MSCA PF 2026
Hosting Offers

Live of Science, Chemistry

Keywords:

BioPolymers, RNA, DNA, Nucleic Acids, Modifications, Thermoresponsive Biotools, Biomaterials, Microbeads, Chemical Synthesis

Prof. Marcin Chmielewski

Head of Department of Biopolymers Chemistry

Research focuses on the chemical synthesis of biopolymers (nucleic acids, peptides, carbohydrates, and lipids) and their chemical modifications. We develop novel functional polymeric materials with potential applications in drug delivery systems and as supports for solid-phase synthesis. Additionally, our team explores thermocyclization reactions in chemical synthesis and advances thermoresponsive technologies, including the design of protective groups, novel fluorescent labels, and thermoreleasable polymers.

We are specialists in qualitative and quantitative instrumental analysis using high-performance liquid chromatography (HPLC) with UV-Vis, fluorescence, and refractometric detectors, as well as MALDI-TOF-MS mass spectrometry.

a) Chemical modification and synthesis of nucleic acids, particularly modified siRNA.

b) Development of novel functional polymeric materials with potential applications in drug delivery systems.

c) Chemical synthesis of thermoresponsive biotools.

d) Functionalized polystyrene microbeads for use in bioorganic chemistry.

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Keywords:
Huntington's disease (HD); Spinocerebellar ataxia type 3 (SCA3); Neurodegeneration; Autophagy; UPS (ubiquitin-proteasome system); Gene silencing; AAV; therapy; Brain organoids; Single-cell RNAseq

Prof. Maciej Figiel

Department of Biomedical Proteomics

Huntington's disease (HD) and spinocerebellar ataxia type 3 (SCA3) are caused by excessive CAG repeats in HTT and ATXN3, leading to brain degeneration by toxic protein aggregates that disrupt key neural cell functions like protein clearance, energetics, axonal transport, RNA and DNA regulation and metabolism. Our research aims to understand neurodegeneration and develop therapeutic strategies, with implications for other neurodegenerative diseases like Alzheimer's and Parkinson's.

Pathogenesis: We explore the neurodevelopmental mechanisms of neurodegenerative diseases, particularly in juvenile forms of HD and SCA3, and ask if early interventions might prevent neuronal degeneration long before symptoms emerge.

We explore therapeutic strategies:

1. CAG-directed gene silencing: This strategy lowers mutant proteins in the brain by shRNA delivered by AAV vectors. The intravenously injected AAV crosses the blood-brain barrier (BBB) and eliminates the need for invasive brain injection.

2. Protein clearance. Enhancing the removal of toxic polyQ aggregates by targeting cellular pathways like autophagy and UPS, where the key regulator is ATXN3. Small molecules activate types of autophagy, promoting protein degradation.

3. Neurodietary interventions - Investigating caloric restriction and ketogenic diets to counteract neurodegenerative mechanisms and improve neuronal resilience.

Models and methodologies:

We utilize knock-in mouse models for HD and SCA3 , alongside advanced brain organoid systems that mimic disease processes. We use high-throughput proteomic, transcriptomic, and single-cell approaches to enable deep analysis of disease mechanisms and therapeutic effects.

Our work combines discovering the mechanisms of brain disease pathogenesis with investigating their translational applications. We aim to advance and expand therapeutic strategies for polyQ disorders and other neurodegenerative diseases. Research topics can be tailored to a candidate's expertise and interests.

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Keywords:

- RNA structure,
- RNA viruses,
- influenza virus,
- SARS-CoV-2,
- nucleic acids thermodynamics
- modified oligonucleotides,
- antisense oligonucleotides,
- small molecules,
- RNA interactions,
- pathogenic RNA

Prof. Elzbieta Kierzek

Head of Department of RNA Structural Genomics

- RNA structural genomics of viruses

- Secondary and tertiary structure of pathogenic RNA

- Modulation RNA functional activities, including pathogenic RNAs related with human diseases

- RNA structural genomics of influenza virus and SARS-CoV-2, influence of RNA structure on virus replication

- Projecting and optimization of modified oligonucleotides, siRNA, ribozymes and small molecules as potential inhibitors RNA viruses.

- Modified oligonucleotides – antisense and microarrays strategies.

- Nucleic acids thermodynamics, prediction of RNA secondary structure with modifications.

- Natural modifications of RNA – influence on structure, thermodynamics and biology of RNA

- Functional RNA structural motifs of RNA viruses

Please note that a topic can be adapted to the candidate's profile

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Keywords:

RNA molecules; three-dimensional structure of RNA; RNA and proteins associated with pathology of neurodegeneration; cryo-EM, x-ray crystallography; bio-physical evaluation of RNA molecules; RNA-ligand interactions

Agnieszka Kiliszek

Head of Department of RNA Structural Research

The general scope of research involves the structural and biophysical analyses of RNA molecules relevant to human physiology and disease etiology.

Example of PhD study topics:

- *Structural characterization of RNA molecules involved in neurodegeneration*
- *Structural and biophysical evaluation of RNA G-quadruplexes.*

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Keywords:

cancer genetics, Copy Number Variation (CNV), Multiplex Ligation-dependent Probe Amplification (MLPA), miRNA, lncRNA, non-coding genomics

Piotr Kozłowski, Prof.

Head of the Department of Molecular Genetics

Analysis of cancer somatic mutations in non-coding genome, particularly in miRNA genes.

Designing and developing MLPA test for large mutation and copy number analysis of a gene/genomic region of interest.

Genomic and transcriptomic NGS data analysis.

Cancer predisposition analysis.

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Anna Kurzyńska-Kokorniak

Head of Department of Ribonucleoprotein Biochemistry

We investigate how RNA and DNA regulate the activity of nucleic acid-binding proteins and explore the broader molecular mechanisms in which these proteins participate. Our research is centered on Dicer-type ribonucleases. Dicer proteins are best known for their role in the biogenesis of small regulatory RNAs, including microRNAs and small interfering RNAs. However, a growing number of reports demonstrate that the activity of Dicer proteins extends beyond the biogenesis of small regulatory RNAs. The research topics carried out in our Department include: (i) the cellular interactome of human ribonuclease Dicer, (ii) non-canonical functions of human Dicer, (iii) ATP hydrolysis activity of vertebrate Dicers, (iv) signaling pathways involving Dicer proteins, (v) evolution of Dicer domains (the topic can be adapted to the candidate's profile).

Keywords:

Dicer-type ribonucleases, RNaes III, helicases, ATPases, nucleic acid-protein interactions

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Agata Tyczewska

Head of Laboratory of Invertebrate Model Organisms

Keywords:

Caenorhabditis elegans, aging, human diseases, nanoparticles, small molecule compounds

We study the role of tRNA-derived small RNAs in the process of aging and age-related diseases using C. elegans as a model. The post-doc may join the existing project or the topic can be adapted to the candidate's profile e.g., analysis of the influence of small molecule compounds on various C. elegans disease models, nanoparticle analysis and uptake, protein, RNA function or chromatin structure analysis.

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Paweł Zmora

Head of the Department of Molecular Virology

Keywords:

emerging viruses; virus-host cell interactions; antiviral strategy; influenza A virus; SARS-CoV-2; coronaviruses, MPXV; wastewater; genomic epidemiology

My research interests focus on the emerging viruses, i.e., influenza A virus, SARS-CoV-2, and virus-host cell interactions, with particular interest in virus entry. The obtained knowledge allows me to design new antiviral strategies, based on RNA and/or small molecules. Recently, my research has focused on the seroprevalence and genomic epidemiology, especially in the context of the mpox virus. My research group works mostly with cell culture models, but we have also done some in vivo experiments. Thanks to the collaboration, we also work with human material.

Within my projects, I combine virology, molecular and structural biology, genomics, immunology, and epidemiology, but I am open to any new interesting topics, which may broaden my scientific horizon.

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Agnieszka Żmieńko

Head of Department of Plant Genomics

Keywords:

plant science, structural variation, copy number variation, nanopore sequencing, epigenetics, symbiotic islands, metabolite gene clusters, microbiome, transposable elements, stress response

New talented and creative members are always welcome in our team. We are interested in deciphering the links between the plant genome and the phenotype by investigating natural differences between the plants of same species adapted to different environments. We use both genotype-first and phenotype-first approaches and heavily rely on genomic techniques such whole-genome sequencing and transcriptomics, including in-house nanopore sequencing. We also use a variety of experimental molecular biology methods. Our current projects include investigating the impact of intraspecies (epi-)genetic variation on the structure and function of secondary metabolite gene clusters (Arabidopsis thaliana) and symbiotic nitrogen fixation (Medicago truncatula). We offer help in planning the research and writing proposal on these topics or any related topic proposal from the candidate will be considered. Bot computational and experimental biologists are equally welcome.