University of South Bohemia

in České Budějovice, Czech Republic

Faculty of Biological Sciences

Biennial information prospectus for everyone interested in collaboration with or the study of biology and ecology at the Faculty of Biological Sciences

October 2006
České Budějovice – the old downtown

Faculty of Biological Sciences – building “B”

... come to discover the world of nature
Faculty of Biological Sciences

15th Year Anniversary of the Faculty

Biennial information prospectus for everyone interested in collaboration with or the study of biology and ecology at the Faculty of Biological Sciences
October 2006

For updated information, see www-pages:
http://www.bf.jcu.cz
Faculty of Biological Sciences
University of South Bohemia in České Budějovice, Czech Republic

Research and study programmes at Faculty of Biological Sciences
2004–2005
Biennial information prospectus for everyone interested
in collaboration with or the study of biology and ecology
at the Faculty of Biological Sciences
October 2006

Published in October 2006
by Faculty of Biological Sciences, University of South Bohemia in České Budějovice, Czech Republic
Typesetting and Design by academic officers and co.
Printed by: WIP Reklama spol. s r.o.
Preface

This biennial information prospectus is meant to serve as an initial information and reference source for anyone interested in collaboration with the Faculty of Biological Sciences, the University of South Bohemia in České Budějovice, Czech Republic, or in the study of biology and ecology. Any such material is limited by two factors: its extent and the time of publication. It was not possible to include all relevant information and we are aware of the changes which will arise after issue due to the development of our institution. Thus, we have to ask the reader to look for further and more regularly updated information on the www pages of our Faculty at the address given on the previous page and – if more information is required – to use the e-mail addresses of the Faculty officers and ask them directly. The www pages also serve to inform the reader of the formalities of arranging long-term residence permits for foreign students, accommodation details, living costs, and other matters of interest to a person visiting or staying in the Czech Republic.

Authors

Organized by František Sedláček; numerous people from various departments of the Faculty collected data for this material. The help given by Petr Kos and Christopher Steer from the Language Department is greatly appreciated as well as the help of Oldřich Nedvěd with typographic corrections.
# Contents

Preface ..................................................................................................................  3

Contents ................................................................................................................  4

About the university ..........................................................................................  5

About the faculty ...............................................................................................  7

Collaborating scientific institutes .................................................................... 15

Departments ........................................................................................................ 19

  Department of Animal Physiology .............................................................. 19

  Department of Botany ............................................................................... 23

  Department of Ecology and Hydrobiology ............................................. 28

  Department of General Biology ............................................................... 34

  Department of Genetics ............................................................................ 38

  Department of Mathematics, Physics and Chemistry ......................... 44

  Department of Molecular Biology and Biochemistry ......................... 46

  Department of Parasitology ...................................................................... 50

  Department of Plant Physiology and Anatomy ................................... 57

  Department of Zoology ............................................................................ 61

  Language Department .............................................................................. 66
Basic information about the University

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

Rector’s Office: Branišovská 31, CZ-370 05 České Budějovice, Czech Republic

Prof. PhDr. Václav Bůžek, CSc. (Rector)

Prof. RNDr. Zdeněk Brandl, CSc. (Vice-Rector, Education and Student Affairs)
Prof. PaedDr. Vladimír Papoušek, CSc. (Vice-Rector, External and Foreign Relations)
Prof. RNDr. Jan Zrzavý, CSc. (Vice-Rector, Research)
Prof. Ing. František Střeleček, CSc. (Vice-Rector, Development)
Doc. PhDr. Jana Šemberová, CSc. (Vice-Rector, Lifelong Learning)
Ing. Hana Kropáčková (Bursar)
Dr. Ing. Alois Křišťan, Th.D. (Academic Senate, Chairman)

Number of Students: 9,290
Total number of staff: 852

Faculties

Faculty of Agriculture
Dean: Prof. Ing. Magdalena Hrabánková, CSc.
Address: Studentská 13, CZ-370 05
České Budějovice, Czech Republic
http://www.zf.jcu.cz/

Faculty of Biological Sciences
Dean: Prof. RNDr. Libor Grubhoffer, CSc.
Address: Branišovská 31, CZ-370 05
České Budějovice, Czech Republic
http://www.bf.jcu.cz/

Faculty of Health and Social Studies
Dean: Prof. MUDr. Miloš Velemínský, CSc.
Address: Jírovcova 24, CZ-370 04
České Budějovice, Czech Republic
http://www.zsf.jcu.cz/

Pedagogical Faculty
Dean: Prof. RNDr. Miroslav Papáček, CSc.
Address: Jeronýmova 10, CZ-371 15
České Budějovice, Czech Republic
http://www.pf.jcu.cz/

Philosophical Faculty (from January 1, 2006)
Dean: PhDr. Miroslav Novotný, CSc.
Address: Na Mlýnské stoece 35, CZ-370 01
České Budějovice, Czech Republic
http://www.ff.jcu.cz/

Theological Faculty
Dean: Doc. Dr. Jiří Kašný, Th.D.
Address: Kněžská 8, CZ-370 01
České Budějovice, Czech Republic
http://www.tf.jcu.cz/

University Institutes

Institute of History (till December 31 2005)
Director: PhDr. Miroslav Novotný, CSc.
Address: Jeronýmova 10, CZ-371 15
České Budějovice, Czech Republic
http://www.hu.jcu.cz/

Research Institute of Fish Culture and Hydrobiology
Director: Doc. Ing. Otomar Linhart, DrSc.
Address: Zátiší 728/II, CZ-389 25
Vodňany, Czech Republic
http://www.vurh.jcu.cz/

Institute of Physical Biology
Director: RNDr. Dalibor Štys, CSc.
Address: Zámek Nové Hrady, Zámecká 136,
CZ-373 33 Nové Hrady, Czech Republic
http://www.ufb.jcu.cz/
History and characteristics of the University of South Bohemia

The University was established by Act of Parliament in September, 1991, as a part of the system of public university institutions. At the very beginning, the new university consisted of just two faculties, the Pedagogical Faculty and the Faculty of Agriculture, that had previously existed independently in the town from the middle of the 20th century. Soon after this, in November 1991, the University Academic Senate decided to establish three more, including the Faculty of Biological Sciences. The original two faculties are still the largest components of the university, while the other three are of the size of approximately one tenth of the total student number each.

The University does not cover all possible fields of tertiary education. It is focused on the education of teachers, specialists in agriculture and its management and economics, non-physician staff of medical and health-care institutions, people in various religious services – and biologists. The future plans of the university include the enlargement of this selection to include humanities and further branches of science. The University offers study programmes at the bachelor, master and doctoral levels. The accredited doctoral programmes are in Biology, Agriculture and Agricultural Management, History, History of Czech Literature, and Theology. The University is located in the regional centre of the South Bohemia Region, the town of České Budějovice (population approx. 100 000), about 150 km south of Prague. The town was established in the thirteenth century at the confluence of the river Vltava and its tributary the Malše where the Czech King Přemysl Otakar II founded a “King’s town”. The wisdom of the King’s choice of location can still clearly be seen while walking around the large central square of the town. During its history, the town was a crossroads of commerce not only in the region but also on trade routes from the European South to Central Europe. The first European horse-drawn railway connected the town with Linz in Austria in 1832. Further industrial development (pencils and beer) stimulated the growth of the city and turned it into a regional centre.

Three of the faculties of the University are located in the old part of the town while the Faculties of Agriculture and of Biological Sciences are placed in the ever growing university campus on the western edge of the town. Besides these two faculties the campus comprises of student residences, a Rector’s office and also the buildings of the Biological Institutes of the Academy of Sciences of the Czech Republic.

The University includes not only the six faculties but also some other institutions, such as the European Information Centre, the University Training Farm, etc. Of special interest to the biologist are the Research Institute of Fish Culture and Hydrobiology, and the Institute of Physical Biology. The former is located in the near-by town of Vodňany, surrounded by carp ponds which are a typical component of the South-Bohemian countryside. The research programme of this institute includes basic and applied research in aquaculture, namely genetics, reproduction and the breeding of carp and other pond-cultivated fish, fish-farming technologies, and the ecology and ecotoxicology of water environment.

The Institute of Physical Biology in Nové Hrady village is a scientific institution focused on basic and applied research including the development of new technologies and devices concerning the physiology of biomembrane processes during photosynthesis in plant cells. Besides research and development activities, the institute offers a number of short-time, highly specialized postgraduate courses for graduate students and postdoctoral scientists involving numerous teachers from other countries.
Basic information about the Faculty

In 1991, scientists from the Academy of Sciences of the Czech Republic (AS CR) established the Faculty of Biological Sciences (BF JU) – see organization chart, figure 1. The faculty became a crucial element responsible for the establishment of the University of South Bohemia. It has served as a base for education and training in biological disciplines within the framework of accredited programmes. At first, only undergraduate programs were provided by the faculty. Later, the undergraduate programs were naturally extended to graduate and post-graduate levels, respectively. Despite administrative separation, close links between the faculty and institutions of the AS CR have been maintained. This association is demonstrated in figure 2, which shows the existing organizational structure of the faculty. Scientists from the AS CR are, to a large extent, involved in teaching and they also supervise Ph.D. studies. The BF JU and corresponding institutions of the AS CR mutually share accreditation for Ph.D. programs.

Fig. 1: Organizational chart of the Faculty of Biological Sciences
Research

Research at the faculty is mainly focused on ecology and biology. The profile is, however, systematically modified in accordance with the concept of “integrative biology”. This concept puts strong emphasis on the evolutionary aspects of biology and ecology. To gain insight into the dynamic development of living systems model systems are studied at all levels, from whole populations to organisms and molecules.

The Faculty of Biological Sciences is formally divided into departments, however collaboration among researchers in these departments is maintained, providing important flexibility and the transfer of knowledge between otherwise historically separated fields. The faculty has gained international respect in the 15 years of its existence, mainly due to support from national as well as international grant agencies. In addition, there has also been significant support from local grant agencies to individual research groups. All grants and research proposals submitted to grant agencies support the long-term development and integration of research performed by the faculty. Research performed at the faculty is predominantly oriented towards the biodiversity.

Biodiversity is one of the most remarkable features of life on earth; from the variety of molecular mechanisms that underlie living functions to the number of alleles in a population, from the morphological variety of organisms to the diversity of ecosystems on Earth. Human society is also dependent on the stability and functioning of the ecosystem. However, we change and threaten the functioning of ecosystems. The study of biodiversity and general biological factors, and the relationship between biodiversity and ecosystem functioning, has recently become a priority scientifically and politically. The ability to predict the behaviour of organisms to a changing environment and how the environment also is shaped by these changes in biodiversity and the functions of organisms is a major task of biological sciences.

The list of problems linked to the modern biodiversity crisis indicates the necessity to focus on the application of molecular approaches. Phylogenetic reconstruction today inevitably needs the identification and sequencing of appropriate genes, which requires specific genomic knowledge. Nowadays, application of molecular methods is widespread in the study of population, ecological and applicable conservation issues. The development of molecular biology as a tool for studying biodiversity is occurring by widening the spectra of model organisms and also further, intensive research on the functional and structural genomics of traditional models (Trypanosoma, Drosophila, Caenorhabditis). Concrete problems under study at the faculty could be divided into five domains as follows:

1) Biodiversity and functional ecology of communities and ecosystems
   - Relation between biodiversity and function of plant communities and the mechanisms of species diversity.
   - Interaction and equilibrium between basic functional types in field communities.
   - Functional relationships between soil and field communities
   - Economic utilisation of plant sources and soil microorganisms.
   - Analysis of the direction, velocity and causes of seral changes and the impact of invasive species on various seral stages.
   - Interaction, function and stability of water community organisms.
   - Modelling life strategies and growth of organisms, populations and communities.

2) Biodiversity: from systematic biology to wildlife protection
   - Tropical ecology.
   - Biodiversity in the Czech Republic and its protection.
   - Synantropisation, synurbisation and fragmentation of terrestrial vertebrate populations.
3) **Phylogeny and evolutionary biology of organisms: the origin of biodiversity**
   - Phylogeny of Metazoa.
   - Phylogeny and evolution of the ecology of insects.
   - Phylogeny and evolution of the biology of vertebrates.

4) **Biodiversity and evolution of ecological association and social systems**
   - Parasitism and symbiosis.
   - Mimicry.
   - Anti predatory behaviour and intra-specific aggression of vertebrates.

5) **Evolutionary genomics of model organisms**
   - Functional genomics of trypanosomes.
   - Functional genomics of transcription factors in nematodes, fruit flies and new insect models.
   - Study of the control of growth and development in fruit flies.
   - Structural genomics: Study of molecular mechanisms in trypanosomes and inhibitor development.
Teaching
The Faculty of Biological Sciences offers programmes at all three levels: Bachelor's, Master's and Ph.D. studies. Above all the Doctoral and partly the Master's levels may be of interest to foreign students.

Bachelor's Programmes
The three-year Bachelor's Programmes should supply a student with the basic knowledge necessary either for subsequent master's studies or for practical professional employment. Students choose either “Introductory Biology Programme” (preparation for further studies in Biology or Biology for teaching) or “Biophysics”, or some professionally orientated programmes – “Environmental Care” or “Biomedical Laboratory Technology”. 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 biological textbooks.

Master's Programmes
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 programmes – “Biophysics”, “Botany”, “Clinical Biology”, “Ecology”, “Experimental Biology”, “Parasitology”, and “Zoology”. Most of these programmes are conducted in Czech only, some also in English and the number of English versions is expected to grow. Students are meant to gain more theoretical knowledge in their field of specialization but should also produce a diploma thesis which should result in a paper to be published in the appropriate regular international scientific journal. A good command of English is a skill which students must obtain during this programme. Due to the growing interest in exchange programmes for students (such as Socrates/Erasmus) in Europe or even further afield, the programmes offer foreign students a set of half-year courses and within those courses a number of interconnected topics.

Doctoral Programmes
The intention of the doctoral programmes is education for highly qualified scientific and research work. The main duty of Ph.D. students is seen in individual work on their theses. During the study programme, which lasts 3 years, the students enlarge their knowledge in a specific field of study. They attend recommended lectures and courses and also are involved in the teaching of undergraduate students. Each year the students have to give a seminar or talk focused on the methodology (first year) and the results of their own experimental work. The students are encouraged to present the results at international conferences). The study is completed by passing the final examinations and by the defence of the student’s doctoral thesis. It is desirable that the thesis comprises of published and accepted papers in recognized international journals.

The student is supervised by a thesis advisor, who is responsible for the appropriate scientific content of the work. The title Doctor of Philosophy (Ph.D.) in a given area of specialization is awarded to successful graduates. A citizen of any country is eligible for enrolment if he/she meets the requirements for the selected area of specialisation, is able to meet the financial obligations related to the studies – tuition fees and residency requirements in the Czech Republic.
Biology – specialization Entomology
Programme Director: Doc. RNDr. Oldřich Nedvěd, CSc.
Study specialization in entomology offers the training of students in basic entomological disciplines and their general scientific basis with respect to the modern field and laboratory methods and laboratory equipment. All the thesis advisors are actively working in the field in question and most of them are distinguished specialists in entomology. Subjects of Ph.D. theses are related to both general and/or theoretical research in (arachno-) entomology, i.e. morphology, physiology, genetics, systematics and taxonomy, and phylogeny, as well as to applied research.

Areas of Ph.D. research: Relations of herbivores and plants in the tropical rain forest, and in the temperate forest. Metapopulation ecology and mobility of butterflies. Taxonomy of selected insect groups. Relations of diapause and cold/heat/drought resistance in arthropods. Aphidophagous insects and their use in biological control.

Biology – specialization Hydrobiology
Programme Director: Prof. RNDr. Karel Šimek, CSc.
The doctoral programme in hydrobiology assures the training of students in various areas of current limnology, dealing mainly with the production, microbial and chemical processes and nutrient transformation in reservoir and lake ecosystems and their watersheds. In the scope of the programme, one can select specific topics of fundamental research of different aspects of the functioning of reservoir and lake ecosystems. Alternatively, an holistic approach and other approaches suitable in applied research and water management area are taught. Specific aspects of fundamental research can be solved by means of the cultivation of organisms under controlled conditions in simplified model systems. Special attention is paid to the acquisition of proper experimental and monitoring skills, supporting the students’ ability to appropriately plan experiment and devise sampling strategies and statistical evaluations.


Biology – specialization Parasitology
Programme Director: Prof. MVDr. Iva Dyková, DrSc.
This study program offers training in the basic fields of parasitology. The lectures and laboratory assignments are given by instructors engaged in parasitological research. Dissertation topics involve fundamental research in the biology of parasitic organisms and their host relations and the area of medical and veterinary parasitology.

Areas of Ph.D. research: Human parasitoses: protozoan infections in immunodeficient patients, host-parasite relation including the immune response. Protozoan and myxosporean parasites in fish: morphology, life cycles and pathogenicity. Amphizico amoebae – distribution in fish, pathogenicity and molecular phylogeny. Biology, ecology and diversity of all principal groups of helminths parasitic in fish. Molecular biology and biochemistry of parasites: phylogenetic relationships of selected groups of protists based on the analysis of
ribosomal RNA genes; structure of mitochondrial DNA in various groups of protists. Molecular ecology of blood sucking vectors in relation to mechanisms of pathogen transmission: protein-saccharide interactions, immune reactions in disease vectors.

**Botany – specialization Botany**  
Programme Director: Prof. RNDr. Jan Š. Lepš, CSc.

Education of students in all basic botanical disciplines including the problems of both cryptogams and vascular plants. Lectures are given by specialists experienced in various branches of botanical science, who usually have long research experience and who participate in projects and scientific programmes at the Faculty of Biological Sciences of the University of South Bohemia, and/or at the Institute of Botany of the Academy of Sciences. The themes of dissertations represent a wide spectrum of botanical research. Several projects are closely connected with the core programme of Czech botanists, i.e. the elaboration of the complete Flora of the Czech Republic, but other projects are broadly concerned with important hydrobiological, ecological or landscape ecological problems. Several areas of study focus on the problems of speciation, diversification, and modern molecular taxonomy of cyanobacteria, algae, bryophytes and vascular plants. The latest modern laboratory (genetic, physiological) and field methodological procedures (population biology, ecological and autecological approach) are used for this work; the methods aimed at the investigation of the ecology of plant communities, succession, invasive plants, the role of plants in ecosystems and in landscape are an integral part of the educational procedures. Students participate in several important Czech or international research projects.


**Ecology – specialization Ecology**  
Programme Director: Prof. Ing. Hana Šantrůčková, CSc.

The programme is focused on the principles and methods of contemporary ecology, with special attention paid to the mechanisms of ecosystem functions. The interactions among plants and animals, in both aquatic and terrestrial ecosystems are considered, with emphasis on the evolutionary consequences of ecological phenomena. Experimental approaches are emphasised, with courses on the design of ecological experiments and analysis of ecological data. Ecological theory is dealt with in several courses.


**Molecular and Cell Biology – specialization Molecular and Cell Biology and Genetics**  
Programme Director: Doc. RNDr. Marek Jindra, CSc.

Independent thinking, good English, and motivation to strive to discover new things, even at the expense of one’s own comfort, are the main prerequisites to succeed in this programme. Students are guided toward independent scientific research in the fields of molecular, cell and developmental biology. They need to master molecular and genetic methods of work with diverse model organisms ranging from protists and yeast to plants and animals. Student
projects are secured by supervisors active in international research. Topics of Ph.D. theses are derived from the aims of grant projects and rely on high-tech equipment as well as on international collaboration; most students experience a short assignment in a foreign partner’s laboratory. Their projects typically aim to clarify some of the fundamental issues of current biology, such as those concerned with the regulation of cell functioning or differentiation. Students are also trained in molecular cytogenetics, gene engineering and animal and plant genetics; special attention is devoted to the techniques of genetic modifications.


Physiology and Immunology – specialization Anatomy and Physiology of Plants
Programme Director: Doc. Ing. Jiří Šantůček, CSc.
The Ph.D. course offers advanced education in several important branches of plant physiology and anatomy. It is supported by the experience of supervisors, renewed scientists working at the Institutes of the Academy of Sciences of the Czech Republic, employing new biochemical and biophysical methods and hi-tech equipment in plant physiology, anatomy and ecophysiology projects. Subjects of the doctoral theses are focused on various topics of the photochemistry of photosynthesis in higher plants, algae and cyanobacteria, on the structural and functional aspects of biomembranes and on interactions of the leaf and the whole plant with the environment (environmental and stress plant biology). The graduates will be competent in a broad scale of plant science research, agricultural, forestry, horticultural and biotechnology programs and should have advanced skills in scientific communication.


Physiology and Immunology – specialization Animal Physiology and Developmental Biology
Programme Director: Prof. RNDr. Ladislav Janský, DrSc.
The animal physiology and developmental biology study discipline provides schooling in various general and specialised physiological fields. Basic research at molecular, cellular or organismic levels from the environmental aspect is being performed on insect, vertebrate and human models. Thesis advisors are well known scientists working actively in the field with the help of modern methodology. Students learn to use up-to-date methods of physiology, biochemistry, endocrinology, cell biology and immunology using computerised data acquisition systems and are trained to present their data at scientific meetings.


**Zoology – specialization Zoology**
Programme Director: Prof. RNDr. Jan Zrzavý, CSc.

The Ph.D. program provides instruction in basic zoological disciplines, supervised by thesis advisors who are active zoological and ecological research workers able to apply modern methods and laboratory equipment. The topics of Ph.D. theses include problems and methodology of modern biology and ecology of animals, especially animal phylogeny, tropical ecology, host-parasite coevolution, arthropod morphology and systematics, bird ecology and behaviour, mammal ecology, neuroethology and sociobiology, and fish ecology and phylogeny.

Collaborating scientific institutes of the Academy of Sciences of the Czech Republic

Five institutes of the Academy of Sciences of the Czech Republic located in České Budějovice and grouped into the Biology Centre as well as five other institutes participate in organising the doctoral study programmes (see Fig. 2).

**Biology Centre AS CR**
*Director:* Vít Našinec, CSc.
*Address:* Branišovská 31, CZ-370 05 České Budějovice, Czech Republic
*http://www.bc.cas.cz/*

**Hydrobiological Institute**
*Director:* Doc. RNDr. Josef Matěna, CSc.
*Address:* Na Sádkách 7, CZ-370 05 České Budějovice, Czech Republic
*http://www.hbu.cas.cz/*

**Institute of Entomology**
*Director:* Doc. RNDr. Jan Šula, CSc.
*Address:* Branišovská 31, CZ-370 05 České Budějovice, Czech Republic
*http://www.entu.cas.cz/*

**Institute of Parasitology**
*Director:* Prof. RNDr. Tomáš Scholz, CSc.
*Address:* Branišovská 31, CZ-370 05 České Budějovice, Czech Republic
*http://www.paru.cas.cz/*

**Institute of Plant Molecular Biology**
*Director:* Doc. Ing. Josef Špak, DrSc.
*Address:* Branišovská 31, CZ-370 05 České Budějovice, Czech Republic
*http://www.umbr.cas.cz/*

**Institute of Soil Biology**
*Director:* RNDr. Václav Pižl, CSc.
*Address:* Na Sádkách 7, CZ-370 05 České Budějovice, Czech Republic
*http://www.upb.cas.cz/*

**Institute of Animal Physiology and Genetics, AS CR**
*Director:* Doc. MVDr. Ivan Míšek, CSc.
*Address:* Rumburská 89, CZ-277 21 Liběchov, Czech Republic
*http://www.iapg.cas.cz/*

**Institute of Botany, AS CR**
*Director:* Doc. RNDr. Jan Kirschner, CSc.
Division of Plant Ecology in Třeboň
*Address:* Dukelská 135, CZ-379 82 Třeboň, Czech Republic
*http://www.butbn.cas.cz/*

**Institute of Microbiology, AS CR**
*Director:* Prof. RNDr. Blanka Říhová, DrSc.
Division of Autotrophic Microorganisms at Třeboň
*Address:* Opatovický mlýn, CZ-379 81 Třeboň, Czech Republic
*http://www.biomed.cas.cz/mbu/autotroph.html*

**Institute of Systems Biology and Ecology, AS CR**
*Director:* Prof. RNDr. Ing. Michal V. Marek, DrSc.
*Address:* Na Sádkách 7, CZ-370 05 České Budějovice, Czech Republic
*http://www.usbe.cas.cz/*

**Institute of Vertebrate Biology, AS CR**
*Director:* Prof. RNDr. Jan Zima, DrSc.
*Address:* Květná 8, CZ-603 65 Brno, Czech Republic
*http://www.ivb.cz/*
Fig. 2 Relations of the Faculty to Academy Institutes

Departments
(numbers indicate intensive connections)

Collaborating scientific institutes of the Academy of Sciences
(accredited for doctoral programmes)

<table>
<thead>
<tr>
<th>Departments</th>
<th>Collaborating institutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dept. of Animal Physiology</td>
<td>4 - Hydrobiological Inst.</td>
</tr>
<tr>
<td>Dept. of Botany</td>
<td>3, 5, 9 - Inst. of Animal Physiology and Genetics</td>
</tr>
<tr>
<td>Dept. of Ecology and Hydrobiology</td>
<td>1 - Inst. of Botany</td>
</tr>
<tr>
<td>Dept. of General Biology</td>
<td>2 - Inst. of Botany</td>
</tr>
<tr>
<td>Dept. of Genetics</td>
<td>3 - Inst. of Botany</td>
</tr>
<tr>
<td>Dept. Mathematics, Physics, Chemistry</td>
<td>4 - Inst. of Entomology</td>
</tr>
<tr>
<td>Dept. of Molecular and Cell Biology</td>
<td>4 - Inst. of Entomology</td>
</tr>
<tr>
<td>Dept. of Parasitology</td>
<td>4, 6 - Institute of Microbiology</td>
</tr>
<tr>
<td>Dept. of Plant Physiology and Anatomy</td>
<td>6 - Inst. of Parasitology</td>
</tr>
<tr>
<td>Dept. of Zoology</td>
<td>7 - Inst. of Plant Molecular Biology</td>
</tr>
<tr>
<td>Language Department</td>
<td>8 - Inst. of Soil Biology</td>
</tr>
<tr>
<td></td>
<td>9 - Inst. of Systems Biology and Ecology</td>
</tr>
<tr>
<td></td>
<td>10 - Inst. of Vertebrate Biology</td>
</tr>
</tbody>
</table>

Joint divisions of the faculty and collaborating scientific institutes of the Academy of Sciences

Laboratory of Molecular Taxonomy
Laboratory of Electron Microscopy
Laboratory of Sequential Methods
Library
Lecture hall of institutes of the Academy of Sciences

Training in microscopy

The Laboratory of Electron Microscopy
Joyful pipetting in the Laboratory of Molecular Taxonomy

Field course of sea invertebrates

Hypselodoris – an amazing capture
Departments

Staff – Scientific activities – Study programmes – Selected publications

Department of Animal Physiology

Staff
Doc. RNDr. Dalibor Kodrik, CSc. (Head) – kodrik@entu.cas.cz – insect physiology, insect neurohormones, protein purification

Prof. RNDr. Pavel Blažka, CSc. – blazka@jcu.cz – physiology of aquatic animals

Prof. RNDr. Ladislav Janský, DrSc. – janskyL@seznam.cz – human physiology, physiology and temperature

Prof. RNDr. František Sehnal, CSc. – sehnal@entu.cas.cz – insect endocrinology, developmental biology

Prof. RNDr. Jan Žďárek, DrSc. – zdarek@uochb.cas.cz – insect etology and endocrinology

Doc. RNDr. Magdalena Hodková, CSc. – magda@entu.cas.cz – insect ecophysiology, chronobiology

Doc. Ing. Vladimír Koštál, CSc. – kostal@entu.cas.cz – insect diapause, cryobiology

Doc. RNDr. Václav Němec, CSc. – nemec@entu.cas.cz – insect physiology, insect endocrinology

Doc. RNDr. František Sedláček, CSc. – sedlacek@usbe.cas.cz – mammal neuroethology

Doc. RNDr. Stanislav Vybíral, CSc. – stvyb@natur.cuni.cz – human physiology, physiology and temperature

RNDr. Ivo Hodek, CSc. – hodek@entu.cas.cz – insect ecophysiology, photoperiodism

RNDr. Blanka Kalinová, CSc. – blanka@uochb.cas.cz – insect neurophysiology
Scientific activities

The Department of Animal Physiology deals with (1) insect physiology, (2) human physiology and (3) the physiology of fish.

Insect physiology is focused on insect endocrinology. The insect physiology research group deals with insect metabolic and stress hormones – adipokinetic peptides from the AKH/RPCH family. The group recently isolated and characterised two new adipokinetic octapeptides from the insect *Pyrrhocoris apterus* corpora cardiaca and is now studying their function in the insect’s body. It was found that topical application and/or injection of the peptide induces lipid mobilisation, but is inactive in the mobilisation of carbohydrates. Application of the hormones also stimulates insect locomotion. The ELISA test revealed that the whole AKH content fluctuates during the development of the adult life of the bug and also within a 24-hour period. The diel changes of AKH content in CNS are correlated with diel changes of adipokinetic response and also with locomotor activity. In addition, significant differences of AKH content among macropterous, brachypterous and diapausing adults were recorded.

Another insect physiology research group studies changes in the content of proteins, glycogen, neutral lipids and sterols in locust eggs from oviposition to hatching. The amount of proteins increased progressively during embryogenesis, while glycogen and lipids were successively metabolised or utilised for the development of the embryo.

Human physiology research group deals with the physiological mechanisms of cold adaptation and fever. It was found that whole body exposure to cold water induces a decrease in rectal temperature, while the local peripheral cooling of lower extremities does not influence rectal temperature and metabolic rate, but increases heart rate and brain temperature. The group also analysed dynamics in the activity of different thermoregulatory outputs and changes in the functions of thermoregulatory centres after peripheral administration of cytokines.

The fish physiology research group studies primarily anaerobic metabolism in the anoxia resistant *C. carassius* and in the wild form of *C. auratus* (silver crucian carp). The ammonia excretion rate in anoxia at 5°C is significantly lower than suggested previously and corresponds evidently to the catabolism of damaged proteins. Current studies deal with mitochondrial anoxia, the role of CO₂ in anaerobic metabolism and the variability of anaerobic end products under different environmental conditions.
Study programmes

The Department of Animal Physiology co-ordinates study programmes and student theses in animal physiology. The department is responsible for the master study programme “Experimental Biology” – specialisation: “Animal Physiology” and Ph.D. study programme “Physiology and Immunology” – specialisation: “Physiology and Developmental Biology of Animals” (guarantees: D. Kodrik and P. Blažka).

Selected publications of the department

2004


2005


Department of Botany

Staff

Prof. RNDr. Karel Prach, CSc. (Head) – prach@bf.jcu.cz – plant ecology, restoration ecology

Prof. Dr. Sándor Bartha – (external member, Inst. Ecology and Botany, Hungarian Academy of Sciences, Vácrátót) – sanyi@botanika.hu – plant ecology

Prof. RNDr. Jiří Komárek, DrSc. – komarek@butbn.cas.cz – algology

Prof. RNDr. Jan Lepš, CSc. – suspa@bf.jcu.cz – plant ecology, biostatistics

Doc. RNDr. Josef Elster, CSc. (external member) – jester@butbn.cas.cz – ecology of algae

Doc. RNDr. Lubomír Hrouda, CSc. (external member) – hrouda@natur.cuni.cz – taxonomy and phytogeography of higher plants

Doc. RNDr. Jitka Klimešová, CSc. (external member) – klimesova@butbn.cas.cz – plant ecology

Mgr. Marek Bastl – marek.bastl@bf.jcu.cz – plant ecology, biostatistics

PhDr. Jaromír Beneš – benes@bf.jcu.cz – archeobotany

RNDr. Jan Kaštovský, Ph.D. – hanys@bf.jcu.cz – algology

Ing. Miloslava Kavková, Ph.D. – kavkova@hotmail.com – mycology

RNDr. Zdenka Křenová, Ph.D. – gentiana@bf.jcu.cz – plant ecology (population ecology)

Mgr. Jan Kučera, Ph.D. – jan.kucera@bf.jcu.cz – taxonomy of bryophytes

RNDr. Jaromír Lukavský, CSc. (external member) – lukavsky@butbn.cas.cz – algology

RNDr. Stanislav Mihulka, Ph.D. – plch@tix.bf.jcu.cz – plant ecology (ecology of invasive plants)
Scientific activities

In the past two years, the Department of Botany conducted research activities predominantly in the following fields, mostly as continuations of previous studies: taxonomy and ecology of cyanobacteria and algae, taxonomy of bryophytes, ecology of selected groups of fungi, taxonomy and phytogeography of higher plants, ecology of populations and communities of higher plants, vegetation ecology, restoration ecology, and archeobotany. Particular topics are evident in the titles of the publications listed below, however the following ones may be highlighted: Taxonomic studies on cyanobacteria are oriented mostly on polyphasic evaluation of diversity of selected genera, mainly from planktic and extreme biotopes. The traditional cytomorphological, ecological, and molecular approaches are applied for revision of strains and natural populations. The cyanobacterial microflora of extreme biotopes is studied mainly in maritime Antarctica, and in various tropical habitats in American continents.

In a comparative study carried out in five European countries it was demonstrated that sampling effect is the most important part of the biodiversity effect in the diversity–productivity studies. The conclusion was confirmed by a pot experiment conducted in controlled conditions. The most successful woodland invasion in Papua New Guinea confirmed the rule that in moist tropics, invasions are restricted disturbed habitats. Comparisons of a higher number of successional seres in human disturbed habitats revealed a pattern across the seres, distinguishing between “ruderal” and “non-ruderal” seres being more important than primary or secondary status of succession. Substratum pH appeared to be the main driving environmental variable. Proportions of woody species used in ancient settlements were quantified using archeobotanical samples, and based on this, the forest vegetation around the settlements was tentatively reconstructed.

Some research and education activities were conducted in close collaboration with the Institute of Botany, Academy of Sciences of the Czech Republic, as well as with several foreigner universities and institutes, e.g. University of Groningen, and University of
Wageningen, The Netherlands; Institute of Botany and Ecology, Hungarian Academy of Sciences; University of Liverpool, and University of Sheffield, England; University of California, Davis; University of Uppsala; University of Helsinki; University of Palermo and others. Two projects within the EU programme Framework V are carried out together with two international consortia, comprising altogether more than ten European countries.

The department organised various excursions inside the country and abroad, among them to the Crimea Peninsula or to the Kola Peninsula. At the end of 2002, the whole Department moved into a newly reconstructed building, which supported closer collaboration and communication among the particular groups inside the Department, which had been located in four distant sites.

Study programmes

After finishing M.S. degree, students can take part in Ph.D. studies in the fields of botany. Generally, an emphasis is put, besides theoretical disciplines and experimental approaches, on broad field experience. The ability to recognise plants and their communities in the field and observe their ecological relations is considered a basis for other research.

Selected publications of the department

2004


2005


**Department of Ecology and Hydrobiology**

**Staff**

Prof. Ing. Hana Šantrůčková, CSc. (Head) – hasan@bf.jcu.cz – microbial ecology, nutrient cycling in soil

Prof. RNDr. Zdeněk Brandl, CSc. – prorektor-studium@jcu.cz – ecology of zooplankton, predatory feeding

Doc. Ing. Jiří Kopáček, CSc. – jkopacek@hbu.cas.cz – limnology, acidification of the catchment

Prof. RNDr. Josef Rusek, DrSc. – rusek@upb.cas.cz – soil micromorphology, taxonomy and ecology of collembolans, proturans, diplurans, elaterids

Prof. RNDr. Karel Šimek, CSc. – ksimek@hbu.cas.cz – water microbiology, bacteria/protozoa interactions

Prof. Ing. Miloslav Šimek, CSc. – misim@upb.cas.cz – soil nitrogen transformations, trace gas formation and emission

Doc. Ing. Josef Hejzlar, CSc. – hejzlar@hbu.cas.cz – limnology of reservoirs, eutrophication

Doc. RNDr. Vlastimil Křivan, CSc. – krivan@entu.cas.cz – population ecology, mathematical ecology

Doc. RNDr. Jan Kubečka, CSc. – kubecka@hbu.cas.cz – fish ecology

Doc. RNDr. Petr Šmilauer, Ph.D. – petrsm@jcu.cz – ecological statistics
RNDr. Jakub Borovec, Ph.D. – jborovec@hbu.cas.cz – limnology of lakes and reservoirs, sediments

Mgr. Miloš Devetter (external member) – mila@bf.jcu.cz – hydrobiology, zooplankton

Mgr. Jiří Dušek, PhD. – zombik@bf.jcu.cz – wetland ecology, constructed wetlands

Dr. Keith Edwards – kredwards59@yahoo.com – ecosystem management, wetland ecology

RNDr. Jaroslava Komárková, CSc. – jarkakom@hbu.cas.cz – plankton primary production, taxonomy od algae

RNDr. Jan Květ, CSc. – kvet@butbn.cas.cz – production ecology of wetlands, conservation and management

RNDr. Jiří Macháček, CSc. – machacek@hbu.cas.cz – zooplankton ecology

Ing. Tomáš Picek, Ph.D. – tompi@upb.cas.cz – soil microbiology, constructed wetlands

RNDr. Ota Rauch, CSc. – rauch@butbn.cas.cz – pedology, soil chemistry, plant–soil interactions

RNDr. Viera Straškrabová, DrSc. – verastr@hbu.cas.cz – water microbiology, bacteria-phyto- and zooplankton interactions

Mgr. Eva Uhlířová, PhD. – uhlirova@bf.jcu.cz – soil microbiology

RNDr. Jaroslav Vrba, CSc. – vrba@hbu.cas.cz – water microbiology, extracellular enzyme activity

PhDr. Jana Vrbová – jvrbov@bf.jcu.cz – secretary of the Department, communication skills

RNDr. Vojtěch Vyhnálek, CSc. (external member) – eia@iol.cz – environmental impact assessment

Scientific activities

1. Nutrient fluxes in the ecosystem and catchment

Attention is paid to the effect of eutrofication and atmospheric acidification on biological and chemical processes in lakes, sediments and soil. Investigating lakes and sediments, a special
emphasis is put on C, P and N - cycling and on the regulation mechanisms of plankton composition and dynamics. Soil studies are focused on C, N and P cycling in soil and on regulation of soil microbial metabolism by temperature, moisture, texture and nitrogen availability. A special emphasis is put on underlying mechanisms and processes of trace gas formation and emission from the soil.

2. The effect of eutrophication and management on wetlands
The research deals with the water balance and C and N cycling in the eutrophicated wetland ecosystems and on the reaction of the wetland plants on high load of nutrients. The results contribute to the knowledge of nutrient removal and retention in constructed wetlands designed for wastewater treatment.

3. The investigation of fish communities in the valley reservoirs
The research includes fish stock assessment, studies of fish feeding, migration, and behaviour and population dynamics. Special part of the research activities is the adaptation of scientific echosounders for studies of various parameters of water environment.

4. Evolutionary and population ecology
The research is carried out by a group of theoretical ecologists. The group synthesises existing empirical information on the role of individual behaviour and life-histories in shaping community dynamics, identify the limitations of existing theory in dealing with issues of scaling from individuals to communities and have begun developing new mathematical tools that explicitly deal with scaling from individual-level processes to community dynamics.

Study programmes
The Department of Ecology and Hydrobiology co-ordinates study programmes and student theses in ecology. This department guarantees one bachelor, four master and two Ph.D. programmes. Students doing bachelor degree can study the “Environmental care” programme both for decision-makers and for analysts. M.Sc. students can choose from among the programmes of “Applied Ecology”, “Ecology”, “Limnology” and “Soil Biology”. After finishing M.Sc. degree, students can take part in Ph.D. studies in the fields of “Ecology”, and “Hydrobiology”.
Selected publications of the department

2004


2005


**Department of General Biology**

**Staff**

Doc. RNDr. **Jan Kopecký**, CSc. (Head) – jan@paru.cas.cz – immunology

Prof. RNDr. **Richard Petrásek**, CSc. – richard.petrasek@medicon.cz – human physiology

Prof. MUDr. **Karel Smetana**, DrSc. – karel.smetana@uhkt.cz – blood cytology, nucleolus

Prof. MUDr. **Václav Zamrazil**, DrSc. – vzamrazil@endo.cz – clinical endocrinology, malfunction of thyroid gland, iodine

Doc. RNDr. **Richard Hampl**, DrSc. – rhampl@endo.cz – steroid hormones (biochemistry and analytic)

Doc. Ing. **Ivo Šafařík**, DrSc. – safarik@usbe.cas.cz – enzymology, biomagnetic research and technology

Doc. MUDr. **Milan Špála**, CSc. – milan.spala@lf1.cuni.cz – human pathophysiology

34
Doc. MUDr. Miroslav Vondra, DrSc. – kvondra@endo.cz – clinical endocrinology, diabetes

Doc. RNDr. František Weyda, CSc. – weyda@entu.cas.cz – morphology and anatomy of arthropods, electron microscopy, digital imaging

Mgr. Ján Štěrba – sterbaj@paru.cas.cz – clinical biochemistry, toxicology

Ing. Radovan Bílek, CSc. – rbilek@endo.cz – proteo-hormones, biofactors

RNDr. Evžen Buchar, CSc. – buchar@biomed.cas.cz – pharmacology

RNDr. Jarmila Čeřovská, CSc. – jcerovska@endo.cz – anthropometrical aspects of nutrition

MUDr. Marie Dryáková, CSc. – diagnostic and treatment of diabetes

MUDr. Radmila Janovská – pathology

MUDr. Josef Klíma, CSc. – pharmkl@mbox.vol.cz – pharmacology

RNDr. Jan Kovář, CSc. – jan.kovar@medicon.cz – metabolism of lipoproteins, atherosclerosis

RNDr. Jan Kvíčala, CSc. – jkvicala@endo.cz – trace elements in organism

MUDr. Jana Přádná – pradna@nemcb.cz – histology

MUDr. Miroslav Verner – verner@nemcb.cz – clinical biochemistry

MUDr. Ivan Vonke – vonke@nemcb.cz – clinical hematology

RNDr. Zdenka Vraiová – vrajova@nemcb.cz – methods of clinical immunology

MUDr. Pavel Žampach – zampach@nemcb.cz – clinical immunology
**Scientific activities**

The research in the Department of General Biology focuses on several different topics including many areas of biomedicine, immunology, enzymology, insect morphology, and methods for particle and protein separation, and digital imaging. The Department is devoted to the study of molecules, microorganisms and cells, for the diagnosis and management of illness and for the investigation of the mechanisms and pathogenesis of disease. Areas of biomedical research include hematology, immunology, clinical biochemistry, clinical endocrinology, pharmacology and other biomedical fields.

In the field of enzymology, magnetic carriers, adsorbents and substrates (e.g., cross-linked erythrocytes and modified *Saccharomyces cerevisiae* cells) have been developed and prepared for enzyme isolation and characterisation. Some proteolytic enzymes and low-molecular-weight organic compounds (e.g., tricyclic drugs) and xenobiotics (e.g., dyes) have been isolated using magnetic adsorbents. Magnetic solid-phase extraction has been applied for the preconcentration of malachite green and crystal violet from large volume of water or urine, and selected xenobiotics have been determined using magnetically modified enzymes.

In insect functional morphology the research has dealt with ultrastructural aspects of the ontogeny of fat body and glands (tarsal and labial) of two termite species. Ultrastructure and function of various organs in tsetse flies, mites, primitive arthropods etc. has been studied. Other topics focused upon are digital imaging – 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 like *Borrelia burgdorferi* and tick-borne encephalitis virus. Another part of immunological research is devoted to the research of immunity against microsporidia, causative agents of opportunistic infections in AIDS patients.

**Study programmes**

The Department of General Biology co-ordinates one bachelor and one master study programme and student theses in general biology and biomedicine.

1. **B. Sc. programme – “Biomedical Laboratory Technique”**
   (Supervisor F. Weyda). Teaches skills necessary for practical work in biological and health institutions including diagnostic methods based on the analysis of nucleic acids and proteins.
Graduates will find positions in laboratories and in the industry of laboratory supplies and equipment.

2. M. Sc. programme – “Clinical Biology”
(Supervisor R. Petrásek). The aim of this programme is to provide students with knowledge of the principles and theories underlying the various methods and their application within the fields of clinical biology and biomedicine. The programme is to help students develop the skill of combining theoretical and technical knowledge in order to solve problems when developing methods, performing and interpreting elaborate diagnostic tests and improving quality. The programme also provides an appropriate educational and professional environment, preparing students for specialisation at postgraduate level. Graduates will find positions in clinical laboratories and in biomedical research institutions.

Selected publications of the department

2004


2005


**Department of Genetics**

**Staff**

Doc. RNDr. **Jindřich Bříza**, CSc. (Head) – briza@umbr.cas.cz – general and plant genetics

Prof. Ing. **Otomar Linhart**, DrSc. – linhart@vurh.jcu.cz – fish genetics

Prof. RNDr. **František Marec**, CSc. – marec@entu.cas.cz – genetics and molecular cytogenetics of insects

Prof. Ing. **Jaroslav Petr**, DrSc. – petr.jaroslav@vuzv.cz – animal genetics

Doc. RNDr. **Miroslav Šíp**, DrSc. – sip@zsf.jcu.cz – biophysics of nucleic acids

Doc. Ing. **Josef Špak**, DrSc. – spak@umbr.cas.cz – plant virology

Doc. RNDr. **Michal Žurovec**, CSc. – zurovec@entu.cas.cz – molecular and cell biology, animal genetics

RNDr. **Jiří Macas**, PhD. – macas@umbr.cas.cz – plant molecular cytogenetics

RNDr. **Jaroslav Matoušek**, CSc. – imat@umbr.cas.cz – plant molecular genetics

Mgr. **Daniela Pavingerová**, CSc. – daniela@umbr.cas.cz – genetic transformation of plants

RNDr. **Karel Petrzík**, CSc. – petrzik@umbr.cas.cz – plant molecular virology
Scientific activities

The Department of Genetics deals with plant molecular genetics, namely transgenosis and genetics of plant viruses, with molecular cytogenetics of plants and insects and with population genetics of insects. In plant transgenosis, research has been carried out on the introduction of selected cloned genes and antisense constructs (GUS, GFP, chalcone synthase, etc.) into the genomes of selected plant species (tobacco, *Chrysanthemum*, potato, tomato, flax). In molecular genetics of plant viruses, developmental relationships of SVBV (strawberry vein banding virus) and PMV (potato mop virus) were studied. In molecular cytogenetics, one research group has examined the structure of repetitive DNA sequences in the family Viciaceae. Another group has mapped the occurrence of TTAGG telomeric repeats in chromosomes of insects and other arthropods and on the basis of new findings, suggested a hypothesis on the origin of TTAGG repeats.

Study programmes

The department runs two specialized study programmes and co-ordinates student theses in genetics.

The master programme “Experimental Biology” – specialisation: “Genetics and Gene Engineering” provides broad options for the study of plant transgenosis, the structure of the plant genome, plant and insect molecular cytogenetics, the genetics of plant viruses and viroids, plant – microbe interactions, manipulations, and human genetics.

The Ph.D. programme “Molecular and Cell Biology and Genetics”, run together with the Department of Molecular Biology, offers possibilities for doctoral studies in the molecular
Selected publications of the department

2004


Field course in tropical habitats in Papua New Guinea

Students take part in the botanical and zoological expedition “Altai 06”

Afrotropical subterranean rodent *Fukomys mechowi* in laboratory breeding colony
Seminars shape essential part of the study

Students take part in international conferences and summer schools

Pub relaxation is fundamental to student’s life too


Department of Mathematics, Physics and Chemistry

Staff

Prof. RNDr. Pavel Kindlmann, DrSc. (Head) – pavel@entu.cas.cz – evolutionary ecology, mathematical modelling
Doc. RNDr. Šárka Klementová, CSc. – sklement@jcu.cz – photochemistry, chemistry of water
Mgr. Kateřina Houdková – houdkova@tix.bf.jcu.cz – statistics, mathematical modelling, predator-prey systems
Mgr. Petra Janečková – ferda1@tix.bf.jcu.cz – ecology of terrestrial orchids
RNDr. Jana Jersáková, Ph.D. – jersa@tix.bf.jcu.cz – ecology of terrestrial orchids

Scientific activities

Due to its heterogenity the Department consists of two small and relatively independent sections, represented usually by one scientist and a group of his/her students, each with its own research programme. Their work is widely cited with more than 200 citations in SCI (excluding autocitations) in 2002. This number is likely to rise, as their average age is well below 40 years.

Research in the section of theoretical ecology focuses on the modelling of the life histories of insects (mainly aphids and their predators) and plants (especially terrestrial orchids and strategies of their pollination). Differential equations and the theory of evolutionarily stable strategies are used as the main tools. Research in the section of chemistry is concentrated in investigating photochemical decay of pesticides in freshwater systems, photochemical
oxygenation of biopolymers (related to photodynamic tumour treatment) and in environmental analytical chemistry.

**Study programmes**

The department provides, above all, educational support in non biological courses. However, the department is also responsible for undergraduate programme leading to a M.Sc. degree “Ecology” – specialisation: “Conservation Biology”.

**Selected publications of the department**

**2004**


**2005**


## Department of Molecular Biology and Biochemistry

**Staf**

Doc. RNDr. **Julius Lukeš**, CSc. (Head) – jula@paru.cas.cz – molecular biology of parasitic protozoa

Prof. RNDr. **František Sehnal**, CSc. – sehnal@entu.cas.cz – insect endocrinology, developmental biology

Doc. RNDr. **Marek Jindra**, CSc. – jindra@entu.cas.cz – molecular biology and genetics of *D. melanogaster, B. mori* and *C. elegans*

Doc. RNDr. **Ivo Šauman**, Ph.D. – sauman@entu.cas.cz – molecular and developmental biology, insect physiology and behavior, circadian rhythms

Mgr. **Tomáš Doležal**, Ph.D. – tomas.dolezal@bf.jcu.cz – developmental genetics, *D. melanogaster* as a model to study human pathologies
Masako Asahina–Jindrová Ph.D. – masako@paru.cas.cz – molecular genetics of nematodes

Ing. Miroslav Oborník, Ph.D. – obornik@paru.cas.cz – molecular taxonomy and phylogenetics

Mgr. Lukáš Trantírek, Ph.D. – trant@bf.jcu.cz – NMR structure of DNA and proteins

Scientific activities

1. Steroid signaling in insects and nematodes
Nuclear receptors of the steroid signaling pathway in model lepidopteran insects have been characterized at the molecular level. We have developed new approaches for targeted gene silencing using the novel method of RNA interference, applied to the organism via germline transformation. The goal is to understand the genetics underlying the steroid control of molting and metamorphosis in non-drosophilid insects.

Molecular identification of the drosophila ecdysoneless (ecd) gene based on available ecd mutants will provide a general insight into the steroid signaling pathway.

The conserved nuclear receptor Ftz-F1, a crucial factor in steroidogenesis in mammals and molting and metamorphosis in insects, has been genetically implicated in molting and the gonad differentiation of the nematode Caenorhabditis elegans. Mechanisms of the Ftz-F1 mode of action are being investigated in our current projects.

2. Functional genetics of a stress-related coactivator
Using reverse genetic methods of mutagenesis and RNA interference in the classical genetic models Drosophila melanogaster and Caenorhabditis elegans, we identify the functions and genetic interactions of a novel type coactivator in aging and stress.

3. Genetic and molecular analyses of growth factors in Drosophila
We focus on two types of growth factors: (i) a family of Imaginal Disc Growth Factors (IDGFs) that cooperate with insulin signaling to stimulate the proliferation, polarization and motility of imaginal disc cells, and (ii) we have identified a previously unknown family of polypeptide growth factors, named ADGFs for their similarity to adenosine deaminases (ADA). Our projects aim to identify the developmental and physiological roles of growth factors using a combination of genetic, molecular and cell biological techniques.

4. Molecular characterization of silk
Protein microsequencing and the isolation of silk-specific cDNAs has led to the identification of the components of waxmoth (Galleria mellonella) silk, most of which have counterparts in
the silkmoth (*Bombyx mori*). A previously unknown protein, which we named seroin, probably has an antibacterial function, and so do two other low-molecular silk proteins that we have discovered. The goal is to understand the purpose of all the components of lepidopteran silk.

5. Molecular basis of the insect circadian clock and diurnal rhythmicity

Circadian biological clocks are found in most living organisms and their fundamental properties are highly conserved. Although the fruitfly (*Drosophila melanogaster*) served as a premier model for the molecular analysis of the circadian rhythms, we have demonstrated that there are striking differences between the molecular regulations of the circadian timing system even among holometabolous insects. The long-term goal of this project is to gain a generally more valid understanding of the cellular and molecular mechanisms that underlie circadian rhythmicity in insects.

6. Molecular parasitology

We are interested in the structure of mitochondrial (=kinetoplast) DNA in primitive flagellates of the order Kinetoplastida. It has a unique structure being composed of a network of mutually interlocked circular molecules. Moreover, it encodes genes whose transcripts undergo extensive editing. We study the evolution of the kinetoplast DNA and the extent and mechanism of RNA editing. Recently we have been employing the process of RNA interference in order to selectively silence the transcription of genes involved in editing and in packaging of the kinetoplast DNA.

**Study programmes**

The department co-ordinates one graduate study programme and student theses in molecular and cell biology.

Ph.D. programme – “Molecular and Cell Biology and Genetics”, supervised by F. Sehnal. This course offers 3-year projects to those outstanding students who wish to excell in molecular biology and genetics as methods of addressing basic biological questions. The Doctoral theses of graduates must be published in recognized international journals and the students will spend a part of the program in a collaborating laboratory abroad.

**Selected publications of the department**

2004


2005


Department of Parasitology

Staff

Doc. RNDr. Václav Hypša, CSc. (Head) – vacatko@paru.cas.cz – molecular phylogeny of parasites, host-parasite co-evolution
Prof. MVDr. Iva Dyková, DrSc. – iva@paru.cas.cz – protozoan parasites of fish, histopathology of protozoan infections

Prof. RNDr. Libor Grubhoffer, CSc. – liborex@paru.cas.cz – biochemistry and molecular biology of vectors and pathogens

Prof. RNDr. Tomáš Scholz, CSc. – tscholz@paru.cas.cz – parasitic helminths of fish

Prof. RNDr. Jiří Vávra, DrSc. – vavra@paru.cas.cz – parasitic protozoa, electron microscopy

RNDr. Oleg Ditrich, CSc. – oleg@paru.cas.cz – medical and veterinary protozoology

RNDr. Petr Kopáček, CSc. – kopajz@paru.cas.cz – arthropod immunity, biochemistry of arthropod defence molecules

**Scientific activities**

At the Department of Parasitology, the research is focused on structural, ecological, biochemical, phylogenetic, and molecular aspects of parasite biology.

Ultrastructural characterization has performed for several new species of fish microsporidia and myxozoa. The epidemiological risk of various cryptosporidian species was assessed on the basis of genotypization of isolates from various animals. The results proved that the genotypes are not strictly host-specific and that in natural conditions cryptosporidia can be transmitted between host species. Monoclonal antibodies have been prepared against important causative agents of human microsporidioses.

The RPL3 gene from *Trypanoplasma borreli* has been cloned, and the ATP-binding activity has been localized to N-terminal region of the protein. It has been shown that an important trypanocidal drug suramin strongly inhibits the binding of $[\gamma35S]$ ATP to RPL3 at subclinical levels (the research has been carried out in collaboration with S. Svensson, University of Linköping).

Topological status, catenation, transcription of mitochondrial genes, and editing of the transcripts have been analyzed in kinetoplast DNA minicircles and maxicircles in primitive flagellates. Based on the results, a novel scenario for the evolution of kinetoplast DNA and RNA editing has been proposed.

The effect of extract from tick salivary glands on phagocytosis and the killing of *Borrelia afzelii* spirochetes was has been demonstrated. The extract also inhibited the killing of
B. afzelii spirochetes by macrophages and reduced the production of two major defense molecules of phagocytes, superoxide and nitric oxide. The results indicate that in addition to reduced phagocytosis, suppression of macrophage microbicidal mechanisms contributed to the inhibitory effect of tick saliva on the killing of Borrelia spirochetes, thus facilitating the transmission of this important pathogen.

Several components of tick recognition and defense system have been purified and biochemically and molecularly characterized (α2 – macroglobulin, gut lysozyme, plasma lectin). The lectin of tick-borne agent, Borrelia burgdorferi, has been cloned and expressed in bacterial and baculoviral expression systems.

Based on molecular data, phylogenetic relationships and evolutionary patterns have been explored within several parasitic groups, e.g., in Coccidia (including evolutionary important species Goussia janae, Choleoeimeria spp. and Sarcocystis singaporensis), amphizoic amoebae of the genera Paramoeba and Neoparamoeba, kintoplastids of suborder Bodonina, the bloodsucking bugs of the subfamily Triatominae, and selected lineages of tapeworms (e.g., order Pseudophyllidea, which includes medically important species such as Diphyllobothrium latum and Spirometra, is an artificial assemblage of two unrelated clades, “Diphyllobothriidae” and “Bothriocephalidae”; reproductive isolation of two veterinary important cestodes, E. crassum from Atlantic salmon and brown trout and E. salvelini from brook trout has been revealed by genetic study).

Study programmes
The Department of Parasitology is responsible for the master and doctoral programmes in “Parasitology”. This department also co-ordinates student theses in parasitology.

Selected publications of the department

2004


52


**2005**


55


**Department of Plant Physiology and Anatomy**

**Staff**

Doc. Ing. Jiří Šantrůček, CSc. (Head) – jsan@umbr.cas.cz – plant physiology, photosynthesis, plant water relations

Doc. RNDr. Ondřej Prášil, Ph.D. – prasil@alga.cz – adaptation of cyanobacteria and algae to variable external conditions

Mgr. Dáša Bastlová, Ph.D. – dasa.bastlova@bf.jcu.cz – plant ecophysiology

RNDr. Jiří Květoň, CSc. – queton@umbr.cas.cz – biochemistry of photosynthesis
Ing. Jana Nebesářová, CSc. – nebe@paru.cas.cz – ultrastructural and surface research in biology, electron microscopy

RNDr. Karel Roháček, CSc. – rohacek@umbr.cas.cz – photosystem II, chlorophyll fluorescence, photoacoustic spectroscopy

RNDr. Jiří Šebestián, CSc. – sebest@jcu.cz – microbiology, ethylen production, membrane transport

RNDr. Ivan Šetlík, CSc. – setlik@alga.cz – plant physiology, biochem. and biophys. of photosynthesis, cell biol. of autotrophic microorganisms

Doc. RNDr. František Vácha, Ph.D. – vacha@umbr.cas.cz – photosystem II reaction center complexes, single molecule spectroscopy

### Scientific activities

1. **Photochemistry and biochemistry of photosynthesis**

Photosynthetic processes in algae are studied with the emphasis on Photosystem II (PSII). The research involves studies of the structure and dynamics of PSII proteins, the role of PSII in the molecular ecology of photosynthetic organisms and the development of new methods and instruments for photosynthesis research. PSII particles isolated from cyanobacterium *Synechococcus elongatus* have been characterized using variable fluorescence and thermoluminescence data, “best” detergents with minimal distortion of the acceptor side have been found and crystals of the PSII reaction center obtained and tested for their X-ray diffraction (Šetlíková, Šetlík et al.).

The mechanism of interaction of heavy metals (Cu, Zn) with photosynthetic apparatus of algae has been studied. The experiments confirmed the role of the LHCII complex as a target of heavy metal substitution of Mg$^{2+}$ in chlorophylls (Šetlík, Prášil et al.). The novel instrumentation recently developed allows measurements of variable fluorescence on a single algal cell and to study processes of energy trapping in PSII in submiliseconds intervals (Šetlík et al.). Photoadaptation and the effect of strong CO$_2$ deficit have been studied using fluorescence quenching measurements. A novel mechanism of fluorescence quenching has been described which does not depend on either reorganization of chlorophyll proteins or the accumulation of reduced pheophytin in reaction centers (Šiffel). Five chlorophyll a reaction centers have been isolated and characterised using hole-burning spectroscopy and single molecule spectroscopy (Vácha).

2. **Leaf-atmosphere interactions**
The research aims to evaluate the efficiency of photosynthetic carbon fixation in terms of water use, adaptations to dry atmosphere and elevated CO₂ expressed in the stomatal function or in the structure of cuticle. The role of stomata, leaf cuticle and mesophyll in CO₂/H₂O exchange between chloroplasts/epidermis and atmosphere are studied. The research includes biochemistry and functional aspects of epicuticular waxes as a transport limiting barrier, spatial and time-based heterogeneity of stomatal conductance (stomatal patchiness), the effect of abscisic acid (ABA) on photosynthetic carbon fixation and stable isotopes (¹³C and ¹⁸O) fractionation in photosynthesis.

A novel approach has been developed allowing separation of the gas phase diffusion (pores) from the solid phase (formed by polymer matrix and cuticular waxes) diffusion of water molecules. We have concluded from our results that the solid cuticle on stomatous leaf side is characterised by significantly lower barrier properties. It is argued that this might be a consequence of a pronounced lateral heterogeneity of stomatous cuticles (Šantrůček, Nebesářová et al., Šantrůček, Šimáňová et al.). Heterogeneity of stomatal conductance has been measured analysing gas exchange signal and using chlorophyll fluorescence imaging. We conclude that stomatal patchiness and the leaf carboxylation capacity vary in proportion during ABA induced stress periods. Consequences in terms of the mesophyll effect on stomata function are investigated (Šantrůček, Hronková et al.).

3. Anatomy and histochemistry of plant stem tissues
The study of hystogenesis of the sclerenchymatous ring in Pelargonium peltatum revealed that the ring is a part of the central cylinder and belongs to the pericycle. It has been determined that safranin shows an affinity to lignin and may be used for selective staining (Beneš et al.).

4. Physiology of invasive behavior of wetland plant species
A correlation was found between growth and flowering characteristics of both Lythrum salicaria and Phragmites australis and the population's position along the north-south transect across Europe (Bastlová, Květ et al.).

Study programmes
and anatomy. It is supported by the experience of supervisors, scientists working in the Institutes of the Academy of Sciences of the Czech Republic and employing new biochemical and biophysical methods. This department also offers coordination of student theses in plant physiology and anatomy.

**Selected publications of the department**

**2004**


2005


**Department of Zoology**

**Staff**

Doc. RNDr. Oldřich Nedvěd, CSc. (Head) – nedved@bf.jcu.cz – insect ecophysiology, biology of ladybird beetles
Scientific activities

The Department of Zoology studies various aspects of the life of multicellular animals, namely vertebrates and insects. Diverse methodical approaches are employed including field observations of ecological and behavioural traits of native species in the Czech Republic, as well as in other temperate and tropical areas; laboratory ethological and physiological experiments, population genetics, morphology, taxonomy – most of the using phylogenetic reconstruction.

Several years of studies in the lowland tropical rainforest in Papua New Guinea has revealed broader host plant specificity than had been previously suggested: most herbivorous insect species feed on several related plant species instead of on a single plant species each. The huge species richness of insects in the tropics is still determined mostly by the plant
species richness. Generalist insect predators like ground beetles facultatively scavenge on decaying small animals. The DNA of the prey species can be detected for a few days in the guts of predators using PCR. The only species of the animal phylum Cycliophora described till 2005, *Symbion pandora*, was known only from the Northern Sea on the host lobster *Nephrops norvegicus*. Recently we have found a population in the Adriatic (Mediterranean) Sea, on the lobster *Homarus gammarus*. Phylogenic relationships of recent dogs, wolves, and foxes – Canidae (Mammalia, Carnivora) has been estimated employing both morphological and molecular data.

**Study programmes**

The Department of Zoology co-ordinates three study programmes and student theses in zoology.

1. **M. Sc. programme – “Zoology”**
(Supervisors R. Fuchs, O. Nedvěd, J. Zrzavý). The department provides studies in three specialisations – “Zoology of Vertebrates”, “Entomology” and “Animal Ecology”. These studies are widely orientated to the aims and methods of study of current animal biology, with emphasis on ecology and ethology of birds, mammals, and fish; and on insect morphology, phylogeny, ecology, and ecophysiology. Graduates will be prepared to work in education, nature conservation, and basic and applied research.

2. **Ph. D. programme – “Zoology”**
(Supervisor J. Zrzavý). This discipline is designed to provide students with a good review of biology, ecology and the evolution of animals, and with a good knowledge of modern zoological methodology. The graduates find work in basic and applied research institutes, schools, environment institutions, zoos and museums. The Ph.D. studies are focused on animal phylogeny, ecology and the behavior of fish, birds, and mammals, and vertebrate population ecology.

3. **Ph. D. programme – “Entomology”**
(Supervisor O. Nedvěd). Study in this discipline includes both the basic and applied research of various aspects of insect life. The current studies are specialized in arthropod ecology, morphology, and ecophysiology, tropical ecology, and life history of biocontrol agents.

**Selected publications of the department**
2004


66
Language Department

Staff

Mgr. Petr Kos (Head) – kos@tix bf.jcu.cz – English

Mgr. Monika Brandlová – zemlicka@transforwarding.cz – English

Dr. Keith Edwards – Kredwards59@yahoo.com – Technical writing in English

Mgr. Petra Kaboňová – kabonka@post.cz – Spanish, English

Richard Klee, M.Sc. – richkleeus@yahoo.com – English

Mgr. Linda Kocmichová – linda.kocmichova@quick.cz – English

PhDr. Ivan Marek – Marek.Ivan@seznam.cz – English, German

Irina Mečířová – irina.mecirova@quick.cz – Russian

Mgr. Jana Šandová – janasandova@tiscali.cz – English

Christopher Steer, B.A. – steer@tix bf.jcu.cz – English

Mgr. Martina Vavreková – Brezinova.Martina@seznam.cz – French

Mgr. David Žaloudek – zalsa@email.cz – English

The language department is not involved in scientific activities. It provides language education and other services, such as translations and proof-reading, according to the needs of the Faculty. It’s main focus is teaching both general and biology-based English, as all students are required to take a final English examination. The department also provides Spanish, French, German and Russian courses, as well as a course on writing scientific texts in English.
Graduation ceremony: second row – dean of the Faculty (left), vice-rector, and vice-dean. First row – mace-bearer and secretary of the Faculty

Pretty and proud biologist

New graduates
Faculty of Biological Sciences, University of South Bohemia
Branišovská 31, CZ-370 05 České Budějovice, Czech Republic
http://www.bf.jcu.cz/