



Major studies and research projects

The Faculty of Biochemistry, Biophysics and Biotechnology of the Jagiellonian University is one of the best national scientific research centres and institutions in the field of biological sciences. It received the highest possible grade, A+, in parametric evaluation, a rating given to 3% of the best scientific units in Poland. In addition, the Faculty received (along with the Jagiellonian Centre of Innovation) the status of the Leading National Research Centre (KNOW).

Key research areas include:

- **Biochemistry and Molecular Biology.** Genomics, proteomics, and lipidomics. This includes: proteomics of the nervous system and isolated fractions of stem cells and cancer cells; bioinformatics; genetic and protein engineering including gene therapy, targeted cell modifications and the production of modified monoclonal antibodies; interactomics, enzymology, and molecular bioenergetics including the study of interactions and energy flow between biological systems, short-lived radicals imaging, and protein-ligand molecular interactions; signal transfer including research on the role of signaling molecules in inflammatory state, cell interactions with the extracellular matrix protein, and the role of cell vesicles; the biology of normal cells and cancer cells.
- **Biophysics.** Molecular modelling; structure and dynamics of bioparticles and biological membranes; metabolic processes modelling; the development of methods based on various types of both magnetic resonance imaging and high sensitivity/resolution optical microscopy.
- **Microbiology, Virology and Immunology.** Encompasses studies on mechanisms of pathogenicity including newly identified microbial enzymes and regulation of immune response mechanisms; identification of new pathways of pathogen cell interaction (including eukaryotic microorganisms) with host cells.
- **Biotechnology of Plants and Environmental Protection.** Synthesis and evaluation of new photosensitizers used in therapy, studies leading to the improvement of photosynthetic efficiency in plants including organelle movement in plant cells, the xanthine cycle, and the development of methods of toxin degradation in water treatment.

Between 2009 and 2013 the Faculty collectively received 159 grants from various institutions with a total nominal value of more than PLN 125 million. The grants, which comprise research and infrastructure grants whose principal investigators are both senior and junior researchers, include, for example:

- "Serine Protease Inhibitors as Regulating Factors of Dendritic Cell Factors," principal investigator: Prof. Joanna Cichy;
- "New cancer therapy based on genetically modified Salmonella strain," principal investigator: Prof. Joanna Bereta;
- "Molecular biotechnology for health," principal investigator: Prof. Józef Dulak;
- "Consequences of faulty electron transfer induced by asymmetric cytochrome bcl for mitochondrial respiratory disease and aging," principal investigator: Prof. Artur Osyczka;
- "Protective role of heme-oxygenase-1 in endothelial cells – construction of helper-dependent adenoviral vectors for long-term heme oxygenase expression," principal investigator: Prof. Alicja Józkwicz;
- "Anticancer therapy of the future: Searching compounds for activation of tumour protein p53," principal investigator: Grzegorz Dubin, PhD.

Collaboration

The Faculty conducts fruitful scientific collaboration with more than 80 Polish and international academic centres. These partnerships carry out joint research, provide for student and academic staff exchange, and have implemented multilateral education programmes leading to a dual diploma. Two centres with which the Faculty has collaborated for an extended period include Lund University (Sweden) and Medical College of Wisconsin (United States). The Faculty frequently organises international scientific conferences (e.g. "International Workshop on EPR in Biology and Medicine").



Scholars

Prof. Jan Potempa – explores virulence factors of *Staphylococcus aureus* and the bacteria responsible for periodontal disease. His pioneering research established a new paradigm in understanding the pathogenesis of disease caused by bacteria whose virulence depends on proteolytic activity. He is the principal researcher for various projects, e.g. “Unique System of Secretion of Bacterial Proteins Responsible for Periodontitis,” “Protein Citrullination as the Cause of Correlation Between Rheumatoid Arthritis (RA) and the Objective of the Development of New Drugs for RA.” He received an honorary doctorate from Lund University and won first prize of the Foundation for Polish Science, also known as the Polish Nobel Prize.

Assoc. Prof. Ewa Zuba-Surma – conducts research on the biology of stem cells and their application in regenerative medicine, particularly in cardiology. Her major projects include: “Studies on the Efficiency of Microfragments from Genetically Modified Stem Cells as MiRNA Carrier with Proangiogenic and Cardiomyogenic Effects” and “Bioactive Microfragments from Stem Cells as a New Tool for Tissue Regeneration.” Her achievements include an award from the International Society for the Advancement of Cytometry, a scholarship from L'Oréal Poland for Women in Science, and an award from the President of the Council of Ministers for her habilitation dissertation.

Assoc. Prof. Krzysztof Pyrc – explores the mechanisms and pathogenesis of human coronavirus infection. He is also developing new antiviral and diagnostic measures for virology. His major projects include “Internalisation of Human Coronavirus to Host Cells” and “Mechanisms of Human Coronavirus NL63 and HKU1 Infections.” Krzysztof Pyrc was awarded a scholarship from the Ministry of Science and Education, a scholarship from *Polityka* magazine, and an award for the best doctoral thesis in the Netherlands between 2005 and 2007.

Achievements

Every year, more than one hundred publications included on the Philadelphia ISI Master List are written at the Faculty. One of these publications, particularly noteworthy, is a paper published in the journal *Science*. It describes the findings of Prof. Artur Osyczka's team concerning molecular mechanism functioning of Complex III in respiratory chain.

A research project conducted at the Faculty, “Cancer Therapy Based on Genetically Modified Salmonella Strain,” received the Polish Product of the Future award (in the category “Technology at the Pre-implementation Stage”). Moreover, among those innovations implemented in clinical practice that should be mentioned is the use of *in vitro* cultured skin cells in the treatment of hard-to-heal wounds. Prof. Jan Potempa and Prof. Józef Dulak, both of whom work at the Faculty, received honorary doctorates for their scientific research; Prof. Potempa was also awarded the Foundation for Polish Science award.

Successes achieved by the Faculty include various activities designed to popularise scientific knowledge: an annual series of lectures “Spotkania w samo południe z biochemią, biofizyką i biotechnologią” (Encounters at High Noon with Biochemistry, Biophysics and Biotechnology) and the “Lifescience dla licealistów” (Life Sciences for High School Students) workshop.

- Biochemistry
- Biotechnology
- Biophysics ● Molecular Biology ● Genomics
- Proteomics ● Molecular Modelling ● Bioenergetics
- Microbiology ● Cell Biology
- Plant Physiology

FACULTY OF BIOCHEMISTRY, BIOPHYSICS AND BIOTECHNOLOGY

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