



**Biotechnology  
Summer School**

**ABSTRACT BOOK**

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# Table of contents

XXVI Biotechnology Summer School .....	5
Targeted audience .....	5
Before we start .....	5
About Biotechnology Summer School .....	6
BSS timeline .....	8
Memories from previous editions .....	9
XXVI BSS Venue .....	14
Organizing committee .....	15
Scientific supervision .....	15
Organizing team .....	16
IFB Dean's Office .....	17
Intercollegiate Faculty of Biotechnology UG & MUG .....	18
30 years of IFB .....	22
International Institute of Molecular and Cell Biology in Warsaw .....	25
XXVI BSS Support .....	31
Speakers Introduction .....	36
<b>Andrzej Dziembowski</b> .....	36
<b>Sebastian Glatt</b> .....	37
<b>Wojciech Galej</b> .....	37
<b>Piotr Kowalski</b> .....	38
<b>Barbara Uszczyńska-Ratajczak</b> .....	39
<b>Aleksandra Kołodziejczyk</b> .....	40
<b>Wojciech Fendler</b> .....	41
<b>Ewelina Małecka-Grajek</b> .....	42
<b>Tomasz Stokowy</b> .....	43
<b>Marcelina Jureczko</b> .....	43
<b>Krzysztof Sobczak</b> .....	44
Abstracts .....	45
Opening Lecture: <b>Mechanisms of eukaryotic RNA Decay</b> .....	45
Lecture 1: <b>tRNAslational Control of Eukaryotic Gene Expression</b> .....	46
Lecture 2: <b>Structural and biochemical studies of RNA-protein complexes</b> .....	47
Lecture 3: <b>Linear therapeutic mRNAs</b> .....	48
Lecture 4: <b>Circular RNAs and their potential as RNA therapeutics</b> .....	49

Lecture 5: <b>The hunt for dark DNA: identification of long noncoding RNAs in vertebrate genomes</b> .....	50
Lecture 6: <b>Women in Science: How I Dared to Become Batman</b> .....	51
Lecture 7: <b>Profiling single-cell transcriptomes to understand disease</b> .....	52
Lecture 8: <b>Circulating microRNA biomarkers in oncology – strengths, limitations and perspectives</b> .....	53
Lecture 9: <b>One molecule at a time. Single-molecule methods to study structural rearrangements of RNA, RNA-RNA and RNA protein assembly</b> .....	54
Workshop 1: <b>RNA in the clouds</b> .....	55
Workshop 2: <b>From Lab to Public: A Journey into Science Popularization</b> .....	56
Lecture 10: <b>Compounds which alleviate the pleiotropic toxicity of RNA harboring expanded CGG repeats in the Fragile X-associated syndrome</b> .....	57
XXVI BSS Programme .....	58



# XXVI Biotechnology Summer School



Biotechnology Summer School aims to promote knowledge about the newest biotechnological achievements and build a vast scientific network between students, PhD students and young scientists together with many experienced researchers from the leading institutions in Poland and abroad. We also want to encourage young scientists to improve their skills in the area of science communication.

## Targeted audience

XXVI BSS (Biotechnology Summer School) is dedicated to students and young scientists interested in experimental and life sciences, especially RNA research. The Summer School will supplement existing knowledge with valuable practical and applied training and allow to discuss research in depth with the academics who are leading experts in their area. It will prepare and enhance appeal to potential employers and graduate schools. The international study will enable gaining a deeper understanding of another culture, make lifelong friends from a wide variety of backgrounds and benefit from globally renowned academic excellence.

## Before we start



Remember to always have your ID on you. Inside your ID there is a condensed version of the BSS programme.

Please pay attention to the organizers' announcements during the whole event.

Check out a Facebook group we made for this year's event. Meet other participants and share info! You can find this group by scanning the QR code on the left or typing the following web address: <https://www.facebook.com/groups/272193108854865>

## About Biotechnology Summer School

Biotechnology Summer Schools are organized annually since 1994. The idea of Biotechnology Summer School (BSS) came from the late Professor Anna J. Podhajska (1938-2006), who implied that students and young scientists should actively participate in obtaining knowledge and establishing contacts with scientists from all over the world, not only in formal conditions but also outside the University. That is why the participants of BSS are not only biotechnology students but also students in related biological fields from Poland and from abroad, young scientists and even advanced pupils interested in this topic. The main aim of this event is to provide students with a wide range of courses which are not available in the standard syllabus. We create a relaxed learning environment and give Polish and foreign students a chance to meet highly renowned specialists during lectures as well as in rather informal circumstances. Moreover, Biotechnology Summer Schools give Polish and foreign scientists a chance to develop cooperative relationships and create a forum for integration. Topics of BSS vary from year to year. Prof. Anna Podhajska gained many people's support over her initiative. The number of sponsors increased every year and thanks to all these companies and institutions the organization of Biotechnology Summer School has been possible. BSS was also supported by big projects like MOBI4Health, which fully financed the XX BSS or Horizon 2020 which financed XXIV BSS.

Biotechnology Summer Schools were honored with the presence of many eminent scientists such as professors: Ewa and Ernest Bartnik, Stanisław Bielecki, Charles Cantor, Klaus Halhlbrock, Waleria Hryniewicz, Robert Huber (Nobel Prize winner in Chemistry in 1988), Berndt Jastorf, Adam Jaworski, Roman Kaliszan, Władysław Kunicki Goldfinger,



Andrzej Legocki, Janusz Limon, Mirosław Małuszyński, Jerzy Paszkowski, Andrzej Płucienniczak, Richard P. Sinden, Piotr Stępień, Waław Szybalski, Dan Tawfik, Tomasz Twardowski, Jacques H. Weil, Robert Wells, Paul Williams, Brigitte Wittman - Liebold, Maciej Zentler, Maciej Żylicz.



No less important than learning is having fun. Many entertaining activities for Summer Schools are always planned. A fancy-dress party, a bonfire with singing, field games, sports, playing on words, and integrational workshops are part of every School. We also organize some visits to local, historical places and regional trips. We hope that this year's Biotechnology Summer School will be as successful as previous ones and will be an unforgettable experience for all participants.

Visit us on the web:



[www.bss.ug.edu.pl](http://www.bss.ug.edu.pl)



<https://www.facebook.com/BiotechnologySummerSchool>



[https://www.instagram.com/bss\\_ifb/](https://www.instagram.com/bss_ifb/)

## BSS timeline

No	Place	Year	Topic examples
I	Wilga	1994	Miscellaneous
II	Łączyño	1995	Miscellaneous
III	Stegna	1996	Miscellaneous
IV	Stegna	1997	Miscellaneous
V	Gołuń	1998	Plant biotechnology, molecular medicine
VI	Łączyño	1999	Fundamentals for bioprocess engineering
VII	Twardy Dół	2000	Genetic modifications in plants and animals
VIII	Łączyño	2001	Ethical aspects of biotechnology
IX	Sobieszewo	2003	Bioinformatics (molecular evolution and protein structure)
X	Sobieszewo	2004	Biotechnological applications in agriculture
XI	Sobieszewo	2005	Bioprocess engineering
XII	Łapino	2006	Immunotherapy (cancer research), clinical stages
XIII	Łapino	2007	Cancer causes, diagnosis and therapy
XIV	Sobieszewo	2008	Virology, mostly involved with HCV
XV	Gdańsk	2009	Plants as a "green factory"
XVI	Sobieszewo	2010	Viral research, HCV, influenza virus
XVII	Gdańsk Górki-Zachodnie	2011	Biochemistry and biotechnology of plant lipids
XVIII	Jurata	2012	Current scientific research and its practical application
XIX	Gdańsk	2013	Molecular evolution
XX	Stegna	2014	Model organisms
XXI	Kadyny	2015	Biotech innovations
XXII	Wielimowo	2016	Biotechnologists love every bit of life
XXIII	Stężyca	2017	Iron metabolism; Biological plant protection
XXIV	Sobieszewo	2018	Responsible Research and Innovation
XXV	Ostrzyce	2019	Introduction to Translational Research

# Memories from previous editions

2017





XXVI Biotechnology Summer School



2018









2019



## XXVI BSS Venue



XXVI Biotechnology Summer School takes place on 11–15 September 2023 in the “SZARLOTA” Holiday Complex located in a picturesque area of Kashubia in Kościerzyna, close to the beach by the lake Osuszyno.

Comfortable hotel rooms and cottages are surrounded by the natural richness of nature. Specially prepared attractions will make integration trips unforgettable for a long time. The cuisine of Szarlota will treat you with regional specialties, as unique as Kashubia itself. Their chefs will satisfy your expectations and try to recall the flavors of childhood.

Szarlota holiday complex is a perfect hot spot for sightseeing Kashubian area. Kościerzyna is the main city of the Kashubia region with almost 800 years of history.

3 km from the city, is Wdzydze landscape park with diverse landscapes and plant-life allowing from mind calming jogging, cycling or walking.



## Organizing committee

### Scientific supervision

#### Prof. Andrzej Dziembowski



Prof. Dziembowski's primary research interest is posttranscriptional gene expression regulation. Currently, the lab studies RNA biology at the organism level, using Direct RNA Sequencing as an experimental approach and transgenic mouse lines as a model system. He is the author of more than 100 research articles, many of which have been published in prestigious journals such as Nature, Cell, Nature Structural or Molecular Biology. His research has been supported by numerous national and international grants, including ERC AdG (2022). Andrzej Dziembowski is the head of an ERA Chair Group at the International Institute of Molecular and Cell Biology in Warsaw, is a professor at the Warsaw University Faculty of Biology and holds the Waclaw Szybalski Honorary Chair at the University of Gdansk. He is also a member of EMBO and Academia Europaea.

Contact: [adziembowski@iimcb.gov.pl](mailto:adziembowski@iimcb.gov.pl)

#### Dr hab. Michał Szymański



Head of the Structural Biology Laboratory at the Intercollegiate Faculty of Biotechnology (IFB UG & GUMed) since 2019. His laboratory aim is to understand fundamental principles underlying the assembly of multi-protein macromolecular machines involved in nucleic acid metabolism, define their structures and gain insight into their activities and regulation. Research in his group has been supported by grants from the National Science Centre of Poland (POLONEZ, SONATA BIS, OPUS), the Foundation for Polish Science (First Team), EMBO (Installation Grant, YIP Small Project Grants) and European Research Council (ERC Starting Grant). He has authored more than 25 original articles published in research journals, such as Science, Nature Communications, PNAS, EMBO Journal, JACS, NAR.

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### Dr hab. Rafał Sądej



Vice-Dean for Science at Intercollegiate Faculty of Biotechnology UG & MUG, head of the Laboratory of Molecular Enzymology and Oncology. He has been working in cancer research for nearly 20 years. He is interested in mechanisms of breast cancer progression and resistance to anticancer drugs. His group is studying the role of growth factor receptors in communication within the tumour microenvironment. This investigation involves detailed molecular and clinical analyses as well as animal model studies. He is beneficent of multiple Polish and international grants and a committee member of the European Network for Breast Development and Cancer (ENBDC labs).

Contact: rafal.sadej@gumed.edu.pl

## Organizing team

### Dr Michał Pierański



PhD from Laboratory of Photobiology and Molecular Diagnostics. Member of the organizing committee from 2019. He splits his life between discovering microbial universes and singing. Both his passions require telling a story and that's their part that satisfies Michał the most.

Contact: michal.pieranski@phdstud.ug.edu.pl

### Michał Prusiński



PhD candidate at Laboratory of Plant Protection and Biotechnology. Avid herbalist and cyclist combining hobbies with laboratory work. He is an activist involved with Polish Children's Fund to show promising young people the world of science by tutoring and organizing workshops. First time organizing BSS.

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### Kinga Panek



A scientist and social activist. She is changing the world of universal education as the originator and leader of the EDUS project. Daily, she expands the knowledge by conducting doctoral research on the human immune system at the University of Gdansk. She loves mountains. She likes to face useful challenges.

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### IFB Dean's Office

Behind-the-scenes IFB staff is doing all the administrative and financial work of the event. Also, they are responsible for contact with the participants and lecturers.

### Patrycja Tucholska



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### Monika Sączewska



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## Intercollegiate Faculty of Biotechnology UG & MUG

The Intercollegiate Faculty of Biotechnology of the University of Gdańsk and the Medical University of Gdańsk (IFB) was established in 1993 by the decision of the Senates of the University of Gdańsk (UG) and the Medical University of Gdańsk (MUG). The initiators of the Faculty were Prof. Anna Podhajska, Prof. Waław Szybalski and Prof. Karol Taylor. The Faculty is a unique institution in Poland created by two universities. This results in interdisciplinary research and teaching focused on biomedical and biomolecular issues and their biotechnological applications for health and quality of life. Since 1999, the IFB has been authorized to confer the degree of doctor, and since 2010, the scientific degree of habilitated doctors in the area of biological sciences – the discipline of biochemistry. Including PhD students, approximately 200 people participate in research and teaching at IFB.



IFB is a leading research and teaching institution that since 2002 has had the status of the European Centre of Excellence in Biosafety and Molecular Biomedicine and is ranked highly by the Ministry of Education and Science regarding scientific effectiveness. In 2017, in a parametric assessment, IFB was granted the highest-level category, A+. The quality of teaching at IFB is the highest in Poland. In 2020, the Polish

Accreditation Committee (PKA) awarded the Biotechnology study programme at IFB the Certificate of Educational Excellence in the category "Excellent programme - excellence in education". These are the only distinctions of that kind granted in Poland in the area of biological sciences.

Faculty members perform important functions in international societies and scientific commissions. For example, Prof. Ewa Łojkowska is President of the Polish Academy of Sciences Committee on Biotechnology, Vice-President of the ScanBalt Association, President of the Polish Jury for the L'Oréal-UNESCO for Women in Science award and a member of the International Selection Committee of the Award L'OREAL-UNESCO For Women in Science International Rising Talents. Prof. Krystyna Bieńkowska-Szewczyk was appointed to the Ministerial Advisory Group on COVID-19. Prof. Krzysztof Bielawski, as Vice-Rector for Innovation and Liaison with Business and the Community, and Prof. Jacek Bigda, as Vice-Rector of Development, are directly involved in governing the University of Gdansk and the Medical University of Gdansk, respectively. IFB staff members are also laureates of prestigious programmes and awards (ERC Starting Grant, EMBO YIP, HHMI, EUPHRESKO ERANET, InfectEra, STRATEGMED2, Polish-Norwegian Research Programme, Polish-South Africa Programme, Polish-Chinese Programme, Polish-French Polonium Programme, and Polish national programmes such as LIDER, TOP



500 Innovators, MISTRZ, START, HOMING PLUS, TEAM, and First TEAM). Publications by IFB staff have received numerous awards and distinctions for the best work conducted in Polish laboratories, granted by the Committee of Microbiology of the Polish Academy of Science, the Polish Genetic Society or the Polish Biochemical Society.



In 2015, the decision was taken to establish the IFB International Scientific Advisory Board. The international board is a part of the strategy for the further development of the faculty supported by distinguished scholars from different fields covering research topics conducted at IFB. The nominations to the IFB International Scientific Advisory Board were based on the experts' research excellence, management experience and extensive research expertise.

We have recently succeeded in increasing the quality of publications, with a consequently growing percentage of Q1 publications. The results of our research have been published in high-impact journals such as *Science*, *Science Translational Medicine*, *Trends in Biotechnology*, *Nucleic Acids Research*, *Journal of Experimental Medicine*, *JNCI-Journal of the National Cancer Institute*, *Genome Research*, *Journal of Allergy and Clinical Immunology*, *Current Biology*, *Industrial Crops and Products*, *Trends in Biochemical Sciences*, *Frontiers in Immunology*, *Journal of Virology*, *Plant Physiology*, *Journal of Molecular Biology*, *The EMBO Journal*, *FEBS Journal*, and the *Journal of Experimental & Clinical Cancer Research*.

The Intercollegiate Faculty of Biotechnology is widely collaborating at the national and international levels. This collaboration results in publications with a large number of institutions in Poland and abroad, including prestigious foreign institutions such as the University of Oxford, University of Texas, Heidelberg University, University of Washington, University of Missouri, Università degli Studi di Roma Tor Vergata, University of Bremen, University of Wisconsin-Madison, Wellcome Sanger Institute, Lawrence Berkeley National Laboratory, Karolinska University, Princeton University, and Cornell University.

IFB comprises 19 teams involved in research activities. The basic and applied research areas at IFBs cover virology, molecular microbiology, medical biology and molecular diagnostics as well as molecular plant biology. These areas are the basis of biotechnology development. At the IFB, approximately 90 research projects supported by external funding are conducted simultaneously. In these projects, various microorganisms are used as models to analyse basic cell processes. The main research topics include protein aggregation and disaggregation; the role of molecular chaperones; proteolysis; DNA replication; plant, animal and human pathogens; infection mechanisms; cell response to viral infections; and pathogen diagnostics. Other projects concern the area of medical biology and molecular diagnostics. We conduct research concerning recombinant and edible vaccines, markers used in neurodegenerative disease diagnostics, and nanobiotechnology for treating burns. Cancer research, including studies on cancer biology, therapy response and resistance, prognostic and predictive biomarkers, liquid biopsy, and new immune-modulating substances and protease inhibitors in anti-cancer treatment, is being dynamically developed. In addition, we have grants involving immunology research focused on allergic and inflammatory reactions and structural biology research which analyses the replication of mitochondrial DNA and its impact on health problems. A third area, covered by external funding involves molecular plant





research, dedicated to the diagnostics and infection mechanisms of plant diseases and the identification of genes and lipid metabolic pathways in plant cells.

Since 2022, in response to changes in Constitution for Science, two scientific disciplines are led by the Faculty: biotechnology and medical sciences. Within the biotechnology, microbiology, including virology and plant research, is the main research topic, while the medical sciences focus on molecular and translational studies of cancer as well as immunology and the use of bacterial spores for medical applications.



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<https://www.facebook.com/MWB.UGiGUMed>



<https://www.youtube.com/@IFBUGandMUG>



<https://www.linkedin.com/company/intercollegiate-faculty-of-biotechnology/>

## 30 years of IFB

On June 12, 2023, the academic community of both universities and people associated with IFB gathered to celebrate the 30th anniversary of the Intercollegiate Faculty of Biotechnology. 30 years ago, in 1993, by virtue of the decision of two Senates - the University of Gdańsk and the Medical University of Gdańsk, the Intercollegiate Faculty of Biotechnology was established. This is a unique undertaking on a national scale and an example of excellent cooperation between the two universities.



*– I am extremely proud that today I can stand with you and witness the achievement of this common milestone of the University of Gdańsk and the Medical University of Gdańsk - said Vice-Rector for Scientific Research of the University of Gdańsk **Prof. Wiesław Laskowski**. - For the last three decades, the Intercollegiate Faculty of Biotechnology has shown that it is at the forefront in terms of scientific innovation, research and quality of education. It was a cradle for sharp minds and developed talents. It made young people want to become biotechnologists.*

The Rector of the MUG, **Prof. Marcin Gruchała** talked about his memories from the times of creating IFB UG and MUG. He noted that the new faculty fit into the broadly understood need from the 90s to join the West and conduct activities at the global level. - *It was emphasized that this faculty is created as in the West, that students can choose an educational path, subjects and that they are engaged in scientific work. We were very*



*interested in it, students of the medical faculty also applied for these first Biotechnology recruitments - said the Rector of the MUG. During his speech, Prof. Marcin Gruchała also emphasized the importance of the IFB UG and MUG in the context of wider cooperation within the Fahrenheit University.*

*“The road to the future is challenging, but our determination and commitment remain unchanged. By working with scientific partners, industry institutions and the business sector, we are confident that we will achieve*



our goals. We are ready to continue our research, develop innovative technologies and transform knowledge into practical solutions that will improve the quality of life of people and the environment – said the current Dean of IFB UG and MUG, **Prof. Ewelina Król** and asked the deans of previous terms to share their reflections on the management of the unit.

**Prof. Jacek Bigda** (Dean in 1999-2005) emphasized the role of Prof. Wiesław Makarewicz, who died in December 2021, in shaping the faculty. To the first dean the

unit owes, above all, many new laboratory spaces. The speakers also emphasized the great role of Prof. **Anna Podhajska** and **Prof. Waław Szybalski**, **Prof. Maciej Żylicz**, **Prof. Stefan Angielski** and **Prof. Karol Taylor**.

**Prof. Ewa Łojkowska** (Dean in 2005-2012) shared her memories when, as an experienced researcher, she came to Gdańsk to work in the newly created faculty. She talked about the importance of the role of Prof. Wiesław Makarewicz and Prof. Anna Podhajska in her scientific development. At the same time, she described the impact of IFB UG and MUG not only on the scientific community, but also on the inhabitants of Gdańsk or Poland e.g. during the COVID-19 pandemic.

– *You should always have a broad perspective and jump beyond the horizon. In my opinion, our faculty has been implementing this vision all the time. During my tenure, we have made several such jumps. One of them was a leap in the context of infrastructure, i.e. a new building, but also the purchase of equipment – said **Prof. Igor Konieczny** (Dean in 2012-2020). – We have also made a scientific leap, during these 8 years you could see a large increase in the quality of our publications, as evidenced by the A+ parameter from the Committee for the Evaluation of Scientific Units. We have also made a big leap in education, which has been appreciated by the Polish Accreditation Committee.*



After the deans' statements, a congratulatory letter from the Mayor of Gdańsk **Aleksandra Dulkiwicz** was read, who emphasized the high quality of education of MWB UG and MUG. **Professor Grzegorz Węgrzyn** recalled the great enthusiasm of people who created the unit in the 90s. And in the letter from the President of the Polish Biochemical Society **Adam Szewczyk**, the uniqueness of the joint initiative of the UG and MUG resounded.

At the end of the event, Prof. Ewelina Król presented the President of KAWA. SKA **Marian Kawczyński**, who received the medal for the 50<sup>th</sup> anniversary of the University of Gdańsk for many years of financial support of the faculty in the organization of Biotechnology Summer Schools and other initiatives for better education of students. *"We started working with the faculty even before it was created, which is a little more than 30 years ago. I promise that we will continue to cooperate for the next decades - announced Marian Kawczyński.*





# International Institute of Molecular and Cell Biology in Warsaw



The International Institute of Molecular and Cell Biology in Warsaw (IIMCB) was formally established in 1995 under an international agreement between the government of the Republic of Poland and UNESCO which was enacted by the Polish parliament on June 26, 1997. The provisions of these documents have secured the Institute's special status and independence since it started its operations in 1999. The unique and international character of the IIMCB follows the best examples of scientific research institutions across the world.

The IIMCB is a research institute in the field of life sciences. For years, the Institute has boasted the highest scientific category (A+) in the evaluation of scientific institutions by the Ministry responsible for science, including the latest one in 2022. With more than 250 staff members on board, the Institute consists of 14 laboratories, 6 core facilities and 10 research support units.

## Mission

The IIMCB consistently strives to achieve its stated mission:

We support ambitious scientists of any nationality, driven by passion to pursue frontier research that aims to make a difference for 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 we encourage collaborations among them. We provide efficient administrative support that enables scientists to focus on their research.

## Research

Within the IIMCB structure, there are 14 independent research groups headed by junior and senior Laboratory Leaders:

- Matthias Bochtler, Laboratory of Structural Biology
- Janusz M. Bujnicki, Laboratory of Bioinformatics and Protein Engineering
- Andrzej Dziembowski, Laboratory of RNA Biology – ERA Chairs Group
- Jacek Jaworski, Laboratory of Molecular and Cellular Neurobiology
- Aleksandra Kołodziejczyk, Laboratory of Cellular Genomics
- Jacek Kuźnicki, Laboratory of Neurodegeneration
- Ewelina Małecka-Grajek, Laboratory of Single-Molecule Biophysics
- Marta Miączyńska, Laboratory of Cell Biology
- Gracjan Michlewski, Laboratory of RNA-Protein Interactions – Dioscuri Centre
- Katarzyna Mleczko-Sanecka, Laboratory of Iron Homeostasis
- Marcin Nowotny, Laboratory of Protein Structure
- Wojciech Pokrzywa, Laboratory of Protein Metabolism
- Cecilia L. Winata, Laboratory of Zebrafish Developmental Genomics
- Jan Brezovsky, Laboratory of Biomolecular Interactions and Transport AMU/IIMCB in Poznań

Generally, their research focuses on studying the molecular mechanisms of human diseases across the levels of biological organization from atoms to organisms (worms, zebrafish, mice).



Only by acting together – like cells  
and tissues in a biological organism – can we  
succeed as an institution.  
I am sure that we will make it happen.

Marta Miączyńska  
IIMCB Director

Research at the IIMCB is supported by an annual statutory subsidy from the Ministry of Education and Science and a budgetary subsidy from PAS. Still, up to 70% of the yearly institutional budget comes from external competitive sources. Since 2000, our scientists have received 348 grants. Many prestigious ones come from European and other foreign sources, such as: the EU Framework Programmes (4 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 (EEA) and Norway Grants, and the Polish-Swiss Research Programme. In 2023, the IIMCB will implement an institutional project entitled “*RNA and Cell Biology – from Fundamental Research to Therapies*” (RACE) funded in the Teaming for Excellence programme under Horizon Europe.



## Career and education

The environment of the Institute is international with English as the working language. The IIMCB implements the 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. 30%).



HR EXCELLENCE IN RESEARCH

Human resources are the most important assets, thus the IIMCB follows the rules put forward by the European Commission in the HR Excellence in Research programme, 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 Gender Equality Plan has been recently implemented.

## Dynamic growth

The IIMCB is on its way to unprecedented scientific and institutional growth, in part supported 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 support research at IIMCB, with a focus on Genomics and Single-Cell Sequencing; Proteomics, Protein Isolation and Analysis; Cellular Models, Organoids and Cell Banking; Bioinformatics and Computational Biology.

You can be part of our team. Check out our recruitments and join us.

## 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. This 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.



EU-LIFE community at the 10<sup>th</sup> Anniversary Conference, Portugal



The IIMCB conducts fundamental research aimed at understanding human diseases at the molecular and cellular level which is a basis for creating innovative therapeutic and diagnostic methods. To ensure that the results of this research are translated into clinical applications, the IIMCB is open to cooperation with the pharmaceutical and biotechnology industry, including sharing resources and expertise.

The Institute also supports social initiatives that serve groups of patients with diseases. To this end, IIMCB has fostered two patient support organizations: Polish Association Supporting People with Inflammatory Bowel Disease “J-elita” and Polish Ciliary Dyskinesia Society.

## Outreach

Moreover, the IIMCB is also 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.



## New building

In 2022 the results of the competition for an architectural concept of a new building were announced during a ceremonial gala. The winning project envisages 4 above-ground floors and 1 underground floor, with a total building area of over 20,000 m<sup>2</sup> and a usable space of nearly 14,000 m<sup>2</sup>. As the next step, a building design is prepared, before tendering for a construction company. We are excited about the future of the IIMCB in this attractive and spacious building.



Concept of the IIMCB building



[www.iimcb.gov.pl](http://www.iimcb.gov.pl)



Biotechnology Summer School is 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.

## XXVI BSS Support

This year's edition of BSS was kindly supported by MegaMocni and KAWA.SKA.

MegaMocni is a leading brand in a private sector of nurseries, preschools and schools in the Pomeranian district in Poland. The brand, which was founded in Gdansk in 2013, is owned by DyNaMo Creative Development Association.

MegaMocni settings aim to offer high quality education to children and students in order to further support their cognitive, social, emotional and physical development. All settings follow the Polish curriculum but our educational offer covers much more than this.



Pedagogical foundations that shape everything that we do are independence and communication. We also offer plenty of opportunities to learn through exploring and experimenting.

### **Communication**

Giving opportunities to speak openly about our thoughts and feelings, using dialogue and interacting through modern technology all contribute to the development of strong communication skills.

### **Independence**

Through acting independently children develop confidence, take challenges, make decisions and ultimately, develop critical thinking skills.

### **Exploring**

Learning through play and active exploration of the world generates positive emotions amongst children which in turn help to develop their concentration skills and lead to effective learning.



Our professional team of pedagogues, psychologists and speech therapists support children's holistic development. We offer specialist guidance to our families and put a lot of focus on staff training so that we can provide exceptional support to children and students in our care. Since 2022 MegaMocni have been particularly engaged in developing social and emotional skills amongst children through the Positive Discipline programme that was introduced across the company. We believe that promoting children's wellbeing in these areas will enable them to become confident communicators and will benefit them in every aspect of their life.

Keeping children safe is our priority. Our commitment to ensure safety in our settings includes daily health and safety checks and regular health and safety and child protection training provided to our staff. We carefully recruit our staff and perform criminal record checks so that only the right people look after children and students in our care. Additionally, our settings are equipped with monitoring systems and intercom on sites.



MegaMocni are aware of the importance of the educational environment that surrounds children and students. Our beautiful and spacious settings are designed and decorated to enrich learning experiences and support children's focus. All spaces are adjusted to children's needs, interests and developmental abilities. All of our facilities cater for children with health issues such as asthma, diabetes or food intolerance.



Our modern facilities are located in some of the key districts of Gdańsk (Jasień, Strzyża, Suchanino, Stogi, Zaspą), Gdynia (Mały Kack), as well as in Borkowo, Gościcino and Gowidlino. In addition to nurseries and preschools, we also run a primary school in Gowidlino. In September 2023 two new settings will be opened: in Rotmanka and in Gdańsk, the latter in cooperation with the Gdańsk University of Technology.

Learn more about us at [www.megamocni.edu.pl](http://www.megamocni.edu.pl)

# MegaMocni



### **Business profile**

We are a supplier of innovative solutions for scientific and research centers in the field of biotechnology. As a trading company, our product portfolio includes devices and consumables used in biology, biophysics, molecular biology, biotechnology, environmental protection, molecular diagnostics, histopathology and quantum optics. We are a Polish company that has been operating for over 24 years. We represent global brands on the domestic market, such as: Leica Microsystems, Leica Biosystems, Pico-Quant, Kurabo, Agena Bioscience, Anathomic Solutions, Cerus, Indica Labs.

### **Mission**

Slogan: "We teach. We advise. We support." is the motto of our daily work. Our overriding goal is to provide substantive support to clients in making decisions that are satisfactory for them, regarding the purchase of research and development equipment that will be best suited and profiled in terms of their research.

### **Vision**

Our future is development. Both the biotechnology market and the solutions we offer, as well as our team. We believe that thanks to the top-class equipment, professional service and substantive support of our specialists, clients receive comfort of work, repeatability of processes and credibility of results. We strive to be a reliable partner for our clients.

### **Strategy**

We believe that the key to success are the latest biotechnological solutions and people who see the potential of modernity. Our employees have extensive knowledge and skills in the field of offered solutions. We conduct microscopy training for our current clients, as well as for students and researchers who want to deepen their knowledge in the field of microscopy, imaging and to work on the most modern equipment on the market. Our authorized Leica service supports our customers during the installation of devices, as well as during the entire life of the devices purchased from us. As part of marketing activities, we participate in many conferences, seminars and workshops, thus wanting to meet your expectations and make it easier for you to get to know the systems and devices we offer. We are open to new markets and new interesting cooperation proposals.

## The beginnings of the company through the eyes of the President

And how did it start? Imagine that although the company is only 24 years old, it all started almost 43 years ago, so in the last century. In 1980, I left the Medical Academy in Warsaw and started working for an American company. The company produced scientific, research and diagnostic equipment. The recipients of this highly specialized equipment were biologists (I am a biologist - geneticist), chemists, physicists, biophysicists and medical diagnosticians.

At that time, access to the application knowledge and technology of Western research and diagnostic centers was very limited. This was the motive for my action aimed at bringing this knowledge and technical solutions closer to Polish users. This is how selling through education began. An American company allocated the appropriate funds for this and in the mid-1980s we started educational activities. Unfortunately, all good things come to an end sometimes. This was to be the case here. The company turned off the money tap. But I decided to continue my educational activities further. Education cannot be interrupted just like that. That is why KAWA.SKA was founded 24 years ago with the mission WE TEACH. WE ADVISE. WE SUPPORT., which sets the direction of our activity to this day.

Have we been successful? I will say immodestly: Yes. We managed to survive crises, overcome difficulties and start another year of existence and activity. The success of our company would not be possible without the wonderful people around. Clients with a vision and willingness to conduct new research, employees with charisma, knowledge and willingness to work, and a family with holy patience. Many, many thanks. I wish us all success together for the next 20 years.

**Marian Kawczynski**  
**President of the Management Board of KAWA.SKA**

### More information about the company:



[https://www.facebook.com/people/Kawaska/100039796579365/?paipv=0&eav=AfbKH-22HEK7qG5V3eOsLfg4PXuqYUC2ZdbA-foueaCUcrZdoNGmK-tTn8dxjl4k10OI&\\_rdr](https://www.facebook.com/people/Kawaska/100039796579365/?paipv=0&eav=AfbKH-22HEK7qG5V3eOsLfg4PXuqYUC2ZdbA-foueaCUcrZdoNGmK-tTn8dxjl4k10OI&_rdr)



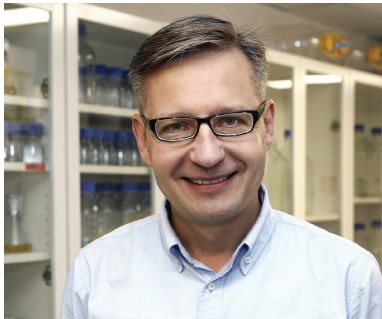
<https://www.linkedin.com/company/kawa-ska/?originalSubdomain=pl>



# Speakers Introduction

## Andrzej Dziembowski

Laboratory of RNA Biology – ERA Chairs Group  
International Institute of Molecular and Cell Biology in Warsaw, Poland



Andrzej Dziembowski is the head of an ERA Chairs Group at the International Institute of Molecular and Cell Biology in Warsaw, is a professor at the Warsaw University Faculty of Biology, and holds the Waclaw Szybalski Honorary Chair at the University of Gdańsk. He is also a member of EMBO and Academia Europaea. Prof. Dziembowski graduated from the Faculty of Biology at the University of Warsaw, where he received his PhD. For several years, he worked at the CNRS Center for Molecular Genetics in Gif-sur- Yvette, France. He then headed an independent laboratory at the Institute of Biochemistry and Biophysics of the Polish Academy of Sciences in Warsaw. In 2019, the laboratory moved to the International Institute of Molecular and Cellular Biology in Warsaw. Prof. Dziembowski's primary research interest is posttranscriptional gene expression regulation. Currently, the lab studies RNA biology at the organism level, using Direct RNA Sequencing as an experimental approach and transgenic mouse lines as a model system. Prof. Dziembowski is the author of more than 100 research articles, many of which have been published in prestigious journals such as Nature, Cell, Nature Structural and Molecular Biology, Genes and Development, Molecular Cell, EMBO Journal and EMBO Reports. His research has been supported by numerous national and international grants, including ERC Advanced Grant (2022).

Talk abstract: see pages 45, 48 (opening lecture, lecture 3)



## Sebastian Glatt

Max Planck Research Group

Małopolska Centre of Biotechnology at Jagiellonian University, Kraków, Poland



Sebastian Glatt studied at the University of Vienna and did his PhD in the pharmaceutical industry. In 2008, he joined the Structural and Computational unit at EMBL Heidelberg as a postdoc. There he transformed from a pure cell biologist into a protein biochemist, crystallographer and electron microscopist. Since September 2015, he leads his own independent Max Planck Research Group at the Malopolska Centre of Biotechnology of the Jagiellonian University in Krakow. He established and maintained fruitful scientific collaborations with leading labs around the world

and he has published in highly prestigious scientific journals. He has received several prestigious grants, including the ERC Consolidator Grant 2020, the EMBO YIP/IG as well as several grants from FNP and NCN. He was the laureate of the NCN Award 2021 for life sciences and his team received the Krakow City Prize 2020. He is not only leading his international research team, but he is also deputy director of science at MCB and head of the “National Cryo-EM facility” at the Solaris Synchrotron in Krakow.

Talk abstract: see page 46 (lecture 1)

## Wojciech Galej

Laboratory of Structure and function of RNA-protein complexes

European Molecular Biology Laboratory, Grenoble, France



Wojciech Galej is a molecular and structural biologist who made scientific contributions in the field of pre-mRNA splicing and gene expression. He completed his undergraduate education at the college of Inter-Faculty Individual Studies in Mathematics and Natural Sciences (MISMaP) at the University of Warsaw from 2004 to 2009. He began his research career as an undergraduate student at the Institute of Genetics and Biotechnology at the University of Warsaw, where he completed a BSc project in the group of Prof.

Joanna Kufel. He continued his education at the same institution, completing an MSc degree in Molecular Biology under the supervision of Prof. Kufel and Prof. Andrzej Dziembowski. During this time, he also completed a second MSc project in Chemistry at the Structural Research Laboratory under the supervision of Dr. Paulina Dominiak. He then went on to earn his PhD in Molecular Biology from the University of Cambridge in 2013, where he used X-ray crystallography to study splicing complexes under the supervision of Dr. Kiyoshi Nagai. After completing his PhD, he continued his research as a postdoctoral fellow at the MRC Laboratory of Molecular Biology in Cambridge, where he used newly emerging cryo-EM technologies to study the structure and function of splicing complexes. During this time, he solved the first high-resolution structure of the substrate-bound catalytic spliceosome. In 2016, he moved to the European Molecular Biology Laboratory (EMBL) in Grenoble, France, where he currently holds a Group Leader position in structural biology. His group uses an integrated structural biology approach combined with biochemistry and biophysics to investigate large RNA-protein complexes involved in gene expression.

Talk abstract: see page 47 (lecture 2)

## Piotr Kowalski

School of Pharmacy  
University College Cork, Cork, Ireland



Dr. Kowalski is an Associate Professor in advanced therapies at the School of Pharmacy, University College Cork, and a Funded Investigator at the APC Microbiome Ireland. He earned his Ph.D. in 2014 from the University of Groningen (the Netherlands) which focused on the development of lipid-based systems for tissue selective delivery of siRNA. He received his postdoctoral training at the Koch Institute for Integrative Cancer Research at the Massachusetts Institute of Technology in the laboratories of Prof. Daniel

Anderson and Prof. Robert Langer. His multidisciplinary research focused on engineering novel biomaterials to enable the delivery of messenger RNAs to treat inflammatory diseases, cancer, and diabetes. Dr. Kowalski's work resulted in a number of high-impact publications, several patents on RNA delivery technologies, and the creation of a US-based biotech startup (Orna Therapeutics). His research at UCC is centered on developing Advanced Therapy Medicinal Products, in particular, novel clinically relevant drug delivery technologies for parental and non-parental applications, to facilitate effective nucleic acid-based therapies aimed at high medical need diseases that lack effective

treatment. Dr. Kowalski has recently won a prestigious European Research Council Starting grant to develop a new class of circular RNA therapeutics. Currently, his group investigates the therapeutic potential of RNA molecules, including short interfering RNAs, messenger RNAs and circular RNAs, to treat diseases such as sepsis, inflammatory bowel disease, and cancer and develops methods to deliver these RNA-based drugs to diseased cells.

Talk abstract: see page 49 (lecture 4)

## Barbara Uszczyńska-Ratajczak

Department of Computational Biology of Non-coding RNA  
Institute of Bioorganic Chemistry Polish Academy of Science, Poznań, Poland



Barbara Uszczyńska-Ratajczak graduated from the Wrocław University of Technology and Adam Mickiewicz University in Poznań, Poland. She obtained her PhD degree in chemical sciences at the Institute of Bioorganic Chemistry PAS. In 2013, as a postdoc, she joined the Bioinformatics and Genomics program at the Centre for Genomic Regulation in Barcelona and also became a member of the GENCODE consortium. This was the moment when she discovered her passion for long noncoding RNAs. Her major research interests focus on annotation and functional

characterization of vertebrate lncRNAs, including zebrafish as a model organism. Her research contributed to the development of revolutionary new methods for full-length lncRNA annotation at high-throughput scales. Barbara has published her work in highly recognized scientific journals and received prestigious scholarships including MNiSW and L'Oréal Poland for Women in Science. Her research is funded by the National Science Centre Poland.

Talk abstract: see pages 50, 51 (lecture 5, lecture 6)

## Aleksandra Kołodziejczyk

Laboratory of Cellular Genomics

International Institute of Molecular and Cell Biology in Warsaw, Poland



Aleksandra Kołodziejczyk completed a first-level degree in Biotechnology at the University of Perugia organized by the consortium of European Universities including Intercollegiate Faculty of Biotechnology UG-MUG. During her studies she trained in the lab of Prof. Fred van Leuven (KU Leuven), Prof. Sir Alan Fersht (MRC LMB, Cambridge) and Prof. Matthias Wilmanns (EMBL). She completed her MSc Degree in Molecular Biosciences, majoring in Molecular and Cellular Biology at the University of Heidelberg. For her thesis, she worked on chemotaxis towards bacterial autoinducer in the lab of Prof. Victor Sourjik. In 2012 to pursue her PhD she joined the group of Dr. Sarah Teichmann at EMBL EBI and Wellcome Trust Sanger Institute and worked in the emerging field of single cell transcriptomics. She focused on technical aspects of the method as well as gaining novel biological insights into T cells and mouse embryonic stem cells. She was awarded by EMBO Long Term Fellowship and Marie Skłodowska-Curie Action Individual Fellowship to undertake Postdoctoral training at the Weizmann Institute of Science in the group of Prof. Eran Elinav, where she applied her genomics skills to study the role of host-microbiota interactions in liver diseases. Since 2023, she leads the Laboratory of Cellular Genomics at IIMCB. Her research employs cutting-edge omics technologies to study host-microbiota interactions and gastrointestinal health.

Talk abstract: see page 52 (Lecture 7)



## Wojciech Fendler

Department of Biostatistics and Translational Medicine  
Medical University of Łódź, Łódź, Poland



Professor Wojciech Fendler MD, PhD (born 1982) graduated from the Medical University of Łódź. After obtaining PhD in 2011 and habilitation in 2013 he launched a biomarker project on micro-RNA biomarkers in oncology and radiotherapy together with prof. Dipanjan Chowdhury from the Dana-Farber Cancer Institute and Harvard Medical School. He has authored numerous high-impact publications in top journals in diabetology (Diabetes Care, Diabetologia), radiotherapy and oncology (International Journal of Radiation

Oncology, Biology, Physics, Cancer Research, Clinical Cancer Research), experimental medicine (Science Translational Medicine) and basic sciences (Cell Reports, Nature Communications, eLife). Prof. Fendler is the recipient of several prestigious awards for young researchers including the Award of the National Science Centre in Life Sciences in 2020, START scholarship of the FNP (twice), Stipend of the Polpharma Foundation, Scholarship of the Ministry of Science and Higher Education, award of the Ministry of Health for habilitation and several others. International recognition of his works was awarded with the ISPAD-Medtronic Young Investigator Award in 2015 granted to outstanding researchers aged <40 in paediatric diabetology. During his career he has led or supervised 28 research projects funded from the National Science Centre, Foundation for Polish Science and EU funds. Currently, as a leader of the Department of Biostatistics and Translational Medicine he explores the potential for biomarker assessment of risk incurred by ionizing radiation and detection of early stages of ovarian, breast and pancreatic cancers.

Talk abstract: see page 53 (Lecture 8)

## Ewelina Małecka-Grajek

Laboratory of Single-Molecule Biophysics

International Institute of Molecular and Cell Biology in Warsaw, Poland



Ewelina Małecka-Grajek is the head of the Single-Molecule Biophysics Lab at the International Institute of Molecular and Cell Biology (IIMCB) in Warsaw. She obtained her PhD in Biochemistry from Adam Mickiewicz University in Poznań in 2017, where she worked with Prof. Mikołaj Olejniczak on studying RNA-protein interactions using biochemical methods.

After completing her doctoral studies, Dr. Małecka-Grajek spent five years at Johns Hopkins University in Baltimore, working in Prof. Sarah Woodson's lab. During this time, she focused on developing innovative methods for single-molecule imaging of biological molecules, with a particular focus on RNA folding and dynamics, as well as RNA-protein interactions in bacterial systems.

At the IIMCB, Dr. Małecka-Grajek will continue to use single-molecule imaging to answer fundamental questions in RNA biology. Her group will study the coordination between RNA targeting, degradation, and translation in bacteria. While most species of bacteria are harmless or even beneficial, some can cause infectious diseases. The goal of these studies is to define molecular mechanisms of complex cellular processes and identify potential targets for antimicrobial drugs.

Talk abstract: see page 54 (Lecture 9)

## Tomasz Stokowy

Scientific Computing Group  
University of Bergen, Bergen, Norway



Tomasz Stokowy works at the University of Bergen IT Division, where he leads the Scientific Computing group. He holds degrees in engineering and medicine, supported by 15 years of practical experience in the analysis of biomedical data. His academic work has resulted in more than 60 scientific publications. He completed TEKNA GILA, a Norwegian program focused on the development of technical leaders. Currently, his role focuses on the development of complex IT infrastructures for research at NRIS (<https://www.sigma2.no/nris>) and NREC (<https://www.nrec.no>).

Workshop abstract: see page 55 (Workshop 1)

## Marcelina Jureczko

Biotechnology Center Silesian University of Technology, Gliwice, Poland  
The Spokesman of Science, Poland



PhD Eng Marcelina Jureczko is a science communicator, academic teacher, and biotechnologist. Since 2020, she has been a member of the Association of the Spokespersons of Science. Her passion is popularizing science through lectures, workshops, laboratory classes, and even stand-up comedy. She has participated in numerous science picnics and festivals and collaborated with various nationwide media outlets (Super Polsat, TVP, Radio Kraków, Radio Katowice, Czwórka – Polskie Radio, Newsweek, Gazeta Wyborcza, Forum Akademickie,

PAP – Nauka w Polsce). She is a finalist in the „Three Minute Thesis” and a semi-finalist in „FameLab” – a competition for the best popular science presentations. In 2021, she received the „POP Science” award at the Silesian Science Festival for her contributions to science popularization. More information about her activities can be found

on her website: <https://www.facebook.com/Marcelina-Jureczko-108851200689784>  
Marcelina holds a MSc and an Eng degree in biotechnology and has obtained a PhD in the field of engineering and technology in scientific discipline: environmental engineering, mining, and energy. For her doctoral dissertation she has received the Prime Minister's Award. She currently teaches at the Silesian University of Technology and leads a research grant funded by the National Science Centre. Her research focuses on the toxicity of cytostatic drugs in the aquatic environment and investigates methods for their removal using fungi. In the past year, she completed internships at prestigious research institutions: the Spanish National Research Council in Barcelona and the Polish Academy of Sciences in Poznań.

Workshop abstract: see page 56 (Workshop 2)

## Krzysztof Sobczak

Department of Gene Expression  
Adam Mickiewicz University, Poznań, Poland



Krzysztof Sobczak – professor of Adam Mickiewicz University (AMU) in Poznan (Poland). He got PhD degree and a postdoctoral degree in chemistry from the Institute of Bioorganic Chemistry PAS. He was awarded the title of professor of biology in 2019. Since 2019, he is the director of the Institute of Molecular Biology and Biotechnology of AMU. In 2005-2009 he completed a postdoctoral fellowship at the University of Rochester (USA). In 2010, he founded a new research group,

whose interests focus on the elucidation of the molecular pathomechanisms of human genetic diseases caused by the expansion of trinucleotide repeats and the development of therapeutic strategies targeting mutant RNA. He is the author of over 70 original articles which were cited ~4,000 times (ORCID: 0000-0001-8352-9812).

Talk abstract: see page 57 (Lecture 10)



# Abstracts

## Opening Lecture: **Mechanisms of eukaryotic RNA Decay**

**Andrzej Dziembowski**

Laboratory of RNA Biology – ERA Chairs Group

International Institute of Molecular and Cell Biology in Warsaw, Poland

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## Lecture 1: tRNAslational Control of Eukaryotic Gene Expression

### Sebastian Glatt

Max Planck Research Group

Małopolska Centre of Biotechnology at Jagiellonian University, Kraków, Poland

My Max Planck Research Group at MCB aims to determine the structure and function of key components of both U34 modification pathways in eukaryotes, namely the highly conserved eukaryotic Elongator complex and the Uba4/Urm1 thiolation pathway. We mainly use X-ray crystallography and cryogenic electron microscopy (cryo-EM) to obtain snapshots of the involved macromolecular machines and analyze their reaction intermediates at atomic resolution. Subsequently, we employ different complementary in vitro and in vivo approaches to validate and challenge our structural observations. We work closely with numerous clinical centers around the world to understand the molecular basis of human diseases that are caused by changes in the cellular tRNA modification patterns. Furthermore, we have started working on other (t)RNA modification pathways, PUS enzymes, DUS enzymes, methyltransferases and queuosine transferases) and elucidate the structure of folded RNA molecules directly by cryo-EM.

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## **Lecture 2: Structural and biochemical studies of RNA-protein complexes**

### **Wojciech Galej**

Laboratory of Structure and function of RNA-protein complexes  
European Molecular Biology Laboratory, Grenoble, France

RNA-protein complexes play a crucial role in various cellular processes, including the removal of non-coding introns from pre-mRNAs by the spliceosome. Due to its complexity and dynamic nature, the spliceosome has proven to be a challenging target for structural studies. Developments in single particle cryo-EM have paved the way towards the structural characterisation of the splicing machinery. Despite tremendous progress, many aspects of spliceosome structure and function remain elusive. During my talk I will use test cases of the spliceosome and Integrator complexes to discuss recent advancements in biochemical and structural studies of RNA-protein complexes, specifically focusing on the sample preparation techniques and methods used for structure determination.

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**Lecture 3: Linear therapeutic mRNAs**

**Andrzej Dziembowski**

Laboratory of RNA Biology – ERA Chairs Group

International Institute of Molecular and Cell Biology in Warsaw, Poland

During the COVID-19 pandemic, we witnessed the application of mRNA vaccines for SARS-CoV-2, paving the way for the widespread use of therapeutic mRNAs in medicine. Therapeutic mRNAs resemble normal mRNA with a cap structure and poly(A) tail but are generated through in vitro transcription. Over the years, the design of these mRNAs has been significantly improved, increasing their stability and translational potential and inhibiting the anti-viral innate immune response by replacing uridine with methylpseudouridine (m $\Psi$ ). In addition to vaccination against infectious diseases and cancer immunotherapy, replacement therapies for Mendelian diseases are in active development. The lecture will summarize current knowledge about the medical applications and the metabolism of therapeutic linear mRNA molecules.

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## Lecture 4: Circular RNAs and their potential as RNA therapeutics

**Piotr Kowalski**

School of Pharmacy  
University College Cork, Cork, Ireland

Circular RNAs (circRNAs) are a new class of non-coding RNAs, characterized by a covalently closed-loop structure and produced from genes through an alternative form of splicing, called back splicing. The lack of free ends necessary for exonuclease-mediated degradation, including 5' Cap and 3'poly(A) tail, makes circRNAs significantly more stable, extending their half-life intracellularly and in blood as compared to their linear counterparts. They were also shown to possess unique roles and structural features and have been implicated in several human diseases, hinting at their potential for therapeutic applications. To date, research predominantly focused on identifying new circRNAs and studying their biological functions leaving a significant gap in the knowledge on the utility of this new class of RNAs for translational research. We developed a method for the circularization and purification of synthetic circRNAs and pioneered the use of these circRNAs for robust and stable protein expression in eukaryotic cells in order to address the short half-life of mRNA in biological systems. In this lecture, we will discuss the potential of circRNAs to expand the toolbox of therapeutic RNA molecules and will talk about the strategies to overcome challenges for intracellular delivery of RNA molecules to relevant cell types beyond the liver that poses a major limitation for therapeutic applications of RNA-based drugs.

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## Lecture 5: The hunt for dark DNA: identification of long noncoding RNAs in vertebrate genomes

Barbara Uszczyńska-Ratajczak

Department of Computational Biology of Non-coding RNA  
Institute of Bioorganic Chemistry Polish Academy of Science, Poznań, Poland

Vertebrate genomes produce tens of thousands of long noncoding RNAs (lncRNAs) – long transcripts with limited protein-coding potential. Although an increasing number of lncRNAs is linked to fundamental physiological processes in the cell, the vast majority of them (>97%), even for the human genome, still remain functionally uncharacterized. Understanding the biological roles of lncRNAs requires accurate genome annotations describing their precise location, gene boundaries and transcript structures. However, current lncRNA catalogues show evident signs of incompleteness with many gene models being fragmented or uncatalogued. To overcome this issue, the present work aims to advance towards a complete and accurate annotation of lncRNAs in human and mouse genomes. By developing and applying targeted long-read RNA sequencing methodology, this study provides accurate lncRNA annotations at high-throughput rates. Presented methodology eliminates the need for the noisy transcriptome assembly and requires minimal manual curation. Produced transcript models uncover thousands and hundreds of novel, full-length lncRNAs for human and mouse genomes, respectively, also substantially increasing the annotated transcript complexity within targeted loci. Resulting lncRNA catalogues are of quality comparable to present-day manually curated annotations. Moreover, we detected human and mouse lncRNA orthologues in the zebrafish genome using a newly designed synteny-based approach. Improved annotation of mammalian lncRNA orthologues in the zebrafish genome is expected to largely facilitate their functional characterization.

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## Lecture 7: Profiling single-cell transcriptomes to understand disease

### Aleksandra Kołodziejczyk

Laboratory of Cellular Genomics

International Institute of Molecular and Cell Biology in Warsaw, Poland

In this talk, I will first cover fundamentals of single cell genomics, with a focus on single cell RNA sequencing. In the second part of the talk, I will show examples from my projects on how this technology can be applied to study diseases in mice.

In particular, I will talk about how we used this technology to identify mechanisms of how microbiota affect liver failure. Acute liver failure (ALF) is a fulminant complication of multiple etiologies, characterized by rapid hepatic destruction, multi-organ failure and mortality. Its treatment is limited to supportive care and liver transplantation. We utilized mouse models of ALF and single-cell transcriptomes to characterize cellular responses to liver damage. We demonstrated that unique, previously uncharacterized stellate cell, endothelial cell, Kupffer cell, monocyte and neutrophil subsets, and their intricate intercellular crosstalk, drive ALF. We unraveled a common MYC-dependent transcriptional program orchestrating stellate, endothelial and Kupffer cell activation during ALF, which is regulated by the gut microbiome through Toll-like receptor (TLR) signaling. Pharmacological inhibition of MYC, upstream TLR signaling checkpoints or microbiome depletion suppressed the MYC-dependent program, thereby attenuating ALF.

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## Lecture 8: Circulating microRNA biomarkers in oncology – strengths, limitations and perspectives

### Wojciech Fendler

Department of Biostatistics and Translational Medicine  
Medical University of Łódź, Łódź, Poland

Given the accessibility, stability of expression and reasonably low costs of quantification, circulating microRNAs have attracted a lot of interest as a promising class of biomarkers in numerous fields, including oncology. The successful design of miRNA-based diagnostic tests seems possible but is severely hindered by variable selection issues, technical limitations regarding the specificity of molecular methods and signal normalization in biofluids devoid of reference genes. In the presented study we attempted to identify germline BRCA1/2 mutation carriers is vital for reducing their risk of breast and ovarian cancer. To derive a serum miRNA-based diagnostic test we used samples from 653 healthy women from six international cohorts, including 350 (53.6%) with BRCA1/2 mutations and 303 (46.4%) BRCA1/2-wild-type. All individuals were cancer-free before and at least 12 months after sampling. Initial miRNA sequencing showed significant technical variability which necessitated batch effect removal, standardization and adjustment for covariates. The differential expression analysis identified 19 miRNAs significantly associated with BRCA mutations, 10 of which were ultimately used for a classification model which achieved area under the receiver operating characteristic curve 0.89 (95%CI: 0.87-0.93). In the validation cohort, the model retained performance with sensitivity and specificity of 93.88% and 80.72% respectively. Importantly, the type of the mutated gene, menopausal status or having preemptive oophorectomy did not affect classification performance highlighting the test's potential for practical application. Circulating microRNAs thus seem to have the capacity used to identify BRCA1/2 mutations in patients of high risk of cancer, offering an opportunity to reduce screening costs.

#### NOTES

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**Lecture 9: One molecule at a time. Single-molecule methods to study structural rearrangements of RNA, RNA-RNA and RNA protein assembly**

**Ewelina Małecka-Grajek**

Laboratory of Single-Molecule Biophysics

International Institute of Molecular and Cell Biology in Warsaw, Poland

Biological processes intricately rely on the dynamic interplay between nucleic acids, proteins, and protein complexes. A comprehensive understanding of the mechanisms governing these interactions is crucial for gaining insight into their regulation and harnessing their potential. In this lecture series, we will delve into the investigation of these molecular interactions by employing single-molecule total internal reflection fluorescence (TIRF) microscopy. TIRF microscopy allows visualization and analysis of individual molecules in real-time with high spatial and temporal resolution. It is particularly useful for studying dynamic processes such as molecular binding, dissociation, and conformational changes and stability of complexes. It can also reveal transient or weak interactions that might be missed in ensemble measurements. Furthermore, single-molecule TIRF microscopy enables the study of interactions under various physiological conditions, mimicking the dynamic environment inside living cells. The first lecture will provide a comprehensive overview of the technique, encompassing experimental design and data analysis. The second lecture will focus on exemplary applications of single-molecule TIRF microscopy, illustrating its utility in unraveling the intricate choreography of gene regulation by small RNAs and the indispensable role of chaperone protein Hfq in bacteria.

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## Workshop 2: From Lab to Public: A Journey into Science Popularization

### Marcelina Jureczko

Biotechnology Center Silesian University of Technology, Gliwice, Poland  
The Spokesman of Science, Poland

1. What is science popularization and why is it worth doing?
2. Communication techniques: effective strategies for simplifying complex scientific concepts without sacrificing accuracy.
  - Exercise on effective communication and timing.
3. Know your audience: utilizing appropriate language for different listeners.
  - Exercise on selecting contents and messages for targeted audience.
4. Storytelling and analogies: making scientific concepts relatable and easier to understand.
  - A brief introduction on making scientific concepts easier to comprehend.
5. Props and visual aids: enhancing explanations or causing distractions?
  - A brief introduction to visual and verbal communication, the importance of body language and captivating the public's attention.
6. An article, podcast, TV program, or own social media channels? - choosing the best medium for science popularization.
  - Exercise on communicating through mass media: interviews.

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## Lecture 10: Compounds which alleviate the pleiotropic toxicity of RNA harboring expanded CGG repeats in the Fragile X-associated syndrome

Krzysztof Sobczak

Department of Gene Expression  
Adam Mickiewicz University, Poznań, Poland

Fragile X-associated tremor/ataxia syndrome (FXTAS) is an incurable neurodegenerative disorder caused by expansion of CGG repeats in the *FMR1* 5'UTR. The RNA containing expanded CGG repeats (rCGG<sup>exp</sup>) causes cell damage by interaction with complementary DNA, forming R-loop structures, sequestration of nuclear proteins involved in RNA metabolism and initiation of noncanonical translation of polyglycine-containing protein (FMRpolyG), which forms nuclear insoluble inclusions. During the lecture, we will discuss the therapeutic potential of short antisense oligonucleotide steric blockers (ASOs) and small compounds targeting directly the rCGG<sup>exp</sup>. In nuclei of FXTAS cells ASOs affect R-loop formation and correct miRNA biogenesis and alternative splicing, indicating that nuclear proteins are released from toxic sequestration. In the cytoplasm, ASOs significantly decrease the biosynthesis and accumulation of FMRpolyG. Delivery of ASO into a brain of FXTAS mouse model reduces the formation of inclusions, improves motor behavior and corrects gene expression profile with marginal signs of toxicity after a few weeks from a treatment. We also identified small compounds, CMBLs, which bind to RNA structure formed by rCGG<sup>exp</sup> and attenuate translation of toxic FMRpolyG and formation of nuclear inclusions in FXTAS cells. Our results indicate that CMBL4c can reduce FMRpolyG-mediated cytotoxicity and apoptosis. Importantly, its therapeutic potential is also observed once the inclusions are already formed.

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# XXVI BSS Programme

<b>Monday, 11th September</b>			
15:00	17:00	Departure from Gdańsk – Arrival at Szarlota Hotel	
18:00	18:05	Welcome word	IFB Dean, BSS Organizing Committee
18:05	19:00	<b>Opening Lecture:</b> Mechanisms of eukaryotic RNA Decay	<b>Andrzej Dziembowski</b> (International Institute of Molecular and Cell Biology in Warsaw, Poland)
19:00	20:00	Dinner	
20:00		<b>Integration – field game</b>	
<b>Tuesday, 12th September</b>			
8:00	9:00	Breakfast	
9:30	10:30	<b>L1:</b> tRNAslational Control of Eukaryotic Gene Expression	<b>Sebastian Glatt</b> (Małopolska Centre of Biotechnology at Jagiellonian University, Kraków, Poland)
10:30	11:30	<b>L2:</b> Structural and biochemical studies of RNA-protein complexes	<b>Wojciech Galej</b> (European Molecular Biology Laboratory, Grenoble, France)
11:30	12:00	Coffee break	
12:00	13:00	<b>L3:</b> Linear therapeutic mRNAs	<b>Andrzej Dziembowski</b> (International Institute of Molecular and Cell Biology in Warsaw, Poland)
13:30	14:30	Lunch	
15:00	16:00	<b>L4:</b> Circular RNAs and their potential as RNA therapeutics	<b>Piotr Kowalski</b> (University College Cork, Cork, Ireland)
16:00	17:00	<b>L5:</b> The hunt for dark DNA: identification of long noncoding RNAs in vertebrate genomes	<b>Barbara Uszczyńska-Ratajczak</b> (Institute of Bioorganic Chemistry Polish Academy of Science, Poznań, Poland)
19:00		<b>Dinner barbecue</b>	
<b>Wednesday, 13th September</b>			
8:00	9:00	Breakfast	
9:30	10:30	<b>L6:</b> Women in Science: How I Dared to Become Batman	<b>Barbara Uszczyńska-Ratajczak</b> (Institute of Bioorganic Chemistry Polish Academy of Science, Poznań, Poland)
10:30	11:30	<b>L7:</b> Profiling single cell transcriptomes to understand disease	<b>Aleksandra Kołodziejczyk</b> (International Institute of Molecular and Cell Biology in Warsaw, Poland)
11:30	12:00	Coffee break	
12:00	13:00	<b>L8:</b> Circulating microRNA biomarkers in oncology – strengths, limitations and perspectives	<b>Wojciech Fendler</b> (Medical University of Łódź, Łódź, Poland)
13:30	14:30	Lunch	

15:00	16:00	<b>L9:</b> One molecule at a time. Single-molecule methods to study structural rearrangements of RNA, RNA-RNA and RNA protein assembly ( <b>Part I</b> )	<b>Ewelina Małecka-Grajek</b> (International Institute of Molecular and Cell Biology in Warsaw, Poland)
16:00	17:00	<b>W1:</b> RNA in the clouds	<b>W2:</b> From Lab to Public: A Journey into Science Popularization
		<b>Tomasz Stokowy</b> (University of Bergen, Bergen, Norway)	<b>Marcelina Jureczko</b> (Biotechnology Center Silesian University of Technology, Gliwice, Poland/ The Spokesman of Science, Poland)
19:00	20:00	Dinner	
<b>Thursday, 14th September</b>			
8:00	9:00	Breakfast	
9:30	10:30	<b>L10:</b> Compounds which alleviate the pleiotropic toxicity of RNA harboring expanded CGG repeats in the Fragile X-associated syndrome	<b>Krzysztof Sobczak</b> (Adam Mickiewicz University, Poznań, Poland)
10:30	11:30	<b>L9:</b> One molecule at a time. Single-molecule methods to study structural rearrangements of RNA, RNA-RNA and RNA protein assembly ( <b>Part II</b> )	<b>Ewelina Małecka-Grajek</b> (International Institute of Molecular and Cell Biology in Warsaw, Poland)
11:30	12:00	Coffee break	
12:00	13:00	<b>W2:</b> From Lab to Public: A Journey into Science Popularization	<b>W1:</b> RNA in the clouds
		<b>Marcelina Jureczko</b> (Biotechnology Center Silesian University of Technology, Gliwice, Poland/The Spokesman of Science, Poland)	<b>Tomasz Stokowy</b> (University of Bergen, Bergen, Norway)
13:30	14:30	Lunch	
<b>Kayaking</b>			
19:00	20:00	Dinner	
20:00		<b>Fancy dress party – theme “Laboratory equipment” / attendance certificate and prizes ceremony</b>	
<b>Friday, 15th September</b>			
8:00	10:00	Breakfast	
10:00	10:45	Checking out	
11:00		Departure	

Glossary:

L = lecture

W = workshop

Please remember to sign your name on a list for the workshops participation order.



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