



Loschmidt Laboratories

/ Department of Experimental Biology
/ Faculty of Science / Masaryk University



RESEARCH GROUP CONTACT >>

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THEMATIC RESEARCH FOCUS >

RESEARCH AREA

- » Enzymatic catalysis
- » Engineering of enzymes for environmental, chemical, biomedical and military-defence applications

EXCELLENCE

New concepts and tools for protein engineering

MISSION

We conduct interdisciplinary research in the fields of protein engineering and synthetic biology. We wish to understand the structure-function relationships of haloalkane dehalogenase enzymes and improve their functionalities for bioremediation, biocatalysis and biosensing.

Our goal is to be recognized as one of the leading protein engineering groups in Europe. We are consistently striving to publish our findings in reputable scientific journals, develop new software tools, and apply research results to practice.

Key components of our daily activities include collaboration between experimentalists and theoreticians, solidarity among the laboratory team, and mentoring of young colleagues—all while maintaining a friendly and creative working environment to honour the name of Jan Josef Loschmidt.

DEVELOPED TECHNOLOGIES >

CONTENT OF RESEARCH

- » Study of the structure-function relationships and molecular evolution of proteins
- » Screening and manipulation of gene coding for enzymes with useful catalytic properties
- » Study of the structure and kinetic properties of wild type and mutant enzymes
- » Development of new concepts and computational tools for protein engineering

MAIN CAPABILITIES

Basic research

- » Results in the area of protein tunnels and their modification - this has an influence on the catalytic rates and specificity of enzymes
- » Screening and characterisation of enzymes with new functions

Applied research + protection of IP

- » Yperit detoxification method (patented),
- » Method of optical active substances production by enzymes isolated from microorganisms (patented)

FIELDS OF RESEARCH RESULTS APPLICATION

- » Medicine – therapeutics, biopharmaceuticals, chiral building blocks
- » Environmental technologies – methods for degradation of harmful substances, biosensors for on-line monitoring of toxic compounds in the environment
- » Military defence technologies – biocatalysts for decontamination and detection of warfare agents



ALUMNI PROFILE

The graduate has knowledge about structure, evolution and function of proteins.

Knowledge and skills:

1. Biology (general biology, genetics, molecular biology, anthropology, microbiology, immunology, biostatistics, physiology of organisms),
2. Biochemistry and chemistry (general biochemistry, enzymology, biochemical methods, inorganic, organic, analytical and physical chemistry)
3. Computer science (bioinformatics, molecular modelling)

NUMBER OF RESEARCH POSITIONS ↘

SENIOR RESEARCH STAFF

6

JUNIOR RESEARCH POSITIONS (INCL. PH.D. STUDENTS)

10

KEY RESEARCH EQUIPMENT ↘

LIST OF DEVICES

Laboratory of Molecular Biology:

- » Bioanalyzer Agilent 2100, Agilent Technologies, USA
- » Biohazard Cabinet VBH-MP, Steril, Italy
- » Centrifuge Mikro 120, 200, Cooled Micro 200R, Hettich, Germany
- » Concentrator centrifuge DNA 120-230 SpeedVac, Thermo, USA
- » Electroporator ECM 399 Generator, BTX, Canada
- » Rapid Translation System ProteoMaster, Roche, France
- » Spectrophotometer Boeco S30, Jenway, United Kingdom
- » Thermocycler T3, Biometra, Germany

Laboratory of Microbiology:

- » Innova 2100 platform shaker, New Brunswick Scientific, USA
- » Labfors 3 fermentor 1.2L, 5L, Infors-HT, Switzerland
- » FPLC Akta, Akta Purifier 10, Amersham Pharmacia Biotech, Sweden
- » Lyophilisator Christ Alpha 1-2, Martin Christ, Germany
- » Ultrasonic Desintegrator Soniprep 150, Sanyo Gallenkamp, England

Laboratory of Enzyme Kinetics:

- » Isothermal Titration Calorimeter CSC 4200, Calorimetry Sciences Corp., USA
- » Microplate Reader FluoStar Optima, BMG Labtech, Germany
- » Microplate Reader SUNRISE, Tecan, Austria
- » Rapid Quench Flow, QFM-400, Biologic, France
- » Spectrophotometer Ultrospec 1000, Pharmacia Biotech, Sweden
- » Spectropolarimeter JASCO J-810, Jasco, Japan
- » Stopped Flow SFM-20, Biologic, France
- » Thermostatic Water Bath GLS400, Grant, England

Laboratory of Gas and Liquid Chromatography:

- » Advanced Compact Ion Chromatograph 861, Metrohm, Switzerland
- » Fluorescence spectrophotometer FluoroMax-P, Horiba Jobin Yvon, France
- » Gas Chromatograph TRACE 2000, Finnigan, USA
- » Gas Chromatograph 6890N, Agilent, USA
- » HPLC 1100, Agilent, USA
- » Mass Spectrometer TRACE MS 2000, Finnigan, USA

BUDGET ↘

TOTAL (MIL. CZK/ MIL. EUR).

13 / 0.52

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

8

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

10

MAIN PROJECTS ↘

2011-2015: International Clinical Research Centre (CZ.1.05/1.1.00/02.0123 – grant of the Ministry of Education, Youth and Sports)

2010-2014: Research Centre for Toxic Substances in the Environment (CZ.1.05/2.1.00/01.0001 – grant of the Ministry of Education, Youth and Sports)

2010-2012: Analysis and Visualization of Protein Structures (P202/10/1435 – Czech Science Foundation)

2009-2013: Evolution of Substrate Specificity in Enzymes Acting on Xenobiotic Compounds (IAA401630901 – Grant Agency of the Czech Academy of Sciences)

2008-2012: Specific Ion Effects for Proteins in Solutions and Related Biologically Relevant Systems (203/08/0114 – Czech Science Foundation)

2006-2011: Centre for Biocatalysis and Biotransformations (LC06010 – programme Research Centres; Ministry of Education, Youth and Sports)



MAIN COLLABORATING PARTNERS ↘

COLLABORATION WITH ACADEMIC PARTNERS

- » Brno University of Technology (Brno, CZ)
- » Institute of Microbiology (Prague, CZ)
- » Institute of Molecular Pathology (Hradec Kralove, CZ)
- » Institute of Organic Chemistry and Biochemistry (Prague, CZ)
- » Institute of Systems Biology and Ecology (Ceske Budejovice, CZ)
- » Mendel University Brno (Brno, CZ)
- » Heyrovsky Institute of Physical Chemistry (Prague, CZ)
- » Mayo Clinic (Rochester, US)
- » Lund University (Lund, SE)
- » Tohoku University (Sendai, JP)
- » National Institute of Advanced Industrial Science and Technology (Tokyo, JP)
- » Imperial College (London, GB)
- » ETH (Zurich, CH)
- » University of Alcala (Alcala, ES)
- » University Groningen (Groningen, NL)

COLLABORATION WITH COMPANIES

- » ANF Data – Siemens (CZ)
- » Bio-Product (NL)
- » Biovondor (CZ)
- » B.R.A.I.N. (DE)
- » Contipro (CZ)
- » DSTL (GB)
- » LentiKat's (CZ)
- » Photon Systems Instruments (CZ)
- » VOP-026 Šternberk (CZ)

EXPECTATIONS ↘

OFFERS

- » Licensing of the patent for enzymatic decontamination of warfare agents
- » Licensing of the patent for the production of optically pure compounds using enzymes
- » Expertise in the field of protein engineering and enzyme technologies
- » Specialized instrumentation for enzymological and biophysical experiments

REQUIREMENTS

- » Internationalization of research team by recruitment of foreign post-docs and doctoral students

