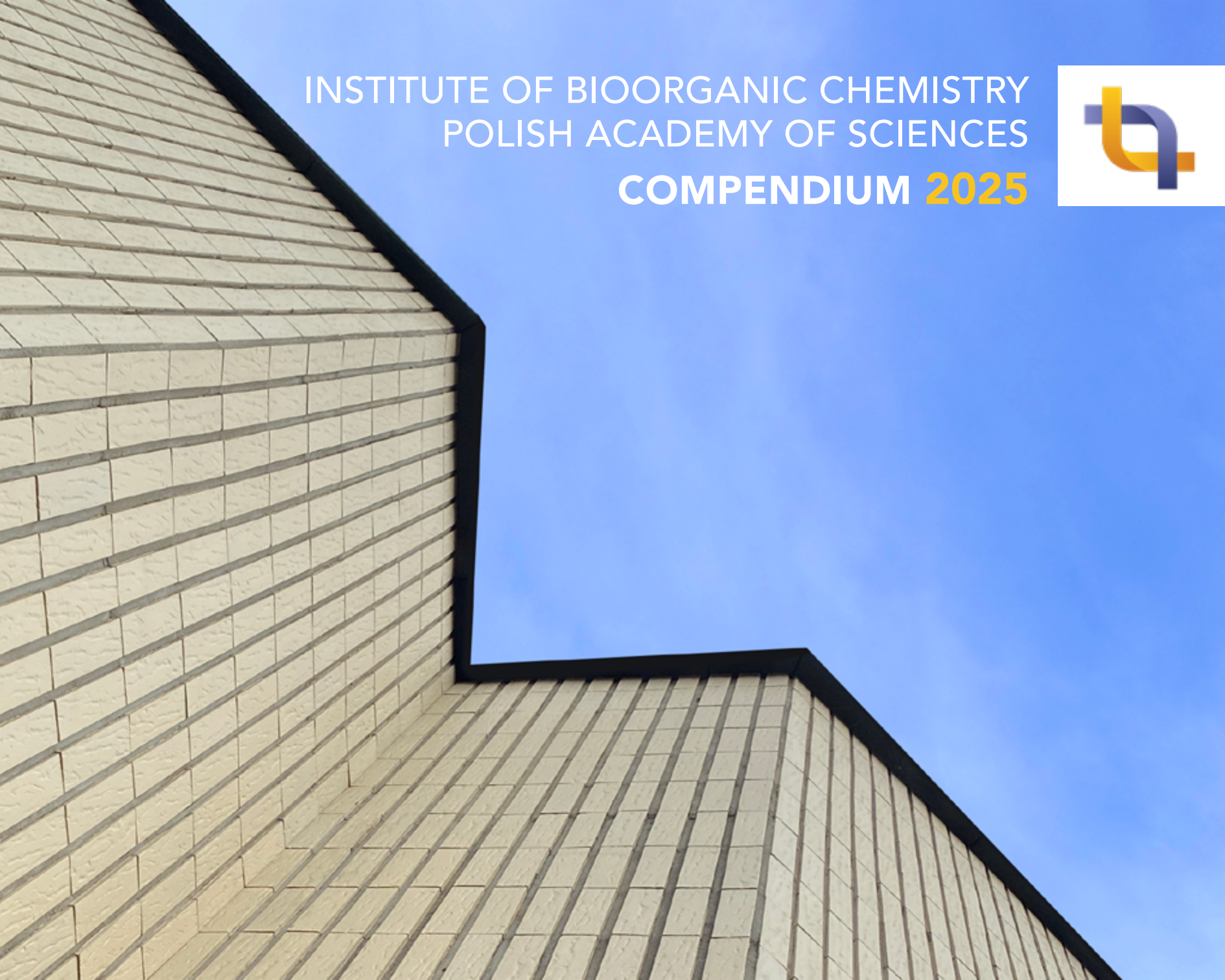

INSTITUTE OF BIOORGANIC CHEMISTRY
POLISH ACADEMY OF SCIENCES
COMPENDIUM 2025

COMPENDIUM

2025

INSTITUTE OF BIOORGANIC CHEMISTRY

Polish Academy of Sciences

CONTENTS

LUIZA HANDSCHUH, PhD, DSc, Assoc. Prof.

Director

Our mission is:

- conducting scientific research and innovative research and development works in the field of biology, chemistry, computer science and related science disciplines at a world-class level
- disseminating the results of conducted research and research and development works (publications, patents, etc.)
- educating high-class specialists
- popularizing science and educating society
- developing, managing and providing a computer network and high-performance computers for the scientific community in Poland and the broad community of users (PSNC)

Magdalena Łuczak, PhD, DSc, Assoc. Prof.

Deputy Director for Scientific Affairs

MAŁGORZATA RADWAŃSKA-BORUCKA, MA

Deputy Director for Administrative Affairs

RENATA WILNICKA, MSc Eng.

Chief Accountant

ADAM KUBASIŃSKI, MA

Deputy Director for Financial Affairs

JULIA BRZOSKA-KARWAT, MA

Deputy Director for Research Coordination

AGNIESZKA KONRAD, MA

Deputy Director for Cooperation

SCIENTIFIC COUNCIL

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Chair of the Scientific Council

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University of Warsaw, Faculty of Biology, Institute of Biochemistry and Biophysics PAS, Warszawa

Prof. Agnieszka Chacińska
Corresponding member of the PAS, International Institute of Molecular Mechanisms and Machines PAS, Warszawa

Prof. Maria Anna Ciemerych-Litwinienko
University of Warsaw, Faculty of Biology, Institute of Biochemistry and Biophysics PAS, Warszawa

Prof. Agnieszka Dobrzyń
Corresponding member of the PAS, Nencki Institute of Experimental Biology PAS, Warszawa

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Jagiellonian University, Faculty of Biochemistry, Kraków

Prof. Tomasz Gośliński
Poznan University of Medical Sciences, Faculty of Pharmacy, Poznań

Prof. Jadwiga Jaruzelska
Institute of Human Genetics PAS, Poznań

Prof. Jacek Jemielity
University of Warsaw, Center of New Technologies, Warszawa

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Corresponding member of the PAS, Institute of Plant Genetics PAS, Poznań

Magda Konarska, PhD, DSc, Assoc. Prof.
Corresponding member of the PAS, International Institute of Molecular Mechanisms and Machines PAS, Warszawa

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Adam Mickiewicz University, Faculty of Biology, Poznań

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Wrocław University of Science and Technology, Faculty of Chemistry, Wrocław

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Center of Molecular and Macromolecular Studies PAS, Łódź

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Nencki Institute of Experimental Biology PAS, Warszawa

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Institute of Biochemistry and Biophysics PAS, Warszawa

Prof. Joanna Wietrzyk
Hirszfeld Institute of Immunology and Experimental Therapy PAS, Wrocław

Prof. Piotr Zielenkiewicz
Institute of Biochemistry and Biophysics PAS, Warszawa

MICHAŁ SOBKOWSKI PhD, DSc, Assoc. Prof.
Deputy Chair of the Scientific Council

Prof. ADAM SZEWCZYK
Nencki Institute of Experimental Biology PAS, Warszawa
Deputy Chair of the Scientific Council

JOANNA BANASIAK, PhD
Secretary of the Scientific Council

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Representative of the Assistant Professors

Prof. Jan Barciszewski

Prof. Paweł Bednarek

Prof. Jacek Błażewicz
Ordinary member of the PAS

Mariola Dutkiewicz, PhD, DSc, Assoc. Prof.

Prof. Maciej Figiel

Prof. Marek Figlerowicz
Corresponding member of the PAS

Agnieszka Fiszer, PhD, DSc, Assoc. Prof.

Kamilla Grzywacz, PhD, DSc, Assoc. Prof.

Luiza Handschuh, PhD, DSc, Assoc. Prof.

Paulina Jackowiak, PhD, DSc, Assoc. Prof.

Prof. Michał Jasiński

Prof. Mariusz Jaskólski
Ordinary member of the PAS

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Prof. Ryszard Kierzek

Prof. Piotr Kozłowski

Anna Kurzyńska-Kokorniak, PhD, DSc, Assoc. Prof.

Krzysztof Kurowski, PhD, DSc, Eng

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Ordinary member of the PAS

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Katarzyna Pachulska-Wieczorek, PhD, DSc, Assoc. Prof.

Prof. Anna Pasternak

Katarzyna Rolle, PhD, DSc, Assoc. Prof.

Miłosz Ruszkowski, PhD, DSc, Assoc. Prof.

Marcin Drzewiecki, MSc, Eng
Representative of PhD Students

Michał Sobkowski, PhD, DSc, Assoc. Prof.

Prof. Marta Szachniuk

Prof. Jan Węglarz
Ordinary member of the PAS

Prof. Eliza Wyszko

INTERNATIONAL ADVISORY TEAM

On October 9, 2024, the International Advisory Team of the Director of the Institute of Bioorganic Chemistry Polish Academy of Sciences in Poznań was established with the following composition:

- Professor Paola B. Arimondo
- Professor François Chaumont
- Professor Sandrine Etienne-Manneville
- Professor Janez Plavec
- Professor Nikolaus Rajewsky

The existence of an international advisory team as a group of outstanding and notable scientists representing different fields of science practiced at IBCH PAS is part of the long-standing tradition of the Institute. The main task of the Board is to support the Director of IBCH PAS in matters related to the long-term scientific development strategy. Over the years, the research topics conducted at the Institute have undergone a certain transformation. Area of bioorganic chemistry and molecular biology has been expanded by such scientific disciplines as biomedicine, genomics, neurobiology and systems biology. Due to this fact, the Director of the Institute, Handschuh, PhD, DSc Luiza Handschuh, after consulting the Scientific Council, decided to appoint a new International Advisory Team. The Team will perform its function during the four-year term lasting until October 2028. Below we present the profiles of the Team members:

Prof. Paola B. Arimondo

CNRS UMR3523 Chem4Life, Institut Pasteur, Université Paris Cité, CNRS, Paris, France

A chemist, director of research at the CNRS, conducts research at the interface of chemistry and biology, developing original tools to study the molecular mechanisms underlying the human diseases. Since 2018, she is head of the Epigenetic Chemical Biology Unit at the Institut Pasteur, Paris, which specializes in designing and using novel chemical tools to study aberrant methylation in human diseases and developing therapeutic strategies based on epigenetic regulation. She is director of the Department of Structural Biology and Chemistry.

Prof. François Chaumont

Louvain Institute of Molecular Science and Technology, Université Catholique de Louvain, Belgium

An outstanding specialist in the field of plant molecular and cellular biology, particularly interested in the growth and development of plant organisms and the role played in these processes by the transport of molecules across cell membranes. Since 1998, Prof. Chaumont has developed and led a research group aiming at addressing hypotheses related to the function and regulation of plant aquaporins. He also supervises research projects aimed at developing an efficient cellular farming platform.

Prof. Sandrine Etienne-Manneville

Institut Pasteur-CNRS, Paris, France

Research Director at the CNRS and the Head of the Cellular Dynamics in Physiology and Pathology CNRS Department as well as the Cell Polarity, Migration and Cancer Lab. Cell biologist well-known for her major discoveries in the elucidation of polarity signaling and more recently of cytoskeletal crosstalk and its role in cell mechanics, her team now focuses on the molecular mechanisms controlling migration and invasion of glial cells in the context of inflammation and glioblastoma invasion - one of the major reasons for the relapse of these incurable brain tumors. In recognition of her scientific expertise, she has received several major awards and been appointed to numerous international scientific councils and editorial boards.

Prof. Janez Plavec

Slovenian NMR Centre, National Institute of Chemistry, Ljubljana, Slovenia

Chemist, Fulbright fellow at Georgia Institute of Technology, Atlanta, USA. Professor of Structural Biology at the University of Ljubljana. Since 1996 the head of the Slovenian NMR Centre at the National Institute of Chemistry. He is a member of the Board of Directors of the Central European Research Infrastructure Consortium CERIC ERIC. Specialist in studies of the dynamics of bio-macro-molecular systems, structural studies of nucleotides and proteins as well as interactions of small molecules and metal ions with DNA and RNA.

Prof. Nikolaus Rajewsky

Max Delbrück Center and the Humboldt University, Berlin, Germany

System biologist specializing in the study of RNA function and the regulation of gene expression in regenerative processes and human pathophysiology. He founded and directs the Berlin Institute for Medical Systems Biology. He also co-chairs LifeTime, a pan-European research initiative of more than 90 academic institutions and 70 companies, which aims to revolutionize healthcare by mapping, understanding, and targeting cells during disease progression. Recipient of numerous awards, including the most important prize in Germany: “Leibniz” award for exceptional achievements in the field of scientific research.

Photo: Pablo Castagnola

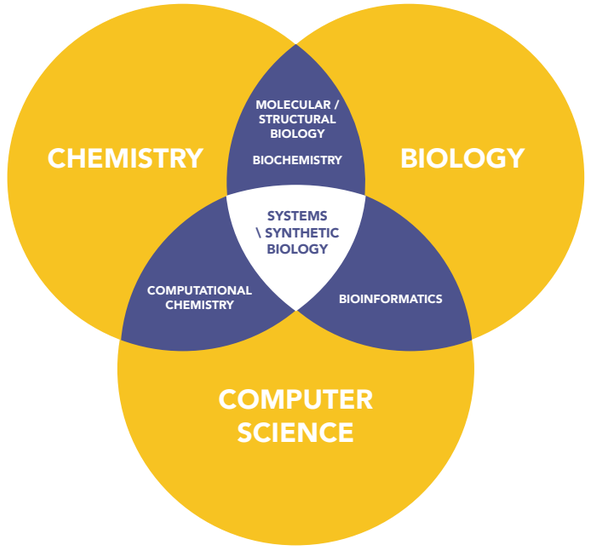
VISION AND DEVELOPMENT STRATEGY

IBCH PAS VISION

In the coming years, the Institute should become one of the leading European scientific centers specializing in interdisciplinary and transdisciplinary research on living organisms at various levels of their organization.

The distinguishing feature of IBCH PAS, compared to other national and international scientific institutions, is and should still be its interdisciplinary nature. Therefore, we should strive to strengthen it and ensure the balanced development of research in the fields of chemistry, biology, and informatics.

Our scientific activity should particularly focus on areas common to these disciplines.



At IBCH PAS, research and development activities are conducted in the fields of chemical, biological, and computer sciences.

THE STRATEGIC GOALS OF IBCH PAS ARE THE FOLLOWING:

- maintaining the Institute's leading position in the country in the field of life sciences,
- strengthening the interdisciplinary nature of research as a distinguishing element of the Institute,
- enhancing the international position and competitiveness of IBCH PAS,
- strengthening and further developing the research potential of the institution.

IBCH PAS HISTORY

The origins of the Institute date back to the mid-1950s, when two specialized laboratories of the Polish Academy of Sciences (PAS) operated within the universities in Poznań: the Laboratory of Alkaloids led by Prof. Jerzy Suszko and the Laboratory of Plant Biochemistry headed by Prof. Stefan Barbacki. In 1969, both laboratories merged to form the Department of Stereochemistry of Natural Products PAS (hereinafter referred to as DSNP PAS), affiliated with the Institute of Organic Chemistry PAS in Warsaw. The head of the new department became Prof. Maciej Wiewiórowski.

Initially, the research conducted in the Department focused mainly on various aspects of the structural chemistry of alkaloids. However, shortly after its establishment, Prof. Wiewiórowski decided on a radical change in the research expertise, shifting towards more promising areas involving the chemistry and biology of nucleic acids. This has remained the Institute's primary research focus to this day. In 1974, the Department was moved from Collegium Chemicum of Adam Mickiewicz University (AMU) to a new location at Z. Noskowskiego Street. A group of doctoral students who gathered around Prof. Wiewiórowski became the stem of the scientific staff. The Department established extensive cooperation with renowned foreign institutions, where its employees undertook long-term scientific internships.

In 1980, DSNP PAS, still headed by Prof. Maciej Wiewiórowski, gained independence and was renamed the Department of Bioorganic Chemistry PAS. The newly formed institution employed 44 individuals, including 19 researchers. In recognition of the outstanding scientific and organizational achievements of the institution, on February 6, 1988, the Prime Minister decided to transform the Department into the Institute of Bioorganic Chemistry, Polish Academy of Sciences (IBCH PAS). At that time, the

scientific staff of the Institute numbered 54, including 10 professors and associate professors, and the Institute employed a total of 121 people. The Institute's structure comprised nine specialized research laboratories. Also in 1988, following Prof. Maciej Wiewiórowski's retirement, Prof. Andrzej B. Legocki was appointed as the Director of IBCH PAS. Prof. Jerzy Pawełkiewicz was elected as the first Chair of the IBCH PAS Scientific Council.

In the following years, the Institute experienced dynamic development. In 1992, a new building for the Poznań Science Center and a modern greenhouse were completed. The first investment was financed by the State Committee for Scientific Research, and the second by the Foundation for Polish-German Cooperation. In 1993, the Poznań Supercomputing and Networking Center (PSNC) was established as an affiliate of the Institute, led by Prof. Jan Węglarz and his deputy, Dr. Maciej Stroiński.

Since 1993, IBCH PAS has been entitled to confer doctoral and habilitation degrees in the field of chemistry, in the discipline of chemistry or biochemistry, which led to

the introduction of the Partnership-based Doctoral Program of the IBCH PAS in 1994. By 1995, IBCH PAS employed 150 people, including 78 in scientific positions (among others, 10 professors and 6 associate professors) and 25 PSNC employees. The Doctoral Program enrolled 28 students.

In 2003, Prof. Andrzej B. Legocki was appointed as the President of the Polish Academy of Sciences. Prof. Wojciech T. Markiewicz became the new Director of IBCH PAS, holding this position for two four-year terms until November 30, 2011.

As a result of a joint initiative by IBCH PAS and the Poznań University of Technology, the European Center for Bioinformatics and Genomics was established in 2011. In the same year, Prof. Marek Figlerowicz was appointed as the new Director of IBCH PAS for three consecutive terms.

In 2014, the Ministry of Science and Higher Education awarded IBCH PAS the prestigious status of the Leading National Research Center (KNOW) in biological sciences.

In 2015, the new headquarters of PSNC were established. The Polish Optical Internet Research Center was located in a complex of buildings at Jana Pawła II Street no. 10 in Poznań. Additionally, IBCH PAS acquired a historic townhouse located in the neighborhood of the conference center at Wieniawskiego Street no. 21/23. According to the plan, the building will house the IBCH PAS Center for Innovation and Education (CIES).

In 2016, IBCH PAS received the European "HR Excellence in Research" award, and a year later, as part of the evaluation of scientific units conducted by the Ministry of

Science and Higher Education for the years 2013-2016, it obtained the highest category A+.

In 2019, five units signed an agreement to establish the Poznań Doctoral School of the Institutes of the Polish Academy of Sciences (PDS IPAS). IBCH PAS became the leader of the consortium, which also included the Institute of Dendrology PAS, the Institute of Molecular Physics PAS, the Institute of Human Genetics PAS, and the Institute of Plant Genetics PAS. At the same time, recruitment to the Partnership-based Doctoral Program of the IBCH PAS was completed. In the same year, the Central Commission for Academic Degrees and Titles granted IBCH PAS the right to confer doctoral and habilitation degrees in the biological sciences. On July 1, 2019, Cezary Mazurek, PhD, Eng, was appointed as the Director's Plenipotentiary for PSNC, and Krzysztof Kurowski, PhD, Dsc, Eng, was appointed as his deputy.

In 2020, a few days after the first case of COVID-19 appeared in Poland, the Viral Support Group was convened at IBCH PAS. The group provided comprehensive assistance to the Provincial Sanitary and Epidemiological Station in Poznań in performing diagnostic tests and subsequently began developing its own genetic tests for detecting SARS-CoV-2 infection. Thanks to collaboration with national companies, the production of MediPAN tests was quickly implemented, making our country independent of foreign supplies. The tests developed at IBCH PAS were among the most sensitive, cost-effective, and fastest tests available on the Polish market. All members of the Viral Group were honored with high state decorations bestowed upon them in an extraordinary manner.

IBCH PAS is one of the national leaders in obtaining national and foreign grants, particularly from European sources. In 2004, 2010, 2016, 2018, and 2020, IBCH PAS was honored with the "Crystal Brussels" award for outstanding achievements in the implementation and promotion of research and innovation programs of the European Union.

In 2022, the Minister of Education and Science announced the results of the categorization of national scientific units for the

years 2017–2021. IBCH PAS achieved the category A+ in the disciplines of biological sciences, A+ in the discipline of chemical sciences, and A in the discipline of information and communication technology. In the same year, IBCH PAS became the owner of the palace-park ensemble in Turew, which will serve as a branch of the IBCH PAS CIES. Additionally, an agreement was signed for PSNC to join the IBM Quantum Network, leading to the establishment of the first Central-Eastern European quantum computing hub in Poznań.

In 2023, PSNC won a competition to install one of the first six European quantum computers in Poznań.At the end of 2023, the President of the PAS appointed Luiza Handschuh, PhD, DSc, Assoc. Prof., as the new Director of the IBCH PAS, for a four-year term from December 2023 to November 2027.

After several years of renovation of the villa at Wieniawskiego 21/23, the ceremonial opening of the Center for Innovation and Education took place on September 3, 2024.

On December 30, 2024, the Director of the IBCH PAS, Luiza Handschuh, PhD, DSc, Assoc. Prof., appointed Robert Pękal, MSc, Eng., as the Director's Plenipotentiary for PSNC. As of February 2025, Urszula Grygier-Soboń, MA, was appointed Deputy Director's Plenipotentiary for PSNC.

Currently, the IBCH PAS is one of the leading scientific institutions in Poland. Its distinctive feature, unique in Poland and Europe, is its interdisciplinary nature; the Institute is conducting interdisciplinary and transdisciplinary research in the fields of chemistry, biology, bioinformatics, and informatics.

SHORT BIOGRAPHY
OF IBCH PAS FOUNDER

PROFESSOR MACIEJ WIEWIÓROWSKI

Prof. Maciej Wiewiórowski (1918–2005) was a Polish chemist, an ordinary member of the PAS, one of the most distinguished Polish scientists of the second half of the 20th century. He mentored dozens of master's and thirty-eight doctoral students, most of whom obtained professorial titles.

Born on August 24, 1918, in Bagatelka, near Września, he began his chemical studies at the University of Poznań at the age of 18. World War II interrupted his studies, during which he fought in the ranks of the Home Army (AK). After the war, he completed his studies and began his scientific work at the Higher School of Economics (HSE) in Poznań. In 1950, under the supervision of Prof. Jerzy Suszko, he obtained his doctoral degree, and in 1954, became an assistant professor and took over the leadership of the Department of General Chemistry HSE.

Following his foreign scientific internships, Prof. Wiewiórowski became a pioneer and advocate of modern instrumental analysis methods in Poland. In 1959, he became an associate professor and took over the management of the Department of Stereochemistry and Organic Spectrochemistry at Adam Mickiewicz University (AMU). In 1969, he obtained the title of full professor, and in the same year, was appointed the director of the Institute of Chemistry AMU.

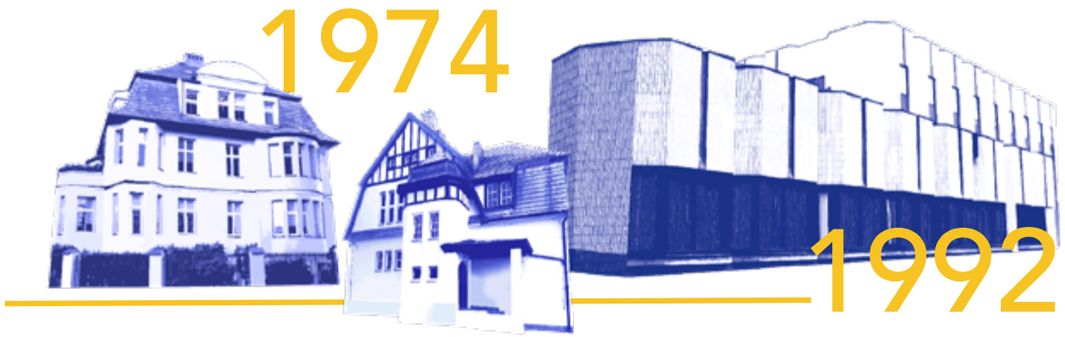
As early as 1955, he began collaborating with the Polish Academy of Sciences, and was entrusted with the management of the Biochemical Laboratory of the Plant Breeding Department (1955–60) and the Laboratory of Biochemistry and Alkaloid Structure at the Institute of Biochemistry and Biophysics PAS (1960–69). In 1969, he became the head of the Department of Stereochemistry of Natural Products PAS (DSNP PAS), and five years later, he relocated the Department to the premises at Z. Noskowskiego Street 12.

Shortly after establishing DSNP PAS, Prof. Wiewiórowski delved into a new area of research: nucleic acid chemistry. Conferences on this topic, organized by him, attracted the most distinguished scientists from around the world, e.g., C.B. Reese, F. Cramer, N.J. Leonard, H. Köster (Kiekrz 1974), H. Vorbrüggen, E. Ohtsuka, W. Sanger, J. Van Boom, and R.L. Letsinger (Dymaczewo 1976). In 1984, he chaired the organizing committee of the IUPAC International Symposium on Natural Products Chemistry in Poznań, and from 1985 to 1988, served as president of the Polish Chemical Society.

In July 1980, the DSNP PAS gained independence and changed its name to the Department of Bioorganic Chemistry PAS. Prof. Wiewiórowski led this Department until its transformation into the Institute in 1988. Shortly after this event, he retired.

His most important roles included serving as Vice-Rector for Research at AMU (1968–73), Member of the Presidium PAS (1969–83), Vice-President PAS (1981–83), and Chair of the Central Qualification Committee for Scientific Cadres (1973–79). Among numerous decorations and honors, he was awarded the degree of doctor honoris causa from the Poznań Academy of Economics (1986) and the Commander's Cross with Star of the Order of Polonia Restituta (2000).

Prof. Wiewiórowski passed away on March 30, 2005, in Poznań. His legacy includes numerous publications but, above all, the school he created and the research techniques he left for his students and subsequent generations of scientists.



1974

1992

1969 Establishment of the Department of Stereochemistry of Natural Products PAS located in Collegium Chemicum

Head: Prof. Maciej Wiewiórowski

1974 New premises at Zygmunta Noskowskiego Street

1980 Transformation into an independent Department of Bioorganic Chemistry PAS

1988 Transformation into the Institute of Bioorganic Chemistry PAS;
Prof. Maciej Wiewiórowski retires

The first director of IBCH PAS becomes Prof. Andrzej B. Legocki

1992 A new complex of buildings comprising modern laboratory spaces and the Poznań Science Center

1993 Establishment of Poznań Supercomputing and Networking Center (PSNC) affiliated with IBCH PAS

Entitlement to confer doctoral and post-doctoral degrees in the field of chemistry and biochemistry

Launch of the Partnership-based Doctoral Program of IBCH PAS

2003 Prof. Andrzej B. Legocki is appointed President of PAS

Prof. Wojciech T. Markiewicz becomes IBCH PAS Director

2007 Establishment of the European Centre for Bioinformatics and Genomics (ECBiG)

2011 Prof. Marek Figlerowicz becomes IBCH PAS Director

IBCH PAS receives the status of the Leading National Research Center (KNOW) for the period 2014-2018

2014

2015

2022

2015 Acquisition of the townhouse at Henryka Wieniawskiego Street 21/23

Establishment of the new headquarters of PSNC at Jana Pawła II Street

2016 Granting the HR Excellence in Research logo to the Institute by the European Commission

2017 Following the scientific activity evaluation for 2013 - 2016, the Ministry of Science and Higher Education awards the Institute an A+ category

2018 Joining the EU-OPENSCREEN ERIC consortium

2019 The Poznań Doctoral School of Institutes of the Polish Academy of Sciences (led by IBCH PAS) commences its activities

Entitlement to confer doctoral and post-doctoral degrees in the field of biological sciences

2020 Establishment of the Viral Support Group

Elaboration of COVID-19 diagnostic tests

2022 The Ministry of Education and Science awards the Institute the following categories:
A+ in the field of biological sciences
A+ in the field of chemical sciences
A in the field of information and communication technology

IBCH PAS becomes the owner of the palace park complex in Turew

2023 Establishment of the IBCH PAS Center for Innovation and Education

Completion of the Genomic Map of Poland

Development of the MOSAIC Platform

Establishment of the Bioimaging Platform

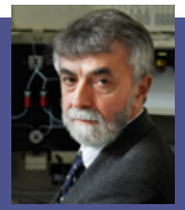
Luiza Handschuh, PhD, DSc, Assoc. Prof. becomes IBCH PAS Director

2024 Opening of the IBCH PAS Center for Innovation and Education

Termination of the Partnership-based Doctoral Program of IBCH PAS

Prof. MACIEJ WIEWIÓROWSKI
Director
1969-1988

Prof. ANDRZEJ B. LEGOCKI
Institute Director
1988-2003



Prof. WOJCIECH T. MARKIEWICZ
Institute Director
2003-2011

Prof. MAREK FIGLEROWICZ
Institute Director
2011-2023

Phd, Dsc, Assoc. Prof. LUIZA HANDSCHUH
Institute Director
2023

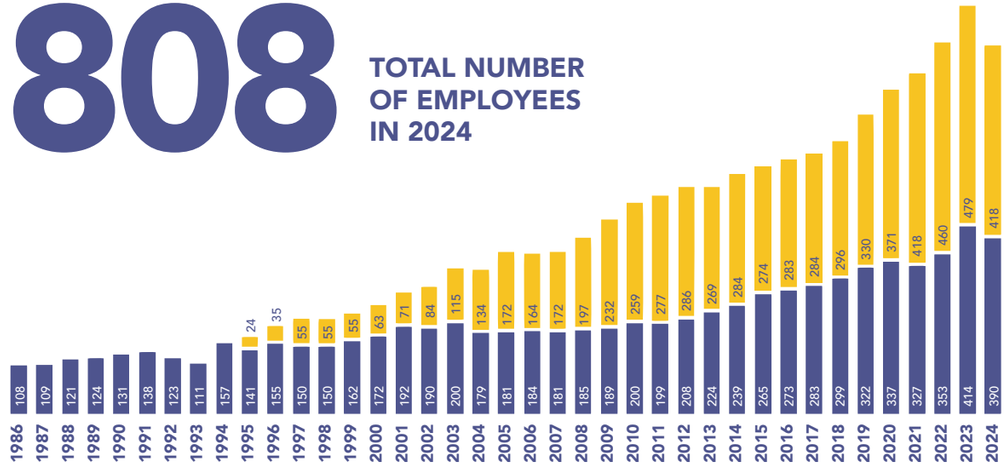
INSTITUTE IN NUMBERS

Currently, IBCH PAS employs almost 800 staff memebers, with an additional 41 doctoral students conducting their research as part of the Poznan Doctoral School of Intitutes of IPAS. Within the Institute, there are 28 scientific departments and 13 specialized laboratories. The PSNC comprises 16 departments organized into 4 divisions.

The Scientific Council of IBCH PAS is entitled to confer doctoral and habilitation degrees in the field of natural sciences, in the disciplines of chemical sciences and biological sciences. Over 40 habilitation degrees (DSc) and over 260 doctoral degrees (PhD) have been awarded so far.

808

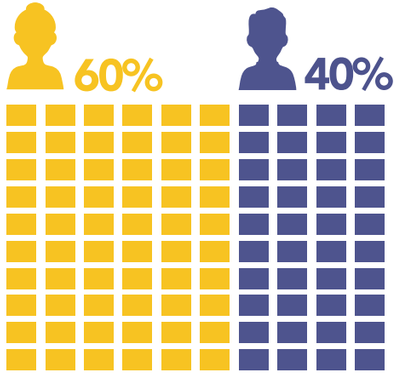
TOTAL NUMBER OF EMPLOYEES IN 2024



NUMBER OF EMPLOYEES AT IBCH PAS AND PSNC
1980s to 2024

PORTUGAL
VIETNAM CROATIA
UKRAINE CHINA TURKEY
POLAND
LITHUANIA MOROCCO
BELARUS SLOVENIA INDIA
GUATEMALA SPAIN

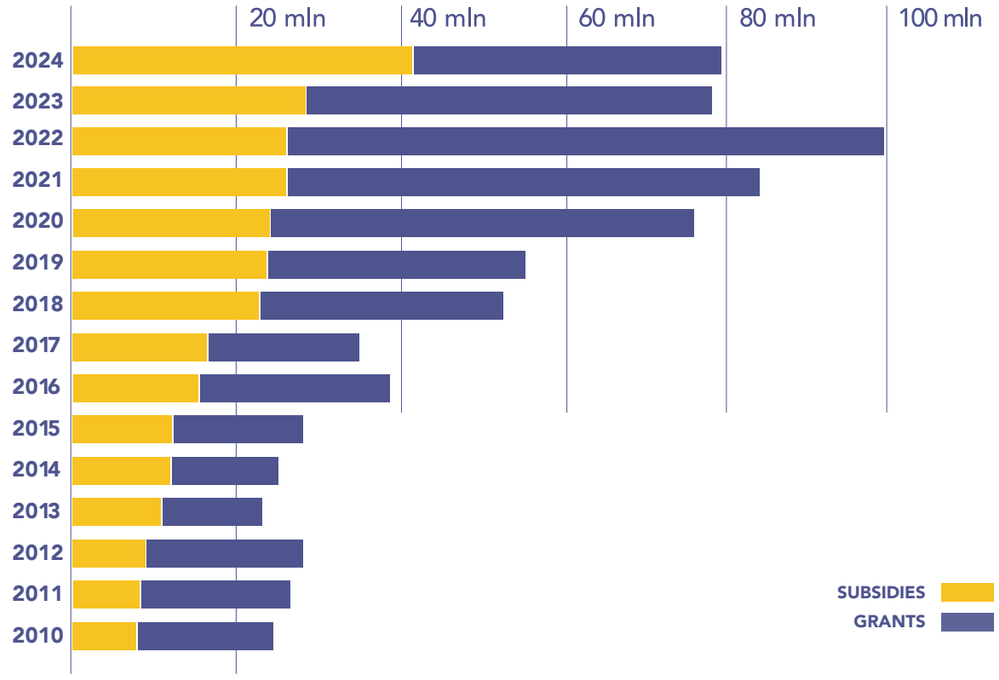
NATIONAL DIVERSITY OF IBCH PAS, PSNC STAFF AND PHD STUDENTS
2024



GENDER RATIO AT IBCH PAS AND PSNC
2024

FINANCIAL INVESTMENTS
IN THE INSTITUTE'S ACTIVITIES (PLN) 2010-2024

776 470 000 PLN



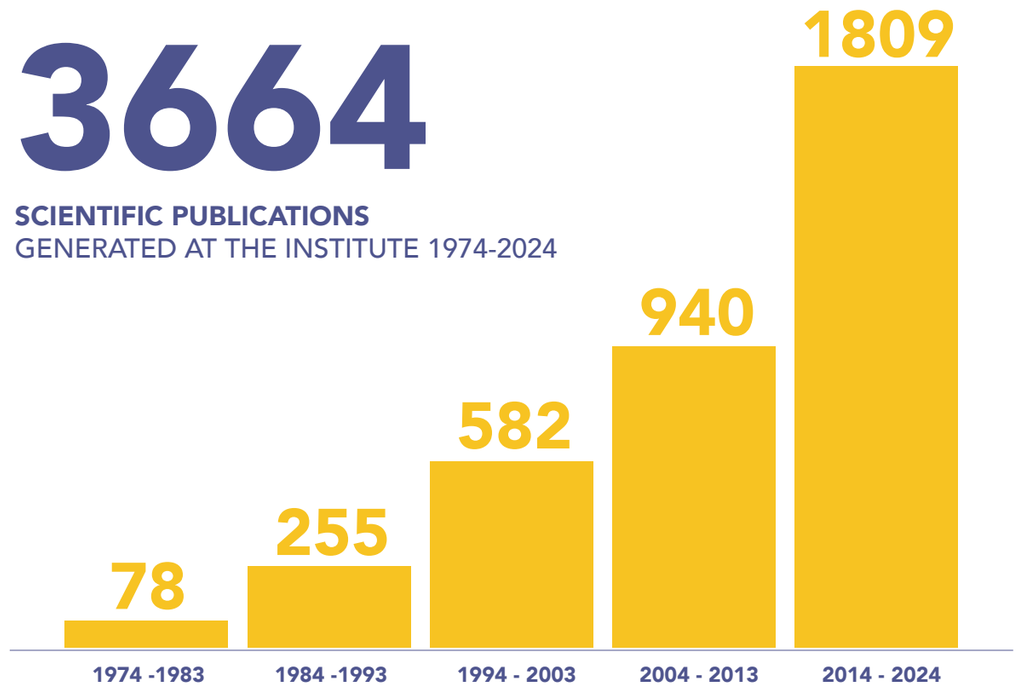
IBCH PAS is one of the country leaders in obtaining national and international grants. Around 200 scientific projects are implemented annually at IBCH PAS. For outstanding achievements in the implementation and promotion of research and innovation programs of the European Union, IBCH PAS has been awarded the "Crystal Brussels" prize five times.

The result of the implementation of numerous projects is the publication of approximately 200 papers annually. Each year, over 50 students pursuing bachelor's and master's degrees undergo internships at IBCH PAS, with some of them conducting their diploma theses under the supervision of the Institute's employees.

IBCH PAS is the organizer and co-organizer of numerous national and international conferences and scientific meetings. Over 15 such events are organized annually. Among the recurring events, we can mention Science on Vacation (in Jurata), Brain Awareness Week, and Researchers' Night.

3664

SCIENTIFIC PUBLICATIONS
GENERATED AT THE INSTITUTE 1974-2024



COLLABORATION OF IBCH PAS WITH FOREIGN INSTITUTIONS

CANADA
- University of British Columbia
- McGill University

UNITED STATES
- University of California
- University of Louisville
- University of Rochester
- University of Georgia
- Florida Atlantic University
- Baylor College of Medicine
- Harvard Medical School
- National Cancer Institute, Frederick
- Argonne National Laboratory
- New York State University

CHILE
- Austral University of Chile

ARMENIA
- Yerevan State University

INDIA
- University of Calcutta

CHINA
- Liaoning University of Technology
- Institute of Plant Physiology and Ecology, Chinese Academy of Sciences
- University of Hong Kong

JAPAN
- Kyoto University
- Osaka University

AUSTRALIA
- Flinders University, Adelaide
- University of Sydney
- University of Melbourne

NEW ZEALAND
- University of Otago

IRELAND
- University College Dublin
- University of Galway

UNITED KINGDOM
- Wellcome Trust Sanger Institute
- European Bioinformatics Institute
- University of Edinburgh
- Scotland's Rural College

SPAIN
- Polytechnic University of Madrid
- University of Valladolid
- Centre for Genomic Regulation (CRG), Barcelona

PORTUGAL
- Center for Neuroscience and Cell
- Biology, University of Coimbra

FRANCE
- INSEEC Business School
- University of Strasbourg
- Institut Curie
- National Institute of Health and Medical Research (INSERM)
- François Jacob Institute of Biology
- Institute of Genetics and Molecular and Cellular Biology (IGBMC), Ostwald

NORWAY
- University of Oslo
- University Centre in Svalbard

SWEDEN
- Swedish University of Agricultural Sciences
- Karolinska Institutet

FINLAND
- University of Helsinki

DENMARK
- University of Southern Denmark

NETHERLANDS
- Erasmus University Medical Center Rotterdam

AUSTRIA
- Wilhelminen Cancer Research Institute

CZECHIA
- Institute of Parasitology in the Biology Centre of the Czech Academy of Sciences

GERMANY
- Bergakademie Freiberg University of Technology
- Albert Ludwig University of Freiburg
- ElementZero Biolabs, Berlin
- Mittweida University of Applied Sciences
- Ruhr University Bochum
- University of Tübingen
- Max Planck Institute for Plant Breeding Research
- Max Delbrück Center for Molecular Medicine
- Leibniz Institute for Primate Research
- University of Cologne

ITALY
- University of Trento
- University of Udine
- University of Milan
- Sapienza University
- Neuromed, Venafro

SWITZERLAND
- F. Miescher Institute for Biomedical Research
- Lausanne University Hospital
- University of Fribourg
- University of Zurich
- Institute of Molecular Plant Biology in Zurich
- Swiss Federal Institute of Technology in Zurich

UKRAINE
- Lviv National Medical University
- Bogomoletz Institute of Physiology of National Academy of Sciences of Ukraine

GREECE
- University of Athens

DOCTORAL EDUCATION

POZNAŃ DOCTORAL SCHOOL OF THE INSTITUTES OF THE PAS

psd-ipan.ichb.pl/index.php/en/home/

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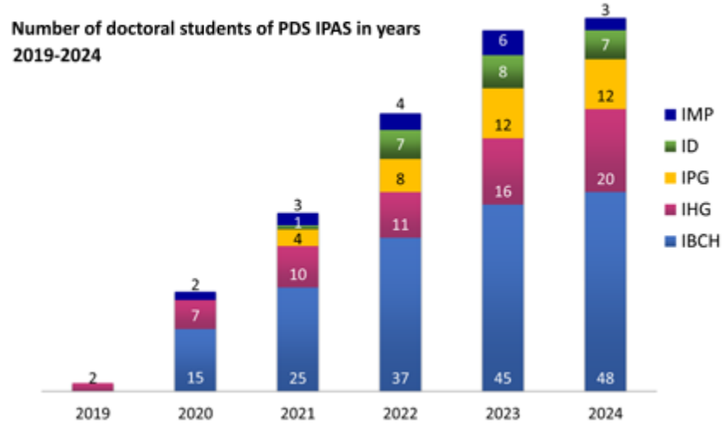
The Poznań Doctoral School of the Institutes of the Polish Academy of Sciences (PDS IPAS) is run jointly by the Institute of Bioorganic Chemistry PAS, the Institute of Dendrology PAS, the Institute of Molecular Physics PAS, the Institute of Human Genetics PAS, and the Institute of Plant Genetics PAS.

Doctoral education takes place in the following disciplines:

- biological sciences (IBCH PAS, ID PAS)
- chemical sciences (IBCH PAS)
- medical sciences (IHG PAS)
- physical sciences (IMP PAS)
- agriculture and horticulture (IPG PAS)
- forestry (ID PAS)

Recruitment to the PDS IPAS takes place on a continuous basis, in line with the acquisition of funds for the implementation of scientific projects, and announcements about the recruitment of new doctoral students are posted, among others, on the PDS IPAS website, EURAXESS, and on the websites of the institutes co-running the Doctoral School.



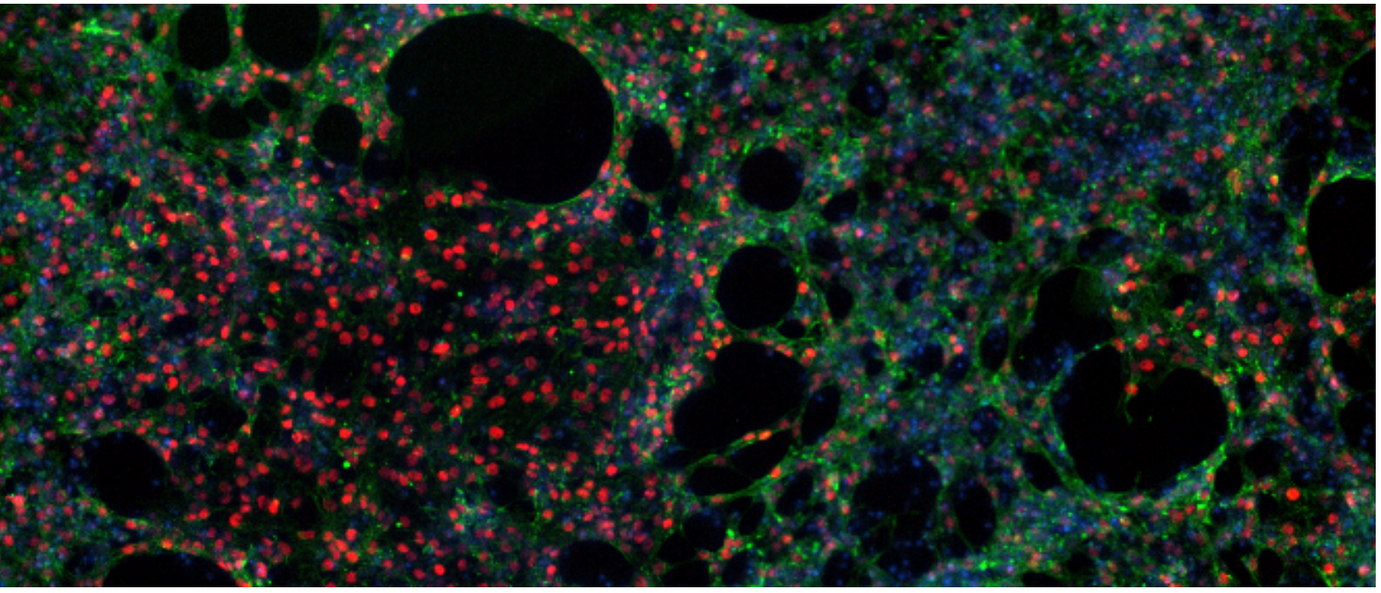
The provisions governing recruitment and the functioning of the School are included in the Rules of the PDS IPAS, Rules on Recruitment to the PDS IPAS, and in the Programme of Study. They can be found, among other places, on the websites of the School or on the BIP pages of individual institutes.

Classes are conducted by qualified lecturers who are not only capable of sharing knowledge but also have their passion for science. The results of research within the scope of doctoral work are published in international journals with a high impact factor, and funding for scholarships and research is obtained from grants provided by institutions funding science.

As of December 31, 2024, PDS IPAS educates 90 PhD students: IBCH PAS: 7 chemists, 41 biologists; ID PAS: 7 biologists; IMP PAS: 3 molecular physicists; IPG PAS: 12 agrobiologists; and IHG PAS: 20 medical scientists. The majority of PhD students are women. 25 participants come from outside Poland, from countries such as Albania, India, Cameroon, Lebanon, Nigeria, Pakistan, Turkey, Ukraine, Spain, Iran, Great Britain and Vietnam.

We associate young, ambitious, and science enthusiasts to acquire knowledge and experience at the Poznań Doctoral School of the Institutes of the Polish Academy of Sciences and thereby develop their passions and scientific careers in our institutes.

STRATEGIC PROJECTS



MOSAIC 3D

ECBG – EUROPEAN CENTRE FOR BIOINFORMATICS AND GENOMICS

The European Centre for Bioinformatics and Genomics is one of the key research infrastructures in Poland. Its primary mission is to develop, implement, and commercialize innovative bioinformatic and multi-omics technologies that support scientific research and the advancement in medical diagnostics and therapy.

Progress in population genomics, molecular biology, and systems biology enables overcoming barriers in the development of new, personalized therapeutic approaches. However, the process of drug development remains costly and highly uncertain - many promising candidates never reach clinical use. One of the primary reasons for this high failure rate is the insufficient predictive value of traditional 2D *in vitro* and animal *in vivo* models used in the preclinical phases of new therapy research. In vitro models, although relatively easy to use, do not fully replicate the complex microenvironment of human tissue. Animal models, despite offering a higher level of biological organization, often exhibit interspecies differences that limit their ability to precisely validate therapies intended for humans. Additionally, their use is constrained by the limited availability of samples and various ethical and practical challenges.

There is, therefore, an urgent need to implement advanced preclinical models and novel analytical methods that allow for a more precise recapitulation of biological processes and more accurate prediction of clinical research outcomes. Improved models could reduce the risk of prematurely discarding valuable drug candidates and investing in therapies that ultimately fail in clinical trials. Consequently, they would enhance efficiency and lower the costs of the entire drug development process.

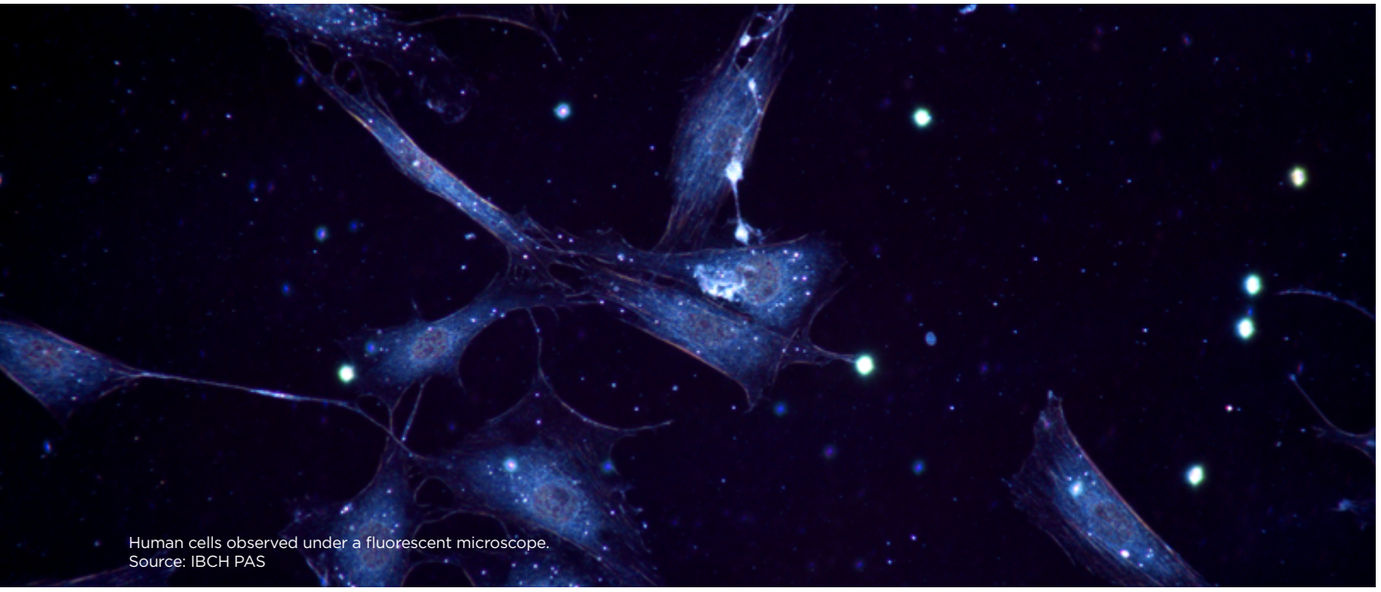
To address these challenges, the research infrastructure developed within the ECBiG-MOSAIC 3D project (FENG.02.04-IP.04-0012/24) aims to provide a platform for obtaining advanced three-dimensional biological system models (*in vitro*-3D) and their digital twins (*in silico*-3D), which will be applied in translational research on oncological and cardiological diseases. As part of the project, the infrastructure of ECBG will be enhanced with state-of-the-art equipment for cell culture, live-cell analysis, and biobanking. Furthermore, it will be expanded with unique cell lines derived from biological material obtained from patients with selected cardiological and oncological diseases.

Additionally, a dedicated service platform will be established to facilitate the development and application of digital twin models in biomedical research.

The tools developed within the project will enable multi-level modelling of pathological processes and therapeutic effects in both live cellular systems and their digital counterparts. This will open new possibilities in biomedical research and contribute to the development of personalized therapies.

The project is carried out by IBCH PAS and its affiliated Poznan Supercomputing and Networking Center, and led by Prof. Marek Figlerowicz. It is co-funded under through European Funds for Smart Economy 2021-2027 Programme (FENG), Action 2.4 Smart Economy Research Infrastructure.

European Funds for Smart Economy
Republic of Poland
Co-funded by the European Union



Human cells observed under a fluorescent microscope.
Source: IBCH PAS

TARGETED SINGLE-CELL TECHNOLOGY FOR CANCER DIAGNOSTICS

TOWARDS CELL-ORIENTED INTERCEPTIVE MEDICINE (INTERCEPT)

Despite significant advancements in oncology, the cellular heterogeneity of cancer remains one of the key challenges in effective diagnostics and therapy. Each tumor consists of diverse cell populations with distinct somatic genome mutations and transcriptional programs, making it difficult to develop precise, personalized treatment strategies. A comprehensive understanding of this complexity – both at the single-cell level and in the context of individual patients – holds great potential for improving cancer treatment outcomes.

Current clinical diagnostic technologies lack the resolution needed to accurately capture cancer cellular landscape. Standard methods, based on bulk analysis and multiple separate tests, lead to a prolonged and often imprecise diagnostic process. This, in turn, can result in suboptimal treatment selection, extended therapy duration, and increased healthcare costs, placing a significant burden on both patients and healthcare systems. Addressing these clinical challenges requires more advanced and precise diagnostic tools capable of characterizing cancer at the single-cell level.

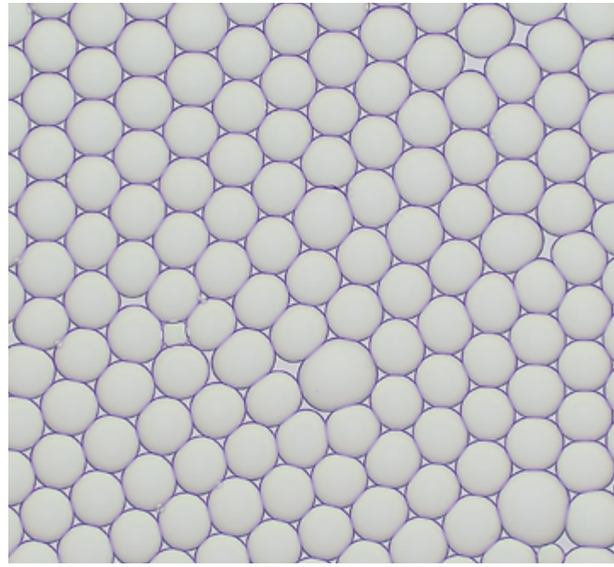
Although existing single-cell analysis technologies show significant potential, their clinical application remains limited due to high costs, technical complexity, and the overwhelming volume of generated data, which is not always relevant for diagnostics and treatment selection. The goal of the INTERCEPT project (UoF/02-WIB-3/2023-004) is to simplify and refine single-cell analysis methods, making them suitable for routine clinical diagnostics. The project focuses on developing a technology for single-cell analysis of selected genes and transcripts that is independent of microfluidic systems. This approach will serve as the foundation for targeted diagnostic tests. The first prototypes will be designed for the diagnostics of acute myeloid leukemia (AML) and chronic lymphocytic leukemia (CLL).

The INTERCEPT project is funded under the Virtual Research Institute Programme from the Polish Science Fund (2024-2029). The research team, led by Prof. Marek Figlerowicz, consists of biologists, chemists, and bioinformaticians from the Institute of Bioorganic Chemistry, Polish Academy of Sciences.

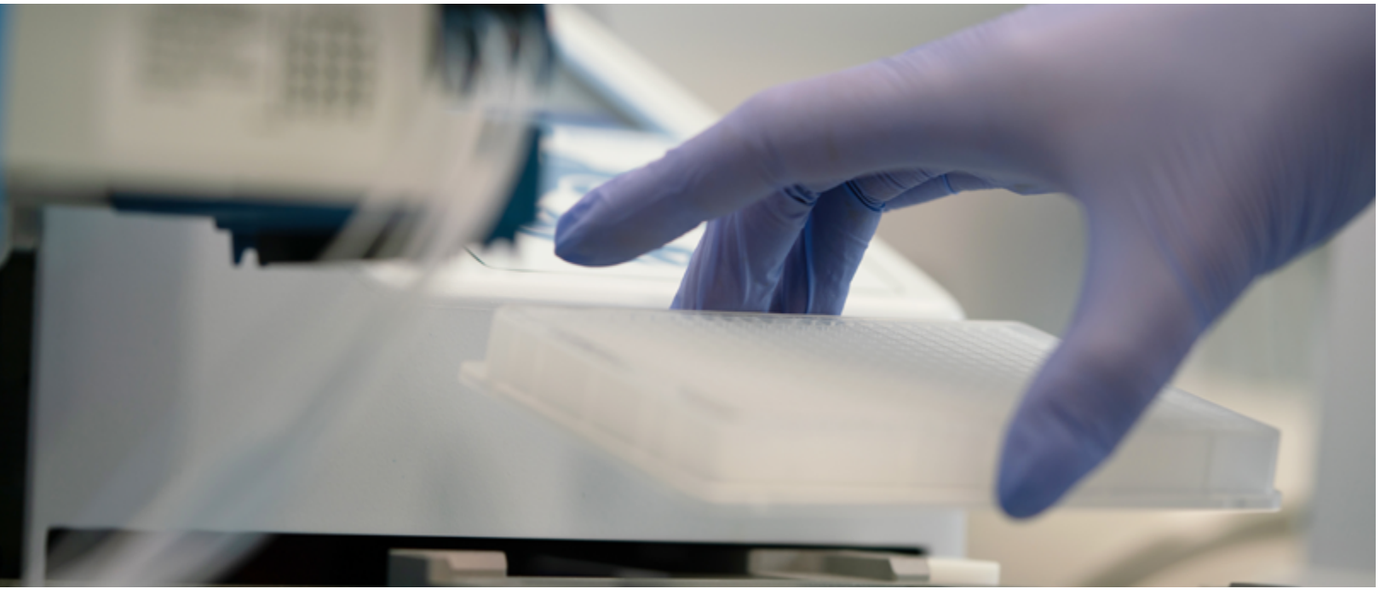
Łukasiewicz
PORT Polish Center
for Technology Development

WIB

CO-FINANCED BY THE POLISH SCIENCE FUND



W/O emulsion observed under a microscope.
Source: IBCH PAS



PLATFORM FOR DESIGNING, SYNTHESIS, AND TESTING

RNA THERAPEUTICS AND VACCINES

Since the birth of RNA technology, it has been accompanied by enormous expectations related to the practical use of RNA therapeutics and vaccines in medicine. Although the results obtained were very promising, they did not immediately lead to the implementation of a new class of therapeutics. For years, the most challenging problems to solve were: (i) to ensure the high specificity of RNA drugs, (ii) to develop effective methods of RNA delivery, and (iii) to ensure the safe use of RNA-based medicines. For these reasons, only a dozen or so therapeutic RNAs are currently approved for use. RNA technology was applied on a large scale only in 2020 to produce vaccines during the COVID-19 pandemic.

In recent years, the development of RNA technology and its application in both therapy and medical prevention has been widely considered one of the priorities of global scientific research. Consequently, this field of study has been recognized with Nobel Prizes in recent years: in 2023 for research on chemical modifications that have enabled the development of RNA vaccines and in 2024 for research on microRNAs, which universally regulate gene expression and can also be used for therapeutic purposes.

At the end of 2021, the IBCH PAS began the implementation of a 6-year project awarded under the Medical Research Agency competition for the development of innovative therapeutic solutions using RNA technology. The long-term goal of our project is to establish a universal platform for designing, synthesizing and testing innovative RNA therapeutics and vaccines.

To create this platform, we are developing:

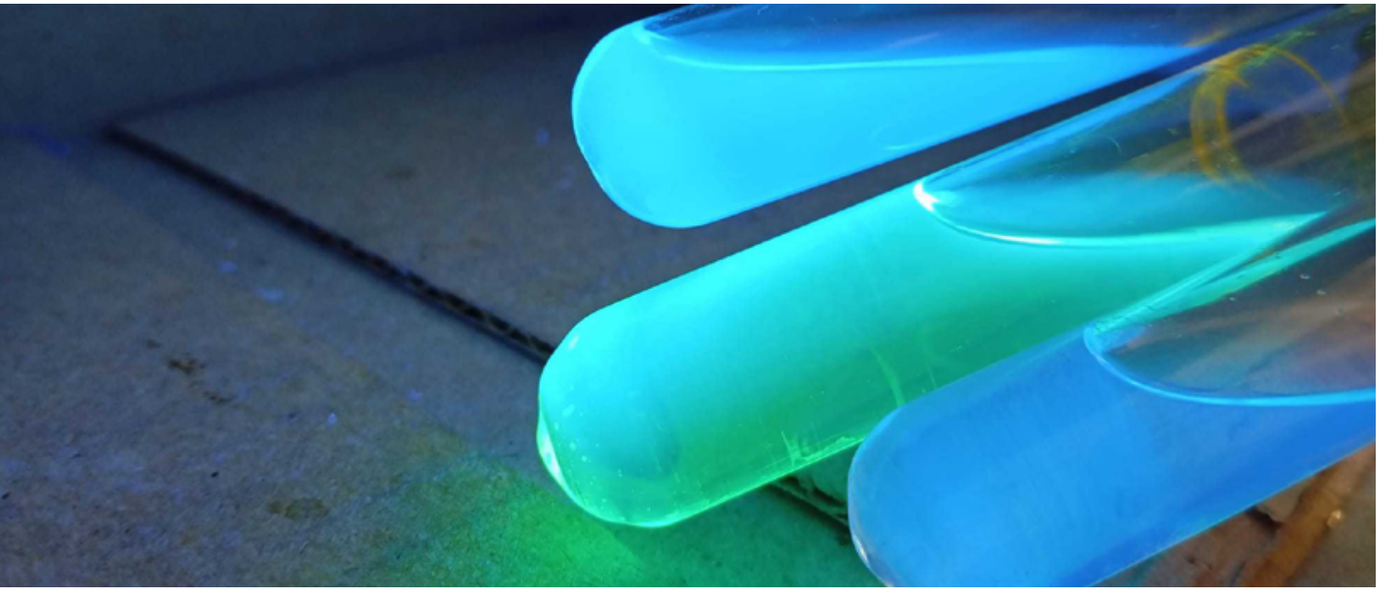
- databases and bioinformatic tools for therapeutic/vaccine RNA design,
- the procedures for chemical and enzymatic synthesis of therapeutic/vaccine RNA,
- optimal methods for delivering each type of RNA to cells and organisms
- methods for assessing candidate RNA therapeutics/vaccines in cell cultures,
- methods for preclinical assessment of candidate RNA therapeutics/vaccines in animal models.

The final product of the project will be both a unique technological platform for therapeutic/vaccine RNA production and a set of potential RNA drugs.

The project titled “Development of a universal fastresponse platform, based on RNA technology, ensuring the national drug and epidemiological safety” was prepared by the consortium formed by ICHB PAS and Polpharma S.A. The project combines the ICHB PAS’s experience in RNA research and the production capabilities of the largest pharmaceutical company in Poland.

The principal investigator of the project is Prof. Marek Figlerowicz. The groups involved are led by: Marcin Chmielewski, Maciej Figiel, Agnieszka Fiszer, Luiza Handschuh, Marta Olejniczak, Katarzyna Rolle, Marta Szachniuk, Anna Urbanowicz, and Paweł Zmora.

Project number 2021/ABM/05/00004-00, financed by the Medical Research Agency, Poland from: state budget funds.



POL-OPENSCREEN POLISH SCREENING INFRASTRUCTURE PLATFORM FOR BIOLOGICAL CHEMISTRY

The project is implemented, among others, as a part of the POL-OPENSCREEN initiative, included in the Polish Research Infrastructure Road Map in 2014. Its goal is to create and make available unique infrastructure and expertise in the field of chemical biology, both to the scientific and business communities, in the country and around the world. As a part of this project, IBCH PAS is creating the most advanced system in Poland for identifying biologically active substances through high-throughput analysis of hundreds of thousands of chemical compounds (so-called libraries).

When Poland joined the EU-OPENSCREEN ERIC (European Research Infrastructure Consortium) network as a founding member, IBCH PAS met the rigorous requirements set by an international team of experts and obtained the status of a partner (so-called Partner Site) of this consortium as one of three Polish units (along with the Institute of Medical Biology PAS in Łódź, the leader of the POL-OPENSCREEN project, and the Institute of Biochemistry and Biophysics PAS in Warsaw). In 2018, the Ministry of Science and Higher Education awarded Polish representatives in EU-OPENSCREEN a targeted financial subsidy for the expansion and launch of research infrastructure. The head of the awarded grant on behalf of IBCH PAS was Prof. Marek Figlerowicz.

Thanks to the received subsidy, the Centre for Chemical Biology ERIC was established at IBCH PAS, headed by dr hab. Jacek Kolanowski. The Centre has specialised and unique laboratories on a global scale (Laboratory of Molecular Assays and Imaging - headed by dr Dorota Kwiatek and Laboratory of Medicinal Chemistry - headed by dr Dorota Jakubczyk), and its staff constitute an interdisciplinary team of experts with many years of international experience. The Centre for Chemical Biology ERIC is currently implementing two key infrastructure projects as a part of the POL-OPENSCREEN consortium:

1. FENG.02.04-IP.04-0010/24-00 POL-OPENSCREEN – Polish Screening Infrastructure Platform for Biological Chemistry. The project is co-financed by the European Regional Development Fund under the 2nd priority of the action 2.4 Research Infrastructure of the Modern Economy program European Funds for Smart Economy

2. POL-OPENSCREEN 2.0 - Maintenance, Development and Sharing of the Polish Screening Infrastructure Platform for Biological Chemistry, in view of the Participation in the EU-OPENSCREEN ERIC Research Infrastructure Consortium) - Co-financed by the Minister of Science program "Support for the participation of Polish research teams in international research infrastructure projects.

As part of its activities, the Centre offers access to expertise and infrastructure and substantive support in the scope of:

- development of molecular tests and high-throughput screening tests on biochemical and cellular models, based on luminescence detection and multiparametric high-throughput imaging;
- medicinal chemistry, including optimisation of bioactive compounds using chemoinformatics and synthesis, semi-synthesis and biosynthesis of dedicated compound libraries;
- development of new technologies and testing;
- development of application notes;
- modern research equipment;
- substantive consulting in developing research ideas and plans as well as preparing R&D projects.

The aim of the Centre for the coming years is to adapt the most modern and reliable tests and technologies to identify and optimize bioactive compounds and discover the mechanisms of their action. Additionally, we plan to continuously expand the portfolio of services in cooperation with academic centres and business partners in Poland and around the world.

European Funds for Smart Economy
Republic of Poland
Co-funded by the European Union

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF RNA STRUCTURAL RESEARCH

RNA crystallography | neurodegenerative diseases caused by expansion of repetitive sequences | RNA cryoEM | RNA microED | RNA-ligand complexes | stability of RNA hairpin structures

HEAD

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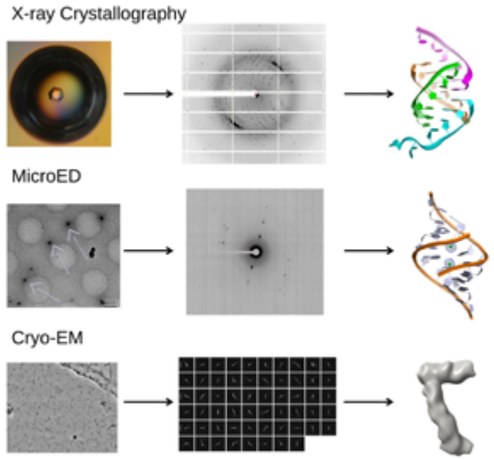


RESEARCH SCOPE

Structural and biophysical analyses of RNA molecules relevant to human physiology and disease etiology.

The main research area is the structural analysis of RNA molecules and their complexes with proteins or low molecular weight compounds. The RNA molecules studied are associated with human diseases such as neurodegenerative diseases of genetic origin, cancer, and viruses. We also study RNA of significant importance in human physiology, for example, mRNA fragments and non-coding RNA. Structural analysis aims to answer fundamental questions concerning the relationship between the structure and function of RNA and to expand knowledge on the rational design and improvement of synthetic compounds with therapeutic and application potential.

MAIN RESEARCH TOPICS

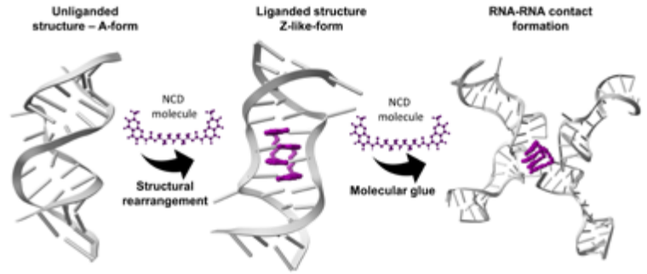
- Structural analysis (crystallography, microED and cryo-EM) of RNA molecules associated with neurodegenerative diseases.
- Rational design of potential drugs based on three-dimensional structures of RNA-ligand complexes.
- Development of a method for stabilizing RNA hairpin structures under crystallization conditions and synthesis of nucleotide and nonnucleotide RNA linkers.
- Impact of modifications on RNA tertiary structure.
- Structural and thermodynamic analysis of RNA quadruplexes.
- Crystallographic analysis of exonuclease complexes with therapeutic oligomers.

RESEARCH PROJECTS

Crystallographic analysis of RNA-ligand complexes. Towards rational design of lead compounds for development of therapies against neurodegenerative disorders (NSC OPUS, PI: A. Kiliszek)

Enzymes of the L-methionine biosynthetic pathway as novel molecular targets for antifungal chemotherapy (NSC OPUS PI: W. Rypniewski)

Development of methodology for stabilisation of RNA hairpins for crystallographic study (NSC SONATA BIS, PI: A. Kiliszek)



SELECTED PUBLICATIONS

Błaszczyk L. et al. Antisense RNA C9orf72 hexanucleotide repeat associated with amyotrophic lateral sclerosis and frontotemporal dementia forms a triplex-like structure and binds small synthetic ligand. Nucleic Acids Research 2024; 52(11):6707–6717

Kiliszek A. et al. Structure and thermodynamics of a UGG motif interacting with Ba2+ and other metal ions: accommodating changes in the RNA structure and the presence of a G(syn)-G(syn) pair. RNA 2023; 29:44-54,

Ryczek M. et al. Overview of Methods for Large- Scale RNA Synthesis. Appl. Sci. 2022; 12:1543,

Mukherjee S. et al. Structural insights into synthetic ligands targeting A-A pairs in disease-related CAG RNA repeats. Nucleic Acids Research 2019; 47:10906-10913

Błaszczyk L. et al. Structures of RNA repeats associated with neurological diseases. WIREs RNA 2017; 8:UNSP e1412 Invited Article

DEPARTMENT OF RIBONUCLEOPROTEIN BIOCHEMISTRY

nucleic acid-binding proteins | regulatory RNAs | regulation of gene expression | Dicer-type ribonucleases | SARS-CoV-2 RNA polymerase complex

HEAD

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Both pre-miRNAs and G-quadruplexes are anchored in the same region of Dicer

RESEARCH SCOPE

Our interests focus on the role of RNA and DNA in the regulation of the activity of nucleic acid-binding proteins and exploring the mechanisms beyond the activity and specific functions of these proteins.

Currently, the main object of our research is Dicer-type ribonucleases. These proteins are mostly known for their important role in the biogenesis of small regulatory RNAs: miRNAs and siRNAs. However, a growing number of reports demonstrate that the activity of Dicer proteins extends beyond the biogenesis of small regulatory RNAs; for example, Dicers may also be involved in apoptosis or DNA damage repair. By identifying the cellular RNAs and DNAs bound by human Dicer, we investigate the role of selected Dicer•RNA and Dicer•DNA complexes in various cellular processes. In addition, by using target-specific inhibitors that selectively interact with individual components of the protein•RNA complexes, we study the specific activity of the protein (on the example of Dicer-type proteins and the RNA polymerase complex of the SARS-CoV-2 virus) and the importance of a given RNA molecule for the functioning of the cell (on the example of Dicer-type proteins).

MAIN RESEARCH TOPICS

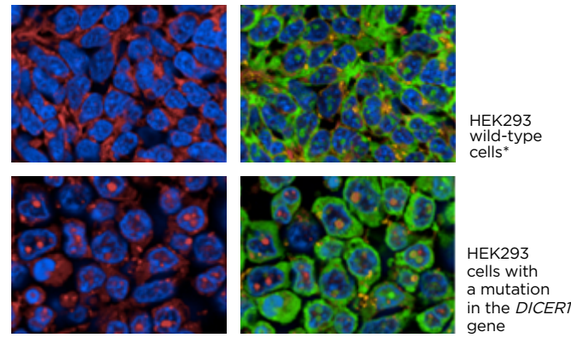
- Structural and functional aspects of protein-nucleic acid interactions.
- The role of RNA/DNA in the regulation of the activity and functions of nucleic acid-binding proteins (on the example of Dicer-type proteins).
- Endogenous factors regulating the activity of Dicer-type ribonucleases.
- Designing and testing inhibitors against Dicer-type ribonucleases.
- Model systems for activity studies of the polymerase complexes (on the example of the SARS-CoV-2 RNA polymerase complex).

RESEARCH PROJECTS

Close Encounters of the Third Kind: what happens when ribonuclease Dicer encounters in the cell RNA and DNA adopting G-quadruplex structures (NSC, OPUS, Principal Investigator: A. Kurzyńska-Kokorniak)

Obtaining two Dicer ribonuclease variants of the model organism Xenopus laevis - preparation for biochemical activity studies and structural analyses. (NSC, MINIATURA 8, Principal Investigator: A. Szczepańska)

Development of a high-throughput system for rapid assessment of biological activity of compounds targeting the SARS-CoV-2 replication complex, selection of compounds with the highest therapeutic potential and assessment of their cytotoxicity to human cells (NCRD, Smart Growth Operational Programme 2014-2020 'Fast Track', project implemented in the consortium, project leader: ideas4biology Sp. z o. o.; task leader from IBCH PAS: A. Kurzyńska-Kokorniak)



HEK293 wild-type cells*

HEK293 cells with a mutation in the *DICER1* gene

SELECTED PUBLICATIONS

Ciechanowska K et al. The human Dicer helicase domain is capable of ATP hydrolysis and single-stranded nucleic acid binding. BMC Biol. 2024; 22(1):287

Koralewska N et al. Short 2'-O-methyl/LNA oligomers as highly-selective inhibitors of miRNA production in vitro and in vivo. Nucleic Acids Res. 2024; 52(10):5804–5824

Szpotkowski K et al. Structural studies of protein-nucleic acid complexes: A brief overview of the selected techniques. Comput Struct Biotechnol J. 2023; 21:2858-2872

Koralewska N et al. RNA and DNA G-quadruplexes bind to human dicer and inhibit its activity. Cell Mol Life Sci. 2021; 78:3709-3724

Pokornowska M et al. The RNA-RNA base pairing potential of human Dicer and Ago2 proteins. Cell Mol Life Sci. 2020; 77:3231-3244

Kurzynska-Kokorniak A et al. The many faces of Dicer: the complexity of the mechanisms regulating Dicer gene expression and enzyme activities. Nucleic Acids Res. 2015; 43:4365-80

DEPARTMENT OF STRUCTURAL BIOINFORMATICS

RNA structure prediction and analysis | structural motifs | algorithms for molecular biology | databases and web applications

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RESEARCH SCOPE

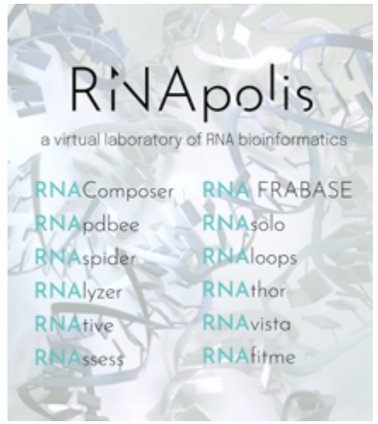
Molecular computational biology and bioinformatics. Ongoing research focuses on issues related to the analysis of biomolecule structures and their interactions, with a strong accent on RNA. This implies the formulation of new bioinformatics challenges, the solution to which is the mainstream of the Department's activities.

Our research aims to model complex problems in structural biology and develop and implement efficient combinatorial algorithms to analyze them. We use the latest methods and computer technologies and conduct *in silico* experiments complementary to the laboratory ones. The Department's flagship and most important achievement is RNApolis, a virtual RNA bioinformatics laboratory bringing together more than 20 computational tools dedicated to RNA molecules.

RESEARCH PROJECTS

Predicting 3D RNA structures using Generative Adversarial Networks (NSC Preludium Bis, PI: M. Szachniuk

Functional motif-targeted RNA structure modeling (NSC, OPUS, PI: M. Szachniuk)



We also study quadruplex structures. As part of the SpaceTetrado project, we have developed a G4 database and tools for analyzing, classifying, and visualizing their structures.

As the RNApolis group, we participate in worldwide blind prediction experiments RNA-Puzzles and CASP, where we predict 3D RNA structures in expert modeling and web server categories.

MAIN RESEARCH TOPICS

- Development of RNApolis, a virtual RNA bioinformatics laboratory
- Development of SpaceTetrado, a collection of computational systems dedicated to quadruplex bioinformatics
- Modeling of 2D and 3D RNA structures
- Comparative analysis of structural data
- Annotation and classification of structure motifs present in RNA, i.e., pseudoknots and quadruplexes

SELECTED PUBLICATIONS

Zok T et al. ONQUADRO: a database of experimentally determined quadruplex structures, NAR 2022; 50:D253-D258

Luwanski K et al. RNAspider: a webserver to analyze entanglements in RNA 3D structures, NAR 2022; 50:W663-W669

Gren BA et al. Knotted artifacts in predicted 3D RNA structures, PLoS Comp Biol 2024; 20:e1011959

Schneider et al. When will RNA get its AlphaFold moment? NAR 2023; 51:9522-9532

Mackowiak M et al. RNAtango: analysing and comparing RNA 3D structures via torsional angles, PLoS Comp Biol 2024; 20:e1012500

Bu F et al. RNA-Puzzles Round V: blind predictions of 23 RNA structures, Nature Methods 2025; 22:399-411

DEPARTMENT OF NUCLEIC ACIDS BIOENGINEERING

modified oligonucleotides | thermodynamics of non-canonical DNAs and RNAs | G-quadruplexes | aptamers | alternative splicing | anticancer therapy

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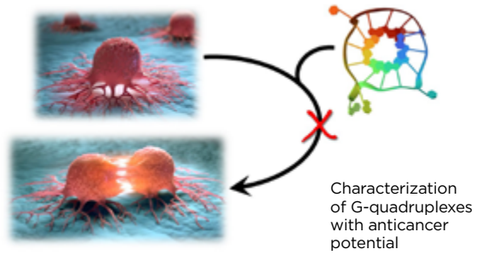
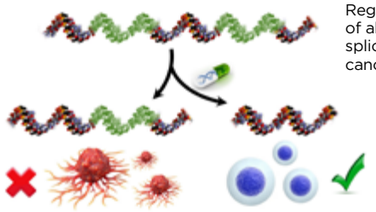


Characterization of G-quadruplexes with anticancer potential



Regulation of alternative splicing in cancer cells

RESEARCH SCOPE

Development, preparation, and characteristics of new molecular tools based on nucleic acids and their analogues.

The variety of chemical modifications provides practically unlimited possibilities for controlled modulation of oligonucleotide physicochemical and biological properties, which can be applied as useful and highly specific diagnostic and therapeutic tools.

Our main activity focuses on G-quadruplexes and aptamers with anticancer and anticoagulant potential. In addition, we are developing research on the regulation of alternative splicing in cancer cells and investigating the effect of chemically modified gapmers in terms of their ability to induce targeted mRNA degradation. We are also developing novel molecular tools that are capable of unfolding G-quadruplexes within biologically relevant therapeutic targets.

MAIN RESEARCH TOPICS

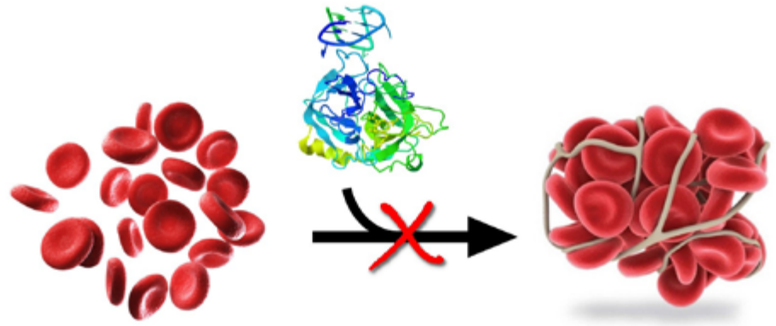
- Physicochemical and biological characteristics of molecular tools based on nucleic acids and their analogues
- Development of sequence-selective oligonucleotides targeted towards interactions with G-quadruplexes
- Regulation of alternative splicing in cancer cell lines
- Development of potent aptamers with improved anticoagulant properties
- *in vitro* studies of chemically modified G-quadruplexes and their antiproliferative properties

RESEARCH PROJECTS

Thrombin binding aptamer with expanded chemical diversity as potential anticoagulant and anticancer agent (NSC, OPUS, PI: W. Kotkowiak)

Thermodynamic identification and characterization of G-quadruplex structures in RON protooncogene pre-mRNA (NSC, MINIATURA, PI: N. Bartyś)

Foldback triplex-forming oligonucleotides as novel tools for G-quadruplex unfolding and selective inhibition of c-Myc oncogene transcription (NSC, OPUS, PI: A. Pasternak)



Research on G-quadruplexes and aptamers with anticoagulant activity

SELECTED PUBLICATIONS

Kotkowiak W et al. Thermodynamic, anticoagulant and antiproliferative properties of thrombin binding aptamer containing novel UNA derivative. Mol. Ther. Nucl. Acids 2018; 2;10:304-316

Kotkowiak W et al. Improved RE31 analogues containing modified nucleic acid monomers: thermodynamic, structural and biological effects. J. Med. Chem. 2018; 62(5), 2499-2507

Roxo C et al. G-Quadruplex-Forming Aptamers—Characteristics, Applications, and Perspectives. Molecules 2019; 24(20):3781

Roxo C et al. G4 Matters—The Influence of G-Quadruplex Structural Elements on the Antiproliferative Properties of G-Rich Oligonucleotides. Int. J. Mol. Sci. 2021; 22: 4941

Bartyś N et al. Optimization of Bifunctional Antisense Oligonucleotides for Regulation of Mutually Exclusive Alternative Splicing of PKM Gene. Molecules 2022; 27, 5682

Kotkowiak W et al. Physicochemical and antiproliferative characteristics of RNA and DNA sequence-related G-quadruplexes. ACS Med. Chem. Lett. 2022; 14(1):35–40

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF NEURONAL CELL BIOLOGY

spinocerebellar ataxia | neurodegeneration | Purkinje cells | selective neuronal vulnerability | epigenetics

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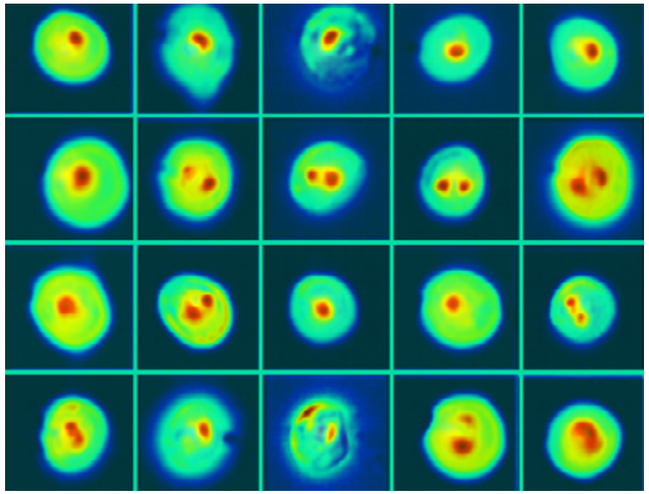


Mapping of differentiating features of SCA7 Purkinje cells

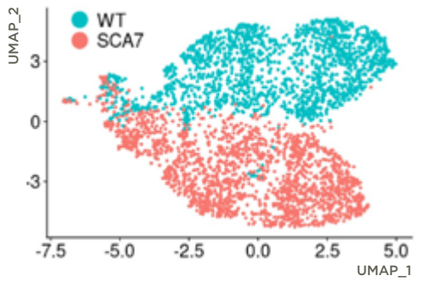
RESEARCH SCOPE

The molecular mechanisms and cellular processes explaining the selective vulnerability of neurons in neurodegenerative diseases and the effective therapies to protect these vulnerable cells.

Our primary research focuses on Purkinje cells, which experience degeneration in spinocerebellar ataxias. By integrating experimental approaches involving animal models with bioinformatics methodologies, we aim to gain a comprehensive understanding of the fundamental aspects of neurodegenerative processes. Specifically, our attention is directed towards unraveling the impact of epigenetic alterations on the selective degeneration of Purkinje cells in the context of spinocerebellar ataxia type 7.

MAIN RESEARCH TOPICS

- Developing and optimizing the protocol for selective isolation of Purkinje cell nuclei
- Analyzing epigenetic changes, including histone modifications, in Purkinje cells derived from mouse models of spinocerebellar ataxia using both bulk and single-cell methods
- Studying chromatin accessibility in ataxia-affected Purkinje cells
- Integrating bioinformatic analysis of transcriptional and epigenetic data to identify molecular differences between healthy and diseased cells
- Creating tools that utilize artificial intelligence for the identification of molecular phenotypes in degenerating Purkinje cells

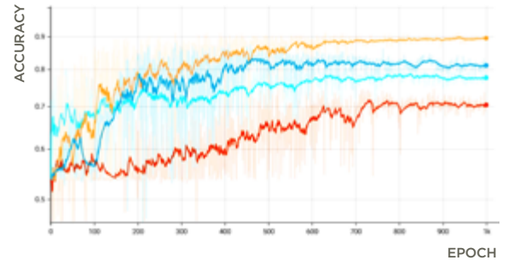


Mouse Purkinje cells

RESEARCH PROJECTS

Elucidating neurodegenerative processes using direct profiling of selectively vulnerable neurons (NSC Sonata, PI: P.M. Switonski)

Multiomic characterization of neurogenerative processes in Zebrin-II positive and Zebrin-II negative Purkinje cells (NSC Preludium, PI: G. Adamek)



AI Classification of Purkinje Cell Nuclei

SELECTED PUBLICATIONS

Bartelt L et al. Dysregulation of zebrin-II cell subtypes in the cerebellum is a shared feature across polyglutamine ataxia mouse models and patients Sci Transl Med. 2024 Nov 6;16(772):eadn5449

Bartelt L. et al. Antibody-assisted selective isolation of Purkinje cell nuclei from mouse cerebellar tissue Cell Rep Methods. 2024 Jul 15;4(7):100816

Switonski PM & La Spada AR, Spinocerebellar Ataxia Type 7: From Mechanistic Pathways to Therapeutic Opportunities, Trials for Cerebellar Ataxias, 2023, ISBN: 9783031243448, publisher Springer Cham, Pages 433-467

Switonski PM et al. Altered H3 histone acetylation impairs high-fidelity DNA repair to promote cerebellar degeneration in spinocerebellar ataxia type 7, Cell Reports, 2021, 37(9):110062

Stoyas CA et al. Nicotinamide Pathway-Dependent Sirt1 Activation Restores Calcium Homeostasis to Achieve Neuroprotection in Spinocerebellar Ataxia Type 7, Neuron, 2020, 105(4):630-644.e9

Switonski PM et al. A new humanized ataxin-3 knock-in mouse model combines the genetic features, pathogenesis of neurons and glia and late disease onset of SCA3/MJD, Neurobiology of Disease, 2015, 73:174-188

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF MEDICAL BIOLOGY

epigenetics | m5C | human brain tumors | modified nucleosides | 8-oxo-dG | temozolomide

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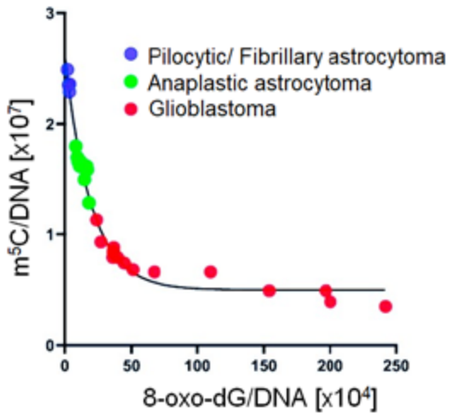
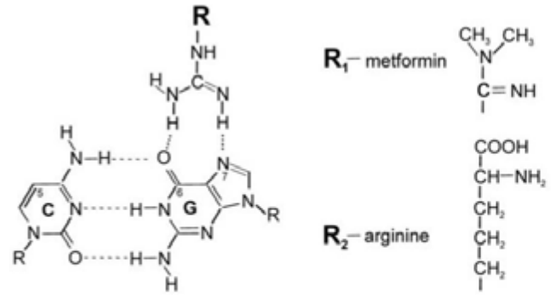


RESEARCH SCOPE

The search for new molecular markers of neoplastic diseases and the development of new therapeutic strategies for high-grade brain gliomas.

Our scope is to understand the role of epigenetic modifications, mostly DNA methylation, on various cellular processes, such as cell differentiation and cell death. DNA methylation is a mammalian epigenetic marker that determines where and when genes are expressed in both normal and cancer cells. It is known that DNA methylation, which represses genes, can be controlled with low molecular weight chemical compounds. The aim of our study is to analyze the impact of small molecules on the activation of genes silenced by DNA methylation.



Interaction of metformin and arginine with Hoogsteen edge of guanosine in DNA. Hydrogen bonds involve O6 and N7 of guanosine.

Our efforts are focused on the search for new compounds or the selection of known drugs that can effectively change DNA methylation in brain tumor cells. The extension of the application of drugs (drug repurposing) to treat other diseases is now increasingly used in medicine.

RESEARCH PROJECTS

Application of small compounds in the epigenetic therapy of malignant brain gliomas (NSC, OPUS, PI: M. Z. Naskręt-Barciszewska)

SELECTED PUBLICATIONS

Barciszewska AM et al. Juglone in Combination with Temozolomide Shows a Promising Epigenetic Therapeutic Effect on the Glioblastoma Cell Line. IJMS, 2023, 24, 6998.

Barciszewska AM et al. Cross-reactivity between histone demethylase inhibitor valproic acid and DNA methylation in glioblastoma cell lines. Front Oncol. 2022, 12,

Barciszewska AM et al. Total DNA methylation changes reflect random oxidative DNA damage in gliomas. Cells 2019,8,1065.

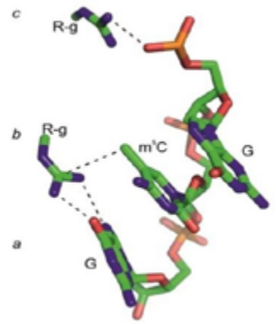
Barciszewska AM et al. A New Epigenetic Mechanism of Temozolomide Action in Glioma Cells. PLoS One 10(8), e0136669 (2015).

Barciszewska AM et al. The Degree of Global DNA Hypomethylation in Peripheral Blood Correlates with that in Matched Tumor Tissues in Several Neoplasia. PLoS One 9(3), e92599 (2014)

Barciszewska AM et al. Mechanistic Insights on Metformin and Arginine Implementation as Repurposed Drugs in Glioblastoma Treatment. IJMS 2024; 25(17): 9460

MAIN RESEARCH TOPICS

- Analysis of 8-oxo-dG and m5C content in DNA isolated from brain tumors.
- Evaluation of the cytotoxicity of selected compounds (valproic acid, temozolomide, juglone, dexamethasone, metformin, cannabidiol, tetrahydrocannabinol) and their effect on cell proliferation
- The use of selected low-molecular-weight compounds in the therapy of brain tumors.
- Induction of stem cells (SCM), determination of pluripotency markers, treatment of cell lines with selected compounds in a selected concentration range, and temozolomide with selected compounds.
- Evaluation of 5-methylcytosine content in DNA isolated from deciduous tree seeds.



Mechanism of recognition of guanidine group of metformin and arginine (R-g) within m5CpG of the DNA.

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF MOLECULAR AND SYSTEMS BIOLOGY

archaeogenomics | genomics | NGS | cell differentiation | RNA transport | regeneration

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RESEARCH SCOPE

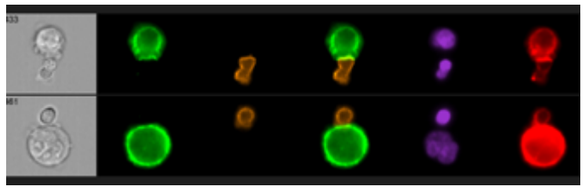
Genomics, particularly population genomics and archaeogenomics; application of genomics in biomedical studies; the role of RNA in cell differentiation and aging.

In recent years, our research interests have focused on issues related to the genetic variability and genetic diversity of populations inhabiting the territory of Central-Eastern Europe in the first millennium AD and in contemporary times. Studies on contemporary populations are also aimed at understanding the genetic determinants of human diseases. Our second leading research area covers a broad spectrum of issues related to the biogenesis, editing, transport, and function of RNA in processes shaping the developmental trajectories of various cell types.

The knowledge and experience are utilized to build new systemic approaches that enable precise descriptions of specific physiological and pathological states at the singlecell level. Ultimately, the acquired information is used to create models illustrating higher levels of life organization.

MAIN RESEARCH TOPICS

- Archaeogenomics: the biological history of populations living in Central–Eastern Europe
- Genetic variability of the contemporary population living in Poland
- Multiomics in the study of human disease
- RNA/DNA editing in the regulation of biological processes
- Understanding and designing cell differentiation trajectories
- Spatial transcriptomics
- In vitro and in silico disease model designing



SELECTED PUBLICATIONS

Budzko L., et al., AID/APOBEC: an expanding repertoire of targets and functions; accepted for publication in Trends in Biochemical Sciences;. 2025, in press

Majewska AM, et al. Secreted novel AID/APOBEC-like deaminase 1 (SNAD1) – a new important player in fish immunology. Frontiers in Immunology, 2024,; 15, 10.3389/fimmu.2024.1340273

Stolarek I et al. Genetic history of East-Central Europe in the first millennium CE. Genome Biology 2023; 24, :173

Ciecierski L et al. Human AGEs: an interactive spatio-temporal visualization and database of human archeogenomics. Nucleic Acids Research 2023; 51, 5,: W269--W273

Ehrlich H, et al. Arrested in Glass: Actin within Sophisticated Architectures of Biosilica in Sponges. Advanced Science 2022,; 9, 11, :2105059

Zmienko A et al. AthCNV: A Map of DNA Copy Number Variations in the Arabidopsis Genome. Plant Cell 2020; 32(6),: 1797--1819

Rajewsky N, et al. LifeTime and improving European healthcare through cell-based interceptive medicine. Nature 2020; 587(7834), :377-386

RESEARCH PROJECTS

Development of a universal fast-response platform, based on RNA technology, ensuring national drug and epidemiological safety (Medical Research Agency, project implemented in the consortium, project leader: Polfa S.A. Pharmaceutical Works, PI: M. Figlerowicz)

A computational platform for optimizing cell development paths to obtain homogeneous populations (National Centre for Research and Development, LIDER, PI: I. Stolarek)

INTERCEPT - Targeted Single Cell Analysis Technology for Cancer Diagnostics – An Introduction to the Development of Interceptive Cellular Medicine (WIB, Łukasiewicz Research Network, PORT, PI: M. Figlerowicz)

ECBiG – European Centre for Bioinformatics and Genomics – MOSAIC 3D (OPI, European Funds for Modern Economy Programme 2021-2027 (FENG, PI: M. Figlerowicz)

An algorithm for personalizing ovarian cancer treatment based on a spatial transcriptomic model of tumor tissue with single-cell resolution (Foundation for Polish Science, FIRST TEAM, PI: M. Zaborowski)

At the beginning of Central European statehoods on the example of the Czech Republic and Poland. Dynasties – elites – societies (late 9th – 11th century) (NCN, OPUS LAP, project implemented in a consortium, PI: M. Figlerowicz)

DEPARTMENT OF COMPUTATIONAL BIOLOGY OF NON-CODING RNA

lncRNA | big data | genomics | transcriptomics | RNA-seq

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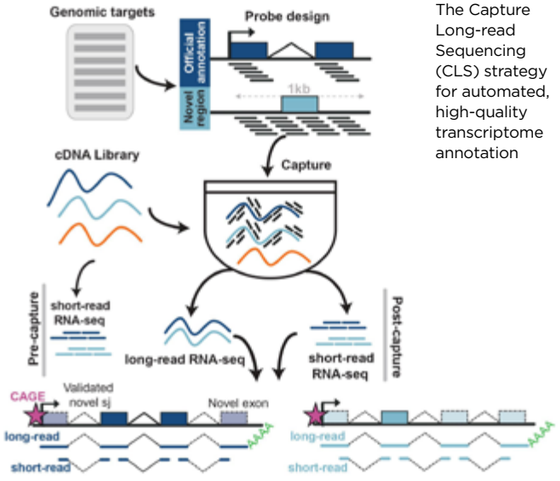
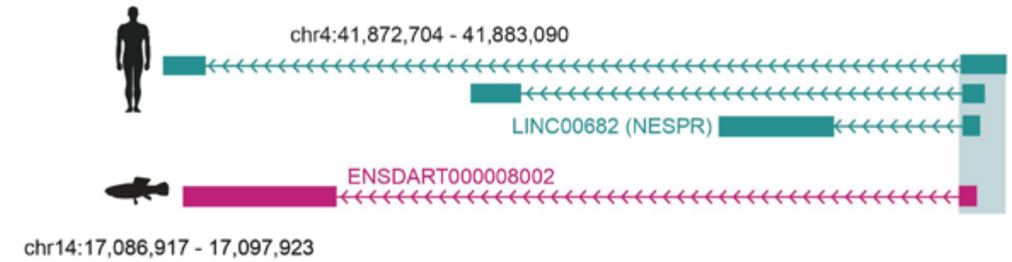


The Capture Long-read Sequencing (CLS) strategy for automated, high-quality transcriptome annotation

RESEARCH SCOPE

The biological importance of long non-coding RNAs (lncRNAs) within the cell.

Employing a comprehensive approach that integrates computational and experimental methodologies, we aim to enhance our understanding of the biological roles of long noncoding RNAs within the cell. The findings from these investigations serve as a basis for further discoveries, including the potential to uncover regulatory mechanisms and the functional significance of lncRNAs, thereby contributing to the broader field of RNA biology and its implications for health and disease.

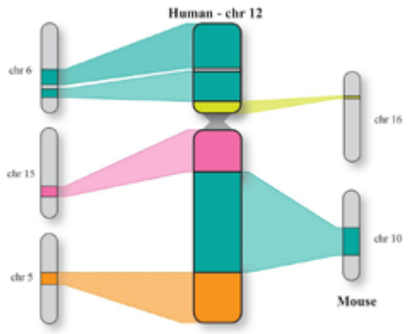


Example of a new alternative transcript version of the lncRNA nespr in zebrafish

MAIN RESEARCH TOPICS

The team's research projects are centered on four key areas:

- Identification of lncRNAs in vertebrate genomes
- Analysis of the evolutionary conservation of lncRNAs
- Functional characterization of lncRNAs *in vivo*
- Development of bioinformatics tools for genome-wide lncRNA analysis



Synteny between human and mouse chromosomes. Colors in the human chromosome indicate regions homologous with parts of the mouse chromosome of the same color.

RESEARCH PROJECTS

Shedding new light on genome's dark matter: identification of novel long non-coding RNAs in zebrafish (NSC OPUS, PI: B. Uszczyńska-Ratajczak)

Functional or not functional? Studying positionally conserved vertebrate lncRNA orthologues at subcellular resolution (NSC SONATA BIS, PI: B. Uszczyńska-Ratajczak)

Game of Tails: Understanding the role of 3'-end processing of long noncoding RNAs during zebrafish development (NSC PRELUDIUM, PI: M. Kwiatkowska)

Jump in with a splash: Exploring the principles of long noncoding RNA import into mitochondria and its biological relevance (NSC OPUS)

SELECTED PUBLICATIONS

Lagarde J et al. High-throughput annotation of full-length long noncoding RNAs with capture long-read sequencing, Nature Genetics, 2017, 49(12), 1731-1740

Uszczynska-Ratajczak B et al. Towards a complete map of the human long non-coding RNA transcriptome, Nature Reviews Genetics, 2018, 19(9), 535-548

Lagarde J et al. Extension of human lncRNA transcripts by RACE coupled with long read high-throughput sequencing (RACE-Seq) Nature Communications, 2016, 17(7), 12339

The ENCODE Project Consortium, Expanded Encyclopedias of DNA Elements in the Human and Mouse Genomes, Nature, 2020, 699-710

The ENCODE Project Consortium, Perspectives on ENCODE, Nature, 2020, 583(7818), 693-698

Carbonell-Sala S et al. CapTrap-seq: a platform-agnostic and quantitative approach for high-fidelity full-length RNA sequencing. Nat Commun 2024; 15, 5278,

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF STRUCTURAL BIOLOGY OF EUKARYOTES

biocrystallography | Cryo-EM | drug design | herbicide design | transcription factors | metabolic pathways

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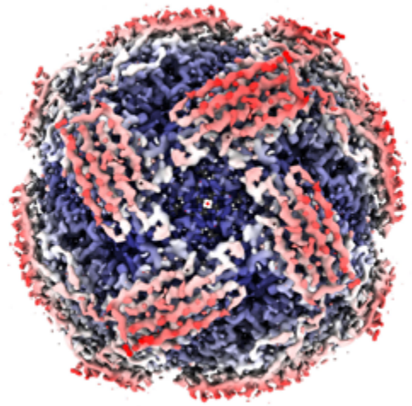


Cryo-EM map of plant HISN5 protein - a molecular target for herbicide design

RESEARCH SCOPE

Structural biology, interactions of proteins with small molecules, other proteins, DNA, and RNA.

Apart from deepening our knowledge, the results of our research enable us to rationally design bioactive compounds, such as drugs or herbicides. We have a particular interest in protein targets for anticancer therapies and plant proteins relevant to modern agriculture. Utilizing macromolecular crystallography and cryoelectron microscopy (Cryo-EM), along with biophysical, biochemical, and bioinformatic methods, we gain new insights into the fascinating world of biomolecules.

MAIN RESEARCH TOPICS

- Resolving the structures of proteins and nucleic acids.
- Structure-based design of anticancer drugs targeting mitochondrial metabolism.
- Molecular basis of interactions between proteins and small- and macro-molecular partners, with particular emphasis on research of transcription factors.
- Structure-based design of herbicides that block metabolic pathways.

SELECTED PUBLICATIONS

Tran LH & Ruszkowski M. ARR1 and AHP interactions in the multi-step phosphorelay system. Frontiers in Plant Science 2025; 16:1537021

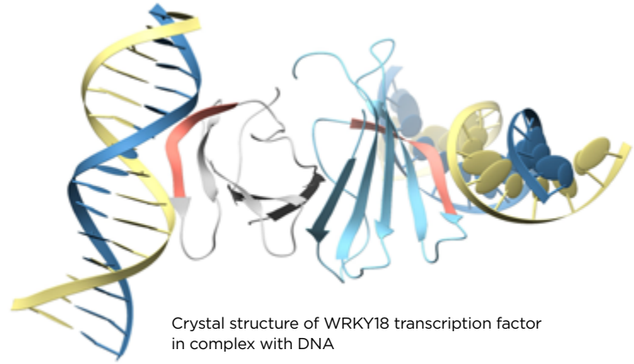
Pokrywka K et al. Controlling enzyme activity by mutagenesis and metal exchange to obtain crystal structures of stable substrate complexes of Class 3 L -asparaginase. FEBS Journal 2025, 17338

Witek W et al. Structural, kinetic, and evolutionary peculiarities of HISN3, a plant 5'-ProFAR isomerase. Plant Physiology and Biochemistry 2024; 215:109065

Grzechowiak M et al. Legume-type glutamate dehydrogenase: Structure, activity, and inhibition studies. International Journal of Biological Macromolecules 2024; 278:134648

Ruszkowski M et al. Cryo-EM reconstructions of BMV-derived virus-like particles reveal assembly defects in the icosahedral lattice structure. Nanoscale 2022; 14:3224

Loch JI et al. Crystal structures of the elusive Rhizobium etli L-asparaginase reveal a peculiar active site. Nature Communications 2021; 12:6717



Crystal structure of WRKY18 transcription factor in complex with DNA

RESEARCH PROJECTS

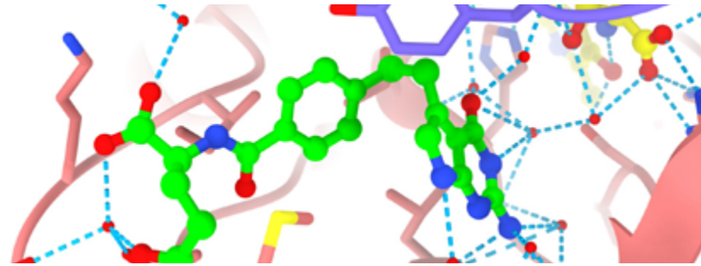
Search for Inhibitors of Human δ1-Pyrroline-5-Carboxylate Reductase 1 (PYCR1) as Lead Molecules for the Development of Novel Anticancer Drugs (NSC OPUS, PI: M. Ruszkowski)

Novel L-asparaginases as potential therapeutic agents and antimicrobial targets: structural and functional studies of enzymes with dual implications for drug design (NSC OPUS, PI: M. Jaskolski)

The puzzling structure of Grainyhead-like human transcription factors involved in tumor growth regulation (NSC SONATINA, PI: M. Rutkiewicz)

Design and Development of Serine Hydroxymethyltransferase-2 (SHMT2) Inhibitors Blocking Tumor Growth (NSC SONATA BIS, PI: M. Ruszkowski)

Molecular basis of the function of WRKY transcription factors as pivotal regulators of plant responses to stress (NSC OPUS, PI: M. Grzechowiak)



Binding of the pemetrexed chemotherapeutic to the mitochondrial isoform of serine hydroxymethyltransferase

DEPARTMENT OF STRUCTURAL BIOLOGY OF PROKARYOTIC ORGANISMS

crystallography | cryo-EM | structural enzymology | antibiotic resistance | cellular methylation

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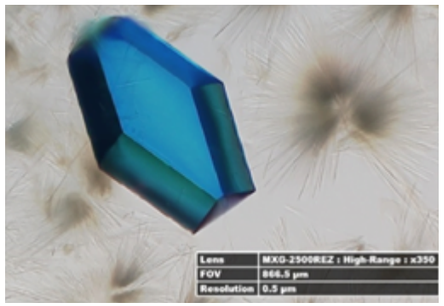
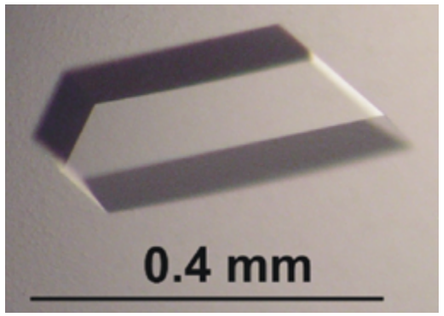
RESEARCH SCOPE

Development of inhibitors of enzymes involved in the regulation of methylation processes in pathogenic microorganisms.

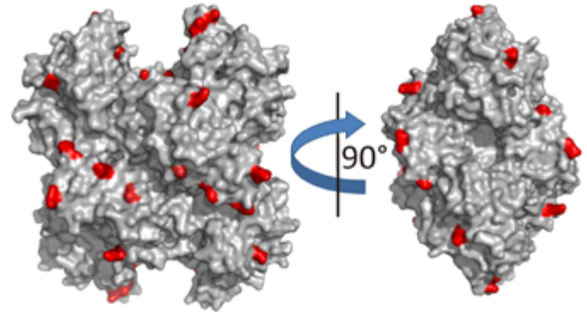
To achieve our goals, we apply structural chemistry and biology methods, including macromolecular crystallography, cryo-EM, and NMR spectroscopy, as well as numerous microbiology, biochemical, and biophysical techniques.



Single crystals of S-adenosyl-L-homocysteine hydrolases from *Thermotoga maritima*



Single crystals of S-adenosyl-L-homocysteine hydrolases from *Pseudomonas aeruginosa*



Surface representation of S-adenosyl-L-homocysteine hydrolase with rare single amino acid substitutions (shown in red) present among *Pseudomonas aeruginosa* strains

Our goal is to create highly potent and selective inhibitors that interfere with fundamental biochemical processes that occur in all living cells to provide a novel class of antibacterial compounds. In particular, we target a regulatory mechanism of S-adenosyl-L-methionine (SAM)-dependent methylation reactions, where SAM is the most common methyl group donor in cellular methylation of a wide range of substrates, including small-molecule compounds as well as all biological macromolecules. Apart from this biological project, we are also interested in the structural analysis of small-molecule compounds and non-crystalline materials.

RESEARCH PROJECTS

Inhibition of S-adenosyl-L-homocysteine hydrolase from *Pseudomonas aeruginosa* by targeting the enzyme dynamics (NSC, SONATA BIS, PI: K. Brzeziński)

Rational, structure-guided design of histone demethylase inhibitors for cancer therapy (NSC, SONATA, PI: P.H. Małecki)

MAIN RESEARCH TOPICS

- Structural enzymology of enzymes of pathogenic origin involved in cellular methylation, including S-adenosyl-L-homocysteine hydrolases and methylenetetrahydrofolate reductases
- Development of species-specific inhibitors of S-adenosyl-L-homocysteine hydrolase targeting the enzyme dynamics
- Application of high-throughput macromolecular crystallography in drug design
- Crystallographic studies of biologically active small molecules
- X-ray diffraction studies of non-crystalline (bio) materials

SELECTED PUBLICATIONS

Malecki PH et al. Biochemical and Structural Insights into an Unusual, Alkali Metal-independent S-adenosyl-L-homocysteine Hydrolase from Synechocystis sp. PCC 6803. Acta Cryst. 2022; D78:865

Wozniak K & Brzezinski K. Biological Catalysis and Information Storage Have Relied on N-Glycosyl Derivatives of β-D-Ribofuranose since the Origins of Life. Biomolecules. 2023; 13, 782

Brzezinski K. S-adenosyl-L-homocysteine hydrolase: a structural perspective on the enzyme with two Rossmann-fold domains. Biomolecules. 2020; 10:1682

Gawel M et al. A closer look at molecular mechanisms underlying inhibition of S-adenosyl-L-homocysteine hydrolase by transition metal cations. Chemical Communications 2024; 60:11504-11507

Wojtulewski S et al. A new look at two polymorphic crystal structures of dibenzoylmethane: Relationship between the Crystal Packing and the Hydrogen Atom Position revealed by Quantum Chemistry and Quantum Crystallography Methods. Acta Cryst. 2020; B76, 95:966

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF BIOMOLECULAR NMR

NMR spectroscopy | nucleic acid structure | G-quadruplexes | duplex-quadruplex hybrids | DNAzymes | aptamers

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RESEARCH SCOPE

Structure, function, and dynamics of biomolecules, especially nucleic acids.
In our work, we mainly employ biomolecular NMR methods, complemented by a set of other biophysical and biochemical methods such as UV and CD spectroscopies or electrophoretic methods.

The performed investigations result in the elucidation of atomic-resolution structures of functionally important RNA and DNA molecules that are invaluable for understanding the structure-function relationship for these systems. The main research topics currently tackled in our group include the search for rules governing G-quadruplex folding, the analysis of duplex-quadruplex hybrid structures as potential therapeutic tools, and the elucidation of the molecular modes of action for functional DNA molecules such as DNAzymes and aptamers.

RESEARCH PROJECTS

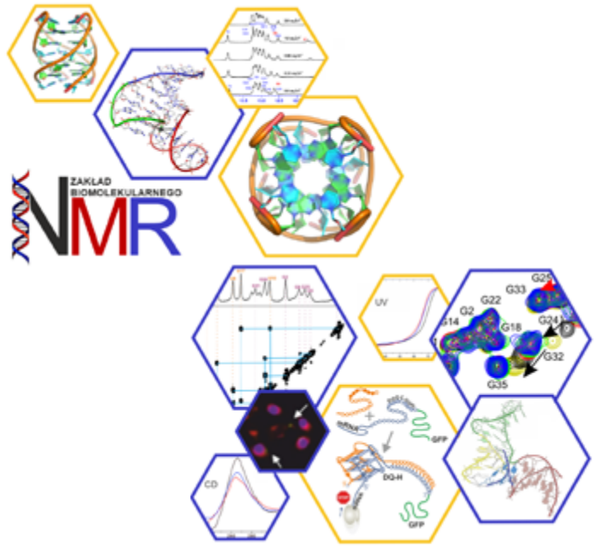
Exploring the sequence-structure relationship as a starting point for the design of DNA G-quadruplexes with a given topology – an integrative approach combining molecular simulations with experimental methods; (NSC OPUS, consortium with Gdańsk University of Technology,PI: J. Czub, Co-Investigator from IBCh PAS: Z Gdaniec)

NMR structural studies of 8-17 and I-R2 DNAzymes; (NSC SONATA, PI: W. Andrałojć)

Lanthanide binding oligonucleotides (LBOs) as paramagnetic tags for NMR spectroscopy of nucleic acids; (NSC OPUS PI: W. Andrałojć)

Synthesis and structural/biophysical studies of model mRNA/mt-tRNA oligomers to evaluate the role of modified nucleosides (m5C, hm5C, f5C, ca5C, m1G) in translation and human diseases; (NSC OPUS, consortium Lodz University of Technology, PI: G. Leszczyńska Co-Investigator from IBCH PAS: W. Andrałojć)

Anti-cancer strategy based on the induced G-quadruplex formation. Structural and biological properties of ligand-RNA/mRNA complexes; (NSC SONATA PI: D. Gudanis)



MAIN RESEARCH TOPICS

- Elucidation of the rules governing G-quadruplex folding
- Structural and functional analysis of RNA duplex-quadruplex hybrids
- Structural studies of functional DNA molecules – DNAzymes and aptamers
- Development of paramagnetic NMR methods
- Design and synthesis of small molecule ligands selective for DNA/RNA G-quadruplexes

SELECTED PUBLICATIONS

Andrałojć W et al. Solution Structure of a Lanthanide-binding DNA Aptamer Determined Using High Quality pseudocontact shift restraints. Chem. Eur. J., 2022, e202202114

Gudanis D et al. Impact of a Single Nucleotide Change or Non-Nucleoside Modifications in G-Rich Region on the Quadruplex-Duplex Hybrid Formation. Biomolecules, 2021, 11, 1236

Andralojc W et al. The origin of the high stability of 3'-terminal uridine tetrads: contributions of hydrogen bonding, stacking interactions, and steric factors evaluated using modified oligonucleotide analogs. RNA 2020, 26, 2000-2016

Wieruszewska J. et al. The 8-17 DNAzyme can operate in a single active structure regardless of metal ion cofactor, Nat. Commun. 2024; 15:4218

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF MEDICAL BIOTECHNOLOGY

RNA biology | CAG repeats | polyQ diseases | RAN translation | iPSC | microRNA

HEAD

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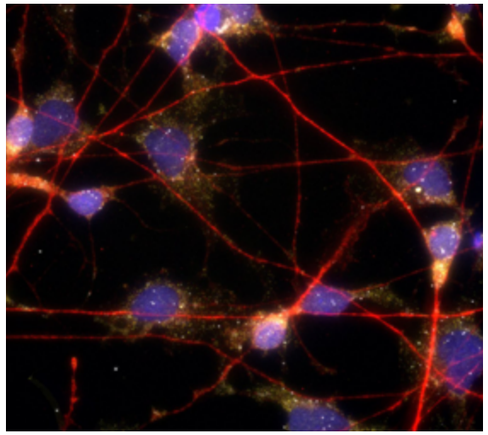


MAP2 DAPI *GAPDH* mRNA *HTT* mRNA

mRNA detection in human HD neurons

RESEARCH SCOPE

The diversity of RNA functions and dysfunctions in the context of repeated tracts and neurodegenerative diseases.

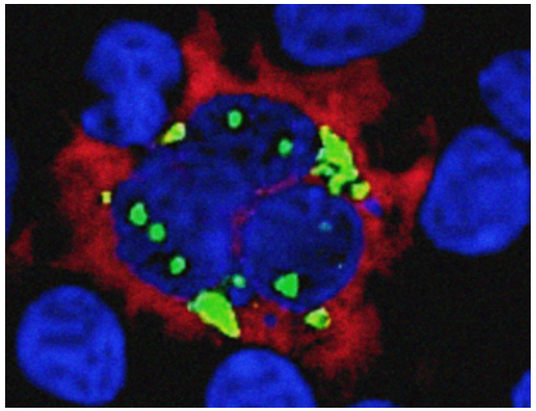
Our research focuses on trinucleotide repeat sequences (mainly CAG) and their expansion related to polyglutamine (polyQ) diseases that include Huntington's disease (HD) and spinocerebellar ataxias (SCAs). We aim to precisely describe new molecular pathogenic pathways for polyQ diseases, with particular emphasis on RNA-dependent pathways and changes in the level of various types of RNA. We investigate the functioning of mutant mRNA containing CAG repeat expansion, as it is a very promising target for oligonucleotide-based tools in therapeutic approaches. We are also interested in determining the function of repeat tracts in wild-type RNAs, including non-coding RNAs.

Human neuronal HD cells

TUJ1 PAX6 DAPI

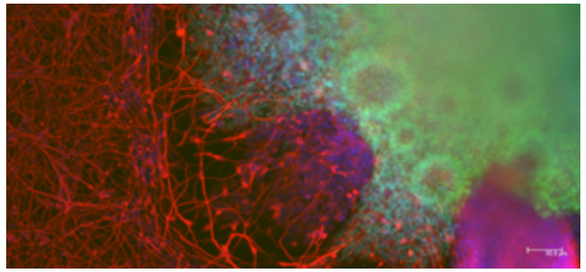
MAIN RESEARCH TOPICS

- RNA and protein toxicity markers in polyQ diseases
- Establishment and characteristics of new models for neurodegenerative diseases
- Role of non-coding RNAs in the pathogenesis of polyQ diseases
- Investigation of RAN translation and alternative polyadenylation events for transcripts with repeat expansions
- Design and testing of oligonucleotide-based therapeutic strategies for neurodegenerative diseases



poliQ poliA DAPI

RAN proteins in the SCA3 model



RESEARCH PROJECTS

Function and dysfunction of repeated tracts in non-coding and protein-coding transcripts (NSC, OPUS, PI: A. Fiszer)

MyRIAD: (Micro)RNA and informatics approaches for diagnosis, prognosis and treatment of Alzheimer's disease and Dementia (JPND, PI: A. Fiszer, Consortium leader: K. Goljanek-Whysall, University of Galway, Ireland)

Development of a universal fast-response platform, based on RNA technology, ensuring the national drug and epidemiological safety (Medical Research Agency, project implemented in the consortium, project leader: Polfa S.A. Pharmaceutical Works, PI: M. Figlerowicz, task leader: A. Fiszer)

SELECTED PUBLICATIONS

Wozna-Wysocka M et al. Insights into RNA-mediated pathology in new mouse models of Huntington's disease. FASEB Journal 2024; 38:e70182

Joachimiak P et al. Allele-specific quantitation of ATXN3 and HTT transcripts in polyQ disease models. BMC Biology 2023; 21:17

Nowak B et al. Atrophin-1 function and dysfunction in dentatorubral-pallidoluysian atrophy. Movement Disorders 2023; 38:526-536

Ciesiolka A et al. Artificial miRNAs targeting CAG repeat expansion in ORFs cause rapid deadenylation and translation inhibition of mutant transcripts. Cellular and Molecular Life Sciences 2021; 78:1577-1596

Jazurek-Ciesiolka M. et al. RAN translation of the expanded CAG repeats in the SCA3 disease context. Journal of Molecular Biology 2020; 432:166699

Ciolak A et al. Generation of human iPS cell line IBCHi002-A from spinocerebellar ataxia type 3/Machado-Joseph disease patient's fibroblasts. Stem Cell Research 2020; 45:101796

DEPARTMENT OF BIOPOLYMER CHEMISTRY

nucleic acids chemical synthesis | thermolabile fluorescent dyes | thermally releasable polymers | biopolymers | triphosphates | functional chitin

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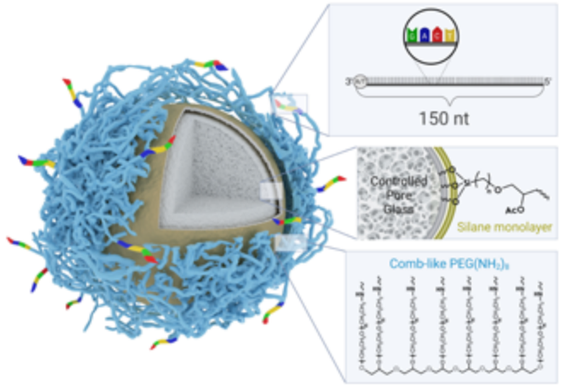
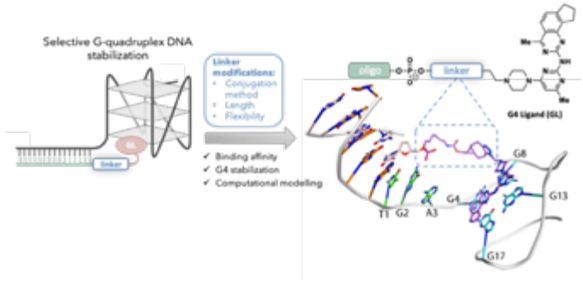


RESEARCH SCOPE

Chemical synthesis of biopolymers with a particular emphasis on nucleic acids, peptides, carbohydrates, and their modifications.
We create and study new, functional polymer materials with potential applications, such as drug carriers or supports in solid-phase chemical synthesis. All molecules that we obtain are thoroughly characterized using structural and mass analysis methods.

We have extensive experience in the chemical synthesis of modified nucleic acids (RNA and DNA) both in the solid and liquid phases. We undertake research aimed at the synthesis of chemical molecules based on thermo-responsive technology and biological polymers. Among the thermosensitive tools developed by us are molecular thermometers, polymers, and fluorescent



tags. An example of functional biopolymers with practical applications can be polyaminosaccharides, such as chitin, where chemical modification transforms them into biocompatible materials.

RESEARCH PROJECTS

Development of universal fast-response platform based on RNA technology, ensuring the national drug and epidemiological safety (Medical Research Agency, project implemented in the consortium, project leader: Polfa S.A. Pharmaceutical Works, PI: M. Figlerowicz, task leader: M.K. Chmielewski)

INTERCEPT - Targeted Single Cell Analysis Technology for Cancer Diagnostics – An Introduction to the Development of Interceptive Cellular Medicine (WIB, Łukasiewicz Research Network, PORT, PI: M. Figlerowicz, task leader: M.K. Chmielewski)

MAIN RESEARCH TOPICS

- Chemical synthesis of biopolymers and their modification, such as nucleic acids, peptides, carbohydrates, and lipids
- Application of thermosensitivity in chemical synthesis
- Thermolability for designing protecting groups, fluorescent dyes, catalysts with thermoactivity, and thermoresponsive polymers
- Qualitative and quantitative instrumental analysis using PVA-type capillary electrophoresis, high-performance HPLC column chromatography with UV-Vis, fluorescent, and Corona detectors, MALDI analysis
- Synthesis of new functional biomaterials, such as chitin modifications

SELECTED PUBLICATIONS

Paluch M et al. "Pyridin-2-yl-substituted smart polymers sensitive to thermally triggered side group cyclization" European Polymer Journal, 2023 186, 15 March, 111865 DOI:10.1016/j.eurpolymj.2023.111865

Brzezinska J et al. From CPG to hybrid support: Review on the approaches in nucleic acids synthesis in various media, Bioorganic Chemistry, 2023, 140, 106806 doi: 10.1016/j.bioorg.2023.106806

Krygier D et al.. "Microwave-Dependent Thermo-Release Approach for Oligonucleotides 5'-Phosphorylation" Organic Letters, 2024, 26 (6), 1134-1137 DOI: ol-2023-03924t.R1

Wiesner M et al. „Low bias charge transport in DNA" Sci Rep, 2024,14, 22405. DOI: 10.1038/s41598-024-74133-w

Trzciński S et al. „Hybrid Supports for Oligonucleotide Synthesis: Controlled Pore Glass Derivatives with Branched Amine-Ended Polyether or Polyimine" Chemistry - A European Journal, 2024, 30, e202403086 DOI: 10.1002/chem.202403086

Abrahamsson A et al. "Linker Design Principles for the Precision Targeting of Oncogenic G-Quadruplex DNA with G4-Ligand-Conjugated Oligonucleotides" Bioconjugate Chemistry 2025, 36, 724-736 DOI: 10.1021/acs.bioconjchem.5c00008

DEPARTMENT OF STRUCTURAL CHEMISTRY AND BIOLOGY OF NUCLEIC ACIDS

RNA structure | thermodynamics of nucleic acids | RNA modifications | therapeutic RNA

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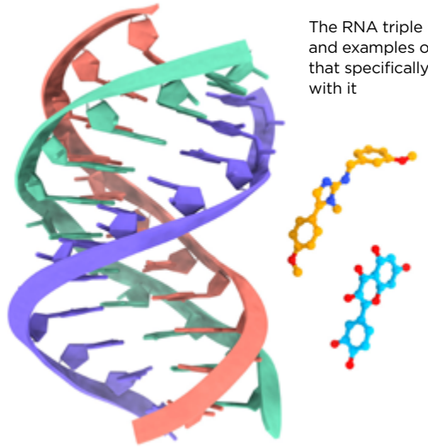

The RNA triple helix and examples of ligands that specifically interact with it

RESEARCH SCOPE

Understanding of the secondary structure of native RNAs and their thermodynamic stability, which determines their folding process. Using RNA oligonucleotides as effective therapeutic tools.

RNA is one of the most important biomolecules necessary for the development of cells, in which it performs a variety of biological, structural, and regulatory functions. RNA is also a molecule involved in a number of human diseases. Modified nucleotides are particularly important for the diverse functions of native RNAs. The most common of them are N6-methyladenosine and pseudouridine. They specifically affect the thermodynamic stability of native RNAs and, thus, their secondary and tertiary structures.

Some of the RNA modifications, especially N1-methylpseudouridine, have become very useful components of RNA vaccines by significantly improving their biological and immunological functions. Such features of modified RNA vaccines make them the subject of intensive research for the development of new antiviral and anticancer vaccines.

MAIN RESEARCH TOPICS

- Structural studies of nucleic acids.
- Chemical synthesis of various oligonucleotides.
- Thermodynamics stability of RNA.
- Therapeutic application of natural and modified oligonucleotides.
- Thermodynamic parameters to predict the folding of RNAs.

RESEARCH PROJECTS

Thermodynamic parameters and rules towards the determination of RNA folding in *in vivo*-like conditions. RNA folding predictions for a better understanding of their structure and function in mammalian cells (NSC, Opus, PI: R. Kierzek)

Thermodynamics of modified RNAs. Impact of RNA modifications on structure and function of natural RNA and vaccine-type *in vitro* transcribed mRNA (IVT mRNA) (NSC, Opus, PI: R. Kierzek)

Effects of small-molecule ligands, selectively targeting the MALAT1 RNA triple helix, on the formation of the MALAT1/METTL16 complex (NSC, Miniatura, PI: A. Ruszkowska)

SELECTED PUBLICATIONS

Piasecka J et al. RNA Secondary Structure Motifs of the Influenza A Virus as Targets for siRNA-Mediated RNA Interference. Molecular Therapy-Nucleic Acids, 19, 627 (2020)

Soszynska-Jozwiak M et al. Universal and strain specific structure features of segment 8 genomic RNA of influenza A virus - application of 4-thiouridine photocrosslinking; Journal of Biological Chemistry, 297, 6, 101245 (2021)

Soszynska-Jozwiak M et al. Secondary Structure of Subgenomic RNA M of SARS-CoV-2; Viruses-Basel, 14, 322 (2022)

Kierzek E et al. Secondary Structure Prediction for RNA Sequences Including N6-methyladenosine; Nature Communications, 13, 1271 (2022)

Czapik T et al. Structural variants and modifications of hammerhead ribozymes targeting influenza A virus conserved structural motifs; Molecular Therapy – Nucleic Acids, 29, 64 (2022)

Magner D et al. A Structural Potential of Rare Trinucleotide Repeat Tracts in RNA; International Journal of Molecular Sciences, 23, 5850 (2022)

DEPARTMENT OF CHEMISTRY OF NUCLEIC ACID COMPONENTS

nucleosides | nucleotides | pronucleotides | medicinal chemistry | phosphorus chemistry

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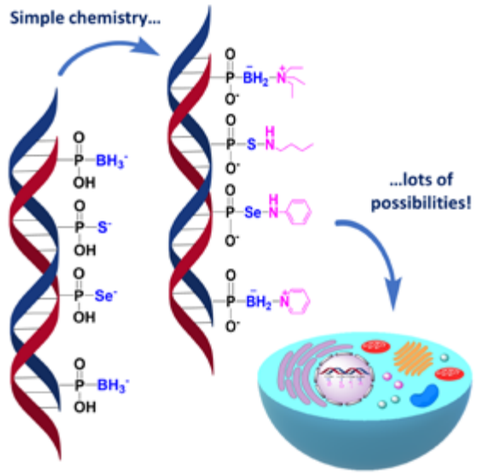
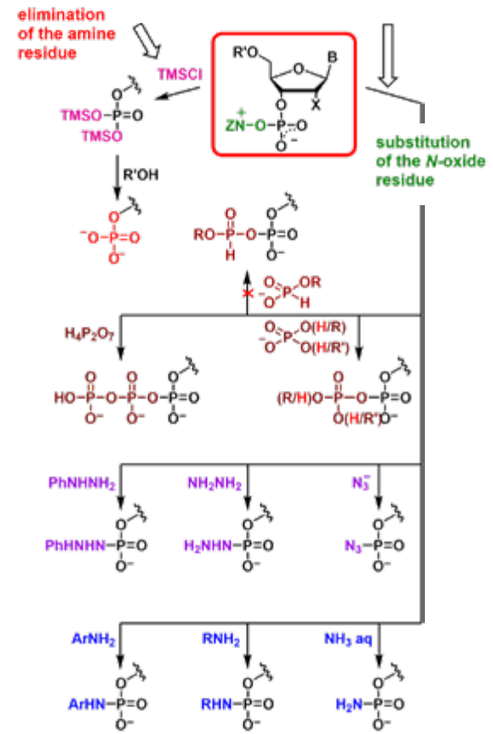


RESEARCH SCOPE

The chemistry of nucleoside and nucleotide analogues focused on searching for new compounds with unique properties, especially in the context of medical applications.

Our studies are focused mainly on the methods of synthesis and properties of nucleotide analogues, with particular emphasis on H-phosphonates and various nucleotide derivatives with a modified phosphorus center. This research covers issues such as the stereochemistry of nucleotide analogues, mechanistic studies, or tracing the metabolic pathways of pronucleotides. In the area of medicinal chemistry, nucleoside fragments are usually compounds with known antiviral and anticancer activity. Modifications of phosphate groups, which are the main subject of our interest, aim to improve biological activity, bypass the pathways that allow pathogens to escape applied therapy, and reduce adverse side effects. An integral part of the above work are mechanistic studies on new nucleotide analogs, in which one or more oxygen atoms of phosphate groups are replaced with sulfur, selenium, nitrogen, or other atoms. Since such modifications generate new stereogenic centers on the phosphorus atom, stereochemical studies are an integral part of this work.



MAIN RESEARCH TOPICS

- Basic studies on methods of synthesis and the properties of H-phosphonates of nucleosides and their analogues.
- Design and synthesis of new nucleotide compounds (e.g., pronucleotides) with potential antiviral or anticancer activity.
- Studies of the metabolic pathways of pronucleotides in various chemical and physiological environments.
- Chemistry and stereochemistry of P-chiral nucleotide analogues, including the development of new synthetic approaches to obtain this type of compounds in a stereocontrolled manner.

SELECTED PUBLICATIONS

Rojewska M et al. The Interactions of Anti-HIV Pronucleotides with a Model Phospholipid Membrane. Molecules 2024; 29, 5787,

Gołębiewska J et al. Synthesis of Nucleoside Selenophosphoramidates via H-Phosphonate Intermediates. J. Org. Chem. 2024; 89:12032-12043

Romanowska J et al. New anti-HIV pronucleotide phosphoramidate diesters containing amino- and hydroxypyridine auxiliaries. Eur.J.Med.Chem. 2019, 164, 47-58

Materna M et al. Oxyonium phosphobetaines - unusually stable nucleophilic catalyst-phosphate complexes formed from H-phosphonates and N-oxides, RSC Adv. 2016, 6, 14448-14451

RomanowskaJ et al. (N-Aryl)phosphoramidates of pyrimidine nucleoside analogues and their synthesis, selected properties, and anti-HIV activity, J. Med. Chem. 2011, 54, 6482-6491

Sobkowski M Chemistry and stereochemistry of internucleotide bond formation by the H-phosphonate method, New J. Chem. 2010, 34, 854-869

DEPARTMENT OF RARE DISEASES

myotonic dystrophies | non-canonical RNA splicing | circular RNA | small molecule compounds | introns' processing and functions

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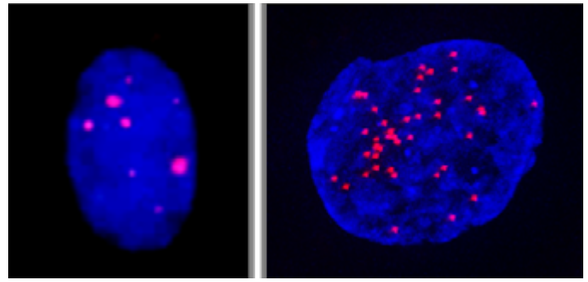
RESEARCH SCOPE

Pathomechanisms and therapeutic approaches in neurodegenerative and neuromuscular diseases associated with mutational expansions of microsatellites.

Our primary focus lies in unraveling the molecular basis underlying the pathogenesis of myotonic dystrophy types 1 (DM1) and 2 (DM2). Our ongoing research focuses on characterizing known biomarkers and identifying novel ones for myotonic dystrophies. Additionally, we are engaged in high-throughput screening of small-molecule compounds to diminish the molecular toxicity of DM2. Furthermore, we investigate the mechanisms responsible for non-canonical splicing of introns, exploring their fate and functionality in neurodegenerative and neuromuscular diseases.

MAIN RESEARCH TOPICS

- Searching for novel biomarkers of DM1 and DM2
- Screening for small-molecule compounds that alleviate the pathogenesis of DM2
- Elucidating the biological role of circular RNAs in DM1 pathogenesis
- Processing of introns harbouring expansions of microsatellites in neuromuscular disorders
- Non-canonical splicing of introns
- Molecular mechanisms and consequences of intron retention in mature transcripts



Therapeutic targets (toxic RNAs) in human DM1 and DM2 fibroblasts

RESEARCH PROJECTS

Deciphering the molecular causes and consequences of circular RNAs elevated expression levels in myotonic dystrophy type 1 (DM1); (NSC, OPUS, PI: M. Wojciechowska)

Cell-based high-throughput screening for small-molecule compounds diminishing molecular markers of pathogenesis in myotonic dystrophy type 2 (DM2); (NSC, OPUS, PI: M. Wojciechowska)

Non-canonical pre-mRNA splicing participates in the editing of CNBP mutant allele in myotonic dystrophy type 2 (DM2); (NSC, Preludium Bis, PI: M. Wojciechowska)

SELECTED PUBLICATIONS

Ketley A et al. CDK12 inhibition reduces abnormalities in cells from patients with myotonic dystrophy and in a mouse model. Science Translational Medicine 2020; 12,541

Wojciechowska M et al. Quantitative Methods to Monitor RNA Biomarkers in Myotonic Dystrophy. Scientific Reports, 2018

Kumari A et al. Differential fates of introns in gene expression due to global alternative splicing. Human Genetics 2022

Czubak K et al. Global increase in circRNA levels in myotonic dystrophy. Frontiers in Genetics 2019

Sedehizadeh S et al. Splicing in two skeletal muscle transcripts correlates with clinical phenotype in myotonic dystrophy type 1 patients. Journal of Neurology 2022

Yenigun V et al. (CCUG)n RNA toxicity in a Drosophila model of myotonic dystrophy type 2 (DM2) activates apoptosis. Disease Models & Mechanisms 2017

Lopez-Morato M et al. Small molecules which improve pathogenesis of myotonic dystrophy type 1 (DM1). Frontiers in Neurology 2018

Arvind Srinivasan A et al. Global dysregulation of circular RNAs in frontal cortex and whole blood from DM1 and DM2. Human Genetics, 2025

DEPARTMENT OF PLANT MOLECULAR PHYSIOLOGY

ABC transporters | Fabaceae | genetic engineering | phytohormones | phenylpropanoids

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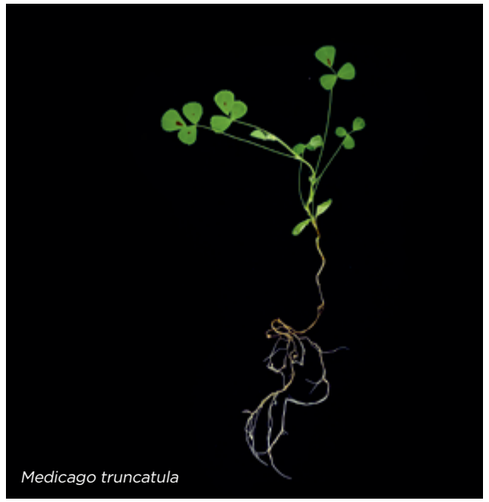


Medicago truncatula

RESEARCH SCOPE

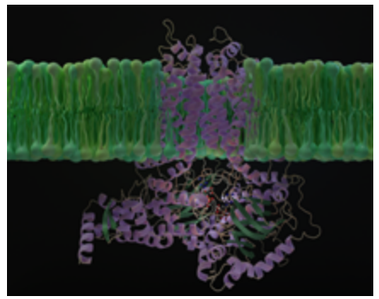
ABC (ATP-binding cassette protein) membrane transporters in the model legume plant *Medicago truncatula*.

The ABC transporters form one of the most numerous and widely distributed protein families. We study the role of ABC proteins in the distribution of both specialized metabolites and phytohormones. The obtained results contribute to a better understanding of the adaptive evolution of these transporters and the resulting molecular determinants. They also have potential for translational biology and could benefit plant producers.

Medicago truncatula flower, embryo, root nodule

MAIN RESEARCH TOPICS

- Identification and classification of plant ABC proteins
- Functional characterization of the ABCG subfamily in *Medicago truncatula*
- The role of ABCG proteins in the distribution of phenylpropanoids and interactions between legumes and microorganisms
- Cytokinin transport and its role in Fabaceae morphogenesis
- Membrane protein-mediated transport of phytohormones in response to biotic and abiotic stresses
- Understanding the signaling pathways involved in the process of seed maturation and germination



Structure of the ABCG membrane protein

RESEARCH PROJECTS

Functional characteristics of ABCG transporters in *Medicago truncatula* seeds (NSC, OPUS, PI: M. Jasiński)

New mechanisms determining MFT-mediated sensitivity to abscisic acid during the germination of *Medicago truncatula* seeds (NSC, OPUS, PI: J. Banasiak)

Relationship between ATPase activity stimulation and transport – the case of selective *Medicago truncatula* ABCG transporter (NSC, PRELUDIUM, PI: K. Pakuła)

ABCG driven transport of phenylpropanoids in *Medicago truncatula* – a versatile but adapted scenario (NSC, OPUS, PI: M. Jasiński)

SELECTED PUBLICATIONS

Jarzyniak K et al. Early stages of legume–rhizobia symbiosis are controlled by ABCG-mediated transport of active cytokinins. Nature Plants 2021; 7:428-436

Banasiak J, Jasiński M. ATP-binding cassette transporters in non-model plants. New Phytologist 2022; 233:1597-1612

Pakuła K et al. Restriction of access to the central cavity is a major contributor to substrate selectivity in plant ABCG transporters. Cellular and Molecular Life Sciences 2023; 80:105

Banasiak J et al. A roadmap of plant membrane transporters in arbuscular mycorrhizal and legume–rhizobium symbioses. Plant Physiology 2021; 187:2071-2091

Biała W et al. Medicago truncatula ABCG10 is a transporter of 4-coumarate and liquiritigenin in the medicarpin biosynthetic pathway. Journal of Experimental Botany 2017; 68:3231-3241

Pawela A et al. MtABCG20 is an ABA exporter influencing root morphology and seed germination of *Medicago truncatula*. The Plant Journal 2019; 98: 511-523

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF MOLECULAR GENETICS

cancer genetics | MLPA | miRNA | lncRNA | circRNA | noncoding mutations

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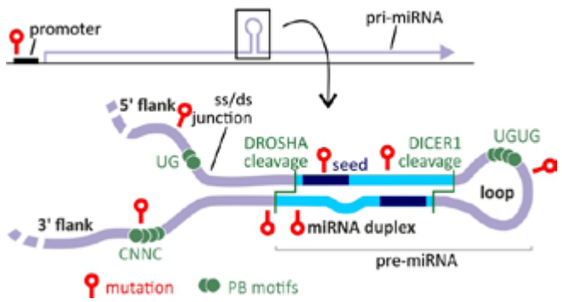
RESEARCH SCOPE

Identification and analysis of the functional consequences of genetic variants.

Our scope of interest encompasses variants of various types - from single nucleotide substitutions to large chromosomal rearrangements, from heritable germline variants to somatic mutations, from common polymorphisms to private aberrations, and from functional to neutral changes.

At present, we are focused on two main areas of research. First, the identification of new genetic and epigenetic variants and risk genes playing a role in heritable genetic predisposition to cancer, especially breast and ovarian cancers, as well as rare heritable cancer syndromes.



Localization of potentially functional mutations within the functional domains of miRNA genes

Second, the identification and functional characterization of somatic mutations, potential cancer-driving mutations in noncoding genetic elements, particularly miRNA genes and noncoding parts of protein-coding genes.

RESEARCH PROJECTS

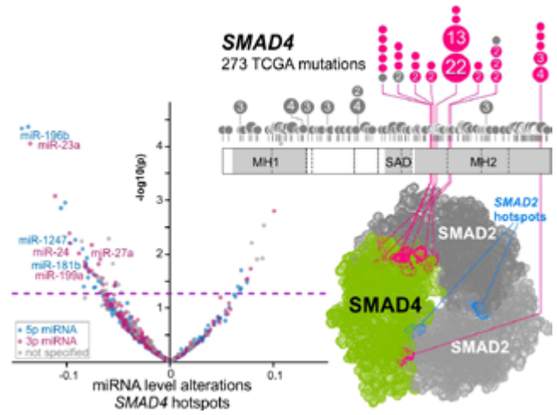
Identification of cancer-driver mutations in non-coding parts of protein-coding genes and long non-coding RNA genes (NSC OPUS 20, PI: P. Kozłowski)

The effect of cancer somatic mutations in miRNA genes on the functioning of these genes and their potential role in cancer (NSC SONATA 16, PI: P. Gałka-Marciniak)

In search for DNA methylation aberrations associated with susceptibility to ovarian cancer (NCN OPUS 26, PI: M. Suszyńska)

MAIN RESEARCH TOPICS

- The study of mutations in the MIR142 gene in blood cancers.
- Analysis of genetic variants and epigenetic changes (promoter methylation) in selected genes associated with ovarian cancer predisposition.
- Identification and characterization of somatic mutations in miRNA genes and microRNA biogenesis genes.
- Development of new methods for genetic analysis.
- Analysis of somatic mutations in non-coding elements of genes.



Localization of somatic cancer mutations in the MH2 domain of the *SMAD4* gene responsible for interaction and heterotrimer formation with SMAD2, and their impact on miRNA levels in cancer

SELECTED PUBLICATIONS

Suszynska M et al. CMC: Cancer miRNA Census - a list of cancer-related miRNA genes. Nucleic Acids Res. 2024; 52:1628

Galka-Marciniak P et al. A pan-cancer atlas of somatic mutations in miRNA biogenesis genes. Nucleic Acids Res. 2021; 49:601

Urbanek-Trzeciak MO et al. Pan-cancer analysis of somatic mutations in miRNA genes. EBioMedicine. 2020; 61:103051

Suszynska M et al. BARD1 is a low/moderate breast cancer risk gene: evidence based on an association study of the central European p.Q564X recurrent mutation. Cancers. 2019; 11:740

Suszynska M et al. Large-scale meta-analysis of mutations identified in panels of breast/ovarian cancer-related genes – Providing evidence of cancer predisposition genes. Gynecol Oncol. 2019; 153:452

Dabrowska M et al. qEva-CRISPR: a method for quantitative evaluation of CRISPR/Cas-mediated genome editing in target and off-target sites. Nucleic Acids Res. 2018; 46:e101

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF CANCER GENETICS

medical genetics | mosaicism | cancer genomics | bioinformatics | ultrasensitive next generation sequencing (NGS) | skin tumors

HEAD

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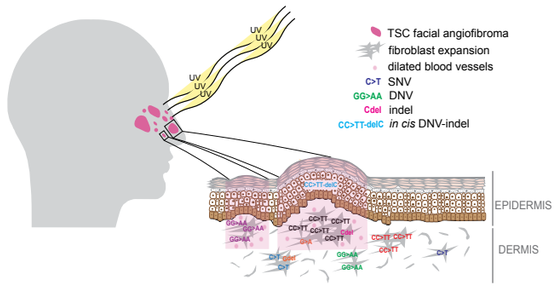


RESEARCH SCOPE

Ultrasensitive profiling uncovering the hidden landscape of tumorigenesis-driving mutations

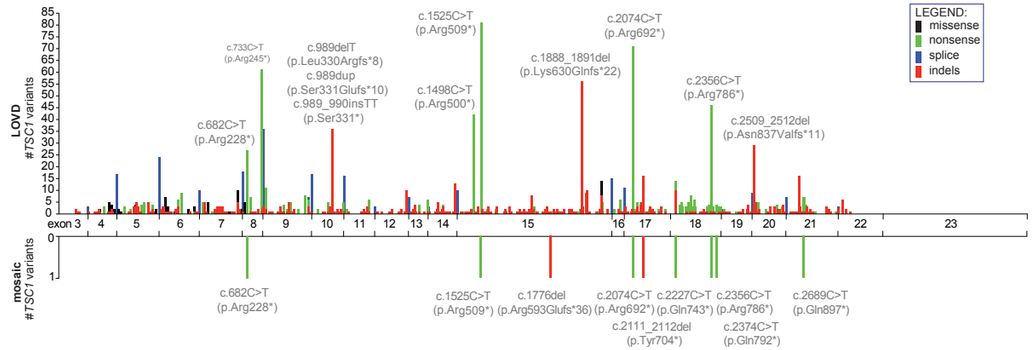
Our research is focused on exploring the genetic basis of hereditary syndromes predisposing to tumors associated with the inactivation of tumor suppressor genes. One of our research areas of interest is the development of novel next-generation sequencing (NGS) methods for ultrasensitive profiling of mutations, including somatic mutations and low-level mosaicism. The research of the Department of Cancer Genetics balances on the border of genetics and medicine, and leads to scientific discoveries with practical applications in diagnostics and potential significance for patients.

RESEARCH PROJECTS

Ultrasensitive profiling of mutations driving tumorigenesis in hereditary syndromes associated with tumor suppressor genes inactivation
(NSC OPUS, PI: K. Klonowska)

MAIN RESEARCH TOPICS

- Development of new strategies for ultrasensitive mutation profiling
- Genetics of hereditary syndromes associated with tumor suppressor genes inactivation
- Characterization of mosaicism and somatic mutations spectrum in tumors in patients with Tuberous Sclerosis Complex (TSC)
- Identification of genes/mutations modifying phenotype in TSC patients
- Genetics of tumorigenesis in skin



SELECTED PUBLICATIONS

Klonowska K et al. Ultrasensitive profiling of UV-induced mutations identifies thousands of subclinical facial tumors in tuberous sclerosis complex. J Clin Invest 2022; 132(10):e155858

Klonowska K et al. Comprehensive genetic and phenotype analysis of 95 individuals with mosaic Tuberous Sclerosis Complex. Am J Hum Genet 2023; 1,110(6): 979-988

Huschner F et al. Molecular EPISTOP: Comprehensive multi-omic analysis of blood from Tuberous Sclerosis Complex infants age birth to two years. Nature Communications 2023; 14(1):7664

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF PLANT GENOMICS

structural variation | model plants | transposable elements | epigenetics | stress

HEAD

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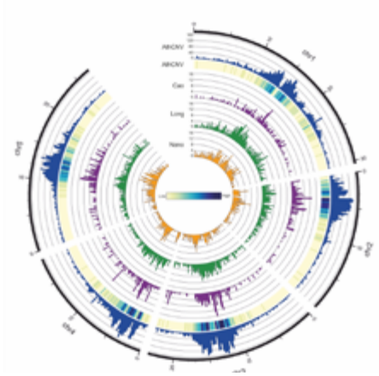
RESEARCH SCOPE

Genome structure, plant genetic variation, and the relationship between genotype and phenotype.

We are interested in the copy number polymorphism of genes encoding proteins and microRNAs, the polymorphism of genomic repeats and the mechanisms of their formation, as well as their putative impact on gene expression diversity. We also study the effects of transposable element presence on genomic DNA methylation patterns and the role of genomic duplications in the adaptation and evolution of a species. Our main plant models are *Arabidopsis thaliana* and *Medicago truncatula*. In our research, we combine experimental and bioinformatics approaches, including short- and long-read DNA/RNA sequencing as well as genome-wide association studies.



We create novel genomic resources, one of which is an online catalog of gene copy number variation in Arabidopsis (http://athcnv.ibch.poznan.pl/).

MAIN RESEARCH TOPICS

- Natural variation of genomic sequence repeats and the mechanisms involved in their formation
- The role of gene copy number polymorphism in shaping plant responses to stress
- Links between the non-coding RNA metabolism and the accumulation of structural variations
- The role of structural and epigenetic changes in plant adaptation to climate change
- The diversity of symbiotic gene islands in the Medicago genome and its impact on nodulation

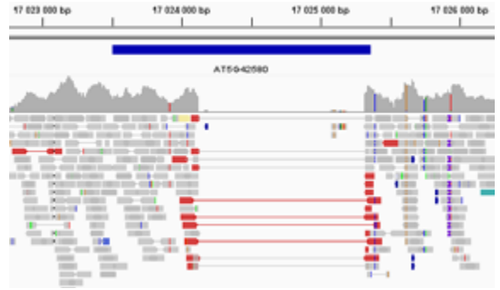
RESEARCH PROJECTS

The role of transposable elements and epigenetic regulation of gene expression in *Medicago truncatula* root nodules development (NSC, Preludium BIS, PI: A. Żmieńko)

The genetic basis underlying immune resistance in selected accessions of the model plant A. thaliana against the plant pathogen Pectobacterium carotovorum (NSC, Preludium, PI: A. Satyr)

Evaluation of the role of genes BARS1 and BARS2, which encodes novel oxidosqualene synthase, in the natural diversity of Arabidopsis growth and adaptation to environmental conditions (NSC, OPUS, PI: A Żmieńko)

Unravelling the conservation of crossover hotspots and regulation of meiotic recombination at the pericentromeres (NSC, SONATINA, PI: M. Szymańska-Lejman)



SELECTED PUBLICATIONS

Marszalek-Zenczak M et al. Analysis of Arabidopsis non-reference accessions reveals high diversity of metabolic gene clusters and discovers new candidate cluster members. Front Plant Sci. 2023; 14:1104303

Samelak-Czajka A et al. Differences in the intraspecies copy number variation of *Arabidopsis thaliana* conserved and nonconserved miRNA genes. Funct Integr Genomics. 2023; 23:120

Zmienko A et al. AthCNV: A Map of DNA Copy Number Variations in the Arabidopsis Genome. Plant Cell. 2020; 32:1797-1819

Samelak-Czajka A et al. MLPA-based Analysis of Copy Number Variation in Plant Populations. Front. Plant Sci. 2017; 8:222

Żmieńko A et al. Copy number polymorphism in plant genomes. Theor Appl Genet. 2014; 127: 1-18

DEPARTMENT OF RNA STRUCTURAL GENOMICS

RNA viruses | influenza virus | SARS-CoV-2 | isoenergetic microarrays | thermodynamics of nucleic acids | antisense oligonucleotides | small molecules | RNA structure | pathogenic RNA | RNA modifications

HEAD

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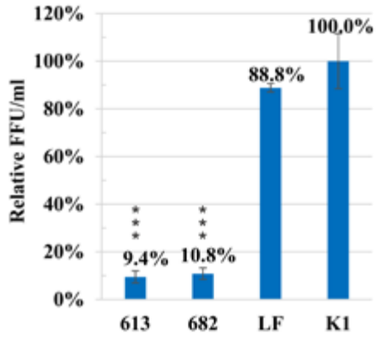
RESEARCH SCOPE

Studies of RNA secondary and tertiary structures as well as complexes of RNA with proteins, other RNA, or small molecules.

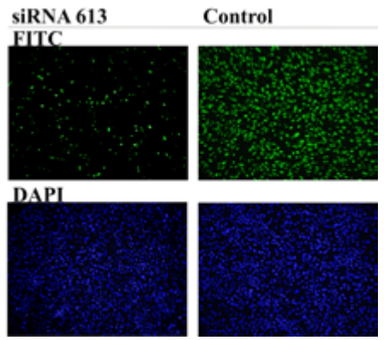
The goal of this research is not only to determine RNA structure but also to use this knowledge to modulate RNA function, including pathogenic RNAs involved in human diseases. At the present moment, the Department's research objects are, among others, the influenza virus and SARS-CoV-2. We are interested in the structure of viral RNA and conserved structural motifs with functional importance. The Department's research also includes the design and application of short modified oligonucleotides and their bioconjugates as functional and structural probes. We also develop inhibitory strategies based on oligonucleotides and small molecules.



Antiviral activity of the two most effective unmodified siRNAs in the IFA assay compared with the negative control (K1) and lipofectamine (LF)

MAIN RESEARCH TOPICS

- RNA structural genomics of viruses, including influenza virus and SARS-CoV-2
- Secondary and tertiary structures of RNA and its complexes
- Modulation of RNA function
- Inhibition and regulation of RNA viruses' proliferation
- Small molecules binding to RNA
- Modified oligonucleotides – antisense and microarray strategies
- Oligonucleotide carriers and bioconjugates
- CRISPR/Cas systems as strategies for replication inhibitors of RNA viruses
- Thermodynamic and comparison analysis of studied RNA,
- Prediction of RNA secondary structure
- RNA motifs functional studies
- RNA modifications



Exemplary fluorescence microscopy images of the influenza virus-infected MDCK cell culture in the IFA assay and effect of siRNA 613

RESEARCH PROJECTS

Input of the structure of influenza A virus RNA in regulation of virus proliferation. High throughput screening of small molecules towards inhibition of influenza virus replication (NSC OPUS, PI: E. Kierzek)

Antiviral strategies targeting RNA: Triplex forming peptide nucleic acids (PNA) and their small molecule conjugates specific to conserved RNA motifs in Influenza A and SARS-CoV-2 (NSC OPUS, PI: E. Kierzek)

Long noncoding RNA - new aim of anti-influenza therapy. UMO-2020/39/D/NZ6/03267, National Science Centre grant (NSC SONATA, PI: M. Soszyńska-Jóźwiak)

The G-rich sequences in the influenza A virus genome – structural features and potential biological function in viral replication cycle (NSC SONATA, PI: M. Szabat)

Antisense oligonucleotides as tools specifically binding viral G-quadruplexes and their experimental verification (NCN OPUS, PI: M. Szabat)

SELECTED PUBLICATIONS

Michalak P et al., Conserved Structural Motifs of Two Distant IAV Subtypes in Genomic Segment 5 RNA. Viruses 2021, 13, 525

Soszynska-Jozwiak M et al., Universal and strain specific structure features of segment 8 genomic RNA of influenza A virus – application of 4-thiouridine photocrosslinking. Journal of Biological Chemistry 2021, 297, 6, 101245

Soszynska-Jozwiak M et al., Secondary Structure of Subgenomic RNA M of SARS-CoV-2. Viruses 2022, 14, 322

Mirska B et al., In vivo secondary structural analysis of Influenza A virus genomic RNA. Cellular and Molecular Life Sciences 2023, 80, 136

Kierzek E et al., Secondary Structure Prediction for RNA Sequences Including N6-methyladenosine. Nature Communications 2022, 13, 1271

Szabat M et al., A Test and Refinement of Folding Free Energy Nearest Neighbor Parameters for RNA Including N6-Methyladenosine. Journal of Molecular Biology 2022, 167632

Baliga-Gil A et al. Targeting sgRNA N secondary structure as a way of inhibiting SARS-CoV-2 replication. Antiviral Research 2024; 105946

Yildirim I et al. Experimental and computational investigations of RNA duplexes containing N7-regioisomers of adenosine and LNA-adenosine, Nucleic Acids Research 2025; 53, gkae1222

DEPARTMENT OF GENOME ENGINEERING

CRISPR-Cas9 | amiRNA | microsatellites | polyglutamine diseases | gene therapy

HEAD

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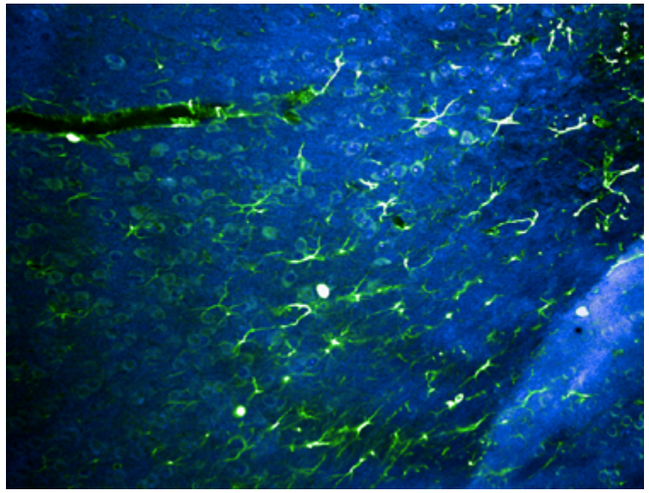


Immunofluorescent staining of mouse brain for the presence of GFAP marker after AAV5 vector injection

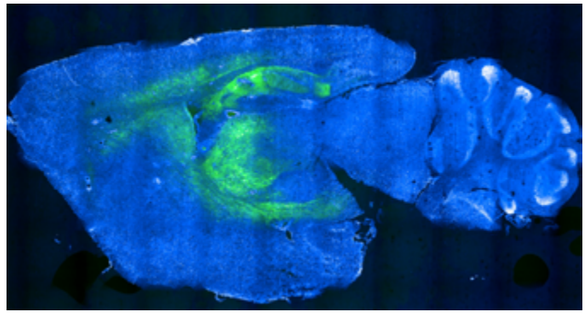
RESEARCH SCOPE

Neurodegenerative diseases caused by short tandem repeat (CAG)n expansion. The mechanisms leading to the instability of expanded repeated sequences and the role of DNA repair in these processes.

In our research, we use the CRISPR-Cas technology to create new disease models, induce double-stranded DNA breaks, and identify genes associated with CAG repeat instability in large-scale experiments. Our goal is to develop a therapeutic approach based on the use of DNA repair mechanisms for controlled shortening of mutated CAG repeats or limiting their expansion.

An important goal of our research is also the development of RNA interference technology in the field of artificial microRNAs (amiRNAs) used to silence the expression of target genes in therapeutic approaches.

Distribution of AAV5-GFP viral vector in the mouse brain after injection into the striatum



MAIN RESEARCH TOPICS

- Study of the mechanisms responsible for the instability of microsatellite sequences
- Study of DNA double-strand break repair mechanisms in microsatellite regions
- Development of genome editing technologies and methods for assessing their effectiveness and specificity
- The use of genome editing technology to establish disease models and in therapy of genetic diseases
- The use of artificial miRNA in the therapy of human diseases

RESEARCH PROJECTS

Assessing efficacy and safety of genome EDITing approaches for Sickle Cell Disease (European Comission, EDITSCD-HOP-ON, PI: M. Olejniczak)

Searching for new therapeutic targets in polyglutamine diseases (NSC, OPUS, PI: M. Olejniczak)

Allele-selective therapy for polyglutamine diseases with the use of RNA interference technology (NSC, PRELUDIUM BIS, PI: M. Olejniczak)

Microscopic identification of proteins involved in DNA repair of CAG repeats regions (NSC, PRELUDIUM, PI: M. Nowaczyk)

The use of artificial miRNAs in experimental therapy of Huntington's Disease (NSC, PRELUDIUM, PI: A. Kotowska-Zimmer)

The importance of CAG repeat length polymorphism in the pathogenesis of cancer (MEN, PERŁY NAUKI, PI: M. Śmiełowska)

SELECTED PUBLICATIONS

Dabrowska M et al. qEva-CRISPR: a method for quantitative evaluation of CRISPR/Cas-mediated genome editing in target and off-target sites. Nucleic Acids Res. 2018, 46:e101

Dabrowska M et al. Precise excision of the CAG tract from the Huntingtin Gene by Cas9 Nickases, Front Neurosci. 2018, 12:75

Sledzinski P et al. Paving the way towards precise and safe CRISPR genome editing. Biotechnology Adv. 2021; 49:107737

Sledzinski P et al. CRISPR/Cas9-induced double-strand breaks in the huntingtin locus lead to CAG repeat contraction through DNA end resection and homology-mediated repair. BMC Biol 2024; 22:282

Kotowska-Zimmer A et al. A CAG repeat-targeting artificial miRNA lowers the mutant huntingtin level in the YAC128 model of Huntington's disease. Molecular Therapy NA 2022; 28: 702-715

Kotowska-Zimmer A et al. Universal RNAi triggers for the specific inhibition of mutant huntingtin, atrophin-1, ataxin-3 and ataxin-7 expression. Molecular Therapy NA 2020, 19:562-571

DEPARTMENT OF PLANT FUNCTIONAL METABOLOMICS

Specialized metabolism | plant immunity | tryptophan | *Arabidopsis*

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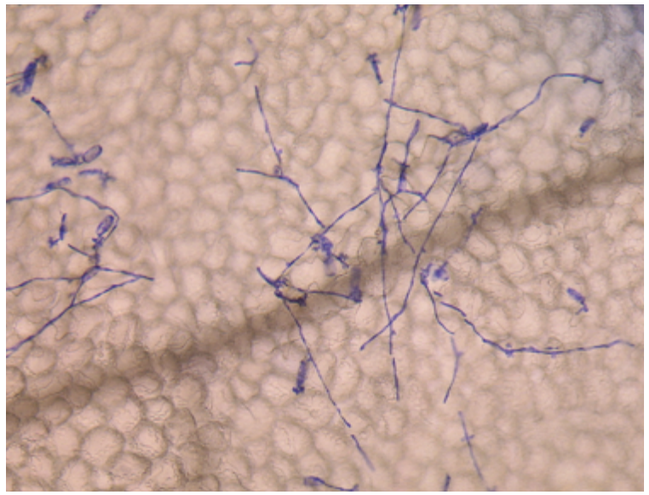

RESEARCH SCOPE

Specialized metabolism of model and crop plants. Particularly, we focus on metabolic pathways with functions in plant-microbe interactions.

One of our main objects of interest is tryptophan metabolism in the model plant *Arabidopsis thaliana* and in related Brassicaceae species. We are also interested in the specialized metabolism of the model grass *Brachypodium distachyon* and of barley. We investigate the profiles of metabolites produced in plants during their response to pathogenic or beneficial microorganisms. In the case of model species, we also analyze the metabolomes of mutant lines defective in selected genes to recognize the function of the corresponding enzymes in metabolic pathways.

We also study the phenotypes of selected mutants during their interactions with microorganisms, which enables the identification of the functions of particular metabolites. Finally, we employ synthetic biology tools to engineer tryptophan-specialized metabolism.

MAIN RESEARCH TOPICS

- Tryptophan metabolism in the immunity of the model plant species *Arabidopsis thaliana*.
- Synthetic biology of tryptophan-specialized metabolism in plants.
- Metabolic pathways involved in the resistance of barley towards abiotic and biotic stresses.
- Function of plant secondary metabolites in growth promotion induced by microbial endophytes.

RESEARCH PROJECTS

Molecular basis of glucosinolate modification and activation in the immunity of Brassicaceae species (NSC OPUS, PI: P. Bednarek)

Interspecies metabolic engineering as a tool to investigate immune functions of plant specialized metabolites (NSC OPUS, PI: P. Bednarek)

Description of the key mechanisms of coordination and prioritization of barley's response to simultaneous biotic and abiotic stresses – a multiomic approach (NSC OPUS, PI: A. Piasecka)

Impact of subcellular localization on the specificity of selected enzymes involved in the biosynthesis and metabolism of bioactive sulfur-containing compounds from Brassicaceae plants (NSC OPUS, PI: P. Bednarek)

SELECTED PUBLICATIONS

Czerniawski P et al. Loss of MYB34 Transcription Factor Supports the Backward Evolution of Indole Glucosinolate Biosynthesis in a Subclade of the Camelineae Tribe and Releases the Feedback Loop in This Pathway in *Arabidopsis*. Plant & Cell Physiol. 2023, 64:80-93

Singh G et al. Specialized metabolites as versatile tools in shaping plant-microbe associations. Mol. Plant, 2023, 16: 122-144

Piślewska-Bednarek et al. Glutathione Transferase U13 Functions in Pathogen-Triggered Glucosinolate Metabolism. Plant Physiol. 2018, 176:538-551

Sugiyama R et al. Retrograde sulfur flow from glucosinolates to cysteine in *Arabidopsis thaliana*. PNAS 2022, 118:e2017890118

Basak AK et al. ER body-resident myrosinases and tryptophan specialized metabolism modulate root microbiota assembly. New Phytol. 2024; 241:329-342

DEPARTMENT OF MOLECULAR NEUROONCOLOGY

brain tumors | glioblastoma | cancer stem cells | regulatory RNA | extracellular matrix

HEAD

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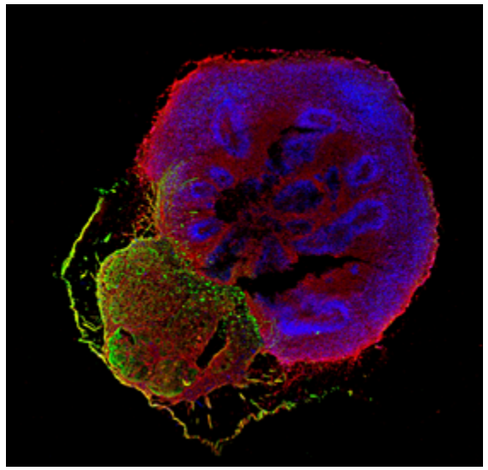


The structure of a hybrid glioma invasion model in immunofluorescent staining

RESEARCH SCOPE

The determination of the importance of RNA in cancer, particularly brain tumors.

We study the impact of the tumor microenvironment on the expression of different RNA classes, e.g., miRNA and circRNA, and their function in development and progression processes. We are particularly interested in the changes within the extracellular matrix and the role of RNAs in the ECM rearrangement. We focus especially on the identification of RNA molecules with special clinical significance (diagnostic markers, therapeutic molecules). We also create innovative models to study tumor progression: organoids and spheroids derived from patients with glioblastoma.

MAIN RESEARCH TOPICS

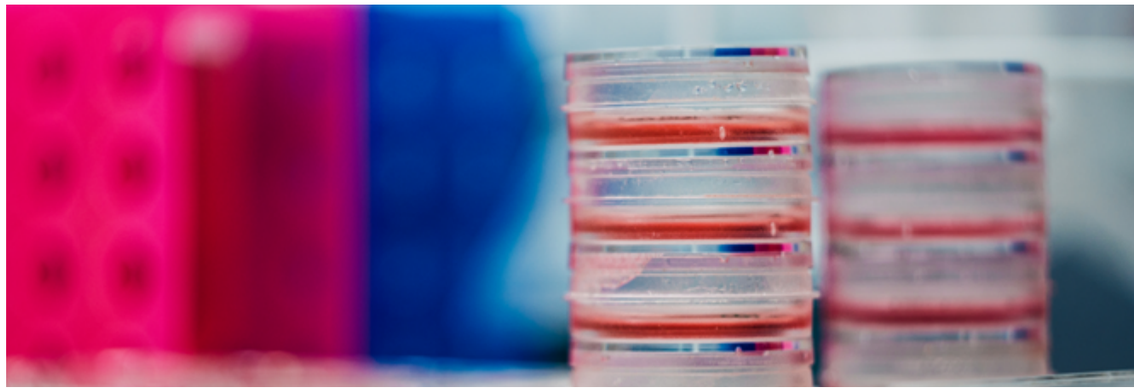
- The role of ncRNA in the function of cancer stem cells
- Identification of RNA and proteins involved in migration and invasion processes
- Identification of molecules with diagnostic, prognostic, and therapeutic potential
- Development and characterization of new models based on primary cell lines from GBM patients
- Development of new therapeutic strategies utilizing RNA

RESEARCH PROJECTS

Patient-derived bioprinted organoids for toxicological prediction analysis and new drugs design. (NSC MINIATURA, PI; D. Wawrzyniak)

Development of universal fast-response platform, based on RNA technology, ensuring the national drug and epidemiological safety (one of the teams involved from IBCH, ABM Project Call: Development of innovative therapeutic solutions with RNA technology. Consortium leader: Polfa S.A., PI: prof. M. Figlerowicz).

Fighting glioblastoma invasiveness: comprehensive transcriptome profiling in time and space based on a new hybrid cellular model (NAWA- Canalleto, PI: Katarzyna Rolle, in cooperation with prof. Stefania Bortoluzzi, Department of Molecular Medicine, Padova University)



SELECTED PUBLICATIONS

Latowska-Łysiak J et al. , Transcriptome-wide analysis of circRNA and RBP profiles and their molecular relevance for GBM. Mol Oncol. 2025

Wawrzyniak O et al. Exploring microRNA signatures in pediatric non-infectious uveitis: meta-analysis and molecular profiling of patient samples. J Appl Genet. 2024

Ciesielska K et al. Diastereoselective synthesis and biological evaluation of new fluorine-containing α-aminophosphonates as anticancer agents and scaffold to human urokinase plasminogen activator inhibitors. 2025. Eur J Med Chem

DEPARTMENT OF NON-CODING RNAs

non-coding RNA | miRNA | circular RNAs | regulatory RNAs | nervous system | pituitary gland

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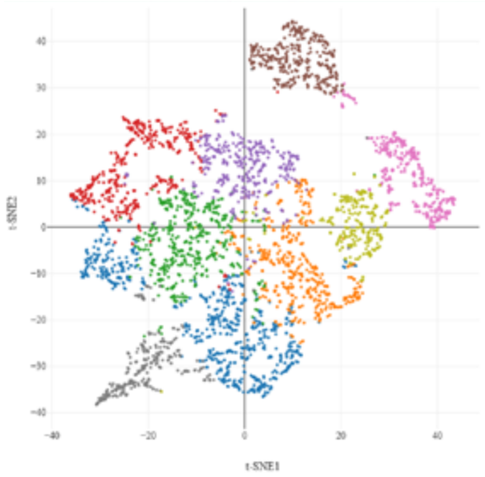
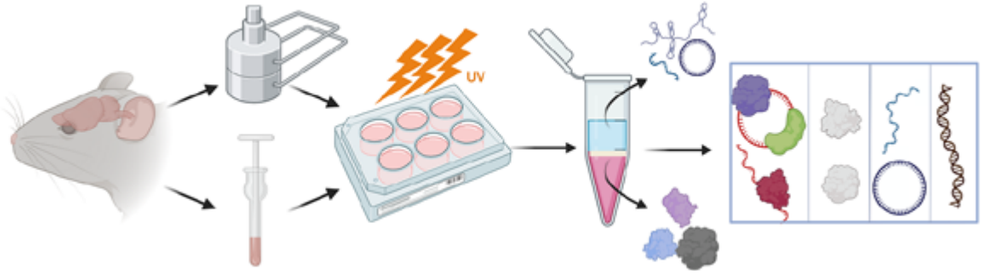


RESEARCH SCOPE

Regulatory RNAs and processes underlying gene expression regulation in neurons, glial cells, and the neuroendocrine system. We combine molecular biology with cell biology, neurobiology, and systems biology.

We study how regulatory RNAs, especially microRNAs, circular RNAs, and long non-coding RNAs, influence protein-coding genes. We are interested in the cellular specificity of regulatory RNAs and their interactions with proteins. We are fascinated by the recognition of gene expression regulation processes in different cell types and subtypes of the brain and pituitary gland. We use mice and cell cultures as models.



MAIN RESEARCH TOPICS

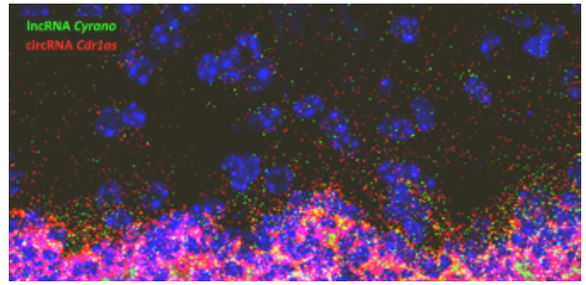
- Expression patterns of ncRNAs in single cells of the nervous and neuroendocrine systems, in different cell types and subtypes.
- Subcellular localization of regulatory RNAs in neurons and neuroglia.
- RNA-protein interactions.
- Regulatory networks formed by ncRNA, their influence on protein-coding genes.
- Functions of ncRNA.
- Deregulation of the non-coding transcriptome in CNS/neuroendocrine system pathologies.

RESEARCH PROJECTS

Non-coding RNAs at single-cell resolution in the pituitary gland and their role in the regulation of gene expression (NSC Opus, PI: M. Piwecka)

Functional implications of brain-enriched circular RNAs (NSC Sonata Bis, PI: M. Piwecka)

Investigation of the new functions of unconventional myosin operating in the mammalian brain (NSC Miniatura, PI: W. Wendlandt-Stanek)



SELECTED PUBLICATIONS

Piwecka M et al. Single-cell and spatial transcriptomics: deciphering brain complexity in health and disease. Nature Reviews Neurology 2023, 19(6):346-362

Piwecka M et al. Loss of a mammalian circular RNA locus causes miRNA deregulation and affects brain function. Science 2017, 357(6357):eaam8526. DOI: 10.1126/science.aam8526

Koliński M et al. RNA-protein interactomes as invaluable resources to study RNA viruses: Insights from SARS CoV-2 studies. Wiley Interdiscip Rev RNA 2022,13(6):e1727

Zacharjasz J et al. Micromanaging the neuroendocrine system - A review on miR-7 and the other physiologically relevant miRNAs in the hypothalamic-pituitary axis. FEBS Lett. 2024; 598(13):1557-1575

Cerda-Jara CA et al. miR-7 controls glutamatergic transmission and neuronal connectivity in a Cdr1as-dependent manner. EMBO Rep. 2024;25(7): 3008-3039

DEPARTMENT OF BIOMEDICAL PROTEOMICS

proteomics | mass spectrometry | chronic kidney disease (CKD) | cardiovascular disease (CVD) | hematopoietic cancer

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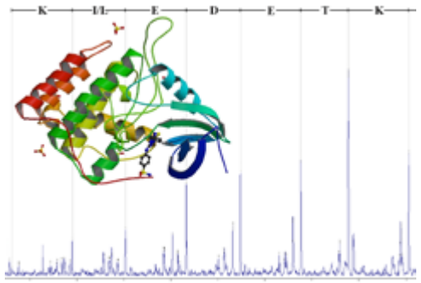
RESEARCH SCOPE

Proteins involved in the development and progression of various human pathophysiological conditions, with particular attention to chronic kidney disease-related atherosclerosis (CKD-A) and hematological malignancies.

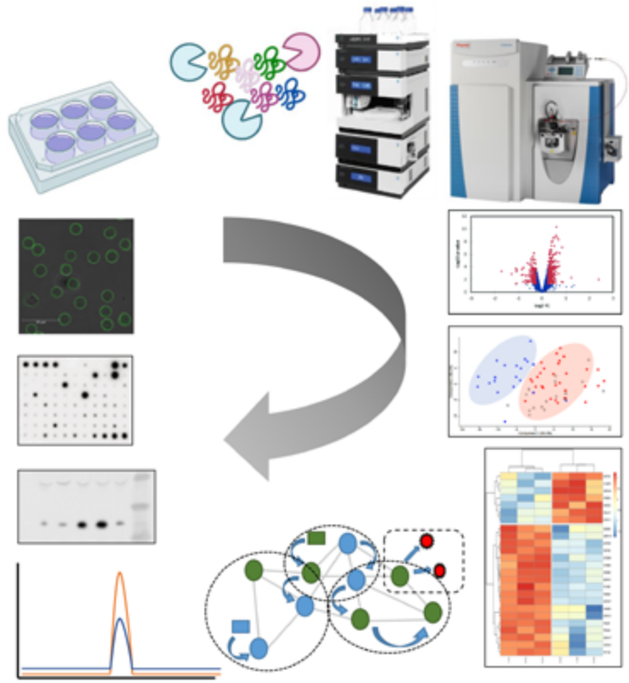
We specialize in the large-scale study of the proteome and its application in the translational studies of human diseases. Mass spectrometry-based quantitative analysis of the proteome leads to the uncovering of disease-affected protein profiles. Analysis of these changes with bioinformatics provides biological insight into the physiological effect, i.e., disease-related signaling pathways and processes altered in a given condition. Complemented by studies on other "omic" levels and functional analyses of cells *in vitro* and *in vivo*, they can contribute to deciphering the molecular pattern of the studied disease and the factors promoting its development and progression. We are also interested in the application of proteomics in precision medicine and understanding the 'individuals' characteristics that determine the susceptibility and outcome of treatment.



Protein identification using mass spectrometry methods

MAIN RESEARCH TOPICS

- Investigations of the role of proteins dysregulated during the development of CKD-A and the mechanism underlying the progression of this disease.
- Analysis of the relationship between oxidative stress and chronic inflammation in CKD and CVD.
- Elaboration of screening and targeted proteomic approaches in biomedical research.
- Analysis of the mechanism of cell resistance to proteasome inhibitors in multiple myeloma.
- Identification of protein biomarkers of resistance to chemotherapy.



Quantitative proteomic analyses

RESEARCH PROJECTS

Comprehensive phosphoproteomic analysis of NKT cells in the context of the role of phosphorylation mechanisms in progression of atherosclerosis in chronic kidney disease (NSC, OPUS, PI: M. Łuczak)

Proteomic analysis of myeloma plasma cells to determine proteins and pathways involved in acquired resistance to proteasome inhibitors (NSC, OPUS, PI: D. Dytfeld)

SELECTED PUBLICATIONS

Watral J et al. Comprehensive proteomics of monocytes indicates oxidative imbalance functionally related to inflammatory response in chronic kidney disease-related atherosclerosis. Frontiers in Molecular Biosciences 2024, doi: 10.3389/fmolb.2024.1229648

Ehrlich H et al. Arrested in Glass: Actin within Sophisticated Architectures of Biosilica in Sponges. Advanced Science 2022; e2105059

Kubicki T et al. Bortezomib- and carfilzomib-resistant myeloma cells show increased activity of all three arms of the unfolded protein response. Am J Cancer Res 2022;12(7): 3280-3293

Tracz J et al. Proteomic Profiling of Leukocytes Reveals Dysregulation of Adhesion and Integrin Proteins in Chronic Kidney Disease-Related Atherosclerosis. Journal of Proteome Research 2021; 20, 6, 3053-3067

DEPARTMENT OF RNA STRUCTURE AND FUNCTION

RNA structure *in vivo* | RNA function | RNA binding proteins | retrotransposons | mRNA bioproduction

HEAD

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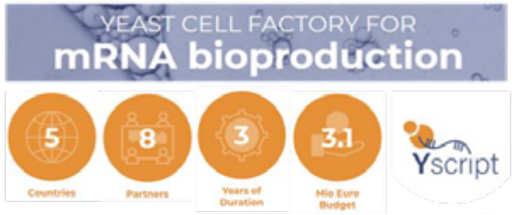


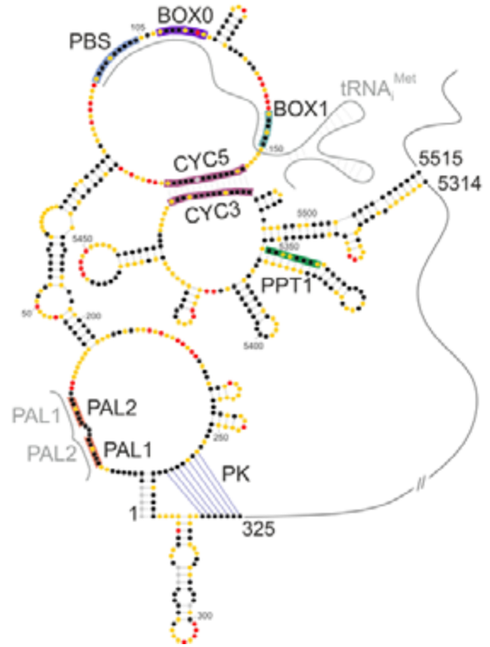
RESEARCH SCOPE

The correlation between RNA structure and function, replication of RNA viruses, RNA in diseases, and RNA-based therapeutics.

The studies of the Department focus on exploring RNA structural dynamics in complex cellular environments using cutting-edge biochemical and bioinformatics technologies. We aim to precisely describe RNA structure features regulating its transport, translation, and decay in the cell. Our research also contributes to understanding how complex multifunctional RNA genomes fold *in vivo* and how RNA structural elements regulate the replication of endogenous retroelements. In addition, we explore factors that can impact RNA structure, including ribosomes and virus-like proteins. Furthermore, we are also involved in the development of groundbreaking technology for mRNA production in microorganisms.

MAIN RESEARCH TOPICS

- RNA structure mapping and the development of bioinformatics tools for RNA structural data analysis.
- Large-scale structural characteristics of transcriptomes and the creation of an mRNA structure database.
- Evaluation of structure's role in RNA functioning.
- Investigation of Gag-like protein interactions with RNA.
- Structural and functional genomics of LTR-retrotransposons (Ty1, Ty3).
- Developing a platform for the bioproduction of therapeutic mRNA.



RESEARCH PROJECTS

Transcriptome-wide analysis of RNA structure in the cell and across cellular compartments, and identification of the impact of cellular factors on RNA structure in S. cerevisiae (NSC, OPUS, PI: K. Pachulska-Wieczorek)

Yeast cell factory for mRNA bioproduction. YSCRIPT (EIC Pathfinder, PI: Ch. Pichon, IBCH PI: K. Pachulska-Wieczorek)

Exploring Ty3 genomic RNA structure during retrotransposition in yeast (NSC, PRELUDIUM, PI: A. Andrzejewska-Romanowska)

SELECTED PUBLICATIONS

Andrzejewska A et al. *In vivo* structure of the Ty1 retrotransposon RNA genome. Nucleic Acids Res. 2021; 49(5):2878-2893

Zawadzka M et al. Cell Compartment-Specific Folding of Ty1 Long Terminal Repeat Retrotransposon RNA Genome. Viruses. 2022; 14(9):2007

Gumna J et al. Retroviral-like determinants and functions required for dimerization of Ty1 retrotransposon RNA. RNA Biol. 2019; 16(12):1749-1763

Gumna J et al. RNA Binding Properties of the Ty1 LTR-Retrotransposon Gag Protein. Int J Mol Sci. 2021; 22(16):9103

Gumna J et al. RNAthor - fast, accurate normalization, visualization and statistical analysis of RNA probing data resolved by capillary electrophoresis. PLoS One. 2020; 15(10):e0239287

Mapping the structural landscape of the yeast Ty3 retrotransposon RNA genome. Andrzejewska-Romanowska A, Gumna J, Tykwińska E, Pachulska-Wieczorek K. Nucleic Acids Res. 2024 Sep 9;52(16):9821-9837. doi: 10.1093/nar/gkae494

SCIENTIFIC DEPARTMENTS

DEPARTMENT OF MOLECULAR VIROLOGY

emerging viruses | influenza virus | coronaviruses | virus-host interactions | novel antiviral strategies

HEAD

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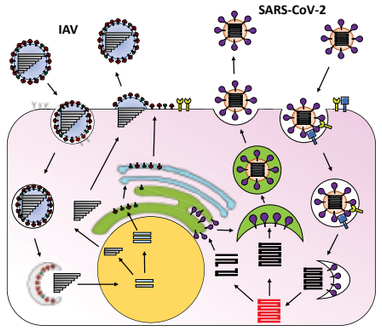
RESEARCH SCOPE

Viruses – host cells interactions, with particular interest in the virus entry, and development of novel antiviral strategies.

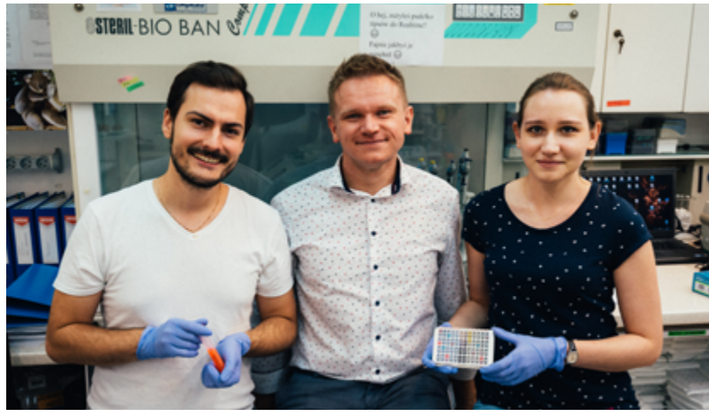
As part of our research, we focus on the proteolytic activation of influenza virus hemagglutinin and the emerging coronaviruses spike protein, as well as the search for new inhibitors blocking virus entry. In addition, we are interested in the analysis of the pathogens genetic diversity and its effect on the virus replication, spread and pathogenesis, as well as interactions between virus and host cell. Our scientific interests focus also on the analysis of the viruses spread in the human population with the so-called wastewater-based epidemiology.

MAIN RESEARCH TOPICS

- Analysis of the virus-host cells interactions.
- Identification of the host cell factors involved in the proteolytic activation of influenza virus hemagglutinin and coronavirus spike proteins.
- Development of novel antiviral strategies.
- Analysis of the pathogens' genetic diversity.
- Monitoring of the respiratory viruses spread in the population based on serosurveillance and wastewater-based epidemiology.
- Development of new molecular diagnostic tests for viral, parasitic, and tropical diseases.



Replication cycles of influenza viruses and coronaviruses



RESEARCH PROJECTS

Development of a universal fast-response platform, based on RNA technology, ensuring the national drug and epidemiological safety (Medical Research Agency, project implemented in the consortium, project leader: Polfa S.A. Pharmaceutical Works, principal investigator: M. Figlerowicz, task leader: P. Zmora)

SELECTED PUBLICATIONS

Nowak R et al. TMPRSS2-specific antisense oligonucleotides inhibit host cell entry of emerging viruses. Virology, 2024, 110218

Biegański P, Gazecka M, et al. Organometallic–Erlotinib Conjugates Active against Lung Cancer Cells and as Emerging Virus Entry Inhibitors. Organometallics, 2024, 43, 20, 2505-2519

Pawełczyk A, Nowak R et al. Novel molecular consortia of cannabidiol with nonsteroidal anti-inflammatory drugs inhibit emerging coronaviruses entry. Pathogens, 2023, 12(7), 951

Gazecka M et al. Mpox virus detection in the wastewater and the number of hospitalized patients in the Poznan metropolitan area, Poland. International Journal of Infectious Diseases, 2023, 133:75-77

Lorent D et al. The Longitudinal Analysis on the Anti-SARS-CoV-2 Antibodies among Healthcare Workers in Poland-Before and after BNT126b2 mRNA COVID-19 Vaccination. Vaccines, 2022, 10(10):1576

Lorent D et al. Prevalence of Anti-SARS-CoV-2 Antibodies in Poznań, Poland, after the First Wave of the COVID-19 Pandemic. Vaccines, 2021, 9(6):541

SPECIALIZED LABORATORIES AND TEAMS

LABORATORY OF SINGLE CELL ANALYSES

single cell RNA-Seq | flow cytometry | cell sorting | high-throughput imaging

HEAD

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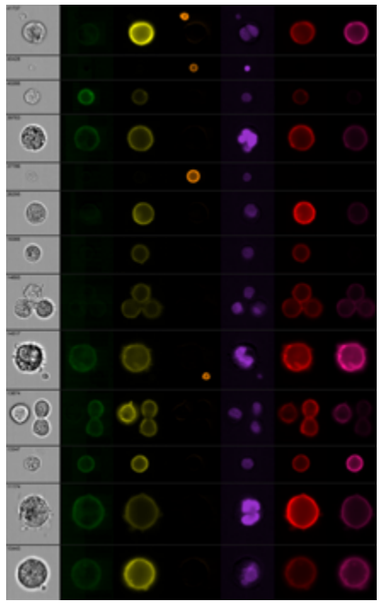
RESEARCH SCOPE

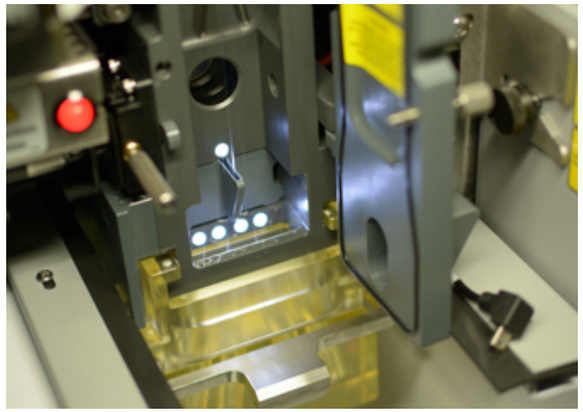
Integration of experimental and computational approaches for comprehensive characterization of diverse biological material at single-cell resolution.

We perform gene expression and chromatin accessibility profiling, as well as cell sorting and advanced analyses using classical and imaging flow cytometry. Our research includes the identification of heterogeneous or rare cell populations, the detection of extracellular vesicles, and the visualization of intracellular processes or interactions.

EQUIPMENT

- Chromium Controller (10x Genomics)
- Drop-Seq (Fluigent)
- Amnis ImageStreamX Mk II imaging flow cytometer (Cytek Biosciences)
- FACSAria Fusion cell sorter (Becton Dickinson)
- Guava easyCyte 12HT flow cytometer (Cytek Biosciences)
- QX200 Droplet Digital PCR system (BioRad)
- TapeStation 4150 analyzer (Agilent)
- Countess 3 FL automated cell counter (Invitrogen)
- epMotion 5073t liquid handler (Eppendorf)





SERVICE OFFER

- Designing and performing analyses using classical and imaging flow cytometry
- Extended analysis of flow cytometry data (including machine learning approaches for image data)
- Cell sorting
- Preparation of libraries for single-cell RNA/ATAC-Seq
- Single-cell RNA/ATAC-Seq data analysis
- Comprehensive consulting on the single-cell-targeted studies

SELECTED PUBLICATIONS

Bartelt LC et al. Antibody-assisted selective isolation of Purkinje cell nuclei from mouse cerebellar tissue. Cell Rep Methods 2024; 4 (7):100816

Mieloch A et al. Biomimetic virus-like particles with magnetic core. From bioactivity to an immunodiagnostic tool. Chemical Engineering Journal 2024; 485:149714

Stolarek I et al. Dimensionality reduction by UMAP for visualizing and aiding in classification of imaging flow cytometry data. iScience 2022; 25(10):105142

Strybel U et al. A. Molecular Composition of Serum Exosomes Could Discriminate Rectal Cancer Patients with Different Responses to Neoadjuvant Radiotherapy. Cancers (Basel) 2022; 14(4)

LABORATORY OF SUBCELLULAR STRUCTURE ANALYSES

properties of small compounds | gene expression | cellular respiration and glycolysis | microscopic and flow cytometry visualisation of cells

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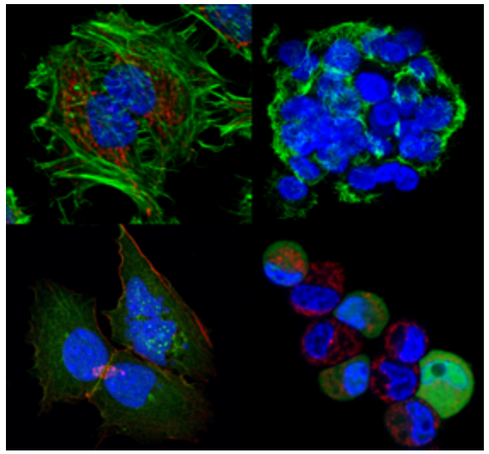

RESEARCH SCOPE

The expertise to analyze the biological properties of small molecular compounds in animal and cellular models.

The equipment available in the laboratory facilitates analyses related to cell cycle, cell death induction (e.g., autophagy, apoptosis, necrosis), oxidative stress and cellular respiration, methylation level, gene expression level, and real-time cell migration and proliferation monitoring.

Our scientific activity focuses on nucleic acid derivatives' anticancer and antiaging properties. We demonstrated that kinetin riboside induces cell death, leading to autophagy, apoptosis, and necrosis through oxidative stress activation. We indicated that cytosine derivatives reveal antioxidative, antiaging, and antiapoptotic properties in cells and eukaryotic model organisms, such as budding yeasts, planarians, and mice. The investigated compound reduces the number of senescent cells, decreases the level of oxidative stress markers and DNA and lipid damage, and stimulates mitochondrial activity. Using bioprinting technology, we established a 3D hepatocellular carcinoma model to analyze the therapeutic properties of small compounds.

EQUIPMENT

- Confocal Microscope TCS SP5 with lasers: white (470-670 nm, 1 nm accuracy), 405 nm, argon (458 nm, 476 nm, 488 nm, 496 nm, 514 nm)
- Flow cytometer FACSCalibur with green (488 nm) and red laser (635 nm)
- Thermocycler LightCycler 480 II
- xCELLigence RTCA system
- Seahorse XFp analyzer
- Oxygraph+ system

SERVICE OFFER

Confocal microscopy:
- visualization of intravital and fixed preparations (environmental chamber providing optimal culturing conditions)
- 2D and 3D analysis,
- fluorescence intensity analysis, FRET, FRAP assays
- colocalization of fluorophores

Flow cytometry:
- cell cycle analysis
- cell viability (apoptosis, necrosis)
- immunodetection of cellular antigens
- oxidative stress

Termocykler LightCycler 480 II:
- real-time PCR with fluorescent probes
- analysis of point mutations (HRM)
- analysis of methylation and genotyping

System xCELLigence:
- real-time analysis of cell migration and proliferation

Oxygraph + system:
- Oxygen uptake analysis in organisms (e.g. *C. elegans*, *S. cerevisiae*), cells and organelles (e.g. chloroplasts, mitochondria)

Seahorse XFp analyzer:
- Oxygen consumption rate (OCR) and extracellular acidification rate (ECAR) measurements in mammalian cells
- Analysis of the ATP production rate

High performance liquid chromatography (HPLC) with electrochemical detector:
- Detection of nucleic acids components and their derivatives
- Detection epigenetic modifications of nucleic acids

SELECTED PUBLICATIONS

Orlicka-Płocka M et al. Circumventing the Crabtree effect: forcing oxidative phosphorylation (OXPHOS) via galactose medium increases sensitivity of HepG2 cells to the purine derivative kinetin riboside Apoptosis 2020; 25, 835–852

Orlicka-Płocka M et al. Implications of Oxidative stress in glioblastoma multiforme following treatment with purine derivatives. Antioxidants 2021; 10:950

Pawelczak P et al. Antiaging Effect of 4-N-Furfurylcytosine in Yeast Model Manifests through Enhancement of Mitochondrial Activity and ROS Reduction. Antioxidants 2022; 11:850

Rykowski S et al. Carboranyl-1,8-naphthalimide intercalators induce lysosomal membrane permeabilization and ferroptosis in cancer cell lines. J. Enzyme Inhib. Med. Chem. 2023; 38:1

Rykowski S et al. Design of DNA Intercalators Based on 4-Carboranyl-1,8-Naphthalimides: Investigation of Their DNA-Binding Ability and Anticancer Activity. Int. J. Mol. Sci. 2022; 23, 4598

BIOINFORMATICS LABORATORY

metagenomics | transcriptomics | statistics | big data | NGS

HEAD

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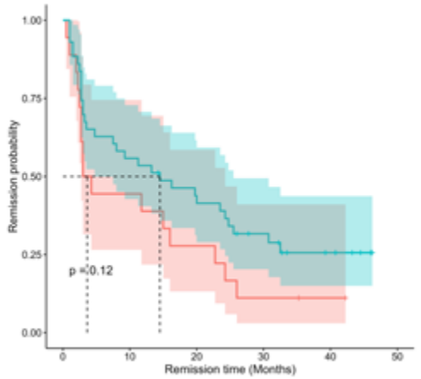
RESEARCH SCOPE

The use of advanced bioinformatics tools and methods to analyze large data sets, including various types of NGS data, e.g., whole genome, exome, RNA, and metagenomic sequencing.

In the area of genomics, we focus on the identification of genetic variants, including pathogenic ones, the analysis of genome structure, and comparative genomics. In cooperation with biologists and clinicians, we study somatic mutations in cancer and discover potential therapeutic targets. We analyze genes' expression patterns, alternative RNA isoforms, and regulatory gene networks.

Using metagenome sequencing, we examine the composition, genetic diversity, and functional potential of microbial communities inhabiting various environments, such as soil, water, air, the gastrointestinal tract, and skin.



Our goal is to understand the complex interactions between microorganisms and between microorganisms and the host.

EQUIPMENT

- High-class computer equipment that enables effective processing of large data sets and performing complex computational operations.
- Infrastructure for data visualization and communication with external servers.

SERVICE OFFER

- Genomic analysis: we offer analysis of the genomes of a variety of organisms, including humans, animals, plants, and microorganisms. We use bioinformatics approaches to identify genetic variants, analyze genome structure, run comparative analysis, and study evolutionary relationships.
- Gene expression analysis: we examine gene expression patterns using RNA sequencing data. We use bioinformatics methods to analyze differential gene expression and alternative RNA isoforms; we identify biomarkers and modified RNA ends; and we analyze regulatory networks.
- Metagenomic analysis: we analyze the microbiomes of various environments, such as soil, water, air, the gastrointestinal tract, and skin. We identify species, investigate the composition and functions of microbial communities, genetic variability, and potential interactions between microorganisms and the host.
- Clinical data analysis: we analyze clinical data, including data from the whole genome or exome sequencing of patients. We use bioinformatics tools to identify pathogenic genetic variants, analyze somatic mutations in cancer, perform differential gene expression analysis, and identify potential therapeutic targets.

SELECTED PUBLICATIONS

Szóstak N et al. Exploring correlations between gut mycobiome and lymphocytes in melanoma patients undergoing anti-PD-1 therapy. Cancer Immunol Immunother. 2025; 74(4):110

Huang Z et al. Varied prevalence and asymptomatic carriage of Cryptococcus gattii in the gut of Chinese populations. Lancet Microbe. 2025; 101086

Szóstak N et al. Gut Mycobiota Dysbiosis Is Associated with Melanoma and Response to Anti-PD-1 Therapy. Cancer Immunol Res. 2024; 12(4):427-439

Szóstak N et al. The emerging role of the gut mycobiome in liver diseases. Gut Microbes. 2023; 15(1):2211922

Szóstak N et al. Host Factors Associated with Gut Mycobiome Structure. mSystems. 2023; 8(2):e0098622

LABORATORY OF MEDICINAL CHEMISTRY

medicinal chemistry | hit to lead |
chemical synthesis | biosynthesis |
natural products | chemoinformatics

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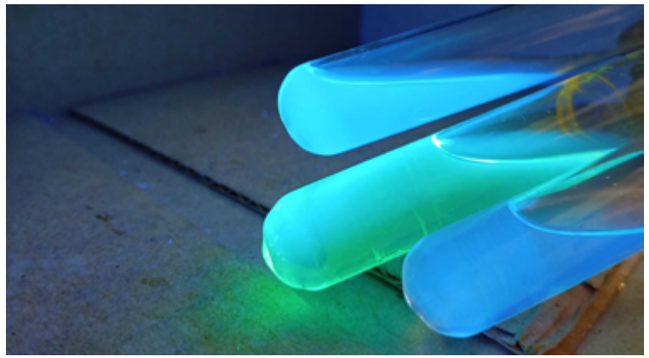
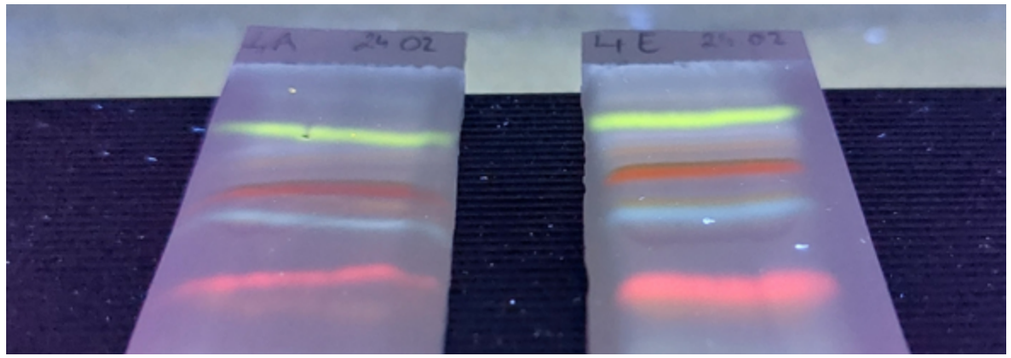


Fractions containing fluorescent probes separated using flash chromatography

RESEARCH SCOPE

Development of new methods for the creation of bioactive molecules, mainly for medicinal applications but also for agricultural or any other industrial applications. Medicinal chemistry services.

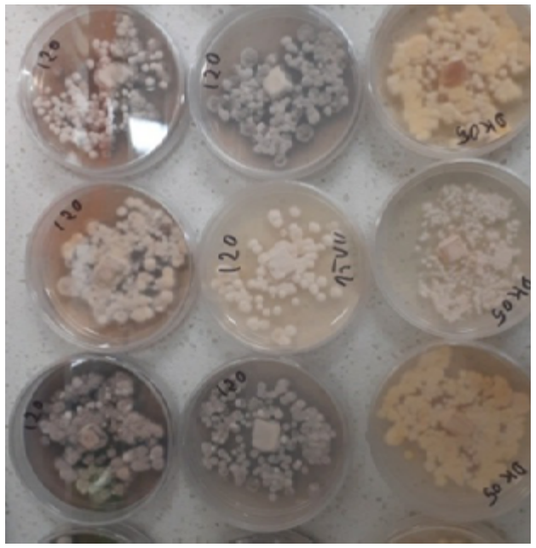
Our preliminary research on the chemical programming of fungi using Ramularia collo-cygni as a model led to the creation and optimization of a method for producing new analogues of secondary metabolites with potential biological activities. This method is now being applied to our services in medicinal chemistry. The Laboratory offers access to expertise and infrastructure for bioactive molecules optimization, including chemoinformatic design, chemical synthesis, biosynthesis, and semi-synthesis of dedicated libraries, especially for compounds difficult to synthesize using classical synthetic chemistry.



Chromatographic separation of new analogues of natural products

EQUIPMENT

- Chromatograph Flash Biotage® Selekt
- LCMS-8040 Shimadzu



Ramularia collo-cygni isolates

SERVICE OFFER

- Chemical synthesis of bioactive molecules
- “Hit to lead” – molecules optimization – chemoinformatic design, the synthesis, biosynthesis, and semi-synthesis of bioactive compounds
- Selection of already existing libraries for bioactivity tests
- Automated isolation and purification of chemical compounds - from biological material or enzymatic reactions

SELECTED PUBLICATIONS

Gawel M et al. A closer look at molecular mechanisms underlying inhibition of S-adenosyl-L-homocysteine hydrolase by transition metal cations. Chem Comm 2024; 60:11504-11507

Błaszczyk L et al. Antisense RNA C9orf72 hexanucleotide repeat associated with amyotrophic lateral sclerosis and frontotemporal dementia forms a triplex-like structure and binds small synthetic ligand. Nucleic Acids Res. 2024; 52:11

Ostrowski T* Bioactive furanyl- or thienyl-substituted nucleobases, nucleosides and their analogues. Mini-Rev. Med. Chem. 2023; 23:633-650

Dussart F and Jakubczyk D* Biosynthesis of Rubellins in Ramularia collo-cygni – Genetic Basis and Pathway Proposition. Int. J. Mol. Sci. 2022; 23:3475

LABORATORY OF GENOMICS

genomics | transcriptomics | archaeogenomics | next generation sequencing (NGS)

HEAD

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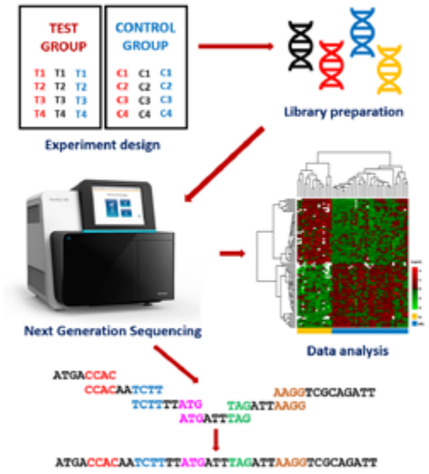

RESEARCH SCOPE

Based on long-term experience and sophisticated equipment, the Laboratory of Genomics participates in the implementation of projects related mainly to human genomics, including oncogenomics, archaeogenomics, and population genomics.

Apart from whole genomes, we study exomes, transcriptomes, microbiomes, and selected genes. We detect mutations, alternative transcripts, determine the expression levels of protein-coding genes and short regulatory RNAs. For this purpose, we use modern technologies of high-throughput sequencing, both second- and third-generation. We isolate nucleic acids and prepare libraries for sequencing using automatic pipetting stations, which allows us to increase the scale of our experiments.

We contribute to the Genomic Map of Poland, study ancient DNA and genome – transcriptome relationships in the process of neoplastic transformation. Our main research model is acute myeloid leukemia.

EQUIPMENT

- High-throughput sequencers NovaSeq 6000, NovaSeq X and NextSeq 550 (Illumina)
- Sequencer for long DNA reads with the use of SMRT technology - Sequel IIe (Pacific Biosciences)
- Two automated workstations Biomek i5 (Beckman Coulter)
- Quantitative emulsion PCR system - QX200 Droplet Digital PCR System (BioRad)
- Rotor-Gene Q real-time PCR cycler (Qiagen)
- 2100 Bioanalyzer (Agilent)
- Bioruptor NextGen sonicator (Diagenode)

SERVICE OFFER

The Laboratory of Genomics offers high-throughput DNA sequencing using two types of technologies, based on short (Illumina platform) and long reads (PacBio platform). We implement projects both in scientific cooperation and in the form of services. Our offer includes:

- whole genome sequencing on the Illumina platform (2x150 bp, minimum 30x coverage)
- transcriptome sequencing on the Illumina platform (total RNA, mRNA, ribodepleted RNA, short non-coding RNA)
- whole genome and transcriptome sequencing on the Pac-Bio platform (HiFi reads, up to 25,000 bp, precision >99.9%)
- planning and estimating the cost of a high-throughput sequencing experiment
- automatic isolation of DNA and RNA from the entrusted material
- quality assessment of the material and library preparation
- analysis of results to the extent agreed with the customer
- verification of the obtained results using quantitative PCR.

SELECTED PUBLICATIONS

Mirska B et al. The landscape of the COVID-19 pandemic in Poland emerging from epidemiological and genomic data. Sci Rep. 2024; 14:14416

Stolarek I et al. Genetic history of East-Central Europe in the first millennium CE. Genome Biol. 2023; 24:173

Szóstak N et al. The standardisation of the approach to metagenomic human gut analysis: from sample collection to microbiome profiling. Sci Rep. 2022; 12:8470.

Handschuh L et al. Transcript-Level Dysregulation of BCL2 Family Genes in Acute Myeloblastic Leukemia. Cancers 2021; 13:3175

Handschuh L. Not Only Mutations Matter: Molecular Picture of Acute Myeloid Leukemia Emerging from Transcriptome Studies. J Oncol. 2019; 2019:7239206

Handschuh L et al. NPM1 alternative transcripts are upregulated in acute myeloid and lymphoblastic leukemia and their expression level affects patient outcome. J Transl Med. 2018; 16:232

SPECIALIZED LABORATORIES

CELL AND TISSUE CULTURE LABORATORY

cell cultures | tissue cultures | preclinical disease models | bioimaging

HEAD

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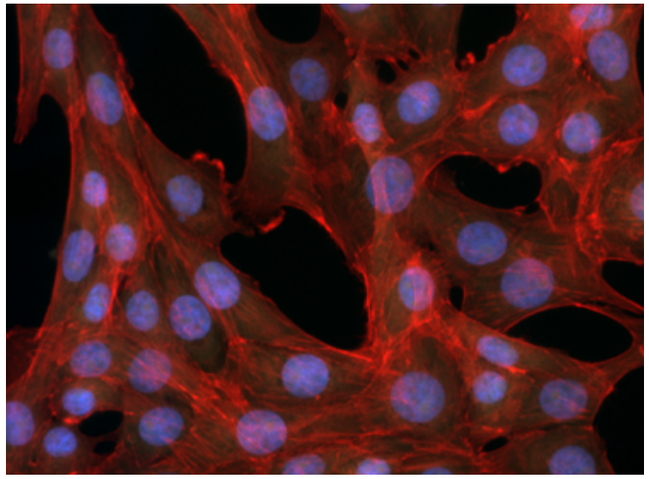


Human cells visible under a fluorescence microscope.
Credit: CTCL IBCH PAS

RESEARCH SCOPE

The application of 2D and 3D cell cultures to study the molecular and cellular foundations of developmental, physiological, and pathological processes.

The Laboratory supports both independent experimentation and on-demand research services. We offer state-of-the-art infrastructure and technical expertise for working with animal cells, including human and insect cell lines. Our facility includes specialized cell culture rooms that meet Biosafety Level 2 (BSL-2) standards, with designated areas for working with viruses and viral vectors. Additionally, we provide access to a broad collection of cell lines.

EQUIPMENT

Cell culture:

- nine independent workstations meeting BSL-2 standards (fully equipped laminar flow cabinets by Alchem, Holten, Alpina), including four stations for work with viruses
- CO2 and CO2/O2 incubators (Memmert, Thermo Scientific, Binder)
- CO2-free incubators dedicated to insect cell cultures
- Orbital shakers for suspension cell culture

Preparation of biological material:

- Lonza 4D-Nucleofector X-Unit electroporation system
- Low- and high-speed table centrifuges by Eppendorf (5702R, 5810R)
- Beckman Coulter Optima XPN-80 ultracentrifuge
- Beckman Coulter Avanti JXN-26 high-speed centrifuge
- Thermo Scientific CryoStar NX70 cryostat

Cell and nanoparticle analysis:

- Automatic cell counters: Bio-Rad TC20, Invitrogen Countess 3 FL
- Leica DM IL LED FL fluorescence microscope
- Nikon Ti 2e inverted microscope with Crest X-Light confocal system, modules for STED, FLIM, TIRF, electrophysiology (patch-clamp) analysis, and micro-patterning (Alveole PRIMO)
- Optical microscopes with phase contrast: Nikon Eclipse Ts2, Leica DM IL LED
- Malvern Panalytical NS300 nanoparticle analyzer

Biobanking:

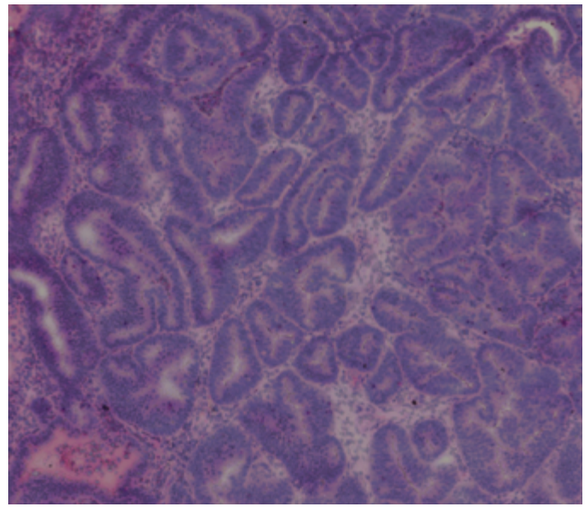
- Dewars for long-term sample storage in liquid nitrogen, -80°C freezers

Sterilization:

- Laboratory washers, dryers, and steam autoclaves

SERVICE OFFER

- Culturing primary and established cell lines
- Derivation of induced pluripotent stem cells from clinical material
- Differentiation and reprogramming of stem cells
- Morphology, electrophysiology, proliferation, adhesion, migration, and cell viability analysis
- Cytotoxicity testing
- Mycoplasma testing
- Biobanking of cell lines
- Thermal sterilization of culture media, buffers, glassware, and laboratory materials
- Support in preparing research funding applications involving *in vitro* models



Histological section of ovarian cancer.
Credit: CTCL IBCH PAS

LABORATORY OF PLANT BREEDING

cell cultures | tissue cultures | plant breeding | plant transformation

HEAD

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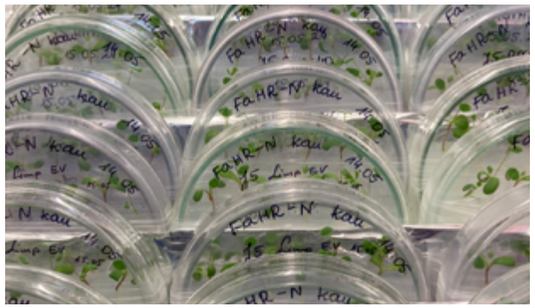
RESEARCH SCOPE

The laboratory focuses on plant cell and tissue culture, plant breeding under strictly controlled conditions, and the optimization of methods for producing transgenic plants.

The laboratory provides specialized equipment and conditions for performing a wide range of experiments on *in vitro* and *in vivo* plant material. The specialized infrastructure allows for precise control of temperature, humidity, and lighting of the cultivated plants and cultures. The laboratory employs number of methods for transforming plant cells while ensuring safe handling of transgenic material in compliance with BSL2 standards. The staff at PHR, based on their knowledge and experience, provide a support in optimizing cultivation conditions for specific plant species and minimizing contamination in phytotron cultures and *in vitro* cultures.

EQUIPMENT

- Laminar flow hoods (Alpina)
- Automated system for sterilization and dispension of culture media, Mediaclave10 (INTEGRA Biosciences AG)
- Leica M205 FA fluorescence microscope. The microscope is equipped with a Leica DFC450C camera and GFP LP filters (excitation filter: 480/40 nm; barrier filter: 510/∞ nm), DSR ET filters (excitation filter: 545/30 nm; barrier filter: 620/60 nm).
- Analytical balance with antistatic ionizer, Cubis MCA125P-2S00-I (Sartorius).
- Biolistic cell transfection system PDS-1000/He Biolistic System (Bio-Rad).
- Habitat Cell SW5 bioreactor (IKA Poland).
- Innova 42 and Innova 44 incubators (New Brunswick Scientific).
- Carbon dioxide-controlled atmosphere incubator (Memmert).
- Plant tissue culture chamber complex, Percival-type climatic chambers, and phytotron complex.



SERVICE OFFER

- Plant breeding, including transgenic plants, for phenotypic analysis and seed propagation
- Plant transformation employing vector-based methods using Agrobacterium
- Regeneration, selection, and evaluation of the transgenicity of transformants
- Transformation of suspension cultures of *Nicotiana tabacum* BY2 callus cells, selection, identification, and propagation of obtained transgenic lines
- Preparation of sterile liquid and solid media for *in vitro* plant cultivation

SELECTED PUBLICATIONS

Pakuła K et al. Restriction of access to the central cavity is a major contributor to substrate selectivity in plant ABCG transporters. Cellular and Molecular Life Sciences 2023; 80:105

Czerniawski P et al. Loss of MYB34 transcription factor supports the backward evolution of indole glucosinolate biosynthesis in a subclade of the Camelineae tribe and releases the feedback loop in this pathway in Arabidopsis. Plant and Cell Physiology 2023; 80:93

Pawela A et al. MtABCG20 is an ABA exporter influencing root morphology and seed germination of Medicago truncatula. The Plant Journal 2019; 98:511-523

Piślewska-Bednarek M et al. Glutathione transferase U13 functions in pathogen-triggered glucosinolate metabolism. Plant Physiol. 2018; 176(1):538-551

SPECIALIZED LABORATORIES

PROTEIN ENGINEERING AND BIOPHYSICS LABORATORY

recombinant protein | interprotein interactions | enzymatic kinetics | ligand | affinity

HEAD

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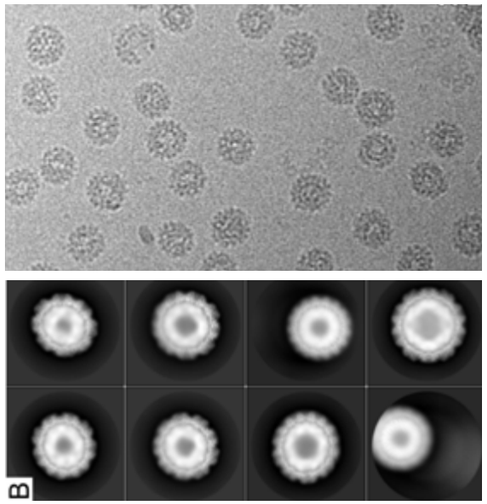
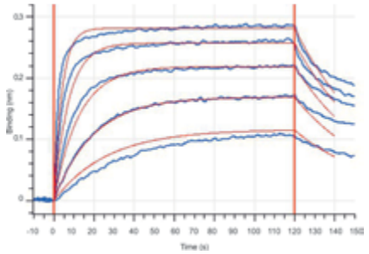


BMV-derived VLPs - cryoEM picture

RESEARCH SCOPE

We offer equipment and provide expertise in terms of the preparation of bacterial expression vectors, the production of recombinant proteins, and their purification, as well as the evaluation of the quality of protein preparations intended for functional and structural research.

We have experience and equipment enabling the physicochemical characteristics of interactions between proteins and other macromolecules. Our measurement methods allow not only to assess affinity and measure constants of association and dissociation but also to determine the number of ligand binding sites or thermodynamic parameters of binding such as enthalpy or entropy, as well as enzymatic kinetics studies.



MST binding curve

Our scientific interests include interactions occurring at the molecular level between Borrelia spirochetes and their vectors and hosts, the process of self-assembly of virions and virus-like particles and their use as RNA carriers, as well as studies of the interactions and enzymatic kinetics of proteins.

SELECTED PUBLICATIONS

Ruszkowski M et al. Cryo-EM reconstructions of BMV-derived virus-like particles reveal assembly defects in the icosahedral lattice structure. Nanoscale 2022; 14: 3224

Loch J I et al. Crystal structures of the elusive Rhizobium etli l-asparaginase reveal a peculiar active site. Nat. Comm. 2021; 12: 6717

Witek W et al. Structural and mechanistic insights into the bifunctional HISN2 enzyme catalyzing the second and third steps of histidine biosynthesis in plants. Sci. Rep. 2021; 11: 9647

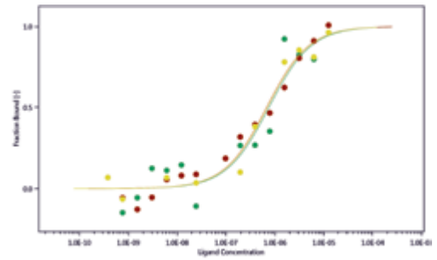
Bierwagen P et al. Strong interactions between Salp15 homologues from the tick I. ricinus and distinct types of the outer surface OspC protein from Borrelia. Ticks Tick Borne Dis. 2021; 12: 101630

Bierwagen P et al. Borrelia outer surface protein C is capable of human fibrinogen binding FEBS J. 2019; 286: 2415-2428

Sliwiak J et al. PR-10 proteins as potential mediators of melatonin-cytokinin crosstalk in plants: crystallographic studies of LIPR-10.2B isoform from yellow lupine. FEBS J. 2018; 285: 1907-1922

EQUIPMENT

- Incubators, sonicators, centrifuges,
- FPLC system ACTA Prime plus GE with columns,
- Zetasizer μV Malvern analyzer for DLS and SLS measurements,
- Microcal iTC200 and Microcal PEAQ-ITC Malvern calorimeters for ITC,
- Monolith NT.115 Nanotemper system for MST,
- Octet K2 ForteBio system for BLI,
- Agilent 8453 spectrometer for concentration and kinetics measurements,
- ARI Gryphon crystallization robot,
- Rigaku XtaLAB Synergy-R diffractometer



Real time interaction monitoring using BLI

SERVICE OFFER

- Protein production in the bacterial system and purification using chromatographic methods
- Dynamic and static light scattering measurements (DLS and SLS) in order to assess molecular mass and hydrodynamic diameter of macromolecules
- Isothermal titration calorimetry (ITC), microscale thermophoresis (MST) and biolayer interferometry (BLI) measurements for assessing the parameters of ligand binding and enzymatic parameters
- X-ray diffraction measurements for crystal quality testing and diffraction pattern recording

LABORATORY OF INVERTEBRATE MODEL ORGANISMS

Caenorhabditis elegans | *Saccharomyces cerevisiae* | aging | short noncoding RNAs | microinjection

HEAD

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Nematodes (*C. elegans*) observed under a stereoscope

RESEARCH SCOPE

Identification and characterization of tRNA-derived short non-coding RNAs (tRFs) during aging in the model organism *Caenorhabditis elegans.*

The laboratory conducts research using model invertebrate organisms, such as nematodes (*Caenorhabditis elegans*) and yeast (*Saccharomyces cerevisiae*). It has a rich collection of *C. elegans* strains, including mutants, that can be used in functional studies. The laboratory also has the "Ahringer C. elegans RNAi feeding library" and "ORFeome-Based RNAi" libraries, which enable RNAi analysis of 94% of *C. elegans* genes. Equipment such as Mediaclave 10 and MediaJet vario (Integra) enable the preparation of sterile media and pouring them into Petri dishes, in the amount of over a thousand per week. The Axio Vert.A1 microscope with an installed microinjection kit (InjectMan®4 and FemtoJet®4i micromanipulator, Eppendorf) allows us to perform microinjections, among others, to the gonads of *C. elegans.* The infrastructure available in the Laboratory (including stereoscopes, microscopes, and incubators) provides the opportunity to conduct research on both *C. elegans* and *S. cerevisiae*.

The scientific interests of the Laboratory include tRF molecules, their role in the aging process, and genes whose expression is disturbed as a result of tRF activity.

EQUIPMENT

- Mediaclave 10 and MediaJet vario (Integra), with sets for Ø 35 mm, 60 mm, 90 mm Petri plates;
- PC-100 microneedle puller (Narishige);
- Axio Vert.A1 microscope (Zeiss), with the Eppendorf microinjection set mounted: the InjectMan®4 micromanipulator with dynamic motion control and the programmable FemtoJet®4i micro diaphragm with integrated pressure supply;
- Nicon SMZ25 fluorescence stereomicroscope with FHD camera (HDMI16MDPXII) – DeltaPix for intravital observations;
- Leica stereomicroscopes and Nikon binoculars;
- Tissue Lyser (Eppendorf) medium and high-throughput low-temperature grinding homogenizer;
- Victor Nivo plate reader (detection modes: Abs, Lum, FI, FP, TRF, and Alpha, gas dispenser and controller, time-resolved fluorescence).

SERVICE OFFER

- Nutrient media sterilization (from 1 l to 10 l) and Petri plates pouring (Ø 35 mm, 60 mm, 90 mm), 330 plates per hour;
- Microneedle preparation;
- Microinjections (possibility to use with *C. elegans*, cell nuclei and cytoplasm of adherent cells, pronucleuses of fertilized mouse oocytes, *Xenopus laevis* oocytes, fish embryos in early development phases);
- Survival analyses of *C. elegans* and *S. cerevisiae* (e.g. under the influence of low-molecular-weight compounds);
- Gene expression profiling using PCR and real-time PCR quantitative and qualitative analysis of nucleic acids;
- Detection of small quantities of short non-coding RNAs.

SELECTED PUBLICATIONS

Bakowska-Zywicka K, Rzepczak A, Plawgo K, Tyczewska A (2025) tRNA-Derived Fragments in Age-Related Diseases: A Systematic Review. WIREs RNA 16(2)

Pietras PJ et al. Saccharomyces cerevisiae recovery from various mild abiotic stresses: viability, fitness, and high resolution three-dimensional morphology imaging. Fungal Genet Biol. 2025; 103975,

Pietras PJ et al. Dynamic protein composition of Saccharomyces cerevisiae ribosomes in response to multiple stress conditions reflects alterations in translation activity. Int J Biol Macromol 268(Pt 2):132004

Tyczewska A et al. The emerging roles of tRNAs and tRNA-derived fragments during aging: Lessons from studies on model organisms. Ageing Research Reviews 2023; 101863

Aygün I et al. A germline-targeted genetic screen for xrn-2 suppressors identifies a novel gene C34C12.2 in *Caenorhabditis elegans*. Genet Mol Biol. 2023; 46(2):e20220328

Sobanska D et al. The silencing of ets-4 mRNA relies on the functional cooperation between REGE-1/Regnase-1 and RLE-1/Roquin-1, Nucleic Acids Research 2022, 50: 8226-8239

Pekec T et al. Ferritin-mediated iron detoxification promotes hypothermia survival in *Caenorhabditis elegans* and murine neurons. Nature Communications 2022, 13:4883

SPECIALIZED LABORATORIES

LABORATORY OF MAMMALIAN MODEL ORGANISMS

in vivo | mice | model organisms | breeding | surgery | immunity

HEAD

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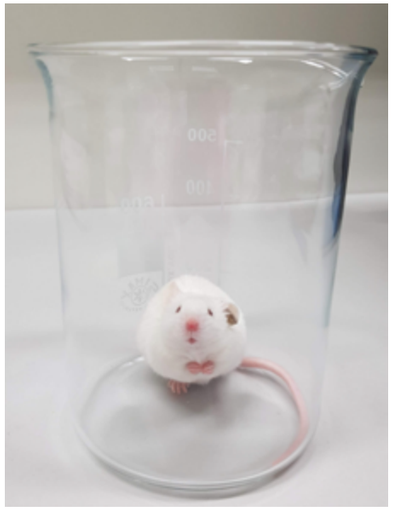


RESEARCH SCOPE

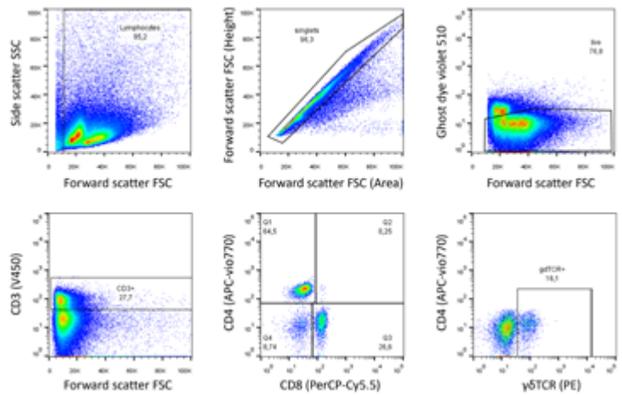
Organization and conduct of various *in vivo* experiments using mice as model organisms, from planning the budget for the grant applications through obtaining appropriate approvals to statistical analyses of the results.

The extensive experience of the Laboratory team allows for the implementation of complex experiments using various animal models, from cardiovascular diseases through pregnancy pathology and oncology to neurodegenerative diseases. In addition to performing surgeries, the team conducts and analyzes a panel of behavioral tests (assessment of psychomotor skills, cognitive disorders, etc.). Our immunology specialists are able to perform a detailed analysis of the immunophenotype (response of T lymphocytes, monocytes, cytokines, etc.) using flow cytometry and also study inflammation and macrophage polarization using real-time RT-qPCR.

We also assess cell proliferation, apoptosis, and the cell cycle. Currently, we are developing new methods in immunohistochemistry and in vitro functional tests (migration, adhesion, invasion, wound healing, and a model of the blood-brain barrier).

SERVICE OFFER

- experimental design of timelines and groups according to the 3 R's rule and ARRIVE guidelines, and preparation of an application to the Local Ethics Committee
- training in the basic techniques used in animal research
- behavioral testing
- intra-stomach administration and injections: intramuscular, intraperitoneal, subcutaneous, and intracranial
- microsurgery - intubation, uninephrectomy, acute kidney injury, implantation of osmotic pumps, xenograft inoculations
- transcardial perfusion, organ weighing and sampling, blood withdrawal, tissue collection including: en face preparation of the whole aorta, brain dissection, and bronchoalveolar lavage
- deep mouse immunophenotyping using flow cytometry
- isolation of mouse primary cells: astrocytes, neurons, microglia, embryonic fibroblasts, bone marrow macrophages, and vascular smooth muscle cells



EQUIPMENT

- Flow cytometer Novocyte with 3 lasers (Agilent)
- Individually Ventilated Cages (Tecniplast)
- Imager for chemiluminescence and fluorescence UVITEC
- Real-time imaging and functional testing system Incucyte S3 (Sartorius)
- Nucleofector (Lonza)
- Cryostat 1950 (Leica)
- Vibratome VT1200S (Leica)

SELECTED PUBLICATIONS

Surdyka M et al. CAG-targeted brain-permeable therapy tested in biallelic humanized polyQ mouse models Molecular Therapy Nucl. Acids, 2025

Latowska-Lysiak J et al. Transcriptome-wide analysis of circRNA and RBP profiles and their molecular relevance for GBM Mol Oncol. 2025

Antonczyk A et al. HAR Identification of ALEKSIN as a novel multi-IRF inhibitor of IRF- and STAT-mediated transcription in vascular inflammation and atherosclerosis Front. Pharmacol. 2025

Sztachera M et al. Interrogation of RNA-bound proteome with XRNAX illuminates molecular alterations in the mouse brain affected with dysmyelination Cell Rep. 2025

Wozna-Wysocka M*, Jazurek-Ciesiolka M*, Przybyl L*et al. Insights into RNA-mediated pathology in new mouse models of Huntington's disease FASEB J 2024

LABORATORY OF NMR

high resolution NMR spectroscopy | spectroscopy CD | spectroscopy UV-Vis

HEAD

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RESEARCH SCOPE

The Laboratory of NMR is conducting research in advanced structural studies of both small molecules and biomolecules, in particular nucleic acids, RNA, and DNA.

The research scope of the Laboratory is:

- structural problem studies
- determining the conformation of compounds of natural or synthetic origin
- intramolecular and intermolecular interaction studies
- ligand interaction studies

SERVICE OFFER

- Assessment of the nucleic acid purity based on HPLC, NMR, UV, and CD
- Application of spectroscopic techniques such as NMR, UV-VIS, CD, and ORD for structure determination of nucleic acids and study of ligand-RNA/DNA interaction
- Structure elucidation of organic compounds based on the analysis of 1D and 2D NMR spectra
- Acquisition and analysis of high-resolution NMR spectra
- Expertise in the interpretation of NMR spectra. Conformational study of natural or synthetic organic compounds
- Spectroscopic study of intra- and intermolecular interactions
- High-throughput and automated acquisition of 1D, 2D NMR spectra (for example, COSY, HSQC, HMBC, NOESY, TOCSY).

EQUIPMENT

- NMR 400 MHz (9.39 T) AVANCE II Bruker spectrometer equipped with BBFO or BBI probe
- NMR 500 MHz (11.74 T) AVANCE III Bruker spectrometer equipped with BBO or TXI probe
- NMR 700 MHz (16.44 T) AVANCE III Bruker spectrometer equipped with QCI-P (Quadruple Resonance CryoProbeTM) or BBO or TXI probe
- Spectropolarimiter circular dichroism (CD) Jasco J-815 S
- Spektrofotometr UV VIS Jasco V-650
- High Performance Liquid Chromatography system Agilent Tech 1260 Infinity

SELECTED PUBLICATIONS

Wieruszewska J et al. The 8-17 DNAzyme can operate in a single active structure regardless of metal ion cofactor. Nat. Commun. 2024; 15:4218

Lazewski D et al. Novel Short PEG Chain-Substituted Porphyrins: Synthesis, Photochemistry, and In Vitro Photodynamic Activity against Cancer Cells. International Journal of Molecular Sciences, 2022, 23, 10029

Koczorowski T et al. The Valence and Spin State Tuning of Iron(II/III) Porphyrazines with Bulky Pyrrolyl Periphery in Solution and Solid State. Molecules, 2022, 27, 7820

Gabryel-Skrodzka M et al. Coordination Chemistry of Phosphate Groups in Systems Including Copper(II) Ions, Phosphoethanolamine and Pyrimidine Nucleotides. International Journal of Molecular Sciences 2022, 23, 13718

SPECIALIZED LABORATORIES

LABORATORY OF MASS SPECTROMETRY

mass spectrometry | liquid chromatography | gas chromatography | proteomics | metabolomics

HEAD

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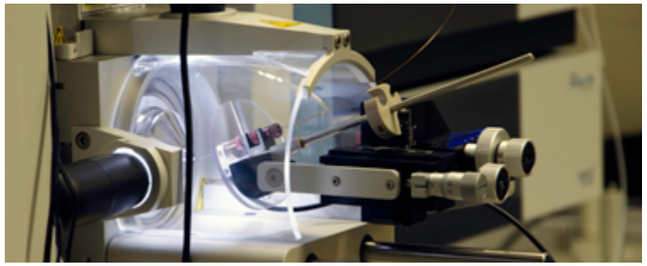

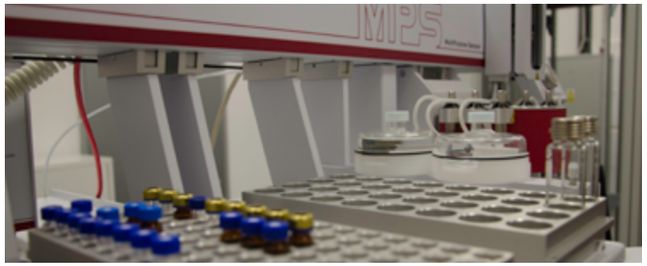

RESEARCH SCOPE

In our laboratory, we employ carefully selected and optimized research approaches based on chromatographic methods and mass spectrometry to identify and quantitatively assess a wide range of compounds isolated from biological material.

These approaches include:

- comprehensive analysis of proteins, metabolites, and lipids from any biological material (plants, tissues, body fluids, small extracellular vesicles, etc.)
- profiling, identification, targeted analysis of proteins and metabolites
- multi-omic functional analysis using bioinformatics tools

Currently pursued projects focus on the analysis of serum at various stages of human disease. We aim to understand the underlying factors contributing to the observed changes in patients with cancers such as acute myeloid leukemia, melanoma, and colorectal cancer. We conduct analyses of serum fractions, blood cells, and isolated extracellular vesicles. Additionally, we investigate in vitro-cultured cells derived from primary tumors and metastases.

EQUIPMENT

- LC-MS system – Bruker timsTOF Pro + Dionex RSLC 3000
- LC-MS system – Thermo Exploris 480 + Dionex nanoRSLC 3000 + Vanquish UPLC
- MALDI-TOF/TOF spectrometer – Bruker UltrafleXtreme
- NanoLC-MS system (ion trap) – Waters nanoAcquity + Bruker Amazon SL
- Nano/micro LC-MS system (OrbiTrap) – Thermo QExactive + Dionex nanoRSLC 3000
- GCxGC–MS (TOF) system – Leco Pegasus 4D
- GC-MS system (TripleQuad) – Thermo TSQ8000

SERVICE OFFER

- Identification of proteins using MS methods
- *De novo* analysis of peptide and protein sequences (MALDI, ISD-MALDI)
- Analysis of post-translational modifications of proteins using MS methods
- Quantitative analysis of proteins using MS methods
- Determination of monoisotopic masses of low-molecular-weight compounds using HR-MS methods
- Structural analysis of low-molecular-weight compounds using tandem mass spectrometry
- Quantitative analysis of low-molecular-weight compounds using MS methods
- Analysis of volatile compounds using GC-MSn methods
- Analysis of protein, metabolite, and lipid profiles using MS methods
- Targeted analysis of proteins, metabolites, and lipids using MS methods

SELECTED PUBLICATIONS

Strybel U et al. Molecular Composition of Serum Exosomes Could Discriminate Rectal Cancer Patients with Different Responses to Neoadjuvant Radiotherapy. Cancers; 14 (2022)

Pietrowska M et al. Proteomic profile of melanoma cell-derived small extracellular vesicles in patients' plasma: a potential correlate of melanoma progression. J. Extracell. VESICLES. 10 (2021)

Marczak L et al. Mass spectrometry-based lipidomics reveals differential changes in the accumulated lipid classes in chronic kidney disease. Metabolites; 11 (2021)

Kimakova K et al. Phenotyping the genus Hypericum by secondary metabolite profiling: emodin vs. skyrin, two possible key intermediates in hypericin biosynthesis. Anal. Bioanal. Chem; 410, 7689–7699 (2018)

Marczak L et al. The use of mass spectrometric techniques to differentiate isobaric and isomeric flavonoid conjugates from Axyris amaranthoides. Molecules; 21 (2016)

Wojakowska A et al. Detection of metabolites discriminating subtypes of thyroid cancer: Molecular profiling of FFPE samples using the GC/MS approach. Mol. Cell. Endocrinol.; 417, 149–157 (2015)

SPECIALIZED LABORATORIES

LABORATORY OF MOLECULAR ASSAYS AND IMAGING

bioimaging | high-throughput screening | MINFLUX | high-throughput microscopy | biochemical assays

HEAD

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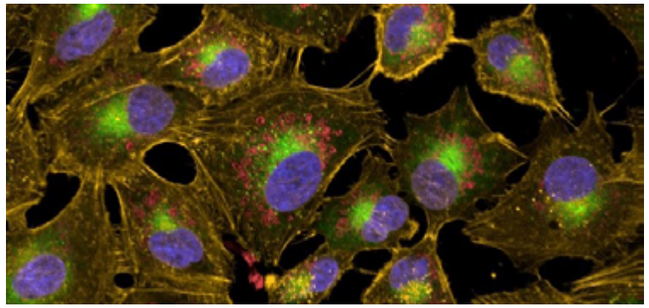


Cell painting

RESEARCH SCOPE

Developing molecular assays, performing high-throughput screening, high-throughput microscopy, ultra-high-resolution microscopy, and image analysis.

The laboratory was created as a result of the Institute's cooperation with European partners as a part of the EU-OPENSCREEN consortium and is a part of the POL-OPEN-SCREEN consortium. It collaborates with users around the world to identify biologically active molecules and deconvolve their mechanisms of action. Thanks to miniaturization, automation, and advanced scientific expertise, the laboratory can test the biological activity of hundreds of thousands of chemical compounds in a high-throughput (HTS) format.

The laboratory is also equipped with an ultra-high-resolution microscopy system combining high-resolution imaging technologies such as STED, FLIM, FCS, and Minflux. The unique MINFLUX microscope (one of several such systems in the world) allows imaging with a resolution below 2 nm.

EQUIPMENT

Detection and analysis:

- Ultra-super-resolution microscope MINFLUX/STED (Abberior)
- Opera Phenix high-throughput confocal microscope (Revvity)
- CLARIOstar Plus (BMGLabtech) and Cytation (Biotek) plate readers

Automation:

- Echo Acoustic Dispenser (Beckman Coulter)
- Multidrop combi liquid dispenser (ThermoFisher)
- Hydrospeed plate washer (Tecan)

SERVICE OFFER

Imaging services:

- Stimulation Depletion Microscopy (STED): 2D and 3D imaging, multicolor imaging
- MINFLUX (Minimal Photon Flux) microscopy: 2D and 3D, multicolor imaging, tracking
- FLIM (Fluorescence Lifetime Imaging) microscopy
- FCS microscopy (Fluorescence Correlation Spectroscopy microscopy)
- High-content multiparametric imaging assays (e.g., cell painting, Opera Phenix)
- Image analysis

Screening services:

Assay development

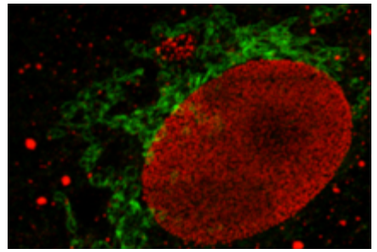
- Single and multi-parametric assays
- Miniaturization and optimization
- Automation and assay transfer
- Orthogonal assay

High-throughput screening:

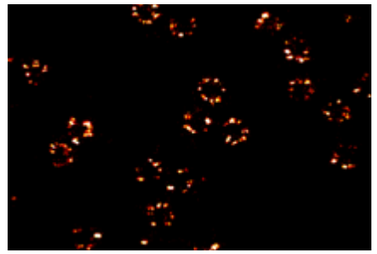
- Primary screening (1 – 100k)
- Hit validation:
- Counter or orthogonal screening
- Combinatorial screening (AI-assisted)

Assay types

- Biochemical assays (bioprofiling)
- Cell-based assays (cell painting)



STED 2 colour/2D



MINFLUX 2D

SELECTED PUBLICATIONS

Canyelles I Font F et al. Interference of metal ions on the bioluminescent signal of firefly, Renilla, and NanoLuc luciferases in high-throughput screening assays. Front. Chem. 2024; 12:1436389, doi: 10.3389/fchem.2024.1436389

Wychowaniec A et al. Wieloanalitowe, małocząsteczkowe sondy luminescencyjne do symultanicznego wykrywania kilku celów molekularnych w modelach komórkowych. Postępy Biochemii 2024; 10.18388/pb.2021_538

Karczewska N et al. Rola i wykorzystanie badań wysokoprzepustowych w poszukiwaniu związków chemicznych o działaniu terapeutycznym. Postępy Biochemii 2024; 10.18388/pb.2021_528

Insińska-Rak M et al. 5-Deazaalloxazine as photosensitizer of singlet oxygen and potential redox-sensitive agent. Photochemical and Photobiological Sciences 2023; 22:1655-1671

Golczak A et al. Tetramethylalloxazines as efficient singlet oxygen photosensitizers and potential redox-sensitive agents. Scientific Reports 2023; 13426

BIOECONOMY AND SUSTAINABLE DEVELOPMENT TEAM

bioeconomy | biotechnology | education | food security | plant genome editing | social opinion | sustainable development

HEAD

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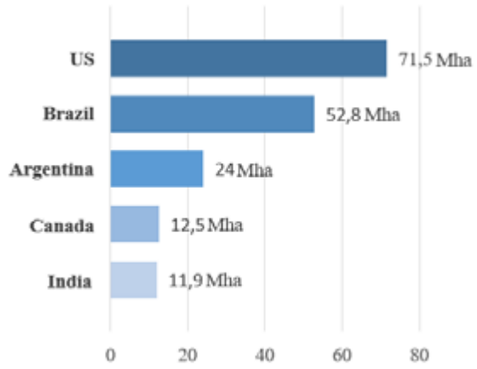


Top 5 countries that planted GM crops

RESEARCH SCOPE

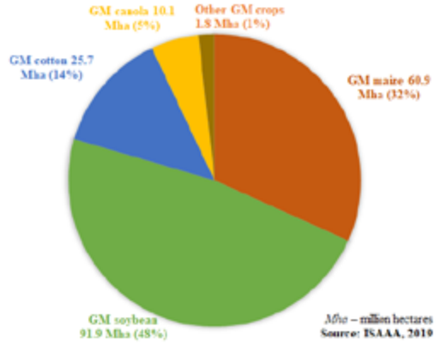
The social, economic, and legal conditions of the bioeconomy and biotechnology development in the world, especially in Poland and the European Union.

The specific objectives implemented by the Team are the following: (1) analysis and monitoring of public opinion and acceptance of biotechnology, bioeconomy, and plant gene technologies; (2) analysis of economic indicators of bioeconomy and biotechnology development, e.g., production and cultivation area of genetically modified plants worldwide; (3) monitoring of changes in legal regulations regarding plant gene editing technology in the world.
The team's research interests extend to the potential development and application of plant gene technologies in the context of food security.

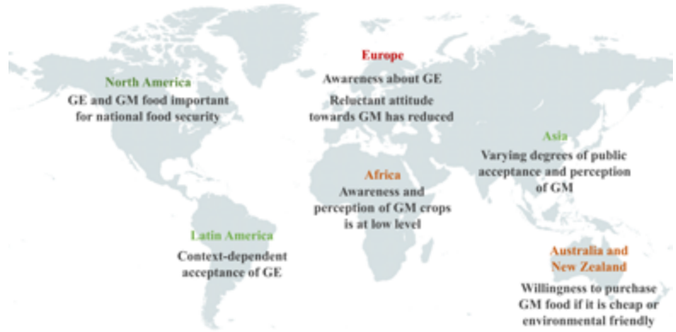
This exploration aligns with several initiatives from the European Commission, including the European Green Deal, the 'Farm to Fork' Strategy, and the United Nations' Sustainable Development Goals.

RESEARCH PROJECTS

Conditions for the development of bioeconomy from a regional perspective (NSC MINIATURA, PI: E. Woźniak-Gientka)



Area of GM crops cultivated worldwide (2019)



Public perception of plant gene technologies across different regions in the world

MAIN RESEARCH TOPICS

- Analysis of social acceptance and public opinion in relation to GMOs, genetically modified plants, new techniques of genetic engineering in the context of the legal status and development of biotechnology and bioeconomy.
- Analysis of bioeconomy development conditions in Poland and the European Union.
- Defining the role of societal education in promoting the circular economy and fostering sustainable market behaviors.
- Educating young people about the bioeconomy, raising awareness and interest in the environmental, social and economic benefits of a sustainable and circular bioeconomy (at the regional and local levels).

SELECTED PUBLICATIONS

Tyczewska A et al. Agricultural biotechnology for sustainable food security. Trends in Biotechnology 2023; 41(3):331-341,

Woźniak-Gientka E et al. Public perception of plant gene technologies worldwide in the light of food security. GM Crops & Food 2022;13(1), 218-241

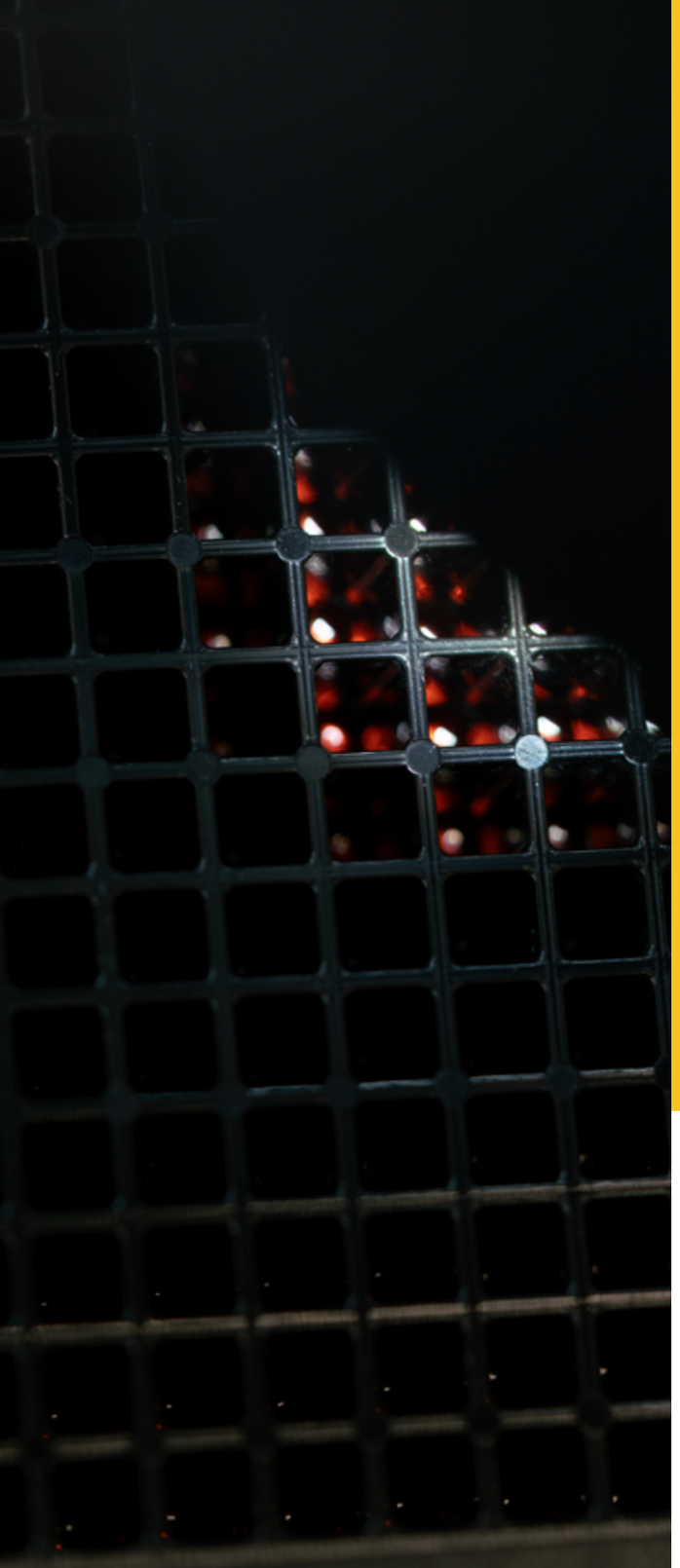
Woźniak-Gientka E et al. Public opinion on biotechnology and genetic engineering in the European Union: Polish consumer study. Biotechnologia 2022; 103 (2) C pp. 185–201

Woźniak E et al. A shift towards biotechnology: Social opinion in the EU. Trends in Biotechnology 2021; 39(3):214-218,

Wozniak E et al. Bioeconomy development factors in the European Union and Poland. New Biotechnology 2021; 60:2-8

Tyczewska A et al. Towards Food Security: Current State and Future Prospects of Agrobiotechnology. Trends in Biotechnology 2018; 36(12), 1219-1229

Woźniak E et al. Bioeconomy during the COVID-19 and perspectives for the post-pandemic world: Example from EU. EFB Bioeconomy Journal 2021; 1:100013



POZNAŃ SUPERCOMPUTING AND NETWORKING CENTER (PSNC)

POZNAŃ SUPERCOMPUTING AND NETWORKING CENTER (PSNC)

Affiliated to the Institute of Bioorganic Chemistry, Polish Academy of Sciences, the Poznan Supercomputing and Networking Center (PSNC) has been developing the information infrastructure for science since 1993. It serves as a national center for High Performance Computers and operates the national scientific network PIONIER recognized for its significant dedication to research and development in information and communication technologies and their applications. PSNC was established by the decision of the College of Rectors of the City of Poznan to coordinate the use of the metropolitan network and supercomputers in Poznan by the units represented in the College. In the following years, the activities of PSNC successfully led to the launch a pilot of the POL-34 national network, followed by developing a program to build a national network of the Polish Optical Internet as part of the PIONIER program. PSNC hosts a node of the GÉANT pan-European scientific network. Through this node, the PIONIER network and the municipal fiber-optic networks attached to it, the Polish scientific community is provided with a broadband connection to the Internet and scientific networks around the world. The PIONIER network and the computing infrastructure attached to it are an integral part of the European Research Area. PSNC is also systematically developing high performance computing services based on supercomputers, which have been ranked among the 500 most powerful supercomputers in the world in more than 20 editions of the prestigious TOP-500 list since 1995. Thanks to this, since 2008 PSNC has represented Poland in the PRACE consortium, and Polish scientists have the opportunity to use the most powerful supercomputers in Europe. Since 2022, PSNC has also offered access to a quantum computer as part of its IBM Quantum Innovation Center activities. In 2023, PSNC was awarded a EuroHPC Joint Udertaking contract to install Piast-Q, one of the first six European quantum computers in Poznan, with installation planned for mid 2025. Furthermore, in 2025 PSNC won the competition for the location for an AI Factory that will be built in 2026. PSNC is part of the EuroHPC JU's "AI Factories" initiative, with Piast-AI Factory located at PSNC aiming to advance AI research and innovation in Poland and Europe. The development of competencies and increase in the number of staff (in 2000, PSNC had more than 60 employees, in 2010 - more than 200, and in 2025 - 452), as well as modern infrastructure, have allowed successful acquisition of projects in competitions of European framework programs and national research programs. To date, PSNC has implemented more than 350 such projects, including 54 as coordinator.

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TOMASZ PARKOŁA, MSc, Eng.
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AGNIESZKA STOKŁOSA, MA
Projects Administration Department of PSNC

JOANNA URBANIAK, MA
Deputy Head of the Human Resources Department

STEERING COMMITTEE

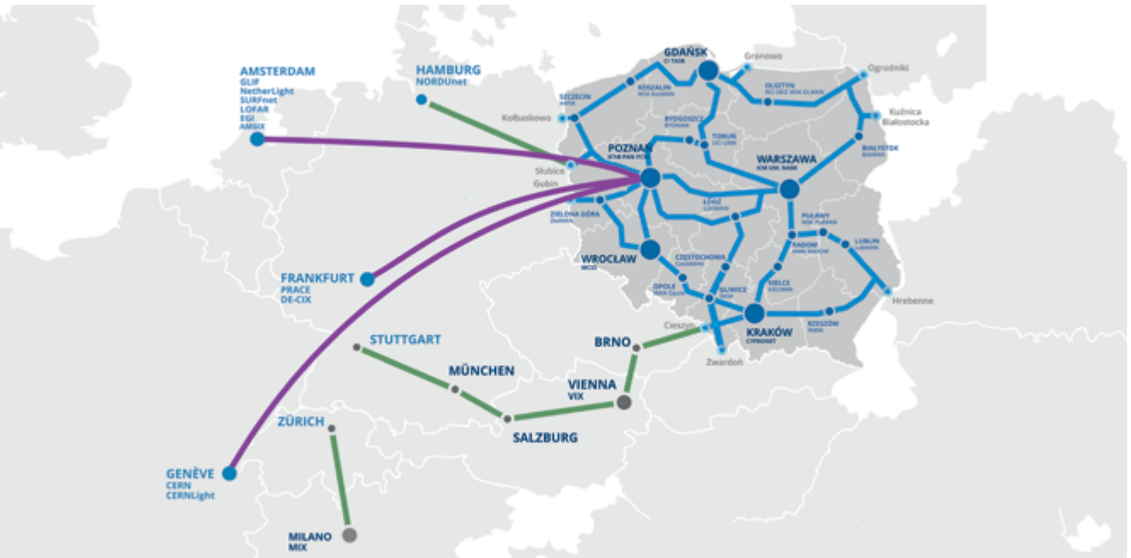
The Steering Committee assists on strategic development of PSNC, focusing on infrastructure, research and cooperation, playing a significant role in scientific development.

Prof. JAN WĘGLARZ
Chairman of the Steering Committee for PSNC Developement

MACIEJ STROIŃSKI, PhD, Eng.
Deputy Chairman of the Steering Committee for PSNC Developement

with Robert Pękal, MSc, Eng. and Urszula Grygier-Soboń, MA

STRATEGIC PROJECTS



PIONIER
POLISH OPTICAL INTERNET PIONIER

One of the key areas of the Poznan Supercomputing and Networking Center's activity is the development and maintenance of the national scientific network PIONIER – Polish Optical Internet. Currently, the network covers about 9,000 km of fiber optic lines in Poland and abroad and offers its services to the Polish scientific and research community.

Operating for over 20 years, the PIONIER fiberoptic network is now one of the most modern in the world. Its construction was possible thanks to the implementation of the Program for the Development of Information Infrastructure of Science PIONIER, prepared on the initiative and with significant contribution of PSNC. The network gathered a community of 22 Leading Units (operators of scientific metropolitan area networks and HPC supercomputing centers), forming the PIONIER Consortium in 2003. In the following years, the Consortium developed successive strategies for upgrading the information infrastructure of science ("Concept of the PIONIER2 Advanced Service Platforms Program for 20072013", "Program for the development of information infrastructure of science in Poland, within the framework of the "Europe 2020" strategy for 20142020") and implemented structural and R&D projects, developing the communication capabilities and services of the PIONIER/MANs network ecosystem.

The establishment of the program, the network and the PIONIER Consortium was preceded by building the community by network enthusiasts from MANs from the early 1990s. The cyclical POLMAN conference (1994 1999) played a major role in this. Within 20 years, the PIONIER Consortium has solidified, finding and implementing numerous challenges. Against all odds, it succeeded in building a network with multiple fiberloops and modern transmission technologies (optical DWDM systems and fast interfaces like Ethernet). The PIONIER network and MANs were at that time modified and developed through joint projects such as NewMAN and 100net. Meanwhile, the next generation PIONIERMAN ecosystem built under the PIONIERLAB project is being used. A number of "added" services have also been made available on this innovative network, resulting from the National Data Repository (1, 2 and 3), universal infrastructure for data storage and sharing, PLATON, MAN-HA and PRACE LAB, PRACE LAB2 projects, which have transformed MANs with PIONIER into a distributed service platform environment; as well as a number of projects launched in 2024, co-financed from the European Union as part of the European Funds for a Modern Economy program. In late 2024, the total length of fiber optic lines was 9,267 km, including 6,878 km in Poland and 2,389 km outside the country. The network also has fiber optic connections to the academic networks of neighboring countries: Germany (Kołbaskowo, Słubice, Gubin), the Czech Republic (Cieszyn), Slovakia (Zwardoń), Ukraine (Hrebenne), Belarus (Kuźnica Białostocka), Lithuania (Ogrodniki), and the Kaliningrad Region (Gronowo). Through a longstanding mutual exchange of fibers with telecommunications operators, the fiber optics of the PIONIER network reach Hamburg, where they have direct points of contact with the Scandinavian networks NORDUnet and SURFnet (Dutch national research and academic network). Until recently, own transmission systems on shared fibers from exchanges with operators provided connectivity to Frankfurt am Main and Geneva (CERN). Currently, the PIONIER foreign communications network is under reconstruction. The links are gradually being replaced by bandwidth acquired from the GEANT network.

A DWDM/Ethernet n x 400/100 Gbps transmission network was launched on this topological structure. Since its very beginning, the PIONIER network has been and continues to be of great importance for the entire Polish scientific community, especially for those research disciplines in which progress depends on access to highspeed computer networks and resources linked to these networks. At the same time, the Polish einfrastructure, based on the PIONIER network, was an integral part of the European Research Area (ERA). The PIONIER environment made a very large contribution to the development of this infrastructure, participating in a very large number of European projects related to the development of this infrastructure at all levels of its architecture, i.e. network, computing and scientific data. Currently, the PIONIER network ecosystem is developing towards terabit bandwidths, offering services to support digital innovation. This is an important element of open science, developed in the European Union under the EOSC (European Open Science Cloud) initiative, allowing the Polish scientific community to develop at a global level and exchange knowledge internationally. Through direct connections to the European GÉANT network and contact with the most important traffic exchange points in Europe, the PIONIER network provides connectivity to European scientific networks (NRENs), as well as providing the Polish scientific community with access to the global Internet.

Supercomputer PROXIMA

HPC AND DATA INFRASTRUCTURE

PSNC has two data centers: main and backup, providing production cloud and HPC infrastructures along with high reliability services for science, economy and administration. The PSNC's data centers of more than 2,000 m2 in geographically remote locations allow the provision of cloud services with increased reliability, thanks to duplicated cooling, protected power, unprotected power and independent power supply systems.

The resources of PSNC are used by the scientific community from all over Poland: not just Poznan, but also centers from Torun, Wroclaw, Bydgoszcz, Krakow, Katowice, Warsaw, and Gdansk. A significant part of the users are also scientists from abroad, using the resources of PSNC as part of the implementation of obligations arising from agreements on the exchange of computing power PRACE (Partnership for Advanced Computing in Europe), in the field of nuclear physics - WLCG (Worldwide LHC Grid Computing), LOFAR (Low-Frequency Array for Radio Astronomy), as well as scientists associated with numerous ESFRI (European Strategy Forum for Research Infrastructures) international projects. PSNC actively supports the international consortium Eurofusion (research on alternative fusion energy sources).

The recent years have also brought significant expansion of the National Data Repository infrastructure - a universal infrastructure for storing and sharing data and efficiently processing large volumes of data in HPC, BigData and artificial intelligence models. This is a national project coordinated by PSNC, which aims to build a national data repository with services for science and economy. In the area of science, NDR supports the guidelines of open science (EOSC - European Open Science Cloud), giving the scientific community the opportunity to store data according to the postulates of EOSC, protection and reliability of stored data. Moreover, PSNC's support in the area of open science and data continues with another KM-D4EOSC initiative, where we have expanded the consortium to include additional units, creating 11 distributed centers in Poland's largest academic centers. Other projects in the area of key research infrastructures in Poland are PRACE-LAB and PRACE-LAB2 (Partnership for Advanced Computing in Europe), which in turn provide computing services for the scientific community with user support in the area of artificial intelligence (AI), big data analytics or typical conventional or cloud computing used by the scientific community in Poland and Europe.. Both of the aforementioned NDR and PRACE-LAB2 environments make their services available in the form of federated 9 NDC and MAN centers. It is worth mentioning that for the last few years the 3 computing systems of PRACE-LAB have been continuously ranked on two lists: TOP500 (the world's fastest computers) and IO500 (the most effective services for data). It should be added that PRACE-LAB's 3 computing systems have been continuously ranked for 2 years in the TOP500 list of the world's fastest computers.

Data Storage Infrastructure (NDS3)

The data and computing infrastructures of the PSNC have also been made available for economic purposes, in accordance with the guidelines of the European Commission granting structural funds for their construction. To meet these requirements, the PSNC has reorganized its structures and organization of services, obtaining ISO9001 and ISO27001 certification in the areas of information security and service quality management. Since 2024, we have been providing EOSC services to the European Commission by delivering the EOSC EU NODE European node, the first in the European federation to support open science.

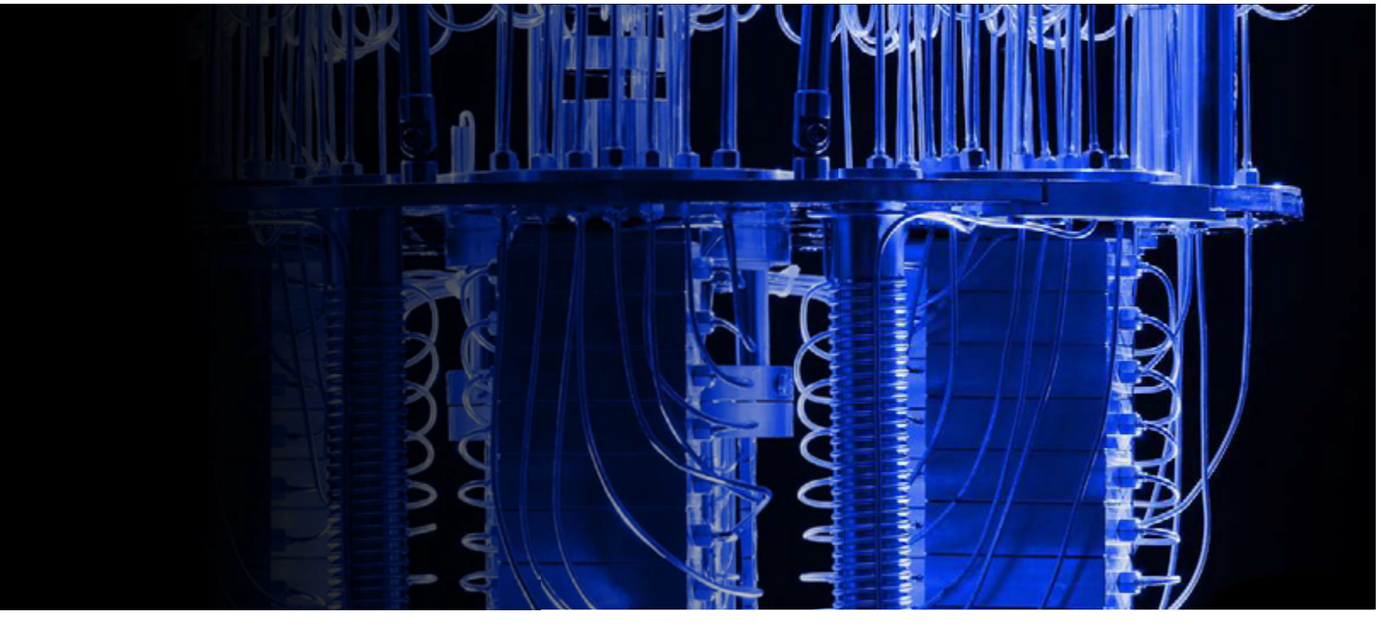
POZNAN METROPOLITAN NETWORK

Poznan Supercomputing and Networking Center is the operator of the POZMAN Metropolitan Computer Network. As part of this activity, PSNC provides access to the Internet and many services dedicated to education and science.

The POZMAN network currently boasts about 330 km of fiberoptic cables in Poznan and the immediate vicinity (Plewiska, Borówiec, Kórnik, Murowana Goślina, Zielonka). Universities and research institutes from Poznan and surrounding towns are connected to the network, and thanks to the POZNAN METROPOLITAN NETWORK use of PIONIER network regional connections also those from Piła, Konin, Leszno and Gniezno. Government and local government administration units, schools, cultural institutions and enterprises are also connected to the network. Thanks to the closed ring topology, most of the connections of the POZMAN networks have fiber optic backup links enabling network operation in case of damage or failure of one of the links. The POZMAN network operates in MPLS technology based on PSNC owned fiber optics, which provides network users with virtually unlimited trans mission capabilities. The speed of users' access to the network is currently 10 Gbit/s, compared to 10 Mbit/s in the initial period of network operation. The most important backbone links of the POZMAN network operate at the speed of 400Gbit/s.

POZMAN metropolitan network

Along with Internet access, the POZMAN network also offers access to high performance computing and data archiving systems as well as the European scientific network GÉANT, and offers a number of services dedicated to the scientific community that have been produced by PSNC or result from cooperation between European scientific networks. These include eduroam and federated login services. An example of a state-of-the-art service available to all users of the POZMAN network is the ability to use high accuracy time and frequency signals. Through the POZMAN network, users have access to PIONIER services including those related to the network layer (as dedicated fiber, dedicated lambdas, VPN service);identity and security (services: PIONIER.Id, PIONIER CERT, eduGAIN); cloud and data (campus services, archiving, digital libraries); POZMAN metropolitan network Video services (Pionier.TV, Videoconferencing, eduMeet) or support services (HELPDesk, perfSONAR, PERT). Moreover, due to the completion of research infrastructure construction projects from the Polish Research Infrastructure Map, PSNC users have gained access to the services and laboratories of the following infrastructures: PIONIER-LAB, PRACE LAB, NLPQT, PRACE-LAB2, NEBI, DARIAH-PL, PL-5G, National Data Repository, EuroHPC PL, and MOSAIC.



QUANTUM COMPUTERS AND QUANTUM COMMUNICATION INFRASTRUCTURE

For several years now, we have witnessed an almost unimaginable race in the development of quantum technologies, with the world's strongest economies behind them. Many practical solutions using quantum technologies, such as quantum communications, have been successfully implemented in the national PIONIER infrastructure. Continuous and intensive work is underway to make the next technological breakthrough, which will significantly impact the further development of not only computational science but also computer science, physics, chemistry, biology and medicine. However, it is worth summarizing the rapid growth of quantum technologies and their PSNC applications over the past few years.

Within the PIONIER consortium, research and implementation work in the field of quantum communication technologies has been carried out since 2018, the results of which are implemented in European projects within the framework of cooperation with GÉANT and the leading European project OpenQKD in development of quantum key distribution technology. In addition, PSNC has been actively involved in several national projects for several years, including the NLPQT project for the construction of the National Laboratory of Photonics and Quantum Technologies within the framework of the Polish Research Infrastructure Roadmap and the development of quantum technology applications for national security and defence.

On the initiative of the Ministry of Digitalisation, the first Quantum Computing Hub in Central Europe - IBM Quantum - was established in PSNC in February 2022. As a result, it was possible to launch a nationwide platform allowing scientific users to remotely access the resources of IBM Quantum computers, where the latest and most advanced solutions with the number of qubits exceeding 120 are located. PSNC teams support scientific users and participate in research, development, and implementation work to develop new quantum methods and algorithms for solving computationally tricky and complex problems in combinatorics, cryptography, artificial intelligence, and quantum chemistry.

PSNC has recently coordinated the PIONIER-Q Consortium within the European EuroQCI initiative and further developed the national quantum communications infrastructure linking all High-Performance Computing centres in Poland. PSNC has also engaged in developing photonic-based quantum computer technology and will launch a unique distributed optical computer architecture.

Additionally, PSNC, as a leader in the EuroQCS-Poland Consortium, has been selected in the EuroHPC JU competition for one of the first six European quantum computers. Thanks to cooperation with leading supercomputing centres in Europe and the involvement of many research and development institutions, PSNC will create the first European hybrid supercomputer infrastructure combining the advantages of classical and quantum computing using advanced trapped ion technology by 2025.

PSNC successfully installed the first two photonic quantum computers in Poland in 2023. Additionally, PSNC has organized various forms of support for researchers interested in using quantum technologies, including lectures, hackathons, training, consultations and workshops, and leading the Workshop on Quantum Computing and Communication at Parallel Processing & Applied Mathematics and the QL Future hackathon with business partners.

PSNC DIVISIONS

NETWORK TECHNOLOGIES DIVISION

optical networks | new media | quantum key distribution | network automation

HEAD

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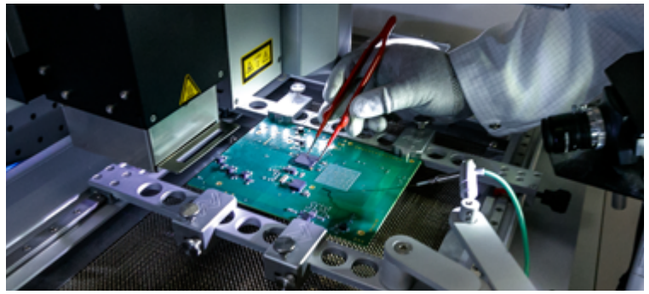

Electronic circuit lab (Open network equipment lab)

RESEARCH AND DEVELOPMENT SCOPE

The Division's tasks include conducting work related to the following areas of activity:

- operation and development of network and service infrastructure, particularly related to the PIONIER and POZMAN networks;
- maintenance and provision of specialized laboratories;
- R&D works related to modern ICT network technologies, including new generation networks, time and frequency pattern signal distribution services, quantum communications, Internet of the Future, resource virtualization, and new media, including 8K, 3D and 360° video processing, ambisonic sound and XR - Extended Reality.

The Division is composed of three departments:

- Network Infrastructure and Services Department (Raimundas Tuminauskas),
- New Media Department (Maciej Głowiak),
- New Generation Networks Department (Bartosz Belter),
- Network Management Center (Szymon Trocha),
- PIONIER Network Maintenance Team (Krzysztof Kołat)
- POZMAN Metropolitan Area Network Maintenance Team (Marcin Garstka)

Laboratory of programmable optical networks

MAIN RESEARCH TOPICS

- virtualization, integration and automation of network and cloud resources including EOSC
- 5G/6G technology development
- research work on quantum key distribution (QKD) technology
- development of technology for distribution of optical carrier signals, time and frequency pattern signals in fiber optic networks
- network streaming of large audiovisual data streams over long distances with low latency
- innovative methods of production and delivery of audiovisual content in new technologies

CURRENT PROJECTS

PLAI4SCIENCE - Polish Research Infrastructure for Artificial Intelligence-enabled Science (FENG, PI: B. Belter)

Q-Chronos - Mobile quantum sensor system with optical clocks integrated in telecommunication networks (FENG, PI: W. Bogacki)

ŚWIATOWID - National research infrastructure for the development of GNSS/ADS-B systems with special focus on automatic threat detection (FENG, PI: R. Tuminauskas)

WEDROWNIQ - Polish infrastructure for satellite-based quantum communication systems (FENG, PI: P. Rydlichowski)

PIONIER-Q - Polish Quantum Communication Infrastructure (DIGITAL, PI: A. Binczewski)

GN5-1 (HORIZON, PI: A. Binczewski)

SUBMERSE - Submarine Cables for Research and Exploration (HORIZON, PI: K. Turza)

SELECTED PUBLICATIONS

Krehlik P et al. Controlling of the bidirectional amplifier chain for optical frequency distribution based on a two-dimensional noise detector. Optics Express, 2023:31(8),12083 – 12096

Fdida S et al. SLICES, a scientific instrument for the networking community. Computer Communications,2022(193):189–203

Scaffardi M et al. 10 Oam × 16 wavelengths two-layer switch based on an integrated mode multiplexer for 19.2 tb/s data traffic. Journal of Lightwave Technology, 2021, 39 (10):3217-3224

Hare BM et al. Needle-like structures discovered on positively charged lightning branches. Nature, 2019,568(7752): 360-363

Krehlik P et al. Fibre-optic delivery of time and frequency to VLBI station. Astronomy & Astrophysics, 2017(603):1-8

Pittaluga M et al. Long-distance coherent quantum communications in deployed telecom networks. Nature 2025 (640): 911–917

NETWORK SERVICES DIVISION

smart city | digital humanities | personalized medicine | software engineering | speech recognition | machine learning | predictive models

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RESEARCH AND DEVELOPMENT SCOPE

The Division's tasks include conducting work related to the following areas of activity:

- Development and implementation of network services software; Maintenance and provision of specialized laboratories;
- R&D works on scientific data platforms, Future Internet services, digital libraries and knowledge platforms, and new user interfaces,
- Maintenance of the Digital Libraries Federation of the PIONIER network Development and maintenance of an official e-services platform for the residents of the city of Poznań

The Division's operations also include software distributionnia:

- NABOR - a system that supports school recruitment,
- DInGO - a system for digitizing, sharing and storing digital cultural heritage resources,
- SINUS - a system for managing information on current academic activities of employees
- ARM - automatic speech recognition system for the Polish language, based on neural networks

There are four departments in the structure of the Division::

- Digital Libraries and Knowledge Platforms Department (Aleksandra Nowak),
- Data Engineering and Analytical Platforms Department (Juliusz Pukacki),
- New User Interfaces Department (Robert Cecko),
- Department of Future Internet Services (Michał Kosiedowski).

MAIN RESEARCH TOPICS

- digital transformation in cultural heritage, art & digital humanities as well as social sciences,
- the use of ICT in health- and social care, including support of older adults, people with disabilities and patients,
- building solutions based on Big Data processing and AI models building using scalable analytics platforms and Big Data technologies in biomedical areas,
- application of AI methods for text, image and sound analysis, including media analysis and development of modern user interfaces.

ASR - Advanced system for automatic speech recognition for Polish

CURRENT PROJECTS

DARIAH-PL - Cyfrowa infrastruktura badawcza dla humanistyki i nauk o sztuce DARI- AH-PL (KPO, T. Parkoła)

ECBiG - MOSAIC 3D - Europejskie Centrum Bioinformatyki i Genomiki-MOSAIC 3D (FENG, J. Pukacki)

HERIFORGE - Cultural heritage and immersive technologies for innovation forge (HORIZON EUROPE, M. Kosiedowski)

ECHOES - European Cloud for Heritage OpEn Science (HORIZON EUROPE, A. Nowak)

RCMC - Uniwersyteckie Centrum Medycyny Cyfrowej i Medycyny Precyzyjnej o specjalizacji w Kompleksowym Fenotypowaniu Chorób Cywilizacyjnych (ABM, J. Pukacki)

LUMEN - Linked User-driven Multidisciplinary Exploration Network (HORIZON EUROPE, A. Nowak)

GRAPHIA - Knowledge Graphs, AI Services and Next Generation Instrumentation for R&D in Social Sciences and Humanities (HORIZON EUROPE, A. Nowak)

3DBigDataSpace - Transforming the Future of 3D Digital Cultural Heritage (Digital Europe Programme (DIGITAL, A. Nowak)

EMMA44 - Extracting Information from Electronic Media Using Artificial Intelligence and Machine Learning Methods (NCBiR, E. Kuśmierek)

SELECTED PUBLICATIONS

Wolski M et al. Alleviating Cold Start in the EOSC Recommendations: Extended Page RankAlgorithm., IEEE ACCESS ,2024

Borejsza-Wysocki M et al. The usefulness and effectiveness of interactive telemedicine in surgery classes – a survey of Polish medical students, POLSKI PRZEGLAD CHIRURGICZNY/ POLISH JOURNAL OF SURGERY, 2024

Buchwald M et al. An automated system for measuring user interest and attitude in real time, PROCEEDINGS OF THE ANNUAL HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES, 57TH ANNUAL HAWAII INTERNATIONAL CONFERENCE ON SYSTEM SCIENCES, HICSS, 2024

Pawlikowski K et al. Improving the Discovery of Musical Heritage Documents in the Digital Libraries Federation Using Melodic Content Search and AI-based Optical Music Recognition. PROCEEDINGS OF THE 2024 ACM/IEEE JOINT CONFERENCE ON DIGITAL LIBRARIES, 2024

Łukasik E et al. Polska grupa DARIAH-PL Music Information Retrieval I jej projekty dla muzykologii cyfrowej / The Polish group DARIAH-PL Music Information Retrieval and its projects for digital musicology", BIBLIOTEKA MUZYCZNA 8, (2010–2022)

DATA PROCESSING TECHNOLOGIES DIVISION

HPC | Cloud | Cyber Security | Internet of Things | Data Services

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https://pcss.pl

RESEARCH AND DEVELOPMENT SCOPE

The Division's tasks include conducting work related to the following areas of activity: operation and development of computing infrastructure, data storage and provision of services; maintenance of security of processing systems, networks and services provided; maintenance and provision of specialized laboratories; research and development of cloud architecture and computing, data management, security, integration of services and infrastructures in Poland and Europe; development of Internet of Things (IoT) technology and applications in relevant areas. The Division's activities also include software sales: Conference4Me - a mobile device application for conference and event organizers. Most of the above-mentioned services have been made available in production to the Polish scientific community for more than 30 years, providing support in the areas of computing, open science and open data in science, economy and government.

The Division consists of five departments:

- ICT Security Department (Gerard Frankowski)
- Data Processing Infrastructure Department (Rafał Mikołajczak)
- New HPC Architectures Department (Radosław Januszewski)
- Internet of Things Technologies Department (Marcin Płóciennik)
- Data Management Technologies Department (Maciej Brzeźniak)

MAIN RESEARCH TOPICS

- Cyber security - protection of infrastructure, IT services
- Smart Agriculture: e-Services for Farmers
- EUROfusion: coordination of the Advanced Computing Hub - support in scientific computing and software engineering.
- Internet of Things: prototyping and making components for Internet of Things applications
- Development of data processing and access technologies; increase in reliability of data storage, backup, replication
- Support for open science (EOSC), big data analytics, support and development of LLM models and AI mechanisms in application solutions

SELECTED PUBLICATIONS

Szustak L et al. Profiling and optimization of Python-based social sciences applications on HPC systems by means of task and data parallelism. Future Generation Computer Systems, 2023(148):623-635

Twardawa MG et al. Estimating the vulnerability of industrial network infrastructure in Central and Eastern Europe. Security and Defence Quarterly, 2024:47(3):53-73.

Meyer N et al. SCADvanceXP – an intelligent Polish system for threat detection and monitoring of industrial networks. Security and Defence Quarterly, 2024:48(4):19-39

Jaworski A et al. Towards a Functional Continuum Operating System – ICOS MetaOS. In: Presser, M. et al.(eds). Global Internet of Things and Edge Computing Summit. Communications in Computer and Information Science, 2025(2328). Springer

CURRENT PROJECTS

PRACE-LAB i PRACE-LAB2: Współpraca w zakresie zaawansowanych obliczeń w Europie (POIR, N. Meyer, R. Januszewski)

Bezpieczeństwo sieci przemysłowych

KMD - Krajowy Magazyn Danych. Uniwersalna infrastruktura dla składowania i udostępniania danych oraz efektywnego przetwarzania dużych wolumenów danych w modelach HPC, BigData i sztucznej inteligencji (POIR, N. Meyer, M. Brzeźniak)

illuMINEation Bright concepts for a safe and sustainable digital mining future (H2020, N. Meyer)

AI4EOSC - Artificial Intelligence for the European Open Science Cloud (HORIZON, N. Meyer)

ICOS - Towards a functional continuum operating system (HORIZON, N. Meyer)

DATAMITE - DATA Monetization, Interoperability, Trading & Exchange (HORIZON, N. Meyer)

EUROfusion - Realising Fusion Energy (HORIZON, N.Meyer)

agrifoodTEF - Test and Experiment Facilities for the Agri-Food Domain (DIGITAL, N. Meyer)

ScaleAgData - Upscaling agricultural sensor data for improved monitoring of agri-environmental conditions (HORIZON, M. Płóciennik)

OpenAgri - Democratising digital farming through tailored open source and open hardware solutions (HORIZON, M. Płóciennik)

EDIH CyberSec - Krajowe Centrum Bezpiecznej Transformacji Cyfrowej (FENG, N.Meyer)

MEDICS - System Zarządzania Informacją Medyczną oraz Wspomagania Procesu Ewakuacji Medycznej Na Polu Walki (SZAFIR, G. Frankowski)

EoCoE-III - Energy-oriented Centre of Excellence for Exascale HPC applications (HORIZON, P. Wolniewicz)

HIDALG02: HPC and Big Data Technologies for Global Challenges (HORIZON, M. Lawenda)

AI4EOSC - Artificial Intelligence for the European Open Science Cloud (HORIZON, N. Meyer)

ICOS - Towards a functional continuum operating system (HORIZON, N. Meyer)

APPLICATIONS DIVISION

services | visualization | energy efficiency | semantics | artificial intelligence | quantum technologies

HEAD

**Tomasz Piontek
MSc, Eng.**

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https://pcss.pl

RESEARCH AND DEVELOPMENT SCOPE

The Applications Division carries out work in the following domain and technology areas, including both scientific and industrial applications:

- development of general and problem-oriented tools and portal services related to multi-aspect data collection, processing and analysis,
- design, implementation, and maintenance of authentication and authorization infrastructure, with particular emphasis on federation issues,
- optimization and automation of software and service production, implementation, and maintenance processes in containerized environments (PaaS),
- photorealistic real-time visualizations using VR, AR, XR, Web3D technologies,
- use and development of artificial intelligence and quantum computing technologies.

The Division is composed of five departments:

- Data Analytics and Semantics Depart-ment (Raul Palma, PhD)
- Large Scale Applications and Services Department (Tomasz Kuczyński)
- Energy-efficient ICT Department (Ariel Oleksiak, PhD)
- Quantum Technologies Department (Krzysztof Kurowski, PhD)
- Advanced Visualization and Interaction Department (Bogdan Ludwiczak)

1 XR visualization tools supporting urban space planning and participatory city management model

MAIN RESEARCH TOPICS

- Quantum and hybrid computing using quantumcomputers and simulators
- Applications of AI and ML techniques and computer-simulations in various areas of science and economy
- Optimization of energy consumption, production,and management with IT solutions for the energy sector
- Validation, verification, and uncertainty quantification (VVUQ) of advanced computational models
- Data analytics and semantic technologies whichsupports aspects of data management, analysis, and knowledge extraction
- Digital twins and multi-scale simulations for the environmental problems, renewable energy sources, air quality, weather forecasts·
- Support adoption of FAIR and Open Science principles by different scientific communities to accelerate the production of science
- Data spaces and (semantic) interoperability aspects for data sharing and exchange to leverage full value of data

CURRENT PROJECTS

PSNC Energy Lab - R&D support for comprehensive socio-economic transformation in Eastern Wielkopolska using new generation information and communication technologies (European Funds for Wielkopolska 2021-2027, T. Piontek)

FAIR2adapt - FAIR (practices) to Adapt to Climate Change (Horizon Europe, R. Palma de Leon)

AD4GD - All Data 4 Green Deal - An Integrated, FAIR Approach for the Common European Data Space (Horizon Europe, R. Palma de Leon)

CEADS - Deploying and operating a European framework for the secure and trusted data space for agriculture (Digital, R. Palma de Leon)

Iliad - INTEGRATED DigitaL Framework FOR Comprehensive MARITIME DATA AND INFORMATION SERVICES (H2020, R. Palma de Leon)

OSTrails - Open Science Plan-Track-Assess Pathways (Horizon Europe, R. Palma de Leon)

Sage - The Data Space for a Sustainable Green Europe (Digital, R. Palma de Leon)

AI-ENTR4YOUTH - Combining Artificial Intelligence and Entrepreneurship Education for Youth (Erasmus+, T. Piontek)

RankInn - Implementation of an application for creating a ranking of investments in the distribution network infrastructure (commercial order for Enea Operator, A. Oleksiak)

BlueBird - Building-integrated User-Empowered flexibIlity trading (Horizon Europe, A. Oleksiak)

Heatwise - Holistic Energy management And Thermal Waste Integrated System for Energy optimization (Horizon Europe, A. Oleksiak)

SELECTED PUBLICATIONS

Urdu D et al. Aligning Interoperability Architectures for Digital Agri-food Platforms. Journal Computers and Electronics in Agriculture. 2024 (224), art.no. 109194

Cabrera A et al. Energy efficient power cap configurations through Pareto front analysis and machine learning categorization. Cluster Computing 2024 (27), 3433–3449

Pecyna T et al. (2024). Quantum Variational Algorithms for the Aircraft Deconfliction Problem. In: Franco L. et al (eds). Computational Science – ICCS 2024. LNCS 2024 (14837)

PSNC FUTURE LAB

living labs | social innovation incubator | digital twin

RESEARCH AND DEVELOPMENT SCOPE

PSNC Future Lab - PSNC living laboratory, currently headed by Adam Olszewski, supports companies and public entities in their digital transformation by developing methods, tools and networks of living labs so that scientific facilities empower leaders to achieve their goals and dreams, interdisciplinary design of cost-effective digital twins and other market-demanded digital solutions; organizing networking events to identify and inspire change leaders.

MAIN RESEARCH TOPICS

- Health care
- Industry 4.0
- Digital twin
- Climate Change
- Living labs
- Interdisciplinary collaboration

Seat of PSNC Future Labs:
20 Zwierzyniecka st., Poznan, Poland

PLANET- ON hackathon

CURRENT PROJECTS

LIVING LABORATORIES

Konin Energy Lab – we support the eastern part of the Wielkopolska region in developing a living laboratory of energy transition from coal to renewable energy sources

Science 4 Business – we incubate and promote seven digital solutions with market potential

HEALTH

Little Strongmen – a pediatric oncology living lab – together with oncologists, we create digital solutions for parents and doctors

Wait Safe – a performance measurement system of medical units with elements of office queue

Next Data AI - we create digital solutions to improve the work of radiologists using digital twin and AI tools,

INDUSTRY 4.0

Niewiadów – we support the digital transformation of a well-known travel trailer manufacturer

Shop4cf – AI and digital twin applications to improve the ergonomics and efficiency of manufacturing stations in VW, Bosch, and Siemens factories

Startup Booster / Industry Lab – we support technology startups in accelerating digital solutions

QL Future – human, planet, climate – a hackathon that harnesses a quantum computer to work for the good of humanity

Planet-ON – a hackathon on climate protection and human and Earth well-being

Design Sprint/Design Thinking – interdisciplinary workshops, e.g., conceptual designs for pedestrian and bicycle bridges over the Warta River

PSNC AEROSPACE LAB

cyber-physical systems | robotics | UAV | autonomy | AI | airspace

RESEARCH AND DEVELOPMENT SCOPE

Our Team, currently headed by Jan Domi niak, concentrates on designing and developing autonomous robotic vehicles, both flying and ground-based, to be used in a variety of operational scenarios.

The pivotal aspect of our research is sensorics, which enables acquisition and processing of data about the environment. The collected information feeds decision-making processes to support multi-criteria optimization of system operations using artificial intelligence.

Our solutions include controlling a single robot (e.g., a drone) and its on-board modules as well as coordinating a fleet of devices. Remote sensing and classification also constitutes an essential part of our work, which allows us to analyze sensory data in order to identify objects, structures and phenomena in the environment.

At the same time, we consider the legal aspects related to the implementation of unmanned missions, which are an integral part of the implementation of modern autonomous systems. All these areas form the foundation of our Team's activities.

The Team also owns and operates research infrastructure as part of the AEROSFERA - Aerospace of Things project which serves for the research, development and testing center in Kąkolewo, dedicated to autonomous robotic systems, oriented to provide services in application scenarios.

MODERN LABORATORY BASE

- Laboratory for Autonomous and Energy Efficient Airport Infrastructure
- Laboratory for the Development of Unmanned Aerial Vehicles.
- Laboratory for Safety and Security of Airport Operations
- Laboratory for the Development of Flight and Airspace Control Systems.

MAIN RESEARCH TOPICS

- Autonomous robotic swarms in complex scenarios, in multi-stage missions and with handling of unusual situations.
- Navigation in environments without access to satellite data, in the presence of obstacles.
- Software for multi-criteria optimal management of unmanned aerial systems.
- Creation, development and provision of services based on unmanned aerial vehicles
- Remote sensing and classification of objects and phenomena using unmanned systems

Drone flight

Hangar in Kąkolewo

PSNC Aerospace Lab, 7 Lotnicza st., 62-065 Kąkolewo

ADMINISTRATION, FINANCE, SERVICES

FINANCIAL AND ACCOUNTING DEPARTMENT

CHIEF ACCOUNTANT
Renata Wilnicka, MSc, Eng.

The Financial and Accounting Department is responsible for financial settlements across all spheres of the Institute's activities, ranging from scientific research to economic operations. The primary task of the department is to manage the institution's finances, settling funds originating from various sources, including the state budget, national research-funding institutions, and foreign entities. The Financial and Accounting Department collaborates with other administrative units of the Institute and scientific staff to implement optimal financial solutions, facilitating the efficient execution of projects and research activities.

DIRECTOR'S SECRETARIAT

HEAD
Agata Redmer, MSc

The Director's Secretariat supports and coordinates all administrative and organizational activities undertaken by the Institute's Director, establishes schedules, and organizes the Director's meetings. It ensures the proper and timely circulation of documents and information and maintains records of incoming and outgoing correspondence, invoices, internal legal acts, powers of attorney, queries, and responses provided as part of public information. The Director's Secretariat also organizes secretarial and office support, drafts letters, and arranges domestic business trips.

HUMAN RESOURCES DEPARTMENT

HEAD
Dorota Nosal, MA

The primary task of the HR Department is to maintain documentation related to the employment of staff (including preparing employment contracts, reporting employees to social security and health insurance, managing personnel files, recording working hours, and handling periodic health check-ups). The department is also responsible for maintaining documentation for doctoral students, including participants in the Partnership-based Doctoral Program of the IBCH PAS and the Poznań Doctoral School of the Institutes of the PAS. In addition, department staff deal with drafting and registering civil-law contracts as well as agreements related to volunteering. The HR Department is also responsible for preparing periodic statistical reports on employment.

INSTITUTE'S LEGAL TEAM

HEAD
Ewa Bartoszek, Atty

The Institute's Legal Assistance Team provides legal services for the Institute aimed at protecting its interests. The scope of legal support includes, in particular: providing legal advice and consultations, issuing legal opinions, drafting and reviewing contracts, legal assessment of internal documents of the Institute, preparing drafts of internal legal acts of the Institute, legal assessment of documentation related to public procurement, and legal advice in its preparation, representing the Institute in administrative proceedings, and acting as a legal representative in legal proceedings before judicial authorities.

SCIENTIFIC SECRETARIAT

HEAD
Paweł Goderski, MA

The tasks of the Scientific Secretariat encompass supporting scientists involved in scientific, research and development or investment projects, as well as those applying for project funding. The team of specialists coordinates formal actions related to project implementation and application for grants and scholarships, such as searching for funding opportunities, providing information on procedures concerning proposal submission, and exchanging correspondence with external institutions regarding proposals, agreements, and preparing project reports. The Secretariat prepares data for evaluation of the research quality, fulfills all sorts of reporting duties (for the Ministry of Science and Higher Education - MNiSW, Polish Academy of Sciences - PAS, and the Central Statistical Office - GUS). It coordinates audits of ongoing projects, and also handles official international trips, as well as foreign guest visits.

PROMOTION AND COMMERCIALIZATION OFFICE

HEAD
Elżbieta Kopińska, MA

The Commercialization and Promotion Office plays a crucial role in the process of utilizing and promoting the results of scientific research and innovative solutions. The main goal of the office is to assist in the commercialization of scientific discoveries and innovative technologies developed at the Institute. The team of specialists operates at the intersection of business and science, creating offers for services provided by the Institute. They collaborate with patent offices to ensure the protection of inventions and research results. The office is responsible for full marketing support, public relations, as well as the promotion of achievements and the internal and external image of the Institute.

RESEARCH SUPPORT UNIT

HEAD
Katarzyna Chojnacka, MSc

The main task of the Research Support Unit is to assist project leaders and heads of departments, specialized laboratories, and research groups by ensuring efficient collaboration with internal units of the Institute and external entities. The unit supports the process of implementing scientific projects in terms of organization, as well as other activities carried out at the Institute, such as organizing conferences or scientific meetings. It supervises and coordinates the expenditure process for ongoing projects. The Unit cooperates with organizations supporting the internationalization of science, including the Euraxess network. In 2024, a Welcome Point was established within the Unit, whose task is to support foreigners - employees and PhD students of the Institute in the relocation process and during their stay in Poland.

DEPARTMENT OF LABORATORY SUPPLY

HEAD
Agata Chmielewska, MSc

The Department of Laboratory Supply is responsible for procuring reagents, laboratory materials, small laboratory equipment, and consumables from domestic and international markets based on requests submitted by scientific staff. It handles customs clearance for imported deliveries and monitors expenditures from agreements made by the Institute. The department ensures timely processing of procurement-related documents, checks the compliance of shipments with order specifications, and manages qualitative and quantitative complaints regarding purchases. It organizes the collection of chemical and biological waste and prepares associated documentation.

CHIEF ENGINEER DEPARTMENT

HEAD
Krzysztof Bąk, MSc

The responsibilities of the Chief Engineer's Department include: managing the Institute's unites; maintaining the technical efficiency of equipment and buildings; placing orders for supplies, services, and construction works, as well as service contracts for equipment; preparing investment estimates for tender procedures; participating in the acceptance of construction works, services, and repairs; settling individual organizational units of the Institute for internet usage; preparing environmental protection reports; receiving financial documents related to deliveries, services, and construction works, as well as their substantive control; reviewing documentation from periodic inspections conducted at the Institute and performing building inspections.

ORGANIZATIONAL AND TECHNICAL DEPARTMENT

HEAD
Grażyna Wawrzyniak, MA

The Technical and Organizational Department serves as the caretaker of the Institute's facilities, ensuring general order, cleanliness, and the secure and efficient functioning of the Institute's buildings. The department manages the supply of necessary administrative and general-use articles and materials. It coordinates the warehouse and inventory management of assets and the use of company vehicles. The department is responsible for organizing equipment repairs and ordering service contracts. It also handles matters related to foreign and domestic courier shipments. The department is also tasked with coordinating activities related to social issues, settling costs associated with employees' stays at a recreational center, and overseeing the facility and adjacent areas of the conference, training, and recreational center in Jurata.

CENTER FOR SCIENCE SERVICE DEPARTMENT

HEAD
Renata Schoenfeld

The Center for Science Service Department at IBCH PAS manages the reservation and comprehensive service of conference rooms, oversees the operation of audiovisual equipment, and implements marketing activities to promote the center.

It serves as the custodian of the buildings, the IBCH PAS Science Centre, and the IBCH PAS Center for Innovation and Education, ensuring general order and cleanliness, security, and their efficient functioning.

DEPARTMENT OF MANAGEMENT SYSTEMS AND INFORMATION SECURITY

HEAD
Agnieszka Ławniczak, MA

The Management Systems and Information Security Department is responsible for tasks related to managing IT security and information security, including data protection, administration, and supervision of management systems implemented at the Institute, as well as the administration of email accounts. The department oversees activities related to the development and implementation of security-related documents, provides substantive support to Institute employees regarding implemented information systems, and manages the Institute's website and the Public Information Bulletin website.

DATA PROTECTION DEPARTMENT

HEAD
Natalia Szymkowiak

The Data Protection Department ensures that the processing of personal data within the Institute complies with the provisions of the European General Data Protection Regulation (GDPR). The main task of the department's employees is to analyze and verify the compliance of data processing with applicable regulations, including providing information, advice, recommending specific actions, providing recommendations upon request within the scope of impact assessments for data protection, and monitoring the implementation of these recommendations.

IT DEPARTMENT

HEAD
Marcin Kiculła, MSc, Eng.

The scope of activities of the IT Department includes the administration of service-oriented information systems at the Institute, technical support for servers, computers, and telecommunication and electronic equipment, network management, user support in computer operation, procurement support in the field of electronic equipment, creating tender specifications, and participation in tender committees. The department also handles the operation of IBCH telephone systems.

PUBLIC PROCUREMENT DEPARTMENT

HEAD
Katarzyna Wielentejczyk, MSc, Eng.

The Public Procurement Department is responsible for the preparation and conduct of public procurement procedures in accordance with the provisions of the Public Procurement Law. The department's tasks include preparing documentation related to ongoing procedures, creating contracts for the supply of materials, equipment, various types of services, and construction works. They also develop and update internal regulations of the Institute, including the Regulations for the Award of Public Contracts at IBCH PAS, provide opinions on the procurement procedure in accordance with the Public Procurement Law, prepare plans, reports, and maintain registers related to public procurement.

INTERNAL AUDITOR

HEAD
Barbara Szeląg, MA

Internal auditing is an independent and objective activity aimed at supporting the Director in achieving the goals and tasks of the Institute by systematically assessing managerial control and providing advisory services.

This assessment focuses on the adequacy, effectiveness, and efficiency of the managerial control system. The internal auditor's tasks include the implementation of audit and advisory tasks, conducting checks on the degree of implementation of recommendations, developing annual internal audit plans based on a conducted and documented risk analysis, and collaborating with the Institute's management in analyzing, assessing, and managing risk.

ADMINISTRATIVE AND FINANCIAL DEPARTMENT OF PSNC

HEAD
Arleta Rutkowska, MA

The department ensures the provision of indispensable administrative materials, coordinates the storage and inventory management of assets and the use of company cars, makes arrangements related to domestic and foreign business trips, ensures proper and timely circulation of documents and information, handles sales of services provided (issuing invoices and supervising the execution of orders), participates in the development of proposals and reports on funding for scientific activities and applications for equipment, construction investments, and supervises their disbursement. The department is responsible for preparing and conducting procurement proceedings in accordance with the Procurement Law. The department includes the Reception and the Registrar's Office.

PUBLIC RELATIONS DEPARTMENT

HEAD
Damian Niemir, MSc

The department is widely involved in the promotion and popularization of PSNC projects, initiatives, and research work. Its tasks include maintaining major news websites, social media channels, internal communication newsletters, and intranet information. At PSNC, the department supports the coordination of events, the organization of information and demonstration stands, maintains contact with the media and external institutions, edits news texts, and co-creates the editorial team of the consortium television PIONIER.TV. The department is also a conceptual support for the implementation of many projects in the fields of art&science, graphic and multimedia setting, up to the marketing activities of PSNC products.

PROJECTS ADMINISTRATION DEPARTMENT OF PSNC

HEAD
Agnieszka Stokłosa, MA

The tasks of the department include carrying out work related to administrative and financial support of projects implemented by PSNC, in particular participation in preparing applications for funding of the grants in terms of compliance with the financial guidelines of relevant programs and projects. The department also participates in the preparation of draft agreements with financing institutions and supervises the correct disbursement of funds under the projects.

PSNC LEGAL SERVICES TEAM

HEAD
Piotr Gabriel, MA

Headed by the Team Coordinator, the department is particularly engaged in providing legal advice, consultations, and clarifications on the content of applicable laws. To this end, legal opinions, normative acts and other acts (such as decisions) are also prepared. Legal advisors participate in the work of committees and problem teams established at the Institute. In addition, they represent PSNC in proceedings in courts, administrative bodies, offices, and other authorities.

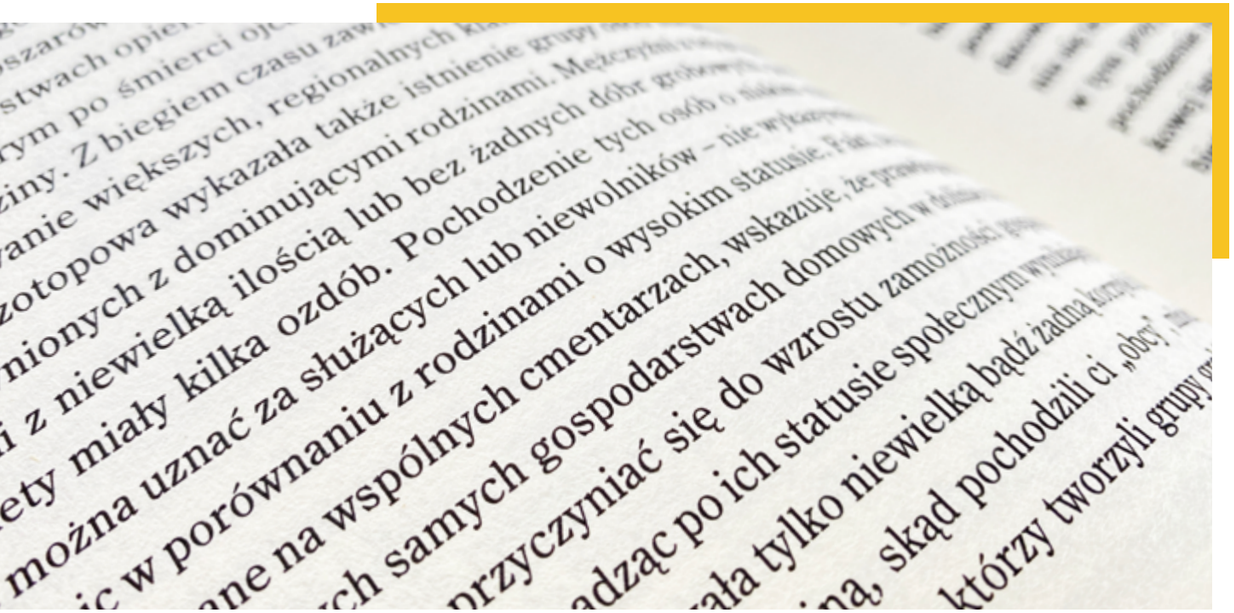
OTHER UNITS

IBCH PAS LIBRARY

The Library hosts approximately 4,200 book titles cataloged in electronic format, accessible online. These books cover various fields, such as organic and inorganic chemistry, molecular biology, biochemistry, and genetics. The Library also houses a unique collection, comprising over 100 titles of scientific journals in print.

Currently, journals from publishers such as Nature, Science, Elsevier, Springer, Wiley, and Taylor & Francis (comprising over 524 titles in total) are available online.

Thanks to the Library's activities, Institute staff have access to databases such as Reaxys, Scopus, and Web of Science.



SCIENTIFIC PUBLISHERS OWN

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Scientific Publishers OWN was founded in 1991 and affiliated with the Poznań Branch of the Polish Academy of Sciences. In 2001, OWN was incorporated into the Institute of Bioorganic Chemistry, Polish Academy of Sciences in Poznań.

Since its establishment, OWN has been engaged in publishing scientific texts, translating, and coordinating the publication processes of books, journals, and conference proceedings. Since 2024, OWN has been participating in the publication of the quarterly journal *Nauka* (a total of 80 volumes) and, since 2011, the quarterly journal *BioTechnologia* (a total of 48 volumes). Moreover, Scientific Publishers OWN publishes various types of books, including academic textbooks, scientific monographs, translations, and conference materials. In its nearly 32 years of activity, OWN has published more than six hundred scientific books and journals, primarily in the fields of medicine, biochemistry, biotechnology, and computer science.

Scientific Publishers OWN also produces editions *pro publico bono* and occasional publications, serving as supplements for various awards or conferences, including *Teorya jestestw organicznych* by J. Śniadecki, *Akademia, tryptyk i flamingi* and *Krótka historia budowy Ośrodka Nauki PAN w Poznaniu* by A.B. Legocki, *Gdy bocian przybywa zbyt wcześnie* by C. Amiel-Tison and D. Vidyasagar, and *Wiek i starzenie* by S. Rattan.

BIOTECHNOLOGIA

The BioTechnologia quarterly is published by the Institute of Bioorganic Chemistry PAS and the Committee of Biotechnology PAS, under the direction of Edyta Kościańska, PhD, DSc (Editor-in-Chief), and Agata Świątkowska, PhD, DSc (Deputy Editor-in-Chief). The topics covered include biotechnology, computational biology, and bionanotechnology. The journal, published in English, is listed in the catalogue of scientific journals and reviewed conference materials, maintained by the Ministry of Science and Higher Education, with a rating of 70 points. All articles published in BioTechnologia are indexed in PubMed, PubMed Central, and Scopus. They are available online in Open Access mode via the Termedia platform.

COMPUTATIONAL METHODS IN SCIENCE AND TECHNOLOGY

Computational Methods in Science and Technology is a quarterly journal published by OWN and the Poznań Supercomputing and Networking Center, under the editorial direction of Prof. Krzysztof W. Wojciechowski, Dr. Maciej Stroiński, and Prof. Jan Węglarz. The articles focus on computational methods and information technology. They are available online in Open Access mode on the PSNC platform.

In 2019, a series of popular science books, *The Institute of Bioorganic Chemistry PAS Recommends*, was initiated. The series includes the following titles:

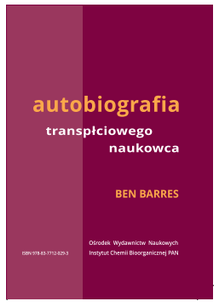
CARLES LALUEZA-FOX

Genetyczna historia nierówności

Inequality: A Genetic History

Poznań 2023

For over a decade, the world has been watching with bated breath, and often astonishment, as archaeogenomics reveals new facts about the biological history of humankind. As a result, we have begun to realize that our conceptions of the past are not always confirmed by hard genetic data. Carles Lalueza-Fox's book represents another milestone on the challenging journey of discovering the truth about ourselves and the civilization we create. It shows that archaeogenomics is a source of information not only about our origins and past migrations but also about interpersonal relationships. The picture emerging from these studies is rather bleak, indicating that inequality and injustice are fundamental elements around which human communities have formed at all levels of their organization, from the family to the state. The book exposes a series of phenomena hitherto unnoticed or overlooked in so-called official history, thus providing an important voice in the ongoing global debate on fundamental human values and rights. | Marek Figlerowicz



BEN BARRES

Autobiografia transpłciowego naukowca

The Autobiography of a Transgender Scientist

Poznań 2020

Ben Barres' book is not only the autobiography of a famous scientist, a professor of neurobiology at Stanford University, but also a kind of message, or rather a testament, written shortly before his death by a man who had the opportunity to look at life from many very different perspectives. Therefore, I would like to recommend it to all fascinated by the extraordinary complexity of the human brain, as well as to those who wish to better understand the complexity of human nature. | Marek Figlerowicz

EDWARD O. WILSON

O pochodzeniu kreatywności

The Origins of Creativity

Poznań 2020

In the challenging times of the COVID-19 pandemic, which prompt reflection on human powerlessness in the face of natural forces, I would like to recommend the book by American biologist and zoologist Edward Osborn Wilson titled "The Origins of Creativity". The author is recognized as one of the founders of modern sociobiology, a scientific discipline that seeks to explain social behaviors by considering them in the context of natural selection. This fundamental aspect of humanity has long escaped the attention not only of biologists but also of humanists. As both creators and products of an extremely anthropocentric civilization, we rarely consider that our behaviors result from experiences gained not only over the past 10,000 years, but at least 200–300,000 years, and that the only way to understand the nature of humans is to understand their biological history. | Marek Figlerowicz

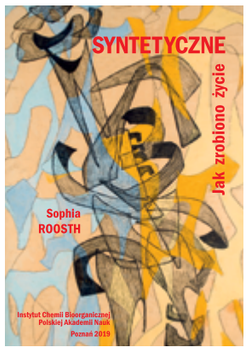
STEVEN J. HEINE

DNA to nie przeznaczenie. Niezwykły i zupełnie błędnie rozumiany związek między tobą a twoimi genami

DNA Is Not Destiny: The Remarkable, Completely Misunderstood Relationship between You and Your Genes

Poznań 2020

Although the full sequence of the human genome has been known for almost 20 years, we still cannot read it with full comprehension. To what extent does this result from a lack of knowledge, and to what extent from our biases and stereotypes? Is the information encoded in the genome sequence unambiguous, and will we ever be able to decipher it completely? Steven J. Heine poses many other fascinating questions in his book. It is worth acquainting oneself with it, even if we do not receive satisfying answers to all the questions posed. I highly recommend this book to readers interested in how human-made culture influences the understanding of their own biology. | Marek Figlerowicz



SOPHIA ROOSTH

Syntetyczne. Jak zrobiono życie

Synthetic: How Life Got Made

Poznań 2019

Sophia Roosth is a cultural anthropologist at the Department of the History of Science at Harvard University. She is not a biologist or biochemist, as the title of the book might suggest. Unlike classical anthropologists who studied the customs of distant tribes, the author spent a few years in MIT laboratories, observing the tribe of synthetic biologists. She was interested not only in what they do but, above all, in what they believe, how they perceive the world, and how it affects the way they conduct science. Therefore, this book is not a textbook for those wishing to engage in synthetic biology. It intrigued us for entirely different reasons. Firstly, it shows how exceptionally innovative research is conducted in leading scientific centers, how theories and research approaches are created, and how old mental frameworks are challenged and new ones are created. Secondly, it shows what questions, doubts, and concerns arise from any ideas and actions aimed at improving or modifying the products of nature. The extremely dynamic development of life sciences in recent years requires a broad discussion, preparing contemporary societies for a better understanding of the practical implications of many breakthrough discoveries. This book is an excellent introduction to such considerations, as it demonstrates how varied and unexpected reactions can be to new possibilities offered by medicine and biotechnology. | Marek Figlerowicz

POZNAŃ CHAMBER CHOIR OF THE PAS

The Poznań Chamber Choir of the Polish Academy of Sciences was established in October 2011 as the initiative of Prof. Jan Barciszewski from the Institute of Bioorganic Chemistry, with the approval and full acceptance of the Institute's Director. The choir primarily brings together doctoral students and Institute employees–enthusiasts of singing who, in addition to their scientific work, share a passion for choral music. None of the ensemble members are professionally trained in music; all choir members are amateurs in the positive sense of the word, united by their love for music. The choir is led by Dr. Alicja Szeluga, the conductor of one of the best girls' choirs in Europe, the SKOWRONKI Girls' Choir in Poznań. The collaboration between young scientists and their conductor quickly yielded the expected results, with successful performances at international symposiums and scientific sessions organized at the IBCH PAS and the Poznań Branch of the PAS. The choir also enhanced the solemn session of the General Assembly of the PAS on the occasion of the 60th anniversary of the Polish Academy of Sciences in Powsin. The ensemble's annual concerts enjoy considerable interest and acclaim among music enthusiasts in Poznań.

ALICJA SZELUGA PhD

Choir Conductor

Prof. JAN BARCISZEWSKI

Initiator of the Choir

IBCH PAS FOUNDATION

The IBCH PAS Foundation has been in operation since 2018. Among its founders are distinguished representatives of scientific communities associated with the Institute of Bioorganic Chemistry PAS in Poznań. The Foundation was established with the idea of promoting science and fostering dialogue and effective collaboration between partners representing the realms of science and business. The first five years of the Foundation's operation were a period of dynamic development. The Foundation successfully implemented projects with local, national, and international scope. These projects include the organization of the English-language scientific conference "RNA goes viral" in two editions and the national scientific conference "Social Sciences and the Crisis of the COVID-19 Pandemic," as well as the implementation of the "IBCH PAS Patents for the Economy" project. The Foundation consistently supports the activities of the IBCH PAS in the areas of promotion, technology transfer, and the organization of scientific and popular science events. The Foundation is open to cooperation, as evidenced by projects carried out in collaboration with the Faculty of Political Science and Journalism at Adam Mickiewicz University, the Institute of Film, Media, and Audiovisual Arts of the Faculty of Polish and Classical Philology at Adam Mickiewicz University, the Poznań Opera House, and Aquanet Laboratory Sp. z o.o. Future planned activities related to the Foundation's statutory goals include supporting integrated initiatives related to the development of science and the economy, active participation in the innovation transfer process, training activities related to the promotion of scientific, technical, and economic progress, providing assistance to the Polish scientific community in carrying out tasks in the field of science and the development of scientific personnel, teaching, and the creation of new inter-university study programs. Additionally, supporting entrepreneurship with a particular focus on academic entrepreneurship, promoting the idea of European integration and broadly understood European scientific and economic cooperation, supporting the internationalization of science in Poland, and conducting educational activities, especially in the field of life sciences.

INSTITUTE LOCATIONS


1a

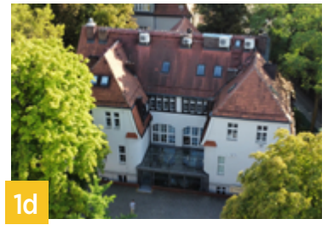
N-W IBCH PAS CAMPUS

1a. Wieniawskiego 17/19 | **1b.** Wieniawskiego 21/23 |
1c. Noskowskiego 10 | **1d.** Noskowskiego 12/14

Within the Noskowskiego-Wieniawskiego (N-W) campus, you will find the main headquarters of the Institute, state-of-the-art biochemical laboratories, conference rooms, as well as the IBCH PAS Center for Innovation and Education (housed in a historic townhouse at Wieniawskiego 21/23), backup server room, and a second network management center for PSNC.


1b


1c


1d

PSNC FUTURE LABS - INTELLIGENT LAB SPACE OF THE FUTURE

2. Zwierzyniecka 20

In the historic building at Zwierzyniecka 20 (Art Nouveau tenement), the vibrant PSNC Future Labs laboratory operates. This place is one of the most advanced laboratories for social innovation in Poznań. Social projects are implemented here, artistic initiatives take place, as well as scientific and business events. Since 2011, the building has also housed Poznań's first co-working space.


2


3

POLISH OPTICAL INTERNET CENTER RESEARCH FACILITY

3. Jana Pawła 10

The main headquarters of PSNC comprises a complex of three buildings: the Building of Technological Halls (BST), housing the Main Data Center of PSNC on two levels with an area of 1600 m2, and Buildings A and B where 14 PSNC research laboratories, Network Management Center, Scientific Television Studio PIONIER.TV, conference rooms, and staff offices are located.

INSTITUTE LOCATIONS
POLAND


4

CONFERENCE, TRAINING, AND RECREATIONAL CENTER

4. Gołębiowskiego 3, Jurata

The center is utilized by the Institute within its statutory activities for organizing scientific meetings and training sessions, as well as serving as a place for creative work and accommodation for participating staff involved in dissemination of science tasks conducted in collaboration with the Polish Academy of Sciences. This includes the organization of annual summer science events called "Science on Vacation."

PALACE AND PARK COMPLEX IN TUREW

5. Szkolna 4, Turew

The Turew Palace is a place intricately connected with the history, tradition, and cultural heritage of Poland. Once a model farmstead owned by the Chłapowski family and the cradle of the idea of organic farming, it is now a place whose potential is being rediscovered. The Institute has been the owner of the palace and park ensemble since October 2022.


5


6

KĄKOLEWO AIRPORT (EPPG) PSNC AEROSPACE LAB

6. Lotnisko Kąkolewo, Kąkolewo

A modern laboratory space and hangar for testing Unmanned Aerial Vehicles (UAVs) with a total area of 2000 m2, where research and development work is carried out in the field of unmanned aerial vehicle applications, autonomous systems, and flight control systems. Located in the Grodzisk Wielkopolski municipality, 58 km from the center of Poznań.

GLOSSARY

ABM	Medical Research Agency Agencja Badań Medycznych
EIC	European Innovation Council Europejska Rada ds. Innowacji
FNP	Foundation for Polish Science Fundacja na Rzecz Nauki Polskiej
FENG	European Funds for Smart Economy Fundusze Europejskie dla Nowoczesnej Gospodarki
H2020	Horizon 2020
HE	Horizon Europe Horyzont Europa
NCBiR	National Centre for Research and Development Narodowe Centrum Badań i Rozwoju
NCN/ NCS	National Science Centre Narodowe Centrum Nauki

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Konrad Kuczyński, Magdalena Madaj, Maciej Rutkowski, Donata Sikorska, Andrzej Wójtowicz

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