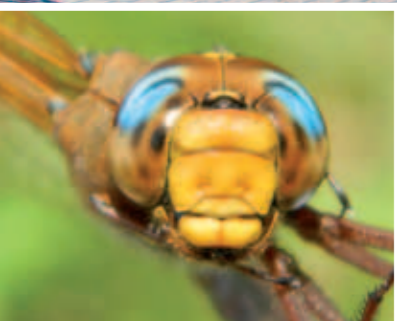




Přírodovědecká
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Faculty
of Science

Jihočeská univerzita
v Českých Budějovicích
University of South Bohemia
in České Budějovice

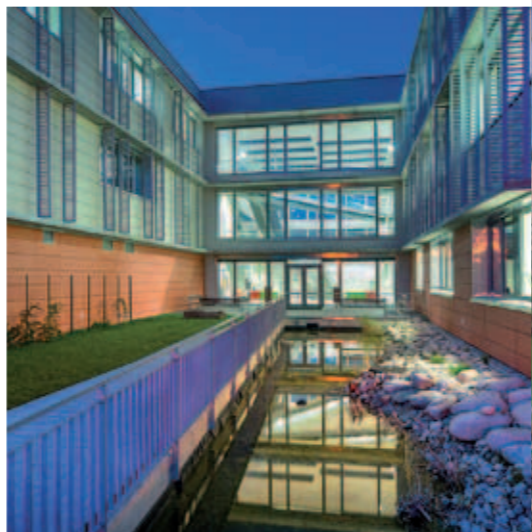


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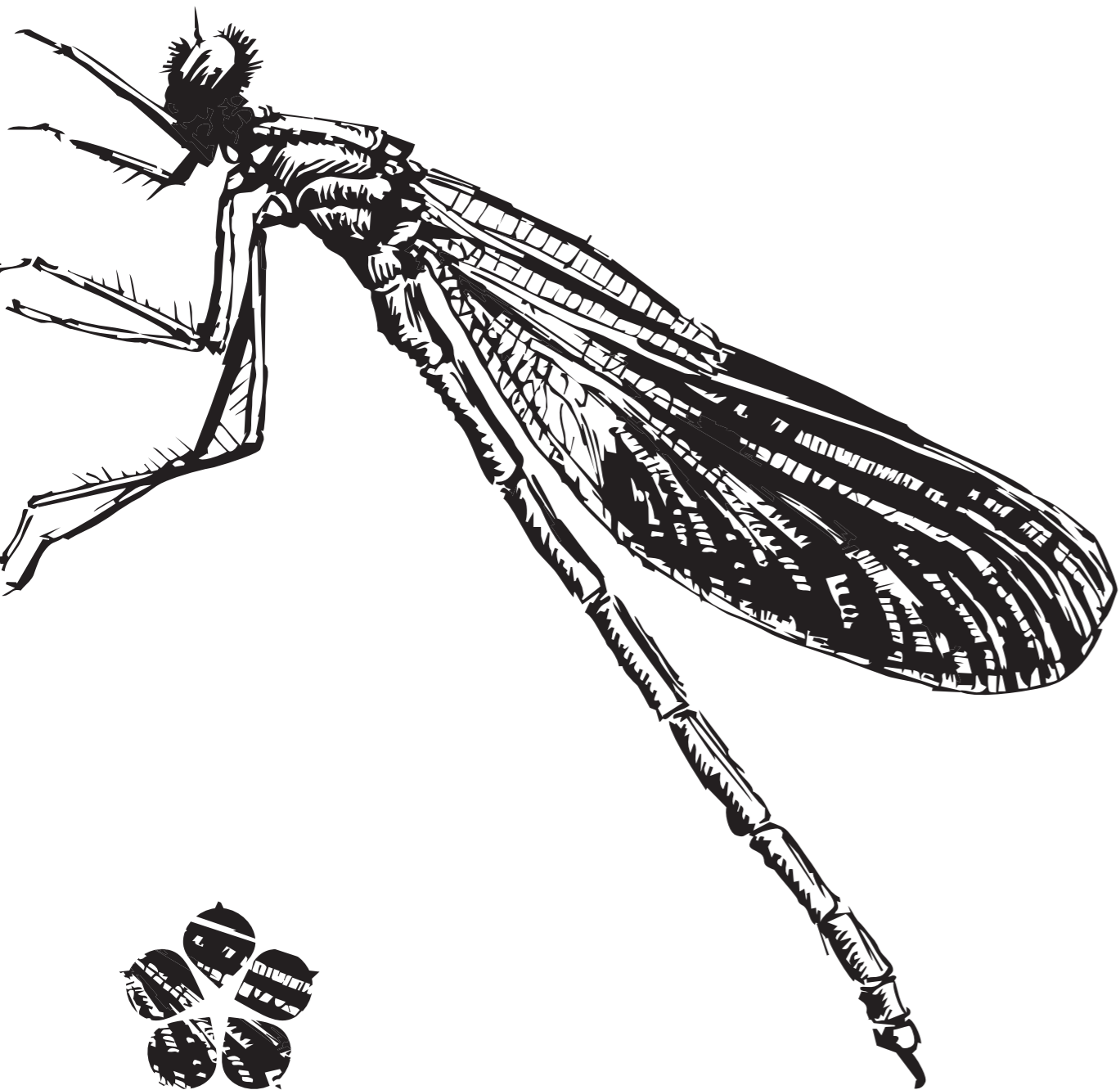
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Research and Doctoral Studies



Faculty of Science

University
of South Bohemia



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THE UNIVERSITY OF SOUTH BOHEMIA

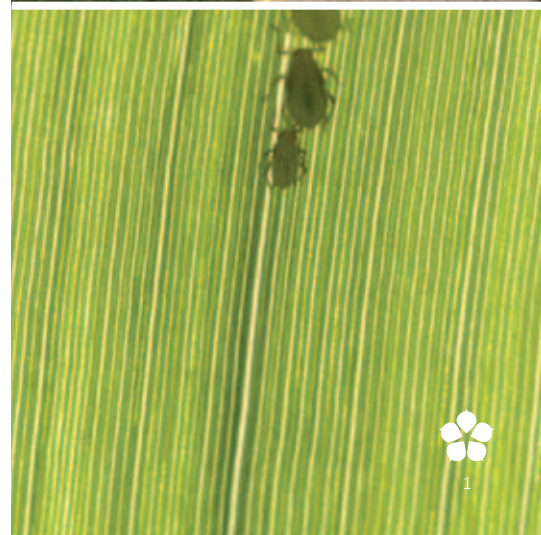
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HISTORY AND CHARACTERISTICS OF THE UNIVERSITY OF SOUTH BOHEMIA

USB is a research university focusing mainly on natural sciences, social sciences, and humanities. A significant aspect of its scientific research activities is close cooperation with the Academy of Sciences of the Czech Republic.

The university comprises eight faculties, which are located in the historical centre of the town and on the university campus on its western edge. The campus also comprises student residences, a Rector's office, academic library and the buildings of the Biology Centre of the Academy of Sciences of the Czech Republic.

Applicants for the Bachelor's, Master's, and Doctoral degrees may choose from 220 majors with a range of further specializations. The study of 24 majors is conducted in English and 3 in German. All faculties and

institutes provide PhD study programmes in chosen fields of study and the majority of them have the right to name professors and associate professors. The university participates in the Erasmus+ programmes KA01 and KA02 and uses other grant programmes i.e. Aktion, EEA/Norway Funds, AIA – government scholarships, CEEPUS, DAAD, Visegrad Fund, Fulbright Commission, and other programmes concerning international cooperation in research, development and innovation. In 2007 the first cross-border common study programme, Biological Chemistry, was initiated with the Johannes Kepler University of Linz, Austria.

Nowadays the university offers 8 double or joint degree programmes - 3 Bachelor's and 5 Master's. These programmes have been accredited at the Faculty of Philosophy, Education, Science and Faculty of Health and

Social Studies. The other Faculties (Economics, Theology, Agriculture, Fisheries and Protection of Waters) have not accredited their double/joint degree programmes yet but at a number of them the accreditation process is already in progress. The university is the Local Contact Point for the EURAXESS Czech Services Centre: Researchers in Motion, which provides foreign scientists with help and advice for arranging stays in the Czech Republic.

The dormitories hold 2,300 places. All rooms (mostly double rooms) are connected to the academic computer network and the Internet. There is a modern cafeteria located on campus which has several branches in the town to cater for students with lectures there. Sports facilities include gyms, an athletics stadium, and basketball, volleyball, and tennis courts.

BASIC INFORMATION ABOUT THE UNIVERSITY

The University of South Bohemia, founded in 1991, is a public educational and research institution of the university type, with eight faculties offering a selection of tertiary education programmes.

It is located in the regional centre of South Bohemia, the town of České Budějovice (population approx. 100 000), about 150 km south of Prague.

The town was established in the thirteenth century as a "King's town" by the Czech King Přemysl Otakar II at the confluence of the rivers Vltava and Malše.

Rector's Office

Branišovská 31a, CZ-370 05 České Budějovice, Czech Republic

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Professor **Miroslav Papáček** (*Vice-Rector, Education and Student Affairs*), prorektor-studium@jcu.cz

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Professor **Michal Bauer** (*Vice-Rector, Academic Affairs*), prorektor-akademicke@jcu.cz

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FACULTIES



FACULTY OF AGRICULTURE

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FACULTY OF ECONOMICS

Dean: Associate Professor Ladislav Rolínek
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<http://www.ef.jcu.cz>



FACULTY OF EDUCATION

Dean: Doctor Michal Vančura
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FACULTY OF FISHERIES AND PROTECTION OF WATERS

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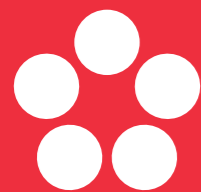
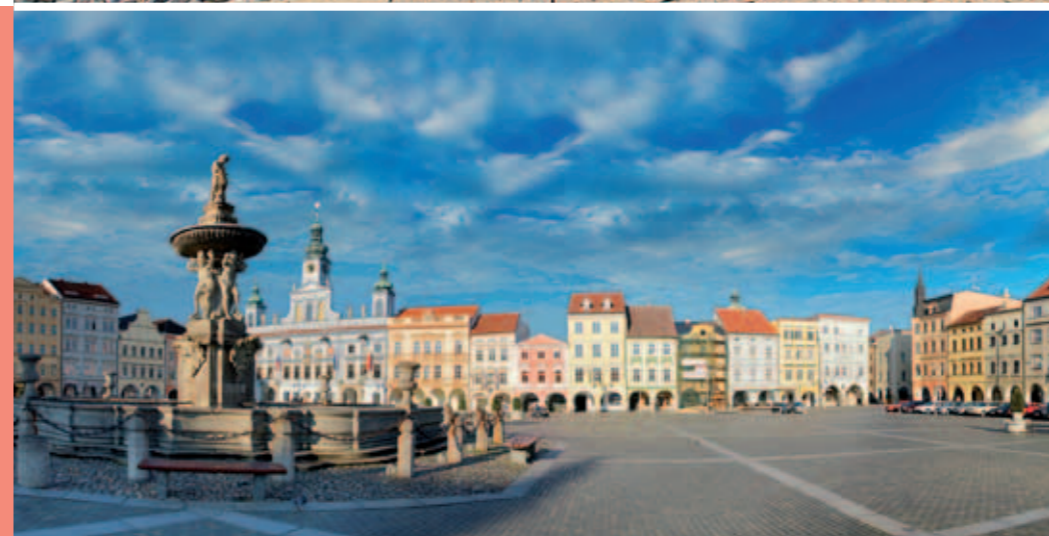
FACULTY OF SCIENCE

Dean: Professor František Vácha
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FACULTY OF THEOLOGY

Dean: Associate Professor Tomáš Machula
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<http://www.tf.jcu.cz>



Number
of students

12,013

Total
number
of staff

1,898

BASIC INFORMATION ON THE FACULTY OF SCIENCE

Ph.D. programme	Chair of the specialist board	Contact	Co-operating institutions	Guaranteeing department
Botany	Dr. Jan Kučera	+420 387 772 384 kucera@prf.jcu.cz	Institute of Botany AS CR	Department of Botany
Zoology	Assoc. Prof. František Sedláček	+420 387 772 258 fsedlac@prf.jcu.cz	Biology Centre of AS CR, Institute of Vertebrate Biology AS CR, Institute of Animal Physiology and Genetics AS CR	Department of Zoology
Entomology	Assoc. Prof. Oldřich Nedvěd	+420 387 772 253 nedved@prf.jcu.cz	Biology Centre of AS CR	Department of Zoology
Ecosystem Biology	Prof. Hana Šantrůčková	+420 387 772 361 hasan@prf.jcu.cz	Biology Centre of AS CR	Department of Ecosystem Biology
Hydrobiology	Prof. Jaroslav Vrba	+420 387 775 873 jaroslav.vrba@prf.jcu.cz	Biology Centre of AS CR, Institute of Microbiology AS CR	Department of Ecosystem Biology
Molecular and Cell Biology and Genetics	Prof. Miroslav Oborník	+420 387 775 428 obornik@paru.cas.cz	Biology Centre of AS CR, Institute of Animal Physiology and Genetics AS CR	Department of Genetics and Department of Molecular biology
Parasitology	Assoc. Prof. Oleg Ditrich	+420 387 775 420 oleg@paru.cas.cz	Biology Centre of AS CR	Department of Parasitology
Physiology and Developmental Biology – Animal or Plant Specialization	Prof. Dalibor Kodrík, Assoc. Prof. Jiří Šantrůček	+420 387 775 271 kodrik@entu.cas.cz +420 387 772 353 jsan@umbr.cas.cz	Biology Centre of AS CR, Institute of Microbiology AS CR	Department of Animal Physiology and Department of Plant Physiology
Biophysics	Prof. Tomáš Polívka	+420 387 776 259 tpolivka@jcu.cz	Biology Centre of AS CR, Global Change Research Centre AS CR	Institute of Physics and Biophysics
Infection biology	Prof. Jan Kopecký	+420 387 776 274 jan@paru.cas.cz	Biology Centre of AS CR	Department of Medical Biology

OTHER DEPARTMENTS AND INSTITUTES AT FS:

- Institute of Chemistry and Biochemistry
- Institute of Mathematics and Biomathematics
- Institute of Applied Informatics

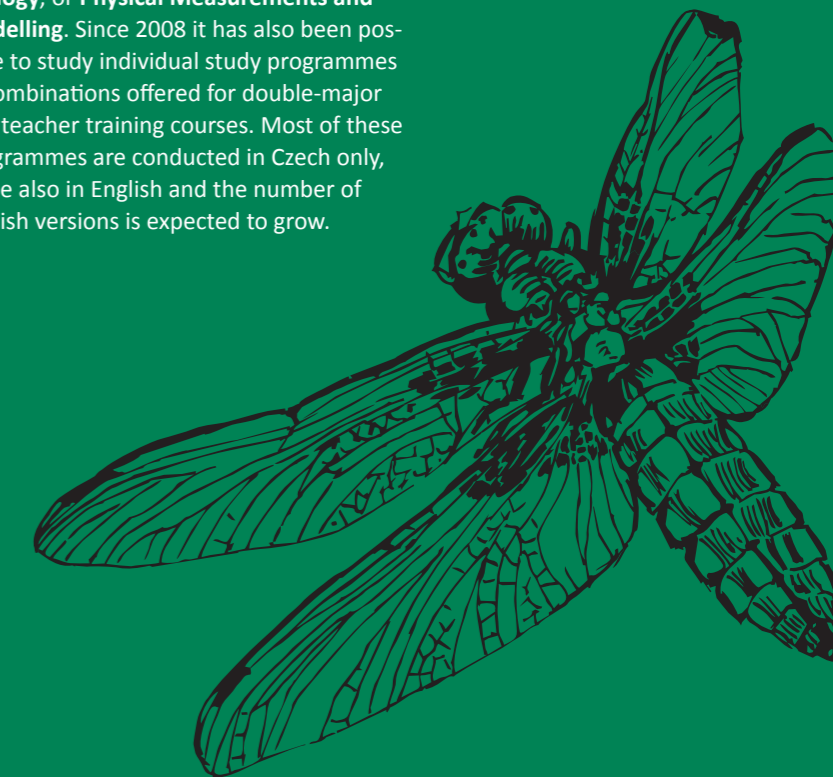
The Faculty of Science is a successor of the Faculty of Biological Sciences founded in 1991. FS offers undergraduate, graduate and post-graduate study in an array of biological disciplines, and since 2007 has extended to include several other fields of science (chemistry, physics, mathematics, informatics).

The three-year Bachelor's Programmes supply students with the basic knowledge necessary either for subsequent Master's studies or for practical professional employment. Students choose from either the **Introductory Biology Programme** (preparation for further studies in Biology or Biology for future teachers), **Biophysics, Chemistry and Chemistry for future teachers, Applied Mathematics, Mathematics for future teachers, Physics and Physics for future teachers, Measuring and Computer Technology** or from the professionally orientated programmes, – **Ecology and Environmental Care, Biomedical Laboratory Techniques, Mechatronics or Applied Informatics**. These programmes are conducted in the Czech language only, although the students are required to achieve a knowledge of English sufficient to allow them to study from English textbooks. In addition to the study programmes conducted in Czech, the Faculty of Science offers the elite Bachelor's programmes of **Biological Chemistry** and **Bioinformatics** running in English.

These study programmes are carried out within a bilateral cross-border collaboration between the Johannes Kepler University in Linz (Austria) and the Faculty of Science of the University of South Bohemia in České Budějovice.

The Master's programmes are open to any student who has successfully finished a Bachelor's programme in biology or related fields at any university. Applicants are accepted on a competitive basis, depending on their results in the admission examination. They may enter different study fields – **Applied Informatics, Biological Chemistry, Biophysics, Botany, Clinical Biology, Ecology, Experimental Biology, Environmental Chemistry, Parasitology, Zoology, or Physical Measurements and Modelling**. Since 2008 it has also been possible to study individual study programmes in combinations offered for double-major and teacher training courses. Most of these programmes are conducted in Czech only, some also in English and the number of English versions is expected to grow.

Students gain more theoretical knowledge in their field of specialization and also produce a diploma thesis which should result in a paper to be published in the appropriate regular international scientific journal. Due to the growing interest in exchange programmes for students (such as Socrates/Erasmus) in Europe or even further afield, the programmes offer a set of half-year courses with a number of interconnected topics to foreign students. The Doctoral level may be of particular interest to foreign students. The Ph.D. study fields are shown in the table and more details on individual programmes are provided on the pages indicated.



DEPARTMENT OF BOTANY

- > <http://botanika.prf.jcu.cz/english>
- > **Assoc. Prof. Jan Kaštovský**
- > hany@prf.jcu.cz

Research and education activities

The Department of Botany is responsible for the Botany Master's and Doctoral programmes. The research covers all fields of botany, including taxonomy and the ecology of plants, and also mycology. The main research topics include:

PLANT SYSTEMATICS

The plant systematics group focuses on the microevolution process (particularly the study of hybridization, polyploid and cryptic speciation), and the ecological differentiation of populations and phylogeography of vascular plants, bryophytes and lichens, using both molecular and conventional methods.

PHYCOLOGY

Phylogenetic relationships of Cyanobacteria and various groups of algae are studied using a polyphasic approach – combined approach using classical methods of optical microscopy, electron microscopy and molecular data. Moreover, we focus on the ecological role of algae and Cyanobacteria in extreme environments in tropical and polar biotopes.

PLANT ECOLOGY AND VEGETATION SCIENCE

In this field the ecology of individuals, populations, and communities, and vegetation on the landscape scale are studied. Individual working groups investigate the ecology of hemiparasitic plants and their

interactions with their hosts, species coexistence in plant communities and the effects of species diversity and ecological invasions. Special attention is paid to methods of (multivariate) data analysis and modelling. Long term research is devoted to vegetation dynamics, especially succession, and its exploitation in restoration ecology. Research is also focused on linking plant functional traits with species adaptations in extreme alpine and arctic conditions and plant responses to land use changes in central European species-rich meadows.

ARCHEOBOTANY

The laboratory of archeobotany and palaeoecology (LAPE) deals with the analysis of large scale plant micro and macro remains, for example pollen, seeds, diatoms, charcoal, and wood from archaeological sites as well as natural and seminatural sediments. The laboratory's research programme is concentrated on the postglacial period in Central Europe.



Example of results

PUBLICATIONS:

ALTMAN J., FIBICH P., DOLEZAL J. AND AAKALA T. (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. *Dendrochronologia* 32(2): 107-112.

CANTONATI M., KOMAREK J., HERNANDEZ-MARINE M. ET AL. (2014) New and poorly known coccoid species (Cyanoprokaryota) from the mid-depth and deep epilithon of a carbonate mountain lake. *Freshwater Science* 33(2): 548-556.

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HAUER T., BOHUNICKÁ M., JOHANSEN J.R., MAREŠ J. AND BERRENDERO-GOMEZ E. (2014) Reassessment of the cyanobacterial family Microchaetaceae and establishment of new families Tolypothrichaceae and Godleyaceae. *Journal of Phycology* 50: 1089-1100.

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KAŠTOVSKÝ J., BERRENDERO E.G., HLADIL J. AND JOHANSEN J.R. (2014) *Cyanocohniella calida* gen. et sp. nov. (Cyanobacteria: Aphanizomenonaceae) a new cyanobacterium from the thermal springs from Karlovy Vary, Czech Republic. *Phytotaxa* 181(5): 279-292.

KOLÁŘ F., DORTOVÁ M., LEPŠ J., POUZAR M., KREJČOVÁ A. AND ŠTECH, M. (2014) Serpentine ecotypic differentiation in a polyploid plant complex: shared tolerance to Mg and Ni stress among di- and tetraploid serpentine populations of *Knautia arvensis* (Dipsacaceae). *Plant and Soil*, 374(1-2): 435-447.

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LE BAGOUSSE-PINGUET Y., DE BELLO F., VANDEWALLE M., LEPŠ J. AND SYKES M.T. (2014) Species richness of limestone grasslands increases with trait overlap: evidence from within- and between-species functional diversity partitioning. *Journal of Ecology* 102(2): 466-474.

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MANUKJANOVA A., KUČERA J. AND ŠTECHOVÁ T. (2014) Drought survival test of eight fen moss species. *Cryptogamie, Bryologie* 35(4): 397-403.

MAREŠ J., HÁJEK J., URAJOVÁ P., KOPECKÝ J. AND HROUZEK P. (2014) A Hybrid Non-Ribosomal peptide/Polyketide Synthetase Containing Fatty-Acyl Ligase (FAAL) Synthesizes the β -Amino Fatty Acid Lipopeptides Puwainaphycins in the Cyanobacterium *Cylindrospermum alatosporum*. *PLoS ONE* 9(11).

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PRACH K., ŘEHOUNKOVÁ K., LENCOVÁ K., JÍROVÁ A., KONVALINKOVÁ P., MUDRÁK O., ŠTUDENT V., VANĚČEK Z., TICH L., PETŘÍK P., ŠMILAUER P. AND PYŠEK P. (2014) Vegetation succession in restoration of disturbed sites in Central Europe: the direction of succession and species richness across 19 seres. *Applied Vegetation Science* 17: 193-200.

PRACH K., JONGEPIEROVÁ I., ŘEHOUNKOVÁ K. AND FAJMON K. (2014) Restoration of grasslands on ex-arable land using regional and commercial seed mixtures and spontaneous succession: Successional trajectories and changes in species richness. *Agric. Ecosyst. Environ.* 182(1): 131-136.

PRACH K., PYŠEK P. AND ŘEHOUNKOVÁ K. (2014) Role of substrate and landscape context in early succession: An experimental approach. *Perspectives in Plant Ecol. Evol. and Systematics* 16(4): 174-179.

ŠMILAUER P. AND LEPŠ J. (2014) *Multivariate Analysis of Ecological Data Using CANOCO 5*. Cambridge University Press.

PH.D. THESES:

KOŠNAR J. (2014) Taxonomic study of the Eurasian taxa of *Tortula muralis* (Pottiaceae, Musci) complex.

BEŠTA T. (2014) Diatom analysis of the Late Quaternary sediments from the area of the Czech Republic.

ALTMAN J. (2014) Tree ring construction of forest disturbances: evaluation of methods and past changes on forest dynamics.

RYCHTECKÁ T. (2014) Biodiversity-functioning studies in grasslands: their design, analysis and the importance of realized diversity.

TĚŠITELOVÁ T. (2014) Ecological and evolutionary consequences of orchid dependence on mycorrhizal fungi.

VESELÁ J. (2014) Diatoms of Acadia national park, Maine, USA, with a detailed account on taxonomy and morphology of several remarkable species.

DVORSKÝ M. (2014) Ecology of alpine plants in NW Himalaya.



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Research and education activities

The Department of Zoology is responsible for the Zoology and Entomology Master's and Doctoral programmes. The Ph. D. programmes are designed to provide students with a thorough overview of biology, ecology and the evolution of animals, and with a good knowledge of modern zoological methodology. The studies are focused on animal phylogeny, ecology and the behavior of fish, birds, mammals, and insects, and animal population ecology. The main areas of focus are listed below:

ANIMAL PHYLOGENY

Phylogenetic relationships are studied using molecular as well as morphological data within various groups of animals. Based on the results of phylogenetic analyzes a range of questions is addressed, such as the origin and role of sociality, evolution of behavior, body size, etc.

ECOLOGY OF PLANT-INSECT INTERACTIONS IN TROPICAL RAINFORESTS

The study of plant-insect food webs in tropical rainforests focuses on the ecological and evolutionary determinants of biodiversity and community structure. We have established a solid logistical base in Papua New Guinea, providing access to tropical ecosystems and have active study sites also in Panama, Cameroon, and Thailand.

NATURAL HISTORY AND EVOLUTION OF TROPICAL FISHES

We study biodiversity, ecology, evolution and biogeography in South and Middle America using fish (focusing on cichlids) as our model group. Phylogenetic analyses form the backbone of our research. New species are routinely being discovered and described. The department's laboratory is fully equipped for the up-to-date phylogenomic methods based on NGS technologies, like ddRAD sequencing.

COGNITIVE ETHOLOGY OF BIRDS

Passerine birds are tested for their ability to distinguish relevant optic patterns and situations coding information on food quality and availability or predation risk. The acoustic information channel is studied using original or modified playbacks.

BEHAVIOURAL ECOLOGY AND REPRODUCTIVE STRATEGY OF BIRDS

Using various field (radio-telemetry, bioacoustics, food analysis, focal observation) as well as laboratory (molecular, endocrinological, physiological) methods we address a wide range of questions from ecology and the reproductive biology of birds. Our research interest is focused on behavioural ecology, especially the influence of food availability on feeding tactics, qualitative and quantitative differential investment in male and female offspring in relation to maternal state, mate choice, and alternative reproductive strategies.

BIOLOGY AND ECOLOGY OF SUBTERRANEAN RODENTS

Rodents are sampled across a large part of Central and Eastern Africa in order to study their molecular taxonomy and phylogeny and to reveal the influences of historical geomorphological processes and climatic events on their diversity. Other studies are focused on the ecology, behavior, and physiology of African mole-rats and ecologically similar rodents.

BEHAVIORAL ECOLOGY OF MAMMALS

In terrestrial rodents – voles – the behavioral variation called animal personality is analyzed. Its modulation during postnatal development is studied under laboratory conditions as well as in free living animals. For verification of observed behavioral traits (bold-shy), correlations to physiological stress parameters are tested. Knowledge of personality is used in study of cognitive abilities in voles e.g. during navigation.



Example of results

PUBLICATIONS:

- NĚMEC, M. ET AL. (2015)** Surface texture plays important role in predator recognition by Red-backed Shrikes in field experiment. *Animal Cognition*, 2015, vol. 18, iss. 1, pp. 259–268.
- FORISTER M.L., NOVOTNY V., PANORSKA A.K., BAJE L., BASSET Y., BUTTERILL P.T., CIZEK L., COLEY P.D., DEM F., DINIZ I. R., DROZD P., FOX M., GLASSMIRE A., HAZEN R., HRCEK J., JAHNER J.P., KAMAN O., KOZUBOWSKI T.J., KURSAR T A., LEWIS O.T., LILL J., MARQUIS R.J., MILLER S.E., MORAIS H.C., MURAKAMI M., NICKEL H., PARDIKES N., RICKLEFS R.E., SINGER M.S., SMILANICH A.M., STIREMAN J.O., VILLAMARÍN-CORTEZ S., VODKA S., VOLF M., WAGNER D.L., WALLA T., WEIBLEN G.D. AND DYER L.A. (2015)** The global distribution of diet breadth in insect herbivores. *PNAS* 112: 442-447.
- PAVELKOVÁ - ŘIČÁNKOVÁ V., ROBOVSKÝ J. AND RIEGERT J. (2014)** Ecological structure of Recent and Last Glacial mammalian faunas in Northern Eurasia: the case of Altai-Sayan refugium. *PLoS ONE* 9(1): e85056. doi:10.1371/journal.pone.0085056
- RIEGER J., ANTCZAK M., FAINOVÁ D. AND BLAŽKOVÁ P. (2014)** Group display in the socially monogamous Northern Double-collared Sunbird (*Cinnyris reichenowi*). *Behavioural Processes* 103: 138-144.

POHLOVÁ L., SCHEPSKY P., LEHMANN T., HOCHKIRCH A., MASOPUSTOVÁ R., ŠIMEK J., SCHOO W., VODIČKA R. AND ROBOVSKÝ J. (2014) Defining management units for European captive aardvarks. *Zoo Biology* 33: 433-439.

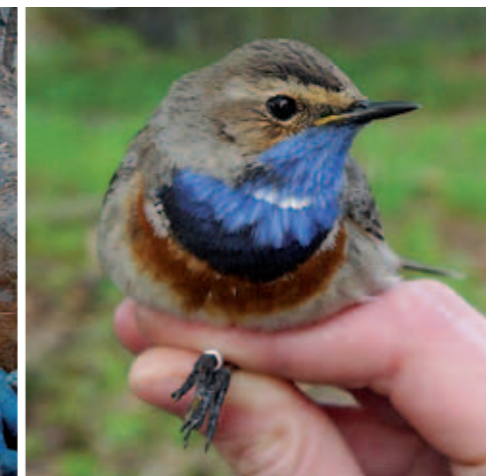
DUDA P. AND ZRZAVÝ J. (2013) Phylogeny, life history and behavior in the Hominoidea: towards phylogenetic reconstruction of the chimpanzee-human last common ancestor. *J. Hum Evol* 65: 424–446.

ŘIČAN O., PIÁLEK L., ZARDOYA R., DOADRIO I. AND ZRZAVÝ J. (2013) Biogeography of the Mesoamerican Cichlidae (Teleostei: Heroini): colonization through the GAARlandia land bridge and early diversification. *J. Biogeogr.* 40: 579-593.

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MACHAČ, A., ZRZAVÝ, J. AND STORCH, D. (2012) Range Size Heritability in Carnivora Is Driven by Geographic Constraints. *American Naturalist* 177: 767-779.

MACHAČ A., ZRZAVÝ J., SMRČKOVA J. AND STORCH D. (2012) Temperature-dependence of evolutionary diversification: differences between two contrasting model taxa support the metabolic theory of ecology. *J. Evol. Biol.* 25: 2449-2456.



NOVOTNÝ V., MILLER S. E., HRČEK J., BAJE L., BASSET Y., LEWIS O.T., STEWART A.J.A. AND WEIBLEN G.D. (2012) Insects on Plants: Explaining the Paradox of Low Diversity within Specialist Herbivore Guilds. *American Naturalist* 179: 351-362.

PIÁLEK L., ŘIČAN O., CASCIOTTA J., ALMIRON A. AND ZRZAVÝ J. (2012) Multilocus phylogeny of *Crenicichla* (Teleostei: Cichlidae), with biogeography of the *C. lacustris* group: Species flocks as a model for sympatric speciation in revers. *Molecular Phylogenetics and Evolution* 62: 46-61.

ROY H.E., ADRIAENS T., ISAAC N.J.B., KENIS M., ONKELINX T., SAN MARTIN G., BROWN P.M. J., HAUTIER L., POLAND R., ROY D.B., COMONT R., ESCHEN R., FROST R., ZINDEL R., VAN VLAENDEREN J., NEDVĚD O., RAVN H.P., GREGOIRE J. C., DE BISEAU J. C. AND MAES D. (2012) Invasive alien predator causes rapid declines of native European ladybirds. *Diversity and Distributions* 18: 717-725.

P.H.D. THESES:

- ČTVRTEČKA R. (2015)** Host specificity and species diversity in communities of frugivorous insect in lowland rain forest of Papua New Guinea.
- OKROUHLÍK J. (2014)** Mammalian energetic savings in subterranean environment the case of African mole-rats.
- LINHART P. (2014)** Songbased rival assessment in songbirds.
- TVARDÍKOVÁ K. (2013)** Trophic relationships between insectivorous birds and insect in Papua New Guinea.
- VLAŠÁNEK P. (2013)** Population structure and dispersal of butterflies in tropical rain forests of Papua New Guinea.
- PIÁLEK L. (2013)** Species diversity and speciation mechanisms in *Crenicichla* (Neotropical cichlids).
- HROUZKOVÁ E. (2012)** Vibrational communication of subterranean rodents.

DEPARTMENT OF ECOSYSTEM BIOLOGY

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Research and education activities

The Department of Ecosystem Biology is responsible for the Environmental Ecology Bachelor's programme, the Ecosystem Biology Master's and Doctoral programmes, and the Hydrology Doctoral programme. Within the scope of the Ecosystem Biology programme, students can choose one of five specializations: Theoretical Ecology, Conservation Biology, Applied Ecology, Hydrology and Soil Biology. Our faculty is the only one in the Czech Republic that offers a study programme focused on soil biology in the ecosystem context. The research covers both terrestrial and aquatic ecosystem studies, the catchment-lake approach, the ecology of aquatic and soil organisms, microbial ecology, processes in soil, and studies of aquatic and wetland ecosystems disturbed by human activity. It employs advanced molecular techniques, short-term laboratory and mesocosm experiments on model organisms, long-term site-based field observations, mathematical modelling and the use of remote sensing in ecology:

HYDROBIOLOGY

The research focuses on carbon and nutrient fluxes, aquatic microbial ecology, biotic interactions in aquatic food webs, community ecology of zooplankton, aquatic insects and fish, evolutionary ecology of aquatic invertebrates, and modelling. Case studies focus on man-made reservoirs, acidified headwater lakes and small standing fishless waters.

ECOSYSTEM BIOLOGY

The research deals with carbon, nitrogen, and phosphorus fluxes and transformations in wetland, forest, and pasture ecosystems with a focus on plant-soil interactions, primary production, C and nutrient transformations in soil and the composition of soil microbial communities. The experimental data are used in the detection of forest disturbances and their subsequent regeneration using remote sensing. Conservation biology focuses on the ecology and management of endangered species, using orchids as a model group.



Example of results

PUBLICATIONS:

KAŠTOVSKÁ E., EDWARDS K.R., PICEK T. AND ŠANTRŮČKOVÁ H. (2015) A larger investment into exudation by competitive versus conservative plants is connected to more coupled plant-microbe N cycling. *Biogeochemistry* 122: 47-59.

SIROVÁ D., ŠANTRŮČEK J., ADAMEC L., BÁRTA J., BOROVEC J., PECH J., OWENS S.M., SCHÄUFELE R., STORCHOVÁ H. AND VRBA, J. (2014) Dinitrogen fixation associated with shoots of aquatic carnivorous plants: is it ecologically important? *Annals of Botany* 114: 125-133.

ŠÍMEK K., NEDOMA J., ZNACHOR P., KASALICKÝ V., JEZBERAJ, HORŇÁK, K. AND SEĎA J. (2014) A finely tuned symphony of factors modulates the microbial food web of a freshwater reservoir in spring. *Limnology and Oceanography* 59: 1477-1492.

ŠMILAUER P. AND LEPŠ, J. (2014) *Multivariate Analysis of Ecological Data using Canoco 5*, Cambridge University Press.

VRBA J., KOPÁČEK J., FOTT J. AND NEDBALOVÁ L. (2014) Forest die-back modified plankton recovery from acidic stress. *AMBIO* 43: 207-217.

KLEČKA J. AND BOUKAL D.S. (2013) Foraging and vulnerability traits modify predator-prey body mass allometry: freshwater macroinvertebrates as a case study. *Journal of Animal Ecology* 82: 1031-1041.

ÖZEN A., ŠORF M., TROCHINE C., LIBORIUSSEN L., BEKLIOGLU M., SØNDERGAARD M., LAURIDSEN T.L., JOHANSSON L. S. AND JEPPESEN E. (2013) Long-term effects of warming and nutrients on microbes and other plankton in mesocosms. *Freshwater Biology* 58: 483-493.

VAŠEK M., PRCHALOVÁ M., PETERKA J., KETELAARS H.A.M., WAGENVOORT A.J., ČECH M., DRAŠTÍK V., ŘÍHA M., JŮZA T., KRATOCHVÍL M., MRKVIČKA T., BLABLIL P., BOUKAL D.S., DURAS J. AND KUBEČKA J. (2013) The utility of predatory fish in biomanipulation of deep reservoirs. *Ecological Engineering* 52: 104-111.

JERSÁKOVÁ J., JÜRGENS A., ŠMILAUER P. AND JOHNSON S. D. (2012) The evolution of floral mimicry: identifying traits that visually attract pollinators. *Functional Ecology* 26: 1381-1389.

KADLECOVÁ V., DRAMSTAD W.E., SEMANČÍKOVÁ E. AND EDWARDS K.R. (2012) Landscape changes and their influence on the heterogeneity of landscape of the South Bohemian Region, the Czech Republic. *International Journal of Sustainable Development and World Ecology* 19: 546 - 556.

P.H.D. THESES:

RYCHTECKÝ P. (2014) Application of modern fluorescence techniques in studying growth, viability and phosphatase production of phytoplankton.

ŠORF M. (2014) The impact of fish and planktonic invertebrate predation on zooplankton in experimental mesocosms.

VANÍČKOVÁ I. (2013) The dynamics of sexual reproduction and ephyppia production of *Daphnia* in reservoirs.

KRATOCHVÍL M. (2013) Spatio-temporal distribution and feeding of age 0+ fish in different reservoir habitats.

KROLOVÁ M. (2013) Factors affecting the occurrence of littoral vegetation in a reservoir with storage function.

TUŠER M. (2013) Fish detection with modern sonar systems.

KLEČKA J. (2013) The role of species traits in predator-prey interactions and food web structure.



DEPARTMENT OF GENETICS

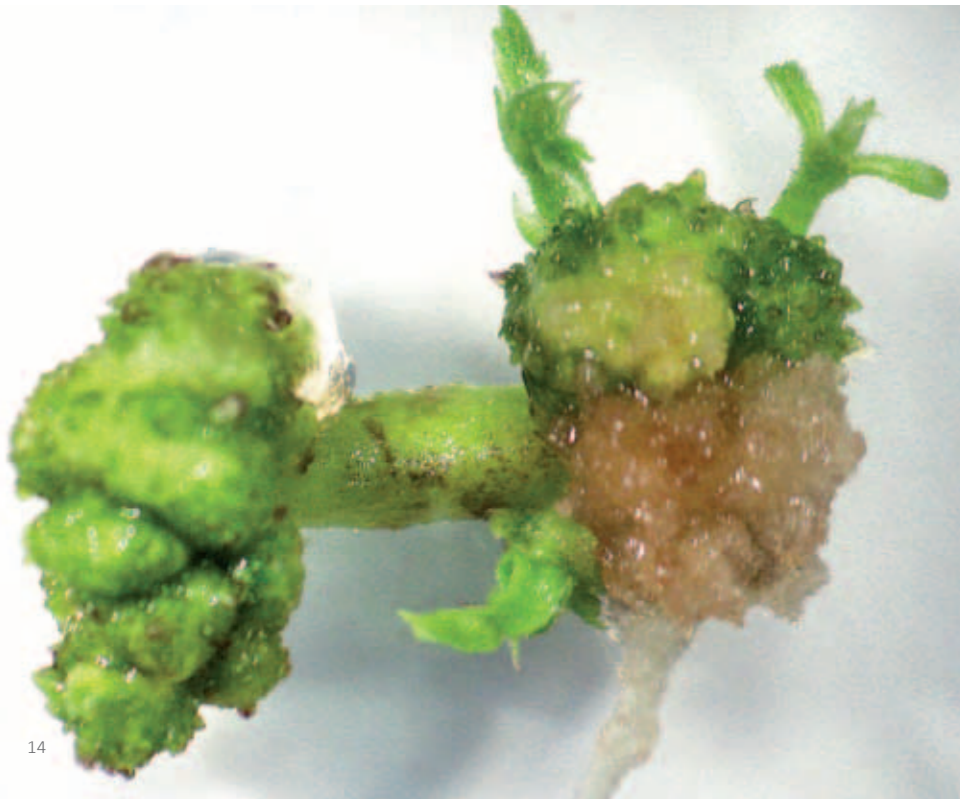
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Research and education activities

The Department of Genetics is responsible for the Experimental Biology Master's programme (specialization Genetics and Genetic Engineering) and for the Molecular, and Cell Biology, and Genetics Doctoral programmes. Its research activities include the genetic engineering of plants, molecular genetics and the diagnosis of plant viruses, viroids, and phytoplasmas, and the molecular cytogenetics and population genetics of insects.

GENETIC ENGINEERING OF PLANTS

A few members of the department have had a long involvement in work on plant transgenesis. At present we focus on the development of transgenic lines in hop showing high activity of hop transcription factors involved in biosynthesis of bitter acids and medicinal prenylchalcones. At the same time we aim at construction of widely thermotolerant photoautotrophic organisms for biotechnological applications by the introduction of mutated psbA gene into plastid DNA.



MOLECULAR GENETICS AND DIAGNOSIS OF PLANT PATHOGENES

The topics of research are the functional genomics of hop, the analysis of plant transcriptional factors in relation to metabolome regulation and the analysis of the mechanism of gene silencing in relation to viroid propagation and pathogenesis. Research on plant nucleases, namely their function and potential utilization in medicine as an anticancer agent, is also conducted. Concerning plant pathogens, the research is focused on the diseases of brassicas, legumes, small fruit and fruit trees that are difficult to diagnose, and the development of molecular diagnostics, including those based on microarrays.

MOLECULAR CYTOGENETICS AND EVOLUTIONARY GENETICS OF INSECTS

Cytogenetic research is focused on W and Z sex chromosomes of moths and butterflies (Lepidoptera) with the aim to clarify the evolutionary history of lepidopteran sex chromosomes and their role in adaptive radiation. In evolutionary genetics, research is done in several areas and on a variety of organisms, mainly insects and entomopathogenic nematodes. Molecular evolution of genes and gene families related to the life-style is investigated; molecular markers are applied for the population genetics of natural populations and whole mitogenomes are used to resolve taxonomic problems and phylogenetic questions.

Example of results

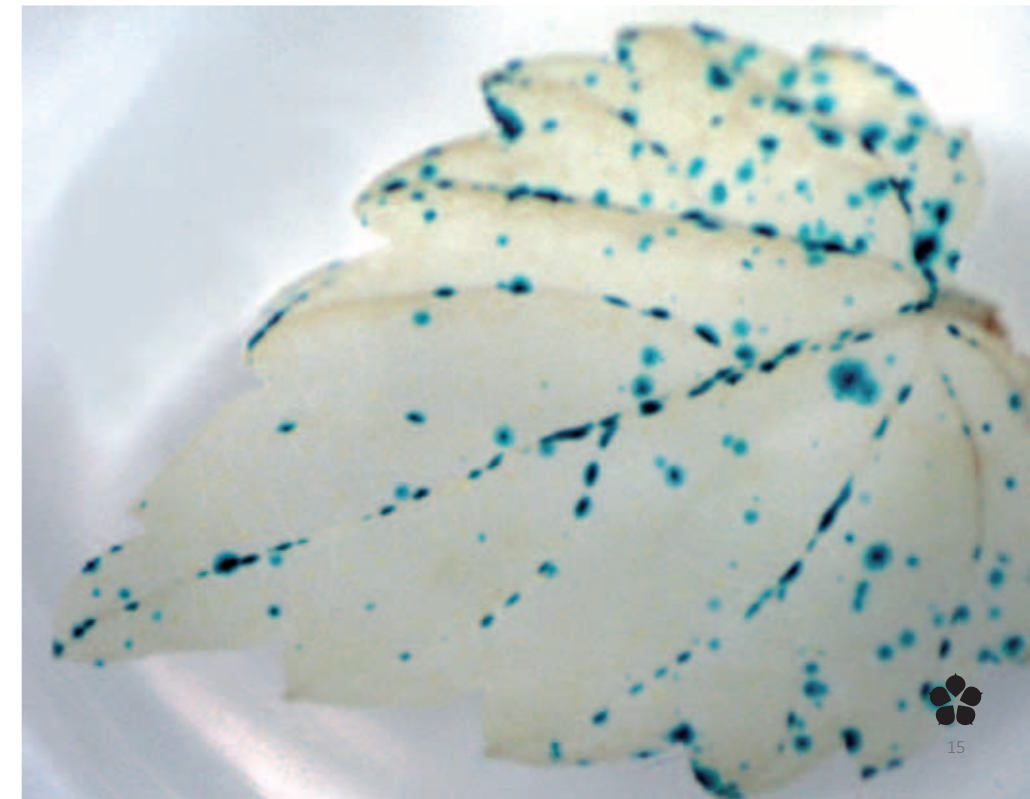
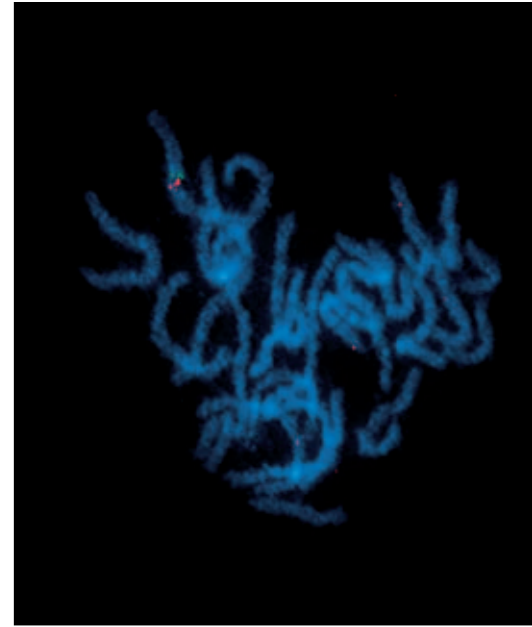
PUBLICATIONS:

- CARABAJAL PALADINO L.Z., NGUYEN P., ŠÍCHOVÁ J. AND MAREC F. (2014) Mapping of single-copy genes by TSA-FISH in the codling moth, *Cydia pomonella*. *BMC Genetics* 15 (Suppl. 2): S15.
- KORANDOVÁ M., KRŮČEK T., VRBOVÁ K. AND FRYDRYCHOVÁ R. (2014) Distribution of TTAGG-specific telomerase activity in insects. *Chromosome Research* 22: 495-503.
- BŘÍZA J., PAVINGEROVÁ D., VLASÁK J. AND NIEDERMEIEROVÁ H. (2013) Norway spruce (*Picea abies*) genetic transformation with modified Cry3A gene of *Bacillus thuringiensis*. *Acta Biochimica Polonica* 60: 395-400.
- TAKASU Y., SAJWAN S., DAIMON T., OSANAI-FUTAHASHI M., UCHINO K., SEZUTSU H., TAMURA T. AND ŽUROVEC M. (2013) Efficient TALEN construction for *Bombyx mori* gene targeting. *PLoS One* 8: 9.
- FÜSSY Z., PATZAK J., STEHLÍK J. AND MATOUŠEK J. (2013) Imbalance in expression of hop (*Humulus lupulus*) chalcone synthase H1 and its regulators during hop stunt viroid pathogenesis. *Journal of Plant Physiology* 170: 688-695.
- NGUYEN P., SÝKOROVÁ M., ŠÍCHOVÁ J., KŮTA V., DALÍKOVÁ M., FRYDRYCHOVÁ R., NEVEN L., SAHARA K. AND MAREC F. (2013) Neo-sex chromosomes and adaptive potential in tortricid pests. *Proceedings of The National Academy of Sciences of The United States of America* 110: 6931-6936.
- ŠÍCHOVÁ J., NGUYEN P., DALÍKOVÁ M. AND MAREC F. (2013) Chromosomal evolution in tortricid moths: conserved karyotypes with diverged features. *PLoS One* 8: 5.
- VAN'T HOF A., NGUYEN P., DALÍKOVÁ M., EDMONDS N., MAREC F. AND SACCHERI I. (2013) Linkage map of the peppered moth, *Biston betularia* (Lepidoptera, Geometridae): a model of industrial melanism. *Heredity* 110: 283-295.

MATOUŠEK J., KOCÁBEK T., PATZAK J., FÜSSY Z., PROCHÁZKOVÁ J. AND HEYERICK A. (2012) Combinatorial analysis of lupulin gland transcription factors from R2R3Myb, bHLH and WDR families indicates a complex regulation of *chs_H1* genes essential for prenylflavonoid biosynthesis in hop (*Humulus lupulus* L.). *BMC Plant Biology* 12: 27.

PH.D. THESES:

- NGUYEN P. (2013) Comparative mapping of sex-linked genes in Lepidoptera.
- FÜSSY Z. (2013) Structure-function analysis of selected hop (*Humulus lupulus* L.) regulatory factors.
- KUČEROVÁ L. (2013) Adenosine signaling in *Drosophila*.
- SAJWAN S. (2013) Gene targeting in silkworm (*Bombyx mori*) by engineered endonucleases.
- STEINBAUEROVÁ V. (2012) Structural and functional characterization of giant plant Ogre-like retrotransposons.



DEPARTMENT OF MOLECULAR BIOLOGY

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Research and education activities

MOLECULAR PARASITOLOGY

Trypanosomes are protists that have found unorthodox solutions to a number of cell processes. We are studying the function of numerous proteins of the mitochondrion of *T. brucei*, causative agents of the sleeping sickness.

EVOLUTIONARY PROTISTOLOGY

We have recently described the phylum Chromerida, a novel group of secondary algae closely related to apicomplexan parasites. Genomes, transcriptomes and proteomes of two of these algae are now being sequenced, and their life cycles, cellular biology, and metabolism are being extensively investigated.

MOLECULAR BASIS OF THE INSECT CIRCADIAN CLOCK AND DIURNAL RHYTHMICITY

Circadian and seasonal (photoperiodic) biological clocks are found in most living organisms and their fundamental properties are highly conserved. The long-term goal of this project is to gain a general understanding of the cellular and molecular mechanisms that underlie circadian rhythmicity in insects.

MOLECULAR NEUROBIOLOGY

We want to understand how the human brain works. We are using a combination of linear and non-linear optical phenomena

with molecular biology tools, towards the development of techniques that will allow optical monitoring of the electrical and chemical activity of neurons.

MECHANISMS OF CELL FATE DECISIONS

The worm, *Caenorhabditis elegans*, offers a unique model in which the differentiation of individual cells can be followed during the development of the animal. We use the tools of RNA interference and modern microscopy to study the molecular signals that determine cellular fate and the formation of distinct organs and tissues.

INSECT DEVELOPMENT

Insects are the most numerous and diverse group of animals on Earth. We study the action of juvenile hormones and steroid hormones on metamorphosis, a dramatic developmental transition from crawling larvae to flying adults.

FRUIT FLY DROSOPHILA MELANOGASTER AS A MODEL FOR HUMAN DISEASES

Using the powerful genetic tools available via the study of *Drosophila* as a model, we study the role of adenosine in the regulation of energy metabolism during immune response and the role of the CKlepsilon gene in cancer.

DEVELOPMENTAL BIOLOGY AND GENOMICS

Understanding the molecular mechanisms that direct cell-fate and function using the pre-implantation mouse embryo as a model system. We also investigate cell-to-cell communication via the Notch signaling pathway, using *Drosophila* genetics and molecular biology techniques.

Example of results

PUBLICATIONS:

VERNER Z., BASU S., BENZ C., DIXIT S., DOBAKOVA E., FAKTOROVA D., HASHIMI H., HORAKOVA E., HUANG Z., PARIS Z., PENA P., RIDLON L., TYC J., WILDRIDGE D., ZIKOVA A. AND LUKES J. (2015) The malleable mitochondrion of *Trypanosoma brucei*. *International Review of Cell and Molecular Biology* 315: 73-151.

KOBELKOVA A., ZAVODSKA R., SAUMAN I., BAZALOVA O. AND DOLEZEL D. (2015) Expression of clock genes *period* and *timeless* in the central nervous system of the Mediterranean flour moth, *Ephesia kuehniella*. *Journal of Biological Rhythms*. DOI: 10.1177/0748730414568430.

BAJGAR A., KUCEROVA K., JONATOVA L., TOMCALA A., SCHNEEDORFEROVA I., OKROUHLIK J. AND DOLEZAL T. (2015) Extracellular adenosine mediates a systemic metabolic switch during immune response. *PLoS Biology*, in press.

SMYKAL V., DAIMON T., KAYUKAWA T., TAKAKI K., SHINODA T. AND JINDRA M. (2014) Importance of juvenile hormone signaling arises with competence of insect larvae to metamorphose. *Developmental Biology* 390: 221-230.

HUANG Z., KALTENBRUNNERS, SIMKOVA E., STANEK D., LUKES J. AND HASHIMI H. (2014) The dynamics of mitochondrial RNA-binding protein complex in *Trypanosoma brucei* and its petite mutant under optimized immobilization conditions. *Eukaryotic Cell* 13: 1232-1240.

CHIDGEY J.W., LINHARTOVA M., KOMENDA J., JACKSON P.J., DICKMAN M.J., CANNIFFE D.P., KONIK P., PILNY J., HUNTER C.N. AND SOBOTKA R. (2014) A Cyanobacterial Chlorophyll Synthase-HliD Complex Associates with the Ycf39 Protein and the YidC/Alb3 Insertase. *Plant Cell* 26:1267-79.

BAJGAR A., JINDRA M. AND DOLEZEL D. (2013) Autonomous regulation of the insect gut by circadian genes acting downstream of juvenile hormone signaling. *PNAS* 110: 4416-21.

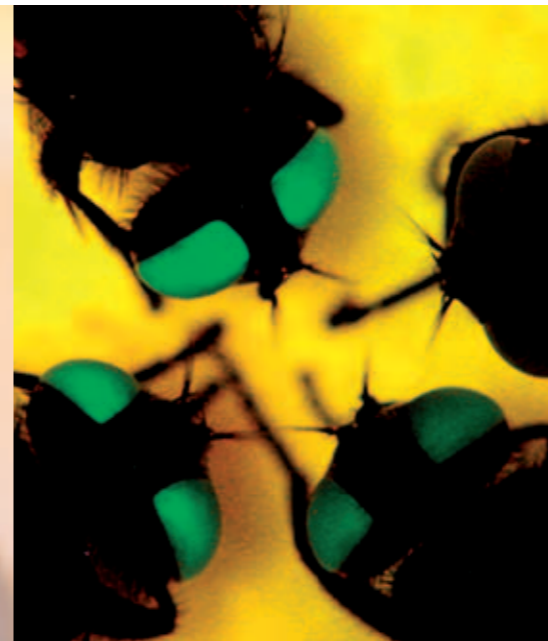
PH.D. THESES:

BASU S. (2014) Erv1 associated mitochondrial import-export pathway and the cytosolic iron-sulfur protein assembly machinery in *Trypanosoma brucei*.

RIDLON-NOVOTNÁ L. (2014) Functional analysis of newly described 45S SSU* complex in *Trypanosoma brucei*.

CHANGMAI P. (2013) Formation of Fe-S clusters in the mitochondrion of *Trypanosoma brucei*.

BAJGAR A. (2013) Circadian Genes and Regulation of Diapause in Insect.



DEPARTMENT OF PARASITOLOGY

- > <http://kpa.prf.jcu.cz>
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Research and education activities

The Department of Parasitology is responsible for the Parasitology Master's and Doctoral programmes. The research covers structural, ecological, biochemical, phylogenetic, and molecular aspects of parasite biology, and is focused on several dominant areas.

FISH-ASSOCIATED AMOEBAE (AND OTHER PROTISTS)

Amoebae are mostly free-living protists belonging to various groups of Eukaryotes. Nonetheless, some of them are able to

facultatively colonize the bodies and body surfaces of various hosts, especially in a water environment. The most economically important hosts of these amphizoic amoebae are fish: both marine and freshwater fish farms can be invaded by amoebae colonizing fish gills or internal organs. *Paramoeba* or *Naegleria* are good examples of such amoebae; they cause gill diseases of salmon and trout, respectively. Some amphizoic amoebae found in fish can also damage humans: the best known example would be *Acanthamoeba*. In our group, we study the interactions between amoebae and their fish hosts, the pathogenesis of the diseases and also other aspects of the biology of amoebae, often not very well known: phylogeny, diversity, ecology, biogeography, symbioses with other organisms (e.g., bacteria), etc. Not only amoebae are responsi-

ble for fish diseases: we are also confronted with other protist groups: microsporidians, ciliates, myxozoans and others.

MEDICAL AND VETERINARY PARASITOLOGY

The research deals with organisms causing opportunistic infections, such as cryptosporidians and microsporidians. It employs natural and experimental infections to study such parameters as the susceptibility of the hosts, host specificity, and histopathological changes.

MOLECULAR PHYLOGENETICS AND EVOLUTION OF PARASITES

Phylogenetic relationships and population structure are studied using molecular data within various types of parasitic and symbiotic associations. Based on the results of phylogenetic analyzes, various questions of evolutionary parasitology are addressed, such as the role of geography and host specificity in parasite population structure, and coevolutionary patterns between the host and the parasite.

APICOMPLEXA

Morphology, phylogenetic relationships, population structure and coevolution with their hosts are studied in these intracellular parasites. The research is focused mainly on gastrointestinal coccidia (*Eimeria*, *Isospora*) of small mammals, and blood apicomplexans (*Hemolivia*, *Haemogregarina*, *Haemoproteus*) of turtles and tortoises. We take advantage of analyzing the large number of samples collected worldwide to obtain reliable data for addressing the evolutionary processes and life strategies of this diverse group of parasites.

Example of results

PUBLICATIONS:

DVORAKOVA N., KVICEROVA J., PAPOUSEK I., JAVANBAKHT H., TIAR G., KAMI H. AND SIROKY P. (2014) Haemogregarines from western Palaearctic freshwater turtles (genera *Emys*, *Mauremys*) are conspecific with *Haemogregarina stepanowi* Danilewsky, 1885. *Parasitology* 141: 522-530.

KVICEROVA J., HYPŠA V., DVORAKOVA N., MIKULICEK P., JANDZIK D., GARDNER M.G., JAVANBAKHT H., TIAR G. AND SIROKY P. (2014) Hemolivia and Hepatozoon: Haemogregarines with Tangled Evolutionary Relationships. *Protist* 165: 688-700.

KUCHTA R., ESTEBAN J.-G., BRABEC J. AND SCHOLZ T. (2014) Misidentification of *Diphyllbothrium* Species Related to Global Fish Trade, Europe. *Emerging Infectious Diseases* 20: 1955-1957.

MYSKOVA E., DITRICH O., SAK B., KVAC M. AND CYMBALAK T. (2014) Detection of Ancient DNA of *Encephalitozoon intestinalis* (Microsporidia) in Archaeological Material. *Journal of Parasitology* 100: 356-359.

BOUZID W., STEFKA J., BAHRI-SFAR L., BEERLI P., LOOT G., LEK S., HADDAOUI N., HYPŠA V., SCHOLZ T., DKHIL-ABBES T., MEDDOUR R. AND BEN HASSINE O.K. (2013) Pathways of cryptic invasion in a fish parasite traced using coalescent analysis and epidemiological survey. *Biological Invasions* 15: 1907-1923.

JIRKU M., KVICEROVA J., MODRY D. AND HYPŠA V. (2013) Evolutionary Plasticity in Coccidia - Striking Morphological Similarity of Unrelated Coccidia (Apicomplexa) from Related Hosts: *Eimeria* spp. from African and Asian Pangolins (Mammalia: Pholidota). *Protist* 164: 470-481.

KVICEROVA J. AND HYPŠA V. (2013) Host-Parasite Incongruences in Rodent *Eimeria* Suggest Significant Role of Adaptation Rather than Cophylogeny in Maintenance of Host Specificity. *PLoS ONE* 8.

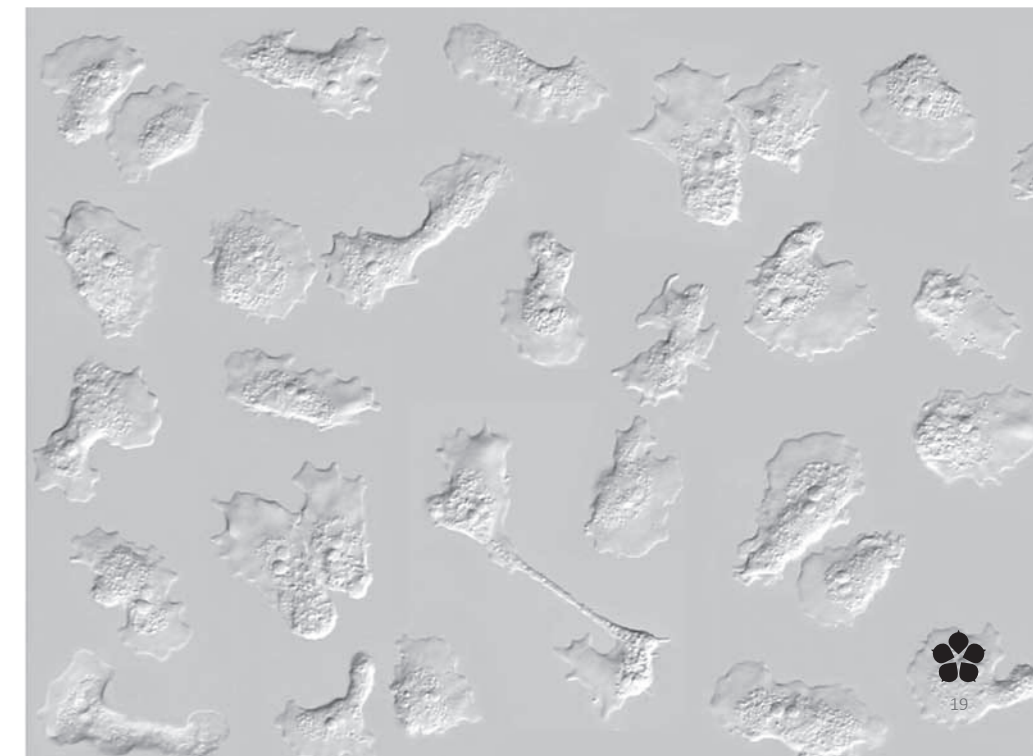
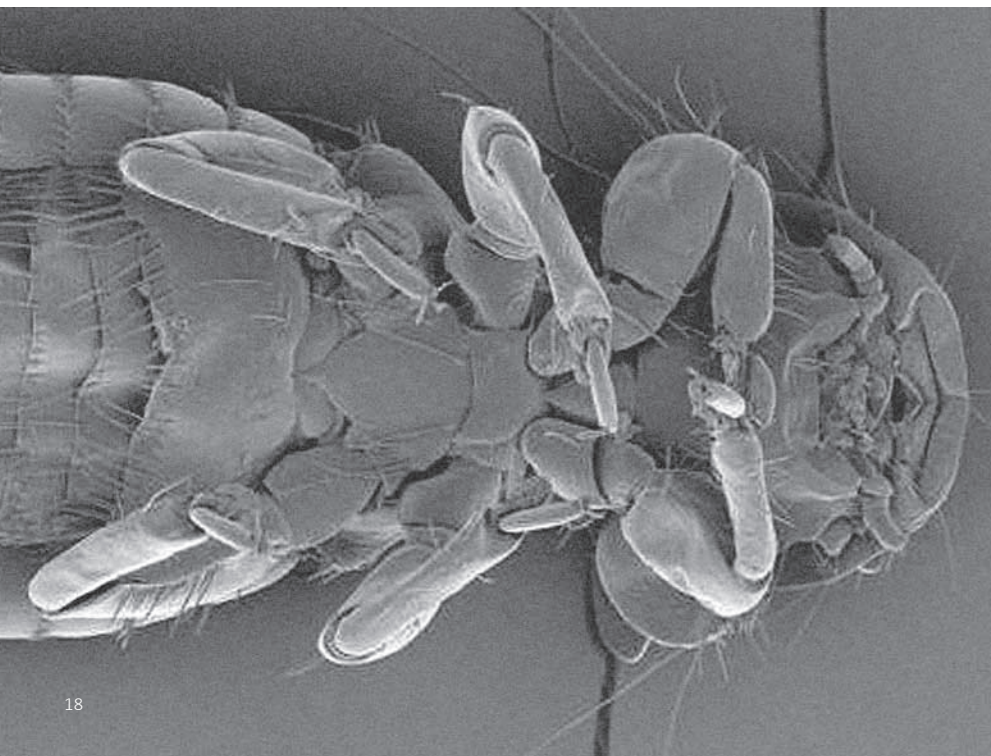
NOVAKOVA E., HYPŠA V., KLEIN J., FOOTITT R.G., VON DOHLEN C.D. AND MORAN N.A., (2013) Reconstructing the phylogeny of aphids (Hemiptera: Aphididae) using DNA of the obligate symbiont *Buchnera aphidicola*. *Molecular Phylogenetics and Evolution* 68: 42-54.

PH.D. THESES:

SIMONA GEORGIEVA (2015) An integrative taxonomic approach to the study of trematode diversity and life-cycles in freshwater ecosystems.

ALENA KODÁDKOVÁ (2014) Myxosporean phylogeny and evolution of myxospore morphotypes.

CARLOS ALONSO PALMERO MENDOZA (2014) Species composition and phylogenetic relationship of oviparous monogeneans (Dactylogyridae: Ancyrocephalinae) of catfish (Siluriformes) of the Amazon River.



DEPARTMENT OF ANIMAL PHYSIOLOGY

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Research and education activities

The Department of Animal Physiology is responsible for the Experimental Biology Master's programme and the Physiology and Developmental Biology Doctoral programme. The research covers structural, ecological, biochemical, and molecular aspects of animal physiology, and is focused on several dominant areas.

INSECT STRESS HORMONES

An anti-stress reaction in insects is controlled by adipokinetic neuropetides. This project deals with the detailed molecular, biochemical and physiological characterisation of the hormones to contribute to a better understanding of their function and evolution.

ANTI-STRESS REACTIONS REGULATING METABOLIC HOMEOSTASIS IN INSECTS

This project is focused on a functional study of adipokinetic hormone (AKH) and its possible links or parallels with the adenosine signalling pathway in physiological processes affecting homeostasis. The emphasis is laid on understanding of the role of AKH in the stress response at the subcellular level.

STUDY OF DIAPAUSE

Diapausing insects cease to develop, rely on accumulated energy resources, and suppress their metabolism. The molecular and biochemical correlates of diapause, including the function of biological clock genes

and their products, are under study. The practical aspects of insect imaginal diapause are studied on the beetle *Ips typhographus* model.

MECHANISMS OF INSECT COLD TOLERANCE AND LONG TERM CRYOPRESERVATION

The physiological nature of high cold tolerance in diapausing insects is analysed. Knowledge of these mechanisms can serve as a basis for development of long-term cryopreservation techniques for insects or other biological materials. The study is focussed on membrane composition and function at low temperatures, and on changes of gene expression which result in metabolic switching and synthesis of protective substances such as polyols or heat shock proteins.

STUDY OF INSECT SILK

Insect silk is a natural source of a number of interesting proteins for practical application. Natural or recombinant silk proteins are studied in several lepidopteran and trichopteran models, and their utilization in practice is considered.



Example of results

PUBLICATIONS:

- KODRÍK D., STAŠKOVÁ T., JEDLIČKOVÁ V., WEYDA F., ZÁVODSKÁ R. AND PFLEGEROVÁ J. (2015) Molecular characterization, tissue distribution, and ultrastructural localization of adipokinetic hormones in the CNS of the firebug *Pyrrhocoris apterus* (Heteroptera, Insecta). *General and Comparative Endocrinology* 210: 1-11.
- PLAVŠIN I., STAŠKOVÁ T., ŠERÝ M., SMÝKAL V., HACKENBERGER H. K. AND KODRÍK D. (2015) Hormonal enhancement of insecticide efficacy in *Tribolium castaneum*: Oxidative stress and metabolic aspects. *Comparative Biochemistry and Physiology C* 170: 19-27.

KOŠTÁL V., MIKLAS B., DOLEŽAL P., ROZSYPAL J. AND ZÁHRADNÍČKOVÁ H. (2014) Physiology of cold tolerance in the bark beetle, *Pityogenes chalcographus* and its overwintering in spruce stands. *Journal of Insect Physiology* 63: 62-70.

HABUŠTOVÁ O., DOLEŽAL P., SPITZER L., SVOBODOVÁ Z., HUSSEIN H. AND SEHNAL F. (2014) Impact of Cry1Ab toxin expression on the non-target insects dwelling on maize plants. *Journal of Applied Entomology* 138: 164-172.

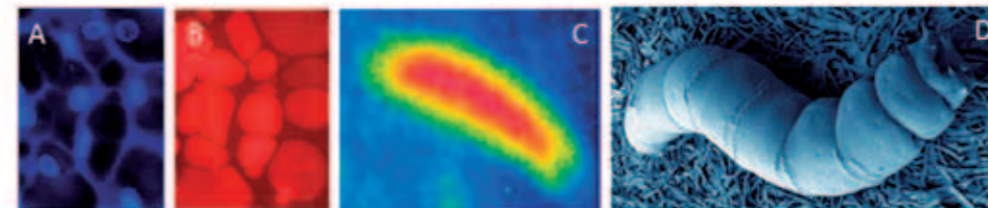
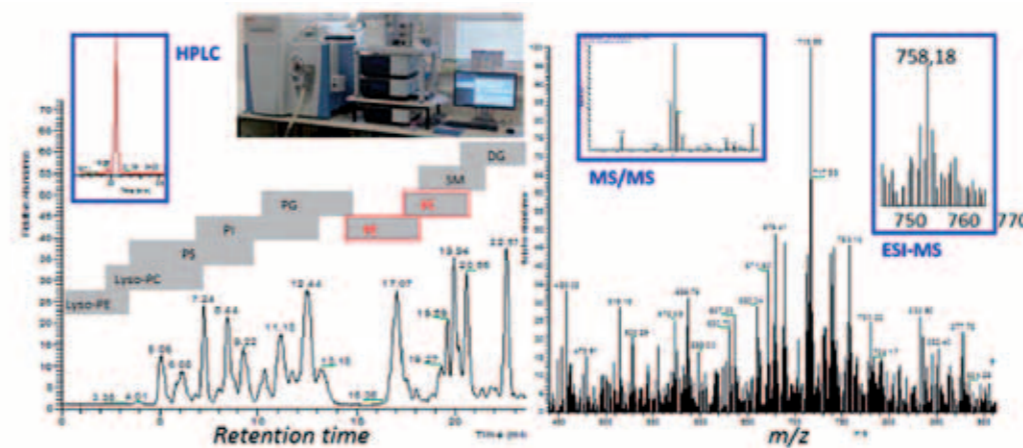
KODRÍK D., VINOKUROV K., TOMČALA A. AND SOCHA R. (2012) The effect of adipokinetic hormone on midgut characteristics in *Pyrrhocoris apterus* L. (Heteroptera). *Journal of Insect Physiology* 58: 194-204.

KOŠTÁL V., ŠIMEK P., ZÁHRADNÍČKOVÁ H., CIMLOVÁ J. AND ŠTĚTINA T. (2012) Conversion of the chill susceptible fruit fly larva (*Drosophila melanogaster*) to a freeze tolerant organism. *Proceedings of the National Academy of Sciences USA* 109: 3270-3274.

YONEMURA N., SEHNAL F., KONIK P., AJIMURA M., TAMURA T. AND MITA K. (2012) Conservation of a pair of serpin 2 genes and their expression in Amphiesmenoptera. *Insect Biochemistry and Molecular Biology* 42: 371-380.

PH.D. THESES:

- ROZSYPAL J. (2013) Insect overwintering: physiological and biochemical adaptations to low temperatures.
- MOATAZ A. M. MOSTAFA (2013) Activity of the Cry3A toxin on beetles.
- VEČEŘA J. (2012) The role of insect adipokinetic hormones in oxidative stress.
- BÁRTŮ I. (2010) Analysis of lipids mobilized by adipokinetic hormones in the firebug *Pyrrhocoris apterus* (Heteroptera: Pyrrhocoridae).



DEPARTMENT OF EXPERIMENTAL PLANT BIOLOGY

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> **Assoc. Prof. Jiří Šantrůček**

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Research and education activities

The Department of Experimental Plant Biology provides education in the Experimental Plant Biology Master's programme and the Doctoral programme of Plant Physiology. The research topics cover environmental plant physiology, biochemistry and the biophysics of photosynthesis and plant-water relations, and are focused on several dominant areas.

PHOTOSYNTHESIS OF HIGHER PLANTS, ALGAE AND CYANOBACTERIA

The regulation of photosynthesis in higher plants, algae, and cyanobacteria is studied on a molecular, cellular and organ level, with respect to environmentally important natural variability of CO₂ concentration, temperature, irradiance and nutrients. In higher plants, leaf internal limitations to CO₂ fixation (mesophyll conductance for CO₂) are studied using gas exchange, chlorophyll fluorescence and stable isotope mass spectrometry techniques.

Contact person:

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Ondřej Prášil (prasil@alga.cz)

STOMATAL DEVELOPMENT, LEAF CUTICLE AND PLANT-ATMOSPHERE INTERACTIONS

Environmental factors controlling stomatal development and patterning in leaf epidermis are studied using gas exchange, thermography, mass spectrometry, and mi-

croscopy. Transport and structural properties of the cuticle as a leaf water loss barrier are studied in cooperation with the Institute of Cellular and Molecular Botany, University of Bonn.

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Marie Hronková (hronkova@umbr.cas.cz)

STABLE ISOTOPES FRACTIONATION IN BIOSPHERE

Fractionation of water isotopes (¹⁸O and D) in the soil-plant-atmosphere continuum and stable carbon isotopes (¹³C/¹²C) in leaves and stems (tree rings) is applied in the assessment of plant growth conditions, water use and in the tracing of the geographical origin of plant products. In cooperation with Technical University Munich (Chair of Grassland Science, Freising), we organize the International Spring School on Stable Isotopes in Environmental Sciences, Ecology and Physiology (<http://isotope-school.wzw.tum.de/>).

Contact person:

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Jiří Šantrůček (jsan@umbr.cas.cz)

BRYOPHYTE ECOPHYSIOLOGY

Bryophytes, the earliest land plants, thrive through a huge range of environmental conditions. Their physiological adaptations are studied with respect to their ecology in extreme habitats, typically under stress from limiting or excess availability of water, mineral nutrients and photosynthetic light. Ecophysiology of peat mosses (*Sphagnum*) is of special interest.

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THERMAL STABILITY OF TYPE II PHOTOSYNTHETIC REACTION CENTRES

A highly collaborative, interdisciplinary approach that combines biophysical, analytical, molecular biology and computational methods is used to investigate molecular mechanisms behind the adaptation of photosynthesis to ambient temperature. The discovered stabilization mechanisms are being exploited together with our partner team at Weizmann Institute of Science in engineering of thermotolerant strains of algae while mutagenesis studies on tobacco are performed at our University. Thermal adaptation of photosynthesis in cryotolerant algae and thermotolerant photosynthetic bacteria is carried out in collaboration with teams at the Institute of Microbiology CAS.

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David Kaftan (david.kaftan@prf.jcu.cz)

Example of results

PUBLICATIONS:

VICHEROVÁ E., HÁJEK M. AND HÁJEK T. (2015) Calcium intolerance of fen mosses: physiological evidences, effects of nutrient availability and successional drivers. *Perspectives in Plant Ecology, Evolution and Systematics*. Provisionally accepted.

BÁRTA J., STONE J.D., PECH J., SIROVÁ D., ADAMEC L., CAMPBELL M.A. AND ŠTORCHOVÁ H. (2015) The transcriptome of *Utricularia vulgaris*, a rootless plant with minimalist genome, reveals extreme alternative splicing and only moderate sequence similarity with *Utricularia gibba*. *BMC Plant Biology* 15: 78 DOI10.1186/s12870-015-0467-8.

HÁJEK T. AND VICHEROVÁ E. (2014) Desiccation tolerance of *Sphagnum* revisited: a puzzle resolved. *Plant Biology* 16: 765-773.

KUBÁSEK J., HÁJEK T. AND GLIME J.M. (2014) Bryophyte photosynthesis in sunflecks: greater relative induction rate than in tracheophytes. *Journal of Bryology*, 36: 110-117.

HÁJEK T. (2014) Physiological Ecology of Peatland Bryophytes. In Hanson D.T. & Rice S.K. (Eds.): Photosynthesis in Bryophytes and Early Land Plants, *Advances in Photosynthesis and Respiration* 37: 233-252.

LUKEŠ M., PROCHÁZKOVÁ L., SHMIDT V., NEDBALOVÁ L. AND KAFTAN D. (2014) Temperature dependence of photosynthesis and thylakoid lipid composition in the red snow alga *Chlamydomonas cf. nivalis* (Chlorophyceae). *FEMS Microbiology Ecology* 89: 303-315. doi: 10.1111/1574-6941.12299.

ŠANTRŮČEK J., VRÁBLOVÁ M., ŠIMKOVÁ M., HRONKOVÁ M., DRTINOVÁ M., KVĚTOŇ J., VRÁBL D., KUBÁSEK J., MACKOVÁ J., WIESNEROVÁ D., NEUWIRTHOVÁ J. AND SCHREIBER, L. (2014) Stomatal and pavement cell density linked to leaf internal CO₂ concentration. *Annals of Botany* 114: 191-202.

VOELKER S.L., BROOKS J.R., MEINZER F.C., RODEN J., PAZDUR A., PAWELCZYK S., HARTSOUGH P., SNYDER K., PLAVCOVÁ L. AND ŠANTRŮČEK J. (2014) Isolating relative humidity: dual isotopes δ¹⁸O and δD as deuterium deviations from the global meteoric water line. *Ecological Applications* 24: 960-975.

SIROVÁ D., ŠANTRŮČEK J., ADAMEC L., BÁRTA J., BOROVEC J., PECH J., QWENSS M., ŠANTRŮČKOVÁ H., SCHÄUFELE R., ŠTORCHOVÁ H. AND VRBA, J. (2014) Dinitrogen fixation associated with shoots of aquatic carnivorous plants: is it ecologically important? *Annals of Botany* 114: 125-133.

TAZOE Y. AND SANTRUCEK J. (2014) Superimposed behavior of g_m under ABA-induced stomata closing and low CO₂. *Plant, Cell and Environment*, doi: 10.1111/pce.12437 2014.

KUBÁSEK J., URBAN O., ŠANTRŮČEK J. (2013) C4 plants use fluctuating light less efficiently than do C3 plants: a study of growth, photosynthesis and carbon isotope discrimination. *Physiologia Plantarum* 149: 528-539.

MACKOVÁ J., VAŠKOVÁ M., MACEK P., HRONKOVÁ M., SCHREIBER L. AND ŠANTRŮČEK J. (2013) Plant response to drought stress simulated by ABA application: changes in chemical composition of cuticular waxes. *Environmental and Experimental Botany* 86: 70-75.

PATENTS:

KAFTAN D., LUKEŠ M. AND NEDBALOVÁ L. (2012) The photosynthetic microorganism for production of phosphatidylglycerol and ways to increase the content of phosphatidylglycerol in the said photosynthetic microorganism. CZ2001-705.

SCHERZ A., SHLYK-KERNER O., SAMISH I., KAFTAN D. AND DINAMARCA J. (2014) Photosynthetic organisms and compositions and methods of generating same. US 8629259.

PH.D. THESES:

KUBÁSEK J. (2014) Photosynthesis, production and growth of plants under temporal light heterogeneity. VRÁBL D. (2013) Carbon dioxide transport within the leaf mesophyll: physico-chemical and biological aspects.

TOMŠÍČKOVÁ J. (2013) Fungicidal activity of cyanobacteria from the genus *Nostoc*.



DEPARTMENT OF MEDICAL BIOLOGY

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- > jan@paru.cas.cz

Research and education activities

The Department of Medical Biology is responsible for the Biomedicine Laboratory Techniques Bachelor's programme and the Clinical Biology Master's programme. Students of both programmes work on their diploma theses in physiology, clinical haematology, clinical biochemistry, microbiology, and immunology. Good collaboration exists between the Department of Medical Biology and the Regional Hospital in České Budějovice. Recently, the Ph.D. study programme of Infection Biology has been approved.

The research done at the department focuses on several different topics, including many areas of biomedicine, immunology, microbiology, virology and digital imaging. The department is devoted to the study of molecules, microorganisms, and cells, for the diagnostics and management of illness and for the investigation of the mechanisms and pathogenesis of disease. Areas of biomedical research include haematology, immunology, clinical biochemistry, clinical endocrinology, pharmacology, and other biomedical fields.

Research on novel approaches to tumour immunotherapy is performed. It is based on installation of phagocytic receptors on tumour cells combined with application of Toll-like receptor ligands into solid tumours. TLR ligands induce early and massive inflammatory infiltration of tumours, anchoring of phagocytic receptors to tumour cells facilitates their recognition by inflammatory cells.

In insect functional morphology the research deals with ultrastructural aspects of the ontogeny of body fat and the glands (tarsal and labial) of two termite species. The ultrastructure and function of various organs in tsetse flies, mites, primitive arthropods etc. have been studied. Another topic focused upon is digital imaging – the application of new technologies and equipment for professional use in entomology (and biology in general). Immunological research is focused on the immunomodulatory compounds present in tick saliva and their effect on the transmission of important human pathogens such as *Borrelia burgdorferi* and the tick-borne encephalitis virus. The research is aimed towards the development of anti-tick vaccines reducing transmission of tick-borne pathogens. Immunomodulatory molecules

from tick saliva are prepared recombinant and their effect on immunocompetent cells, including cell signalling pathways, is tested. As a research by-product, the anti-asthmatic effect of the tick saliva cystatin was discovered.

Attention is also devoted to the interaction of the tick-borne encephalitis virus with the host and the pathogenesis of the infection. Important data about the localisation of mutations resulting in a reduction of the pathogenicity of TBE virus were published. Also the role of cytotoxic T lymphocytes in the pathogenesis of TBE was described and immunological processes involved in the breakdown of the blood-brain barrier during TBE infection were elucidated. Present research is also focused on the development of new antivirals effective against TBE virus infection.



Example of results

TICK SALIVA FACILITATES THE TRANSMISSION OF TICK-BORNE PATHOGENS

We were able to show that tick saliva increases replication of tick-borne encephalitis virus in mouse dendritic cells, thus facilitating transmission of this important tick-borne pathogen. The interference of tick salivary molecule sialostatin L2 with interferon action led to the enhanced replication of TBE virus in DC. The same cystatin increased growth of Lyme disease spirochete *Borrelia burgdorferi* in murine skin and other organs.

TUMOUR IMMUNOTHERAPY

The binding to tumour cells (melanoma B16-F10) of zymosan A and both Gram-positive and Gram-negative bacteria was revealed as a key requirement for strong immunotherapeutic effect. Simultaneous stimulation of both Toll-like and phagocytic receptors led to very strong synergy resulting in tumour shrinkage and their temporary or permanent vanishing.

PUBLICATIONS:

SCHWARZ A., CABEZAS-CRUZ A., KOPECKÝ J. AND VALDÉS J.J. (2014) Understanding the evolutionary structural variability and target specificity of tick salivary Kunitz peptides using next generation transcriptome data. *BMC Evol. Biol.* 14: 4.

JANOTOVÁ T., JALOVECKÁ M., AUEROVÁ M., ŠVECŮVÁ I., BRUZLOVÁ P., MAIEROVÁ V., KUMŽÁKOVÁ Z., CUNÁTOVÁ Š., VLČKOVÁ Z., CAISOVÁ V., ROZSYPALOVÁ P., LUKÁČOVÁ K., VÁCOVÁ N., WACHTLOVÁ M., SALÁT J., LIESKOVSKÁ J., KOPECKÝ J. AND ŽENKA J. (2014) The use of anchored agonists of phagocytic receptors for cancer immunotherapy: B16-F10 murine melanoma model. *PLoS ONE* 9: e85222.

PALUS M., ŽAMPACHOVÁ E., ELSTEROVÁ J. AND RŮŽEK D. (2014) Serum matrix metalloproteinase-9 and tissue inhibitor of metalloproteinase-1 levels in patients with tick-borne encephalitis. *J. Infect* 68: 165-169.

DAMMER J., WEYDA F., BENEŠ J., ŠOPKO V. AND GELBIČ I. (2013) Micro-radiography of biological samples with medical contrast agents. *Nuclear Instruments & Methods in Physics Research* 730: 149-151.

KILIAN P., VALDÉS J.J., LECINA-CACAS D., CHRUDIMSKÝ T. AND RŮŽEK D. (2013) The variability of the large genomic segment of řahyňa orthobunyavirus and an all-atom exploration of its anti-viral drug resistance. *Infect. Genet. and Evol.* 94: 2129-2139.

PALUS M., VOJTŠKOVÁ J., SALÁT J., KOPECKÝ J., GRUBHOFFER L., LIPOLDOVÁ M., DEMANT P. AND RŮŽEK D. (2013) Mice with different susceptibility to tick-borne encephalitis virus infection show selective neutralizing antibody response and inflammatory reaction in the central nervous system. *J. Neuroinflammation* 10: doi 10.1186/1742-2094-10-77.

M.SC. THESES:

DIVOKÁ P. (2014) Histological analysis of melanoma B16-F10 therapy using agonists of TLR and phagocytic receptors.

HARTMANN D. (2014) Characterization and function of factor C from the tick *Ixodes ricinus*.

HOLÁ H. (2014) Prognostic significance of combination of PCA3, fusion gene TMPRSS2:ERG and other markers in prostate carcinoma.

HUSPEKOVÁ H. (2014) Study on the influence of *Borrelia burgdorferi* sensu lato infection on behaviour of *Ixodes ricinus* ticks.

MARTYKÁNOVÁ D. (2014) Novel nanoparticles in ultrastructure diagnostics.

NERADOVÁ H. (2014) Effect of tick cystatins on TLR-induced maturation of myeloid dendritic cells.

SCHRENKOVÁ J. (2014) Localization of cathepsin L isoforms in tissues of *Ixodes bricinus* ticks.

ŠVECŮVÁ I. (2014) Optimization of immunotherapy based on laminarin anchoring to the surface of cancer cells.

WALDMANNOVÁ E. (2014) Cancer therapy by means of anchored agonists of phagocytic receptors. Study of mechanisms using immunodeficient mice.



INSTITUTE OF CHEMISTRY AND BIOCHEMISTRY

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Research and education activities

The Institute of Chemistry and Biochemistry is responsible for the Bachelor's and Master's programmes in Chemistry. The research covers biochemistry, analytical chemistry, computational chemistry, and interdisciplinary fields such as environmental chemistry and biophysical chemistry.

BIOCHEMISTRY

Glycobiology, mainly focused on blood-feeding arthropods. Protein-saccharide interactions in transmission and infectivity of tick-borne pathogens, identification of glycans and glycoproteins of ticks.

STRUCTURAL CHEMISTRY AND PROTEIN CRYSTALLOGRAPHY

X-ray crystallography is the major technique to get the structure of biological macromolecules at atomic resolution. These protein structures are central to understanding the detailed mechanisms of biological processes and to discovering novel therapeutics using a structure-based approach. Structural studies of membrane and soluble biological macromolecular complexes using methods of X-ray diffraction are the main aim of our research.

LIGHT AND PHOTOSYNTHESIS – AN ULTIMATE SOURCE OF ENERGY

The structure of photosynthetic light antennae and the function of light harvesting processes are studied to better understand

these principal energy conversion processes and as a tool for development of artificial light harvesting systems.

ANALYTICAL CHEMISTRY

The occurrence of the biologically active compounds and pollutants in the air, water, and plants, their isolation, concentration, and determination with modern instrumental techniques.

ENVIRONMENTAL PHOTOCHEMISTRY

The photochemical degradation of resistant pollutants (herbicides, hormones, cosmetic preservatives) is investigated in systems relevant to fresh water bodies, toxicity of photoproducts is tested.

COMPUTATIONAL CHEMISTRY

We deal mainly with the interactions of inorganic surfaces with organic molecules and biomolecules in order to find the ideal conditions for trapping toxic organic compounds from water on mineral surfaces, or to ensure the suitable procedure for the preparation of biosensors.

Example of results

PUBLICATIONS:

LISKOVA V., BEDNAR D., PRUDNIKOVA T., REZACOVA P., KOUDELAKOVA T., SEBESTOVA E., KUTA SMATANOVA I., BREZOVSKY J., CHALOUPOKOVA R. AND DAMBORSKY J. (2015) Balancing the stability-activity trade-off by fine-tuning dehalogenase access tunnels. *ChemCatChem* 7: 648–659. DOI: 10.1002/cctc.201402792.

KLEMENTOVA, S., RABOVA-TOUSOVA, Z., BLAHA, L., KAHOUN, D., SIMEK, P., KELTNEROVA, L. AND ZLAMAL, M. (2015) Photodegradation of Atrazine on TiO₂—Products Toxicity Assessment. *Open Journal of Applied Sciences* 5: 14-21.

STERBA J., VANOVA M., STERBOVA J. ET AL. (2014) The majority of sialylated glycoproteins in adult Ixodes ricinus ticks originate in the host, not the tick. *Carbohydrate Research* 389: 93-99.

CHALOUPOKOVA R., PRUDNIKOVA T., REZACOVA P., PROKOP Z., KOUDELAKOVA T., DANIEL L., BREZOVSKY J., WAKAKO IKEDA-OHTSUBO, YUKARI SATO, MICHAL KUTY, YUJI NAGATA, KUTA SMATANOVA I. AND DAMBORSKY J. (2014) Structural and functional analysis of a novel haloalkane dehalogenase with two halide-binding sites. *Acta Cryst.* D70: 1884–1897. doi: 10.1107/S13990004714009018.

SYKORA J., BREZOVSKY J., KOUDELAKOVA T., LAHODA M., FORTOVA A., CHERNOVETS T., CHALOUPOKOVA R., STEPANKOVA V., PROKOP Z., KUTA SMATANOVA I., HOF M. AND DAMBORSKY J. (2014) Dynamics and hydration explain failed functional transformation in dehalogenase design. *Nature Chemical Biology* Vol. 10, No. 6: 428-430. ISSN 1552-4450, doi:10.1038/nchembio.1502

FURUMAKI S., VACHA F., HIRATA S. AND VACHA M. (2014) Bacteriochlorophyll Aggregates Self-Assembled on Functionalized Gold Nanorod Cores as Mimics of Photosynthetic Chlorosomal Antennae: A Single Molecule Study. *ACS Nano* 8(3): 2176-2182.

DOSTAL J., MANCAL T., VACHA F., PSENCIK J. AND ZIGMANTAS D. (2014) Unraveling the nature of coherent beatings in chlorosomes. *J Chem Phys* 140(11), Article Number: 115103, DOI: 10.1063/1.4868557.

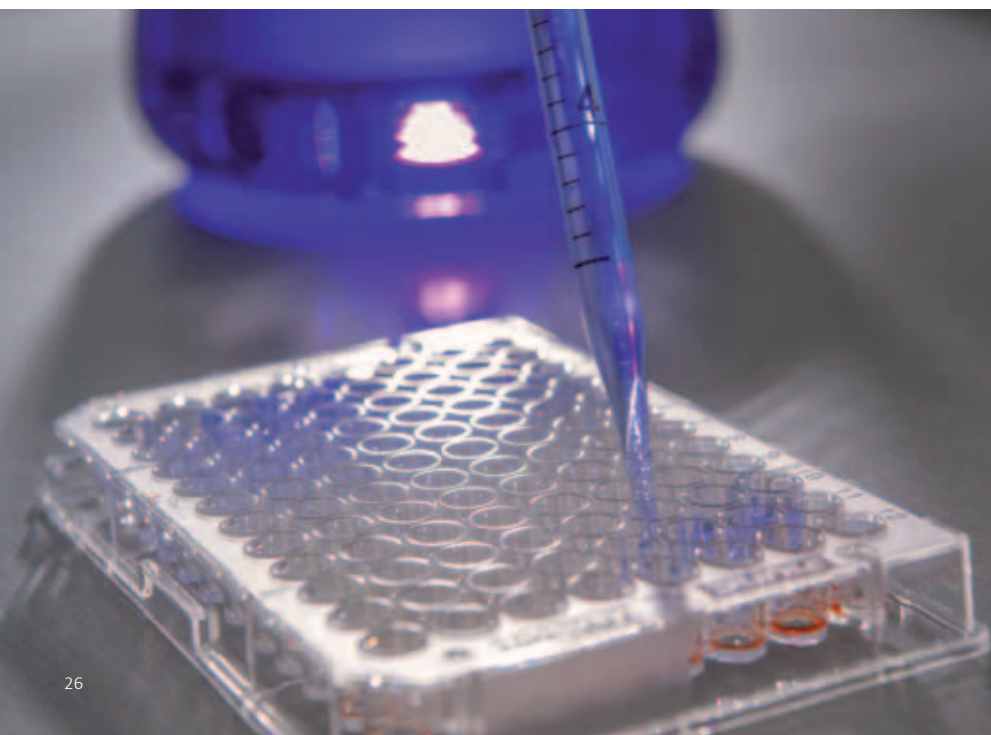
GARDIAN Z., LITVIN R., BINA D. AND VACHA F. (2014) Supramolecular Organization of Fucoxanthin-Chlorophyll Proteins in Centric and Pennate Diatoms. *Photosynth Res* 121: 79-86.

BINA D., GARDIAN Z., VACHA F. AND LITVIN R. (2014) Supramolecular organization of photosynthetic membrane proteins in the chlorosome-containing bacterium *Chloroflexus aurantiacus*. *Photosynth Res* 122: 13-21.

PANDEY S. K., REHA D., ZAYATS V., MELICHERCIK M., CAREY J. AND ETRICH R. (2014) Binding-competent states for L-arginine in E. coli arginine repressor apoprotein. *Journal of Molecular Modeling* 20(7): 2330.

HORÁKOVÁ M., KLEMENTOVÁ Š., KRÍŽ P., BALAKRISHNAN S.K., ŠPATENKA P., GOLOVKO O., HÁJKOVÁ P. AND EXNAR P. (2014) The synergistic effect of advanced oxidation processes to eliminate resistant chemical compounds. *Surface and Coatings Technology* 241: 154-158.

CHVAL Z., KABELÁČ M. AND BURDA J.V. (2013) Mechanism of the cis-[Pt(1R,2R-DACH)(H₂O)(2)](2+) Intrastrand Binding to the Double-Stranded (pGpG) center dot(CpC) Dinucleotide in Aqueous Solution: A Computational DFT Study. *Inorganic Chemistry* 52,10: 5801-5813.



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 > predota@prf.jcu.cz

Research and education activities

The Institute of Physics and Biophysics offers Bachelor's, Master's and PhD. programmes in Biophysics, Bachelor's and Master's programmes in Physics and Teaching of Physics, and Bachelor's programmes in Mechatronics and Measurement and Information Technology.

TIME-RESOLVED SPECTROSCOPY

Research is focused on ultrafast excited-state processes, taking place at time scales of femtoseconds to nanoseconds, in a variety of systems, ranging from natural pigments (e.g. carotenoids), synthetic systems aimed at controlling electron and energy transfer reactions, to complex pigment-protein complexes responsible for light-driven reactions in various natural systems.

MOLECULAR DYNAMICS SIMULATIONS

Molecular simulations provide detailed molecular-level understanding of the structure, function, and origin of experimental signals. Research focuses on computer simulations of fluids (water and aqueous solutions), phase equilibria, solid-liquid interface, mineral surfaces, and the interactions of biomolecules with surfaces.

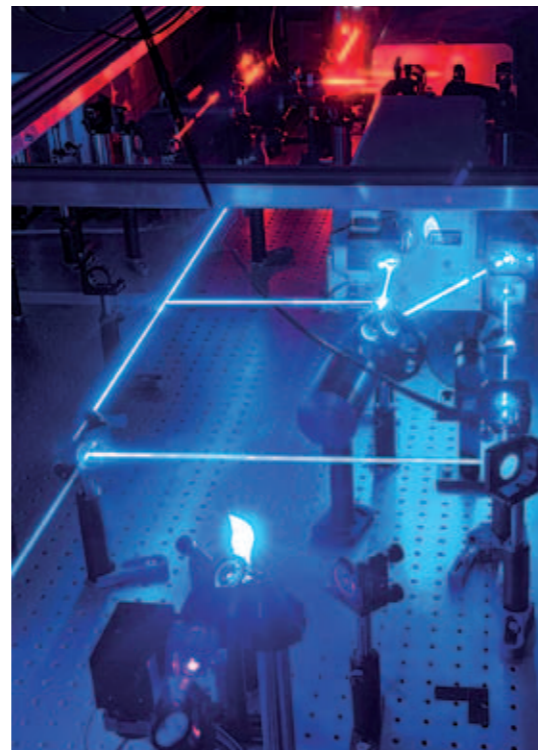
APPLIED PLASMA PHYSICS

The laboratory aims at basic experimental research on the border of low-temperature plasma physics and material science to

bring deep understanding of the growth of nanostructured films. Hence, the research is focused on deposition of thin functional films together with fundamental investigation of internal plasma process parameters. The growth mechanisms of different classes of nanostructured coatings ranging from metallic, metal-oxides to plasma polymers are intensively explored.

PLASMA ASTROPHYSICS – SOLAR PLASMA PHYSICS

For decades, the effect of solar coronal heating has remained one of the unsolved problems of solar plasma physics. Presently, two possible features are believed to be responsible for this interesting phenomenon – magnetic reconnection and MHD waves. We numerically calculate the MHD equations describing the plasma dynamics and investigate the plasma waves, e.g. wave trains, magnetoacoustic waves, in solar corona.



NEW MARKERS FOR IMMUNO-LOCALIZATION IN SCANNING ELECTRON MICROSCOPY

Scanning electron microscopes (SEM) enable the use of low voltage for acceleration of primary electrons (>10kV), which is very important for the examination of frozen biological specimens, and the possibility to use signals like backscattered electrons (BSE), which are very sensitive to the metal nanoparticle detection in cell structure. Our project is focused on the identifying and testing of

new nanoparticles (with a diameter below 10 nm) suitable as labels for multiple immunolocalization of molecules of interest in cell structure or as fiducial markers in correlative light and scanning electron microscopy.

AUTOMATIC RECOGNITION OF INDIVIDUAL BIRDS BY THEIR VOICES

The identification of individual birds by ornithologists using ring girdling is invasive and has a negative influence on the behavior

of the particular bird. Using computer voice recognition, individual birds can be identified non-invasively via voice recordings and recognition. The project's approach is based on the production of individual models using Gaussian Model Mixtures. The examined bird is the Chiffchaff (*phylloscopus collybita*).

Example of results

PUBLICATIONS:

STALEVA H., KOMENDA J., SHUKLA M.K., ŠLOUF V., KAŇA R., POLÍVKA T. AND SOBOTKA R. (2015) Mechanism of photoprotection in the cyanobacterial ancestor of plant antenna proteins. *Nat. Chem. Biol.* 11: 287–291.

PAREZ S., PŘEDOTA M. AND MACHESKY M. (2014) The Dielectric Properties of Water at Rutile and Graphite Surfaces: Effect of Molecular Structure. *J. Phys. Chem. C* 118: 4818-4834.

STRANAK V., HUBICKA Z., CADA M., DRACHE S., TICHY M. AND HIPPLER R. (2014) Investigation of ionized metal flux in enhanced high power impulse magnetron sputtering discharges. *J. Appl. Phys.* 115: 153301.

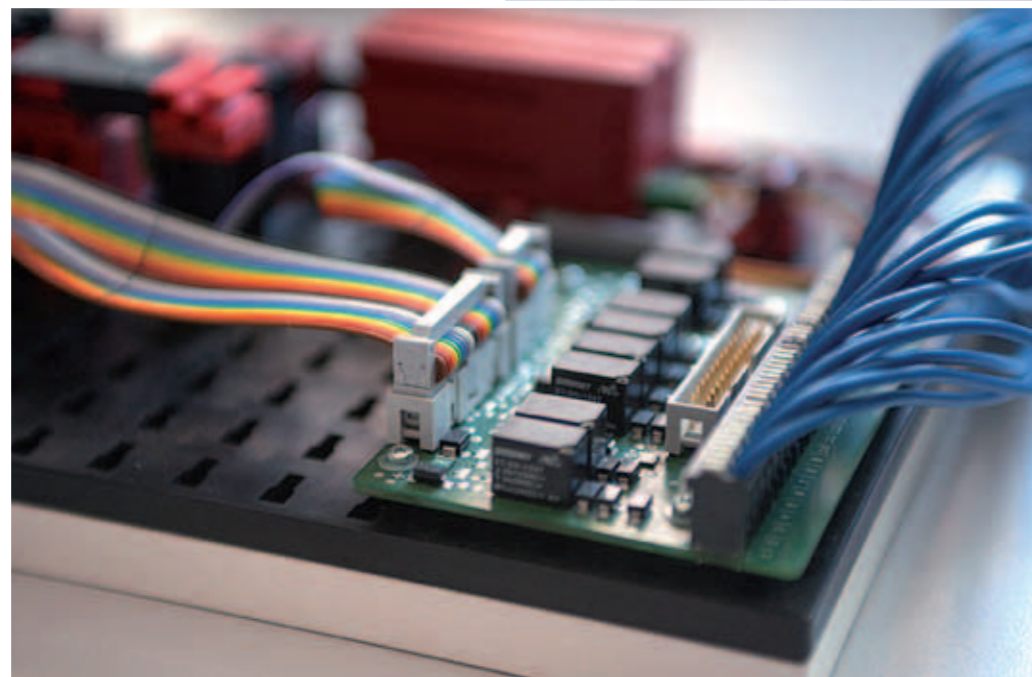
MÉSZÁROSOVÁ H., KARLICKÝ M., JELÍNEK P. AND RYBÁK J. (2014) Magnetoacoustic waves propagating along a dense slab and Harris current sheet and their wavelet spectra. *The Astrophysical Journal* 788: 44.

WANDROL P., VANCOVÁ M. AND NEBESÁŘOVÁ J. (2014) New Method for Multiple Immunodetection on Resin Ultrathin Section in the Field Emission Scanning Electron Microscope. *Microsc. Microanal.* 20 (Suppl. S3):1266-1267.

PH.D. THESES:

ŠLOUF V. (2013) Protein control over carotenoid spectroscopy and functions.

CHÁBERA P. (2010) Excited-state dynamics of carotenoids in solution and proteins.



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Research and education activities

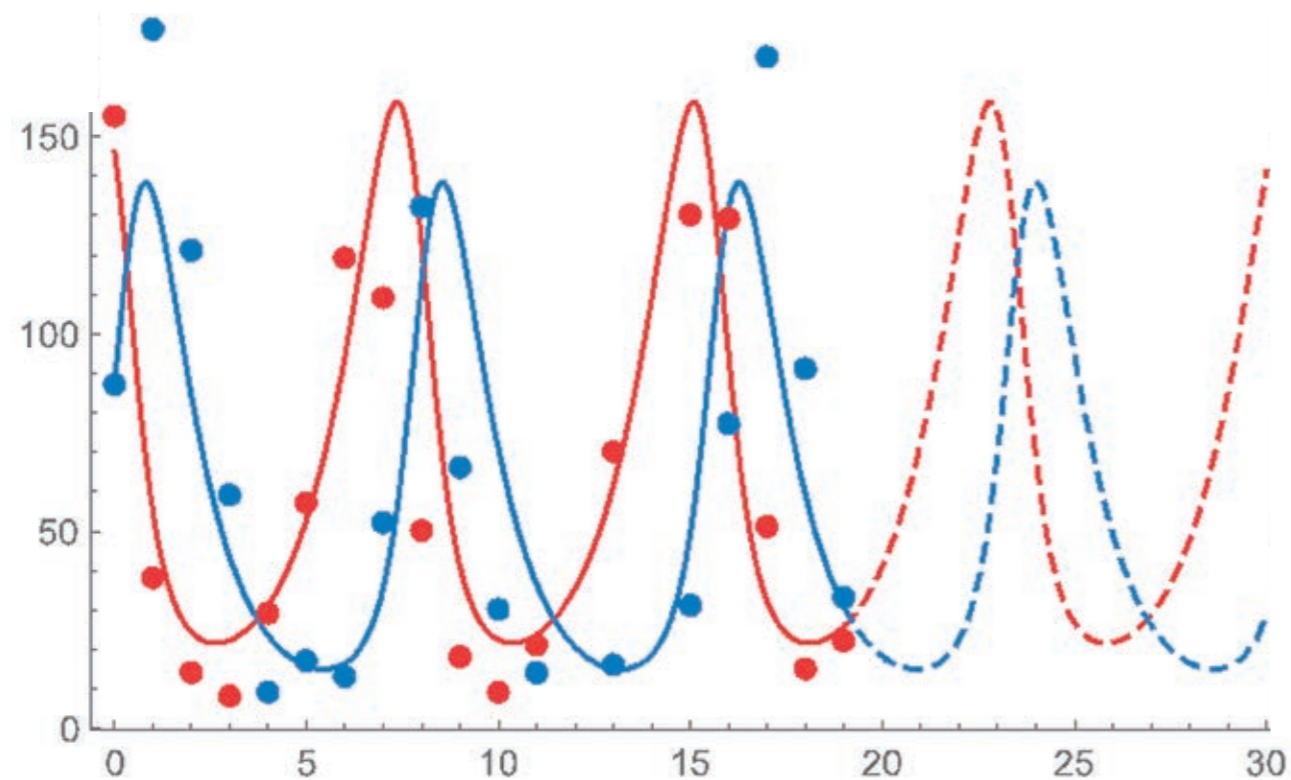
The Institute of Mathematics and Biomathematics offers Bachelor's and Master's Programmes in Teaching of Mathematics and a Bachelor's programme in Applied Mathematics. The current research of the Institute focuses on applied mathematics in biological and technical sciences, differential equations, numerical methods, and geometry.

MATHEMATICAL BIOLOGY

The research in mathematical biology, conducted jointly with the Biology Centre of the Czech Academy of Sciences, focuses on the development and analysis of mathematical models of behavioural, population, and evolutionary ecology with the aim of understanding mechanisms regulating species biodiversity. Mathematical methodologies based on game theory, differential and difference equations, stochastic processes, and rule-based computer simulations of interacting individuals are used.

TECHNICAL APPLICATIONS

The institute pursues research in the technical applications of mathematics. In particular, this research focuses on the theory and numerical solution of nonlinear differential equations used in the mechanics of solids including elastoplasticity and damage processes in materials. These methods are based on finite element computations, fast solution of linear systems of equations, and error control in terms of posteriori error estimates.



Example of results

PUBLICATIONS:

DANĚČEK J. AND VISZUS E. (2015) $\{C^{0,\gamma}\}$ - Regularity for Vector-Valued Minimizers of Quasilinear Functionals with VMO-Coefficients. *Mediterr. J. Math.* doi:10.1007/s00009-014-0476-0.

EISNER J., KUČERA M. AND RECKE L. (2015) Direction and stability of bifurcating solutions for a Signorini problem Nonlinear Analysis. *T.M.A.* 113: 357-371.

KALOVÁ J. AND MAREŠ R. (2015) Size dependences of surface tension. *Int J Thermophys* 36: 10.1007/s10765-015-1851-1.

BEREC L. AND MAXIN D. (2014) Why have parasites promoting mating success been observed so rarely? *Journal of Theoretical Biology* 342: 47-61

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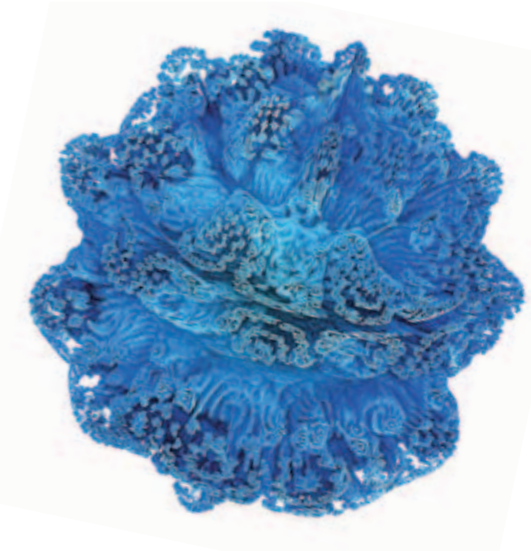
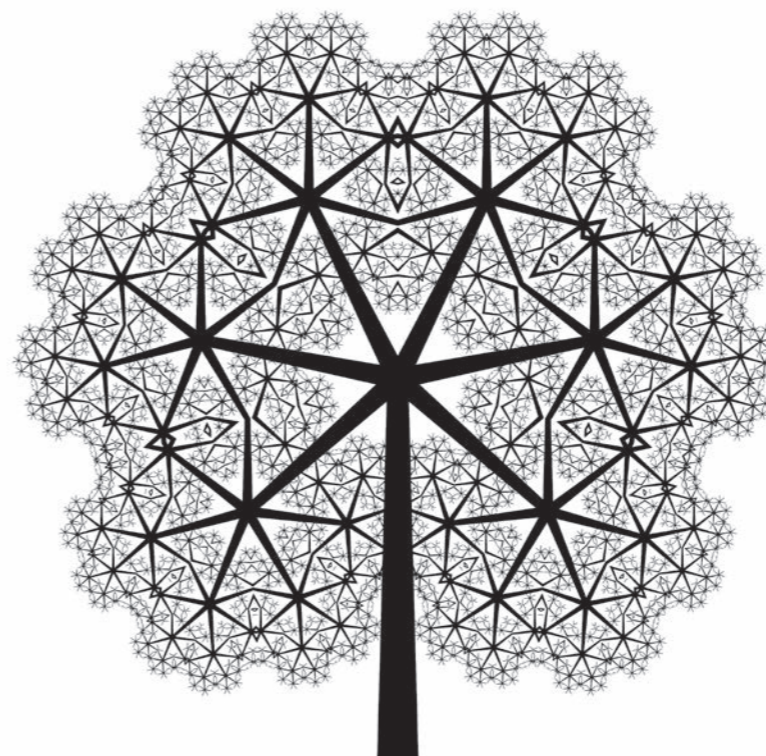
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INSTITUTE OF APPLIED INFORMATICS

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Characteristics

The Institute of Applied Informatics (hereafter "UAI") was established on the 1st of January 2009 as one of several new non-biological study programmes at the Faculty of Science. Since then it has gradually worked on the expansion and improvement of informatics and computer science within the faculty. The study programmes offered by the UAI have proven very popular among prospective students.

The Institute consists of four departments. Particular departments guarantee concrete study specializations and take care of research in their areas. The departments are:

- Informatics and bioinformatics.
- Security and networks.
- Embedded systems and robotics.
- Forensic Science and Criminology.

Study Programmes and Education Activities

At the time of writing the UAI performs education at the Bachelor's and Master's level. Students study either Applied Informatics or Bioinformatics.

After the first semester, students of Applied Informatics choose their specializations, which are provided by particular departments of the institute.

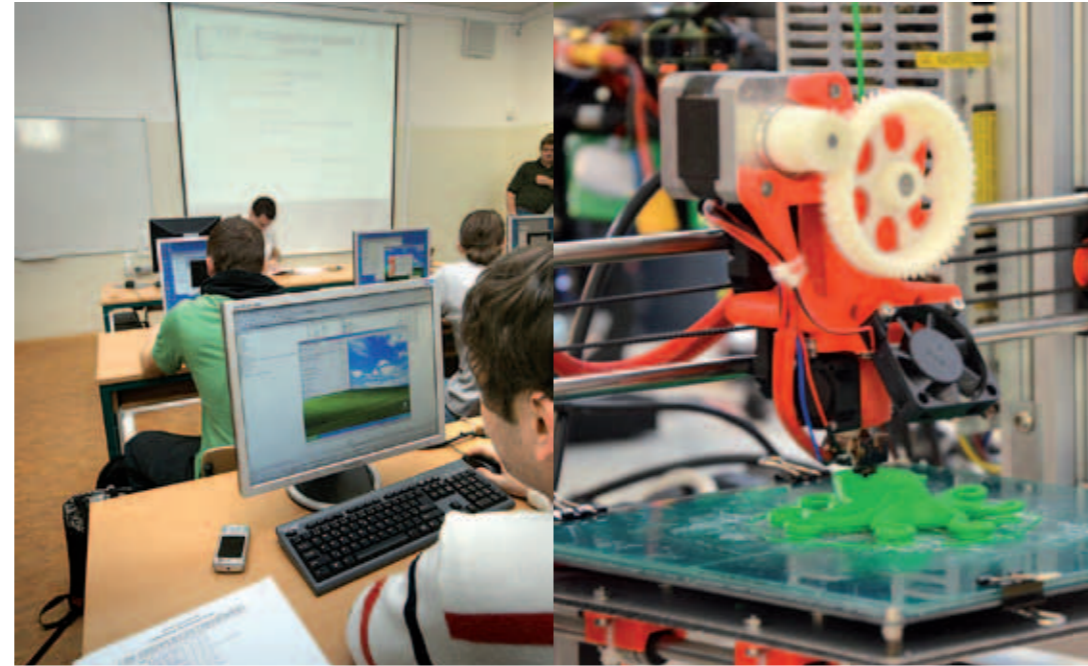
Bioinformatics can be studied either in Czech or in English. The study of informatics in English is a so called cross-border study which is provided along with the Johannes Kepler University in Linz, Austria. Students

study alternately at our university and at the Johannes Kepler University in Linz. In the end, they receive both Czech and Austrian diplomas.

Research Activities

DEPARTMENT OF INFORMATICS AND BIOINFORMATICS

The Department of Informatics and Bioinformatics pursues development and realization of systems, algorithms for analysis and interpretation of biological and chemometric data using supercomputers or distributed systems. At present, the main trend of research is the usage of virtualization in computing systems.



DEPARTMENT OF SECURITY AND NETWORKS

The department namely pursues: wireless networks, sensory networks and telecommunications networks. It also deals with safety nets and long-term archiving of electronic documents

DEPARTMENT OF ROBOTICS AND EMBEDDED SYSTEMS

The Department of Robotics and Embedded Systems is engaged in scientific activities aimed at the construction of UAV resources and their exploitation in industry and especially in geographical and biological monitoring, control transmission lines, power plants, etc. With this basic intent is associated research in the field of image processing and data. An integral part of the department's teaching is technical subjects

related to operating systems in open source development platforms. This is accompanied by developments in smart homes.

FORENSIC SCIENCE AND CRIMINOLOGY

The department deals with teaching vocational subjects and scientific activities in the areas of criminology, forensic and legal sciences. As a part of its activities the department is a guarantor of the specialization "forensic and technical activities in IT" bachelor study programme "Applied Informatics". The department deals with forensic documentation of data for the purposes of criminal proceedings. Furthermore, the department solves issues of forensic examinations of digital technologies.

Example of results

PUBLICATIONS:

- VOHNOUT R., ŘÍHOVÁ Z. AND BŘEHOVSKÝ P. (2014) Cash Holdings Profitability Threshold Model. IDIMT-2014: Networking Societies - Cooperation And Conflict. Linz : Universitätsverlag Rudolf Trauner: 125-132. ISBN 978-3-99033-340-2.
- PROKÝŠEK M. AND NOVÁK V. (2014) Large Smart Metering System & Security. In *IGBSG 2014 Proceedings*. Taipei : IEEE Electrical Insulation Society Staff,s. 1-5. ISBN 978-1-4673-6121-7
- DOSTÁLEK L. AND NOVÁK V. (2013) The Cryptographic Sensor. In 25.5.2013. Brno : University of Defence Brno, 43-48. ISSN 2336-5587.
- FESL J., KLEE R., DOLEŽALOVÁ M. (2013) Distributed Conditional Multicast Access for IP TV in High-Speed Wireless Networks (Destination Specific Multicast). *International Journal of Computer Science and Network* 2: 137-141.

RESEARCH FIELD STATIONS

Researchers and students of the Faculty of Science take part in several projects carried out at field stations in extreme biological environments, particularly at the polar station on Svalbard and tropical station in Papua New Guinea.

The scientific programmes cover various biological fields such as ecology, entomology, algology, and parasitology. A practical course in Tropical Ecology in Papua New Guinea is available bi-yearly for ten MSc. Students.

RESEARCH IN PETUNIABUKTA, SVALBARD ISLANDS



FIELD COURSE OF TROPICAL ECOLOGY AT THE BINATANG RESEARCH CENTER, MADANG, PAPUA NEW GUINEA.

