Department of Biophysical Chemistry and Molecular Oncology

/ Institute of Biophysics
/ Academy of Sciences of the Czech Republic

CEITEC
central european institute of technology
BRNO | CZECH REPUBLIC

INSTITUTE CONTACT

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http://www.ibp.cz/cs/oddeleni/biofyzikalni-chemie-a-molekularni-onkologie/vyzkum

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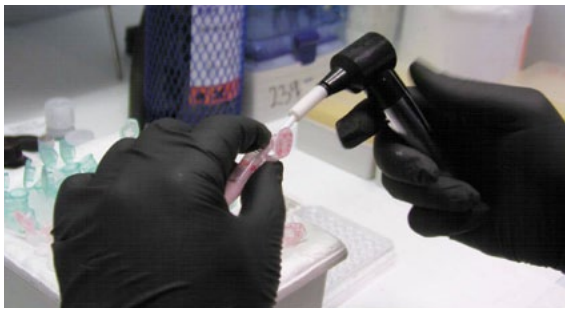

THEMATIC RESEARCH FOCUS

RESEARCH AREA

- Biophysical Chemistry
- Molecular Oncology
- Bioelectrochemistry
- Bioanalysis

EXCELLENCE

Novel tools for the study of biopolymer structure and interactions. Biosensors and bioassays.

MISSION

Our mission is to maintain the position of the world-recognized bioelectrochemistry school and one of the leading laboratories in the area of electrochemical nucleic acids and protein sensing, consistently publishing our findings in respected international journals.

DEVELOPED TECHNOLOGIES

CONTENT OF RESEARCH

- Electrochemistry of nucleic acids, proteins, their components, metabolites and related therapeutics
- Electrochemical biosensors and bioassays
- New methods for biopolymer labelling and detection
- Tumor suppressor proteins and their interactions in vitro and in cellular context

We perform interdisciplinary research in the field of biopolymer structure and interactions in solution and on electrically charged surfaces, combining biophysical, electrochemical, biochemical and molecular-biological approaches. Methodology development, based on introducing and application of novel techniques of biopolymer labelling and detection, oriented towards highly sensitive, selective and widely accessible biosensing techniques for molecular biology and biomedicine, represents an important part of our efforts.

MAIN CAPABILITIES

Our collaboration with numerous research and clinical laboratories creates a mutually stimulating environment and helps us to define areas of potential application of our findings. As typical examples, the following application areas can be identified:

- DNA diagnostics (SNP typing, analysis of triplet repeat expansions) by electrochemical techniques
- Studies of protein aggregation related to severe disorders such as Parkinson's
- Simple, highly sensitive and selective analysis of drugs and metabolites in clinical material
- DNA-drug interactions potentially related to drug development
- Studies of DNA damage related to genotoxicity
- Environmental monitoring

FIELDS OF RESEARCH RESULTS APPLICATION

Basic Research

- DNA structure and mechanisms of interaction of DNA with protein
- Interactions of biopolymers with electrically charged surfaces, effects of structure
- Chemical modification of nucleic acids and proteins

Areas of Application

- Electrochemical (bio)sensors and (bio)assays
- Molecular diagnostics
- Environmental monitoring

ALUMNI PROFILE

Graduates have knowledge of and practical skills in:

» Structure, interactions and chemical reactivity of nucleic acids and proteins
» Molecular mechanisms of disease such as cancer or nerodegenerative disorders
» Principles of electrochemical and other physico-chemical and biophysical experimental methods

NUMBER OF RESEARCH POSITIONS ↘

SENIOR RESEARCH STAFF

11

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

16

KEY RESEARCH EQUIPMENT ↘

LIST OF DEVICES

» Scanning probe microscope
» Electrochemical and impedance analyzers
» Spectrofluorometer
» Biohazard box
» FPLC
» PCR cyclers
» Other standard equipment for biochemistry and molecular biology (centrifuges, concentrators, electrophoreses etc.)

BUDGET ↘

TOTAL (MIL. CZK/ MIL. EUR)

15 / 0.6

PART OF THE TOTAL BUDGET FROM PRIVATE RESOURCES (%)

1

PART OF THE TOTAL BUDGET FROM FOREIGN RESOURCES (%)

7

MAIN PROJECTS ↘

2009–2013: Construction of novel functional nucleic acids for applications in chemical biology, catalysis and self assembly (project 203/09/0317, Czech Science Foundation, co-investigator: M. Fojta)

2009–2013: DNA labeling with redox markers for electrochemical sensing. Applications in analysis of nucleotide sequences and molecular diagnostic (project IAA400040901, Academy of Sciences of the Czech Republic, principal investigator: M. Fojta)

2007–2010: Interactions of wild type and mutant p53 proteins with damaged DNA and their roles in cellular response to anticancer chemotherapy (project IAA500040701, Academy of Sciences of the Czech Republic, principal investigator: M. Fojta)

2006–2010: Centre of biophysical chemistry, bioelectrochemistry and bioanalysis. New tools for genomics, proteomics and biomedicine (project LC06035, Ministry of Education, Youth and Sports, Coordinator: M. Fojta)

MAIN COLLABORATING PARTNERS ↘

COLLABORATION WITH ACADEMIC PARTNERS

» Institute of Organic Chemistry and Biochemistry, AS CR (Prague, CZ)
» Institute of Physical Chemistry of J. Heyrovsky, AS CR (Prague, CZ)
» Masaryk Memorial Cancer Institute (Brno, CZ)
» Faculty of Science, University of Ostrava (Ostrava, CZ)
» Department of Theoretical and Physical Chemistry, Faculty of Science, Masaryk University (Brno, CZ)
» Department of Analytical Chemistry, Faculty of Science, Charles University (Prague, CZ)
» Cancer Centre Karolinska (SE)
» Max Planck Institute for Biophysical Chemistry (Gottingen, DE)
» University of East Anglia, School of Biological Sciences (Norwich, GB)
» Univerité Libre de Bruxelles (Brussels, BE)
» Department of Analytical Chemistry, Slovak University of Technology (Bratislava, SK)
» Department of Nuclear Physics and Biophysics, Faculty of Mathematics, Physics and Informatics, Commenius University (Bratislava, SK)
» Department of Nanoengineering, University California San Diego (La Jolla, CA, US)

COLLABORATION WITH COMPANIES

» HVM PLASMA (Prague, CZ)

EXPECTATIONS ↘

REQUIREMENTS

» Cooperation with companies

OFFERS

» Adaptation of basic research products for practical applications