International Institute of Molecular and Cell Biology in Warsaw

Annual Report

2023

International Institute
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Wojciech Kwilecki (7,71), **Instituto Gulbenkian de Ciência** (74), **Kryspin Andrzejewski** (75)

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In Pursuit of Excellence

Prof. Marta Miączyńska, Director of the International Institute of Molecular and Cell Biology in Warsaw discusses the institute's ambitious goals, its research activities, and contributions to both science and society. She highlights the collective effort to transcend national boundaries in pursuit of scientific excellence in RNA and cell biology.

What are the major aims and activities of the IIMCB? How does it contribute to society?

Our broad aim is to understand the molecular basis of human diseases, including infectious, neurodegenerative, oncological, and rare diseases. We specialize in two major research fields: RNA biology and cell biology. As a forefront basic science institute, our discoveries represent the groundwork and the first link in a chain of research and development towards new biomedical applications and therapies. We strive to embody the world's best practices in research performance and organization. The results of our work provide the knowledge necessary for the diagnosis and treatment of diseases and, more generally, help us better understand the world, address societal challenges, and build a knowledge-based economy.

What is the scope of the research that is conducted at the Institute?

Experimental work spans all levels of biological complexity, from atoms and molecules to whole organisms. We use methods of molecular and structural biology, bioinformatics, biochemistry, genomics and epigenomics, cell and developmental biology, physiology, and molecular medicine. In applying such a broad methodological portfolio, our scientists are supported by specialized core facilities.

The IIMCB has been awarded the highest scientific category, A+, by the Polish Ministry of Science and Higher Education and has established a truly international environment. How was this achieved?

The mission of the IIMCB is to support ambitious scientists of any nationality, driven by a passion for pursuing frontier research that aims to make a difference for society. Our laboratory leaders are either Polish researchers returning from abroad or international experts who have chosen Poland as their research base.

The IIMCB ranks among the top research institutions in Poland, thanks to the scientific contributions of hard-working and self-motivated researchers, a growth-fostering organizational culture, and effective administration. However, our ambitions go higher, to be on a par with the best institutions worldwide.

The RACE project, i.e., "RNA and Cell Biology – from Fundamental Research to Therapies," has been a significant success for the Institute. It ranked first in the 2022 competition of the Teaming for Excellence program under Horizon Europe, receiving nearly 15 million euros. Could you describe what the RACE project entails?

We believe that the 5-year RACE project, which we have just started in 2023, is the next chapter in our development and a springboard to accelerate it at the same time. Within this project, our overarching goal is to make the IIMCB a world-class center of excellence in RNA and cell biology, strengthening several aspects of our activities, with a special focus on translational research and technology transfer. We are recruiting new group leaders to expand our research scope, particularly towards RNA-based antiviral and antimicrobial therapeutic strategies and advanced models of rare diseases, which could ultimately enable the development of personalized therapies. We are upgrading our existing core facilities and establishing new ones. We are launching an internal support system for technology transfer, commercialization of research results, and collaboration with industry.

All these aspects are just a part of the project. Significantly, we have great partners assisting us on this journey: the MRC Human Genetics Unit of the University of Edinburgh and the Flanders Institute for Biotechnology.

You've outlined the development strategy for the Institute and the opportunities it brings, but how do you personally view your role as the Director of the IIMCB in accomplishing the set goals?

The mission of the IIMCB emphasizes the central role of researchers as drivers of discoveries, and this primary focus on people resonates deeply with my personal values. In my view, the role of a director is to steer the development and culture of an institution towards creating an environment that empowers all staff to succeed in their endeavors while also accepting and learning from setbacks. I am a strong believer in collective wisdom and collaboration of diverse individuals. Therefore, I support collegiality at all levels and consult with key coworkers and staff representatives on strategic issues, while taking full responsibility for my decisions. The growth of the Institute is constantly powered by ideas, work, and commitment of all staff – and my role is to foster it. I believe the past few years have proven that we can accomplish our goals when we all work together.

About
The International Institute of Molecular and Cell Biology in Warsaw

The International Institute of Molecular and Cell Biology in Warsaw (IIMCB) stands at the forefront of life sciences research, dedicated to uncovering the mechanisms that govern organisms at the cellular and molecular levels. With a commitment to both basic and applied research, the IIMCB seeks to deepen our understanding of the biological foundations of life.

Focusing primarily on RNA and cell biology, the Institute aims to understand the fundamentals of human disease, which is the basis for the development of innovative therapeutic and diagnostic methods. IIMCB's research focuses on infectious, neurological, oncological, and rare diseases.

The Institute has consistently received the highest scientific category (A+) in evaluations conducted by the Ministry of Science and Higher Education of Poland.

Established in 1995 by an international agreement between the Government of the Republic of Poland and UNESCO, and further confirmed by the Act of the Polish Parliament of June 26, 1997, the Institute was granted special status. This recognition ensures the Institute's independence and international character and brings it into line with the standards of the world's leading research institutions.

Since the start of operations in 1999, the IIMCB has grown to 14 laboratories, 6 core facilities and 10 research support units.

Funding and Grants

Research at the IIMCB is supported by an annual statutory subsidy from the Ministry of Science and Higher Education and a budgetary subsidy from the Polish Academy of Sciences (PAS). Still, up to 70% of the yearly institutional budget comes from external competitive sources. Since 2000, our scientists have received 362 grants, including many prestigious awards from European and other foreign sources, such as the EU Framework Programmes (5 ERC grants, 1 EIC grant), Structural Funds through the Foundation for Polish Science, European Molecular Biology Organization, Howard Hughes Medical Institute, Wellcome Trust, European Economic Area and Norway Grants, and the Polish-Swiss Research Programme.

Mission

We support ambitious scientists of any nationality driven by a passion to pursue frontier research that aims to make a difference in society.

We follow the principles of scientific freedom, integrity, and responsibility.

We help researchers develop their careers through training and mentoring at all levels and encourage collaboration among them.

We provide efficient administrative support that enables scientists to focus on their research.

Working Culture

The environment of the Institute is international, with English as the working language. The IIMCB implements a policy of:

- international competitions for all research positions, including PhD students,
- open, transparent, and merit-based recruitment,
- institutionalized support for foreign candidates, which has resulted in an increase in the number of foreign employees (currently approx. 22%).

Human resources are the most important assets, and thus, the IIMCB follows the rules put forward by the European Commission in the HR Excellence in Research program, which the IIMCB joined in 2013. The HR Excellence in Research logo is an accreditation that identifies institutions as a stimulating and favorable working environment. Respect for the principles of equality and diversity is important to the IIMCB; therefore, a Gender Equality Plan has been recently implemented.

Dynamic Growth

The IIMCB is on its way to unprecedented scientific and institutional growth, supported in part by the RACE project. Through planned expansion from 14 to eventually 20 research groups involved in innovative translational projects in RNA and cell biology, the Institute aims to become a unique Polish center where excellent science profits from state-of-the-art technologies and services provided by the core facilities. By 2025, our portfolio of core facilities will heavily expand, with advanced technologies critical to supporting research at IIMCB focusing on Genomics and Single-Cell Sequencing; Proteomics, Protein Isolation and Analysis; Cellular Models, Organoids and Cell Banking; Bioinformatics, and Computational Biology.

Partnership

To strengthen its international position, in January 2020, the IIMCB became the first Polish member of the EU-LIFE alliance of 15 independent research institutes from 15 European countries.

The alliance is working towards excellence in life sciences, giving high regard to quality and responsible science, as well as shining the spotlight on issues related to European science policies.

Outreach

Moreover, the IIMCB is involved in various educational programs and popularization activities performed by the Centre for Innovative Bioscience Education (BioCEN), for which the IIMCB is a strategic partner. The Centre organizes laboratory workshops for elementary and high school students, practical courses for school teachers, scientific training for businesses, open lectures for broader audiences, scientific shows, and picnics for children. The IIMCB scientists frequently appear on radio and television programs, in newspapers, and participate in science festivals and science nights.

The IIMCB in 2023

at a glance

New EMBO member from the IIMCB

Jacek Jaworski joins the organization as the 17th Pole and the 5th member from the IIMCB

The Minister of Education and Science Award for significant achievements in scientific activities

for Matthias Bochtler

Best Polish experimental paper in biochemistry and molecular biology published in 2022

The Parnas Award for: M. Nowotny, M. Figiel, M. Gapińska, M. Czarnocki-Cieciura, W. Zajko, M. Sroka, K. Skowronek

52 scientific publications

and 22 preprints have been published

9 scientific promotions

1 habilitation & 8 doctoral dissertations

1st Edition of the Polish RNA Biology Meeting

organized by the IIMCB

New chapter in the development of the IIMCB

RACE project has been launched

RACE

1st ERC Advanced Grant in life sciences in Poland

for Andrzej Dziembowski

Best experimental paper on nucleic acid research performed in a Polish laboratory published in 2022

The Włodzimierz Krzyżosiak Distinction for: C.L. Winata, K. Nieścierowicz, L. Pryszcz, C. Navarrete, E. Tralle, A. Sulej, K. Abu Nahia, M. E. Kasprzyk, K. Misztal, A. Pateria, A. Pakuła, M. Bochtler

18 new grants for over 20 million EUR

from European Commission, National Science Centre

RACE to the Future

The International Institute of Molecular and Cell Biology in Warsaw has initiated the "RNA and Cell Biology - from Fundamental Research to Therapies" project (acronym RACE). Our goal with this grant is to become a world-class Centre of Excellence in RNA and Cell Biology, combining scientific excellence with a strong emphasis on commercial activities to effectively translate our research into market-ready therapies.

With a budget of nearly 15 million euros, over the coming 6 years, we aim to reach a critical mass of 20 scientific groups with the complementary expertise in RNA and cell biology; provide entrepreneurial training for the researchers; develop sustainable core facilities tailored for industry needs; establish a professional technology transfer incubator; and finally, digitilize our administrative processes. All these activities will be implemented with the support of our project partners: The Medical Research Council Human Genetics Unit (MRC-HGU) at the University of Edinburgh, UK, and The Flanders Institute for Biotechnology (VIB), Belgium.

RACE is funded by the Horizon Europe Teaming for Excellence program and was ranked first in the 2022 call. The project implementation period is 1 September 2023 - 30 August 2029.

Main objectives:

1. Expand IIMCB Research & Innovation (R&I) activities by recruiting new research groups and broadening collaborations.
2. Train the next generation of IIMCB world-class researchers for academia and industry, aligning their expertise and skills to the best research centres across the European Research Area (ERA).
3. Enhance the IIMCB methodological capabilities through the development of modern core facilities (CFs), which will provide services to both academia and industry sectors.
4. Facilitate the implementation of IIMCB discoveries by launching the IIMCB's RACE Technology Incubator.
5. Enhance the IIMCB science management and administrative structure to fit new challenges.

"The RACE project will make the IIMCB a reference model in translational research countrywide. It will elevate the Institute to the top tier of European research centres ready to engage in competitive EU and global biomedical research and innovation projects at the frontiers of science."

Urszula Białek-Wyrzykowska, PhD,
Deputy Director for Development

Concept Towards Outcomes

	Project launch	Actions (within 6 years)	Outcomes
Research Staff	**14 Groups**	**6 New Groups** → RNA and cell biology → advanced bioinformatics/big data analysis → AI/machine learning	**20 Research Groups**
Trainings	Low entrepreneurial culture and moblity of Polish researchers	**Training Programmes** for PhD students and post-docs → research secondments → courses in technology transfer, leadership, science management	**Next Generation of Leaders** for academia and industry
Core Facilities	**6 Core Facilities**	**4 New Core Facilities** supported by: → business management → training programme for CF staff	**10 Core Facilities** High-end infrastructure Cutting-edge technologies Services for academia and industry
Commercialization	Increasing number of projects with commercialization potential	**RACE Incubator** → Technology Transfer Unit → Commercialization Advisory Council	**Patent Applications** Spin-off companies Accelerator program
Science Management	Paper-based administrative processes	**Digitalisation**	**Efficient Digitalized Administrative Processes** in the upscaled Institute

Impact Beyond the Project

Scientific

- Improved R&I performance indicators for Poland
- Enhanced competence of research staff in science and science-related jobs in Poland
- Increased participation of Poland in EU Framework Programmes

Economic

- New technologies developed in Poland
- New start-ups and jobs created

Societal

- Reversal of brain drain - Poland attractive for returning expats and foreign scientists
- Discoveries leading to therapies of human diseases

Project: RACE Partners: VIB THE UNIVERSITY of EDINBURGH Funding: Funded by the European Union

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Best Papers Awards 2023

The IIMCB annually honors research excellence with its Best Papers Awards, focusing on the significance and content of research, rather than relying on bibliometric indicators. An inclusive approach allows all authors from the IIMCB to submit their scientific experimental work, emphasizing the impact and broader contributions of the research.

Laboratory Leaders reviewed the nominated papers, refraining from voting for their own lab's work. The selection concluded in a meeting where the most impactful submissions were chosen, underscoring IIMCB's dedication to advancing scientific knowledge.

1st prize

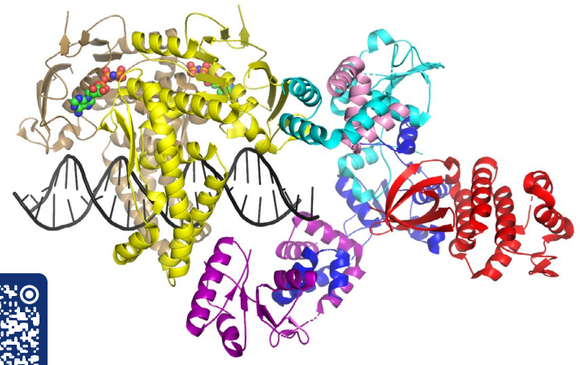
Mechanism of RecF–RecO–RecR cooperation in bacterial homologous recombination

Nature Structural & Molecular Biology

Laboratory
of Protein Structure

Shivlee Nirwal
Mariusz Czarnocki-Cieciura
Anuradha Chaudhary
Weronika Zajko
Krzysztof Skowronek
Sebastian Chamera
Małgorzata Figiel
Marcin Nowotny

In bacteria, one type of homologous-recombination-based DNA-repair pathway involves RecFOR proteins that bind at the junction between single-stranded (ss) and double-stranded (ds) DNA. They facilitate the replacement of SSB protein, which initially covers ssDNA, with RecA, which mediates the search for homologous sequences. However, the molecular mechanism of RecFOR cooperation remains largely unknown. We used Thermus thermophilus proteins to study this system. Here, we present a cryo-electron microscopy structure of the RecF–dsDNA complex, and another reconstruction that shows how RecF interacts with two different regions of the tetrameric RecR ring. Lower-resolution reconstructions of the RecR–RecO subcomplex and the RecFOR–DNA assembly explain how RecO is positioned to interact with ssDNA and SSB, which is proposed to lock the complex on a ssDNA–dsDNA junction. Our results integrate the biochemical data available for the RecFOR system and provide a framework for its complete understanding.



READ ARTICLE

Structure of the RecFOR-DNA complex involved in bacterial homologous recombination. RecF dimer is shown in yellow and sand, RecR tetramer in cyan, pink, blue and purple. RecO is shown in red and DNA in black.

"We are very interested in how bacteria deal with damage to the genetic material encoded in their DNA. We wanted to understand the mechanism of a particularly complex DNA repair machinery consisting of the RecF, RecO and RecR proteins. Thanks to a team effort led by Shivlee Nirwal, we discovered the molecular architecture of this cellular machinery."

Marcin Nowotny, PhD, Professor

2nd prize

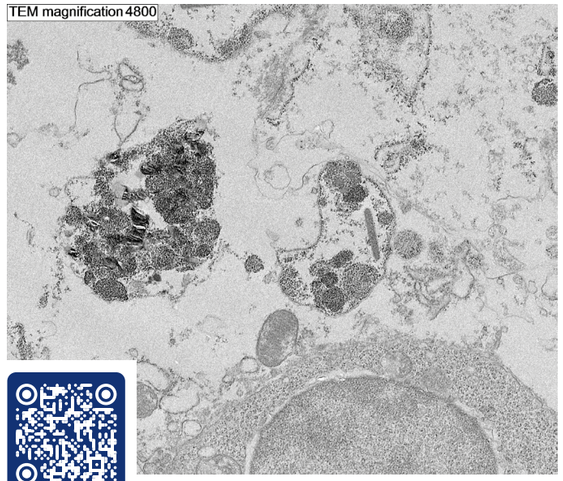
Impaired iron recycling from erythrocytes is an early hallmark of aging

eLife

Laboratory of
Iron Homeostasis

Patryk Ślusarczyk
Pratik Kumar Mandal
Gabriela Żurawska
Marta Niklewicz
Komal Chouhan
Raghunandan Mahadeva
Aneta Jończy
Matylda Macias
Aleksandra Szybińska
Magdalena Cybulska-Lubak
Olga Krawczyk
Sylwia Herman
Michal Mikula
Remigiusz Serwa
Małgorzata Lenartowicz
Wojciech Pokrzywa
Katarzyna Mleczko-Sanecka

Aging affects iron homeostasis, as evidenced by tissue iron loading and anemia in the elderly. Iron needs in mammals are met primarily by iron recycling from senescent red blood cells (RBCs), a task chiefly accomplished by splenic red pulp macrophages (RPMs) via erythrophagocytosis. Given that RPMs continuously process iron, their cellular functions might be susceptible to age-dependent decline, a possibility that has been unexplored to date. Here, we found that 10- to 11-month-old female mice exhibit iron loading in RPMs, largely attributable to a drop in iron exporter ferroportin, which diminishes their erythrophagocytosis capacity and lysosomal activity. Furthermore, we identified a loss of RPMs during aging, underlain by the combination of proteotoxic stress and iron-dependent cell death resembling ferroptosis. These impairments lead to the retention of senescent hemolytic RBCs in the spleen, and the formation of undegradable iron- and heme-rich extracellular protein aggregates, likely derived from ferroptotic RPMs. We further found that feeding mice an iron-reduced diet alleviates iron accumulation in RPMs, enhances their ability to clear erythrocytes, and reduces damage. Consequently, this diet ameliorates hemolysis of splenic RBCs and reduces the burden of protein aggregates, mildly increasing serum iron availability in aging mice. Taken together, we identified RPM collapse as an early hallmark of aging and demonstrated that dietary iron reduction improves iron turnover efficacy.



Ultrastructural visualization of extracellular aggregates in the splenic red pulp of aged mice by transmission electron microscopy.

READ ARTICLE

"This work revealed that splenic macrophages, specialized cells responsible for the removal of defective red blood cells, become impaired and die during aging, an adverse phenomenon that can be alleviated by dietary iron restriction in mice. This discovery provided new information on the relationship between aging and iron homeostasis and suggested limiting dietary iron intake as a potential strategy for improving health in the elderly."

Katarzyna Mleczko-Sanecka, PhD

3rd prize

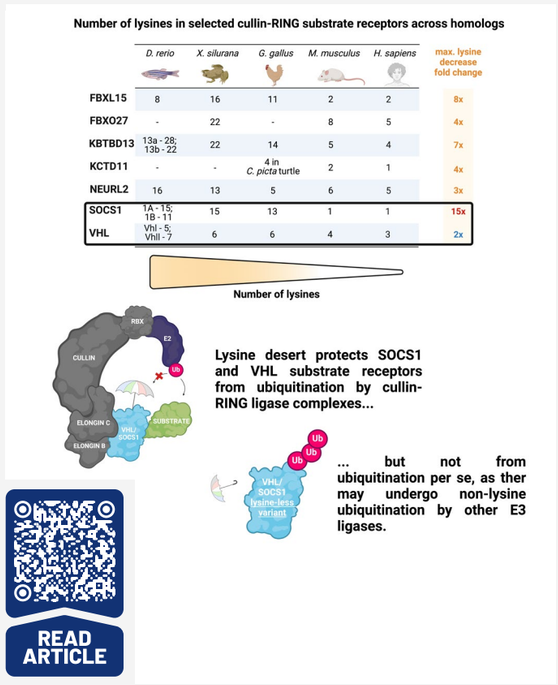
Lysine deserts and cullin-RING ligase receptors: Navigating untrodden paths in proteostasis

iScience

Laboratory of
Protein Metabolism

Natalia A. Szulc
Małgorzata Piechota
Lilla Biriczová
Pankaj Thapa
Wojciech Pokrzywa

The ubiquitin-proteasome system (UPS) governs the degradation of proteins by ubiquitinating their lysine residues. Our study focuses on lysine deserts - regions in proteins conspicuously low in lysine residues – in averting ubiquitin-dependent proteolysis. We spotlight the prevalence of lysine deserts among bacteria leveraging the pupylation-dependent proteasomal degradation, and in the UPS of eukaryotes. To further scrutinize this phenomenon, we focused on human receptors VHL and SOCS1 to ascertain if lysine deserts could limit their ubiquitination within the cullin-RING ligase (CRL) complex. Our data indicate that the wild-type and lysine-free variants of VHL and SOCS1 maintain consistent turnover rates, unaltered by CRL-mediated ubiquitination, hinting at a protective mechanism facilitated by lysine deserts. Nonetheless, we noted their ubiquitination at non-lysine sites, alluding to alternative regulation by the UPS. Our research underscores the role of lysine deserts in limiting CRL-mediated ubiquitin tagging while promoting non-lysine ubiquitination, thereby advancing our understanding of proteostasis.



READ ARTICLE

"Our study unveils the underexplored role of lysine deserts in the ubiquitin-proteasome system, highlighting a distinctive evolutionary path. We reveal the critical role of non-lysine ubiquitination in managing lysine-deficient proteomes, opening new perspectives on protein structure and function."

Wojciech Pokrzywa, PhD, DSc Habil

RESEARCH
Laboratories

At the IIMCB, we focus on RNA biology and cell biology research to better understand the fundamentals of human diseases. This knowledge is the foundation for creating innovative therapeutic and diagnostic methods. We strive for scientific excellence by implementing ambitious research projects and scientific initiatives, and forming partnerships with leading research centers in Poland and abroad. To make sure that the results of this research are put into clinical use, we at IIMCB are happy to collaborate with the pharmaceutical and biotechnological industries.

Laboratory of

Structural Biology

We study epigenetics, specifically nucleic acid and histone modifications that control cell fate change and maintenance. Our methods range from various flavors of high-throughput sequencing to classical biochemistry and structural biology. We also rely increasingly on “big data”. Our work has implications in oncology, particularly for hematologic malignancies that have a strong epigenetic component.

Research Summary

Our work is focused on chromatin modifications, and on their role in maintaining and changing cell fate. Most of our projects revolve around DNA modifications, particularly DNA maintenance methylation at the replisome, and its reversal by active and active-passive DNA demethylation. We study the links between "epigenetic" and "repair" enzymes, as well as the recruitment and adaptation of DNA repair processes to epigenetic reprogramming. We are also interested in the contributions of histone modifications to cell fate maintenance and change. Specifically, we are investigating COMPASS-like complexes - the mediators of positive genetic memory. Our methodology includes classical biochemistry and structural biology, as well as genetic methods and high-throughput sequencing. Increasingly, we also rely on “big data” to address biological questions.

Future Goals

In the future, we plan to extend our chromatin studies, taking into account preventive epigenome maintenance by nucleotide pool control. We want to focus on "epigenome repair" mechanisms that counteract gradual epigenome degradation with age and in disease. Furthermore, we want to better understand how the loss of enzymes with antagonistic roles (DNMT3A, TET2) can have similar, malignancy-promoting effects in cancers with a strong epigenetic component.

SCAN

The lab works on epigenetic marks on DNA and histones and their effects on cell fate maintenance and change. The picture is an “artistic” representation of the theme of the lab, prepared using generative artificial intelligence.

Scientific Impact

We have contributed to a better understanding of TET dioxygenases that are the drivers of active and active-passive DNA demethylation.

We have helped to elucidate the feedback loop that implements positive genetic memory.

We have discovered and classified a dozen of reader domains for nucleic acid modifications.

We have elucidated a chemically novel nucleic acid modification pathway.

Collaborations

Our collaborators come from both academia (e.g. G. Xu, J. Wong, T. Jurkowski, T. Hore, C. Winata, W. Bickmore, A. Wlodawer) and the biotech industry (S. Xu, P. Weigele). Thanks to this strong circle of partners, we have extended our research methods spectrum and we can now ask questions at very different levels, ranging from atomistic studies to experiments in animals.

Group Leader

Matthias Bochtler is a structural biologist and professor of biological sciences. He graduated from Munich University. He was a postdoctoral fellow at the Max Planck Institute of Biochemistry (MPIB) in Martinsried. He moved to Poland initially as part of shared position with Max Planck Institute and the IIMCB. He is a laureate of the Minister of Education and Science Award for significant achievements in scientific activities (2023), Włodzimierz Krzyżosiak Distinction awarded by the Polish Academy of Sciences (2023), the Pieńkowski Award (2005) and EMBO/HHMI Young Researcher Award (2004).

"With minor exceptions, all cells in our body carry the same genetic information and yet they are very different. Much of the difference is epigenetically encoded in the form of DNA and histone modifications. We combine genetics, biochemistry and structural biology to study the maintenance and remodeling of the epigenetic layer of our genomes."

Matthias Bochtler, PhD, Professor

Group Members

Senior Researcher
Honorata Czapińska, PhD, DSc Habil
Postdoctoral Researcher
Anton Slyvka, PhD
PhD Students
Anna Fedenko, Msc
Terry Karimi, MSc
Magdalena Klimczak, Msc Eng.
Abhishek Pateria, MSc
Volunteers
Mateusz Fortuna, MSc, Igor Helbrecht, MSc
Joanna Krwawicz, PhD, Dominik Rafalski, PhD
Lab Technician
Julia Kędzierska
Laboratory Support Specialist
Katarzyna Krakowska, MSc

Laboratory of

Bioinformatics and Protein Engineering

We explore the universe of RNA, not just as a messenger of genetic blueprints but as a dynamic entity that shapes life at the molecular level. Our work treats RNA as a puzzle, where each piece is a clue to its myriad roles from catalysts to regulators within the cell. With advanced computational models and experimental techniques, we decode RNA's complex structures and interactions, especially with proteins and small molecules.

Research Summary

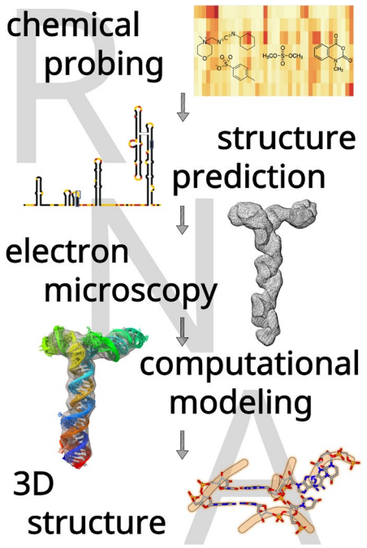
Our work is focused on the development and applications of new methods for RNA structure determination and modeling RNA interactions, combining computational predictions with experimental analyses. This approach is vital for delving into RNA's role in biological processes, contributing significantly to the fields of molecular biology, bioinformatics, and structural biology. Our contributions include software tools like ModeRNA and SimRNA, which have become essential for researchers globally. We investigate the three-dimensional structures of RNA from viruses, bacteria, and humans, focusing on potential targets for small molecules. Our research is enriched by interdisciplinary collaborations with various research groups and with commercial partners in Poland and worldwide.

Scientific Impact

Tools for RNA modeling & small molecule interactions

Determined structures of viral & bacterial RNAs (e.g., coronavirus 5' regions)

Collaborated with Molecure to validate tools in drug discovery (inhibiting cancer protein translation)



Determination of RNA 3D structure and dynamics, using a combination of computational and experimental methods. Example for the 5'-proximal region in SARS-CoV-2 RNA.

SCAN

Future Goals

We aim to deepen our understanding of RNA structure and function, particularly by studying molecules with therapeutic potential. Our advances in computational methods, integrated with experimental studies, are geared towards contributing to both fundamental research and future practical applications, with the ultimate goal of positively impacting scientific knowledge and human health.

Collaborations

Cryo-EM & RNA structure: S. Glatt (Poland), Z. Su (China)
RNA dynamics & AFM: F. Moreno-Herrero (Spain)
RNA CD and FTIR: V. Arluison, F. Wien (France)
RNA-targeting drugs: Molecure (Poland)

Group Leader

Janusz M. Bujnicki is a interdisciplinary structural biologist, professor of biological sciences. Graduated with an MSc and received a PhD from the University of Warsaw. Alumnus of the Leadership Academy for Poland. Visiting professor at the Adam Mickiewicz University (2006-2020). Executive Editor at Nucleic Acids Research (2013-). Elected member of European Molecular Biology Organization, Academia Europaea, and Polish Academy of Sciences. Founding member and president (2011-2013) of the Polish Bioinformatics Society. Member of European Commission's Group of Chief Scientific Advisors (2015-2020). Member (2019-2024) and the first chair of the University Council at the University of Warsaw. Founding member of the Association of ERC Grantees. Laureate of numerous national and international awards.

"Our aim is to determine RNA structures and interactions, and design new molecules with functions with potential for applications in medicine and biotechnology."

Janusz M. Bujnicki, PhD, Professor

Group Members

Senior Researchers
Elżbieta Purta, PhD
Filip Stefaniak, PhD

Postdoctoral Researchers
Hassan Bassereh, PhD
Evgenii Baulin, PhD
Rui João Loureiro, PhD
Satyabrata Maiti, PhD
Sunandan Mukherjee, PhD
Tales Rocha de Moura, PhD
Ryhor Nikalayeu, PhD
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Laboratory Support Specialist
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Laboratory of

RNA Biology — ERA Chairs Group

We are molecular biologists who are trying to understand how the stability of mRNA is regulated. We have recently discovered a previously overlooked mechanism that increases the stability of both naturally produced and therapeutic mRNA (like mRNA vaccines), operating only in specific cell types and tissues. In the future, we plan to understand this new mechanism better and exploit it to design more effective mRNA-based therapeutics.

Research Summary

Although mRNA degradation has been studied for years, and the major decay pathways conserved between eukaryotes are already established, we know very little about how these are integrated in vivo. The stability of mRNA is mainly controlled by the dynamics of 3' terminal poly(A) tails initially synthesized in the nucleus. At the same time, the analysis of poly(A) tails is challenging as for any other homopolymeric tract. In the lab, we implemented direct RNA sequencing on nanopores to study the metabolism of poly(A) tails. This methodology enables us to look more comprehensively at the dynamics of poly(A) tails in vivo. We discovered that a metazoan-specific family of cytoplasmic poly(A) polymerases (TENT5) that by extending mRNA's tails play crucial roles in mammalian physiology. TENT5B, C, and D participate in gametogenesis, while TENT5A regulates collagen expression in osteoblasts. In immune cells, TENT5A and C enhance the expression of innate immunity effector proteins. Notably, we have recently described the unexpected role of TENT5A in the regulation of the stability of anti-COVID19 mRNA vaccine.

Scientific Impact

Description of TENT5 cytoplasmic poly(A) polymerases as important regulators of physiological processes.

Discovery that TENT5A re-adenylates and stabilizes anti-SARS-CoV-2 mRNA vaccine, enhancing antigen production and vaccine efficacy.

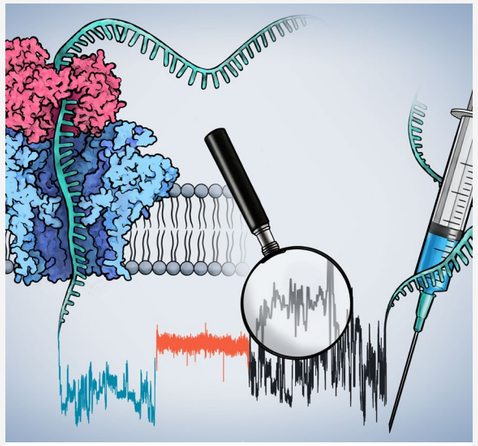
Future Goals

Within the framework of the recently-funded ERC Advanced Grant ViveRNA, we plan to comprehensively study the stability of both endogenous and therapeutic mRNA in vivo. We will enhance the accuracy of the methods used to determine the properties of mRNAs, especially computational protocols for the analysis of poly(A) tails. These, combined with carefully designed transgenic mouse models, primary cell cultures, and synthetic biology approaches, should, in the future, enable the design of next-generation mRNA therapeutics. In parallel, together with our collaborators from the Virtual Research Institute, we are actively working on improving mRNA-based therapies using chemical approaches and applying them for cancer immunotherapy.

SCAN

Group Leader

Andrzej Dziembowski is a molecular biologist and professor of biological sciences. He graduated from the University of Warsaw. After postdoctoral studies at the CNRS Molecular Genetics Centre in Gif-sur-Yvette, France, and several years of a PI position at the Polish Academy of Sciences, he assumed the ERA Chairs group leader position at the IIMCB in 2019. His work has been recognized with numerous awards and prestigious grants, including the ERC Advanced Grant (2023), the Prime Minister Award (2022) and the Prize of the Foundation for Polish Science (2018). He is a member of the European Molecular Biology Organization, Polish Academy of Sciences, Academia Europaea and RNA Society.



We aim to use nanopore sequencing to identify factors that affect mRNA stability. This will allow the design of better therapeutic mRNAs to help fight diseases. Illustration by Natalia Gumińska

Collaborations

Our lab coordinates a large Virtual Research Institute project, the Horizon for Excellence in messenger RNA applications in immunoOncology (HERO). Within HERO, we collaborate with Marcin Nowotny and Marta Miączyńska from our Institute, Jacek Jemielity, and Joanna Kowalska from the University of Warsaw, as well as Dominika Nowis and Jakub Gołąb from the Warsaw Medical University. At the same time, we have several other ongoing collaborations. These mainly focus on mRNA stability and include Magdalena Dziembowska (University of Warsaw), Bertrand Séraphin (IGBMC, France), Agnieszka Tudek (IBB Warsaw), Torben Jensen (Aarhus University), and Greg Kudla (HGU, UK).

"We are very intrigued by the fact that although the machinery involved in mRNA metabolism is the same everywhere, there is high variability in mRNA stability and poly(A) tail dynamics in all tissues. This is reflected, for instance, by high differences in the average lengths of poly(A) tails depending on the cell type. Understanding of this variation is particularly important in the context of future applications for mRNA-based therapeutics"

Andrzej Dziembowski, PhD, Professor

Group Members

Senior Researcher: Seweryn Mroczek, PhD
Postdoctoral Researchers: Aleksandra Brouze, PhD, Natalia Gumińska, PhD, Paweł Krawczyk, PhD, Tomasz Kuliński, PhD, Monika Kusio-Kobiałka, PhD, Ewa Poniecka, PhD, Bartosz Tarkowski, PhD
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Research Assistans: Kamila Affek, MSc, Michał Brouze, MSc, Paula Castañeda Londoño, MSc, Karolina Kasztelan, MSc, Ewelina Patrycja Owczarek, MSc **Volunteers:** Alicja Bień, Dawid Dzadz, BSc, Julia Gilewska, BSc, Jakub Guzek, Sebastian Jeleń, PhD, Vladyslava Liudkovska, PhD, Marcin Małkowski, MSc, Katarzyna Matylla-Kulińska, PhD, Maria Nizik, BSc, Aleksandra Okrasa, Wiktoria Orzeł, MSc, Weronika Sobczak, Marcin Szpila, MSc
Lab Technician: Alina Zielińska, BSc
Laboratory Support Specialist: Paula Kwapisz, MSc

Laboratory of

Molecular and Cellular Neurobiology

Our goal is to understand how nerve cells develop their characteristic shape, critical for the functioning of the brain. Our "gateway" to the world of neurons is the protein mTOR. By utilizing molecular and cellular biology tools, we have come to understand what functions of mTOR are essential for neurons. We want to use this knowledge to diagnose and treat tuberous sclerosis, a disease caused by excessive mTOR activity.

Research Summary

Since the inception of our laboratory, our goal has been to understand how neurons develop their characteristic shape, which is crucial for brain function. We have sought to identify such mechanisms by studying the mammalian/mechanistic target of rapamycin (mTOR) protein, which is involved in neuronal development and various neuropathologies known as mTORopathies. mTOR is a serine-threonine kinase involved in almost all aspects of mammalian cell function. It forms two protein complexes that were originally thought to regulate translation (mTORC1) or affect the actin cytoskeleton (mTORC2). My postdoctoral work showed that regulating mTOR-dependent translation contributes to dendritogenesis. However, our subsequent work has shown that mTOR functions during neuronal development go beyond the canonical control of translation, e.g., cytoskeleton regulation, intracellular transport or transcription. Our recent studies focus mainly on mTOR functions in neuronal nuclei. An essential part of our work has been to apply our findings in cellular models to clinically relevant models and material. We focused on tuberous sclerosis (TSC), a disease caused by hyperactive mTOR. As a result, we have identified new potential drug targets (TrkB, GCLC) and predictive biomarkers for epilepsy in TSC. In parallel, in recent years we have investigated the mechanisms underlying the stability of neuronal morphology associated with the development of depression.

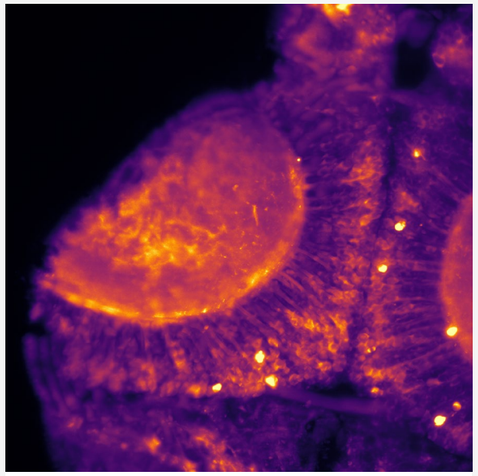
Scientific Impact

Discovery of numerous regulators of neuronal cell morphology, including several mTOR substrates.

Identification of GCLC and TrkB as new potential therapeutic targets in tuberous sclerosis.

Development of predictive biomarkers for drug-resistant epilepsy in children with tuberous sclerosis.

SCAN



Activity of neurons in zebrafish brain measured using genetic calcium ion sensors after inhibition of chromatin modifying enzymes. Brighter color represents higher activity. Illustration by Roberto Pagano

Future Goals

Our primary goal for the coming years is to find out what functions mTOR fulfills in the nucleus of neurons and how they affect their proper development and function. Our current research suggests that destabilizing nuclear mTOR functions, such as controlling transcription factors, can lead to epilepsy. Therefore, we want to test this hypothesis thoroughly.

Collaborations

Our key collaborators include Prof. Kathrin Thedieck, Prof. Sergiusz Jóźwiak, Prof. Katarzyna Kotulska, Prof. David Kwiatkowski, Prof. Eleonora Aronica, Prof. Leszek Kaczmarek and Prof. Ewelina Knapska.
We are working to understand how molecular biology translates into clinical features of tuberous sclerosis or depression and how this knowledge can be used to help patients.

Group Leader

Jacek Jaworski is a neurobiologist and professor of biological sciences. Currently, he is the Deputy Director for Science at the IIMCB. He graduated from the University of Warsaw and later received a PhD from the Nencki Institute of Experimental Biology PAS. After his postdoctoral studies at the Massachusetts Institute of Technology, USA, he established his own laboratory at the IIMCB in 2005 that focuses on the molecular basis of the development and stability of neuronal networks. He is a member of the European Molecular Biology Organization.

"Our research focuses on the molecular basis of the development and stability of neuronal networks. In particular, we focus on the molecular functions of the mTOR protein, which will enable better diagnosis and potential therapy of mTORopathies, diseases caused by mTOR hyperactivity."

Jacek Jaworski, PhD, Professor

Group Members

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Małgorzata Urbańska, PhD
Postdoctoral Researcher
Roberto Pagano, PhD
Research Specialist
Katarzyna Machnicka, MSc
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Laboratory Support Specialists
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Laboratory of

Cellular Genomics

We are a research group working on functional, metabolic, and immune aspects of gastrointestinal health. We use experimental and computational methods to describe mechanisms underlying chronic gut and liver diseases. Our goal is to understand the role of microbiota in driving disease-associated changes in the state of cells and their interactions.

Research Summary

Our lab studies various aspects of the gut-liver axis in health and disease. We are investigating the bidirectional crosstalk between the liver and the intestine, focusing on the role of resident microbiota. We are exploring how shifts in bacterial composition and changes in intestinal physiology affect liver cells and how liver health contributes to homeostasis in the gut. By studying how cells respond to microbiota-derived metabolites and molecules coming from nutrition, we uncover mechanisms through which diet and microbiota affect host physiology.

To achieve our goals, we apply various modern techniques. We are developing and adopting sequencing-based methods to study host cells and microbiome (single-cell RNA-seq, ATAC-seq, ChIP-seq, metagenomics). We integrate these data with metabolomics to generate comprehensive multimodal characterisations. To identify underlying molecular mechanisms, we are establishing in vitro high-throughput screening methods in cell lines and organoids. Finally, we are using advanced bioinformatics to generate insights and predictions, which we then validate experimentally. Moreover, in the spirit of "data parasitism", we are integrating and reusing underutilised published datasets to generate novel discoveries.

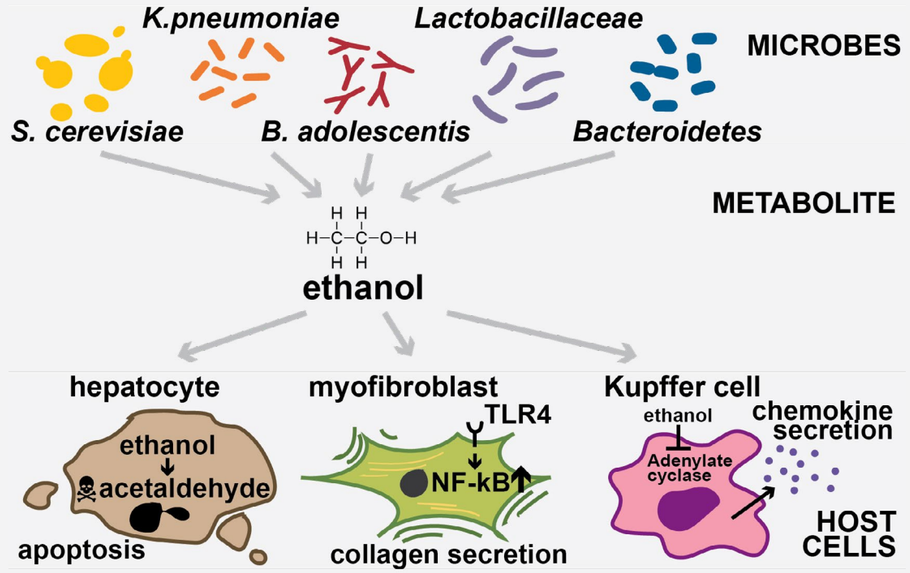
Scientific Impact

We started our group in 2023. We work on genomic, metabolic, and immune aspects of gastrointestinal health. We use experimental and computational methods to describe mechanisms for underlying chronic gut and liver diseases, focusing on cellular phenotypes, associated niches, and host-microbiota cross-talk.

Future Goals

Our goal is to understand the host-microbiota interactions and to utilize that knowledge in the treatment and prevention of gastrointestinal diseases. We envisage that our results will lay a stepping-stone for new prebiotics, probiotics and postbiotics, which will allow better clinical outcomes.

SCAN



Ethanol as an example of the complexity of host-microbiome interactions on the gut-liver axis

Group Leader

Aleksandra Kołodziejczyk is an interdisciplinary biologist. She initially completed an international first-level degree in biotechnology, run by a consortium of European Universities at the University of Perugia. She then completed her MSc degree in molecular biosciences, majoring in molecular and cellular biology at the University of Heidelberg, Germany. In 2012, to pursue her PhD, she joined the group of Dr. Sarah Teichmann at the EMBL EBI and the Wellcome Trust Sanger Institute and worked in the emerging field of single-cell transcriptomics. Awarded by the EMBO Long Term Fellowship and the Marie Skłodowska-Curie Action Individual Fellowship, she attained funding to undertake postdoctoral training at the Weizmann Institute of Science. She established her own research group at the IIMCB in 2023, which employs cutting-edge "omic" technologies to study host-microbiota interactions and gastrointestinal health.

"In our lab, we study the complexity of the interactions between food, microbiota and host cells of the gastrointestinal system in health and disease. There are many components to this system, different chemicals in food, different microbes and different cell types, which all interact with each other in various ways. We want to describe this system and understand its underlying laws."

Aleksandra Kołodziejczyk, PhD

Group members

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PhD Students
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Aleksandra Uryga, MSc
Lab Technnican
Karolina Komorowska, BSc

Volunteers
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Joanna Siatecka, BEng
Laboratory Support Specialist
Anna Sobocińska, PhD

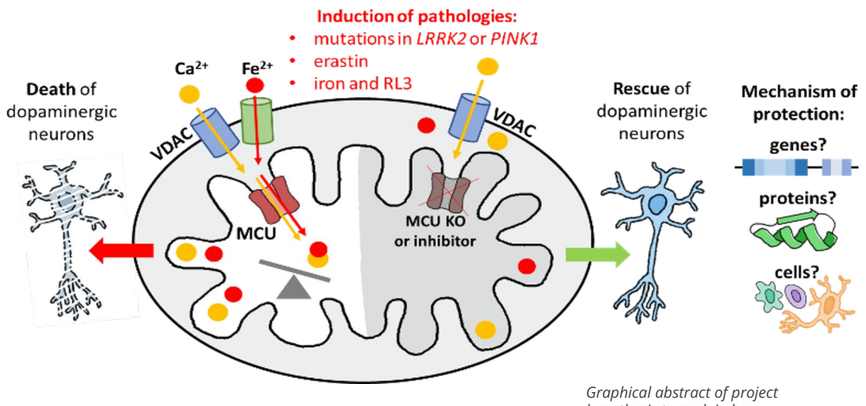
Laboratory of

Neurodegeneration

We study molecular processes, which degenerate neurons in Alzheimer's (AD), Parkinson's (PD) and Huntington's (HD) diseases. We use cultured human and animal cells as well as fish and mouse models of these diseases. Recently we have shown that the disappearance of neurons in the PD zebrafish model can be stopped by inhibiting the influx of calcium ions to mitochondria. We plan to identify calcium sensitive proteins that take part in the development of this disease.

Research Summary

Parkinson disease (PD) is an incurable neurodegenerative disorder. Its pathological hallmarks include the aggregation of α-synuclein and loss of dopaminergic neurons. In various PD animal models and in cells from PD patients, perturbations of calcium homeostasis occur. Our major focus are on Ca2+-dependent mechanisms involved in the development of PD. Its three types can be distinguished: most prevalent sporadic with a late onset, familial that is caused by mutations of genes such as PINK1 or LRRK2, and environmentally-induced by drugs such as MPTP. Our published data show that degeneration of dopaminergic neurons in zebrafish PD models as a result of a pink1 mutation or MPTP toxicity is rescued by inactivation of the mitochondrial calcium uniporter (MCU). Others showed that MCU inhibition rescues neurons with mutation in LRRK2. If different factors that cause PD have a common denominator that is related to MCU activity, then what is it? Our hypothesis is that specific genes are turned on or off when MCU inactivation exhibits protection of dopaminergic neurons. The aim of our work is to identify those genes, proteins and cells in which they are expressed to understand how they provide neuronal protection.



Graphical abstract of project hypothesis to explain how inactivation of mitochondrial calcium uniporter protects dopaminergic neurons. Illustration by Ewelina Latoszek

SCAN

Scientific Impact

We expect to identify genes that are turned on or off when calcium ions cannot enter mitochondria via uniporter.

We will identify cells in which proteins that are encoded by these genes operate.

The identified genes and proteins might have potential diagnostic value for pre-symptomatic stages of PD and provide a basis for novel anti-PD treatments.

Future Goals

After identifying gene(s) that are turned on or off when calcium ions cannot enter mitochondria via their uniporter and cells in which it takes place to preserve neuronal protection, the goal will be to confirm this mechanism in animal models such as zebrafish and killifish.

Group Leader

Jacek Kuźnicki is a neurobiologist and professor of biological sciences. He graduated from the University of Warsaw and later received his PhD from the Nencki Institute of Experimental Biology PAS. He was a postdoctoral fellow at the National Institutes of Health in Bethesda, MD, USA. He was a Director of the IIMCB in 1999-2018, the President of the National Science Centre Council in 2020-2022, and has been an ordinary member of the Polish Academy of Sciences since 2020. He is a laureate of many awards, for example, the Officer's and Knight's Crosses of Polonia Restituta (1998, 2008), the Prime Minister's Award for Scientific Achievements (2003), and the Crystal Brussels Sprout Award for outstanding achievements in 7FP EU (2013).

"In various animal models of Parkinson's (PD), as well as of Alzheimer's (AD) and Huntington's (HD) diseases and in cells from PD, AD and HD patients, perturbations of calcium homeostasis occur. Studying these processes may identify common pathological mechanism in neurodegenerative diseases."

Jacek Kuźnicki, PhD, Professor

Group Members

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Daniel Kozłowski, BSc
Monika Kwiatkowska, MSc Eng. (from IBCH[3])
Anna Sarosiak, MSc (from IPPH[1]),
Iga Wasilewska, PhD (from MMRI[2])
Lab Technician
Monika Matuszczyk
Laboratory Support Specialist
Dominika Dubicka-Boroch, MSc

1 Institute of Physiology and Pathology of Hearing
2 Mossakowski Medical Research Institute Polish Academy of Sciences
3 Institute of Bioorganic Chemistry Polish Academy of Sciences

Laboratory of

Single-Molecule Biophysics

We are studying the choreography of RNA-protein interactions in bacteria to understand how these tiny organisms regulate gene expression. To capture these molecular maestros in action, we employ single-molecule microscopy. It enables us to observe hundreds of biomolecules, each with its own fluorescent tag to monitor their interactions in real-time. By exploring the assembly of RNA-protein complexes, we are establishing how bacteria rapidly respond to signals, influencing gene expression within minutes. We are deciphering the bacterial script, with the hope of rewriting it for the better. Our work is supported by Sonata Bis grant from the National Science Centre, Poland.

Research Summary

We study the interplay between various cellular processes within bacteria. We delve into the world of RNA chaperones and sRNAs, investigating how they team up to control the expression of genes in bacteria. Our spotlight is on the degradosome, a squad of molecular players orchestrating RNA degradation, led by ribonuclease E. We are exploring if these players can form super-efficient complexes, influencing gene regulation in exciting new ways. Beyond advancing our understanding of bacterial gene regulation, we strive to create tools for designing artificial sRNAs with specific effects on targeted genes. Employing a bottom-up approach that combines in vitro and in vivo methods, the aim is to establish rules governing efficient regulation of the bacterial transcriptome for practical application.

Future Goals

Global antibiotic resistance leading to incerased medical costs and mortality, demands urgent attention. Our future project will focus on antibiotic-resistant ESKAPE organisms. We will explore jumbo bacteriophages, aiming to uncover their potential in combating A. baumannii. The project will study host-phage interactions to identify potential genes involved in antibacterial actions. Based on the results, we might be able to design phage-mimicking therapeutics.

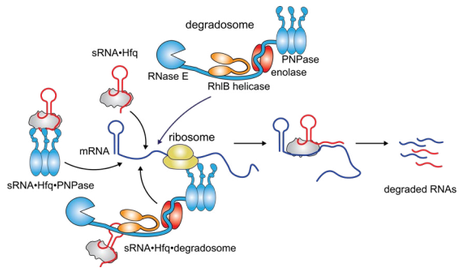
SCAN

Scientific Impact

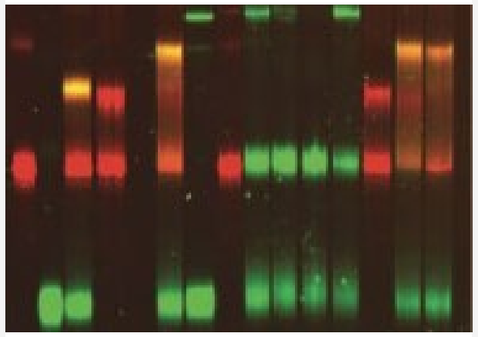
Deep insights: we will gain a profound understanding of RNA regulation in bacteria, exploring the nuances of targeting and degradation.

Potential biotechnological applications: we will contribute to the development of more efficient mRNA regulators.

Cutting-edge technology: we are building a state-of-the-art microscope to monitor single molecules in action.



The interplay between sRNA-targeting and RNA degradation involves degrading complexes that assemble through diverse pathways. Are these pathways specific to individual RNAs? The sRNA-Hfq complex can interact with the degradosome before binding to mRNA. Does the presence of the degradosome aid in sRNA-mRNA annealing? PNPase, when not associated with the degradosome, can assemble with the sRNA-Hfq complex. Are sRNAs in such complexes active in targeting mRNAs? The sRNA-mRNA duplex often undergoes coupled degradation. What are the steps of this process? How do these processes occur in the context of actively translating ribosomes?



Fluorescent gel: This image shows the results of an electrophoretic mobility shift assay. The experiment aimed to determine if two RNAs (labeled with green and red fluorophores) interact and form complexes with other proteins. The higher the band appears in the gel, the slower the complex migrates, indicating the presence of bound complexes. Illustration by Ewelina Małecka

Collaborations

We collaborate with Prof. Ben Luisi (University of Cambridge), who is an expert in the field of bacterial RNA degradation.

Group Leader

Ewelina Małecka is a biochemist who graduated with an MSc and then received a PhD from the Adam Mickiewicz University, Poznań. After completing her postdoctoral studies in 2022 at Johns Hopkins University, USA, she established her own laboratory at the IIMCB that focused on studying RNA-protein interactions, RNA metabolism in bacteria, and bacteria-phage interactions. She is a member of the RNA Society.

"The highlight of research in our era is to understand how biological processes are interconnected at the molecular level within the cellular environment. We are striving to achieve this by visualizing individual RNAs and proteins in action."

Ewelina Małecka, PhD

Group Members

Postdoctoral Researcher
Maciej Dylewski, PhD
PhD Student
Maxim Serdakov, BSc
Lab Technnican
Karolina Komorowska, BSc
Laboratory Support Specialist
Anna Sobocińska, PhD

Laboratory of

Cell Biology

We study how cells take up and transport various substances in their interior, focusing on how these logistics rules are changed in cancer cells to fuel their unstoppable growth. Understanding differences in functioning between normal and cancer cells can guide the design of therapies to selectively kill cancer cells. We have already identified one such vulnerability, "an Achilles' heel," in certain cancer cells and continue searching for more.

Research Summary

We are fascinated by two intracellular processes, endocytosis and receptor signaling, and how they are interlinked. We seek to understand how endosomal compartments contribute to the trafficking and signaling of receptors for growth factors and cytokines in normal and cancer cells.

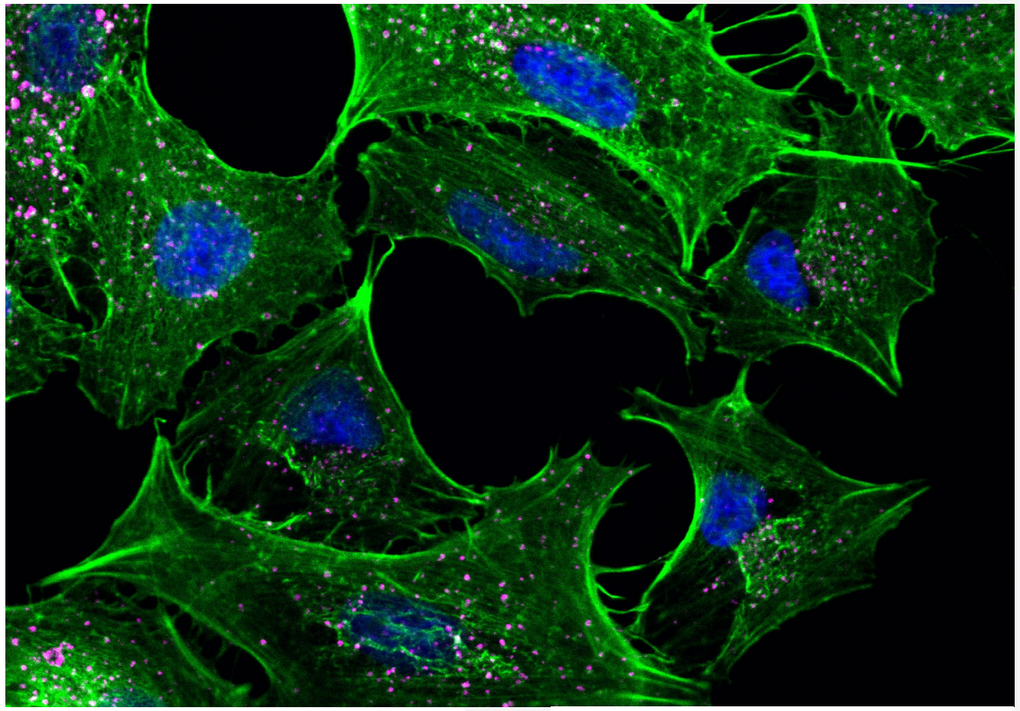
We investigate the roles of endosomal sorting complexes required for transport (ESCRT) in cell physiology and oncogenesis. We discovered that the dysfunction of endosomes due to lack of ESCRT function induces an intracellular sterile inflammatory reaction.

We also found out that the ESCRT-I complex is indispensable for the biogenesis and functioning of lysosomes.

The synthetic lethality we identified between two paralogous ATPases of ESCRT machinery, VPS4A and VPS4B, revealed a novel pair of druggable targets for personalized oncology.

In another line of research, we focus on the receptor tyrosine kinase AXL, which is overexpressed in late-stage cancers. By identifying the interactome of AXL, we revealed that its activation induces several actin-dependent processes, including macropinocytosis.

SCAN



Human lung adenocarcinoma cells cultured in vitro, with nuclei stained in blue, actin in green and endosomes in magenta. Ilustration by Patrycja Daszczuk.

Scientific Impact

Our studies provide proof of concept that intracellular trafficking and molecules regulating it can represent a viable therapeutic target in personalized oncology. For example, the synthetic lethality between VPS4A and VPS4B ATPases provides a rationale for developing VPS4 inhibitors for the precision treatment of VPS4B-deficient cancers. Our ongoing studies of AXL-dependent macropinocytosis aim to uncover the means of blocking this process in metastatic and drug-resistant cancers with AXL overexpression.

Future Goals

We wish to understand how altered expression or mutations in the ESCRT components, observed in cancer or some rare diseases, modify cell physiology. In parallel, we aim to elucidate the mechanisms and effector proteins by which the activated AXL receptor drives macropinocytosis in cancer cells.

Collaborations

We collaborate with partners from the IIMCB and external institutions within the HERO consortium project that aims to develop the next generation of mRNA–based cancer immunotherapies.

Group Leader

Marta Miączyńska is a molecular cell biologist and professor of biological sciences, currently Director of the IIMCB. She graduated from the Jagiellonian University and received her PhD from the University of Vienna. She was a postdoctoral fellow at the European Molecular Biology Laboratory in Heidelberg and the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden. She is a member of European Molecular Biology Organization Council (2021-2026), Polish Academy of Sciences, and Academia Europaea. Since 2024, she has been a co-chair of the EU-LIFE alliance of leading life science research institutes in Europe.

"We study alterations that occur in signaling and trafficking processes in cancer cells because such changes may represent vulnerabilities of cancer cells to specific therapies."

Marta Miączyńska, PhD, Professor

Group Members

Senior Researchers
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PhD Students
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Marta Jakubik, MSc
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Renata Wyszyńska, MSc

Laboratory of

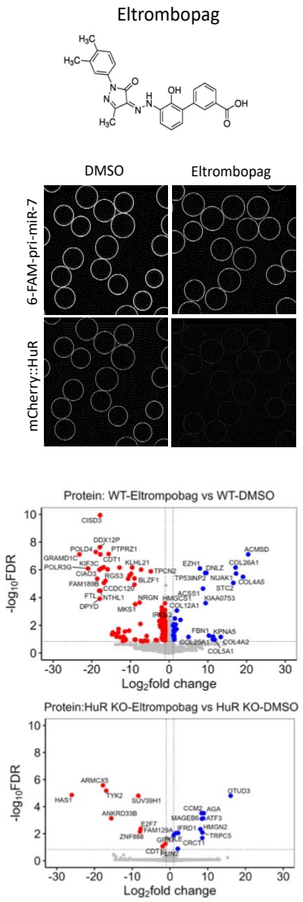
RNA-Protein Interactions – Dioscuri Centre

We investigate how human RNA-binding proteins (RBPs) control gene expression and combat RNA viruses. Using diverse methods from structure determination to assays in cells, we have uncovered RBPs and small molecules regulating mRNA production linked to Parkinson's disease. Additionally, we identified a novel RBP crucial in the innate immune response to RNA viruses. Our work tackles fundamental molecular biology questions and offers insights for treating human infectious and non-infectious diseases.

Research Summary

RNA-binding proteins (RBPs) play pivotal roles in regulating gene expression through RNA-protein interactions, impacting cellular homeostasis and disease pathogenesis. Despite the continuous discovery of new RBPs via high-throughput proteomics, our understanding of their functions remains limited. Particularly in the context of human health and disease, the molecular mechanisms governing their RNA-related roles are not fully elucidated. RNA viruses, such as SARS-CoV-2 and influenza A, pose significant threats to global health and economies. Understanding host-virus interactions at the molecular level is crucial for devising effective strategies against viral infections. Our recent study investigates the RNA-binding activities of E3 ubiquitin ligase TRIM25 in the innate immune response to RNA viruses, shedding light on its role in destabilizing influenza A mRNA to combat viral infections. Additionally, we aim to decipher the structure of the TRIM25/RNA complex, elucidating novel RNA-binding domains and the RNA-mediated stimulation of ubiquitination, crucial for antiviral functions. Parkinson's disease (PD) presents a daunting challenge, with an escalating socioeconomic burden and limited treatment options. Our research focuses on unravelling the regulatory mechanisms controlling alpha-Synuclein (alpha-Syn) production, a key player in PD pathology. We identified HuR as a regulator of miR-7 biogenesis and a potential target for decreasing alpha-Syn levels. Elucidating the biological control and pharmacological regulation of HuR is a critical aspect of our research agenda, aiming to advance our understanding and treatment of PD.

SCAN



Eltrombopag inhibits HuR-RNA interactions. Eltrombopag's chemical structure. RP-CONA depicting decreased intensity of mCherry:HuR binding to 6-FAM-pri-miR-7. Eltrombopag's impact on the proteome is HuR-dependent.

Scientific Impact

We have discovered various aspects of RNA biology in eukaryotic cells. Our work uncovered how RNA-binding proteins interact with miRNAs precursors, critical for development and disease. Additionally, we identified factors controlling brain-specific miRNAs. Furthermore, we revealed TRIM25's role as an RBP in the innate immune response to RNA viruses. Our research, supported by grants including an MRC Career Development Award, NAWA Polish Returns, BBSRC Project grant, Dioscuri Centre of Scientific Excellence, and OPUS NCN contributes to our understanding of RNA biology.

Collaborations

Together with Prof. Juri Rappsilber (Berlin Technical University) we use mass spectrometry for whole proteome studies as well as structure analyses. Prof. Rappsilber is a German partner of the Dioscuri Centre for RNA-Protein Interaction in Human Health and Disease.

Together with Prof. Javier Caceres (University of Edinburgh) we are investigating the role of TRIM25 in the Nonsense Mediated Decay pathway.

Together with Elżbieta Nowak, PhD, DSc Habil and Prof. Marcin Nowotny (IIMCB) we are elucidating the structures of RBPs.

Together with Dr. Katarzyna Mleczko-Sanecka (IIMCB), Wojciech Pokrzywa, PhD, DSc Habil (IIMCB) and Prof. Tilo Kunath (University of Edinburgh) we are elucidating the effects of RBP-targeted compounds in cells and whole organisms.

Future Goals

We aim to employ a multidisciplinary approach to explore the links between RNA biology and human diseases. We will be probing the involvement of RBPs in viral signaling pathways. This can lead us to identification of a novel and broad range of antiviral therapies. Furthermore, we will be expanding our understanding of HuR/RNA regulatory pathways and seeking compounds to decrease alpha-Syn expression in PD.

Group Leader

Gracjan Michlewski is a molecular biologist and professor of biological sciences. He graduated from the Adam Mickiewicz University, Poznań and received his PhD from the Institute of Bioorganic Chemistry PAS, Poznań. He worked as a postdoctoral fellow at the MRC Human Genetics Unit in Edinburgh, United Kingdom (2005-2010). In 2011, he founded a laboratory at The Wellcome Trust Centre for Cell Biology, University of Edinburgh, supported by an MRC Career Development Award. From 2018, he held roles as Senior Lecturer and Reader at the Infectious Medicine Department of the University of Edinburgh, and concurrently served as an Associate Professor at the Zhejiang University-University of Edinburgh Institute in Haining, China. In 2021, he established a laboratory at the IIMCB with the Dioscuri Centre for RNA-Protein Interactions in Human Health and Disease. He is a member of the RNA Society. Additionally, he co-organized the successful first Polish RNA Biology Meeting in September 2023 in Warsaw.

"In my research, I unravel the intricate connections between RNA biology and human diseases, aiming to discover innovative approaches for next-generation treatments."

Gracjan Michlewski, PhD, Professor

Group Members

Postdoctoral Researchers
Ivan Trus, PhD, Magdalena Wołczyk, PhD
Research Assistants
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Research Specialists
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Technican
Julia Kędzierska
Laboratory Support Specialists
Kamila Gajdek, MSc Eng.
Eliza Ratkowska
Contractor
Nila Roy Choudhury, PhD

Laboratory of

Iron Homeostasis

Iron is vital for cellular functions, but excess amounts can be toxic. Using mice and primary cells, we employ techniques to analyze specific cell types. This helps us investigate mechanisms controlling iron balance and understand its impact on specialized cell functioning. Identifying new iron-related processes at the level of individual cell types enhances our knowledge of mammalian physiology and diseases associated with iron dyshomeostasis.

Research Summary

One aspect of our research focuses on iron recycling, mainly orchestrated by splenic red pulp macrophages (RPMs) that break down aging erythrocytes, releasing iron into the bloodstream. Despite being the primary iron source, limited knowledge exists about RPMs and the mechanisms influencing iron turnover efficacy. Our recent findings highlight the impairment of this process during aging. We demonstrated that age-related iron deposition in RPMs leads to their failure and demise, a challenge mitigated by dietary iron restriction in mice. Another project explores unique functional and metabolic changes in RPMs in response to iron deficiency, aiding the organism's adjustment to restricted iron supplies. Concurrently, we investigate novel mechanisms in the sensing of body iron levels, particularly by specialized liver endothelial cells known as LSECs. We uncovered a new signaling pathway involving MAP kinases and the transcription factor ETS1, activated by excessive iron to amplify the expression of the well-known "iron sensor" Bmp6. Additionally, our research identifies LSECs as the primary cells removing free hemoglobin from circulation, playing a role in physiological iron recycling and hemoglobin detoxification under hemolytic conditions.

Future Goals

In the future, our goal is to explore the connections between iron recycling efficiency and splenic immune functions. We aspire to deepen our understanding of the diverse roles of liver endothelium in maintaining iron homeostasis. Additionally, we aim to apply the insights gained from the rewiring of red pulp in response to iron deficiency to the contexts of cancer-related iron deficits and anemia.

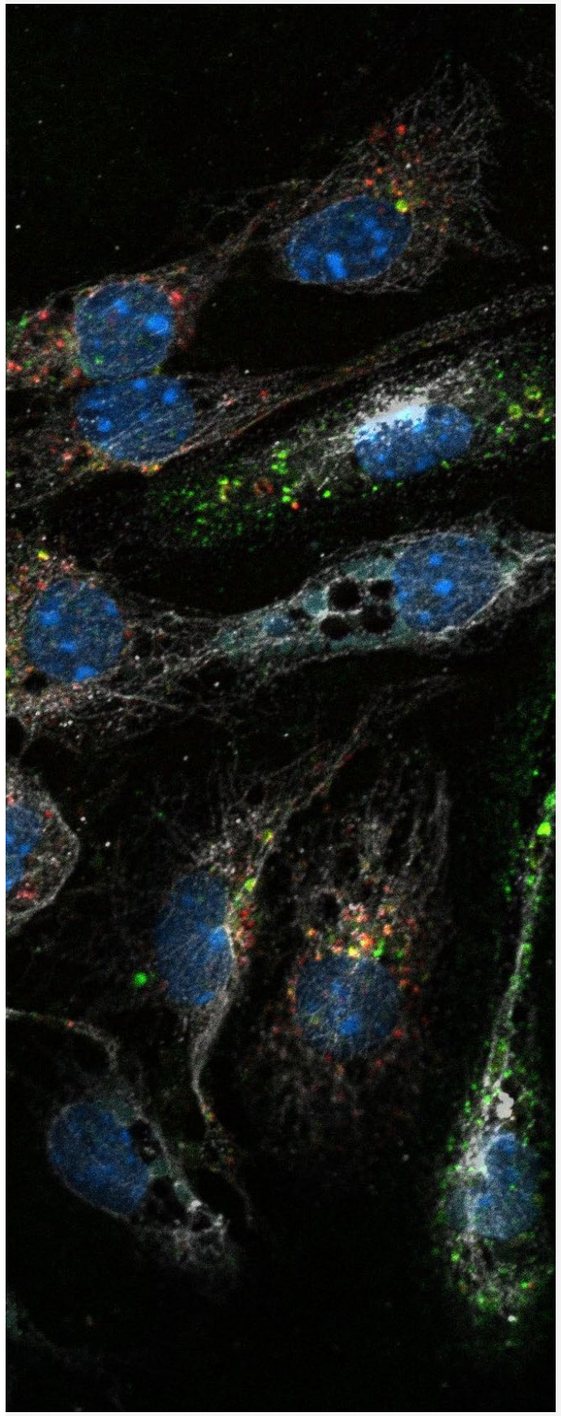
SCAN

Scientific Impact

We identified an impairment of iron recycling as an early hallmark of aging.

We discovered a new signaling pathway involved in iron sensing by liver endothelium.

We uncovered a previously unknown role of liver endothelium in the clearance of free hemoglobin, operating both under physiological and hemolytic conditions.



Primary murine LSECs performing uptake of fluorescently-labeled hemoglobin. Illustration by Aneta Jończy.

Group Leader

Katarzyna Mleczko-Sanecka is a biomedical researcher interested in signaling and intercellular communication, with a longstanding focus on principles governing iron metabolism. She graduated from the Jagiellonian University, Kraków. As a fellow of the Louis-Jeantet Foundation, she obtained a joint PhD degree from the European Molecular Biology Laboratory in Heidelberg and at Heidelberg University. In 2017, she established her research group at the IIMCB, and in 2023, she received the Gunshin Levy Award from the BioIron Society, recognizing her dedication, commitment, and contributions to the research field of iron homeostasis.

"In our research, what we find particularly exciting is to realize that certain "dogmas" may only be partially accurate or even entirely false. This not only challenges existing beliefs but also creates opportunities to discover new principles in mammalian physiology that remain incompletely understood."

Katarzyna Mleczko-Sanecka, PhD

Group Members

Postdoctoral Researcher
Aneta Jończy, PhD
Research Specialist
Marta Niklewicz, MSc
PhD Students
Komal Kumari Chouhan, MSc
Raghunandan Mahadeva, MSc
Pratik Kumar Mandal, MSc
Technician
Krzysztof Franczak
Laboratory Support Specialist
Anna Grabowska, PhD

Laboratory of

Protein Structure

Our group studies the systems that process genetic information in living cells. This information is encoded in DNA and RNA. Special protein machines in the cell decode this information, ensure its stability and copy it. We study these machines at the level of individual chemical groups. For example, we have determined the molecular mechanisms of machineries that repair chemically damaged DNA or viral machineries that replicate genomes of the viruses.

Research Summary

Our group uses structural biology, mainly cryo-electron microscopy, and protein biochemistry to elucidate the mechanism of action of enzymes involved in the processing of genetic information encoded in DNA and RNA. In particular, we study DNA repair and transposition, reverse transcription, viral replication, RNA processing, and bacterial antiphage systems. For example, in our recent work we determined the molecular architecture of a key complex in one of the major DNA repair pathways in bacteria: homologous recombination. This complex, consisting of the RecF, RecR and RecO proteins, is responsible for the formation of a filament of single-stranded DNA and RecA. The latter promotes the search for homologous DNA in the repair process. We have also determined the structure and mechanism of action of unusual reverse transcriptases involved in the antiphage response - AbiK and Abi-P2. These enzymes are unique in that they produce long stretches of single-stranded DNA in a template and primer independent manner. They initiate synthesis by covalently attaching the first nucleotide to their tyrosine residue. Their other unique property is their ability to form hexamers and trimers.

Future Goals

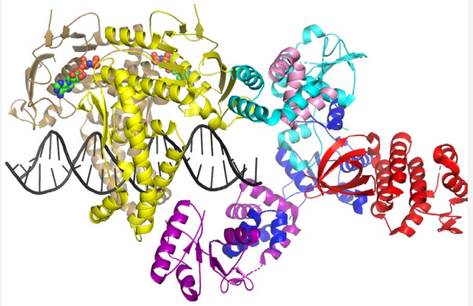
In the near future, we will continue our studies on DNA repair and transposition. We would like to fully elucidate the mechanism of action of the RecFOR complex and provide an understanding of the in vivo mechanism of antiphage reverse transcriptases.

SCAN

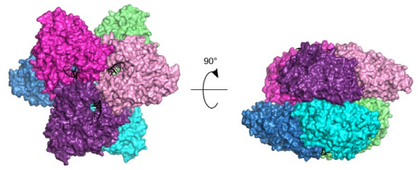
Scientific Impact

The determination of the first structure of the bacterial homologous recombination complex RecFOR, explaining how it finds single-stranded double-stranded DNA junctions.

The first structures of antiphage reverse transcriptases, revealing their hexameric/ trimeric architecture and the mechanism of protein priming.



Structure of the RecFOR-DNA complex involved in bacterial homologous recombination. RecF dimer is shown in yellow and sand, RecR tetramer in cyan, pink, blue and purple. RecO is shown in red and DNA in black.



Surface representation of the structure of AbiK antiphage reverse transcriptase. Subunits of the hexamer are shown in different colors and the DNA is shown as black ladder.

"Our goal is to provide complete pictures of the mechanisms of action of certain DNA and RNA-processing pathways at the level of single atoms."

Marcin Nowotny, PhD, Professor

Group Leader

Marcin Nowotny is a structural biologist and professor of biological sciences. He graduated from the University of Warsaw and received his PhD from the Nencki Institute of Experimental Biology, PAS. After postdoctoral studies at the National Institutes of Health (USA), in 2008 he established his own laboratory at the IIMCB. He is the laureate of numerous awards, such as the Jan Karol Parnas Award (2023), the Prize of the Foundation for Polish Science (2022), and the Team Award of the Minister of Education and Science for significant achievements in scientific activities (2021). He is a member of the European Molecular Biology Organization and Academia Europaea.

Group Members

Senior Researchers
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Elżbieta Nowak, PhD, DSc Habil
Postdoctoral Researchers
Małgorzata Figiel, PhD
Malwina Hyjek-Składanowska, PhD
Zuzanna Kaczmarska, PhD
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Research Assistant
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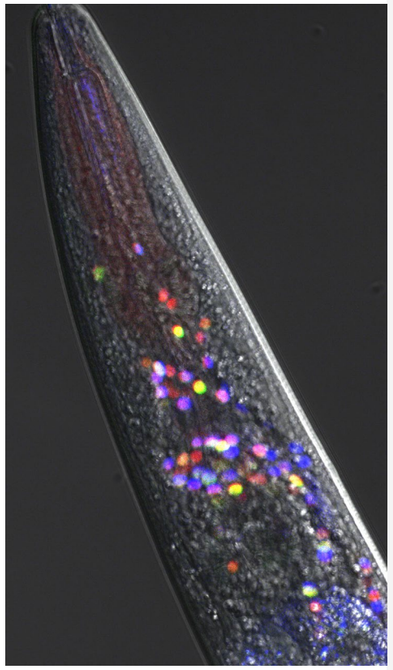
Junior Research Specialist
Justyna Jackiewicz, MSc
PhD Students
Sebastian Chamera, MSc
Prabaharan Chandrasekaran, MSc
Anuradha Chaudhary, MSc
Vysakh Viswanath Komathattu, MSc
Co-worker
Zara Naz, MSc
Volunteer
Nicola de Franceschi, PhD
Technician
Iwona Ptasiewicz
Laboratory Support Specialist
Kinga Adamska, MSc

Laboratory of

Protein Metabolism

Our research is centered on the dynamics of proteostasis, which involves the intricate equilibrium between protein synthesis and degradation. Our primary investigative focus is on the ubiquitin-proteasome system and the role of muscular exophers in maintaining proteostasis. Nonetheless, our curiosity extends beyond these areas, exploring a broader spectrum of topics related to protein homeostasis. To dissect these complex biological phenomena, we employ an integrated approach that combines biochemical assays, microscopy, molecular genetics, and bioinformatics analyses. Our studies are conducted using both mammalian cell models and the model organism Caenorhabditis elegans, leveraging their unique advantages to unravel the mechanisms underlying protein balance in cells.



The image, generated by the lab's team, showcases C. elegans modified with the NeuroPAL multicolor transgene, originally developed by Yemini et al., 2021, Cell. This modification offers a uniform, multicolor fluorescence map of the entire hermaphrodite nervous system. Illustration by Katarzyna Olek.

Research Summary

In our laboratory, we broach the frontiers of cellular and molecular biology, focusing on the mechanisms of cellular adaptation to various stresses, protein homeostasis, and the nuanced roles of ubiquitination in health and disease. Our research spans several exciting areas:

Cellular adaptation to cold: We aim to unravel the complex mechanisms that regulate the abundance and types of cellular RNAs and proteins, critical for cellular survival decisions. Our investigation into protein quality control networks and the ubiquitin-proteasome system during C. elegans' recovery from cold stress is pioneering, shedding light on cellular resilience.

Regulation of lysine-deficient proteome through non-canonical ubiquitination: At the heart of our research is the ubiquitin-proteasome system, a crucial pathway for removing damaged and surplus proteins. Our work challenges traditional views by focusing on ubiquitination beyond lysine residues, offering insights into the proteasome's recognition and degradation processes. We are also excited about our development of the DEGRONOPEDIA web server (available at degronopedia.com) facilitating the in-depth exploration and prediction of degron motifs across various model organisms.

SCAN

Exophers in proteostasis: Our findings on exophers, large extracellular vesicles, have revealed their unexpected role in nutrient delivery to embryos via muscle metabolism products. This discovery opened new avenues for understanding reproduction and offspring health, driving our current investigations into the molecular mechanisms of exophergenesis.

Nucleolar ubiquitination in ribosome biogenesis and stress protection: We have recently initiated research to understand how nucleolar ubiquitination influences the production of ribosomes and the stress response mechanisms in cancer cells. Our goal is to elucidate how nucleoli configurations contribute to cellular proteostasis and life-supporting functions.

Scientific Impact

CHIP and UFD-2 Ubiquitin Ligases Synergy: We demonstrated a highly processive ubiquitination system essential for regulating key enzymatic processes, impacting protein degradation strategies and potential breast cancer therapies. Our research was featured on the cover of the EMBO Journal in August 2022.

Unraveling FEM1C's Role in Neurological Diseases We identified an ultra-rare mutation linked to a previously uncharacterized neurological condition, leveraging insights into its pathological mechanism through a C. elegans model harboring an analogous mutation to the one found in patients.

Exophers in Embryonic Support: We discovered the role of exophers, the largest class of extracellular vesicles, in delivering nutrients from muscles to embryos, challenging existing paradigms of proteostasis and offspring quality assurance. Our findings were highlighted on the cover of the EMBO Reports in August 2021.

Future Goals

Our laboratory aims to deepen our understanding of the ubiquitin-proteasome system's role in cellular stress responses, explore the novel functions of exophers in intercellular communication, and harness bioinformatics to uncover new degron motifs. Additionally, we are dedicated to the development of a C. elegans-based platform for modeling rare diseases, which will not only enhance our understanding of these conditions but also facilitate the discovery of targeted therapies.

Group Leader

Wojciech Pokrzywa is a molecular biologist with expertise in C. elegans animal models. He graduated from the University of Wrocław and later received his PhD from the Catholic University of Louvain, Belgium. He was a postdoctoral fellow at the Cologne Excellence Cluster on Cellular Stress Responses in Aging-Associated Diseases (CECAD) at the University of Cologne, Germany. In mid-2017, he established his own research group that focuses on mechanisms of protein metabolism at the IIMCB. He and his team have been recognized with an award for outstanding scientific achievement by the Minister of Science and Higher Education (2024). He has authored numerous publications that have appeared in the most influential scientific journals, such as Cell, EMBO Journal, EMBO Reports, Molecular Cell, and Nature Communications.

"Our research efforts are dedicated to unraveling the complex molecular mechanisms of proteostasis and cellular adaptation, setting the stage for groundbreaking discoveries in biological science and new therapeutic strategies."

Wojciech Pokrzywa, PhD, DSc Habil

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Research Specialists
Lilla Biriczová, MSc
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Technican
Krzysztof Franczak
Laboratory Support Specialist
Anna Grabowska, PhD

Laboratory of

Zebrafish Developmental Genomics

Our research utilizes the zebrafish model organism to study how gene expression is regulated in the developing embryo, examining its links to congenital malformations in humans. We specifically focus on heart development and diseases, employing classical genetics alongside bulk and single-cell genomics techniques.

Research Summary

Intricate embryonic patterning is achieved through highly precise regulatory mechanisms that ensure controlled gene expression in the correct time and space. Our research aims to decipher the mechanism by which gene expression is regulated by transcription factors (TFs) and the epigenetic landscape. By exploring these mechanisms, we aim to illuminate how disruptions contribute to human congenital malformations. While key genetic factors that regulate the development and function of the heart are known, understanding their regulation, interactions, and coordination with epigenetic factors at different phases of heart development remains a gap. Our research focuses on cardiomyocytes and cardiac pacemaker cells.

Future Goals

We aim to generate zebrafish models of human genetic diseases which could be used for in-depth studies to elucidate disease mechanisms or screening for potential therapies. Ultimately, we hope that our research could contribute to a better understanding of the complex molecular pathways underlying human congenital diseases.

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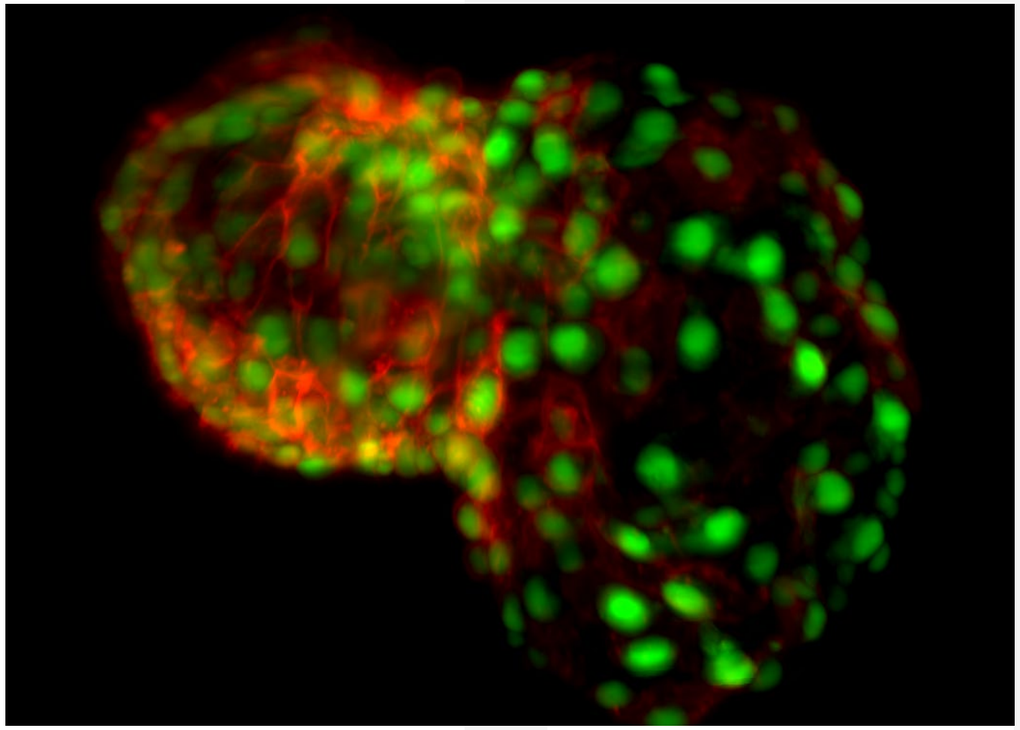

A 2-day old zebrafish heart. Cardiomyocytes are visualized by the expression of both green (nuclear) and red (cell membrane) fluorescent proteins. Illustration by Costantino Parisi.

Scientific Impact

We have generated transcriptomics and epigenomics resources of the developing zebrafish heart, covering the cardiomyocytes as well as rare cell types such as pacemakers. Our most recent work established a single cell transcriptome atlas of the developing zebrafish heart, revealing new cell types and their molecular profile. Additionally, our investigations have also revealed putative novel regulatory elements implicated in generating the cardiovascular cell diversity.

Collaborations

We collaborate with labs within the IIMCB as well as externally. We also collaborate internationally with leading labs in the genomics and clinical genetics field.

Group Leader

Cecilia Lanny Winata is a developmental biologist with an expertise in genomics and gene regulation. She received her PhD from the National University of Singapore and completed a postdoctoral fellowship at the Genome Institute of Singapore. In 2014, she established her own research group at the IIMCB through a project funded by the European Union's FP7 program in partnership with the Max Planck Institute for Heart and Lung Research, Germany. Her lab investigates gene regulation during embryonic development using the zebrafish (Danio rerio) as a model organism. Besides advancing the understanding of various aspects of developmental gene regulation, her research has generated invaluable genomics resources which contributed to enhancing the annotation of the zebrafish genome as part of the international DANIO-CODE consortium.

"Eventually, we believe that our research in zebrafish must benefit humans. Therefore, we are always striving to select candidates which possess clinical relevance or potential for therapy."

Cecilia Lanny Winata, PhD, DSc Habil

Group members

Postdoctoral Researchers
Agata Sulej, PhD
Shikha Vashist, PhD
Research Technician
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PhD Students
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Maciej Migdał, MSc
Karim Abu Nahia, MSc
Constantino Parisi, MSc
Eugeniusz Tralle, MSc
Lab Technician
Julia Kędzierska
Research Assistant
Shamba Mondal, MSc
Laboratory Support Specialist
Agnieszka Konkol, Msc

Laboratory of

Biomolecular Interactions and Transport AMU/IIMCB

We search for hidden passages that allow the transport of various small molecules through proteins. To achieve these goals, we develop new computational protocols and tools and apply them to analyzing biotechnologically relevant proteins, enabling us to engineer them to become better biocatalysts. In the long term, we aim to understand the role of transport processes in the function of living cells and to reveal the molecular nature of transport-related pathologies.

Research Summary

The primary research focus of our laboratory is to disclose molecular mechanisms involved in enzymatic catalysis in a broad sense. More specifically, we investigate principal factors involved in the function of enzymes with buried active sites connected to a bulk solvent through molecular tunnels, which is the case for more than 50% of known enzymes. Molecular mechanisms governing the functions of tunnels are poorly understood despite their central importance to enzyme selectivity and efficiency required for the survival of the living cell. Hence, such knowledge has key implications for precision medicine, protein engineering, and drug discovery. To establish the link between the structure of putative tunnels and their transport function, we have to overcome several challenges spanning from the predominantly transient nature of tunnels, thwarting their detection, and the rare character of the actual ligand transport events motivating us to plunge into the development of dedicated software and methods.

Scientific Impact

Enabling high-throughput analyses of transport processes by developing Transport Tools Python library and divide-and-conquer methods for long simulations based on this library.

Exposing molecular basis of quorum quenching activity shared among N-terminal serine hydrolases.

Assembling and verifying the first structural model of a full-size ABCG transporter, which sheds light on its initial selectivity.

Future Goals

Since the activation of functional tunnels is a recent discovery, we lack even elementary insights into the mechanisms underlying the pathologies linked to the emergence of such tunnels. Therefore, we want to learn where the potential tunnels amenable to activation are located in the majority of relevant proteins and what their characteristic properties are, so that we can adopt a more holistic approach to predicting the effect of mutations on protein function.

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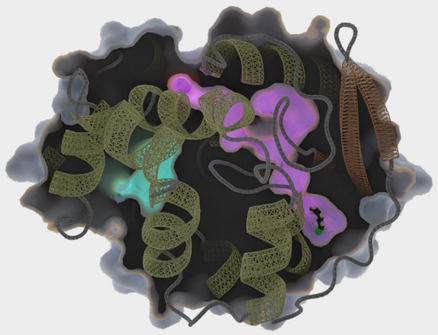

Complexity of ligand transport pathways inside a hydrolytic enzyme. Ligand transport pathways (light green and pink volumes) connect the interior of the enzyme (yellow and orange ribbons) with its surface (overall light gray shape) and enable migration of cognate small molecules (shown with black, white, and green spheres inside the pink pathway).

Collaborations

With the group of Prof. Jasiński (Institute of Bioorganic Chemistry, Polish Academy of Sciences), we study the unique selectivity of ABCG transporters.

With Dr. Grulich (Institute of Microbiology, Czech Academy of Sciences), we investigate molecular details of the quorum quenching enzymes to develop new antimicrobial agents.

Group Leader

Jan Brezovsky is a biophysicist and bioinformatician, who leads a joint group between the IIMCB and the Adam Mickiewicz University (AMU). He graduated and received his PhD from the Masaryk University in Brno. He has co-authored over 60 peer-reviewed publications and 4 international patents related to protein engineering and drug discovery. He has also contributed to the development of several widely used software in the field of molecular transport, precision medicine, and rational protein engineering, which are regularly used by 10,000s of users worldwide. He served as an elected member of the executive body of the national Head of Nodes Committee of the European Life-Science Infrastructure for Biological Information consortium (ELIXIR).

"You can find the tunnels everywhere, hidden in the voids of protein structures, often just waiting for an impulse to open them – be it a conservative mutation or the binding of other molecules from their environment. Then, the real fun begins – we often witness unexpected consequences for a protein function when such tunnels are activated."

Jan Brezovsky, PhD, DSc Habil

Group Members

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Aravind Selvaram Thirunavukkarasu, PhD (AMU)
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Dheeraj Kumar Sarkar, MSc (AMU)
Undergraduate Students
Igor Marchlewski, BSc
Wiktor Szymkowski, BSc (AMU)
Wojciech Warmuz, BSc (AMU)
Laboratory Support Specialist
Marianna Sassek, MSc

A Homecoming of Opportunities

Dr. Aleksandra Kolodziejczyk is a laureate of the Polish Returns Program of the Polish National Agency for Academic Exchange (NAWA). Read about her journey from an international academic career to leading the Laboratory of Cellular Genomics at the International Institute of Molecular and Cell Biology in Warsaw.

With your extensive international educational and professional background, spanning from Italy, Germany, and the UK to Israel, what inspired you to join the International Institute of Molecular and Cell Biology in Warsaw?

Quite frankly, putting personal aspects of this decision aside, I returned to Poland because I believe there are more opportunities for me as a young researcher. Here, I am a relatively "big fish in a small pond", and I think it will be easier to recruit talent to join my team and acquire funding.

I decided to join the IIMCB because of its good reputation for providing substantial support to scientists on both the scientific and administrative sides. The second key aspect for me was a relatively flat structure, where junior lab leaders are fully independent, which is not always the case in other countries.

Considering your Laboratory of Cellular Genomics is the most recently established laboratory at the IIMCB, could you share the initial challenges and opportunities you faced in setting it up?

I think most of the challenges are exactly the same as in other parts of the world: adjusting to the new role, learning how to manage and structure the lab, recruiting team members, planning projects, and dealing with bureaucracy. It is similar when considering opportunities; the new role brings new research avenues and scientific collaborations that were, for many reasons, not possible for postdocs. The scientific freedom and opportunity to establish my own lines of research and build a team based on my values are also aspects that I appreciate a lot.

It may be a bit surprising, but previous challenges (that sometimes still arise) stem from my Polish heritage. Understandably, people hearing me speak the language fluently assume I understand how "things work" in Poland. The reality was that my grasp of formal procedures and requirements was as good as that of a foreigner because I never previously lived in Poland as an adult. Also, writing in Polish, especially for formal documents such as applications to ethics committees for which there is no option to submit documents in English, required some adjustment time.

How have your international experiences influenced the foundational goals and research directions of the Laboratory of Cellular Genomics?

This is a difficult question. Undoubtedly, I am a sum of all my experiences, but I do not know how much the international aspect of my career matters. My research directions are mainly based on my expertise in genomics and bioinformatics that I gained at the Welcome Sanger Institute and EMBL European Bioinformatics Institute, and the expertise in studying host-microbiota interactions in in vitro and in vivo models that I acquired at the Weizmann Institute of Science.

I decided to join the IIMCB because of its good reputation for providing substantial support to scientists on both the scientific and administrative sides.

How do you envision the Laboratory of Cellular Genomics contributing to the scientific landscape in Poland?

At the moment, we are building collaborations within the IIMCB and with other teams in Poland and supporting others with either single-cell genomics or microbiome characterization. I see this as a stepping stone towards building a community of microbiome researchers in academia within an industry that delivers high-quality knowledge and products.

In terms of Poland's scientific landscape, what advancements do you envision for the future, and how can the country become a more attractive hub for international researchers?

I think that, in Poland, we are often very critical about what we have and see Western Europe as much more attractive. Although there are significant disparities in available resources between institutes in Poland, the top ones can provide adequate infrastructure for researchers comparable to many prestigious institutes abroad. I believe we should focus our communication on the positive aspects because there are many, but I think others are not aware of them.

Core Facilities

Cutting edge support for R&D

Biophysics and Bioanalytics *Facility*

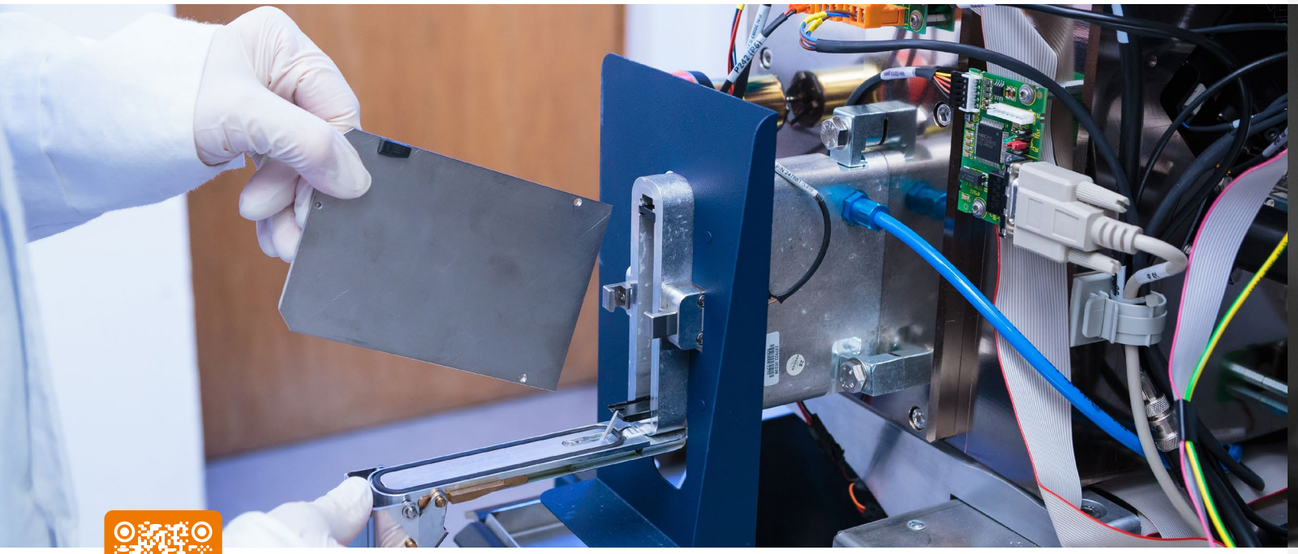
The Biophysics and Bioanalytics Facility (BBF) offers contracted research on biophysical characterization of different macromolecules (proteins, nucleic acids, and polysaccharides) and their complexes, conducted by two highly qualified scientists. We also offer free initial consultations.

Services

- Size distribution analysis (SEC-MALS, AUC)
- Intermolecular interactions (AUC, ITC, SPR)
- Secondary structures of proteins and RNAs (FT-IR, CD)
- Selective analysis with UPLC (qualitative and quantitative)
- Stability studies (DSC, CD, FT-IR)
- Assessment of biosimilarity
- Hit validation and characterization

Clients

- Adamed
- Captor Therapeutics
- Celon Pharma
- Malopolska Centre of Biotechnology of the Jagiellonian University
- Molecure
- Polfa
- Poznań University of Life Sciences
- Selvita
- University of Gdańsk
- Warsaw University of Technology



SCAN

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Microscopy *Facility*

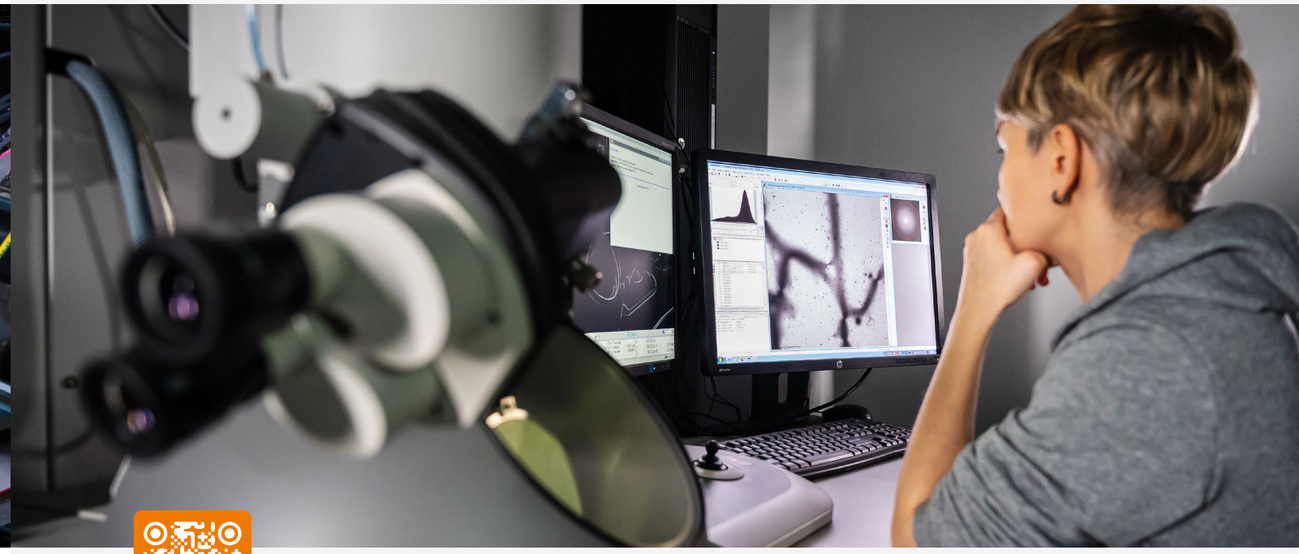
The Microscopy Facility (MF) provides expertise and support for experimental work involving light and electron microscopy of biological specimens. The MF operates in either full-service mode or access mode, depending on equipment, application, and the customer. In the latter mode, our staff offers initial training for facility users and assistance with experimental design, data analysis, and final data interpretation. Currently, the MF also offers cell sorting service by flow cytometry.

Services

- Access to advanced fluorescence light microscopes
- High-content analysis of samples cultured in multi-well plates
- Ultrastructure analysis of cells and viruses on a transmission electron microscope
- Cell sorting by flow cytometry

Clients

- Adamed
- Institute of Biochemistry and Biophysics PAS
- Institute of Hematology and Transfusion Medicine
- International Institute of Molecular Mechanisms and Machines PAS
- Medical University of Warsaw
- Mossakowski Medical Research Institute PAS
- University of Warsaw



SCAN

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Genome Engineering *Facility*

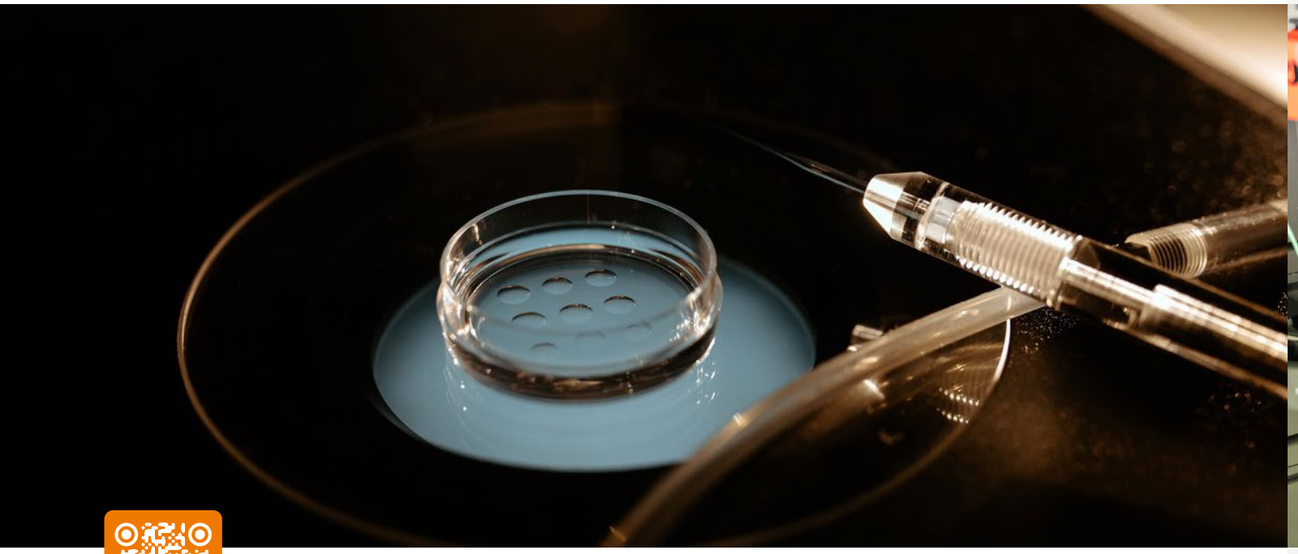
The Genome Engineering Facility (GEU) seeks to provide high-quality, cutting-edge services for new mouse line generation. In contrast to many transgenic facilities, the GEU provides "all-in-one" packages for new mouse line generation, from mutagenesis strategy design to F1 pups, and charges only when the model is successfully generated. We also offer other embryological services, as well as genotyping and plasmid preparation: our expert team provides scientific and technical assistance for researchers to choose the most suitable cloning strategy and prepare ready-to-use vectors.

Services

- Mouse gene editing by CRISPR/Cas9
- Embryological services (cryopreservation, embryotransfer, rederivation, in vitro fertilisation etc.)
- Genotyping
- Preparation of plasmids
- Nanopore sequencing

Clients

- Cambridge University
- Jagiellonian University
- Linkoping University
- Medical University of Gdańsk
- Medical University of Łódź
- Mnm Diagnostics
- National Research Institute of Oncology
- University of Edinburgh
- University of Warsaw



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Contact us:

Phone: (48) 609 462 139
E-mail: geu-manager@iimcb.gov.pl

Preclinical Drug Development *Facility*

The Preclinical Drug Development Facility provides services and consultancy in the field of structural biology, with an emphasis on supporting drug discovery projects. This venture comprises a complete range of X-ray crystallography research, from gene to structure, enriched by biophysical and biochemical characterization of target-ligand interactions.

Services

- Protein production in different expression systems
- Protein purification
- Macromolecular X-ray crystallography of proteins and protein ligand complexes
- Biophysical and biochemical characterization of target-ligand interactions, enzymatic assay design, and optimization

Clients

- Celon Pharma
- Molecure
- Mossakowski Medical Research Institute PAS
- Selvita

SCAN

Contact us:

Phone: (48) 225 970 721
E-mail: enowak@iimcb.gov.pl

Rodent *Facility*

The Rodent Facility (RF) is committed to ensuring the highest standards of humane care for the welfare of animals that are used in research, with the understanding that this commitment is critical to the success of our scientific projects.

Services

- Consulting on scientific projects involving mouse models
- Husbandry and breeding
- Health control of animals

Clients

- International Institute of Molecular Mechanisms and Machines PAS

SCAN

Contact us:

E-mail: rf-team@iimcb.gov.pl

Zebrafish Core *Facility*

The Zebrafish Core Facility (ZCF) introduced a novel vertebrate model, Danio rerio, into IIMCB research in 2012. We are proud to have the largest collection of zebrafish in Poland, consisting of both wildtype and genetically modified lines, including mutants and transgenics. Our facility provides access to animals, offers technical training, and supports the conduct of complex research projects.

Services

- Husbandry and breeding
- Health control of animals
- Providing of embryos and adult fish

Clients

- Adam Mickiewicz University
- Institute of Bioorganic Chemistry PAS
- Medical University of Warsaw
- Mossakowski Medical Research Institute PAS
- University of Warsaw
- Warsaw University of Life Sciences

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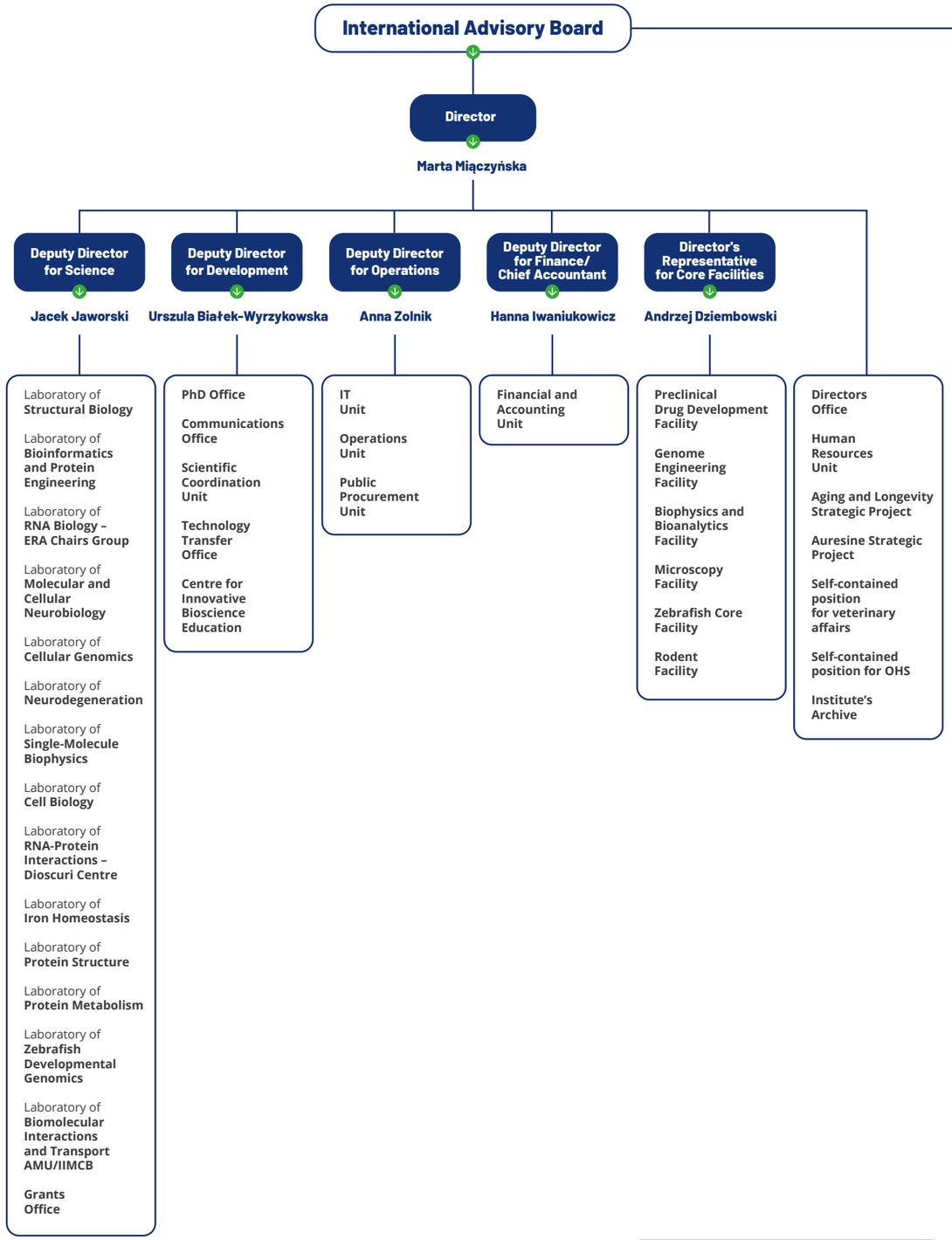
Contact us:

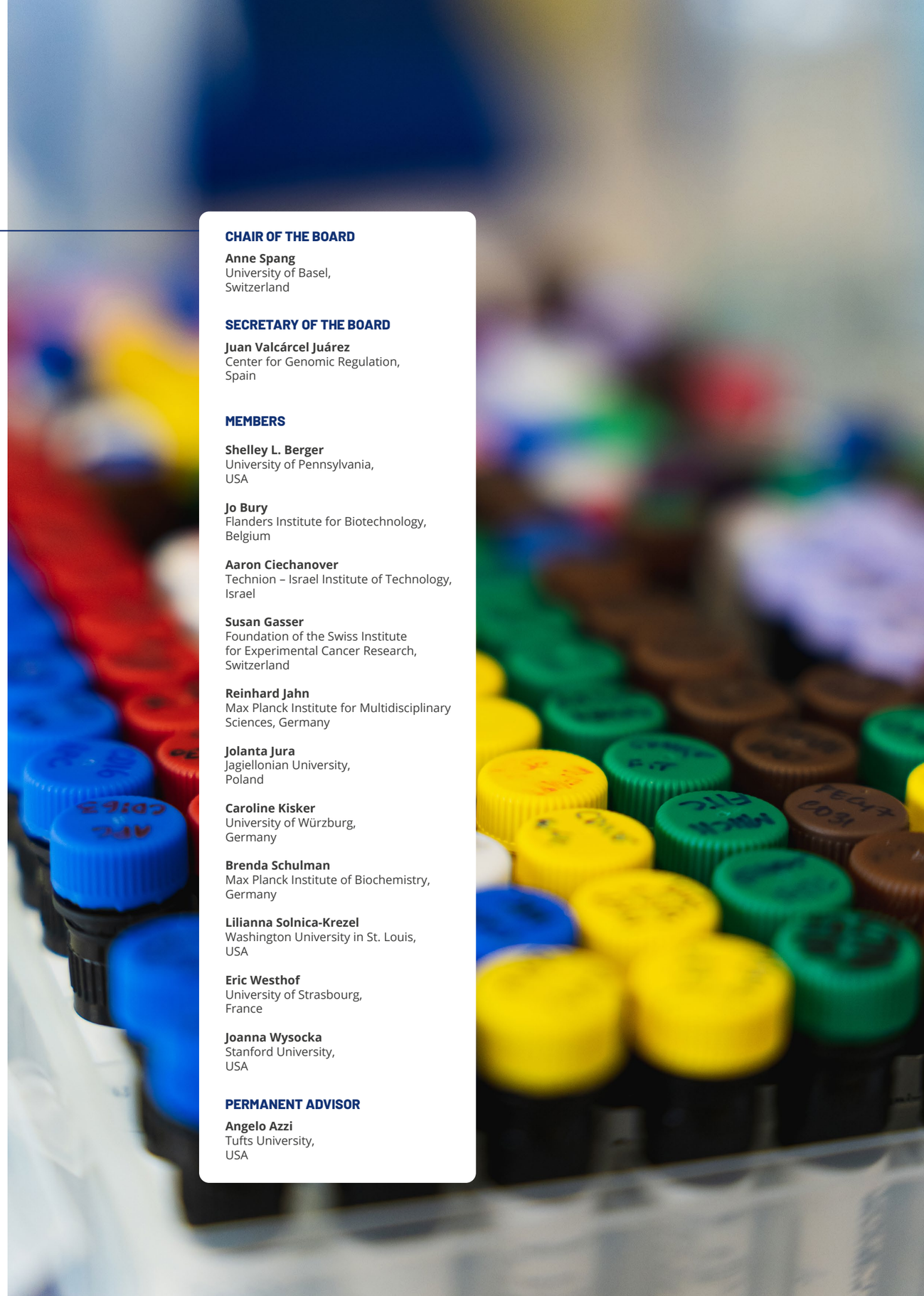
E-mail: ZCFrequest@iimcb.gov.pl

Inside the IIMCB:

Insights & Opportunities

Organizational Structure





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Driving Progress:
The Role of the Grants Office in IIMCB's Achievements

In 2023, the International Institute of Molecular and Cell Biology in Warsaw celebrated a year of remarkable achievements, with the Grants Office (GO) involved in securing funding for groundbreaking projects. Meet Dorota Libiszowska, the Head of IIMCB's Grants Office, and see her formula for fostering a successful team spirit.

The RACE project was a significant milestone for the IIMCB in 2023, with the Grants Office playing a pivotal role in securing this crucial funding. Could you share some insights into how the Grants Office contributed to this success?

Indeed, the Grants Office was fully engaged in creating RACE. We were part of the proposal writing team, along with our directors and two lab leaders, where everyone contributed. GO ensured that the agreed ideas were structured in the proposal according to the call's rules. We wrote different parts of the application, prepared the budget, coordinated works in time, and liaised with our RACE partners, external consultants, and internal colleagues who also contributed with their expertise. It was quite a demanding, but fantastic and insightful teamwork experience that will continue now that RACE has been funded and is being implemented.

Could you summarize 2023 in terms of grants and how they have contributed to the IIMCB's general goals?

It was an intense but successful year. We have had over 50 ongoing grants, 10 initiated in 2023, and we have submitted 30 new proposals. Our research projects were primarily funded by domestic sources including National Science Centre, the Foundation for Polish Science, the Polish Science Fund, the Polish National Agency for Academic Exchange. Additionally, our researchers secured grants from international sources. Our pearls include ERC Advanced Grant, EIC Transition from Horizon Europe, and two Installation Grants from EMBO. Importantly, 2023 was a remarkable year for the application and securing of strategic institutional grants. These include running RACE project, the recently awarded RACE-PRIME from International Research Agenda Programme of the Foundation for Polish Science, and still under evaluation, project of the Polish Roadmap for Research Infrastructure from the Recovery and Resilience Plan. These grants will greatly facilitate the realization of our ambitious vision for the scientific and institutional development of IIMCB.

Could you tell us more about the people behind the Grant Office?

As the IIMCB has been growing over the years, so has the GO. Now, we are a team of eight members, and I have the honor of collaborating with fantastic colleagues who are professional, caring, and fun. Our job requires a blend of managerial, technical, and soft skills. We excel as grant writers, financial experts, and interpreters of complex regulations. With meticulous attention to detail, we navigate through extensive paperwork and Excel spreadsheets, consistently resolving challenges and ensuring compliance with external and internal procedures. Our goal is to streamline administrative processes for researchers while delivering optimal solutions with minimal hassle.

How does the GO identify and secure key funding opportunities?

We conduct weekly monitoring of funding opportunities. Upon announcement, we analyze each call and disseminate key information to potential applicants - our researchers, relevant units, or directors. In case of research projects, the GO primarily focuses on ensuring the accuracy of all formal and financial aspects. However, for institutional non-scientific grants, GO and other administrative teams' collaborative engagment and thus contribution to the grant success is much more significant.

What core support does your office provide to researchers during grant applications?

Each applying Principal Investigator receives personalized support from our team members. We guide scientists through proposal requirements, establish internal deadlines, complete formal sections, and develop budgets. We also facilitate connections with internal units contributing to the proposal, interpret grant rules, and liaise with funding agencies when needed.

For grants like MSCA Individual Fellowships, we offer strategic advice and coaching to scientists. Finally, we oversee the collection of signatures and navigate the grant submission. Nowadays, grant proposals are increasingly complex. Besides scientific parts they often include sections on ethics, data management, communication, or gender. The role of the GO is to collaborate closely with colleagues across different units for their expertise and ingrate all these aspects in compliance with grant agency regulations.

What are the Grants Office main goals for the future, and how are you preparing for emerging trends in funding?

I envision two primary goals. First, we want to maximize the potential of RACE and related complementary projects. Secondly, regardless of evolving funding trends, we want to steadily support our researchers and the IIMCB in securing grants, ensuring optimal use of funds, and facilitating desired outcomes.

How do we recruit?

Recruitment Pillars

1. **Open,** transparent and merit-based recruitment
2. **No discrimination** based on age, gender, culture, race, or disability
3. **The salary** always stated in the job offer
4. **Status updates** for candidates
5. **Recruitment Committee** involved in each step of the process

6 easy steps to join us

step 1 — **Check our website** for job offers

step 2 — **Apply online** (We will contact selected candidates; it might be you)

step 3 — **Meet us at the first** job interview

step 4 — **Complete** the recruitment task

step 5 — **Meet us at the second** job interview

step 6 — **Accept** the job offer

*Depending on the position, the recruitment process described may vary.

Contact us:
Aleksandra Janicka
Phone: + 48 601 159 660
E-mail: recruitment@iimcb.gov.pl

CHECK our job offers

Human Resources Strategy

Organizational culture objectives

- Give every staff member a sense of common mission and shared responsibility.
- Ensure transparent internal regulations, including the principles of equal treatment of all coworkers and stipulations of the HR Excellence in Research Award.
- Support the career development of all coworkers.
- Provide a clear institutional structure, effective internal procedures, and the division of duties.
- Lessen administrative duties for scientists.
- Support collegiality at all levels of the Institute.
- Foster a professional and friendly work atmosphere and effective internal communication among all staff members.
- Care for the common property and areas of the Institute.
- Adjust the organization and management of the Institute according to its growth and emerging needs.

HR Excellence in Research

Since 2013, the IIMCB has been a holder of the HR Excellence in Research Award. It is a prestigious recognition that acknowledges that the Institute is an attractive place for researchers to work and develop their careers. It confirms IIMCB's commitment to implementing fair and transparent recruitment and appraisal procedures for researchers.

HR EXCELLENCE IN RESEARCH

Support for Researchers

"I am very proud that together with a group of researchers from the IIMCB and with the support of experts from the administration, we are working in the HR Excellence in Research Working Group. We meet regularly and develop solutions to improve the IIMCB's attractiveness as an employer for researchers from every part of the world by offering them a favorable working environment, supporting them in their career development, enhancing the quality of research and innovation, and supporting international mobility in accordance with the European recommendations in HRS4R"

Agnieszka Faliszewska,
Leader of the HR Excellence in Research Working Group at the IIMCB

Gender equality

The IIMCB fosters a working environment in which all individuals are treated equally, with respect and fairness. In 2021, the Institute implemented the Gender Equality Plan. The Working Group on Gender Equality Opportunities implements its activities and addresses all gender equality issues.

The Gender Equality Plan 2022-2025 for the IIMCB takes into account the assumptions and principles contained in the "European Charter of the Code of Researchers and Code of Conduct for the Recruitment of Researchers 2015-2019," one of the most important documents of European policy for increasing the attractiveness of working conditions and career development of researchers in Europe.

Goals of the Gender Equality Plan 2022-2025

- Raise awareness of the importance of gender equality issues and reinforce positive attitudes towards diversity within the workforce and in education.
- Assist in the career development of women.
- Achieve and maintain a balance of gender opportunities in recruitment.
- Facilitate the balance of work and study with family life.
- Achieve and maintain balanced gender representation on committees, boards, delegations, panels, and other advisory bodies.

"The Scientific Coordination Unit supports scientists at the IIMCB in maintaining high standards of integrity and transparency in research, in accordance with legal guidelines and best practices. Our responsibilities encompass various aspects, including guidance on principles of open science, ethical considerations within grant applications and reports, or assistance in acquiring permits for the contained use of genetically modified organisms and microorganisms. Our team contributes to research data management by aiding in the development and implementation of data management plans, as well as facilitating the deposition and archiving of data and associated metadata. We also deal with institutional reporting and scientific evaluations, tracking publications, and documenting the societal impact of research. We manage the use of laboratory animals at the Institute and oversee the theoretical e-learning course that prepares for work with animals used in research. Additionally, our team provides administrative support in recognizing foreign qualifications, obtaining research degrees, and applying for individual or group awards."

Iwona Pilecka, PhD
Head of Scientific Coordination Unit

Employment Structure

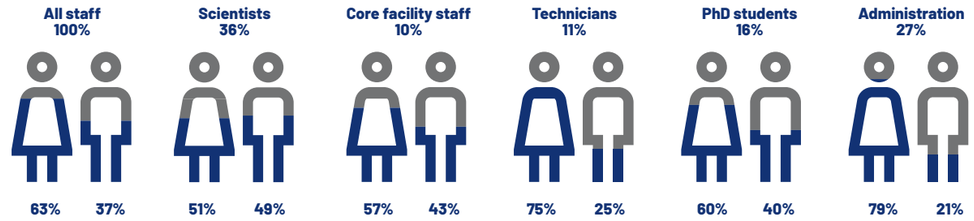
Staff increase:

International work environment:

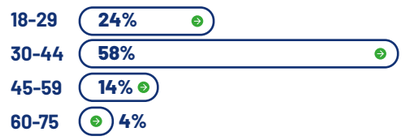
22%
of international staff

Belarus, Brazil, China, Colombia Czechia, France, Germany, India, Iran, Italy, Kenya, Pakistan Portugal, Russia, Singapore, Slovakia, Ukraine

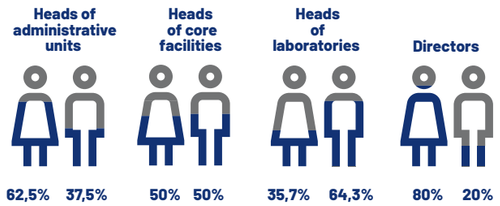
Employment diversity:



Age structure:



Gender division in management:



27 Reasons to Work at the IIMCB

Organization

1. The highest scientific category A+ from the Ministry of Science and Higher Education in Poland.
2. Specialization in rapidly growing fields of RNA and cell biology.
3. A unique legal status based on the agreement between the Polish Government and UNESCO, which guarantees independence and the international character of the IIMCB.
4. Operates based on the standards of leading scientific institutions in the world.
5. Supervised by the International Advisory Board consisting of eminent scientists from all over the world, including Professor Aaron Ciechanover, a Nobel Prize laureate.
6. One of the leaders among research institutes in Poland in terms of obtaining EU funds.
7. Publications in renowned scientific journals.
8. Dynamic growth thanks to the RACE project. The Institute is on its way to become the center of excellence in RNA and cell biology.

Work environment

9. Professional and collaborative work environment.
10. English as the official language of communication.
11. Flat management structure.
12. Comprehensive support for foreigners (processing of documents related to residency, assistance in finding accommodation, 24/7 emergency number etc.)
13. Mentoring program for researchers.
14. Efficient and friendly administration.
15. Close institutional cooperation with the leading scientific centers in Europe within the EU-LIFE alliance and RACE project.

Work culture

16. "HR Excellence in Research" standard.
17. Organized work system with clearly defined premises, goals, and tasks.
18. A culture of personal development.
19. Flexible working hours.
20. Hybrid work mode for administration with up to 50% remote work.

Benefits

21. 13th salary.
22. 36 days of annual leave for scientific staff.
23. Additional paid annual leave up to 36 days for non-scientific staff.
24. Competitive scholarships for PhD students.
25. Co-financing of private healthcare.
26. Co-funding for training and language courses.
27. Access to social benefit packages: subsidies for vacations, sports card and cultural activities, nursery and pre-school, and holiday benefits.

Inside the IIMCB: Team Perspectives

"I joined the IIMCB in July 2016 as a "Grasz o staż" intern student. Over the years, I have met a lot of great people, experienced many ups and downs, and thrilling adventures. I would not change that for anything else. I would like to highlight my appreciation to all the people whom I have met on my way - I learned a lot from you, and I am grateful to all of you. I am also happy I could be a part of the IIMCB community."

Karim Abu Nahia, PhD student

"I believe that having a supportive and understanding supervisor, fostering a positive working environment, possessing the freedom to explore my own unique perspective on the research topic, and maintaining a healthy work-life balance are all crucial elements of the PhD studies. Luckily, I consider myself incredibly fortunate to have found all of these essential components within the welcoming community. Moreover, I must commend the incredible assistance I received from the HR team. They went above and beyond to help me with various aspects, such as arranging the necessary documents for the visa process, guiding me in finding suitable accommodation upon my arrival, and even assisting with obtaining a Temporary Residence Card. Their unwavering support made my transition to life in Warsaw remarkably smooth and stress-free."

Ruchi Prakash Jain, PhD student

"Working here has been an incredible experience for me, and it has been a pleasure collaborating with all of you. I've learned a lot, and I couldn't have asked for better colleagues. Your passion and dedication made every day enjoyable. I wish the Institute nothing but success and the fulfillment of dreams on the journey to achieving their goals!"

Karolina Bodzon, Grants Office

"Coming from India and moving to Warsaw, I was afraid that I would not be able to fit into a scientific environment that was different from my community back in my country. But, I am growing so much on the personal level and at the scientific level because of the immense support that this program offers. The best part is that we have an international and very welcoming scientific community here, which I appreciate the most. I feel now confident to be able to take my research questions along with my personal goals and really go out and do some good science. I can say that the support I continue to receive from my supervisor and colleagues has made me believe that this PhD program has the vision and ability to create great scientists."

Shiwani Kumari, PhD student

"I am fortunate to have embarked on my PhD journey at the International Institute of Molecular and Cell Biology in Warsaw, an integral part of the Warsaw-4-PhD school. It offers an extraordinary path towards intellectual growth and research distinction. The privilege of engaging with state-of-the-art facilities, distinguished faculty members, and an environment of collaboration has been a cornerstone of my experience. As a PhD student within this community, I have reaped the rewards of personalized mentorship, unfettered access to cutting-edge resources, and the camaraderie of a dynamic fellowship of scholars, fostering cross-disciplinary insights and cultivating innovative thought. I am indebted to both the institution itself and my supervisor, Dr. Wojciech Pokrzywa, for consistently guiding me towards abundant avenues of personal and professional growth."

Anwesha Sarkar, PhD student

"As I reflect upon my time here at the IIMCB, I would like to express my gratitude for the invaluable experiences, lasting memories, and friendly atmosphere. The combined efforts and dedication of both the administrative and scientific staff surely make this Institute an exceptional place to learn, grow, and contribute to the scientific field."

Malwina Hyjek-Składanowska, PhD

Human Resources as a Catalyst for Growth and Innovation

At the IIMCB, we greatly value our colleagues, with the HR Unit's policies playing a pivotal role in fostering a culture of teamwork and inclusivity. Meet Katarzyna Fiedorowicz, Head of the Human Resources Unit, who delves into the strategies designed to build a supportive, forward-looking, and stimulating work environment alongside the challenges accompanying the Institute's anticipated expansion.

You have been developing the Human Resources Unit at the IIMCB for 6 years now. How has it changed during this time?

I joined the IIMCB six years ago, full of enthusiasm and plans. I must admit that the beginnings were difficult. The HR Unit actually had to be built from scratch; tasks had to be divided up and a timetable planned for the solutions to be introduced. Fortunately, I received a very warm welcome from the management as well as from other colleagues. They all cheered me on but also had high expectations for the results of my work. This support has driven me even more. Over these six years, my team and I have really worked hard so that today, we can say that from the HR Unit, the IIMCB community has comprehensive support. This provides me with great satisfaction.

How would you describe the current work environment at the Institute?

Above all, there is a positive atmosphere at the IIMCB. People are friendly to each other, respect each other's work and feel that everyone, scientists and administration together, has the same goal: to make the IIMCB one of the best research centers in the world. We support each other by sharing knowledge, experience, and ideas. Open communication is very important to us. The staff is free to express their opinions, ideas, and concerns, and their voice is heard and respected. We also care about integration. We organize various events to strengthen attitudes of openness and tolerance.

Joining the IIMCB was one of the best decisions of my professional life.

The IIMCB is an international research organization. One out of four employees comes from abroad. What does this mean for your work?

This is a great value but also a challenge on many levels – formal, organizational, as well as regards social and cultural integration. The Institute takes many measures to support foreigners to provide them with the best possible conditions for scientific work in an atmosphere based on kindness and respect. The HR Unit is responsible, among other things, for assisting foreigners with legalizing their stay and employment, but also with the challenges of everyday life during their stay in Poland. We meet with foreigners on an ongoing basis to resolve any problems. We have also launched an emergency call for urgent medical emergencies that require immediate action outside of the IIMCB working hours when they need support from the HR Unit, such as translation when contacting medical staff. In our unit, support for foreigners is handled by a dedicated person for these tasks. Not all scientific institutions have this kind of internal support.

How do you perceive the role of the HR Unit?

In my opinion, the HR Unit plays an important role in supporting the Institute's mission, but also in supporting employees: their development, well-being, and job satisfaction. In addition to our day-to-day tasks, such as coordinating recruitment and onboarding, preparing employee documentation, handling salaries and benefits, coordinating training, and supporting foreigners, the HR Unit creates policies and procedures through which it plays a significant role in shaping the IIMCB's working environment. I am very lucky to be part of the HR team, which is a group

of committed, friendly, and helpful people. I would like to thank them very much for the fact that together, we have built a close-knit team, to which each of them brings something unique.

What kind of challenges does your unit need to face in the coming years? How do you plan to tackle them?

The Institute is on a path of continuous scientific but also organizational development. Increasing the number of staff will be a challenge for the administration as a whole in terms of maintaining high efficiency. The most important challenge we face in this area is the digitalization of processes, which will reduce the amount of time spent on tasks in the HR Unit and make it easier for our colleagues to access their data and reduce administrative effort. We are also constantly working to implement best practices from more developed scientific institutions at the IIMCB. By working with EU-LIFE partners and RACE grant partners, we have access to their expertise.

If there is a person who is considering joining the IIMCB but still hasn't decided to do so, what would you say to them?

I would say:

Don't hesitate! This could be an opportunity for a great professional adventure in an open, culturally diverse, integrated community.

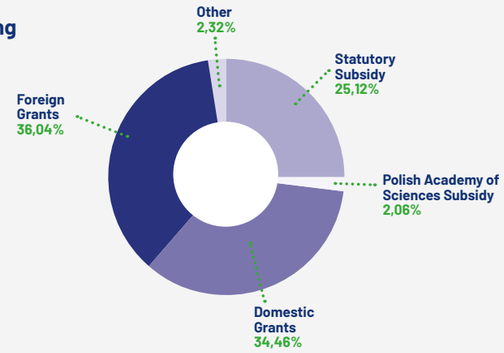
Finance and Funding 2023

Sources of Funding

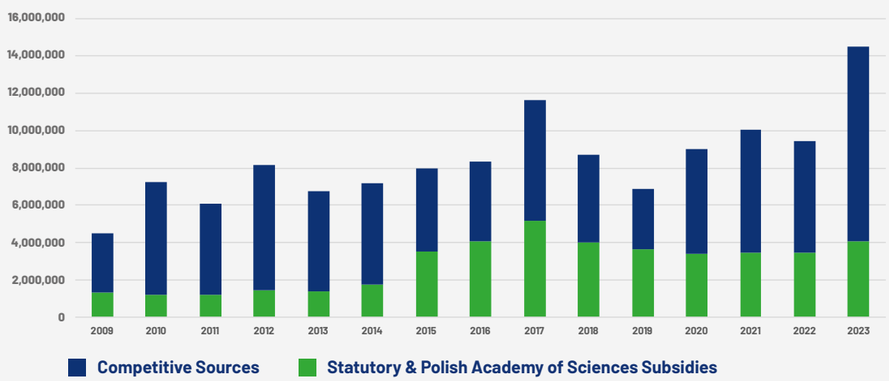
	PLN	EUR
Statutory Subsidy	16,231,700	3,733,142
Polish Academy of Sciences Subsidy	1,328,000	305,428
Domestic Grants	22,265,349	5,120,825
Foreign Grants	23,280,710	5,354,349
Other	1,499,910	344,965
Total:	**64,605,669**	**14,858,709**

1 EUR = 4.34 PLN as at 29 December 2023

Structure of Funding



Annual Income 2009-2023 (EUR)



Warsaw PhD School in Natural and BioMedical Sciences

The Warsaw PhD School in Natural and BioMedical Sciences (Warsaw-4-PhD) began its operations in the 2019/2020 academic year. The School is an organized form of education for PhD students who are preparing to obtain their degrees in four disciplines: physics, chemistry, biology and medical sciences.

Admission to Warsaw-4-PhD is preceded by an open international competition in which the leading criterion is the candidate's excellence and predisposition to conduct groundbreaking research. Enrollment occurs three times annually, and candidates commence their education in either the winter or summer semester.
Doctoral students, under the guidance of their supervisors, implement individual research plans and develop their research and soft skills. Research progress, as measured against the individual research plan, is subject to a midterm evaluation that is conducted at the midpoint of the 4-year period of education. The Warsaw-4-PhD program ends with the submission of a dissertation. The next step is to obtain a doctoral degree via a separate procedure conducted outside of the scope of the School.

The IIMCB offers their PhD students the opportunity to work in a vibrant, inclusive, and diverse international community, where their research and social needs are fully met. Believing that personalized academic mentoring is the key to scientific success, we support our doctoral students in their journey to the PhD. We encourage PhD students to participate in international activities, ranging from research visits and conferences to workshops and training, by financing their trips.

PhD students who choose to apply for competitive funding are fully supported by our administrative staff at every step. Additionally, the IIMCB provides PhD students with access to a private medical package, subsidized opportunities to improve their professional qualifications and knowledge enrichment, and social benefits that are on par with IIMCB employees.

We know that students' voices matter. Our appreciation of our PhD students' opinions is demonstrated by regular meetings of PhD Students' Council representatives with IIMCB directors and International Advisory Board members. The IIMCB endeavors to address the concerns of doctoral students and support their initiatives.

Warsaw-4-PhD is the largest institute-based doctoral school in Poland. It is committed to internationalization. Our activities to date and plans for the future were recognized and awarded 2,186,700 PLN worth of funding by the Polish National Agency for Academic Exchange under the STER Internationalisation of doctoral schools program.

SCAN

Centre for Innovative Bioscience Education

The Centre for Innovative Bioscience Education (BioCEN) was established in 2002 by the IIMCB, which has been BioCEN's strategic sponsor since 2015. The other founders are Nencki Institute of Experimental Biology, PAS; Institute of Biochemistry and Biophysics, PAS (IBB); and Science Festival in Warsaw.

BioCEN's aim is to bridge the gap between research and education. It provides hands-on experience in topics of interest. Apart from receiving financial support from the IIMCB, BioCEN is also subsidized by the Nencki Institute, IBB, the University of Warsaw Faculty of Biology, and the BioEducation Foundation.

BioCEN activities in 2023

Compound training
BioCEN organized a two-day course for high school groups that covered a variety of topics related to the search for extraterrestrial life. Lectures, seminars, and lab workshops pertained to cell and molecular biology, as well as astrobiology. The training was intense but proved to be a viable and successful option for our students.

Life-long learning
We offered novel workshops for adult non-scientists interested in research and technology. Our main goal was to maintain scientific interest and encourage adults to seek scientific knowledge on their own, despite not being professionally obliged to do so.

Early inspiration program
BioCEN started an internal program aiming to inspire the youngest primary school students from rural areas in Poland. We reached out to educational facilities in Polish villages and smaller towns and organized online meetings of local students with scientists and BioCEN educators.

Mentoring program
As BioCEN, we offered individual classes for gifted students who were seeking knowledge that exceeded the school curriculum. We organized one-on-one classes pertaining to advanced microscopic techniques and slide preparations. A total of 5 teenagers sought and received personalized mentoring from BioCEN in 2023.

Science popularizing events
BioCEN actively participated in events promoting medical and biological research: Motoserce Ciechanów edition and Motoserce Warszawa edition were two sister events aimed at promoting blood donation. The Center was present at both events with a stand, at which families could perform experiments related to the physiological importance of vitamin C. A total of over 100,000 people attended both events.

BioCEN's permanent patronages

- International Conference – Aspects of Neuroscience,
- Intercollegiate Biotechnology Symposium "Symbioza"
- Students' Project STEM4u

In 2023, BioCEN, together with the Nencki Institute, organized an annual event, the 22nd Symposium for Teachers of Biology, which occurred on December 2, 2023. Participation was available both live (31 participants) and online on the Zoom platform (147 participants). This annual symposium has become one of our most important recurring events.

SCAN

EU-LIFE Network: Synergy and Development

The IIMCB, as a member of the EU-LIFE alliance, collaborates with 14 other institutes to achieve and maintain excellence in the life sciences. This effort emphasizes quality and responsible science, and brings attention to issues related to European science policies.

EU-LIFE is an alliance of research centres whose mission is to support and strengthen European research excellence. EU-LIFE members are leading research institutes in their countries and are internationally renowned for producing excellent research. They are widely recognized for transferring knowledge and nurturing talent. The IIMCB takes an active part in the life of EU-LIFE and contributes to its various initiatives.

Here are 2023 highlights:

- February: Natalia Szulc and Cecilia Winata, representing the IIMCB, participated in the EU-LIFE campaign to celebrate **Women in STEM Week.** Natalia highlighted the persistent, yet incorrect, perception that women are less suited for STEM fields a belief that undermines young girls' self-confidence. Cecilia emphasized the critical role of access to quality mentors and teachers in encouraging women to pursue science.
- May: A booklet "Groundbreaking science for a healthier future - 15 stories from EU-LIFE institutes" was published. It included an IIMCB's story by Małgorzata Staszkowska **"Rare diseases – big challenges"** featuring how the simple organism, Caenorhabditis elegans, can be utilized in studying the molecular mechanisms underlying rare diseases.
- June: A large delegation from the IIMCB attended the Annual Community Meeting and the **"Envisioning the Research Centres of the Future"** conference in Lisbon, marking the 10th anniversary of the alliance. The event aimed to envision future research environments that empower scientists, promote groundbreaking discoveries, and foster active societal engagement.
- October: IIMCB's invention **"Novel blood miRNA biomarkers for early diagnosis of Alzheimer's disease"** was presented at the yearly EU-LIFE Pitching Event. This invention could potentially meet the urgent need for non-invasive, early-stage biomarkers for Alzheimer's disease, which impacts millions worldwide.
- November: The IIMCB hosted the EU-LIFE **Strategy Meeting** - a gathering of the directors and main representatives who identify current challenges for research institutes and establish the priorities of the alliance for the upcoming months. The many topics covered included European Research & Innovation policy, expansion of the EU-LIFE, and evolution of EU-LIFE benchmarking of research institutes' performance. In the scientific part, Aleksandra Kołodziejczyk and Jacek Jaworski presented their recent research results.

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Polish RNA Biology Meeting 2023

In the last days of September 2023, Warsaw became a regional hub for scientists engaged in RNA research. The IIMCB initiated and hosted the international conference "Polish RNA Biology Meeting 2023", which brought together over 250 experts from Poland and Europe. The 2nd edition is planned for 2025 and will take place in Poznań.

"Recent breakthroughs in RNA research have revolutionized medicine, ushering us into a new era of genome editing and mRNA vaccines. Despite remarkable progress, much remains to be uncovered about RNA's role in organismal physiology and pathology, as well as its potential in medical and industrial applications", says Prof. Gracjan Michlewski, Chair of the Scientific Committee for this event.

Prof. Michlewski emphasized the rapid development of efficient COVID-19 vaccines through mRNA technology and the potential of CRISPR in treating genetic diseases previously considered incurable. Additionally, these technologies have applications in agriculture, where they can contribute to increasing crop yields and resistance.

The conference featured 7 sessions with a total of 50 lectures, covering a wide range of topics related to the latest research and technological advancements in RNA biology. This extensive program provided attendees with a comprehensive overview of the current state and future directions of RNA research.

This meeting served as a platform for sharing findings and ideas, networking, nurturing existing collaborations, and establishing new ones, thereby catalyzing advancements in RNA biology. It was also an opportunity to showcase the dynamically developing community of Polish RNA researchers, who are increasingly making their mark on the international scientific stage.

Polish RNA Biology Meeting was supported by the MOSaIC project which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 810425

New Headquarters Prospects

The dynamic development of the International Institute of Molecular and Cell Biology in Warsaw faces a significant barrier. It does not have its own headquarters. Currently, it uses premises lent by the Polish Academy of Sciences, which are no longer sufficient. The plan is to construct a new spacious building for the 21st century.

A winning architectural design by Atelier Tektura studio was selected in 2023. It includes four above-ground floors and one underground floor, with a total building area of over 20,000 m^2 and a usable space of almost 14,000 m^2.

The building is divided into three main sections: research, administration, and public. The research section accommodates 20 groups and 10 specialized core facilities: laboratories and offices. The administration wing is located on the ground floor and houses offices and a conference room. The public area is located on the ground floor and includes an exhibition hall, conference rooms and a laboratory for BioCEN. Staff and guests will surely enjoy the spacious courtyard adjacent to the building.

The IIMCB has the necessary land, but recent price increases make it a financial challenge to complete the building investment. Although scientific grants have been secured, these funds cannot be allocated to construction purposes.

Upon acquiring the new headquarters, the IIMCB will gain momentum, thereby solidifying its place as a center for excellence in RNA and cell biology. This milestone will mark the creation of one of the most advanced facilities in Europe, serving not only scientists but also biotech and pharma industries. It will enable the IIMCB to attract the most talented scientists from around the world.

“Ten years ago, we had nine research laboratories. Thanks to RACE, we will soon have twenty. We are beginning to run out of space for our specialists and research equipment. Therefore, the need to build a new headquarters is becoming more urgent”

Marta Miączyńska, Director of the IIMCB

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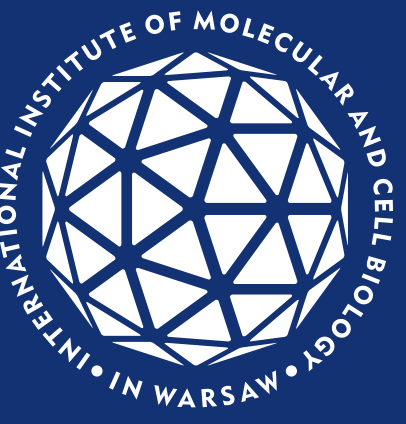

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