods: Forty schizophrenic male patients on stable antipsychotic medication with prominent negative symptoms were included in the study. They were divided into two groups: 23 were treated with active and 17 with placebo rTMS. Both treatments were similar, but placebo rTMS was administered using a purpose-built sham coil. Stimulation was applied to the left dorsolateral prefrontal cortex (DLPFC). The stimulation frequency was 10 Hz; stimulation intensity was 110% of the individual motor threshold intensity. Each patient received 15 rTMS sessions on 15 consecutive working days

(five working days “on” and two weekend days “off” design). Each daily session consisted of 20 applications of 10-second duration with 30-second intervals between sequences. The patients and raters were blind to condition of stimulation treatment.

Results: The active rTMS led to a statistically significantly higher reduction of the Scale for the Assessment of Negative Symptoms (SANS) total score and of all domains of negative symptoms of schizophrenia. After Bonferroni adjustments for multiple testing, the statistical significance disappeared in alogia only.

Conclusion: High-frequency rTMS stimulation over the left DLPFC at a high stimulation intensity with a sufficient number of applied stimulating pulses may represent an efficient augmentation of antipsychotics in alleviating the negative symptoms of schizophrenia.

□ Brain Topography

Association Between the Basal Ganglia and Large-Scale Brain Networks in Epilepsy.

Rektor I., Tomcik J., **Mikl M.**, **Marecek R.**, **Brázdil M.**, **Rektorová I.**

Research Groups: Multi-modal and Functional Neuroimaging (main author), Behavioural and Social Neuroscience & Applied Neuroscience

Summary: Epilepsy may affect connectivity between the putamen and cortex even during the resting state. Putamen is part of the basal ganglia resting state network (BG-RSN) which is anticorrelated with the default mode network (DMN) in healthy subjects. Therefore, we aimed at studying the functional brain connectivity (FC) of the putamen with the cortical areas engaged in the DMN as well as with the primary somatomotor cortex which is a cortical region engaged in the BG-RSN. We compared the data obtained in patients with epilepsy with that in healthy controls (HC). Functional magnetic resonance imaging (fMRI) was performed in 10 HC and 24 patients with epilepsy: 14 patients with extratemporal epilepsy (PE) and 10 patients with temporal epilepsy (PT). Resting state fMRI data was obtained using the 1.5 T Siemens Symphony scanner. The Group ICA of fMRI Toolbox (GIFT) program was used for independent component analysis. The component representing the DMN was

chosen according to a spatial correlation with a mask typical for DMN. The FC between the putamen and the primary somatomotor cortex was studied to assess the connectivity of the putamen within the BG-RSN. A second-level analysis was calculated to evaluate differences among the groups using SPM software. In patients with epilepsy as compared to HC, the magnitude of anti-correlation between the putamen and brain regions engaged in the DMN was significantly lower. In fact, the correlation changed the connectivity direction from negative in HC to positive in PE and PT. The disturbed FC of the BG in patients with epilepsy as compared with HC was further illustrated by a significant decrease in connectivity between the left/right putamen and the left/right somatomotor cortex, i.e. between regions that are engaged in the BG-RSN. The FC between the putamen and the cortex is disturbed in patients with epilepsy. This may reflect an altered function of the BG in epilepsy.

□ PLOS One

Grey Matter Changes in Cognitively Impaired Parkinson's Disease Patients.

Rektorova I., Biundo R., **Marecek R.**, Weis L., Aarsland D., Antonini A.

Research Groups: Applied Neuroscience (main author) & Multi-modal and Functional Neuroimaging

Background: Cortical changes associated with cognitive decline in Parkinson's disease (PD) are not fully explored and require investigations with established diagnostic classification criteria.

Objective: We used MRI source-based morphometry to evaluate specific differences in grey matter volume patterns across 4 groups of subjects: healthy controls (HC), PD with normal cognition (PD-NC), PD with mild cognitive impairment (MCI-PD)

Methods: We examined 151 consecutive subjects: 25 HC, 75 PD-NC, 29 MCI-PD, and 22 PDD at an Italian and Czech movement disorder centre. Operational diagnostic criteria were applied to classify MCI-PD and PDD. All structural MRI images were processed together in the Czech centre.

The spatial independent component analysis was used to assess group differences of local grey matter volume.

Results: We identified two independent patterns of grey matter volume deviations: a) Reductions in the hippocampus and temporal lobes; b) Decreases in fronto-parietal regions and increases in the midbrain/cerebellum. Both patterns differentiated PDD from all other groups and correlated with visuospatial deficits and letter verbal fluency, respectively. Only the second pattern additionally differentiated PD-NC from HC.

Conclusion: Grey matter changes in PDD involve areas associated with Alzheimer-like pathology while fronto-parietal abnormalities are possibly an early marker of PD cognitive decline. These findings are consistent with a non-linear cognitive progression in PD.

MOLECULAR VETERINARY MEDICINE

☐ Antimicrobial Agents and Chemotherapy

Plasmid-Mediated Quinolone Resistance Genes in Enterobacteriaceae from American Crows: High Prevalence of Bacteria with Variable qnrB Genes.

Halová D., Papousek I., Jamborova I., **Masarikova M.**, **Cizek A.**, Janecko N., **Oravcova V.**, Zurek L., Clark A.B., Townsend A., Ellis J.C., **Literak I.**

Research Group: Molecular Bacteriology

Summary: This study revealed a prevalence of ciprofloxacin-resistant *Enterobacteriaceae* bacteria with PMQR genes in feces of American crows in the USA. The high prevalence may have derived from their close contact with human populations and their anthropogenic sources of food. The potential exposure to antimicrobial

resistant bacteria in crow diets and our results emphasize the importance of crows in the transmission of antibiotic resistant bacteria in the environment. Therefore American crows should be considered as a vector of the resistance genes in the USA.

☐ PLOS One

Long-term monitoring of microsporidia, Cryptosporidium and Giardia infections in western lowland gorillas (Gorilla gorilla gorilla) at different stages of habituation in Dzanga Sangha Protected Areas, Central African Republic.

Sak B., Petrzalkova K.J., Kvetonova D., Mynarova A., Shutt K.A., Pomajbikova K., Kalousova B., **Modry D.**, Benavides J., Todd A., Kvac, M.

Research Group: Parasitology

Summary: To evaluate the impact of close contact with humans on the occurrence of potentially zoonotic protozoists in great apes, we conducted a long-term monitoring of microsporidia, *Cryptosporidium* and *Giardia infections* in western lowland gorillas at different stages of the habituation process, humans, and other wildlife in Dzanga-Sangha Protected Areas in the Central African Republic. As *Giardia intestinalis* was recorded primarily in gorilla groups with closer human contact, we sug-

gest that human-gorilla transmission has occurred. We call attention to a potentially negative impact of habituation on selected pathogens which might occur as a result of the more frequent presence of humans in the vicinity of both gorillas under habituation and habituated gorillas, rather than as a consequence of the close contact with humans, which might be a more traditional assumption.



Please send us your comments and ideas to pavla.vyhankova@ceitec.cz

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