nencki institute
of experimental biology

PLACE FOR

LEARNING
DISCOVERY
EXPRESSION
AND DISCOURSE

nencki institute
of experimental biology

OUR MISSION

The Institute's activity concentrates on three main fields: scientific research, innovation and education. Our scientific team combines biology, chemistry, computation and technology in order to apply novel approaches to understand the fundamental nature of biological processes and solve complex research problems. The main interest is focused on studies directly translated into health protection and the improvement of the quality of life within society, including novel therapies and diagnostic methods in cancer, diabetes, neurodegenerative diseases, neurological disorders, and other diseases of modern civilization.

To speed up innovation and accelerate the translation of basic discoveries we provide support for the Technology Transfer Unit and the Institute's translational platform, within the frame of SPARK Global initiative, which fosters research conducted in cooperation with business and facilitates the transfer of knowledge from laboratory to industry.

We are committed to educate and inspire future leaders in science through the multi-directional training of young scientists within the framework of the Warsaw-4-PhD Doctoral School, the Interdisciplinary Tri-Bio-Chem Doctoral Studies and the International PhD Program in Biomedical Research – Bio4Med.

prof. dr hab.
AGNIESZKA DOBRZYŃ
DIRECTOR OF THE INSTITUTE

The Nencki Institute of Experimental Biology is over 100 years old. From its founding, the Institute has been extremely successful in recruiting the best scientists in biological research. The combination of a high intellectual capacity, pioneering spirit, can-do attitude, and optimism for the future has enabled the Nencki Institute to defy tradition and constantly provide new opportunities.
In February 2018, when I began my role as Director of the Nencki Institute, I had to ask myself important questions: How can we ensure that the Institute continues moving forward? How can we further advance our service to society as a whole? What priorities should guide the Institute throughout the next decade and beyond?
The answers to these questions are crucial because we live in a world that is marked by accelerating change, reflected by rapid technological transformation and greater societal challenges. Thus, over the next decade we would like to further increase the excellence and international standing of the Nencki Institute as a primary research center in life sciences. We fulfill this mission by investing in human capital and modern technologies, by stressing the importance of effective international collaborations, and by supporting translational research. We were already successful in setting up centers of scientific excellence that bring us closer to achieve our goals.
In 2015, the Institute established the Neurobiology Center consisting of ten core-facility labs. In 2019, we launched the Center for Neural Plasticity and Brain Disorders, BRAINCITY, an international research agenda, in cooperation with the European Molecular Biology Laboratory (EMBL). In 2019, the Institute also established two DIOSCURI Centers of Scientific Excellence, focused on chromatin biology and metabolic disorders, supported by the Max Planck Society. The Institute is also in the process of creating the National Center for Advanced Analysis of Biological and Bio-Medical Imaging which will be launched in 2022.
I am excited and optimistic as we embark on this journey. The vision to make the Nencki Institute more focused on interdisciplinary and translational research can be achieved. I strongly believe that when we come together, set ambitious goals, and strive to achieve these goals, great things happen.

A. Dobrzyń

DIRECTOR OF THE INSTITUTE

prof. dr hab.
AGNIESZKA DOBRZYŃ
DIRECTOR OF THE INSTITUTE

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PAWEŁ BOGUSZEWSKI
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CENTER FOR BASIC AND TRANSLATIONAL
RESEARCH IN BIOLOGY AND BIOMEDICAL SCIENCES

CENTER FOR NEURAL PLASTICITY AND BRAIN DISORDERS, **BRAINCITY**

CORE FACILITIES **NEUROBIOLOGY CENTER**

NENCKI IN NUMBERS

103 YEARS OF RESEARCH

357 PROFESSIONAL EMPLOYEES

32 RESEARCH LABORATORIES

168 PHD STUDENTS FROM 9 COUNTRIES

10 CORE FACILITIES

52 BREAKTHROUGH PATENTS

180 ONGOING NATIONAL AND INTERNATIONAL PROJECTS

MARCELI **NENCKI**

Marceli Nencki was born in 1847 in Boczki near Sieradz in western Poland. He studied medicine in Berlin and obtained the degree of Doctor of Medicine in 1870 for his studies on the oxidation of aromatic compounds. In 1872, he worked as a research assistant at the University of Berne (Switzerland). In 1876, he was appointed Associate Professor and a year later full Professor and Director of the Institute of Medical Chemistry at the University of Berne. In 1884 he became the Dean of the Faculty of Medicine. In 1885, his laboratory received a new location in the newly constructed building of the Institute of Pathology.

Nencki's scientific interests concentrated, among others, on urea synthesis, chemistry of purines and biological oxidation of aromatic compounds. He was also interested in the structure of proteins, enzymatic processes in the intestine and bacterial biochemistry. One of his key achievements was the demonstration that urea is formed from amino acids. He also demonstrated, together with Ivan P. Pavlov, that the liver is the site of urea synthesis in animals. Another of his key discoveries, in collaboration with Leon Marchlewski, was on the chemical structure of haemoglobin. Marceli Nencki's publications include 173 experimental and review papers. Nencki is also the author of several review and popularizing articles in Polish.

In addition to his research and teaching activities, Marceli Nencki took an active part in the life of the scientific community in Bern and in his adopted homeland, Switzerland. He is known for his articles and speeches on the organization of science in Switzerland and the establishment of the Swiss Academy of Sciences, the organization of health care, and the reform of pharmaceutical studies. In 1890 he became an editor of the international scientific journal Jahresberichte über die Fortschritte der Thierbiochemie. In recognition of his scientific merits he was elected a foreign full member of the Academy of Sciences in Krakow in 1884 and a correspondent member of the Royal Academy of Medicine in Rome in 1889. The Jagiellonian University twice offered him to come to Cracow and take professorships.

After 20 years of working in Berne, Nencki and Pavlov established the Institute of Experimental Medicine in St. Petersburg, Russia, where he spent the last decade of his life. Prof. Marceli Nencki died in 1901 at the age of 54.

RESEARCH LABORATORIES

Research laboratories of the Nencki Institute operate within two scientific centers: Center for Basic and Translational Research in the Field of Biology and Biomedical Sciences, and Center for Neural Plasticity and Brain Disorders, BRAINCITY. We combine state-of-the-art research approaches with the use of precise tools and methods and with the achievements of computational biology and bioinformatics to implement ambitious and interdisciplinary research projects responding to the challenges of modern biology and medicine.

CENTER FOR BASIC AND TRANSLATIONAL RESEARCH IN BIOLOGY AND BIOMEDICAL SCIENCES

Comprises 27 research laboratories which combine biology, chemistry, computation and technology, to create novel approaches to understand the fundamental nature of biological processes and solve complex research problems of biology and medicine. Particular emphasis is placed on basic and translational research within the fields of neurobiology and civilization diseases.

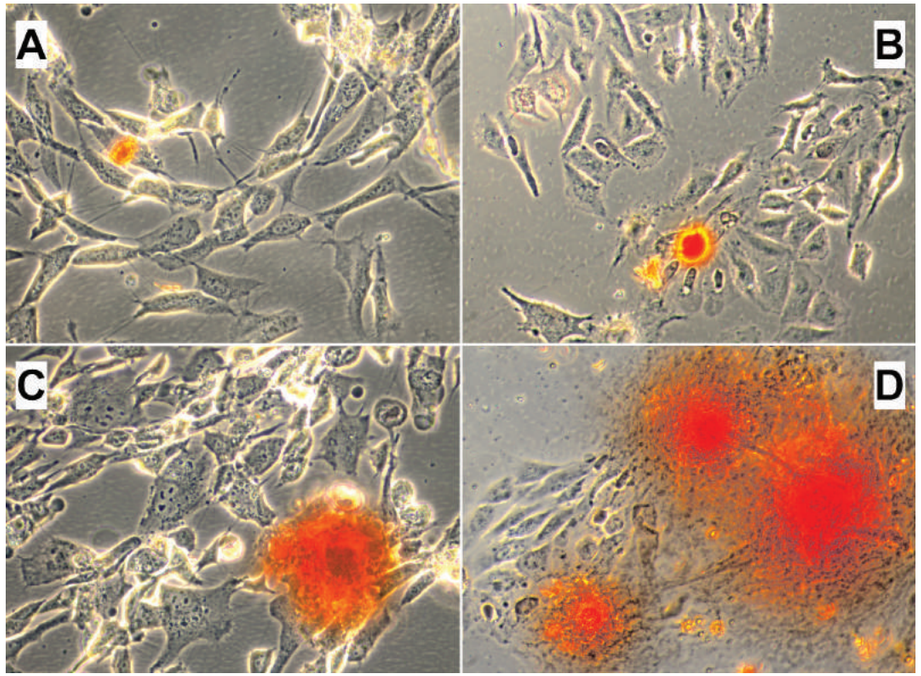
LABORATORY OF BIOCHEMISTRY OF LIPIDS

RESEARCH PROFILE

Calcium homeostasis with an emphasis on calcium- and lipid-binding proteins, including mammalian annexins. Early stages of biomineralization with a focus on biogenesis and the function of matrix vesicles, and the role of tissue nonspecific alkaline phosphatase (TNAP). Membrane dynamics, membrane repair processes and vesicular transport. Lipid metabolism in health and disease with a focus on signal transduction. Transport of ions and metabolites through biological membranes. Ion channels formed by calcium- and membrane-binding proteins. Annexin-related human diseases – annexinopathies.

CURRENT RESEARCH ACTIVITIES

Structure-function relationship within the mammalian family of membrane- and calcium-binding proteins, annexins, with special emphasis on their role in physiological and pathological mineralization; ion channel properties of annexins; factors affecting annexins, TNAP, and S100 protein functioning during matrix vesicles-mediated biological mineralization.

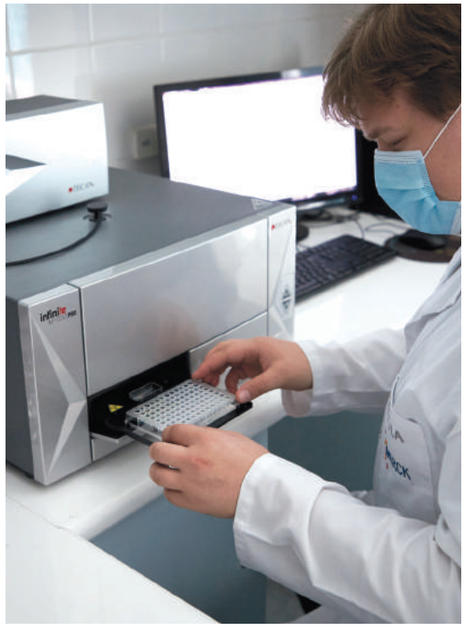


Mineralization of hFOB 1.19 (A, C) and of Saos-2 (B, D) cells under resting conditions (A, B) or after stimulation with ascorbic acid and β-glycerophosphate (C, D). Cells were stained with alizarin red (AR-S) and visualized by RGB (magnification 200 x). Ca salts in hFOB 1.19 (E) and Saos-2 (F) were dissolved in CPC and their content was measured spectrophotometrically at lambda 562 nm. Data are means ± S.E. of at least three independent experiments (**p<0.01, ***p<0.001).

HEAD
Sławomir Pikuła

SELECTED EXPERIENCE

MSc in Biology, 1977, Warsaw University; PhD in Biology, 1985, Nencki Institute of Experimental Biology, PAS; Habilitation in Biology, 1995, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2002, Nencki Institute of Experimental Biology PAS; Post-doc (1985-88) Department of Biochemistry and Molecular Biology, Health, Science Center at Syracuse, State University of New York, Syracuse, NY (Dr. Anthony N. Martonosi), USA. Head of the Laboratory of Lipid Biochemistry (1997-present). Prof. Sławomir Pikuła is the author or co-author of over 140 research publications (H-index=31; WoS). Prof. Pikuła is a Member of the Polish Biochemical Society, he was editor-in-chief of polish scientific journal Postępy Biochemii (Advances in Biochemistry) and member of the editorial board of international journal Acta Biochimica Polonica (associate editor).

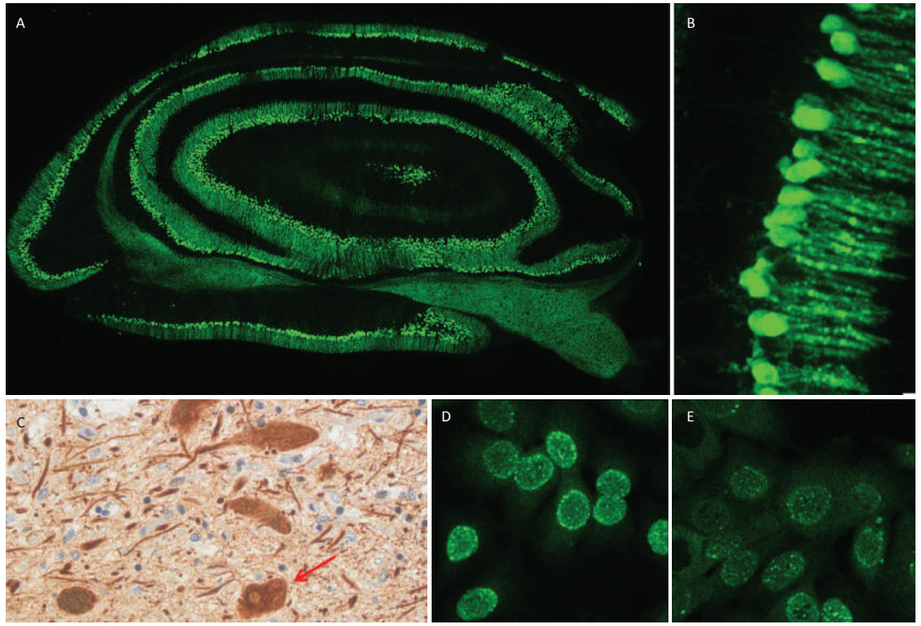


SELECTED PUBLICATIONS

- Goettsch C, Strzelecka-Kiliszek A, Bessueille L, Quillard T, Mechtouff L, Pikula S, Canet-Soulas, Millan JL, Fonta C, Magne D. (2020) TNAP as a therapeutic target for cardiovascular calcification: a discussion of its pleiotropic functions in the body. Cardiovascular Research, 00: 1-13.
- Veschi EA, Bolean M, Strzelecka-Kiliszek A, Bandorowicz-Pikula J, Pikula S, Granjon T, Mebarek S, Magne D, Ramos AP, Rosato N, Millán JL, Buchet R, Bottini M, Ciancaglini P. (2020) Localization of Annexin A6 in Matrix Vesicles During Physiological Mineralization. Int. J. Mol. Sci. 21(4): 1367.
- Strzelecka-Kiliszek A, Romiszewska M, Bozycki L, Mebarek S, Bandorowicz-Pikula J, Buchet R, Pikula S. (2019) Src and ROCK Kinases Differentially Regulate Mineralization of Human Osteosarcoma Saos-2 Cells. Int. J. Mol. Sci. 20(12): 2872.
- Bozycki L, Komiazyk M, Mebarek S, Buchet R, Pikula S, Strzelecka-Kiliszek A. (2018) Analysis of Minerals Produced by hFOB 1.19 and Saos-2 Cells Using Transmission Electron Microscopy with Energy Dispersive X-ray Microanalysis. J. Vis. Exp. (136): 57423.
- Bottini M, Mebarek S, Anderson KL, Strzelecka-Kiliszek A, Bozycki L, Simão AMS, Bolean M, Ciancaglini P, Pikula JB, Pikula S, Magne D, Volkmann N, Hanein D, Millán JL, Buchet R. (2018) Matrix vesicles from chondrocytes and osteoblasts: Their biogenesis, properties, functions and biomimetic models. Biochim. Biophys. Acta. Gen. Subj. 1862(3): 532-546.

LABORATORY OF CALCIUM BINDING PROTEINS

Research carried by the laboratory centers on the role of a calcium binding protein S100A6, and its ligands in signaling pathways under normal and stress conditions. In particular the research is focused on: the role of Hsp90 (its various co-chaperones) and of tau and a-synuclein in neurodegenerative diseases; the role of S100A6 and its ligands in cytoskeletal organization and cilia formation; transcriptional and epigenetic regulation of genes encoding S100 and other proteins involved in epidermal differentiation; the effect of ribosome biogenesis inhibition on oligodendrocyte differentiation and myelination process; the structur and function of IFIT anti-viral complexes. To study these processes we apply various biological and biochemical methods, among them are plasmid construction, cell culture and transfection, immunoprecipitation, Western blot, immunocyto / histochemistry / immunofluorescence, ELISA, luciferase assay, gel-shift, chromatin immunoprecipitation (ChIP), RT-qPCR. Another line of research conducted in the laboratory is the investigation of the molecular mechanisms regulating development of different brain structures in the opossum (Monodelphis domestica). This study requires a multidisciplinary approach from behavioral observations to gene / protein expression.



A, B. Calbindin immunofluorescent staining in the cerebellum of the opossum.
C. Presence of Hsp90 in Lewy body (red arrow) of substantia nigra in brain of Parkinson's disease patient.
D, E. H3K9me3 immunofluorescent staining in wild type (D) HaCaT keratinocytes and after knock-out (E) of SUV39H1 histone methyltransferase.

HEAD
Anna Filipek

SELECTED EXPERIENCE

MSc in Chemistry, 1985, University of Warsaw; PhD in Biology, 1990, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, 2000, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2009, Nencki Institute of Experimental Biology, PAS; Post-doc (1990-91) Vollum Institute, OHSU, Portland, USA.
Prof. Anna Filipek is the author or co-author of 93 research publications (H-index=24; WoS) and the supervisor of 11 doctoral theses. For her work prof. Filipek received the Award of the Polish Histochemistry and Cytochemistry Society, Mozołowski Award of the Polish Biochemical Society, Konorski Award of the Polish Neuroscience Society and the Committee of Neurological Sciences. Prof. Filipek is a member of the Polish Biochemical Society, Polish Neuroscience Society and European Calcium Society.

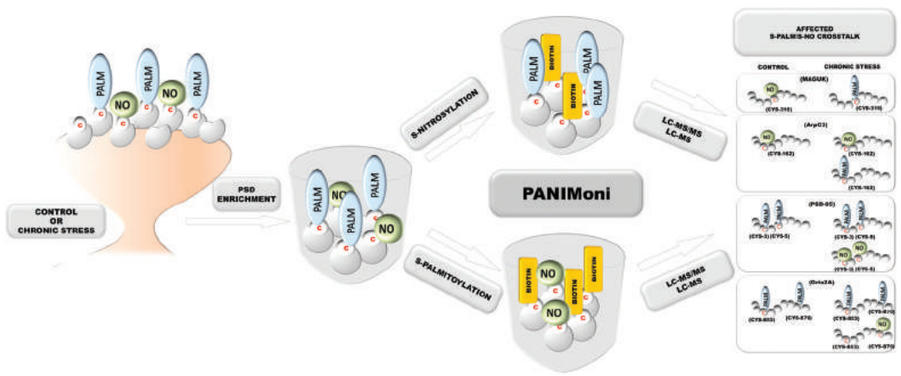
SELECTED PUBLICATIONS

- Jurewicz E, Miazga K, Fabczak H, Sławińska U, Filipek A. (2020) CacyBP/SIP in the rat spinal cord in norm and after transection – Influence on the phosphorylation state of ERK1/2 and p38 kinases. Neurochem. Int. 138: 104757.
- Sobiak B, Leśniak W. (2019) The Effect of Single CpG Demethylation on the Pattern of DNA-Protein Binding. Int. J. Mol. Sci. 20(4): 914.
- Bohush A, Niewiadomska G, Weis S, Filipek A. (2019) HSP90 and Its Novel Co-Chaperones, SGT1 and CHP-1, in Brain of Patients with Parkinson's Disease and Dementia with Lewy Bodies. J Parkinsons Dis. 9(1): 97-107.
- Bartkowska K, Tepper B, Gawda A, Jarosik M, Sobolewska P, Turlejski K, Djavadian RL. (2019) Inhibition of TrkB- and TrkC-Signaling Pathways Affects Neurogenesis in the Opossum Developing Neocortex. Cereb. Cortex 29(9): 3666-3675.
- Tepper B, Aniszewska A, Bartkowska K, Grochocka L, Turlejski K, Djavadian R. (2019) Aged Opossums Show Alterations in Spatial Learning Behavior and Reduced Neurogenesis in the Dentate Gyrus. Front. Neurosci. 13:1210.

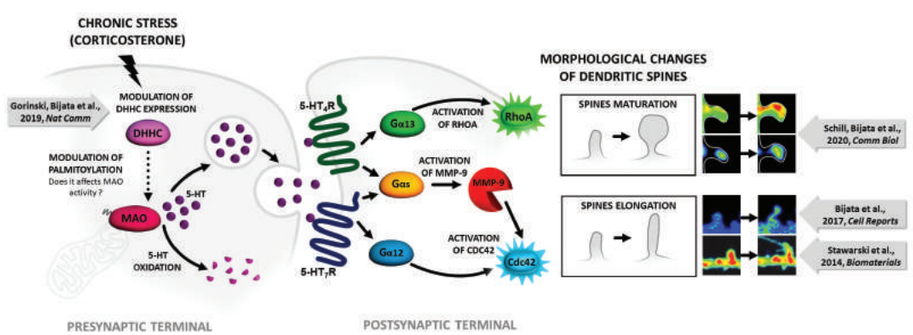
LABORATORY OF CELL BIOPHYSICS

Brain plasticity requires functional modification of neuronal networks through reorganization of existing synapses, modification of their efficacy, or modulation of neuronal endogenous excitability. Synapses are particularly prone to dynamic alterations and thus are believed to play a major role in plasticity. We study structural and functional synaptic plasticity.

We focus on aberrant synaptic plasticity associated with neuropsychiatric diseases such as depression. In particular, we work on the role of i) serotonin signalling, ii) S-palmitoylation of synaptic proteins, iii) cell adhesion molecules and iv) ageing in the etiology of neuropsychiatric disorders. We develop novel imaging based techniques and mass spectrometry methods for the analysis of structural plasticity and posttranslational modifications of synaptic proteins.



S-palmitoylation and S-nitrosylation interplay studies in aberrant synaptic plasticity.



Serotonergic signalling studies in aberrant synaptic plasticity.

SELECTED EXPERIENCE

MSc in Physics, 2001, Institute of Experimental Physics, Warsaw University; PhD in Physical Science, 2006, Institute of Experimental Physics, Warsaw University; Habilitation in Biological Sciences, 2014, Nencki Institute of Experimental Biology, PAS; Professor of natural sciences, 2020; Postdoctoral training: Max Planck Institute, Göttingen, Germany (2006-08).
Prof. Jakub Włodarczyk is the author or co-author of 50 publications and 1 patent (H-index=22; WoS).

Such a small thingies as interplay leads to huge impact on brain connectivity.

HEAD
Jakub Włodarczyk

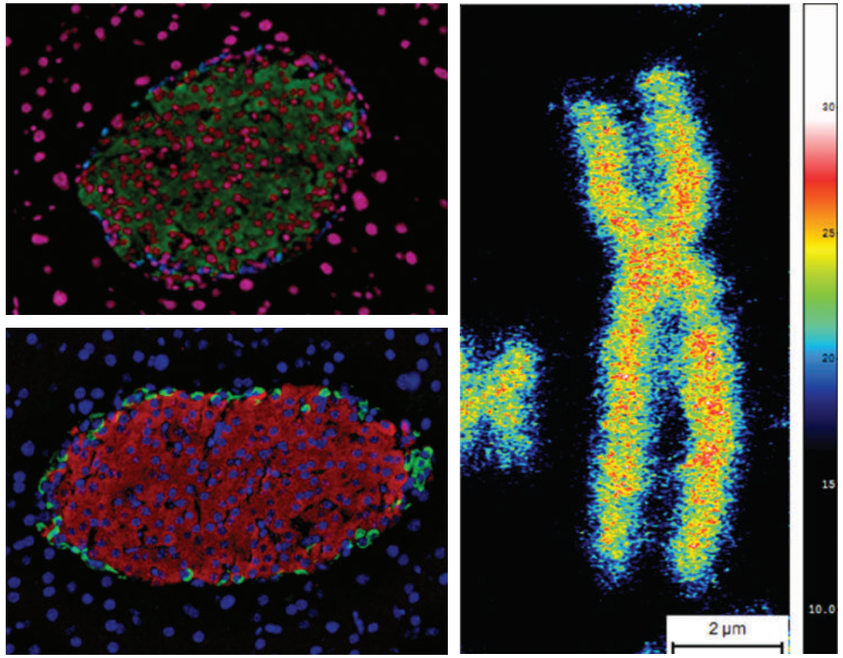
SELECTED PUBLICATIONS

- Zareba-Koziol M, Bartkowiak-Kaczmarek A, Figiel I, Krzystyniak A, Wojtowicz T, Bijata M, Wlodarczyk J. (2019) Stress-induced changes in the S-palmitoylation and S-nitrosylation of synaptic proteins. Mol. Cell Prot. 18: 1916-1938.
- Antoniuk S, Bijata M, Ponimaskin E, Wlodarczyk J. (2019) Chronic unpredictable mild stress for modeling depression in rodents: meta-analysis of model reliability. Neurosci. Biobeh. Rev. 99:101-116.
- Bijata M, Labus J, Guseva D, Stawarski M, Butzlaff M, Dzwonek J, Schneeberg J, Bohm K, Michaluk P, Rusakov DA, Dityatev A, Wilczynski G, Wlodarczyk J *, Ponimaskin E *. (2017) Synaptic remodeling depends on signaling between serotonin receptors and the extracellular matrix. Cell Rep., 19:1767-1782.
*co-corresponding author.
- Tang Z, Junhong Luo O, Li X, Zheng M, Jufen Zhu J, Szalaj P, Trzaskoma P, Magalska A, Włodarczyk J, Ruszczycki B, Michalski P, Piecuch E, Wang P, Wang D, Zhongyuan Tian S, Penrad-Mobayed M, Sachs L, Ruan X, Wei C, Liu E, Wilczyński G, Plewczyński D, Li G, Ruan Y. (2015) CTCF-mediated human 3D genome architecture reveals chromatin topology for transcription. Cell, 163 (7): 1611-1627.
- Stawarski M, Rutkowska-Wlodarczyk I, Zeug A, Bijata M, Madej H, Kaczmarek L, Wlodarczyk J. (2014) Genetically encoded FRET-based biosensor for imaging MMP-9 activity. Biomaterials, 35: 1402-1410.

LABORATORY OF CELL SIGNALING AND METABOLIC DISORDERS

Fit or Fat?

We carry out multidisciplinary studies on signaling and transcriptional cascades that have far-reaching implications on cell metabolism and human metabolic diseases, mainly type 2 diabetes. Our main priority is to understand the role of lipid metabolites and epigenetic modifications of gene expression in the development of insulin resistance and pancreatic β-cell dysfunction. We focus on signaling pathways affected by fatty acids during pancreatic organogenesis, and determining the role of lipid mediators in pancreatic β-cell – α-cell communication, as well as the cross-talk between insulin resistant tissues (i.e. skeletal muscle and adipose tissue) and pancreatic islets. Our genuine intention is to provide a foundation for knowledge about the role of lipid mediators in pancreatic islet function, and to increase understanding of mechanisms that trigger pancreatic β-cell adaptation towards systemic insulin resistance. Our second priority is to use the advantage of human pluripotent stem cells and 3D printing technology to generate personalized medicine-based therapy for diabetic patients, and the early diagnosis of type 2 diabetes. The current research activity includes (1) metabolic regulation of the DNA damage response in pancreatic β cells, (2) epigenetic regulation of pancreatic islets' metabolism and function, (3) adipose-derived stem cells and iPSc as a source of insulin- and glucagon-producing cells for tissue engineering and regenerative medicine applications.

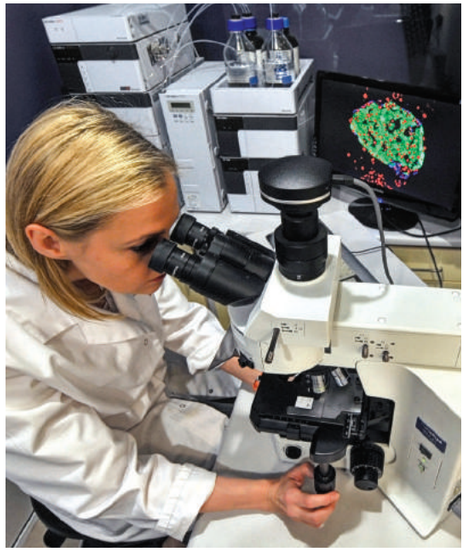


iPSc
»
insulin secreting cells

Cytoarchitecture of pancreatic islets (insulin/glucagon/DAPI), and spectroscopic map of spatial distribution of methyl groups in chromosome 1 isolated from pancreatic β-cell.

SELECTED EXPERIENCE

MSc in Biology, 1997, Warsaw University; PhD in Medical Sciences, 2001, Medical University of Bialystok; Habilitation in Medical Sciences, 2006, Medical University of Bialystok; Full Professor of Biological Sciences, 2015, Nencki Institute of Experimental Biology PAS; Fellow (1999) Department of Biochemistry, Munster University, Vienna University Hospital, Austria; Post-doc (2002-06) Department of Biochemistry, University of Wisconsin-Madison, USA. Prof. Dobrzyn is the author or co-author of 92 research publications and 4 patents (H-index=31; WoS). For her work prof. Dobrzyn received the Minister of Science and Higher Education awards for outstanding scientific achievements in 2016 and 2020, and Health Minister's Research Awards (in 2003 and 2005). Prof. Dobrzyn is a director of SPARK-Poland (translational scientist without borders initiative); Advisory Board Member of PolSCA in Brussels, Member of EMBO-YIP, Head of the team responsible for the development and implementation of SARS-CoV-2 pooled testing in Poland.



HEAD
Agnieszka Dobrzyń

SELECTED PUBLICATIONS

- Dobosz AM, Janikiewicz J, Borkowska AM, Dziewulska A, Lipiec E, Dobrzyn P, Kwiatek WM, Dobrzyn A. (2020) Stearoyl-CoA desaturase 1 activity determines the maintenance of DNMT1-mediated DNA methylation patterns in pancreatic beta-cells. Int J Mol Sci. 21(18):6844.
- Sokolowska P, Janikiewicz J, Jastrzebska E, Brzozka Z, Dobrzyn A. (2020) Combinations of regenerative medicine and Lab-on-a-chip systems: New hope to restoring the proper function of pancreatic islets in diabetes. Biosens Bioelectron. 167:112451.
- Jazurek-Ciesiolka M, Janikiewicz J, Dobrzyn P, Dziewulska A, Kozinski K, Dobrzyn A. (2019) Oleic acid increases the transcriptional activity of FoxO1 by promoting its nuclear translocation and beta-catenin binding in pancreatic beta-cells. Biochim Biophys Acta Mol Basis Dis. 1865(10):2753-2764.
- Dziewulska A, Dobosz AM, Dobrzyn A. (2018) High throughput approaches onto uncover (epi)genomic architecture of type 2 diabetes. Genes (Basel). 9(8). pii: E374.
- Kozinski K, Jazurek M, Dobrzyn P, Janikiewicz J, Kolczynska K, Gajda A, Dobrzyn A. (2016) Adipose- and muscle-derived Wnts trigger pancreatic beta-cell adaptation to systemic insulin resistance. Sci Rep. 6:31553.
- Janikiewicz J, Hanzelka K, Dziewulska A, Kozinski K, Dobrzyn P, Bernas T, Dobrzyn A. (2015) Inhibition of SCD1 impairs palmitate-derived autophagy at the step of autophagosome-lysosome fusion in pancreatic beta-cells. J Lipid Res. 56:1901-1911.

LABORATORY OF CELLULAR METABOLISM

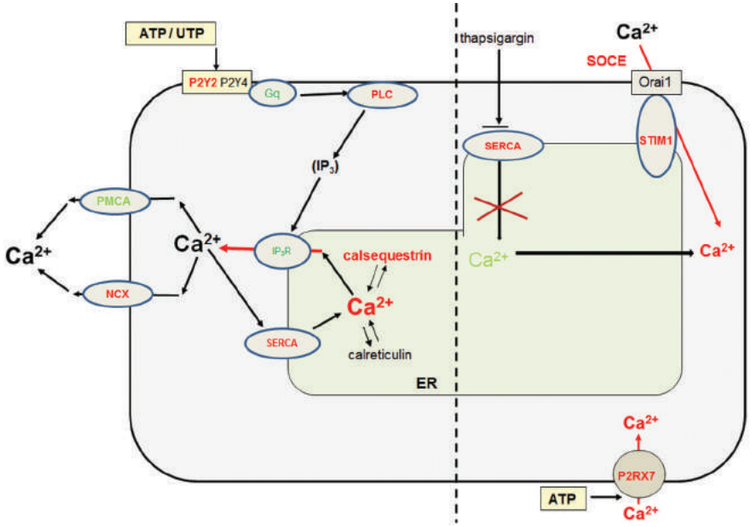
MAJOR INTEREST

Bioenergetics, cellular calcium handling and cellular signalling in mammalian cells.
In particular, we are interested in:

- Effects of mutation in the dystrophin-encoding gene on calcium signalling, intracellular calcium homeostasis (purinergic receptors, in particular) and energy metabolism in muscle and non-muscle cells derived from mdx mice (animal model of Duchenne Muscular Dystrophy) in relation to cell functions (adhesion, motility proliferation etc.).
- Biochemical basis of muscle calcification in dystrophic mice; Role of mitochondria and the endoplasmic reticulum stress in muscle and non-muscle (e.g. macrophages) cells.
- Endothelial cells response to various stress-inducing stimuli such as: inflammation, insulin resistance, dislipideamia etc. with special emphasis on mitochondrial metabolism, calcium signalling and exocytosis.

METHODS

Cell culture, spectrofluorimetry, confocal microscopy, polarography, flow and laser scanning cytometry, molecular biology, and many standard biochemical techniques are in use. Also proteomics, transcriptomics and metabolomics are applied within the framework of collaborations with other groups.



Calcium signalling; the never-ending story

Diagrammatic summary of the main concept concerning aberrant calcium homeostasis in *mdx* myoblasts.
Red characters or red arrow mean an increased protein level or stimulated process, respectively.
Green – decreased protein level. Black – unchanged or not determined.

HEAD
Krzysztof Zabłocki

SELECTED EXPERIENCE

MSc in Biochemistry, 1979, Institute of Biochemistry, University of Warsaw; PhD in Biochemistry, 1988, Institute of Biochemistry, University of Warsaw; Postdoctoral fellowship in the Laboratory of Kidney and Electrolyte Metabolism, National Heart, Lung and Blood Institute, National Institutes of Health, Bethesda MD, USA (1989-91), Assistant professor, Institute of Biochemistry, Faculty of Biology, University of Warsaw (1991-1995). Habilitation in Biological Sciences, 2005, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2014, Nencki Institute of Experimental Biology, PAS;
Prof. Zabłocki is the author or co-author of 57 publications and 2 patents (H-index=18; WoS). Prof. Zabłocki is a Member of European Calcium Society.

SELECTED PUBLICATIONS

- Young NJ, Gosselin MRF, Rumney R, Oksiejuk A, Chira N, Matryba Ł, Łukasiewicz K, Kao A, Dunlop J, Robson SC, Zabłocki K, Górecki DC. (2020) Total Absence of dystrophin expression exacerbates ectopic myofiber calcification and fibrosis and alters macrophage infiltration pattern. Am. J. Pathol. 190(1):190-205.
- Woś M, Komiażyk M, Pikula S, Tylki-Szymanska A, Bandorowicz-Pikula J. (2019) Activation of mammalian target of rapamycin kinase and glycogen synthase kinase-3β accompanies abnormal accumulation of cholesterol in fibroblasts from Niemann-Pick type C patients. J. Cell. Biochem. 120(4):6580-6588.
- Al-Khalidi R, Chiara Panicucci C, Cox P, Chira N, Róg J, Young CNJ, McGeehan RE, Ambati K, Ambati J, Zabłocki K, Gazzerro E, Arkle S, Bruno C, Górecki DC. (2018) Zidovudine ameliorates pathology in the mouse model of Duchenne muscular dystrophy via P2RX7 purinoceptor antagonism. Acta Neuropathologica Communications (2018)6:27.
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- Róg J, Oksiejuk A, Gosselin MRF, Brutkowski W, Dymkowska D, Nowak N, Robson S, Górecki DC, Zabłocki K. (2019) Dystrophic mdx mouse myoblasts exhibit elevated ATP/UTP-evoked metabotropic purinergic responses and alterations in calcium signalling. Biochim. Biophys. Acta. Mol. Basis Dis. 1865(6):1138-1151.

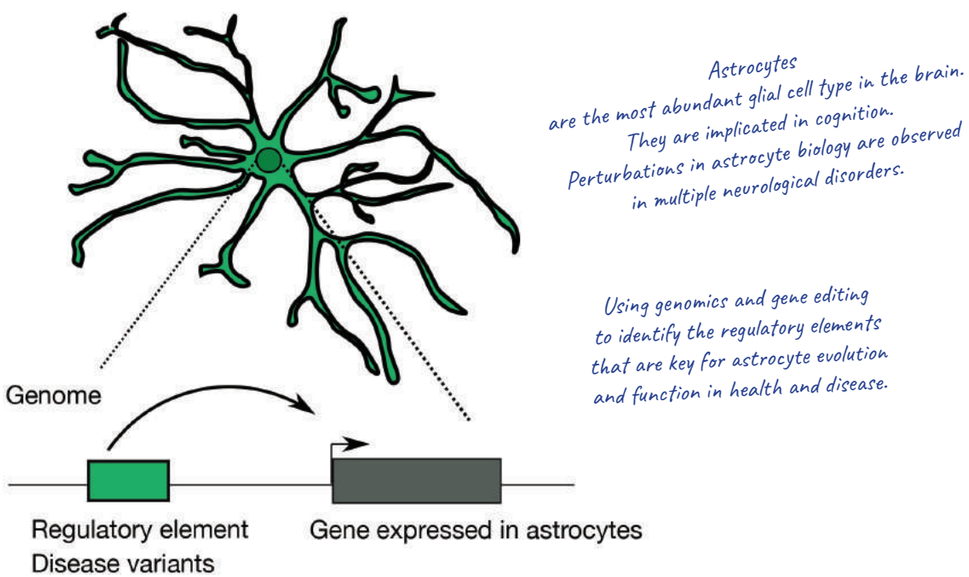
LABORATORY OF CHROMATIN BIOLOGY AND EPIGENOMICS
DIOSCURI CENTER

Astrocytes are the most abundant glial cell type in the central nervous system. They are critical for brain plasticity. Various neurological conditions, including Alzheimer's disease, feature aberrant activity of astrocytes. The understanding of the gene regulatory network underlying astrocyte biology will likely shed new light on mechanisms of a broad range of neuropathologies. We use induced pluripotent stem cell-based models, high throughput sequencing technologies (ChIP-seq, RNA-seq, Hi-C), CRISPR-Cas9 mediated genome editing, and computational tools, to define regulatory elements that underlie astrocyte biology.

Human astrocytes display marked morphological and functional differences in comparison to their rodent counterparts suggesting a marked evolutionary change in the biology of these cells. These differences arise in part, as a result of an altered pattern of gene expression in human astrocytes. Our goal is to identify the changes in the regulatory DNA sequences that underlie the evolution of astrocytes in mammals.

We are also taking advantage of the cellular and molecular models of astrocyte and neuronal development to provide new insights into the relationship between chromatin topology and transcriptional regulation.

We are a part of the NIH Regulome Project https://regulome.github.io/People/index.html



We study transcriptional regulation in human astrocytes. By identifying genes and the regulatory elements that orchestrate their expression, we hope to gain new insights into astrocyte biology, diseases of the central nervous system, and brain evolution.

SELECTED EXPERIENCE

MSc in Biology, 2006, University of Lodz; PhD, 2011, University of the Mediterranean Aix-Marseilles, France within a Marie Curie Research Training Network; she was an EMBL Interdisciplinary Postdoc (EIPOD EMBL / Marie Curie Actions, 2011-2014) and a postdoctoral fellow of the National Institute of Arthritis Musculoskeletal and Skin Diseases at the National Institutes of Health, Bethesda, USA (2016-2019).

Dr. Pękowska is the author or co-author of 16 research publications (H-index=11; WoS). For her work she received stipends by the Polish Ministry of Science and Higher Education (2002-2005), Socrates-Erasmus (2004), Fondation pour la Recherche Médicale and EIPOD (EMBL / Marie Curie Actions, 2011). She was awarded the Gold Medal for studies (2005) by the Dean of the University of Lodz.

HEAD
Aleksandra Pękowska

SELECTED PUBLICATIONS

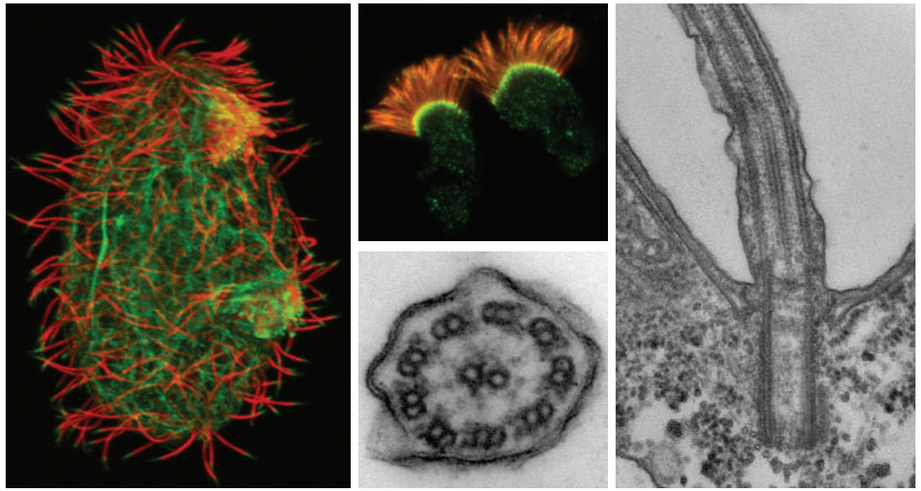
- Pękowska A, Klaus B, Xiang W, Severino J, Daigle N, Klein FA, Oleś M, Casellas R, Ellenberg J, Steinmetz LMS, Bertone P, Huber W. (2018) Gain of CTCF-anchored chromatin loops marks the exit from naive pluripotency. Cell Systems Nov. 28; 7(5):482-495.
- Vian L, Pękowska A, Rao SSR, Kieffer-Kwon KR, Jung S, Baranello L, Huang SC, El Khattabi L, Dose M, Pruett N, Sanborn AL, Canela A, Maman Y, Oksanen A, Resch W, Li X, Lee B, Kovalchuk AL, Tang Z, Nelson S, Di Pierro M, Cheng RR, Machol I, St Hilaire BG, Durand NC, Shamim MS, Stamenova EK, Onuchic JN, Ruan Y, Nussenzweig A, Levens D, Aidn EL, Casellas R. (2018) The energetics and physiological impact of cohesin extrusion. Cell 2018 May 17;173(5):1165-1178.e20.
- Schwarzer W, Abdennur N, Goloborodko A, Pękowska A, Fudenberg G, Loe-Mie Y, Fonseca NA, Huber W, Haering C, Mirny L, Spitz F. (2017) Two independent modes of chromosome organization are revealed by cohesin removal. Nature 2017 Nov 2;551(7678):51-56.
- Pękowska A, Benoukraf T, Zacarias-Cabeza J, Belhocine M, Koch F, Holota H, Imbert J, Andrau JC, Ferrier P, Spicuglia S. (2011) H3K4 tri-methylation provides an epigenetic signature of active enhancers. EMBO J. 2011;(July):1–13.
- Pękowska A, Benoukraf T, Ferrier P, Spicuglia S. (2010) A unique H3K4me2 profile marks tissue-specific gene regulation. Genome Research, 2010 Nov; 20(11):1493–502.

LABORATORY OF CYTOSKELETON AND CILIA BIOLOGY

Cilia, the microtubule-based highly evolutionarily conserved structures, are assembled by nearly all types of cells in the human body. Lack of cilia or their defects lead to disorders called ciliopathies. The primary ciliary dyskinesia, a disorder caused by improper function or loss of motile cilia, affects one in 15 000 individuals.

The genetic and biochemical studies have suggested that several hundred proteins could be involved in the assembly and function of motile cilia. Using free living ciliate Tetrahymena thermophila and mammalian cells as models we perform functional analyses of as-yet uncharacterized proteins that are involved in the assembly and functioning of motile cilia. One of our main goals is to decipher the molecular mechanism(s) that regulate(s) cilia beating. To do so we search for novel ciliary proteins (we call them “missing links”) that play roles in the transduction of the mechano-chemical signals from the central pair complex to the dynein arms.

We are also interested in the identification of proteins and minor complexes that regulate the activity of major ciliary structures. The above issues are addressed using a broad range of molecular, biochemical and cell biology techniques.



Tetrahymena thermophila cell co-labeled with an anti-tubulin (green) and anti-polyglycytated tubulin (red) antibodies (confocal microscopy).
Localization of Cfap61 in cilia of rat trachea epithelial cells (acetylated tubulin in red, confocal microscopy).
Transmission electron microscopy images showing cilia ultrastructure (cross and longitudinal sections).

HEAD
Dorota Włoga

SELECTED EXPERIENCE

MSc in Biology, University of Warsaw, 1993; PhD in Biology, University of Warsaw, 1999; DSc, Habilitation in Biological Sciences, Nencki Institute of Experimental Biology, PAS, 2013 PAS; Postdoctoral Research Associate, Cellular Biology Department, University of Georgia, Athens, USA (2002-2009). Assistant Professor, Nencki Institute of Exper-imental Biology, PAS (2010-2015); Associated professor, 2015.
Prof. Dorota Włoga is the author or co-author of 47 publications and 1 patent (H-index=21; WoS). She received Kościuszko Foundation Postdoctoral Fellowship (2000), Marie Curie International Reintegration Grant (2011) and EMBO Installation Grant (2012).

Don’t shake so hard!

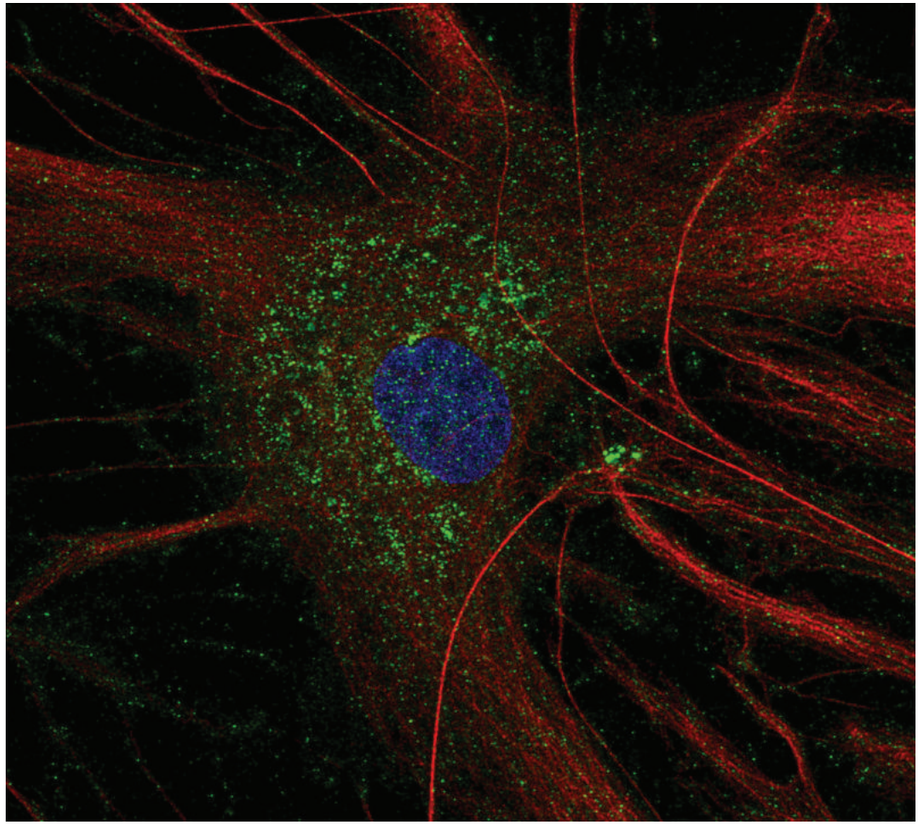
SELECTED PUBLICATIONS

Good job!

- Joachimiak E, Waclawek E, Osinka A, Niziolek M, Fabczak H, Gaertig J, Wloga D. (2020) LisH domain-containing N-terminal fragment is important for localization, dimerization and stability of Katnal2 in Tetrahymena. Cells. 9(2):292.
- Urbanska P, Joachimiak E, Bazan R, Fu G, Poprzeczko M, Fabczak H, Nicastro D, Wloga D. (2018) Ciliary proteins Fap43 and Fap44 interact with each other and are essential for proper cilia and flagella beating. Cell. Mol. Life Sci. 75(24):4479-4493.
- Joachimiak E, Jerka-Dziadosz M, Krzemień-Ojak Ł, Wacławek E, Jedynak K, Urbanska P, Brutkowski W, Sas-Nowosielska H, Fabczak H, Gaertig J, Wloga D. (2018) Multiple phosphorylation sites on g-tubulin are essential and contribute to the biogenesis of basal bodies in Tetrahymena. J. Cellular Physiology 233(11):8648-8665.
- Louka P, Vasudevan K, Guha M, Joachimiak E, Wloga D, Tomasi R, Baroud CN, Dupuis-Williams P, Galati DF, Pearson CG, Rice LM, Moresco J, Yates JR III, Jiang Y, Lechtreck K, Dentler W, Gaertig J. (2018) Proteins that control the geometry of ciliary ends. J. Cell Biol. 217(12):4298-4313.
- Wloga D, Joachimiak E, Louka P, Gaertig J. (2017) Post-translation Modifications of Tubulin and Cilia. Cold Spring Harbor Perspectives in Biology. 1,9(6).
- Jiang YY, Maier W, Chukka UN, Choromanski M, Lee C, Joachimiak E, Wloga D, Yeung W, Kannan N, Frankel J, Gaertig J. (2020) Mutual antagonism between Hippo signaling and cyclin E drives intracellular pattern formation. J Cell Biol. 219(9):e202002077.

LABORATORY OF EPILEPTOGENESIS

Our research interests concentrate on molecular events resulting from brain damage and molecular basis of epileptogenesis. Our research projects aim at the description of transcriptome changes in experimental models of epileptogenesis and epilepsy *in vivo,* deciphering the role of selected proteins potentially involved in epileptogenesis and epilepsy genes, for example TTYH1 or MBD3. We are also interested in epigenetic mechanisms of gene regulation, including the role of microRNA. Another field of research conducted in our lab is the search for noninvasive biomarkers of epileptogenesis and epilepsy: circulating microRNA and behavior. Finally, we work on the creation of new models, as well as the improvement of existing models, of epilepsy. We also study the role of extracellular matrix and perineuronal nets in animal models of stroke.



Hyaluronan synthase 2 (Has2) localization on the surface of a neuron in the mouse neuronal cortical culture in vitro.
Has2 - green, NeuN - red, nucleus- blue.

SELECTED EXPERIENCE

MSc in Biology, 1989, Department of Embryology, University of Warsaw; PhD in Neurophysiology, 1996, Nencki Institute of Experimental Biology, PAS, Habilitation in Biological Sciences, 2005, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2018, Nencki Institute of Experimental Biology; Researcher, Epilepsy Research Group, A. I. Virtanen Institute for Molecular Sciences, Kuopio, Finland (1996-2002). Prof. Katarzyna Łukasiuk is the author or co-author of 63 publications (H-index=28; WoS), was a member of the editorial board of Epilepsy Research (2011-2019) and is an editor-in-chief of Acta Neurobiologiae Experimentalis. She was a secretary of the committee of Neurobiology PAS (two terms) and vice president (one term) and secretary (two terms) of the Polish Neuroscience Society.

HEAD
Katarzyna Łukasiuk

SELECTED PUBLICATIONS

- Vuokila N, Lukasiuk K, Bot AM, van Vliet EA, Aronica E, Pitkänen A, Puhakka N. (2018) miR-124-3p is a chronic regulator of gene expression after brain injury. Cell Mol Life Sci. 75(24):4557-4581.
- Bednarczyk J, Dębski KJ, Bot AM, Lukasiuk K. (2016) MBD3 expression and DNA binding patterns are altered in a rat model of temporal lobe epilepsy. Sci Rep. 6:33736.
- Pitkänen A, Löscher W, Vezzani A, Becker AJ, Simonato M, Lukasiuk K, Gröhn O, Bankstahl JP, Friedman A, Aronica E, Gorter JA, Ravizza T, Sisodiya SM, Kokaia M, Beck H. (2016) Advances in the development of biomarkers for epilepsy. Lancet Neurol. 15(8):843-856.
- Dębski KJ, Pitkanen A, Puhakka N, Bot AM, Khurana I, Harikrishnan KN, Ziemann M, Kaspi A, El-Osta A, Lukasiuk K, Kobow K. (2016) Etiology matters – Genomic DNA Methylation Patterns in Three Rat Models of Acquired Epilepsy. Sci Rep. 6:25668.
- Miszczuk D, Dębski KJ, Tanila H, Lukasiuk K, Pitkänen A. (2016) Traumatic Brain Injury Increases the Expression of Nos1, Aβ Clearance, and Epileptogenesis in APP/PS1 Mouse Model of Alzheimer's Disease. Mol Neurobiol. 53(10):7010-7027.

LABORATORY OF ETHOLOGY

We work in the field of ant ethology, sociobiology and social neuroscience. We lay stress on comparative research which allows us to broaden our knowledge about proximate causal factors underlying the behaviour of social insects, and to gain better understanding of biological roots of social phenomena encountered in humans. We are particularly interested in the analysis of the multidirectional information flow between various levels of organization present in ant societies, and in the ontogeny and neurochemical correlates of ant aggressive and friendly social behaviour. Our current research is focused on the analysis of the impact of neurochemical, endocrine and social causal factors on ant aggressive behaviour (both ritualized and overt aggression), friendly social behaviour (in particular rescue behaviour, i.e., providing help to endangered individuals, and various forms of brood care), and social withdrawal of ant workers. We are also interested in the role of social context in the control of expression/suppression of ant behaviour. We try to unravel the effects of worker behavioural status (nurse versus forager) on ant behaviour and physiology, and to identify behavioural, morphological, physiological and neurochemical correlates of ant behavioural maturation (transition nurse – forager) and behavioural reversion (return of a forager to inside-nest activities). We are also testing new, less invasive methods of administration of neuroactive compounds to ant workers.

A worker of the amazon ant (*Polyergus rufescens*) during a trophallactic exchange with its slave, a worker of *Formica cinerea*.
Photo by Maciej Nielubowicz.

SELECTED EXPERIENCE

MSc in General Biology, 1978, University of Warsaw; PhD in Natural Sciences, 1984, Nencki Institute of Experimental Biology, PAS; Habilitation in Biology, 1995, Nencki Institute of Experimental Biology, PAS; Professor of Biological Sciences, 2005, Nencki Institute of Experimental Biology, PAS; Fellow, European Training Programme in Brain and Behaviour Research, 1985, Department of Zoology, University of Oxford, Great Britain; Associate Lecturer, 1988-1989, Laboratory of Ethology and Sociobiology, University Paris Nord, Villetaneuse, France.
Prof. Ewa J. Godzińska is the author of 65 publications (H-index = 9; WoS), the President of the Polish Ethological Society (2002-present), and a Member of the Committee of European Societies of Behavioural Biology (CESBB) (2005-present). She was awarded the title “Media-Friendly Scientist 2010” by the Polish Science Journalists’ Association (2010).

HEAD
Ewa Joanna Godzińska

SELECTED PUBLICATIONS

- Symonowicz B, Kieruzel M, Szczuka A, Korczyńska J, Wnuk A, Mazurkiewicz PJ, Chiliński M, Godzińska EJ. (2015) Behavioral reversion and dark-light choice behavior in workers of the red wood ant *Formica polyctena*. J. Insect Behav. 28(3): 245-256.
- Godzińska EJ. (2016) Human and ant social behavior should be compared in a very careful way to draw valid parallels. Behav. Brain Sci. 39: e98.
- Mazurkiewicz PJ, Wagner-Ziemka A, Mirecka A, Godzińska EJ. (2016) Behaviour of intranidal and extranidal major workers of the African carpenter ant *Camponotus maculatus* Fabricius (Hymenoptera: Formicidae) during dyadic nestmate reunion tests. Afr. Entomol. 24(2): 307-320.
- Miler K, Symonowicz B, Godzińska EJ. (2017) Increased risk proneness or social withdrawal? The effects of shortened life expectancy on the expression of rescue behavior in workers of the ant *Formica cinerea* (Hymenoptera: Formicidae). J. Insect Behav. 30(6):632-644.
- Szczuka A, Godzińska EJ, Korczyńska J. (2019) Factors mediating ant social behavior: interplay of neuromodulation and social context. Kosmos 68(4): 575-589.

Go to the ant to study biological roots of social behaviour

LABORATORY OF INTRACELLULAR ION CHANNELS

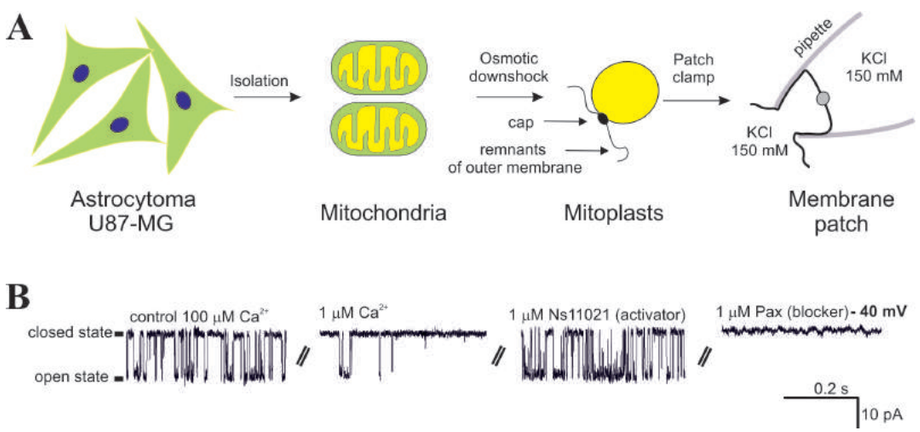
Intracellular ion channels regulate many key cellular functions by controlling the ion fluxes across intracellular compartments. Laboratory is particularly interested in potassium channels found in the inner mitochondrial membrane. We focus on the pharmacology of intracellular potassium channels, the interaction of potassium channels openers with mitochondria, and the role of mitochondria in cytoprotection. Our overall objective is to study the role of intracellular potassium channels in cellular function during health and disease. The laboratory was established in June 1999, and is focused on mitochondrial potassium channels.

Mitochondria: masters of life and death!

WE STUDY THE FOLLOWING TOPICS

- interactions of mitochondrial potassium channels with regulatory proteins,
- mechanism of cytoprotective action of potassium channels openers,
- the functional role of mitochondrial ATP-regulated and BK-types potassium channels,
- regulation of mitochondrial potassium channels by plant-derived substances such as flavonoids, and gaseous signaling molecules,
- role of mitochondrial potassium channels in skin physiology.

Within our group, we use the following main techniques: patch-clamp and planar lipid bilayers for recording activity of single mitochondrial channels; high resolution respirometry; proximity biotinylation, co-immunoprecipitation, and Blue-Native PAGE for analysis of mitochondrial potassium channels interactomes; high resolution microscopy; CRISPR-Cas9 for construction of functional knock-outs of ion channel subunits.

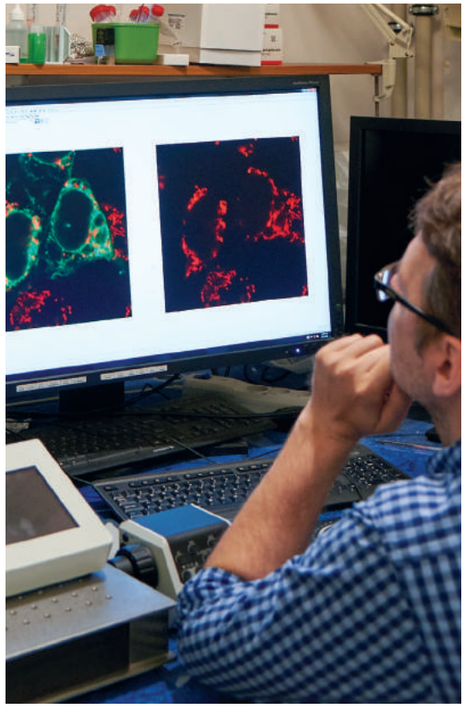


Ion channels reside in the inner mitochondrial membrane. A, Scheme of procedure leading to the recording of the activity of mitochondrial ion channels. B, Example of the recording activity of a mitochondrial calcium-activated large conductance potassium channel (mitoBKCa) in the presence of high and low calcium ions concentration, and after activation with channel opener (NS11021). Paxlilline (Pax), the channel blocker reversed the effect of NS11021.

HEAD
Adam Szewczyk

SELECTED EXPERIENCE

MSc in Chemistry, 1984, Chemical Faculty, University of Warsaw; PhD in Biology, 1989, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, 1998, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2004, Nencki Institute of Experimental Biology PAS; Postdoctoral Fellow, Angelo Azzi Lab, Bern University, Switzerland (1989-90) and Michel Lazdunski Lab, University of Nice, Sophia Antipolis, France (1990-91); Visiting Scientist, Eduardo Marban Lab, Johns Hopkins University, MD. Director of the Nencki Institute of Experimental Biology, PAS (2008-2018); FEBS Congress Counselor (2006-2014); Deputy President of Biochemical Society (2008-present).
Prof. Adam Szewczyk is the author or co-author of 125 publications and 1 patent (H-index=36; WoS).



SELECTED PUBLICATIONS

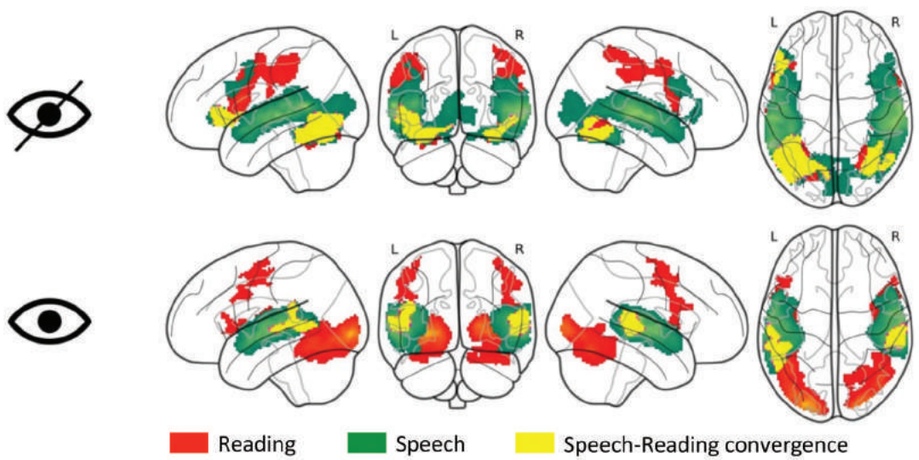
- Rotko, D, Bednarczyk, P, Koprowski, P, Kunz WS, Szewczyk, A, Kulawiak B. (2020) Heme is required for carbon monoxide activation of mitochondrial BKCa channel. Eur. J. Pharmacol., 881, 173191.
- Laskowski M, Augustynek B, Bednarczyk P, Żochowska M, Kalisz J, O'Rourke B, Szewczyk A, Kulawiak B. (2019) Single-Channel Properties of the ROMK-Pore-Forming Subunit of the Mitochondrial ATP-Sensitive Potassium Channel. Int J Mol Sci. 20, pii: E5323.
- Kampa RP, Kicinska A, Jarmuszkiewicz W, Pasikowska-Piwko M, Dolegowska B, Debowska R, Szewczyk A, Bednarczyk P. (2019) Naringenin as an opener of mitochondrial potassium channels in dermal fibroblasts. Exp Dermatol. 28, 543-550.
- Walewska A, Szewczyk A, Koprowski P. (2018) Gas Signaling Molecules and Mitochondrial Potassium Channels. Int J Mol Sci. 19, pii: E3227.
- Frankenreiter S, Bednarczyk P, Kniess A, Bork NI, Straubinger J, Koprowski P, Wrzosek A, Mohr E, Logan A, Murphy MP, Gawaz M, Krieg T, Szewczyk A, Nikolaev VO, Ruth P, Lukowski R. (2017) cGMP-Elevating Compounds and Ischemic Conditioning Provide Cardioprotection Against Ischemia and Reperfusion Injury via Cardiomyocyte-Specific BK Channels. Circulation. 136, 2337-2355.

LABORATORY OF LANGUAGE NEUROBIOLOGY

Research activities of our laboratory are focused on the neurobiological basis of language skills in typical and atypical development. We are particularly interested in the mechanisms of typical and atypical literacy acquisition in children. Our investigations involve characterizing the predictors of developmental disorders, particularly language-based learning disabilities as well as testing different evidence-based interventions. Additionally we aim to uncover a universal brain organization for spoken and written language independent of orthography (contrasting orthographies differing in phoneme-grapheme transparency) or sensory modality (contrasting visual reading in sighted and tactile reading in blind). We also strive to understand the long-term consequences of late language emergence in children at both behavioral and neural levels.

Another line of research refers to the issue of the relationship between consciousness / self-consciousness and language. We aim at investigating whether conscious and unconscious processing of verbal information (in comparison to non-verbal information) is prioritized if such information is self-relevant.

Our research is performed with the use of non-invasive neuroimaging methods – functional (fMRI) and structural (sMRI) magnetic resonance imaging as well as electroencephalography (EEG). To study the concentration of neurotransmitters non-invasively we employ magnetic resonance MEGA-PRESS spectroscopy.



Neural language network in blind and sighted adults. Brain regions active for Reading only (red), Speech only (green), or both Reading and Speech (yellow) in early blind (top row) and sighted (bottom row) adults.

SELECTED EXPERIENCE

MSc in Psychology, 2005, Jagiellonian University; PhD in Biology, 2010, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, 2017, Nencki Institute of Experimental Biology, PAS; Mentoring program (Foundation for Polish Science) with Prof. Kenneth Pugh, Haskins Laboratories, Yale University, New Haven, USA (2013-15); Postdoctoral training, Laboratoire de Sciences Cognitives et Psycholinguistiques, École Normale Supérieure, Paris, France (2010-11). Scholarship for outstanding young scientists, Minister of Science and Higher Education (2012-2014), START scholarship, Foundation for Polish Science (2009, 2010).
Prof. Katarzyna Jednoróg is the author or co-author of 55 publications (H-index=18; WoS).

Mock scanner training guarantees successful completion of MRI for children.

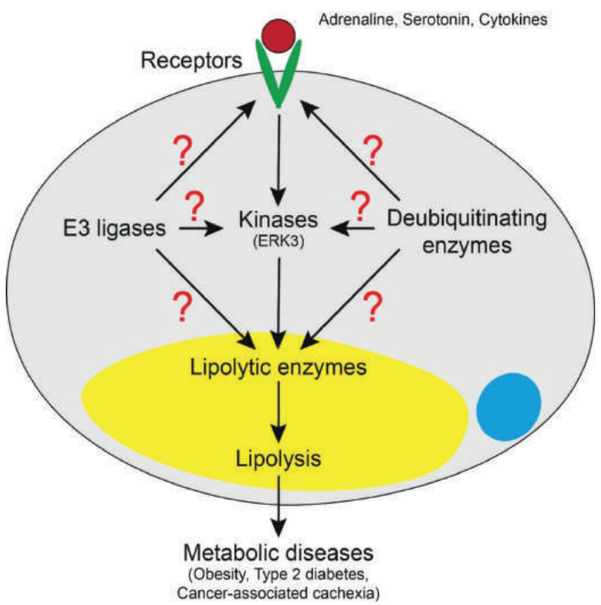
HEAD
Katarzyna Jednoróg

SELECTED PUBLICATIONS

- Chyl K, Kossowski B, Dębska A, Łuniewska M, Banaszkiewicz A, Żelechowska A, Frost SJ, Mencl WE, Wypych M, Marchewka A, Pugh KR, Jednoróg K. (2018) Prereader to beginning reader: changes induced by reading acquisition in print and speech brain networks. J. Child Psychol. Psychiatry. 59(1): 76-87.
- Ramus F, Altarelli I, Jednoróg K, Zhao J, Scotto di Covella L. (2018) Neuroanatomy of developmental dyslexia: Pitfalls and promise. Neurosci. Biobehav. Rev. 84: 434-452.
- Dębska A, Chyl K, Dzięgiel G, Kacprzak A, Łuniewska M, Plewko J, Marchewka A, Grabowska A, Jednoróg K. (2019) Reading and Spelling Skills Are Differentially Related to Phonological Processing: Behavioral and fMRI Study. Dev. Cogn. Neurosci. 39: 100683.
- Kossowski B, Chyl K, Kacprzak A, Bogorodzki P, Jednoróg K. (2019) Dyslexia and Age Related Effects in the Neurometabolites Concentration in the Visual and Temporo-Parietal Cortex. Sci. Rep. 9(1): 5096.
- Chyl K, Kossowski B, Wang S, Dębska A, Łuniewska M, Marchewka A, Wypych M, Bunt MVD, Mencl W, Pugh K, Jednoróg K. (2021) The brain signature of emerging reading in two contrasting languages. Neuroimage. 225:117503.
- Wójcik MJ, Nowicka MM, Bola M, Nowicka A. (2019) Unconscious detection of one's own image. Psychol. Sci. 30(4): 471-480.

LABORATORY OF METABOLIC DISEASES
DIOSCURI CENTER

Perturbations in signaling cascades regulating basic metabolic processes of adipose tissue, intestine and liver often result in metabolic diseases. Excessive absorption of lipids in intestines promotes adiposity. Elevated lipogenesis and lipolysis in combination with reduced energy dissipation are the hallmarks of obesity and type 2 diabetes (T2D). Increased lipogenesis also contributes to the development of liver steatosis. Conversely, induction of negative energy balance during cancer-associated cachexia (CAC) is partially caused by increased metabolic activity of adipocytes. In my research group we aim at the understanding of the complex signaling networks regulating the above-mentioned basic metabolic processes. For this purpose we combine cell biology, biochemical and omics approaches with mouse genetics. Using high throughput siRNA-based screening we identified a number of novel kinases regulating lipolysis, including ERK3. Targeted mouse genetics approach led us to establish members of the Protein kinase D family as central regulators of adipocytes, enterocytes and hepatocytes metabolism. We plan to further investigate the identified pathways and, in parallel, to utilize screening approaches to find other, noncanonical signaling modules (components of the ubiquitin system) regulating metabolism. By determining essential signaling networks this project will contribute to more targeted pharmacological strategies for treatment of metabolic diseases such as obesity, T2D and CAC.



Misregulation of signaling cascades promotes metabolic diseases.

We hypothesize that the cross-talk between different classes of signaling molecules determines the precise regulation of metabolism. Thus, we aim to identify novel non-canonical modules (E3 ligases and deubiquitinating enzymes) in the regulation of ERK3-dependent and independent lipolysis.

SELECTED EXPERIENCE

MSc in Biology, 2004, Research Institute of Biology and Earth Sciences, Jagiellonian University; PhD, 2009, Institute of Physiology, University of Zürich and the Institute of Cell Biology, ETH Hoenggerberg, Zürich, Switzerland; Postdoc (2009-12), Department of Genetics and Development, Columbia University, New York, USA, and (2013), Institut de Génétique et Biologie Moléculaire et Cellulaire (IGBMC), Strasbourg, France; Group Leader at the Rudolf Virchow Center (RVC) for Experimental Biomedicine, University of Würzburg, Germany (2013-2020).
Dr. Sumara is the author or co-author of 21 research publications (H-index=15; WoS). He was a long-term postdoctoral fellow of the Human Frontier Science Program Organization (2009); a Rising Star Fellow of the European Foundation for the Study of Diabetes (2013). In 2014 Dr. Sumara received an Emmy Noether grant for young group leaders from the German Research Foundation (DFG), and in 2016 a European Research Council (ERC) Starting Grant.

HEAD
Grzegorz Sumara

SELECTED PUBLICATIONS

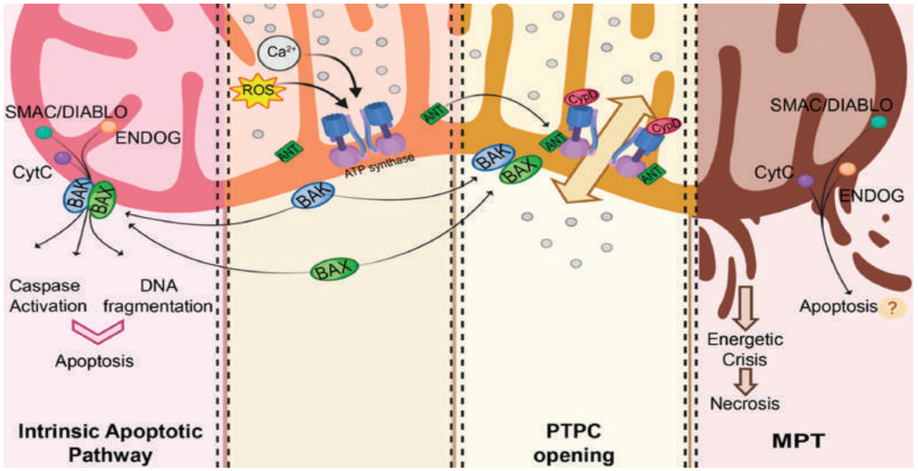
- El-Merahbi R, Viera JT, Valdes AL, Kolczynska K, Reuter S, Löffler MC, Erk M, Ade CP, Karwen T, Mayer AE, Eilers M, Sumara G. (2020) The adrenergic-induced ERK3 pathway drives lipolysis and suppresses energy dissipation. Genes Dev. 34(7-8):495-510.
- Mayer AE, Löffler MC, Loza Valdés AE, Schmitz W, El-Merahbi R, Viera JT, Erk M, Zhang T, Braun U, Heikenwalder M, Leitges M, Schulze A, Sumara G. (2019) The kinase PKD3 provides negative feedback on cholesterol and triglyceride synthesis by suppressing insulin signaling. Sci Signal. 12(593):eaav9150.
- Löffler MC, Mayer AE, Trujillo Viera J, Loza Valdes A, El-Merahbi R, Ade CP, Karwen T, Schmitz W, Slotta A, Erk M, Janaki-Raman S, Matesanz N, Torres J, Marcos M, Sabio G, Eilers M, Schulze A and Sumara G. (2018) Protein kinase D1 deletion in adipocytes enhances energy dissipation and protects against adiposity. EMBO J. 37(22):e99182.
- Sumara G, Sumara O, Kim J, Karsenty G. (2012) Gut-derived serotonin is a multifunctional determinant to fasting adaptation. Cell Metab. 16(5):588-600.
- Sumara G, Formentini I, Collins S, Sumara I, Windak R, Bodenmiller B, Ramracheya R, Caille D, Jiang H, Platt KA, Meda P, Aebersold R, Rorsman P, Ricci R. (2009) Regulation of PKD by the MAPK p38delta in insulin secretion and glucose homeostasis. Cell. 136(2):235-48.

LABORATORY OF MITOCHONDRIAL BIOLOGY AND METABOLISM

The research profile of our laboratory is focused on mitochondrial physiology. We are investigating the relations between mitochondrial bioenergetics and oxidative stress in several pathological situations.

ESPECIALLY

- we intend to disclose the hepatic redox alterations and the specific end-points for mitochondrial dysfunction which drive the progression of Non-Alcoholic Fatty Liver Disease (NAFLD). We address many conceptually exciting and fundamental questions, such as:
a) what are the molecular mechanisms underlying NAFLD progression?
b) is there a possibility by modulating oxidative stress to protect against or slow down development or the progression of NAFLD?
- we are investigating the molecular composition and role in cellular physiology and pathology of the mitochondria-associated membranes (MAMs), that are physical platforms enabling communication between mitochondria and endoplasmic reticulum (ER). The proteins and enzymes localized in MAM are involved in several crucial processes and can impact cell metabolism and the cell fate.
- we are investigating the precise molecular composition of the mitochondrial Permeability Transition Pore Complex (PTPC), which despite the intense experimental interest throughout the last two decades still remains elusive. The precise knowledge of the structure, mode of action and regulators of PTPC is lacking and this constitutes a substantial obstacle in the development of MPT-targeting agents with clinical applications.



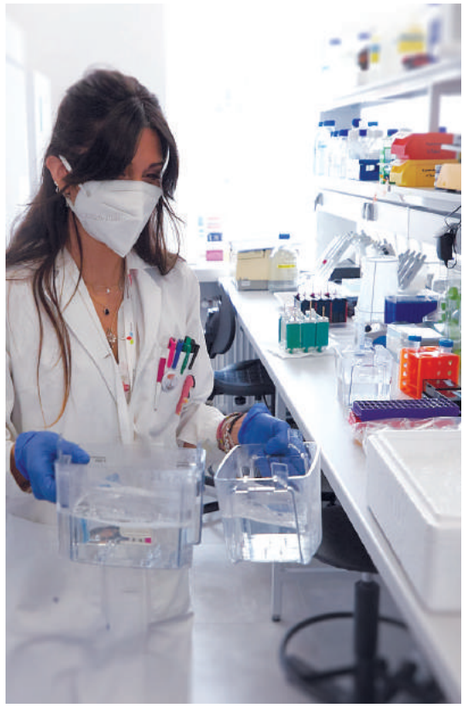
Major molecular paths in mitochondria-related regulated cell death (RCD). Mitochondrial calcium overload and ROS levels can trigger either the activation of intrinsic apoptotic pathway (left side) through the recruitment of Bcl-2 family proteins at the mitochondria, or permeability transition pore complex (PTPC) formation which could lead to mitochondrial outer membrane permeabilization (MOMP), energetic imbalance, and subsequent release of proapoptotic cofactors from the inter membrane space, such as SMAC/DIABLO, CytC, and ENDOG (right side).

HEAD
Mariusz R. Więckowski

SELECTED EXPERIENCE

MSc in Biology, 1997, Warsaw University; PhD in Biochemistry, 1999, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, 2008, Nencki Institute of Experimental Biology PAS; Full Professor, 2015, Nencki Institute of Experimental Biology PAS; Technician, Warsaw University, Institute of Biochemistry, Department of Metabolic Regulation (1991-95), Postdoc, Department of Experimental and Diagnostic Medicine, University of Ferrara, Ferrara, Italy (2002-04).
Prof. Mariusz Więckowski is the author or co-author of 160 research publications and 1 patent (H-index=46; WoS) Prof. Mariusz Więckowski is a Member of Mitochondrial Physiology Society.

We should prioritize mitochondrial health to keep our mito in a good condition.



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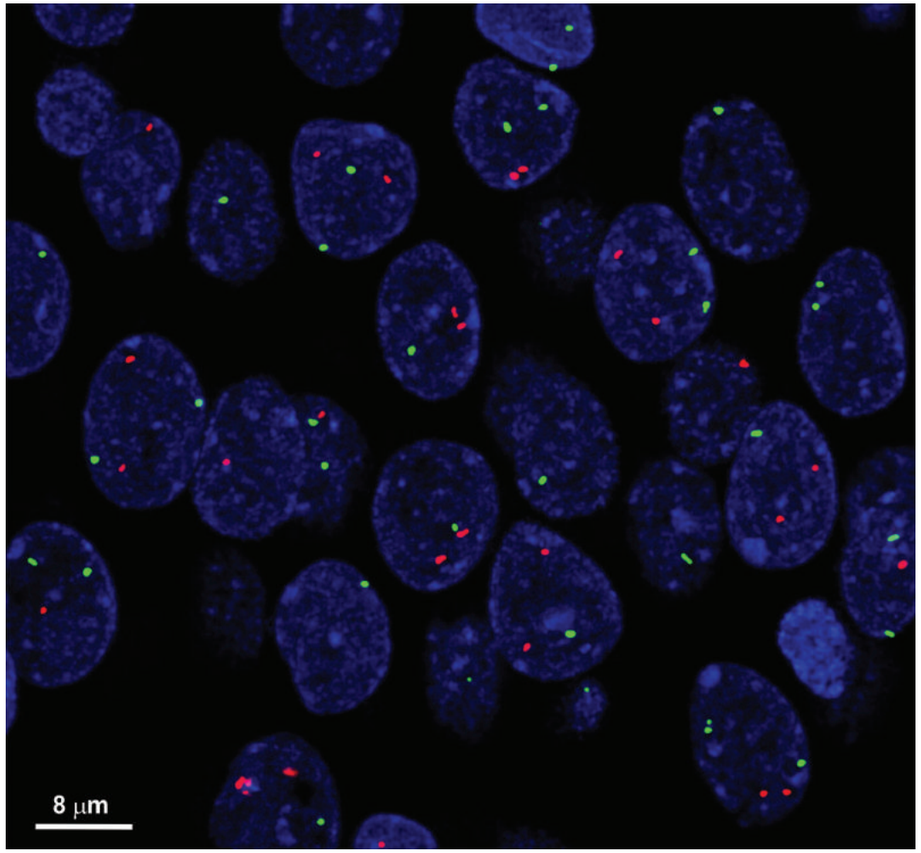
- Bonora M, Wieckowski MR, Sinclair DA, Kroemer G, Pinton P, Galluzzi L. (2019) Targeting mitochondria for cardiovascular disorders: therapeutic potential and obstacles. Nat. Rev. Cardiol. 16(1): 33-55.
- Malik AN, Simões ICM, Rosa HS, Khan S, Karkucinska-Wieckowska A, Wieckowski MR. (2019) A Diet Induced Maladaptive Increase in Hepatic Mitochondrial DNA Precedes OXPHOS Defects and May Contribute to Non-Alcoholic Fatty Liver Disease. Cells. 8(10):1222.
- Bonora M, Morganti C, Morciano G, Pedriali G, Lebiedzinska-Arciszewska M, Aquila G, Giorgi C, Rizzo P, Campo G, Ferrari R, Kroemer G, Wieckowski MR, Galluzzi L, Pinton P. (2017) Mitochondrial permeability transition involves dissociation of F1FO ATP synthase dimers and C-ring conformation. EMBO Rep. 18(7): 1077-1089.

LABORATORY OF MOLECULAR AND SYSTEMIC NEUROMORPHOLOGY

Our research interest focuses on the structural and functional plasticity of the nervous system, in both health and disease. We study phenomena occurring at various levels of organization, including anatomical sub-structures of the brain, the nervous tissue with all its cellular constituents, subcellular-, and macromolecular levels. One major issue that we investigate is the role of neuronal nuclear structure in epileptogenesis and depression. Another major project focuses on the role of the extracellular matrix receptors in synaptic plasticity in the brain, this also involves studies of pathological plasticity occurring in various forms of epilepsy. We are also interested in advances of microscopy and tissue-visualization techniques. Using an innovative high-resolution Optical Coherence Microscopy (OCM), we examine the vascular network after a stroke in the cortex of mice.



Spatial distribution of Bdnf and Trkb in the nuclei of rat hippocampal dentate gyrus neurons.
FISH labeling of the rat dentate gyrus for Bdnf (green) and Trkb (red); DNA was counterstained using TOPRO3 (blue).

Structural and functional plasticity of the brain:
from the nucleus to the extracellular matrix

HEAD IN ACTING
Joanna Dzwonek

SELECTED EXPERIENCE

MSc in Biology, 1998, University of Warsaw; Msc in Mathematics, 2002, University of Warsaw, PhD in Biology, 2004, Nencki Institute of Experimental Biology; Postdoctoral Fellow 2005-2008, Laboratory of Molecular Biology, K.U.Leuven, Belgium, Habilitation in Biological Sciences, 2017, Nencki Institute of Experimental Biology, PAS.
Prof. Joanna Dzwonek is the author or co-author of 19 research publications (H-index=16; WoS) and was honored with the Team Award from Biological Sciences Division of Polish Academy of Sciences for research in neurobiology in 2009, Long-term FEBS fellowship for the postdoctoral research, and Polish Science Foundation (FNP) fellowship for young investigators in 2003.

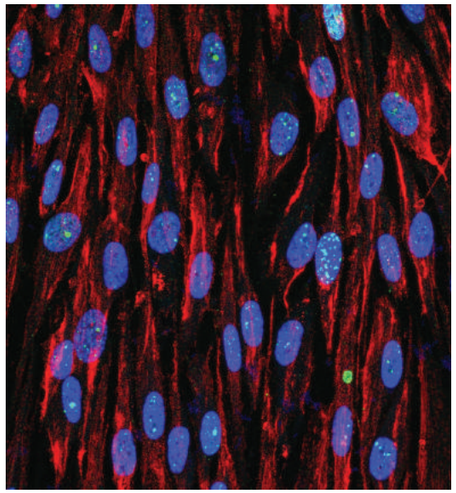
SELECTED PUBLICATIONS

- Trzaskoma P, Ruszczycki B, Lee B, Pels KK, Krawczyk K, Bokota G, Szczepankiewicz AA, Aaron J, Walczak A, Sliwinska MA, Magalska A, Kadlof M, Wolny A, Parteka Z, Arabasz S, Kiss-Arabasz M, Plewczynski D, Ruan Y and Wilczynski GM. (2020) Ultrastructural visualization of 3D chromatin folding using volume electron microscopy and DNA in situ hybridization. Nat Commun 11(1): 2120.
- Dolezyczek H, Tamborski S, Majka P, Sampson D, Wojtkowski M, Wilczynski G, Szkulmowski M and Malinowska M. (2020) *In vivo* brain imaging with multimodal optical coherence microscopy in a mouse model of thromboembolic photochemical stroke. Neurophotonics 7(1): 015002.
- Roszkowska M, Skupien A, Wojtowicz T, Konopka A, Gorlewicz A, Kisiel M, Bekisz M, Ruszczycki B, Dolezyczek H, Rejmak E, Knapska E, Mozrzymas J W, Wlodarczyk J, Wilczynski GM and Dzwonek J. (2016) CD44: a novel synaptic cell adhesion molecule regulating structural and functional plasticity of dendritic spines. Mol Biol Cell 27(25): 4055-4066.
- Tang Z, Luo OJ, Li X, Zheng M, Zhu JJ, Szalaj P, Trzaskoma P, Magalska A, Wlodarczyk J, Ruszczycki B, Michalski P, Piecuch E, Wang P, Wang D, Tian SZ, Penrad-Mobayed M, Sachs LM, Ruan X, Wei CL, Liu ET, Wilczynski GM, Plewczynski D, Li G and Ruan Y. (2015) CTCF-Mediated Human 3D Genome Architecture Reveals Chromatin Topology for Transcription. Cell 163(7): 1611-1627.
- Dzwonek J and Wilczynski GM. (2015) CD44: molecular interactions, signaling and functions in the nervous system. Front Cell Neurosci 9: 175.

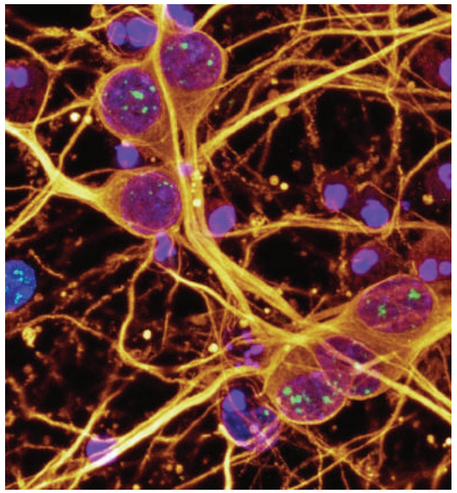
LABORATORY OF MOLECULAR BASES OF AGING

Aging is a complex process that imposes enormous emotional and economic burdens on societies. Many age-related pathologies are caused by accumulating with age senescent cells, which are characterized by growth arrest, changes in morphology, nuclear structure and function, gene expression, changed autophagy regulation, the secretion of inflammatory cytokines and other molecules, which is termed the senescence-associated secretory phenotype (SASP). Elimination of senescent cells by so termed senolytics, can prevent the development of certain age-related disorders in mouse models, strongly supporting the idea of their harmfulness. Cellular senescence provides also a determinant of the outcome of cancer treatment. Senescence of cancer cells has been recently linked to their polyploidization. Giant senescent cancer cells are characterized by reversible growth arrest, thus participating in cancer relapse. Understanding cell senescence is essential to developing safe interventions that can extend the years of healthy life in human populations. Accordingly, our laboratory is involved in studies concentrated on understanding cellular and molecular mechanisms of normal and cancer cell senescence, such as division, autophagy and cell death, chromatin structure and function, SASP and exosomes. Using in vitro and animal models we aim to reveal way to eliminate senescent cells and improve health status.

We can really see aging under the microscope.
And reverse it!



Hydrogen peroxide-induced senescence in vascular smooth muscle cells. DNA damage foci visible in nuclei (γ H2AX, green), caveolin in cell membranes (red).



Rat cortical neurons in primary culture. Doxorubicin-induced DNA damage foci have been stained in green (γH2AX), neuronal marker (MAP2) in yellow.

SELECTED EXPERIENCE

MSc in Biology, 1977, University of Warsaw; PhD in Biology, 1983, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, 1998, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2002, Nencki Institute of Experimental Biology PAS; Postdoctoral fellowship, Institute of Cancer Research, Sutton, Surrey, England (1986-87); Contract Professor of University of Modena, Italy, 1995.
Prof. Ewa Sikora is the author or co-author of 143 publications and 1 patent (H-index=33; WoS); a Member of the International Cell Senescence Association, Full member of Societas Scientarum Varsoviensis and a member of the Associate Editor of Ageing Research Reviews.

HEAD
Ewa Sikora

SELECTED PUBLICATIONS

- Sunderland P, Augustyniak J, Lenart J, Bużańska L, Carlessi L, Delia D, Sikora E. (2020) ATM-deficient neural precursors develop senescence phenotype with disturbances in autophagy. Mech Ageing Dev. 190:111296.
- Bojko A, Czarnecka-Herok J, Charzynska A, Dabrowski M, Sikora E. (2019) Diversity of the Senescence Phenotype of Cancer Cells Treated with Chemotherapeutic Agents. Cells. 8(12)1501.
- Sikora E, Bielak-Zmijewska A, Mosieniak G. (2019) Targeting normal and cancer senescent cells as a strategy of senotherapy. Ageing Res Rev. 55100941.
- Kucharewicz K, Dudkowska M, Zawadzka A, Ogrodnik M, Szczepankiewicz AA, Czarnocki Z, Sikora E. (2018) Simultaneous induction and blockade of autophagy by asingle agent. Cell Death Dis. 9(3)353.
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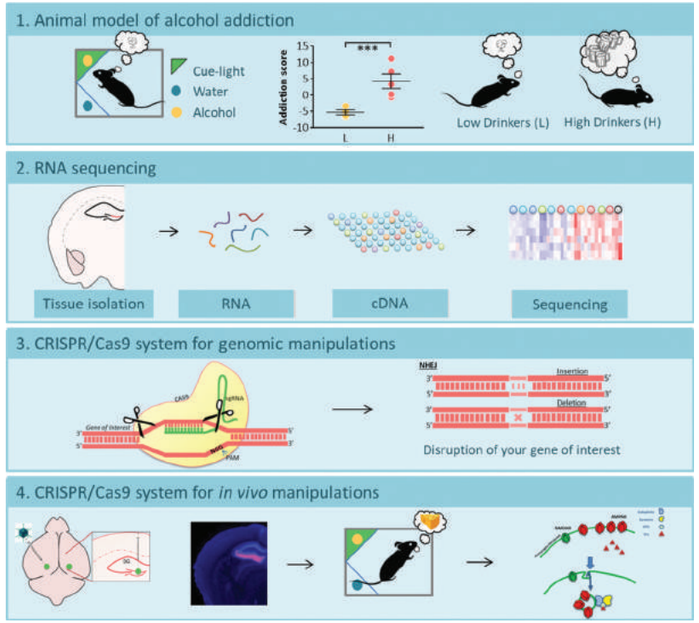
- Bielak-Zmijewska A, Wnuk M, Przybylska D, Grabowska W, Lewinska A, Alster O, Korwek Z, Cmoch A, Myszka A, Pikula S, Mosieniak G, Sikora E. (2014) A comparison of replicative senescence and doxorubicin-induced premature senescence of vascular smooth muscle cells isolated from human aorta. Biogerontology. 15(1) 47-64.

LABORATORY OF MOLECULAR BASIS OF BEHAVIOR

Memory processes, such as memory formation, long-term storage or forgetting, are fundamental brain functions. The importance of these processes can be understood not only in daily life, when our car keys are not where we left them, but most importantly in various psychiatric and neurologic disorders. For example, patients diagnosed with post-traumatic stress disorder, addiction or Alzheimer's disease suffer memory impairments. Currently, the molecular basis of physiological and pathologic memories are not sufficiently understood to develop successful treatments for memory dysfunctions. Therefore, our team is highly motivated to understand how the memory is formed and affected by our experiences. To this end we combine behavioral analysis of laboratory animals with molecular and morphological analyses of neurons. We use genetic (CRISPR system, AAVs) and chemogenetic (DREADDs) modifications as well as *ex vivo* electrophysiology, confocal, electron and correlative 3D microscopy (see the figure). The long-term aim of our research is to develop insights for treatments of memory dysfunctions in psychiatric illnesses. In particular, we look for the molecules which are specifically expressed in the brains of individuals that abuse alcohol.



Experimental pipeline to look for alcohol addiction-related genes. (1) We developed a unique model of alcohol addiction in the IntelliCages. The model allows for distinguishing mice highly motivated to drink alcohol (High drinkers) from those that drink rarely (Low drinkers). (2) We look for transcripts which differentiate High and Low drinkers. To this end, new generation RNA sequencing is used. (3) To manipulate the expression of addiction-relevant genes, CRISPR/Cas9 system for genomic manipulations is used. (4) Tools for genomic manipulations are delivered to the specific brain regions by viral vectors. Behavioural effect are tested in the IntelliCages. The aim of our research is to discover a new signalling pathways that characterise High and Low drinkers, and therefore may by targeted by future pharmacotherapy of addiction.

SELECTED EXPERIENCE

MSc in Biology, 1999, University of Warsaw; PhD in Neuroscience, 2005, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, Nencki Institute of Experimental Biology, PAS, 2012; Marie Curie postdoctoral research fellow, Laboratory of Molecular Analysis of Memory of Prof. Karl Peter Giese, Centre for the Cellular Basis of Behaviour, IoP, KCL, UK (2006-08).
Prof. Katarzyna Radwańska is the author or co-author of 30 research publications and 1 patent (H-index=14; WoS). For her work Prof. Radwańska received an Award from the Polish Prime Minister for the Outstanding Habilitation (2013).

HEAD
Kasia Radwańska

SELECTED PUBLICATIONS

- Skóra MN, Pattij T, Beroun A, Kogias G, Mielenz D, de Vries T, Radwanska K, Müller CP. (2020) Personality driven alcohol and drug abuse: New mechanisms revealed. Neurosci Biobehav Rev. 116:64-73.
- Śliwińska MA, Cały A, Borczyk M, Ziółkowska M, Skonieczna E, Chilimoniuk M, Bernaś T, Giese KP, Radwanska K. (2020) Long-term Memory Upscales Volume of Postsynaptic Densities in the Process that Requires Autophosphorylation of αCaMKII. Cereb Cortex. 30(4):2573-2585.
- Borczyk M, Śliwińska MA, Caly A, Bernas T, Radwanska K. (2019) Neuronal plasticity affects correlation between the size of dendritic spine and its postsynaptic density. Sci Rep. 9(1):1693.
- Beroun A, Nalberczak-Skóra M, Harda Z, Piechota M, Ziółkowska M, Cały A, Pagano R, Radwanska K. (2018) Generation of silent synapses in dentate gyrus correlates with development of alcohol addiction. Neuropsychopharmacology. 43(10):1989-1999.
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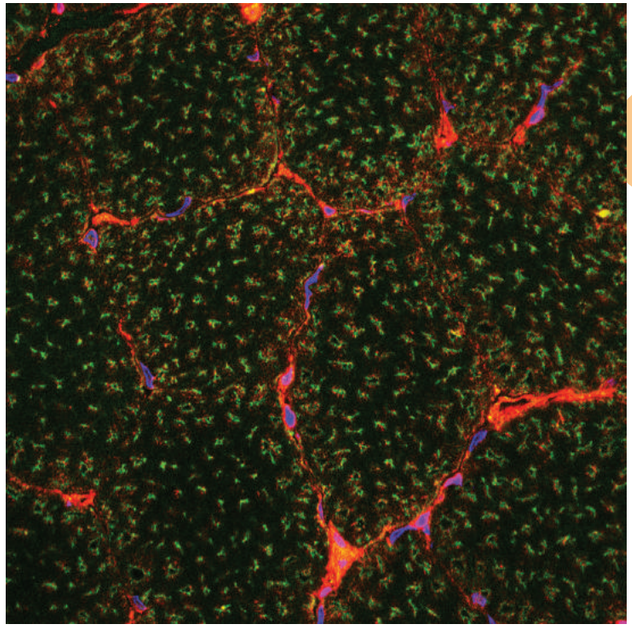
LABORATORY OF MOLECULAR BASIS OF CELL MOTILTY

- understanding a role of molecular motors, in particular of myosin VI, in cell migration, adhesion, cell-cell contact formation, organelle trafficking as well as nuclear functions. Studies are currently performed on differentiating myogenic cells, skeletal and heart muscles, and on neurosecretory PC12 cells;
- elucidation of the role of prion protein in Alzheimer's disease and other tauopathies. We have demonstrated neuroprotective action of prion protein in these neurodegenerative diseases and proposed potential therapy which is currently the subject of a patent application;
- understanding mechanisms of muscular dystrophies. We have performed clinical, genetic and biological analysis muscle biopsies of patients with limb girdle muscular dystrophy;
- understanding mechanisms of the neuromuscular junction development and organization;
- probing arginine analogs, and in particular of L-canavanine, in development of a potential arginine deprivation-based anti-cancer therapeutical strategy;
- exploring mechanisms of calcium signaling; in particular studies are aimed at understanding the crosstalk between calcium and small Rho GTPases signaling in glioma cells;
- elucidation of signaling pathways of selected nucleotide receptors in glioma cells;
- examination of neuronal nucleus organization in response to activation; in particular the mechanisms of chromatin remodeling evoked by the long term potentiation (LTP) are in focus.

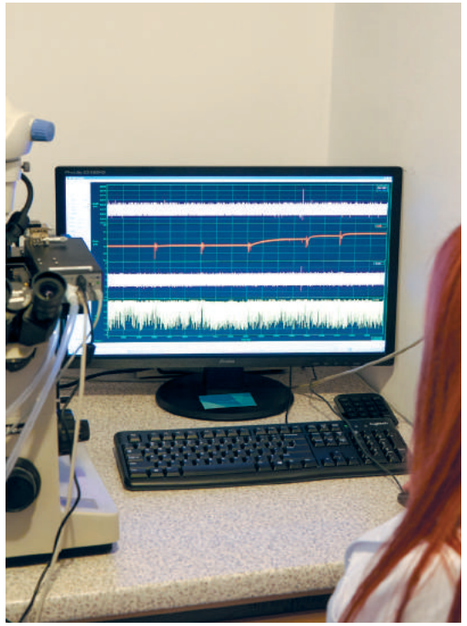


Muscle contraction and cell motility are mainly in focus. Research interests have broadened to neurons and nuclei.

Figure muscle. Cross section of human muscle stained for Ano5 (in green), calnexin (in red) and nuclei (in blue).

SELECTED EXPERIENCE

MSc in Pharmacy (Diploma cum laude), 1984, Medical University of Warsaw; PhD in Biology, 1991, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences Nencki, 2002, Institute of Experimental Biology, PAS; Professor of Biological Sciences, 2010, Nencki Institute of Experimental Biology PAS; Fellow in Laboratory of Cell Biology, NHLBI, NIH, Bethesda, USA, (1992-98); Head of the Department of Biochemistry, Nencki Institute of Experimental Biology, PAS (2011-15); Head of the Department of Muscle Biochemistry, Nencki Institute of Experimental Biology, PAS (2003-07). Prof. Maria Jolanta Rędowicz is the author or co-author of 74 research publications (H-index=18; WoS) and a member of European Society for Muscle Research (member of a board), American Society for Cell Biology and Polish Biochemical Society.



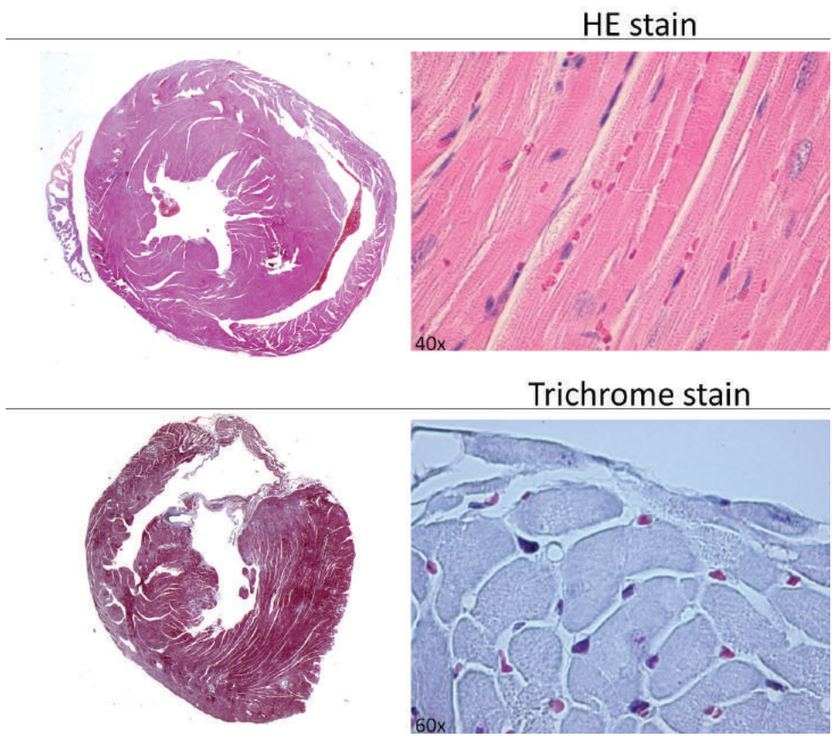
HEAD
Maria Jolanta Rędowicz

SELECTED PUBLICATIONS

- Sobczak M, Chumak V, Pomorski P, Wojtera E, Majewski L, Nowak J, Yamauchi J, Redowicz MJ. (2016) Interaction of myosin VI and its binding partner DOCK7 plays an important role in NGF--stimulated protrusion formation in PC12 cells. Biochim Biophys Acta Mol. Cell Res. 1863:1589-1600.
- Nieznanska H, Bandyszewska M, Surewicz K, Zajkowski T, Surewicz WK, Nieznanski K. (2018) Identification of prion protein-derived peptides of potential use in Alzheimer's disease therapy. Biochim Biophys Acta Mol. Basis Dis. 1864(6 Pt A):2143-2153.
- Majewski L, Nowak J, Sobczak M, Karatsai O,Havrylov S, Lenartowski R, Suszek M, Lenartowska M, Rędowicz MJ. (2018) Myosin VI in the nucleus of neurosecretory PC12 cells: Stimulation-dependent nuclear translocation and interaction with nuclear proteins. Nucleus 9:125-141.
- Jarmula A, Łusakowska A, Fichna JP, Topolewska M, Macias A, Johnson K, Töpf A, Straub V, Rosiak E, Szczepaniak K, Dunin-Horkawicz S, Maruszak A, Kaminska AM, Redowicz MJ. (2019) ANO5 mutations in the Polish limb girdle muscular dystrophy patients: Effects on the clinical phenotype and protein structure. Sci. Rep. 9:11533.
- Lehka L, Redowicz MJ. (2020) Mechanisms regulating myoblast fusion: A multilevel interplay. Sem. Cell Dev. Biol. 104:81-92.

LABORATORY OF MOLECULAR MEDICAL BIOCHEMISTRY

Our research is focused on the cellular and molecular mechanisms of heart dysfunction. The research involves in vivo and in vitro studies of signaling pathways and transcription factors associated with the regulation of cardiomyocyte metabolism and pathogenesis of left ventricular hypertrophy, lipotoxic cardiomyopathy and atherosclerosis. In particular, we decipher the mechanisms controlling pericardial and pericoronary adipose tissue function, coronary plaque formation and angiogenesis by functional analysis of stearoyl-CoA desaturase (SCD)-dependent signaling in murine models of lipotoxic heart disease and atherosclerosis. Our second priority is to examine the role of SCD1 and SCD4 genes in coronary atherosclerosis and to determine the role for lipid mediators in cardiomyocyte-pericoronary adipose tissue-endothelial cells communication. We are also interested in mechanisms linking hypoxic cardiomyocytes with angiogenic capacity of endothelial progenitor cells and plasticity of vascular smooth muscle cells. Understanding how hypoxia and lipotoxicity affect vascular homeostasis will not only gain insight into basic mechanisms governing vascular biology in health and disease, but it will also provide opportunities for the development of new treatment strategies to augment cardiac vascular function and heart remodeling.

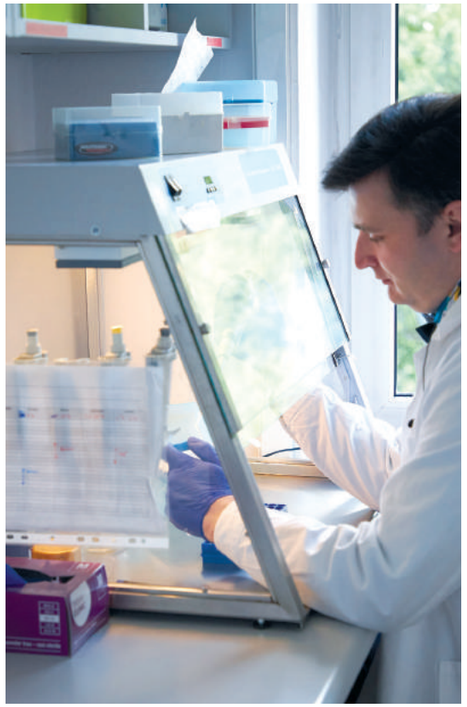


Morphology of the mouse heart.

SCD may be used to reprogram myocardial metabolism

SELECTED EXPERIENCE

MSc in Biology, 1996, Warsaw University; PhD in Biological Sciences, 2006, University of Bialystok; Habilitation in Biological Sciences, 2013, Nencki Institute of Experimental Biology PAS; Associate Professor, 2013, Nencki Institute of Experimental Biology PAS; Fellow (1996-1997) University Courses on Svalbard, Norway; Associate Researcher (2002-05) Department of Biochemistry, University of Wisconsin-Madison, USA.
Prof. Pawel Dobrzyń is the author or co-author of 60 research publications and 1 patent (H-index=21; WoS). For his work prof. Paweł Dobrzyń received the Award from American Association for the Advancement of Science (AAAS) in 2007. Prof. Paweł Dobrzyń is a Member of Polish Biochemical Society and International Society for the Study of Fatty Acids and Lipids.



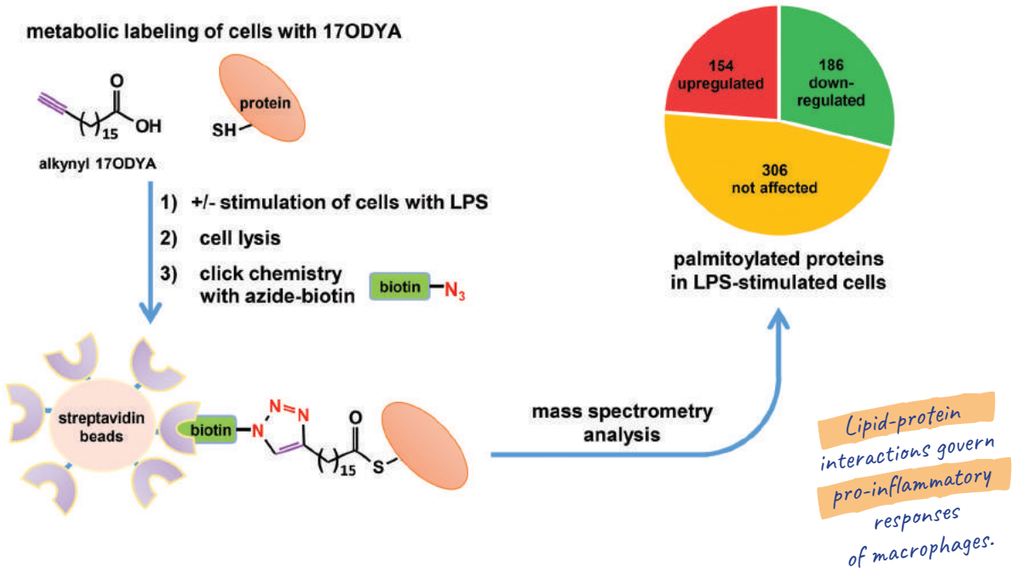
HEAD
Paweł Dobrzyń

SELECTED PUBLICATIONS

- Dziewulska A, Dobosz AM, Dobrzyn A, Smolinska A, Kolczynska K, Ntambi JM, Dobrzyn P. (2020) SCD1 regulates the AMPK/SIRT1 pathway and histone acetylation through changes in adenine nucleotide metabolism in skeletal muscle. J. Cell. Physiol. 235(2): 1129-1140.
- Bednarski T, Olichwier A, Opasinska A, Pyrkowska A, Gan AM, Ntambi JM, Dobrzyn P. (2016) Stearoyl-CoA desaturase 1 deficiency reduces lipid accumulation in the heart by activating lipolysis independently of peroxisome proliferator-activated receptor α. Biochim. Biophys. Acta Mol. Cell Biol. Lipids 1861(12): 2029-2037.
- Dobrzyn P, Bednarski T, Dobrzyn A. (2015) Metabolic reprogramming of the heart through stearoyl-CoA desaturase. Prog. Lipid Res. 57(1): 1-12.
- Dobrzyn P, Pyrkowska A, Duda MK, Bednarski T, Maczewski M, Langfort J, Dobrzyn A. (2013) Expression of lipogenic genes is upregulated in the heart with exercise training-induced but not pressure overload-induced left ventricular hypertrophy. Am. J. Physiol. Endocrinol. Metab. 304(12): E1348-E1358.
- Dobrzyn P, Dobrzyn A, Miyazaki M, Cohen P, Asilmaz E, Hardie DG, Friedman JM, Ntambi JM. (2004) Stearoyl-CoA desaturase 1 deficiency increases fatty acid oxidation by activating AMP-activated protein kinase in liver. Proc. Natl. Acad. Sci. USA 101(17): 6409-6414.

LABORATORY OF MOLECULAR MEMBRANE BIOLOGY

Our studies concern molecular mechanisms of the activation of receptors localized in the plasma membrane of macrophages with a focus on signaling induced by bacterial lipopolysaccharide (LPS). LPS binds to CD14 and TLR4 receptor, primes inflammasomes and triggers pro-inflammatory reactions which facilitate combating the infection. An exaggerated reaction to LPS can lead to life-threatening sepsis while diet-induced low-grade inflammation is linked with several chronic diseases. We are especially interested in the contribution of plasma membrane lipids, including phosphatidylinositols and sphingolipids, and also palmitoylated proteins to the LPS-induced signaling. Our aim is to elucidate how signaling complexes of TLR4 are assembled and how sphingolipid- and cholesterol-rich nanodomains of the plasma membrane affect formation of those complexes and subsequent endocytosis of the receptor. We conduct the studies on cell culture lines, CD14 knockout mice and primary macrophages transiently or stably depleted / overexpressing distinct proteins of LPS-induced signaling pathways. For analyses we utilize an array of molecular biology and immunobiology techniques, and also confocal microscopy, various biochemical techniques including “click chemistry”, ABE and mass spectrometry. These complementary approaches are dedicated to unravel factors shaping the mode and magnitude of activation of macrophages by LPS and can in the future help to invent new therapeutic tools for the treatment of sepsis.



Click-chemistry based approach to studying changes of the level of palmitoylated proteins in LPS-stimulated cells.

SELECTED EXPERIENCE

MSc in Biology, 1986, Nicolaus Copernicus University in Toruń; PhD in Biology, 1993, Nencki Institute of Experimental Biology, PAS; Habilitation, 2003, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2012, Nencki Institute of Experimental Biology, PAS; Postdoctoral Fellow (1993-95), University of Texas Southwestern Medical Center, Dallas, USA; Head of the Department of Cell Biology Nencki Institute of Experimental Biology, PAS (2006-2018). The head of the Laboratory since 2013. Prof. Kwiatkowska is the author or co-author of 63 research publications (H-index=24; WoS). She supervised seven PhD students. In 2013 she was awarded a prestigious Maestro research grant of NCN. For her work Prof. Kwiatkowska received several prizes of the Second Division of the Polish Academy of Sciences (2001, 2004, 2011, 2018).

HEAD
Katarzyna Kwiatkowska

SELECTED PUBLICATIONS

- Prymas K, Świątkowska A, Traczyk G, Ziemlińska E, Dziewulska A, Ciesielska A, Kwiatkowska K. (2019) Sphingomyelin synthase activity affects TRIF-dependent signaling of Toll-like receptor 4 in cells stimulated with lipopolisaccharide. Biochim. Biophys. Acta Mol. Cell. Biol. Lipids. 1865(2):158549.
- Ciesielska A, Hromada-Judycka A, Ziemlińska E, Kwiatkowska K. (2019) Lysophosphatic acid up-regulates IL-10 production to inhibit TNF -α synthesis in macrophages stimulated with LPS. J. Leukoc. Biol. 106(6):1285-1301.
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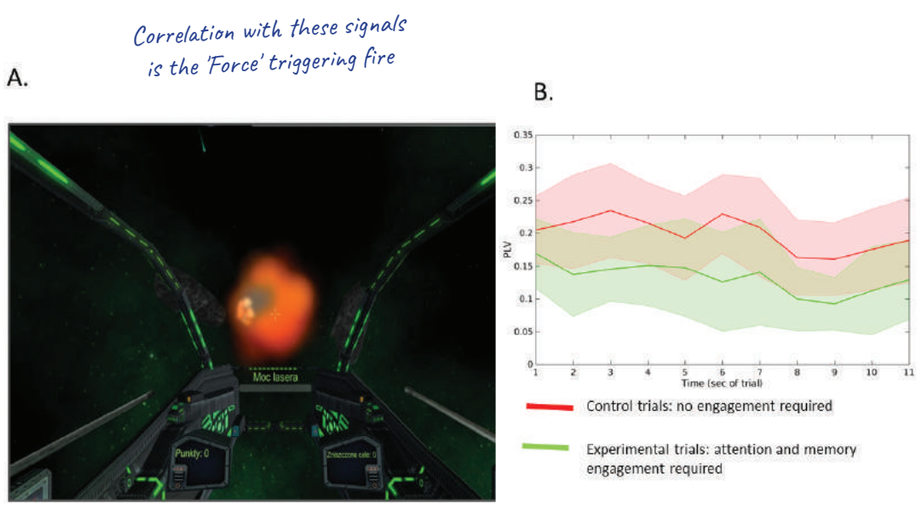
LABORATORY OF NEUROINFORMATICS

Our main activity is development of computational tools and models to understand the function and structure of the brain at multiple levels, from subcellular to human behavior. We support open and reproducible science. We analyze and model electrophysiological, behavioral and imaging data. An important part of our activity is the development of neuroinformatics infrastructure for analysis of multimodal imaging information. We also study experimentally animal models of schizophrenia and EEG-based neurofeedback in humans.

CURRENT PROJECTS

- development of methods for reliable reconstruction of neural activity from extracellular recordings, in particular source reconstruction for epileptic patients (kernel Electric Source Imaging);
- understanding the mechanisms and behavioral consequences of abnormal high frequency oscillations, after ketamine, in freely moving rats;
- virtual reality EEG neurofeedback;
- Structural Connectivity in Non-Human Primates http://marmosetbrain.org;
- Light-Sheet Fluorescent Microscopy imaging;
- image processing and analysis, including deep-learning based methods for feature detection;
- in silico molecular dynamics underlying synaptic long-term plasticity in Schaffer collateral synapses;
- reinforcement learning in spiking neural network models and behavior.



Virtual reality EEG neurofeedback training based on phase correlations. During the training participants equipped with VR goggles are engaged in "Star Wars" like therapeutic game aiming at shooting down enemy's starship using their "Force" – adjustment of the brain activity measured by EEG phase correlations to the individually identified state of vigilance.
(A) screenshot form the game at the moment of shooting down enemy's starship. (B) Level of phase correlation value between two electrodes triggering shot (green line). Electrodes and values triggering the shot were identified during diagnostic sessions based on comparison between control trials which do not require memory and attention engagement (red) and experimental trials (green). (Jacek Rogala)

HEAD
Daniel Wójcik

SELECTED EXPERIENCE

MSc in Physics, 1996, University of Warsaw; PhD in theoretical physics, 2000, University of Warsaw; Habilitation in theoretical physics, 2008, Institute of Physics, PAS; Full Professor of Biological Sciences, 2015, Nencki Institute of Experimental Biology, PAS. Research Assistant (1996-2003), Center for Theoretical Physics, PAS; Research Associate (2000-02), Institute for Physical Science and Technology, University of Maryland, USA; Joseph Ford Fellow (2002-03), Center for Nonlinear Science, Georgia Institute of Technology, USA. Head of the PhD Studies, Nencki Institute of Experimental Biology, PAS (2015-present).
Prof. Wójcik is the author or co-author of 47 research publications (H-index=14; WoS). He was the Polish Representative at the International Neuroinformatics Coordinating Facility Governing Board (2007-2015).

SELECTED PUBLICATIONS

- Majka P, Bai S, Bakola S, Bednarek S, Chan J, Jermakow N, Passarelli L, Reser D, Theodoni P, Worthy K, Wang XJ, Wójcik D, Mitra P, Rosa M. (2020) Open Access Resource for Cellular-Resolution Analyses of Corticocortical Connectivity in the Marmoset Monkey. Nature Communications, 11:1133.
- Rogala J, Kublik E, Krauz R, Wróbel A. (2020) Resting-state EEG activity predicts frontoparietal network reconfiguration and improved attentional performance. Scientific Reports 10:5064.
- Hunt MJ, Adams NE, Średniawa W, Wójcik DK, Simon A, Kasicki S & Whittington MA. (2019) The olfactory bulb is a source of high-frequency oscillations (130–180 Hz)associated with a subanesthetic dose of ketamine in rodents. Neuropsychopharmacology 44:435–442.
- Jędrzejewska-Szmek J, Blackwell KT. (2019) From membrane receptors to protein synthesis and actin cytoskeleton: Mechanisms underlying long lasting forms of synaptic plasticity. Seminars in Cell & Developmental Biology 95:120–129.
- Cserpan D, Meszena D, Wittner L, Toth K, Ulbert I, Somogyvari Z, Wójcik DK. (2017) Revealing The Distribution Of Transmembrane Currents Along The Dendritic Tree Of A Neuron With Known Morphology From Extracellular Recordings. eLife 6:e29384.

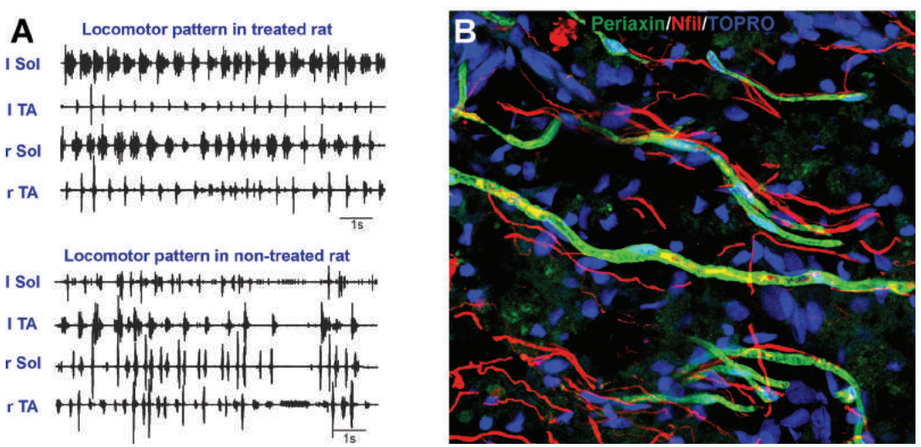
LABORATORY OF NEUROMUSCULAR PLASTICITY

Our research is directed towards identifying new strategies for the treatment of spinal cord or peripheral nerve injuries. The overall goal of our studies is to understand the basic mechanisms of neuronal plasticity that are triggered after nervous system injury and that can be used to enhance recovery of locomotor function. In particular, we focus our attention on the role of monoaminergic systems in control locomotor movements in norm and pathology.

We aim to promote recovery after nervous system injury by:

- enhancing endogenous repair response and remyelination in the injured spinal cord white matter
- identifying and applying novel factors activating the neural niche to produce new neurons
- identifying and modulating of the microenvironmental clues expressed within the injured spinal cord and peripheral nerves to enhance their endogenous regenerative ability
- restitution of serotonergic / noradrenergic innervation using intraspinal neural transplantation of 5-HT and NA neurons possessed from the embryonic brainstem or generated *in vitro*.

We employ both well-established and modern state-of-the-art neurophysiology and molecular biology methods. Our research involves investigations of the functional aspects of the locomotor movement recovery after central and peripheral nervous system injury in young and adult rats. The restitution of locomotor hindlimb movements is investigated using behavioral and electrophysiological methods in chronic and acute conditions.

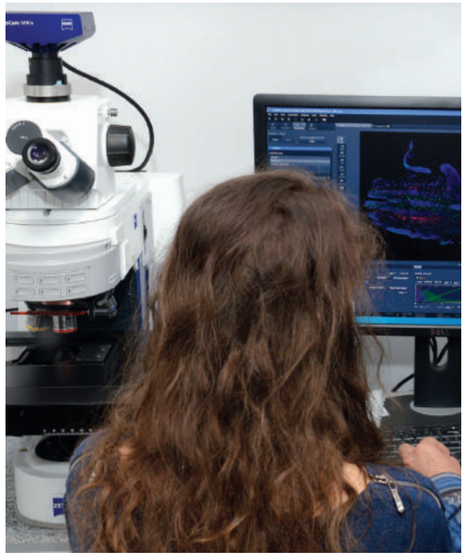


Locomotor EMG pattern in a rat with (A top) and without (A bottom) treatment enhancing axonal regeneration by peripheral myelin cells (Periaxin; green) in the side of spinal cord injury (B). Neurofilament (red); DAPI (blue).

SELECTED EXPERIENCE

MSc in Physics, 1982, University of Warsaw; PhD in Biology, 1993, Nencki Institute of Experimental Biology, PAS; Habilitation, 2002, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2010, Nencki Institute of Experimental Biology, PAS; The Wellcome Trust Fellow (1987-2000), British Society, Royal Council at the University College of London, London, UK; Fellow (1994-1995) at the University of Rene Descartes, Paris, France and (2001, 2006), Göteborg University, Sweden; Visiting Professor (2010-2020), University of Manitoba, Winnipeg, Canada. Deputy Director for Scientific Matters at the Nencki Institute of Experimental Biology, PAS (2007-2014).
Prof. Sławińska is the author or co-author of 76 research publications (H-index=19; WoS).

Neurobiology and electrophysiology of functional recovery



HEAD
Urszula Sławińska

SELECTED PUBLICATIONS

- Kwaśniewska A, Miazga K, Majczyński H, Jordan LM, Zawadzka M, Sławińska U. (2020) Noradrenergic Components of Locomotor Recovery Induced by Intraspinal Grafting of the Embryonic Brainstem in Adult Paraplegic Rats. Int J Mol Sci. 21(15):5520.
- Majczyński H, Cabaj AM, Jordan LM, Sławińska U. (2020) Contribution of 5-HT2 Receptors to the Control of the Spinal Locomotor System in Intact Rats. Front. Neural Circuits. 14: 14.
- Wylot B, Mieczkowski J, Niedziolka S, Kamińska B, Zawadzka M. (2019) Csf1 Deficiency Dysregulates Glial Responses to Demyelination and Disturbs CNS White Matter Remyelination. Cells. 9(1): 99.
- Ulańska-Poutanen J, Mieczkowski J, Zhao C, Konarzewska K, Kaza B, Pohl Hartmut BF, Bugajski L, Kamińska B, Franklin RJM, Zawadzka M. (2019) Injury-Induced Perivascular Niche Supports Alternative Differentiation of Adult Rodent CNS Progenitor Cells. eLife. 7:e30325.
- Miazga K, Fabczak H, Joachimiak E, Zawadzka M, Krzemień-Ojak Ł, Bekisz M, Bejrowska A, Jordan LM, Sławińska U. (2018) Intraspinal Grafting of Serotonergic Neurons Modifies Expression of Genes Important for Functional Recovery in Paraplegic Rats. Neural Plast. 2018:4232706.

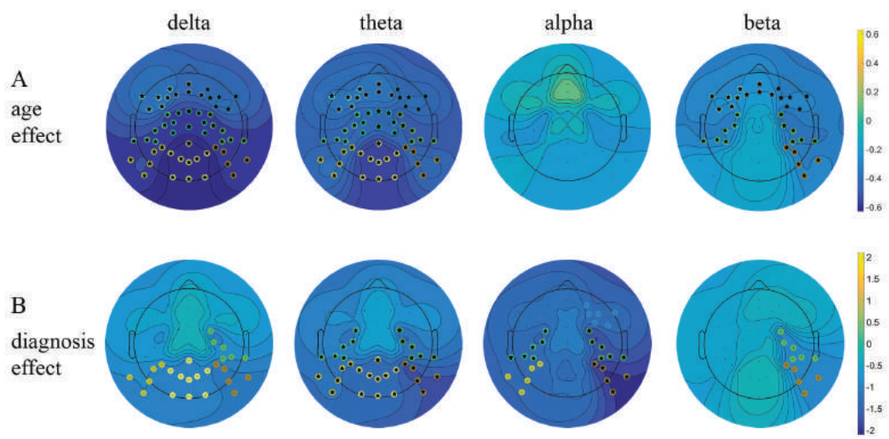
LABORATORY OF NEUROPLASTICITY

In the Laboratory of Neuroplasticity cellular, molecular and systemic mechanisms of neuroplasticity are explored in three experimental models:

- learning-induced plasticity in somatosensory barrel cortex of rodents. We investigate the role of GABAergic interneurons containing somatostatin in learning-induced modifications of cortical sensory representations
- the role of inhibition in plasticity mechanisms of the aging brain
- plasticity of human visual cortex evoked by degenerative diseases of the retina
- the role of dopamine transporter1 in functioning of attention in mice and children with ADHD.

CURRENT RESEARCH ACTIVITIES

- chemogenetic investigations of the role of somatostatin and VIP interneurons in learning-induced plasticity of the barrel cortex
- chemogenetic investigation of inhibitory interaction in the barrel field following sensory deprivation of vibrissae
- age-related changes of glutamatergic and GABAergic presynaptic markers and their influence on neuronal plasticity
- examination with behavioral, MRI spectroscopy and DTI techniques, the plastic changes of visual pathways following central or peripheral retinal degeneration.

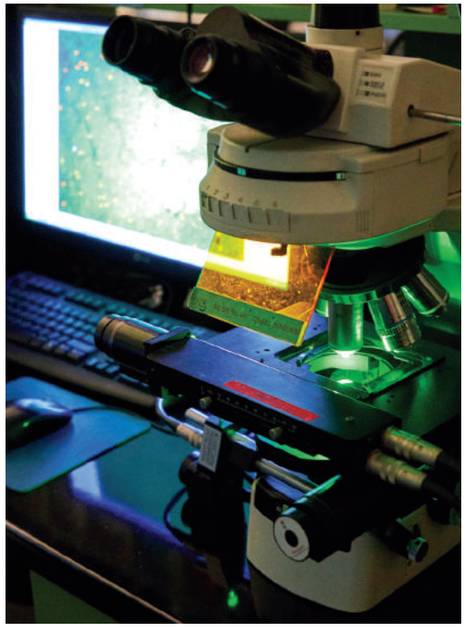


Linear regression analysis of the resting EEG predicted by ADHD diagnosis. Beta coefficient maps for the main effects of diagnosis are plotted respectively for all frequency bands, indicating differences between groups. The ADHD group had significantly lower absolute power in all frequency bands across centro-posterior clusters, with the most pronounced difference in lower theta absolute power. Significant clusters ($p < 0.05$) are marked with dots in cluster-corresponding colors. Star signs indicate significant clusters after false discovery rate correction.

HEAD
Małgorzata Kossut

SELECTED EXPERIENCE

MSc in Biology, 1973, Warsaw University; PhD, 1976, Nencki Institute of Experimental Biology PAS, Habilitation in Biological Sciences, 1989; Nencki Institute of Experimental Biology PAS; Full Professor of Biological Sciences, 1994, Nencki Institute of Experimental Biology, PAS; University of Pennsylvania, Philadelphia, School of Veterinary Medicine (1978-79); University of Oxford, Physiological Laboratory (1981); Department of Biology, Purdue University, Indiana, USA (1985-86); Max Planck Institute for Brain Research (1988); Fulbright Senior Research Scholar at Uniformed Services University of Health Sciences (1995-96).
Prof. Kossut is the author or co-author of 150 research publications (H-index=28; WoS), a corresponding member of the Polish Academy of Arts and Sciences and a full member of the Polish Academy of Sciences.



SELECTED PUBLICATIONS

- Burnat K, Hu TT, Kossut M, Eysel UT, Arckens L. (2017) Plasticity Beyond V1: Reinforcement of Motion Perception upon Binocular Central Retinal Lesions in Adulthood. J Neurosci. 37(37):8989-8999.
- Rozycka A, Charzynska A, Misiewicz Z, Maciej Stepniewski T, Sobolewska A, Kossut M, Liguz-Lecznar M. (2019). Glutamate, GABA, and Presynaptic Markers Involved in Neurotransmission Are Differently Affected by Age in Distinct Mouse Brain Regions. ACS Chem Neurosci. 10(11):4449-4461.
- Lukomska A, Dobrzanski G, Liguz-Lecznar M, Kossut M. (2020) Somatostatin receptors (SSTR1-5) on inhibitory interneurons in the barrel cortex. Brain Struct Funct. 225:387-401.
- Kuc K, Bielecki M, Racick-Pawlukiewicz E, Czerwinski MB, Cybulska-Klosowicz A. (2020) The SLC6A3 gene polymorphism is related to the development of attentional functions but not to ADHD. Sci. Rep. Aprol10(1):6176.
- Dobrzanski G, Lukomska A, Zakrzewska R, Posluszny A, Kanigowski D, Urban-Ciećko J, Liguz-Lecznar M, Kossut M. (2020) Learning-induced plasticity in the barrel cortex is disrupted by inhibition of layer 4 somatostatin-containing interneurons. BioRxiv doi: https://doi.org/10.1101/2020.05.11.087791.

Small whiskers cause a lot of plasticity

LABORATORY OF NEUROPSYCHOLOGY

The research is focused on neuropsychology of human cognition in norm and pathology. The studies are combined with neuropsychological, electrophysiological and fMRI techniques. The main topics of our studies are temporal aspects of information processing, time perception, language, memory (with a special focus on working memory), learning, attention, executive functions and are aimed at development of new diagnostic and therapy methods. The research involves normal subjects (children, adults), individuals suffering from various brain diseases (stroke, focal brain damage, dementia), and subjects with speech and / or language disorders, e.g. language learning impairment, aphasia, deafness, stuttering, infantile autism.

CURRENT RESEARCH ACTIVITIES

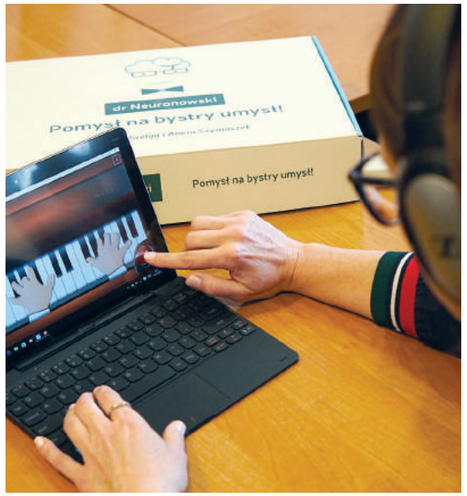
- temporal information processing on different time levels
- neuropsychology of aging, longevity and neurodegeneration
- development and validation of the innovative therapy program Dr Neuronowski®
www.neuronowski.com addressed to subjects with language and other cognitive disorders
- application of cognitive and physical training in the enhancement of mental health in the elderly
- cognitive abilities in patients with brain damage, post stroke aphasia, and other neurodevelopmental or neurodegenerative disorders
- cerebral language representation
- links between brain activity and cognitive functions across the lifespan.

Our therapy program www.neuronowski.com

SELECTED EXPERIENCE

MSc in Biology, 1975, University of Warsaw; Certified Speech Therapist, 1984, University of Warsaw; PhD in Biology (psychophysiology), 1985, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, 1996, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences (neuropsychology), 2005, Nencki Institute of Experimental Biology, PAS;
Humboldt Research Fellowship (1991-93) Institute of Medical Psychology, Ludwig-Maximilians University of Munich, Germany; Chair of Neurorehabilitation, (2006-17), University of Social Sciences and Humanities, Warsaw; Member of Human Science Center, Ludwig-Maximilians University of Munich, Germany.
Prof. Elżbieta Szeląg is the co-author of over 100 publications (H-index=23; WoS).

Time is of the essence for human cognitive processes Training in temporal processing keeps us mentally sharp!



HEAD
Elżbieta Szeląg

SELECTED PUBLICATIONS

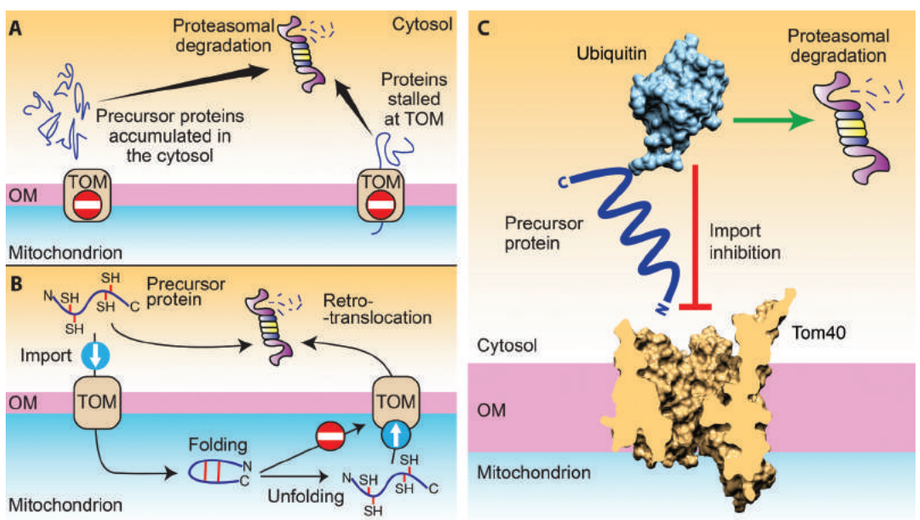
- Jablonska K, Piotrowska M, Bednarek H, Szymaszek A, Marchewka A, Wypych M, Szelag E. (2020) Maintenance vs Manipulation in Auditory Verbal Working Memory in the Elderly: New Insights Based on Temporal Dynamics of Information Processing in the Millisecond Time Range. Front. Aging. Neurosci. 12:194.
- Choinski M, Szelag E, Wolak T, Szymaszek A. (2020) Working Memory in Aphasia: The Role of Temporal Information Processing. Front. Human Neurosci. 14: 589802.
- Oron A, Szelag E, Nowak K, Dacewicz A, Szymaszek A. (2019) Age-related differences in Voice Onset Time in Polish language users: an ERP study. Acta Psychol. 193: 18-29.
- Dacewicz A, Szymaszek A, Nowak K, Szelag E. (2018) Training induced Changes in Rapid Auditory Processing in Children with Specific Language Impairment: Electrophysiological Indicators. Front. Hum. Neurosci. 12: 310.
- Szymaszek A, Wolak T, Szelag E. (2017) The Treatment Based on Temporal Information Processing Reduces Speech Comprehension Deficits in Aphasic Subjects. Front. Aging. Neurosci. 9: 98.

FOR MORE INFORMATION PLEASE VISIT

www.pracownia-neuropsychologii.nencki.gov.pl
www.elzbietaszelag.pl

LABORATORY OF PROTEIN HOMEOSTASIS

Proteins are always at risk of misfolding, becoming damaged, or aggregating. Cellular proteomes are shaped by opposing, highly regulated processes of protein synthesis and degradation. Furthermore, over half of newly synthesized proteins need to be transported from the site of their synthesis to their final subcellular destinations. Thus, numerous specialized protein quality control and transport pathways are required to guarantee the proper distribution and function of proteins. Such quality control mechanisms that react to the damage or mislocalization of proteins are essential to maintain cellular protein homeostasis – proteostasis. The proteostasis failure is among the pivotal factors of many pathological conditions. The group, established in 2020, aims to understand the molecular mechanisms that govern cellular proteostasis maintenance. Most of our efforts concentrate on the major cellular machinery for specific protein degradation – the ubiquitin-proteasome system. We focus on the quality control of proteins during their transport into cellular organelles. We combine hypothesis based and unbiased screening approaches to discover new factors that integrate these processes.



The cytosolic ubiquitin-proteasome system plays a vital role in regulating mitochondrial protein import. Precursor proteins are the most accessible to the ubiquitin-proteasome system as they originate in the cytosol (A). Proteins can also be extracted from mitochondria or can retro-translocate from internal compartments (B). Attachment of ubiquitin to mitochondrial precursor proteins not only targets them for degradation but also directly interferes with their import (C). We aim to understand the mutual relations between cytosolic protein quality control and mitochondrial proteome maintenance. Adapted from doi.org/10.1098/rsob.170007, and doi.org/10.1186/s12915-018-0536-1.

SELECTED EXPERIENCE

MSc in Biotechnology, 2004, Warsaw University of Life Sciences; PhD in Medical Sciences, 2008, Medical Centre of Postgraduate Education in Warsaw; Fellow, 2009, Laboratory of Molecular Biology, GEQA, Institut National de la Recherche Agronomique (INRA), France; Fellow and Associate Researcher (2010-17), Laboratory of Mitochondrial Biogenesis, International Institute of Molecular and Cell Biology in Warsaw; Senior Researcher (2017-20), Laboratory of Mitochondrial Biogenesis, Centre of New Technologies, University of Warsaw.
Dr. Piotr Brągoszewski is the author or co-author of 18 research publications (H-index=14; WoS). For his work Dr. Brągoszewski received the Minister of Health Group Awards (2008, 2011).
Dr Brągoszewski is a Member of Polish Biochemical Society and Proteostasis Group of European New Investigators (PROGENIE).

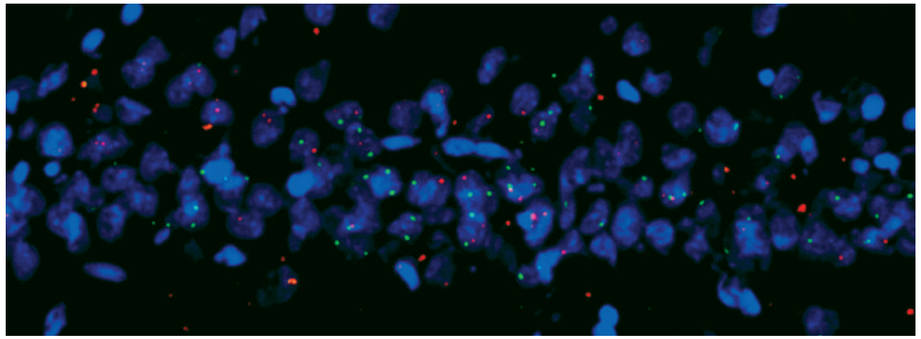
HEAD
Piotr Brągoszewski

SELECTED PUBLICATIONS

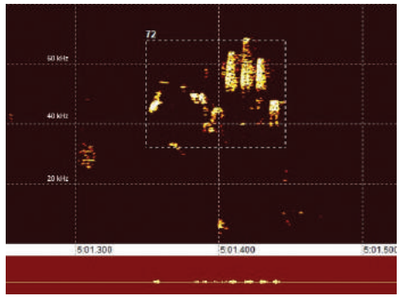
- Kowalski L, Bragoszewski P, Khmelinskii A, Glow E, Knop M, and Chacinska A. (2018) Determinants of the cytosolic turnover of mitochondrial intermembrane space proteins. BMC Biol. 16(1): p. 66.
- Schendzielorz AB, Bragoszewski P, Naumenko N, Gomkale R, Schulz C, Guiard B, Chacinska A, Rehling P. (2018) Motor recruitment to the TIM23 channel's lateral gate restricts polypeptide release into the inner membrane. Nat Commun. 9(1): p. 4028.
- Bragoszewski P, Turek M, Chacinska A. (2017) Control of mitochondrial biogenesis and function by the ubiquitin-proteasome system. Open Biol. 7(4).
- Bragoszewski P, Wasilewski M, Sakowska P, Gornicka A, Bottinger L, Qiu J, Wiedemann N, Chacinska A. (2015) Retro-translocation of mitochondrial intermembrane space proteins. Proc Natl Acad Sci USA. 112(25): p. 7713-8.
- Wrobel L, Topf U, Bragoszewski P, Wiese S, Sztolsztener ME, Oeljeklaus S, Varabyova A, Lirski M, Chroscicki P, Mroczek S, Januszewicz E, Dziembowski A, Koblowska M, Warscheid B, Chacinska A. Mistargeted mitochondrial proteins activate a proteostatic response in the cytosol. (2015) Nature. 524(7566): p. 485-8.

LABORATORY OF SPATIAL MEMORY

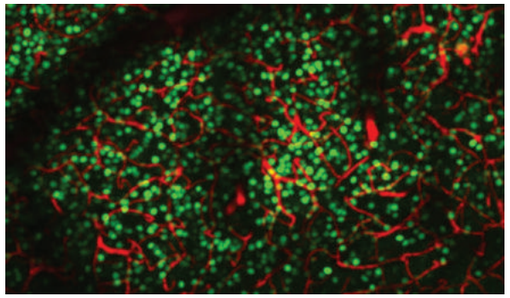
Our group studies some aspects of the brain's ability to recognize and remember the external environment and to utilize this knowledge in order to guide behavior. We are also interested in the interplay between internally driven motivational and spatial behaviors. Spatial memory is necessary for independent functioning of humans, its defects lead to deep functional disability. In all mammals the central structure involved in spatial memory is the hippocampus. Certain cortical and subcortical structures that connect to the hippocampus also participate in these processes. They gather information from other brain areas, filter and synchronize it. The interactions between brain structures responsible for spatial memory allow optimal selection of navigation strategy and provide balance between exploration of novel areas and the exploiting of already learned places. The importance of cortical structures in encoding and storage of spatial memory has been acknowledged only recently and its role has not yet been fully explained. Also, the relationship between internally driven affective states and the spatial behavior is still largely unknown. It is therefore necessary to create an overall model that would describe the functioning of the entire system and explain how the interactions between different areas, layers or neuronal populations produce a coherent output that is manifested by successful behavior. Understanding of such a complex system is possible with the use of animal models.



Fluorescent detection of mRNA transcripts for immediate early genes (Arc: red puncta, Homer: green puncta) in CA1 field of the hippocampus after learning.



Ultrasonic vocalization of rats during appetitive spatial task.



Two channel in vivo two-photon imaging of the fluorescent reporter for immediate early gene Fos (green) and brain vasculature (red) in retrosplenial cortex after learning.

SELECTED EXPERIENCE

MSc, 1998, University of Warsaw; PhD, 2004, Nencki Institute of Experimental Biology, PAS; Post-doc (2004-09), University of California Los Angeles, USA; Post-Doc Fellow (2009-12), Norwegian University of Science and Technology.
Dr Czajkowski is the author or co-author of 27 research publications (H-index=12; WoS). Dr Czajkowski received the Prime Minister Award for the Best Doctoral Dissertation (2005) and Award for Teaching Excellence (2017).

Final adjustments before we take a look into the living brain.

HEAD
Rafał Czajkowski

SELECTED PUBLICATIONS

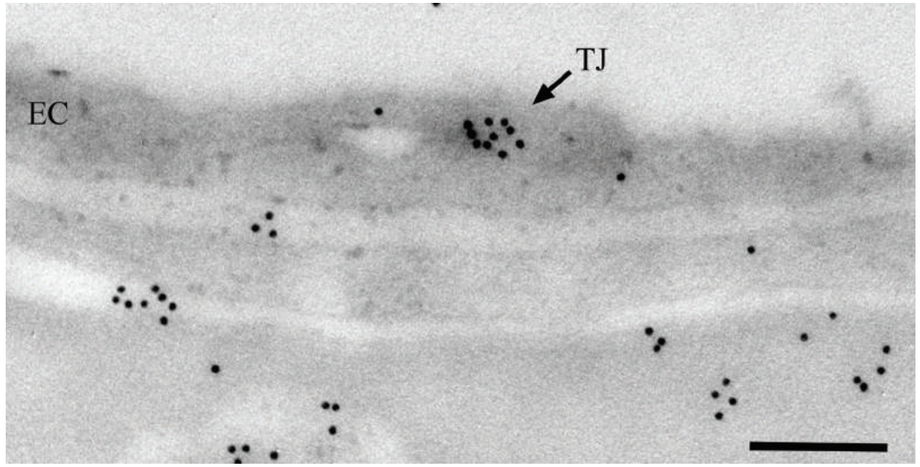
- Czajkowski R, Zglinicki B, Rejmak E, Konopka W. (2020) Strategy-Specific Patterns of Arc Expression in the Retrosplenial Cortex and Hippocampus during T-Maze Learning in Rats. Brain Sci. 10:854; doi: 10.3390/brainsci10110854.
- Hamed A, Kursa MB. (2020) Social deprivation substantially changes multi-structural neurotransmitter signature of social interaction: Glutamate concentration in amygdala and VTA as a key factor in social encounter-induced 50-kHz ultrasonic vocalization. Eur Neuropsychopharmacol. 37:82-99.
- Mitchell A, Czajkowski R, Zhang N, Jeffery K, Nelson AJD. (2018) Retrosplenial cortex and its role in spatial cognition. Brain Neurosci Adv. 2:1-33.
- Hamed A, Kursa MB. (2018) Inter-individual differences in serotonin and glutamate co-transmission reflect differentiation in context-induced conditioned 50-kHz USVs response after morphine withdrawal. Brain Struct Funct. 223:3149-3167.
- Łukasiewicz K, Robacha M, Bożycki, Ł, Radwańska K, Czajkowski, R. (2016) Simultaneous two-photon in vivo imaging of synaptic inputs and postsynaptic targets in the mouse retrosplenial cortex. J Vis Exp. 109 doi: 10.3791/53802.
- Czajkowski R, Balaji J, Wiltgen B, Rogerson T, Guzman Karlsson M, Barth AL, Trachtenberg JT, Silva AJ. (2014) Encoding and storage of spatial information in the retrosplenial cortex. Proc Natl Acad Sci. 111:8661-6.

LABORATORY OF TRANSPORT THROUGH BIOMEMBRANES

Studies are carried on transporter proteins within the plasma membrane, in particular on two Solute Carrier (SLC) family members transporting carnitine, a compound necessary for fatty acid oxidation: organic cation / carnitine transporter – OCTN2 (SLC22A5) and amino acid transporter B(0,+) – ATB(0,+) (SLC6A14). The experiments have been focused on the mechanism of transporters exit from the endoplasmic reticulum and further trafficking to the cell surface, a process necessary for their activity, i.e. substrates delivery to the cell. Both, uptake of carnitine and amino acids promote energy delivery and anabolic processes, which supports quick growth of cancer cells in which both transporters are up-regulated. We study the role of other proteins in regulation of this trafficking, in particular the role of heat-shock proteins in controlling transporters conformation and folding, which, when distorted, directs the transporter towards degradation pathway.

We also study an involvement of coatomer II (COPII) proteins in vesicular trafficking of both studied transporters to the plasma membrane. We are also interested in the role of protein kinases. Experiments on the role of two kinases known to have increased activity in transformed cells – protein kinase C and kinase AKT, are carried on. The far-reaching goal would be to find the conditions leading to a decrease of the studied transporters within the plasma membrane, which should diminish cancer cell viability and survival.

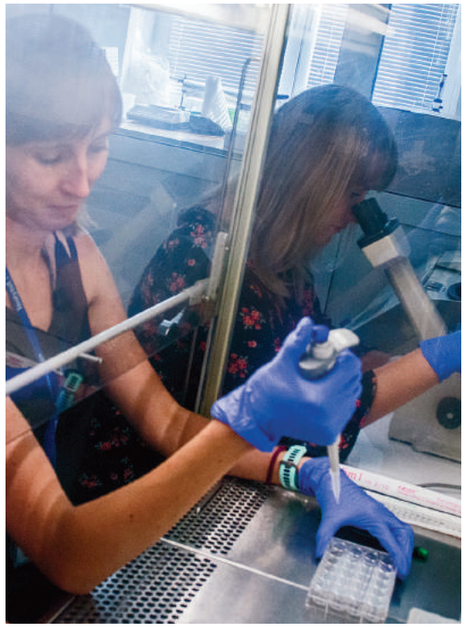
What is the kick that moves transporters to the cell surface?



SLC22A5 in rat brain.

SELECTED EXPERIENCE

MSc in Biology (Diploma cum laudae,) in biochemistry, 1976, University of Warsaw; PhD in Biology (Diploma cum laudae), 1982, Nencki Institute of Experimental Biology, PAS; Habilitation in biochemistry, 1993, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2001, Nencki Institute of Experimental Biology, PAS; Long-term stay (1982-85), University of Berne, Switzerland; Visiting professor (2002), Université d'Artois, France.
Prof. Nałęcz is the author or co-author of 86 research publications (H-index=19; WoS). For her work Prof. Nałęcz received the Polish Academy of Sciences award for exceptional scientific achievements. In 2003-2005 she was the President of the Polish Neuroscience Society.



HEAD
Katarzyna A. Nałęcz

SELECTED PUBLICATIONS

- Juraszek B, Nałęcz KA. (2020) SLC22A5 (OCTN2) Carnitine Transporter – indispensable for cell metabolism, a Jekyll and Hyde of human cance. Molecules 25,14; DOI:10.3390/molecules 25010014.
- Rogala-Koziarska K, Samluk Ł, Nałęcz KA. (2019) Amino acid transporter SLC6A14 depends on heat shock protein HSP90 in trafficking to the cell surface,BBA – Mol. Cell Res., 1866, 1544-1555, DOI: 10.1016/j.bbamcr.201908.009.
- Kovalchuk V, Samluk Ł, Juraszek B, Jurkiewicz-Trząska D, Sucic S, Freissmuth M, Nałęcz KA. (2019) Trafficking of the amino acid transporter B(0,+) (SLC6A14) to the plasma membrane involves an exclusive interaction with SEC24C for its exit from the endoplasmic reticulum. BBA – Mol. Cell Res., 1866, 252-263.
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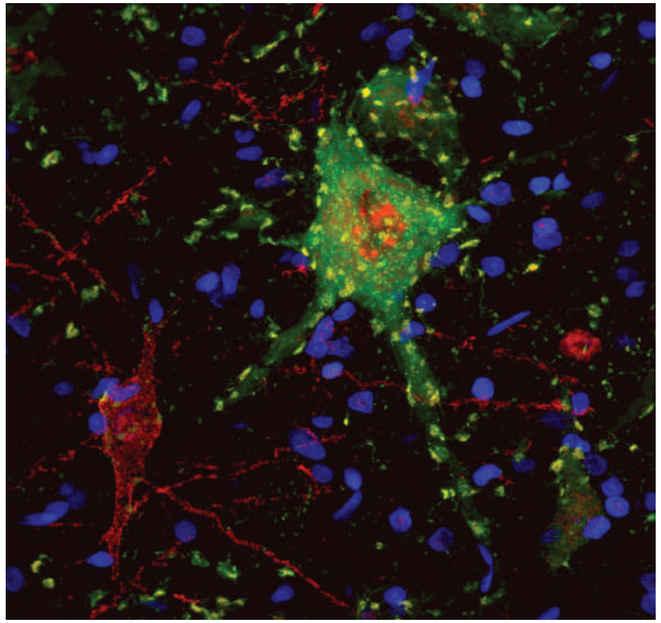
GROUP OF RESTORATIVE NEUROBIOLOGY

Our research concerns the elucidation of mechanisms involved in assembly, plasticity and function of neuronal circuits in control of motor behavior. Malfunctioning of motor circuits after spinal cord injury in adult rats and interventions promoting structural, molecular and functional recovery are investigated. Understanding the principles of motor neuron responses at central and peripheral synapses after injury and stimulation of motor circuits will be essential for future treatment.

Current studies focus on synaptology of excitatory and inhibitory afferents to functionally distinct motoneurons, in a context of spinal and muscular neurotrophic activity. Our assumptions are that selective regulation may approach functional demands and promote plastic changes underpinning maintenance of connections and functional recovery. We use locomotor exercise, electrical stimulation of the peripheral nerves and intraspinal or intramuscular administration of AAV-carried transgenes to modulate neurotrophin expression after spinal cord injury. Transfer of the genes encoding neurotrophin TrkB receptors and mutated muscarinic receptors (DREADD) is used to verify to which extent experimental manipulation of motoneuron receptivity may result in functional output. Contribution and rearrangements of extracellular matrix proteoglycans and postsynaptic receptors are also in focus.



Synaptic density shows how motoneurons listen and talk

Spinal cord motoneuron receives and responds to multiple excitatory and inhibitory inputs. Here cholinergic terminals under studies (green) and GABAergic receptors on motoneurons and non-motoneuronal cells are labeled with immunofluorescence (confocal imaging). Green - Vesicular Acetylcholine Transporter; red – GABA receptor type A subunit alpha1; blue – nuclei.

HEAD
Małgorzata Skup

SELECTED EXPERIENCE

MSc in Biology, 1977, University of Warsaw; PhD in Biology, 1988, Nencki Institute of Experimental Biology, PAS; Postdoctoral trainee (1991-93), McGill University, Department of Pharmacology and Therapeutics, Montreal, Canada; Visiting scientist (1998) at NIPS in Okazaki, Japan; Habilitation, 2004, Nencki Institute; Full Professor of Biological Sciences, 2014, Nencki Institute; Head of the Department of Neurophysiology at the Nencki Institute (2014-2018).
Prof. Skup is the author or co-author of 73 research publications (H-index=17; WoS), and the author of two book chapters. Prof. Skup was a long-time member of the Executive Committee (2007-2019), and served as Vice-President (2009-2011) and President (2015-2017) of the Polish Neuroscience Society; a member of the Governing Council of Federation of European Neuroscience Societies (2015-2017). Prof. Skup is a member of the Warsaw Scientific Society and serves as President of the Committee of Neurobiology, PAS (2020-2023).

SELECTED PUBLICATIONS

- Wójcik-Gryciuk A, Gajewska-Woźniak O, Kordecka K, Boguszewski PM, Waleszczyk M, Skup M. (2020) Neuroprotection of Retinal Ganglion Cells with AAV2-BDNF Pretreatment Restoring Normal TrkB Receptor Protein Levels in Glaucoma. Int. J. Mol. Sci. 21(17): 6262.
- Grycz K, Głowacka A, Ji B, Czarkowska-Bauch J, Gajewska-Wozniak O, Skup M. (2019) Early pre- and postsynaptic decrease in glutamatergic and cholinergic signaling after spinalization is not modified when stimulating proprioceptive input to the ankle extensor alpha-motoneurons: Anatomical and neurochemical study. PLOS ONE 14(9):e022849.
- Płatek R, Grycz K, Więckowska A, Czarkowska-Bauch J, Skup M. (2019) L1 cell adhesion molecule overexpression down regulates phosphacan and up regulates structural plasticity-related genes rostral and caudal to the complete spinal cord transection. J. Neurotrauma 37(3): 534-554.
- Więckowska A, Gajewska-Wozniak O, Głowacka A, Ji B, Czarkowska-Bauch J, Skup M. (2018) Spinalization and locomotor training differentially affect muscarinic acetylcholine receptor type 2 abutting on alpha-motoneurons innervating the ankle extensor and flexor muscles. J. Neurochem. 147(3): 361-379.
- Gajewska-Wozniak O, Grycz K, Czarkowska-Bauch J, Skup M. (2016) Electrical Stimulation of Low-Threshold Proprioceptive Fibers in the Adult Rat Increases Density of Glutamatergic and Cholinergic Terminals on Ankle Extensor alpha-Motoneurons. PLOS ONE 11(8):e0161614.

CENTER FOR NEURAL PLASTICITY AND BRAIN DISORDERS, **BRAINCITY**

Comprises of 5 research laboratories and is created as the International Research Agenda under the partnership of the European Molecular Biology Laboratory (EMBL).

The key aims of BRAINCITY are to advance scientific understanding of the mechanisms of brain disease and thus identify critical target genes and molecules; to find biomarkers for better diagnosis, prediction and monitoring of disease; and to develop novel therapeutic approaches targeting abnormal genes and proteins, as well as neuronal network deficiencies.

EMBL partnership provides active support, offering complementary knowledge in neuroscience; institutional expertise; training and management approaches; and technology transfer best practices.

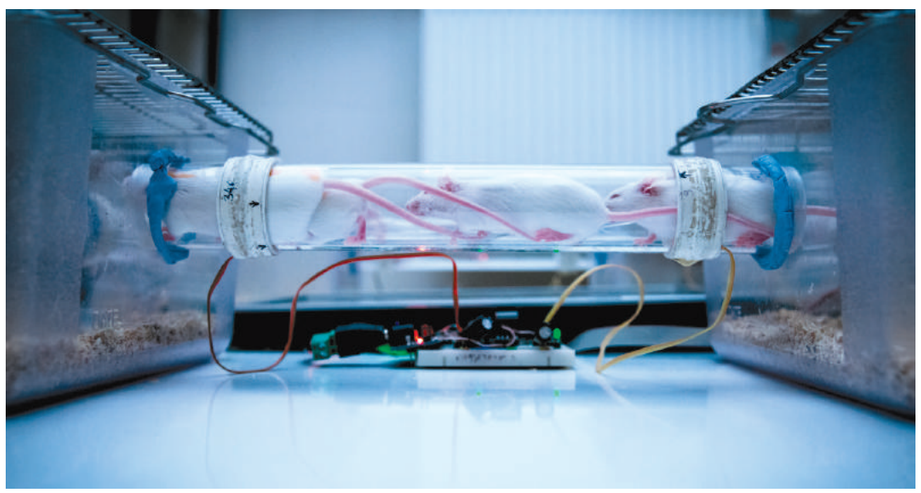
LABORATORY OF EMOTIONS NEUROBIOLOGY

Understanding how the brain controls social life is one of the most fascinating quests of neuroscience. Although social interactions among individuals are central to most animals, including humans, we are only beginning to understand the underlying neural processes. To study mechanisms of social interactions at the level of neural circuits and cells we need simple animal models. The search for the ultimate neural correlates of social processes is very much in its infancy, but the recent development of relevant rat and mouse behavioral models combined with optogenetic, electrophysiological, and imaging techniques has accelerated the rate of discovery.

THE TWO MAIN QUESTIONS OUR RESEARCH IS FOCUSED ON ARE

- Are the neural circuits underlying positive and negative social emotions distinct?
- Are there neural circuits specialized in social emotions?

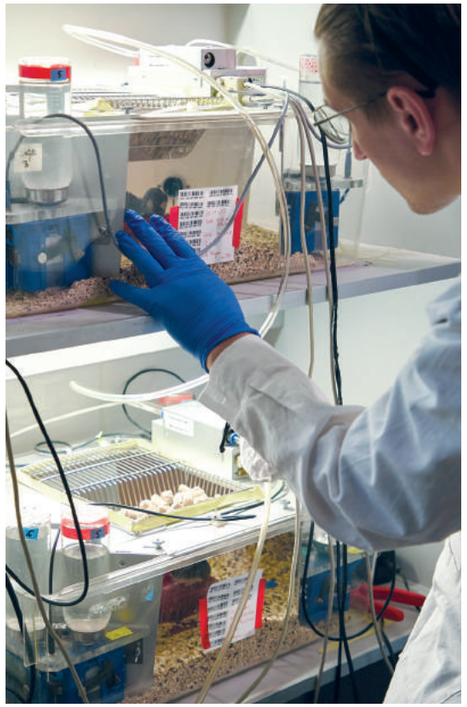
Malfunctioning neural circuits governing social interactions are responsible for a number of neuropsychiatric disorders, including autism spectrum disorder and psychopathy. Our research focuses on the brain circuits and cellular mechanisms underlying impaired social interactions. We are trying to test the possibilities for therapeutic intervention in mouse genetic and idiopathic models of autism spectrum disorder. Using state-of-the-art automatic systems for assessing social behavior and neurobiological tools we would like to explain why some individuals are more likely to suffer from autism than others.



Group of mice jointly exploring the Eco-HAB territory.

SELECTED EXPERIENCE

MSc in Biology, 2001, University of Warsaw; PhD in Biology, 2006, Nencki Institute of Experimental Biology, PAS; Habilitation, 2013, Nencki Institute of Experimental Biology, PAS; research training at the University of Zurich, Switzerland, 2004; Postdoctoral Research Training (2006-08), University of Michigan, USA.
Prof. Knapska is the author or co-author of 50 research publications and 1 patent (H-index=20; WoS). She is an ERC Starting Grant laureate (2016). For her work she received a Young Investigator Award of Polish Neuroscience Society (2005), the Polish Prime Minister Awards for the PhD Thesis (2007) and Habilitation (2014). Prof. Knapska is a member of the European Brain and Behaviour Society Committee (2014), AcademiaNet (2015) and Dana Alliance for Brain Initiatives (2016).



HEAD
Ewelina Knapska

SELECTED PUBLICATIONS

- Olsson A, Knapska E, Lindström B. (2020) The neural and computational systems of social learning. Nat. Rev. Neurosci. 21(4): 197-212.
- Meyza KZ, Bartal IB, Monfils MH, Panksepp JB, Knapska E. (2017) The roots of empathy: Through the lens of rodent models. Neurosci. Biobehav. Rev. 76(Pt B): 216-234.
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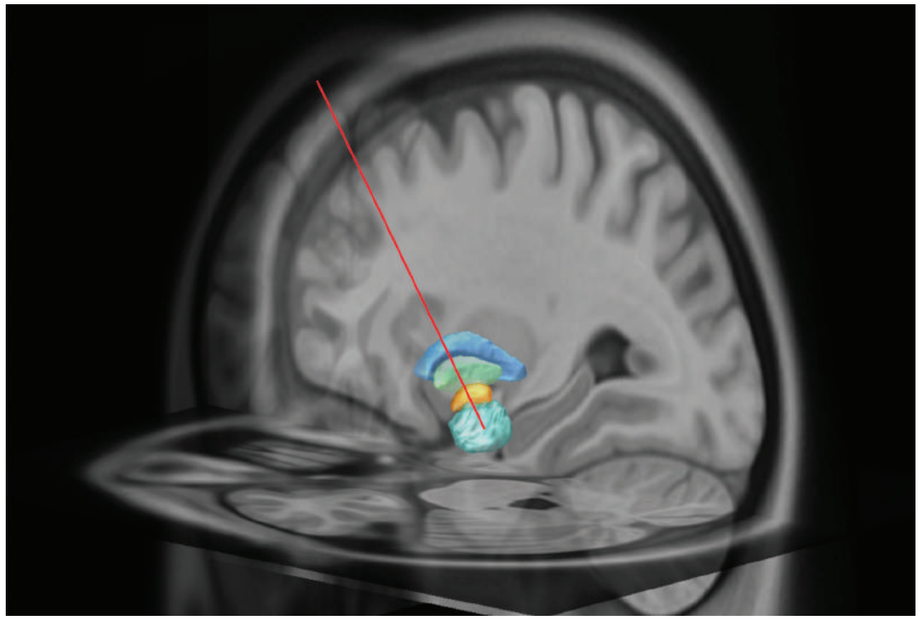
- Knapska E, Lioudyno V, Kiryk A, Mikosz M, Gorkiewicz T, Michaluk P, Gawlak M, Chaturvedi M, Mochol G, Balcerzyk M, Wojcik DK, Wilczynski GM, Kaczmarek L. (2013) Reward learning requires activity of matrix metalloproteinase-9 in the central amygdala. J Neurosci. 33(36): 14591-14600.
- Knapska E, Macias M, Mikosz M, Nowak A, Owczarek D, Wawrzyniak M, Pieprzyk M, Cymerman IA, Werka T, Sheng M, Maren S, Jaworski J, Kaczmarek L. (2012) Functional anatomy of neural circuits regulating fear and extinction. Proc Natl Acad Sci US A. 109(42): 17093-17098.

LABORATORY OF NEUROPHYSIOLOGY OF MIND

RESEARCH PROFILE

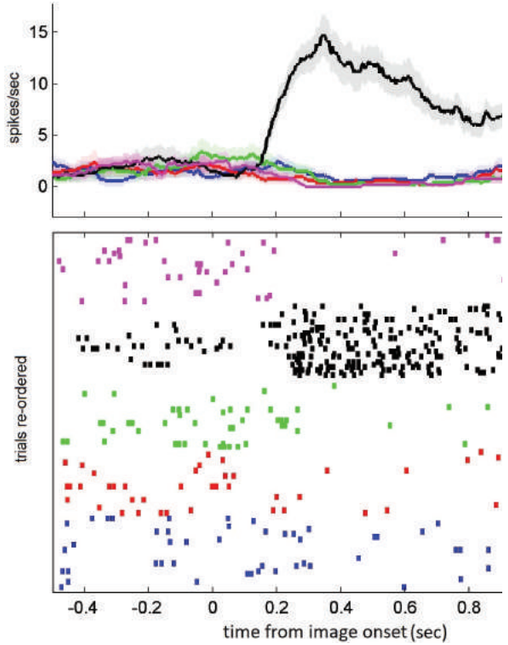
Neurons are fundamental – structural and functional – blocks of the brain. Because of that our progress in understanding brain mechanisms stems from studying activity of these specialized cells. Unfortunately, possibilities to record activity of human neurons are extremely limited. This is a significant obstacle to our quest for understanding neuronal mechanisms underlying cognitive processes unique to humans. In the laboratory we utilize a rare opportunity to record a single-neuron activity during surgical procedures when a direct access to the human brain is necessary for treatment. Those opportunities include implantations of Deep Brain Stimulation electrode in Parkinson's subjects or invasive Epilepsy monitoring. We focus our work on higher cognitive functions, especially Working Memory that constitutes the basis of our mind. To fully understand interactions of recorded neuronal populations we use advanced computational techniques like machine learning or neuronal networks' modeling. Finally, our intracranial research is always performed on subjects who need treatment, so we also test how brain pathologies impact cognition and cells' activity with the hope to create more effective treatments.



Trajectory of Deep Brain Stimulation electrode used for treatment of patients with Parkinson's disease. It is possible to record a single-neuron activity along of this trajectory. Image shows localization of nuclei in Basal Ganglia. From the top: External Globus Pallidus, Internal Globus Pallidus, Subthalamic Nucleus and Substantia Nigra.

SELECTED EXPERIENCE

MSc in Psychology, 2007, University SWPS; PhD in Biology, 2012, Nencki Institute of Experimental Biology; Postdoctoral Fellow (2012-2018), Cedars-Sinai Medical Center and California Institute of Technology; Project Scientist (2018-2020) Cedars-Sinai Medical Center.
Author or co-author of 30 research publications (H-index=10, WoS) and Member of the Society of Neuroscience since 2010. For his work he received 2012 and 2011 START scholarship founded by Foundation for Polish Science; 2012 and 2010: Federation of European Neuroscience Societies travel grant; 2009: European Brain and Behavior Society Rhodes Young Investigator Award.



Activity of neuron recorded in human amygdala during encoding of images to working memory. In the bottom panel each line represents one trial and each dot represents one action potential. Colors denote prestation of different images. Upper panel shows average activity for each image.

HEAD
Jan Kamiński

SELECTED PUBLICATIONS

- Kamiński J, Rutishauser U. (2020) Between persistently active and activity-silent frameworks: novel vistas on the cellular basis of working memory. Annals of the New York Academy of Sciences, 1464(1):64–75.
- Kamiński J, Brzezicka A, Mamelak AN, Rutishauser U. (2020) Combined Phase-Rate Coding by Persistently Active Neurons as a Mechanism for Maintaining Multiple Items in Working Memory in Humans. Neuron, 106(2):256-264.e3.
- Kamiński J, Mamelak AN, Birch K, Mosher CP, Tagliati M, Rutishauser U. (2018) Novelty-Sensitive Dopaminergic Neurons in the Human Substantia Nigra Predict Success of Declarative Memory Formation. Current Biology, 28(9):1333-1343.e4.
- Kamiński J. (2017) Intermediate-Term Memory as a Bridge between Working and Long-Term Memory. The Journal of Neuroscience, 37(20):5045–5047.
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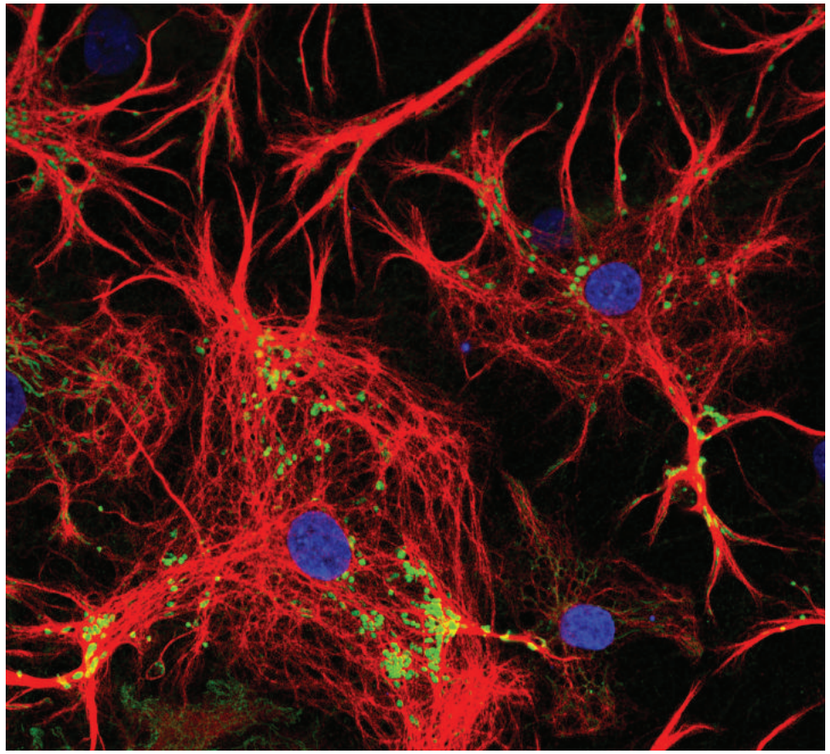
LABORATORY OF NEUROBIOLOGY

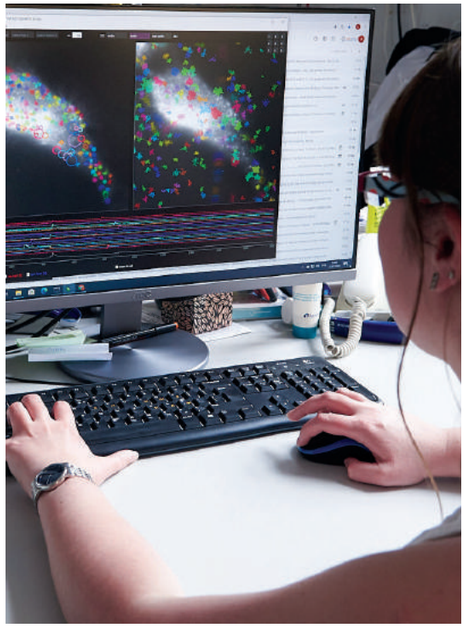
Our research aim is to understand brain-mind connection. We believe that it is possible to localize specific mind functions into the brain and then reveal their molecular and cellular underpinnings. The window to understand the mind is learning and memory that can be successfully studied in animals. At the molecular and cellular levels, synaptic plasticity provides plausible explanations for those phenomena. Over thirty years ago, together with H.J. Matthies and his colleagues from Magdeburg and simultaneously with K.V. Anokhin and his coworkers in Moscow, we have discovered gene expression in the mammalian brain in learning. The first such gene was *c-fos*, encoding a component of transcription factor AP-1. This led us to identify such c-Fos/AP-1 target genes in activated neurons as TIMP-1 (tissue inhibitor of matrix metalloproteinases) and MMP-9 (matrix metalloproteinase). Over the last twenty years we have demonstrated that MMP-9 is produced and released at the excitatory synapses in response to enhanced neuronal activity to play a major role in the synaptic plasticity, learning and memory as well as in neuropsychiatric disorders, including epilepsy, addiction, schizophrenia and autistic conditions.



Expression of lipocalin-2 protein in cultured astrocytes 6 h after lipopolysaccharide treatment. Confocal image of rat primary hippocampal cell culture immunostained for astrocytic marker GFAP (red) and lcn-2 (green). Cell nuclei were stained with DAPI (blue).

SELECTED EXPERIENCE

PhD, 1983, Nencki Institute; Habilitation, 1988, Hirszfeld Institute, Wroclaw; Full Professor of Biological Sciences, 1996; Postdoc: Temple Univ. Philadelphia, USA (1984-1986); Visiting Professor: University of Catania, Italy; McGill Univ. Montreal, Canada, UCLA, Los Angeles, USA, Institute for Photonic Sciences, Castelldefels, Spain, Chair of the Division for Biological Sciences PAS (2003-07); Dean of the Division for Biological and Agricultural Sciences PAS (2015-18); President BRAINCITY, Center of Excellence for Neural Plasticity and Brain Disorders (2019-present).
Prof. Kaczmarek is the author or co-author of over 250 research publications (cited > 10 000 times; H-index > 60; WoS) and 4 patents. Prof. Kaczmarek received numerous awards, including the Foundation for Polish Science Prize, 2000 and the Prime Minister Award for the lifetime achievements in science, 2011.



HEAD
Leszek Kaczmarek

SELECTED PUBLICATIONS

- Salamian A, Legutko D, Nowicka K, Badyra B, Kaźmierska-Grębowska P, Caban B, Kowalczyk T, Kaczmarek L, Beroun A. (2021) Inhibition of matrix metalloproteinase 9 activity promotes synaptogenesis in the hippocampus. Cerebral Cortex, in press.
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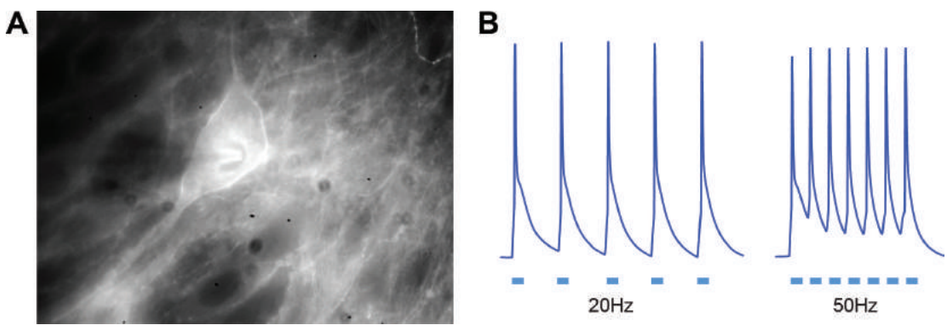
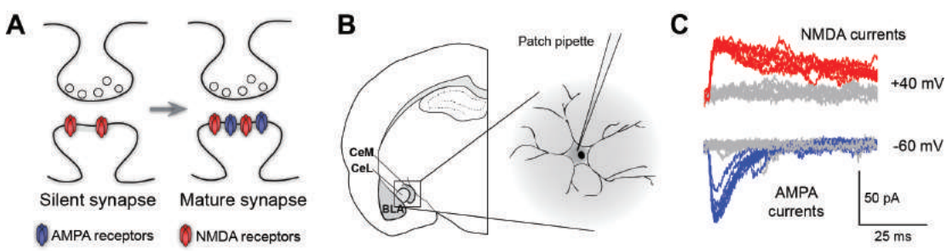
- Lepeta K, Purzycka K, Pachulska-Wieczorek K, Mitjans M, Begemann M, Vafadari B, Bijata K, Adamiak R, Ehrenreich H, Dziembowska M, Kaczmarek L. (2017) A normal genetic variation modulates synaptic MMP-9 protein levels and the severity of schizophrenia symptoms. EMBO Molecular Medicine, 9: 1100-1116.
- Stefaniuk M, Beroun A, Lebitko T, Markina O, Leski S, Meyza K, Grzywacz A, Samochowiec J, Samochowiec A, Radwanska K, Kaczmarek L. (2017) Matrix metalloproteinase-9 and synaptic plasticity in the central amygdala in control of alcohol seeking behavior. Biological Psychiatry, 81: 907–917.

LABORATORY OF NEURONAL PLASTICITY

One of the brain's most unique features is its ability to constantly change and adapt to its environment. The capacity to create or lose connections and strengthen or weaken them in response to the surrounding world is the cellular basis of learning. During the development, when brain circuits rapidly rewire, one of the cellular mechanisms of the increased capacity to learn is the existence of silent synapses. These are immature connections that do not participate in basal synaptic transmission (hence the term "silent") but are easily recruited during learning processes. Thus, silent synapses are the substrates for enhanced learning. Yet, their function does not end in early life. Our research on cocaine addiction shows that silent synapses transiently reappear during addiction-related learning, which is considered as a pathological, extremely durable form of memory. We showed that these synapses are likely to be newly formed synaptic contacts that later, during drug withdrawal, become fully functional connections and contribute to the development of addiction-related behaviours. Our findings, therefore, prove that the brain preserves the ability to silence and unsilence synapses throughout adulthood but the mechanisms that drive the formation of silent synapses in various forms of learning is yet to be explained. Our research aims to bridge the knowledge gap between the phenomenon of silent synapse existence in adult brains and their actual function in learning and memory.



(A) A ChR2-expressing neuron patched with a glass pipette. (B) Blue light illumination triggers action potentials.

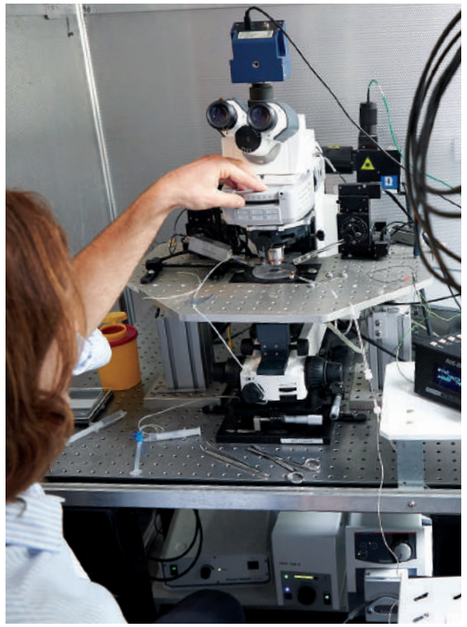


(A) A silent synapse synapse is an excitatory connection that possesses NMDA receptors but lacks AMPA receptors. As it matures, it acquires functional AMPA receptors. (B) Silent synapses content can be measured using patch-clamp electrophysiology on acute brain slices. (C) To measure the percentage of silent synapses at any given neuron, synaptic currents from AMPA and NMDA receptors are compared.

SELECTED EXPERIENCE

MSc, 2008, Jagiellonian University, Cracow; PhD, 2012, University of Goettingen, Germany; Post-doc (2012-13) European Neuroscience Institute, Goettingen, Germany and (2013-2020), Nencki Institute of Experimental Biology, PAS.
Dr Beroun is the author or co-author of 16 research publications (H-index=10; WoS). In 2015 Dr Beroun was granted a START Fellowship for young excellent researchers by the Foundation for Polish Science. Dr Anna Beroun in 2018 and 2019 received the Jerzy Konorski Awards for the best research work in neurobiology conducted in Poland.

Electrophysiology allows access to neuron's every synapse



HEAD
Anna Beroun

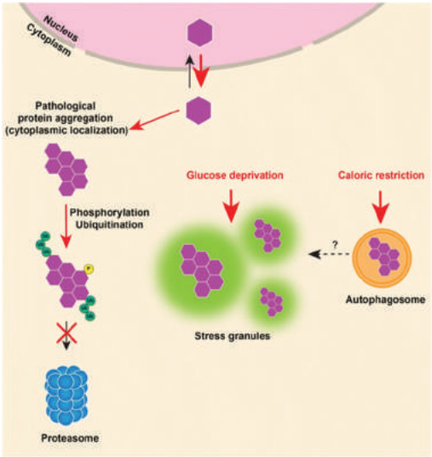
SELECTED PUBLICATIONS

- Beroun A, Nalberczak-Skóra M, Harda Z, Piechota, M Ziółkowska, M Cały, A, Pagano R, Radwanska K. (2018) Generation of silent synapses in dentate gyrus correlates with development of alcohol addiction. Neuropsychopharmacol. 43: 1989-1999.
- Shukla A, Beroun A, Panopoulou M, Neumann PA, Grant SG, Olive MF, Dong Y, Schlüter OM. (2017) Calcium-permeable AMPA receptors and silent synapses in cocaine-induced place preference. EMBO J. 36: 458-474.
- Stefaniuk M, Beroun A, Lebitko T, Markina O, Leski S, Meyza K, Grzywacz A, Samochowiec J, Samochowiec A, Radwanska K, Kaczmarek L. (2017) Matrix metalloproteinase-9 and synaptic plasticity in the central amygdala in control of alcohol-seeking behavior. Biol. Psychiatry 81: 907-917.
- Suska (Beroun) A, Lee BR, Huang YH, Dong Y, Schlüter OM. (2013) Selective presynaptic enhancement of the prefrontal cortex to nucleus accumbens pathway by cocaine. PNAS. 110: 713-718.
- Lee BR, Ma YY, Huang YH, Wang X, Otaka M, Ishikawa M, Neumann PA, Graziane NM, Brown TE, Suska (Beroun) A, Guo C, Lobo MK, Sesack SR, Wolf ME, Nestler EJ, Shaham Y, Schlüter OM, Dong Y. (2013) Maturation of silent synapses in amygdala-accumbens projection contributes to incubation of cocaine craving. Nat. Neurosci. 16: 1644-1651.

LABORATORY FOR TRANSLATIONAL RESEARCH IN NEUROPSYCHIATRIC DISORDERS (TREND)

Laboratory of Translational Research in Neuropsychiatric Disorders (TEND) has an over-arching focus on the interplay between epigenetic and metabolic factors in pathogenesis and inheritance of neuropsychiatric disorders. TREND lab is lead by Dr. Ali Jawaid, MD-PhD who is a physician-scientist with training in both clinical and basic neuroscience (clinical research training from Baylor College of Medicine, USA; and MD-PhD in Neuroscience from University of Zurich, Switzerland) with over 70 pubmed publications, five book chapters, and a current H-index of 20.

TREND lab aims to investigate the activation of epigenetic and metabolic cascades in response to early life trauma and their role in adulthood psychopathology, as well as, epigenetic intergenerational transmission of brain pathologies. Another aim is to investigate how changes in brain microRNAs lead to abnormal impairment and enhancement of memories in dementia and PTSD respectively. A final aim is to ascertain the epigenetic and / or metabolic factors that can counter pathological aggregation of proteins in certain neurodegenerative disorders, such as amyotrophic lateral sclerosis (ALS) and frontotemporal lobar degeneration (FTLD), as well as, their down-stream toxicity. These projects lie at the intriguing interface of neuroscience, epigenetics, metabolism, and involve state-of-the-art investigations in immortalised cell lines, neural stem cells, 3D cultures, brain organoids, rodent models, and human cohorts.



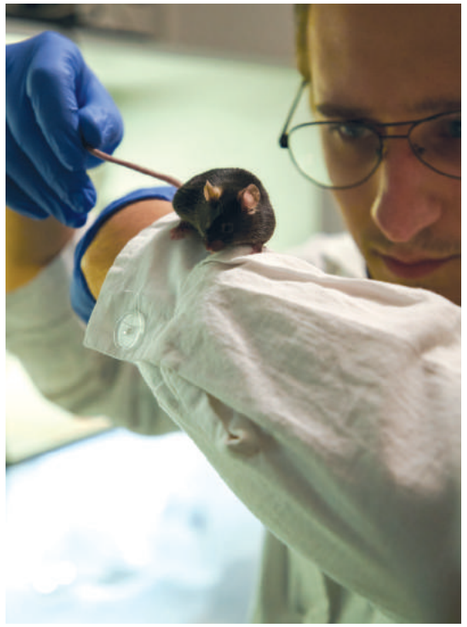
Understanding origins and eliciting novel treatments for neuropsychiatric and neurodegenerative disorders

Working model of how metabolic processes may contribute to abnormal TDP-43 aggregation in ALS/FTD.
TDP-43 is primarily a nuclear protein that mislocalizes to the cytoplasm of neurons in pathological conditions, such as ALS/ FTD, where it undergoes phosphorylation and ubiquitination and forms cytoplasmic aggregates. Glucose starvation contributes to the formation of TDP-43 aggregates by inducing the formation of stress granules. These stress granules might serve as precursors to TDP-43 inclusions. Similarly, caloric restriction can contribute to TDP-43 aggregation by triggering auto-phagosomes formation, which might serve as another site for TDP-43 aggregation.

HEAD
Ali Jawaid

SELECTED EXPERIENCE

MBBS / MD (medical doctorate), 2007, Aga Khan University (Pakistan); Clinical research post-doctoral fellowship in Neuropsychiatry, 2010, Baylor College of Medicine, TX, USA; PhD – Dual doctoral degrees awarded in Neuroscience and MD-PhD (2016), University of Zurich, Switzerland; Basic research post-doctoral fellowship in Neuroepigenetics (2019), ETH Zurich, Switzerland, Senior scientist/junior group leader (2020), University of Zurich (Switzerland).
Dr Ali Jawaid (H-index=20; WoS) has published in top-tier scientific journals, has been a TEDx speaker and has received numerous awards and recognitions. His research has been featured in Science magazine, Sciencedaily, BBC, Le Figaro, and Psychology Today. He chaired European MD-PhD association between 2016 and 2018 and currently serves on the advisory board of multiple research and humanitarian organizations.



SELECTED PUBLICATIONS

- Jawaid A. (2020) Protecting older adults during social distancing. Science; 386:6487.
- Jawaid A, Woldemichael BT, Kremer EA, Gaur N, LaFerriere F, Polymenidou M, Mansuy IM. (2018) Memory decline and its reversal in aging and neurodegeneration involve miR-183/96/182 biogenesis. Molecular Neurobiology; 56:3451-62.
- Paolicelli R, Jawaid A, Valeri A, Henstridge C, Merlini M, Robsinson JL, Lee EB, Appel S, Spires-Jones T, Lee VM, Trojanowski JQ, Schulz PE, Rajendran L. (2017) Increased microglial phagocytosis regulates enhanced amyloid clearance and synaptic pruning through TDP-43. Neuron; 95:297-308.
- Jawaid A, Woldemichael BT, Kremer EA, Gaur N, Krol J, March is A, Mansuy IM. (2016) The microRNAs cluster miR-183/96/182 contributes to long-term memory in a protein phosphatase 1-dependent manner. Nature Communications; 7:12594.
- Gapp K, Jawaid A, Sarkies P, Bohacek J, Pelczar P, Prados J, Farinelli, Miska E, Mansuy IM. (2014) Implication of sperm RNAs in transgenerational inheritance of the effects of early trauma in mice. Nature Neuroscience; 17:667-9.

CORE FACILITY LABORATORIES

NEUROBIOLOGY CENTER

The Neurobiology Center gathers 10 core facility laboratories, offering internal and external users high-class the state-of-the-art research equipment and expertise required to conduct advanced investigations within neurobiology, molecular biology and biological imaging at various levels of the organization. It also offers a wide range of services including preclinical research, genetic engineering services and transgenic animal production aimed at introducing innovative diagnostic methods and modern therapies to the market.

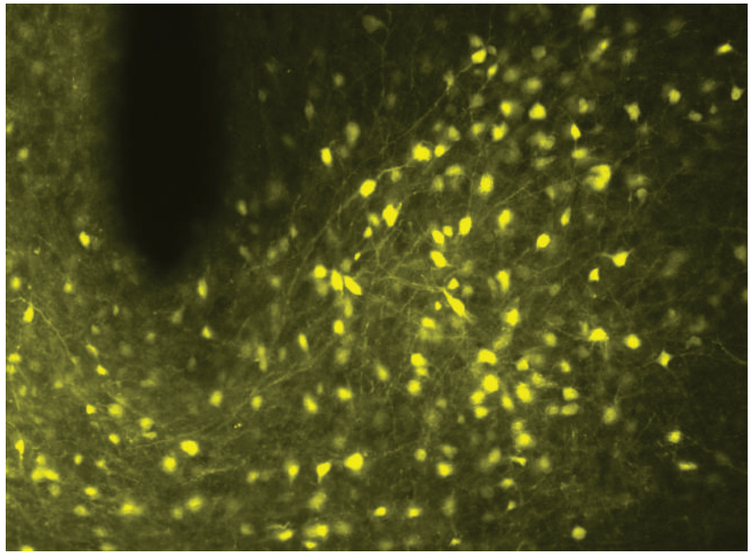
The aim of the Neurobiology Center is to speed up innovation and accelerate the translation of basic discoveries through the cooperation with industrial entities to bring novel products to the pharmaceutical, biomedical and biotechnological market.

LABORATORY OF ANIMAL MODELS

The Laboratory of Animal Models focuses on generation and analysis of animal models (mouse and rat). Our main goal is to determine the effects of genetic modifications on cognitive functions, behaviour and metabolism. We are using conventional global transgenes as well targeted mutations by Cre / lox system or CRISPR. The laboratory is well equipped with instruments necessary for the production of genetically modified animals. In addition, the laboratory serves as a "core-facility" providing services for the production of genetically modified animals, cryopreservation of sperm and embryos and viral vector technology (AAV and LV).

CURRENT PROJECTS

- A role of microRNAs and Pten protein in synaptic plasticity in neurons involved in the formation of memory trace.
- Metabolic characterization of Dicer / CaMKCreERT2 hyperphagic obesity model.
- Identity of cell subpopulation in the hypothalamus crucial for development of the obesity phenotype following microRNA loss in the forebrain of transgenic mutants.
- c-fos in the arcuate nucleus during fasting.
- microRNAs induced in white adipose tissue during calorie restriction and their impact on motivation of animals to food seeking.
- A function of microRNAs in thermogenesis in brown adipose tissue in mice.
- Role of CREB transcription factor in spatial memory formation.
- Role of TDP-43 protein in development of FTLD and ALS neurodegenerative diseases.
- PML nuclear protein manipulation in neurons – overexpression and knock-out models.



Fluorescently labeled neurons in the arcuate nucleus of the hypothalamus.

SELECTED EXPERIENCE

MSc, Faculty of Biology and Environmental Protection, 2000, University of Silesia, Katowice, Poland; PhD in Biology, 2006, Nencki Institute of Experimental Biology, PAS; Fellow in Laboratory of Stress Cellular Genes, Department of Tumour Biology, Institute of Oncology, Gliwice, Poland, 2000; Postdoctoral Fellow Molecular Biology of the Cell I, German Cancer Research Center (DKFZ),Heidelberg, Germany (2006-12); Deputy Director, Nencki Institute of Experimental Biology, PAS (2014-18).
Dr Witold Konopka is the author or co-author of 23 research publications and 1 patent (H-index=11; WoS).

HEAD
Witold Konopka

SELECTED PUBLICATIONS

- Kiryk A, Janusz A, Zglinicki B, Turkes E, Knapska E, Konopka W, Lipp HP, Kaczmarek L. (2020) IntelliCage as a tool for measuring mouse behavior – 20 years perspective. Behav Brain Res. 388:112620.
- Koza P, Przybyś J, Klejman A, Olech-Kochańczyk G, Konopka W. (2020) Generation of transgenic rats using a lentiviral vector approach. JoVE. 2020 May 17;(159).
- Aklan I, Sayar Atasoy N, Yavuz Y, Ates T, Coban I, Koksalar F, Filiz G, Topcu IC, Oncul M, Dilsiz P, Cebecioglu U, Alp MI, Yilmaz B, Davis DR, Hajdukiewicz K, Saito K, Konopka W, Cui H, Atasoy D. (2019) NTS Catecholamine Neurons Mediate Hypoglycemic Hunger via Medial Hypothalamic Feeding Pathways. Cell Metab. 31(2):313-326.e5.
- Koza P, Beroun A, Konopka A, Górkiewicz T, Bijoch L, Torres JC, Bulska E, Knapska E, Kaczmarek L, Konopka W. (2019) Neuronal TDP-43 depletion affects activity-dependent plasticity. Neurobiol Dis. 130:104499.
- Vinnikov IA, Hajdukiewicz K, Reymann J, Beneke J, Czajkowski R, Roth LC, Novak M, Roller A, Dörner N, Starkuviene V, Theis FJ, Erfle H, Schütz G, Grinevich V, Konopka W. (2014) Hypothalamic miR-103 protects from hyperphagic obesity in mice. J Neurosci. 6;34(32):10659-74.

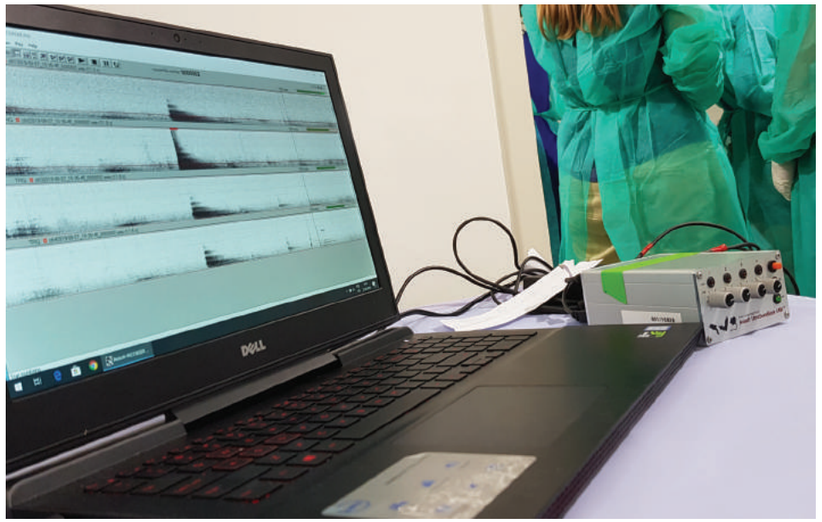
LABORATORY OF BEHAVIORAL METHODS

The overarching aim of the Laboratory of Behavioral Methods (LBM) is to provide high quality behavioral screening and testing service for the Nencki Institute as well as other scientists and companies. We focus primarily on animal models in modern biomedical sciences for the study of basic biological mechanisms and applied pharmacology research / drug development to use this knowledge to address problems in human health.

LBM has been equipped with a broad spectrum of equipment suitable for behavioral phenotyping:

- general activity screening
- sensory, motor and agility tests
- emotional level assessment
- learning and memory, including various spatial memory paradigms
- social interactions in pairs and groups
- complex cognitive tasks.

We employ modern automatic, computerized devices for non-invasive testing of animal cohorts like IntelliCages and Eco-HAB systems. To make our research reproducible and replicable video tracking and video analysis systems for common and customized tests are implemented (BehaView, Etho Vision, Deep lab cut). There is strong emphasis on the development of new paradigms, technologies and software solutions as well. Our service is a complex process – from planning experiments and manufacturing equipment through execution and finishing with advanced statistical data analysis and manuscript preparation.



PCB for new Eco-HAB system.

SELECTED EXPERIENCE

MSc in Biology, 1996, University of Warsaw; PhD in Biology, 2004, Nencki Institute of Experimental Biology; Postdoctoral Fellow (2005-08), Yale University, USA.
Dr Paweł Boguszewski is the author or co-author of 30 research publications (H-index=13; WoS) and Member of the European Brain and Behaviour Society and Member of the Federation of European Neuroscience Societies.

Large scale Eco-HAB system located in Mikołajki Station (Puścian, Knapska)

HEAD
Paweł M. Boguszewski

SELECTED PUBLICATIONS

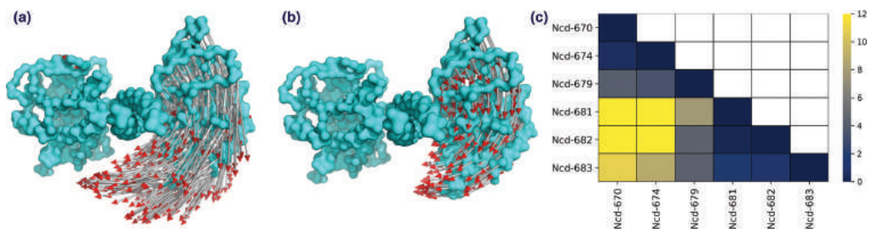
- Majewski L, Maciąg F, Boguszewski PM, Kuznicki J. (2020) Transgenic Mice Overexpressing Human STIM2 and ORAI1 in Neurons Exhibit Changes in Behavior and Calcium Homeostasis but Show No Signs of Neurodegeneration. Int J Mol Sci. 2020 Jan 28;21(3):842.
- Rojek KO, Krzemień J, Doleżyczek H, Boguszewski PM, Kaczmarek L, Konopka W, Rylski M, Jaworski J, Holmgren L, Prószyński TJ. (2019) Amot and Yap1 regulate neuronal dendritic tree complexity and locomotor coordination in mice. PLoS Biol. 2019 May 1;17(5):e3000253.
- Domin H, Przykaza Ł, Kozniewska E, Boguszewski PM, Śmiałowska M. (2018) Neuroprotective effect of the group III mGlu receptor agonist ACPT-I after ischemic stroke in rats with essential hypertension. Prog Neuropsychopharmacol Biol Psychiatry. 2018 Jun 8;84(Pt A):93-101.
- Puścian A, Łęski S, Kasprowicz G, Winiarski M, Borowska J, Nikolaev T, Boguszewski PM, Lipp HP, Knapska E. (2016) Eco-HAB as a fully automated and ecologically relevant assessment of social impairments in mouse models of autism. Elife. 2016 Oct 12;5:e19532.
- Hamed A, Daszczuk P, Kursa MB, Turzyńska D, Sobolewska A, Lehner M, Boguszewski PM, Szyndler J. (2016) Non-parametric analysis of neurochemical effects and Arc expression in amphetamine-induced 50-kHz ultrasonic vocalization. Behav Brain Res. 2016 Oct 1;312:174-85.

LABORATORY OF BIOINFORMATICS

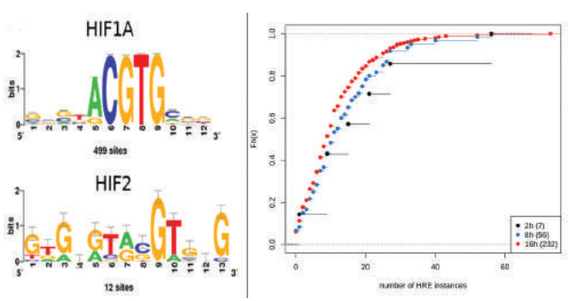
The mission of our laboratory is to provide world-class bioinformatics support to experimental groups at the Nencki Institute. The main form of our activity are collaborative projects with experimental groups, in which we are responsible for the bioinformatics part. In addition to this and often simultaneously, we pursue our own research interests, in the fields of regulatory genomics, machine learning, dynamic modeling and structural bioinformatics. Our long-term goal is to incorporate the information on the genomic sequence and chromatin epigenetic state (including 3D loop structure) into dynamic models of gene regulation at specific genomic loci.

RESEARCH ACTIVITIES

- Dynamic modeling of gene regulation in the cellular response to hypoxia.
- Coarse-grained molecular dynamics simulation of chromatin fiber at specific genomic loci.
- Sequence analysis of cis-regulatory regions interacting by formation of chromatin loops.
- Analysis of cis-regulatory landscape in classically and alternatively activated microglia.
- Bioinformatics identification of functional cis-regulatory mutations in cancer.
- Analysis of interactions of ABeta-42 with small peptides that block its toxicity.
- Molecular dynamics studies of mechanisms of motion generation by molecular motors.
- Design of inhibitors of the thymidylate biosynthesis cycle and of the human dihydrofolate reductase and thymidylate synthase complex.



Interactions between motor domains in kinesin-14 Ncd — a molecular dynamics study Motion along the first eigenvector from the PCA analysis for Ncd-682 (a) and Ncd-670 (b). Panel (c) presents similarities (in terms of the Kullback–Leibler divergence) of the projections along the first eigenvector (PC1) in the studied systems. Figure 4 from Biochem J. 476(17): 2449-2462 with the caption modified.



A higher HRE binding motif number is associated with an earlier response to hypoxia Left panel shows logos of HIF-1 and HIF-2 binding motifs (hypoxia response elements – HRE). Right panel presents cumulative distribution functions of counts of HREs per gene in groups of genes activated at 2, 8 and 16 h from the start of hypoxia. Numbers of genes in each group are given in brackets. Figure 6 A,B from FASEB J. 33(7): 7929-7941, with the caption modified.

SELECTED EXPERIENCE

MD, 1994, Medical University of Warsaw; PhD, Medical University of Warsaw, 1998, Habilitation in Biological Sciences, 2012, Nencki Institute of Experimental Biology, PAS; Physician, Specialist Hospital in Kościerzyna (1998-2000); Postdoc, Katholieke Universiteit Leuven, Belgium (2000-03), Associate professor, Nencki Institute of Experimental Biology, PAS, (2003-14).
Prof. Michał Dąbrowski is the author or co-author of 46 research publications (H-index=19; WoS). Prof. Dąbrowski is a Member of Science Infrastructure Management Society and Polish Bioinformatics Society.

All we have to decide is what to do with the time that is given to us

HEAD
Michał Dąbrowski

SELECTED PUBLICATIONS

- Przanowski P, Mondal SS, Cabaj A, Dębski KJ, Wojtas B, Gielniewski B, Kaza B, Kaminska B, Dabrowski M. (2019) Open chromatin landscape of rat microglia upon proinvasive or inflammatory polarization. Glia. 67(12): 2312-2328.
- Ludwiczak J, Szczęsna E, da Silva Neto AM, Cieplak P, Kasprzak AA, Jarmuła A. (2019) Interactions between motor domains in kinesin-14 Ncd – a molecular dynamics study. Biochem J. 476(17): 2449-2462.
- Bartoszewski R, Moszyńska A, Serocki M, Cabaj A, Polten A, Ochocka R, Dell'Italia L, Bartoszewska S, Króliczewski J, Dąbrowski M, Collawn JF. (2019) Primary endothelial cell-specific regulation of hypoxia-inducible factor (HIF)-1 and HIF-2 and their target gene expression profiles during hypoxia. FASEB J. 33(7): 7929-7941.
- Jarmula A, Łusakowska A, Fichna JP, Topolewska M, Macias A, Johnson K, Töpf A, Straub V, Rosiak E, Szczepaniak K, Dunin-Horkawicz S, Maruszak A, Kaminska AM, Redowicz MJ. (2019) ANO5 mutations in the Polish limb girdle muscular dystrophy patients: Effects on the protein structure. Sci Rep. 9(1): 11533.
- Mathiyalagan N, Miles LB, Anderson PJ, Wilanowski T, Grills BL, McDonald SJ, Keightley MC, Charzynska A, Dabrowski M, Dworkin S. (2019) Meta-Analysis of Grainyhead-Like Dependent Transcriptional Networks: A Roadmap for Identifying Novel Conserved Genetic Pathways. Genes (Basel). 10(11): 876.

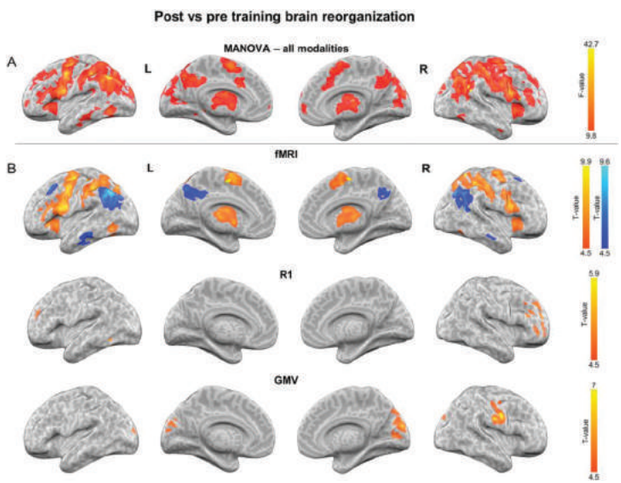
LABORATORY OF BRAIN IMAGING

Laboratory of Brain Imaging (LOBI) is a cognitive neuroscience laboratory conducting a broad range of neuroimaging and behavioral studies. See more www.lobi.nencki.edu.pl

MAIN SCIENTIFIC RESEARCH TOPICS AT LOBI ARE

- functional and structural brain plasticity in adult learning
- behavioral and neuronal mechanisms of self-regulation disorders, especially related to emotion regulation and learning on errors and punishments
- perceptual consciousness, including its neuronal mechanisms and relation with cognitive processes
- cognitive and affective neuroscience, associative memory, basic emotions
- psychology and neuroscience of climate change, understanding patterns of emotional responses to climate change and their relation to mental health and climate action taking
- databases of emotional stimuli (Nencki Affective Picture System, Nencki Affective Word List, Nencki Children Eyes Test, see www.lobi.nencki.edu.pl/research/behavioral)
- neuroimaging methodology.

LOBI is also a core facility at the Nencki Institute, providing access to cutting edge neuroimaging methods for internal and external researchers. The core technologies being developed and used at LOBI are magnetic resonance imaging (MRI), spectroscopy (MRS), electroencephalography (EEG – including EEG-fMRI simultaneous recordings), Transcranial Magnetic Stimulation (TMS), and computational image analysis.



Post (TP3) – vs pre-training (TP0) brain reorganization. A. Multivariate analysis of variance (MANOVA) results. Results show differences between TP0 and TP3 in all of the measured MRI modalities. B. Unimodal follow-up test. Upper panel: fMRI results of *experimental* > *control* contrast in the tactile lexical detection task. Middle panel: longitudinal relaxation rate (R1) results indicative of intracortical myelin changes. Lower panel: voxel-based morphometry indicating relative grey matter volume (GMV) increases. For unimodal analysis red-yellow colour maps indicate increases (post- > pre-training; TP3 > TP0) and blue-cyan colour maps indicate decreases (pre- > Post-training; TP0 > TP3). All maps are thresholded at $p < 0.05$, FWE (Family-Wise Error) corrected at the voxel level with an additional cluster extent threshold of 20 voxels. L = left hemisphere, R = right hemisphere.

SELECTED EXPERIENCE

MSc in Psychology, 2004, Department of Psychology, University of Warsaw; PhD in Biology, 2009, Nencki Institute of Experimental Biology, PAS; Post-doctoral training, Laboratoire de recherche en neuro-imagerie (LREN), Département des Neurosciences Cliniques – Centre hospitalier universitaire vaudois (CHUV), University of Lausanne, Switzerland, (2010-11); Mentoring Program, Foundation for Polish Science (2014-2015) – LREN, University of Lausanne, Switzerland.
Prof. Artur Marchewka is the author or co-author of 70 research publications (H-index=18; WoS). Board member of The European Society for Cognitive and Affective Neuroscience (ESCAN) (2014-2015). Scholarship for outstanding young scientists, Minister of Science and Higher Education (2013-2015).

*The **human brain** has the **amazing** ability to reorganize itself*

HEAD
Artur Marchewka

SELECTED PUBLICATIONS

- Matuszewski J, Kossowski B, Bola Ł, Banaszkiewicz A, Paplińska M, Gyger L, Kherif F, Szwed M, Frackowiak RS, Jednoróg K, Draganski B, Marchewka A. (2021) Brain plasticity dynamics during tactile Braille learning in sighted subjects: multi-contrast MRI approach. NeuroImage 227: 117613.
- Banaszkiewicz A, Matuszewski J, Bola Ł, Szczepanik M, Kossowski B, Rutkowski P, Szwed M, Emmorey K, Jednoróg K, Marchewka A. (2020) Multimodal imaging of brain reorganization in hearing late learners of sign language. Hum Brain Mapp. 1-14.
- Furtak M, Doradzińska Ł, Ptashynska A, Mudrik L, Nowicka A, Bola M. (2020) Automatic Attention Capture by Threatening, But Not by Semantically Incongruent Natural Scene Images. Cereb. Cortex. 30(7): 4158-4168.
- Gola M, Wordecha M, Sescousse G, Lew-Starowicz M, Kossowski B, Wypych M, Makeig S, Potenza MN, Marchewka A. (2017) Can pornography be addictive? An fMRI study of men seeking treatment for problematic pornography use. Neuropsychopharmacol Nature. 42: 2021-2031.
- Bola Ł, Zimmermann M, Mostowski P, Jednoróg K, Marchewka A, Rutkowski P, Szwed M. (2017) Task-specific reorganization of the auditory cortex in deaf humans. Proc. Natl. Acad. Sci. U.S.A. 114(4): E600-E609.

LABORATORY OF CYTOMETRY

CORE FACILITY ACTIVITIES

Our mission is to provide high quality service, expertise, instrumentation and technical assistance in flow cytometry, with dedicated help in experiment planning and design, fluorochrome selection, acquisition and data analysis for in-house and outside investigators from research, commercial and R&D institutions. We offer expertise in a broad range of flow cytometry applications, multiparameter / multicolor studies, unsupervised data analysis and advanced cell sorting. We are involved in basic science and innovative projects, development as well as organization of lectures, training and hands-on workshops. Also, we realize our own research program. To increase our know-how, provide educational opportunities and collaborate with experts we actively participate in the ISAC (International Society for Advancement of Cytometry) initiatives.
For more information see our website www.piwocka-lab.nencki.edu.pl

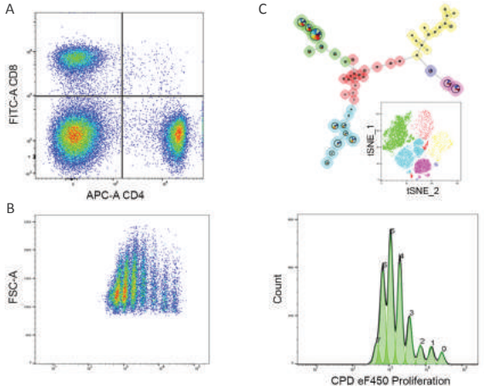
RESEARCH PROFILE

Our goal is to understand mechanisms promoting cancer progression and development of the resistance, to propose novel molecular targets and personalized therapeutic strategies to efficiently eradicate cancer cells. Among others, we focus on the Integrated Stress Response, DNA repair mechanisms as well as remodeling of the immune system. Our high priority is to understand the intercellular cross-talk between leukemic and surrounding cells, primarily of the leukemia micro-environment – the bone marrow stroma or immune system cells, and its role in disease progression and resistance.

Understand to cure

CURRENTLY WE INVESTIGATE

Role of Integrated Stress Response in leukemia, Non-classical mechanisms of BRCA1/2 deficiency in cancer and sensitivity to personalized therapies, The leukemia-bone marrow stroma interactions, Direct intercellular connections by tunneling nanotubes (TNTs), Leukemic extracellular vesicles and influence on immune system. Functionality of the immune system in patients recovering from COVID-19.



The cutting-edge cytometry helps

Flow cytometry analysis of CD4 (APC) and CD8 (FITC) surface receptors in lymphoid cells (A).
Proliferation analysis in lymphocytes (B) and FlowSOM unsupervised analysis of different subpopulation of leukemic cells (C).

SELECTED EXPERIENCE

MSc in Biology, 1994, Faculty of Biology, University of Warsaw; PhD in Biochemistry 2001, Nencki Institute of Experimental Biology, PAS; Habilitation in Biological Sciences, 2013, Nencki Institute of Experimental Biology, PAS; Post-doctoral Fellow, Development and Disease Laboratory, BioSciences Institute, University College Cork, Cork, Ireland (2003-04).
Prof. Katarzyna Piwocka is the author or co-author of 85 research publications (H-index=23; WoS) and Member of the International Society for Advancement of Cytometry and the Polish Biochemical Society. She serves as Member (2016-2018) and Co-chair (2018-2020) of the ISAC Marylou Ingram Scholars Program Committee.

HEAD
Katarzyna Piwocka

SELECTED PUBLICATIONS

- Le BV, Podszywalow-Bartnicka P, Maifrede S, Sullivan-Reed K, Nieborowska-Skorska M, Golovine K, Yao JC, Nejati R, Cai KQ, Caruso LB, Swatler J, Dabrowski M, Lian Z, Valent P, Paietta EM, Levine RL, Fernandez HF, Tallman MS, Litzow MR, Huang J, Challen GA, Link D, Tempera I, Wasik MA, Piwocka K, Skorski T. (2020) TGFβR-SMAD3 Signaling Induces Resistance to PARP Inhibitors in the Bone Marrow Microenvironment. Cell Rep. 2020 Oct 6;33(1):108221.
- Swatler J, Dudka W, Piwocka K. (2020) Isolation and Characterization of Extracellular Vesicles from Cell Culture Conditioned Medium for Immunological Studies. Curr Protoc Immunol. 129(1):e96.
- Swatler J, Dudka W, Bugajski L, Brewinska-Olchowik M, Kozlowska E, Piwocka K. (2019) Chronic myeloid leukemia-derived extracellular vesicles increase Foxp3 level and suppressive activity of thymic regulatory T cells. Eur J Immunol. 50(4):606-609.
- Kolba MD, Dudka W, Zaręba-Kozioł M, Kominek A, Ronchi P, Turos L, Chroscicki P, Wlodarczyk J, Schwab Y, Klejman A, Cysewski D, Srpan K, Davis DM, Piwocka K. (2019) Tunneling nanotube-mediated intercellular vesicle and protein transfer in the stroma-provided imatinib resistance in chronic myeloid leukemia cells. Cell Death Dis. 10(11):817.
- Podszywalow-Bartnicka P, Maifrede S, Le BV, Nieborowska-Skorska M, Piwocka K, Skorski T. (2019) PARP1 Inhibitor Eliminated Imatinib-Refractory Chronic Myeloid Leukemia Cells in Bone Marrow Microenvironment Conditions. Leuk Lymphoma. 60(1):262-264.

LABORATORY OF ELECTRON MICROSCOPY

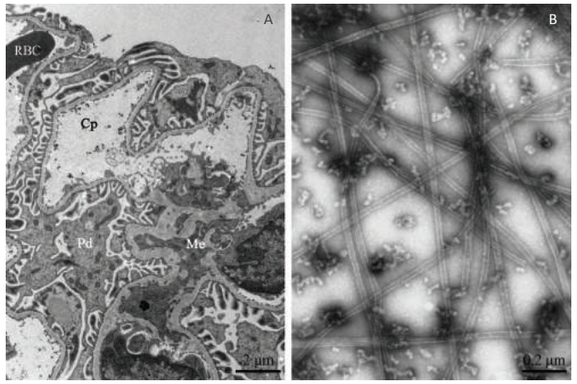
The goal of the Electron Microscopy Laboratory is to provide electron microscopy services to the Nencki Institute, along with other academic institutions and industrial partners. We provide expertise and assistance as well as project consultations in electron microscopy studies. Laboratory staff is experienced in imaging of macromolecular assemblies of proteins, ultrastructural analysis of cells and tissues, energy-dispersive X-ray microanalysis (EDX) and electron tomography. We also provide high quality sample preparation service, including sample processing, embedding, and ultrathin sectioning, which is essential to obtain uniqe information about the ultrastructure and composition of the specimen at the cellular to molecular level. Additionally, we use the immune-EM technique as a powerful tool for subcellular localization of molecules of interest. Based on our experience, we offer a full range of electron microscopy services from experiment planning to qualitative and quantitative ultrastructural analysis.

THE LABORATORY IS EQUIPPED WITH

- Transmission electron microscope JEOL JEM 1400 with energy-dispersive full range X-ray microanalysis system, tomographic holder and Camera MORADA G2;
- Leica ultramicrotom;
- Leica specimen trimming device EM TRIM2;
- Leica EM PACT2 with AFS2.

WE ALSO OFFER COMPLETE HISTOLOGY SERVICE

- specimen processing for cryostat sectioning;
- specimen processing and embedding for paraffin sectioning;
- histological staining: H&E, Nissl, Klüver, Timm, CO, AChE.

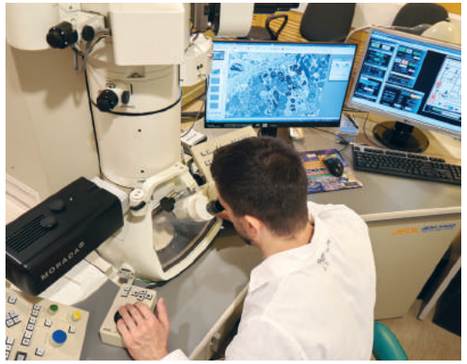


Cellular highways for molecular motors

A. Transmission electron microscopy micrograph of the glomeruli of rat kidney. Capillary network (Cp) with red blood cells (RBC), podocytes (Pd) and mesangial cells (Ms) are visible. (TEM studies for ALAB Bioscience were supported by grant DIALOG from the Ministry of Science and Higher Education).
B. Transmission electron microscopy micrograph of microtubules.

SELECTED EXPERIENCE

MSc in Pharmacy, 1995, Medical University of Warsaw; PhD in Biology, 2002, Nencki Institute of Experimental Biology, PAS. Research stay in the Institute of Molecular Biology, Austrian Academy of Science, Salzburg, Austria, 1995; 2016-present Assistant Professor, Nencki Institute of Experimental Biology, PAS; 2002-2016 Research Assistant, Nencki Institute of Experimental Biology, PAS; 1995-2000 Research Assistant, Nencki Institute of Experimental Biology, PAS.
Dr Hanna Nieznańska is the author or co-author of 20 research publications (H-index=11; WoS) and US patent No US10815292 for the invention: "Prion protein-dendrimer conjugates for use in treatment of Alzheimer disease".



HEAD
Hanna Nieznańska

SELECTED PUBLICATIONS

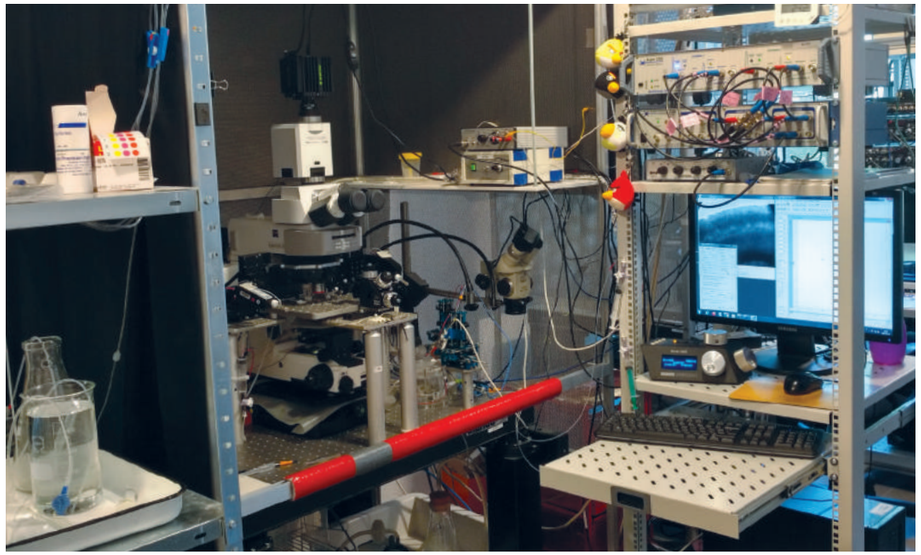
- Kravenska Y, Nieznanska H, Nieznanski K, Lukyanetz E, Szewczyk A, Koprowski P. (2020) The monomers, oligomers, and fibrils of amyloid-β inhibit the activity of mitoBKCa channels by a membrane-mediated mechanism. Biochim. Biophys. Acta Biomembr. 1862, 183337.
- Lipinski M, Muñoz-Viana R, Del Blanco B, Marquez-Galera A, Medrano-Relinque J, Caramés JM, Szczepankiewicz AA, Fernandez-Albert J, Navarrón CM, Olivares R, Wilczyński GM, Canals S, Lopez-Atalaya JP, Barco A. (2020) KAT3-dependent acetylation of cell type-specific genes maintains neuronal identity in the adult mouse brain. Nat Commun. 11(1):2588.
- Matuła K, Richter Ł, Janczuk-Richter M, Nogala W, Grzeszkowiak M, Peplińska B, Jurga S, Wyroba E, Suski S, Bilski H, Silesian A, Bluyssen HAR, Derebecka N, Wesoly J, Łoś J, Łoś M, Decewicz P, Dziewit Ł, Paczesny J and Holyst R. (2019) Phenotypic plasticity of Escherichia coli upon exposure to physical stress induced by ZnO nanorods. Scientific Reports Of The Nature Publishing Group, 9: 8575.
- Nieznanska H, Bandyszewska M, Surewicz K, Zajkowski T, Surewicz WK, Nieznanski K. (2018) Identification of prion protein-derived peptides of potential use in Alzheimer's disease therapy. Biochim. Biophys. Acta Mol. Basis. Dis. 1864, 2143-2153.
- Zajkowski T, Nieznanska H, Nieznanski K. (2015) Stabilization of microtubular cytoskeleton protects neurons from toxicity of N-terminal fragment of cytosolic prion protein. Biochim. Biophys. Acta, 1853, 2228–2239.

LABORATORY OF ELECTROPHYSIOLOGY

The aim of our research is to understand the mechanisms that govern the modulation of synaptic transmission in cortical microcircuits during different brain states, and we especially focus on studying the interplay between excitatory and inhibitory neurons in the somatosensory cortex of mice. Using electrophysiological recordings and optogenetic tools, we are able to study synaptic transmission at the functional level.

The aim of the core-facility lab is to provide the electrophysiological service of high standard for scientist at Nencki Institute and abroad. The lab possesses equipment for extracellular recordings and intrinsic signal imaging in vivo as well as a rig for in vitro single-cell recording. The lab offers the complex service in designing and performing experiments and analyzing data. Additionally, the lab provides the support during the process of manuscript and grant preparations.

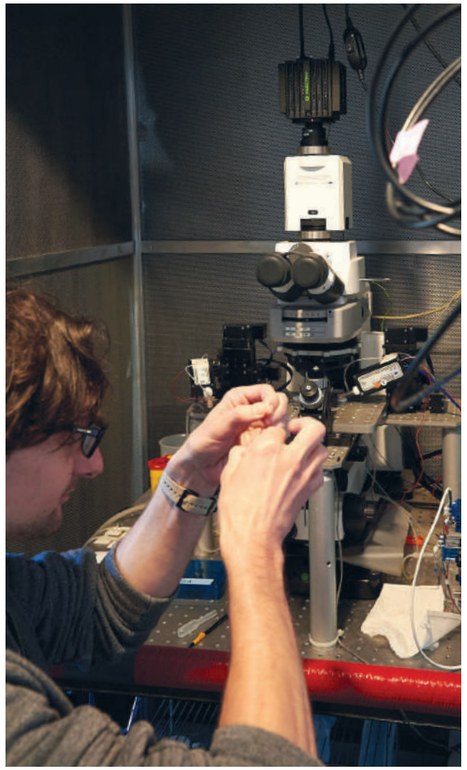
Voltage clamp or Current clamp, that is the question.



Picture showing an electrophysiological rig for in vitro recordings.

SELECTED EXPERIENCE

MSc in Biology, 1999, Jagiellonian University; PhD in Biology, 2006, Nencki Institute of Experimental Biology; Postdoctoral Fellows (2011-16), Wroclaw Medical University and Carnegie Mellon University; Habilitation in Biology, 2018, Nencki Institute of Experimental Biology, PAS.
Joanna Urban-Ciećko is the author or co-author of 12 research publications and 2 reviews (H-index=10; WoS). For her work she has received the Prime Minister Award for outstanding habilitation achievements in 2018.



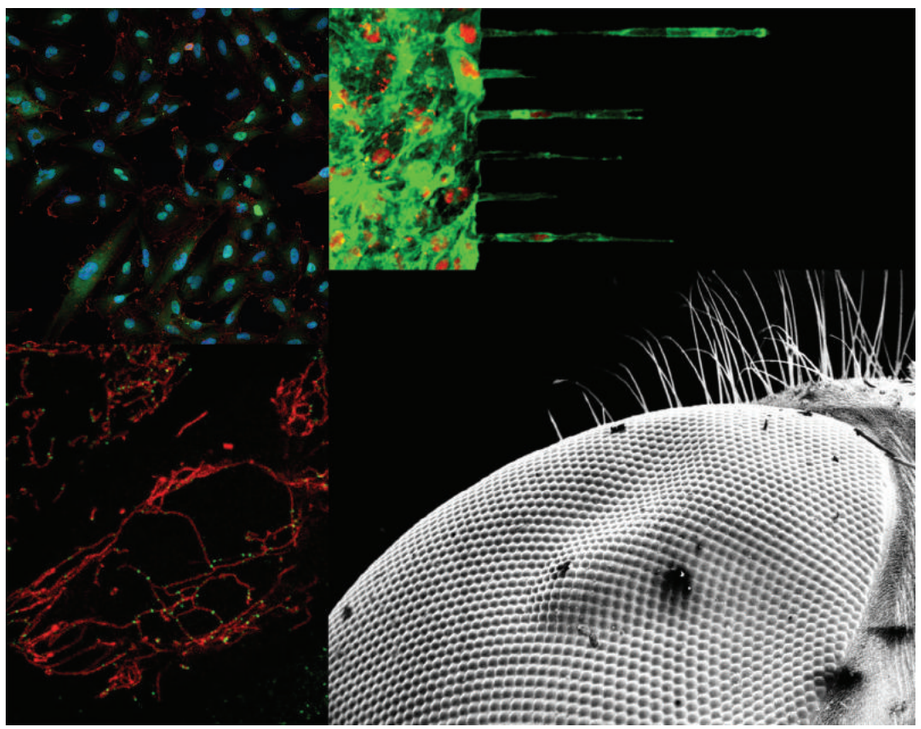
HEAD
Joanna Urban-Ciećko

SELECTED PUBLICATIONS

- Urban-Ciećko J, Jouhanneau JS, Myal SE, Poulet JFA, Barth AL. (2018) Precisely-timed nicotinic activation drives SST inhibition in neocortical circuits. Neuron, 97, 611-25.
- Urban-Ciećko J, Barth AL. (2016) Somatostatin-expressing neurons in cortical networks. Nature Reviews Neuroscience, 17, 401-9.
- Urban-Ciećko J, Fanselow E, Barth AL. (2015) Neocortical somatostatin neurons reversibly silence excitatory transmission via GABAb receptors. Current Biology, 25, 722-31.
- Urban-Ciećko J, Wen JA, Parekh PK, Barth AL. (2014) Experience-dependent regulation of presynaptic NMDARs enhances neurotransmitter release at neocortical synapses. Learning and Memory, 22, 47-55.
- Urban-Ciećko J, Kossut M, Mozrzymas JW. (2010) Sensory learning differentially affects GABAergic tonic currents in excitatory neurons and fast spiking interneurons in layer IV of mouse barrel cortex. Journal of Neurophysiology, 104, 746-54.

LABORATORY OF IMAGING TISSUE STRUCTURE AND FUNCTION

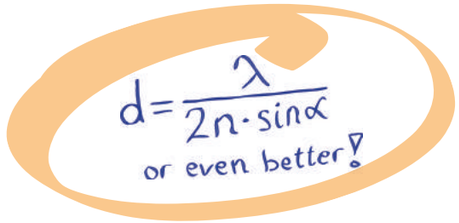
The Laboratory is established as a core facility providing a spectrum of microscopic techniques dedicated to functional and structural studies of biological samples. It is equipped with electron and optical microscopes enabling application of various imaging methods including time-lapse, multi-dimensional (confocal, multiphoton, deconvolution), time-resolved (fluorescence lifetime and fluorescence correlation spectroscopy), multispectral and high-resolution microscopy of live and fixed material. These studies are supported by image analysis and visualization algorithms used to derive quantitative results from obtained data. Laboratory provides equipment and expertise to support a wide range of research projects concerning e.g. neuron architecture in physiological and pathological processes, cell motility, structure and dynamics of cell membranes, mitochondrial dynamics and analysis of protein dynamics and interactions in living cells.

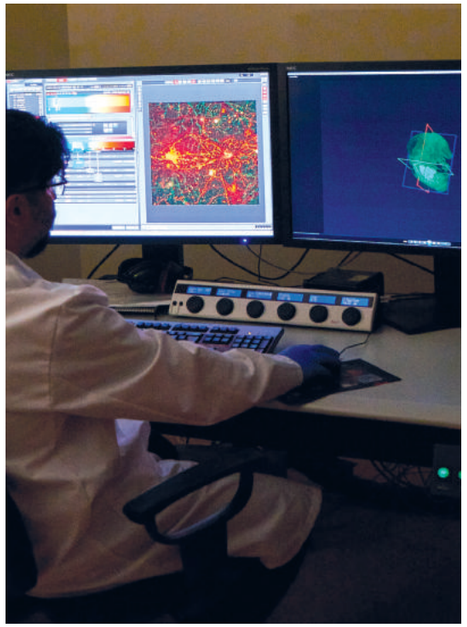


Human glioma cells in culture (top left) and invading artificial channels (top right).
Mitochondrial network in HeLa cells expressing fission protein (Drp1-GFP) (bottom left). Eye of the fly (bottom right).

SELECTED EXPERIENCE

Msc in Biophysics, 2002, Institute of Experimental Physics, University of Warsaw; PhD in Chemistry, 2006, Institute of Physical Chemistry Polish Academy of Science; Postdoctoral researcher at German Cancer Research Center (DKFZ) in Heidelberg, Cellular Biophysics group (2007-10); Postdoctoral training at European Molecular Biology Laboratory (EMBL) Heidelberg, Structural and Computational Biology and Cell Biology and Biophysics Units (2010-12).
Dr Jędrzej Szymański is the author or co-author of 35 research publications (H-index=14; WoS).





HEAD
Jędrzej Szymański

SELECTED PUBLICATIONS

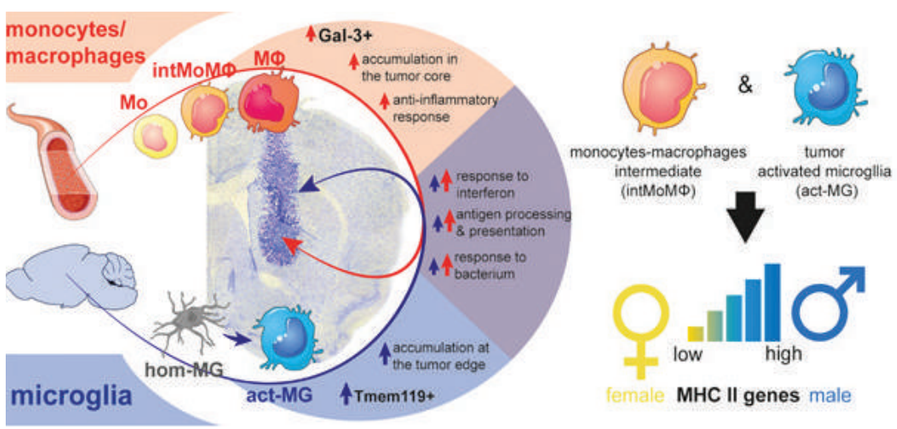
- Michalska BM, Kwapiszewska K, Szczepanowska J, Kalwarczyk T, Patalas-Krawczyk P, Szczepański, Hołyst R, Duszyński J, Szymański J. (2018) Insight into the fission mechanism by quantitative characterization of Drp1 protein distribution in the living cel. Scientific Reports, 8, 8122.
- Walczak J, Debska-Vielhaber G, Vielhaber S, Szymanski J, Charzynska A, Duszynski J, Szczepanowska J. (2019) Distinction of sporadic and familial forms of ALS based on mitochondrial characteristics, FASEB J., 33, 4388-4403.
- Trzaskoma P, Ruszczycki B, Lee B, Pels KK, Krawczyk K, Bokota G, Szczepankiewicz AA, Aaron J, Walczak A, Śliwińska MA, Magalska A, Kadlof M, Wolny A, Parteka Z, Arabasz S, Kiss-Arabasz M, Plewczyński D, Ruan Y, Wilczyński GM. (2020) Ultrastructural visualization of 3D chromatin folding using volume electron microscopy and DNA in situ hybridization, Nature Communications, 11, 2120.
- Walczak J, Malińska D, Drabik K, Michalska B, Prill M, Johne S, Luettich K, Szymański J, Peitsch MB, Hoeng J, Duszyński J, Więckowski MR, van der Toorn M, Szczepanowska J. (2020) Mitochondrial Network and Biogenesis in Response to Short and Long-Term Exposure of Human BEAS-2B Cells to Aerosol Extracts from the Tobacco Heating System 2.2, Cellular Physiology and Biochemistry 54, 230-251.

LABORATORY OF MOLECULAR NEUROBIOLOGY

Glioma-induced polarization of microglia and macrophages into the tumor-supportive cells from molecular mechanism to therapy. We study heterogeneity of immune infiltrates in murine and human gliomas using single cell sequencing and molecular mechanisms underlying microglia reprogramming induced by tumors in experimental gliomas by analyzing open chromatin, epigenetic marks and gene expression.

We study roles of specific genes and histone modifications, and their therapeutic targeting in murine gliomas. We develop short interfering peptides with anti-glioma activity, which are tested in preclinical studies.

We identify brain regulatory regions and transcriptomic networks in glial brain tumors (gliomas) to create an Atlas of brain regulatory regions / networks and discover novel pathogenic mechanisms. By determining whole genome transcriptome, open chromatin, activating / repressive histone marks patterns we generate maps of regulatory networks associated with different malignancy. Histone marks and expression profiling defines active transcription sites and allows us to generate the brain-specific, regulatory DNA maps. We perform targeted sequencing of 700 cancer- and epigenetic related genes. Novel mutations have been identified and functional studies using RNAi and CRISPRCas9 technologies are employed to define their role in genome biology. We host the NGS sequencing core facility.



Microglia and peripheral myeloid cells accumulate and adapt tumor supporting roles in human glioblastomas that show prevalence in men. Single-cell RNA sequencing (scRNA-seq) of sorted CD11b+ myeloid cells from control and GL261 glioma-bearing mice revealed distinct transcriptomic profiles in microglia, infiltrating monocytes and macrophages. Unforeseen molecular heterogeneity among myeloid cells and distinct spatial distribution of identified subsets was found in experimental gliomas. The expression of MHCII encoding genes was higher in male glioma-activated microglia, in mice and in human diffuse gliomas.

HEAD
Bożena Kamińska-Kaczmarek

SELECTED EXPERIENCE

MSc, 1985, University of Warsaw; PhD in Biochemistry, 1991, Nencki Institute of Experimental Biology; Habilitation in Biological Sciences, 1997, Nencki Institute of Experimental Biology, PAS; Full Professor of Biological Sciences, 2003, Nencki Institute of Experimental Biology PAS; Postdoctoral researcher, Dept. Psychology, McGill University, Montreal, Canada, (1994-96), Visiting scientist, Brain Research Institute, UCLA, USA (2001-02); Head of the Laboratory of Transcription Regulation, Nencki Institute of Experimental Biology, PAS (1997-13).
Prof. Bożena Kamińska-Kaczmarek is the author or co-author of 145 research publications and 3 patents (H-index=42; WoS). Prof. Bożena Kamińska-Kaczmarek was elected a Corresponding Member of the Polish Academy of Sciences (2016-present).

SELECTED PUBLICATIONS

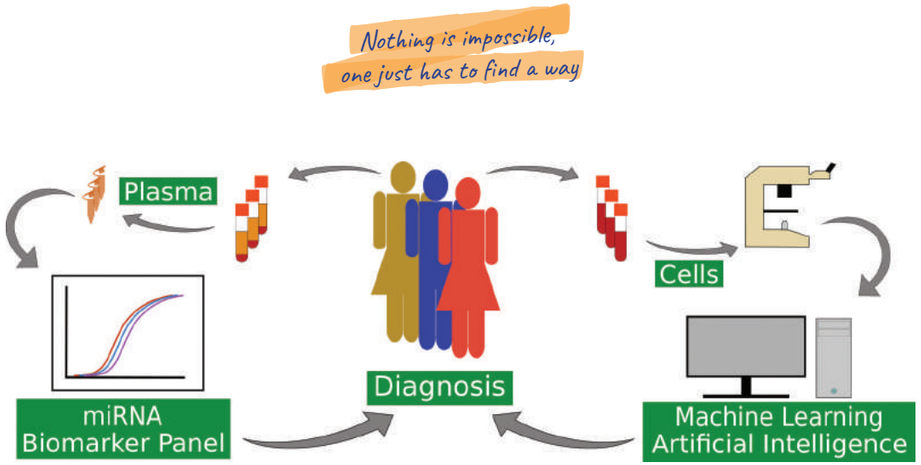
- Malta TM, Sokolov A, Gentles AJ, Burzykowski T, Poisson L, Weinstein JN, Kamińska B, Huelsken J, Omberg L, Gevaert O, Colaprico A, Czerwińska P, Mazurek S, Mishra L, Heyn H, Krasnitz A, Godwin AK, Lazar AJ; Cancer Genome Atlas Research Network, Stuart JM, Hoadley KA, Laird PW, Noushmehr H, Wiznerowicz M. (2018) Machine Learning Identifies Stemness Features Associated with Oncogenic Dedifferentiation. Cell 173(2):338-354.
- Rajan WD, Wojtas B, Gielniewski B, Gieryng A, Zawadzka M, Kaminska B. (2019) Dissecting functional phenotypes of microglia and macrophages in the rat brain after transient cerebral ischemia. Glia 67(2):232-245.
- Ellert-Miklaszewska A, Ochocka N, Maleszewska M, Ding L, Laurini E, Jiang Y, Roura AJ, Giorgio S, Gielniewski B, Pricl S, Peng L, Kaminska B. (2019) Efficient and innocuous delivery of small interfering RNA to microglia using an amphiphilic dendrimer nanovector. Nanomedicine (Lond). 14(18):2441-2458.
- Rajan WD, Wojtas B, Gielniewski B, Miró-Mur F, Pedragosa J, Zawadzka M, Pilanc P, Planas AM, Kaminska B. (2020) Defining molecular identity and fates of CNS-border associated macrophages after ischemic stroke in rodents and humans. Neurobiol Dis. 137:104722.
- Sielska M, Przanowski P, Pasierbińska M, Wojnicki K, Poleszak K, Wojtas B, Grzeganek D, Ellert-Miklaszewska A, Ku MC, Kettenmann H, Kaminska B. (2020) Tumour-derived CSF2/granulocyte macrophage colony stimulating factor controls myeloid cell accumulation and progression of gliomas. Br J Cancer. doi: 10.1038/s41416-020-0862-2.

LABORATORY OF PRECLINICAL TESTING OF HIGHER STANDARD

Our aim is the elucidation of molecular and cellular pathomechanisms in the early, pre-dementia stage of Alzheimer's disease (AD) and identification of new drug targets and non-invasive biomarkers for personalized medicine. One research project focuses on the regulation of the cell cycle, cell death, and cellular senescence in neurodegeneration and carcinogenesis, the two main aging-related pathologies. Also, we investigate the role of modifiable environmental AD risk factors, such as diet, in the development of AD as a systemic disease and the role of metabolic processes in neuroinflammation and neurodegeneration. The processes underlying AD are being studied in tissues from AD patients, and in standard and developed by us mouse AD models. We analyze AD-related changes in transcriptomics, in epigenomic regulation mediated by microRNA, and in protein signaling. In the development of novel AD diagnostics based on human blood biomarkers we employ computational biology and machine learning approaches.

CORE FACILITY ACTIVITY

Preclinical testing of safety and activity of potential new therapeutics for cancer or for diseases of the nervous system, in accordance with the principles of Good Laboratory Practice (GLP): consultations for experimental design and data analysis, testing of potential neuroprotective or anticancer substances in cell cultures and in mouse models of diseases, toxicological studies comprising histological preparation & histopathological analysis.



Development of novel strategies for diagnosing early-stage Alzheimer's disease (AD) based on minimally-invasive blood biomarkers and machine learning approaches. AD places an increasing burden on aging populations. One of the main challenges is identification of minimally-invasive, easy-to access biomarkers for diagnosing the disease in its early stages. Moreover, diagnostic assays that are reliant on human expertise to interpret findings are often subject to significant variation, particularly as the volume of samples being analyzed increases. To respond to these needs, we are developing microRNA profiling of blood plasma and immunostaining of blood cells followed by Machine Learning to extract meaningful information from high-resolution images in a repeatable manner that will support physicians in early detection of AD.

HEAD
Urszula Wojda

SELECTED EXPERIENCE

MSc in Molecular Biology, 1987, Faculty of Biology, University of Warsaw; PhD in Biochemistry, 1996, Nencki Institute of Experimental Biology, PAS; Postgraduate Diploma in Management, 2010, Warsaw Medical University / Warsaw School of Economics, Habilitation in Biological Sciences Nencki, 2004, Institute of Experimental Biology, PAS, Professor of Biological Sciences, 2013, Nencki Institute of Experimental Biology PAS; Postdoctoral Fellow, Bioorganic Chemistry Lab., NIDDK, National Institutes of Health, USA (1996-2001); (2002-12) Associated Professor, Deputy Head, Lab. of Neurodegeneration, International Institute of Molecular and Cell Biology, Warsaw. Prof. Urszula Wojda is the author or co-author of 48 research publications and 1 patent (H-index=20; WoS) and Member of the Management Board of the Polish Biochemical Society (2015-present). Prof. Urszula Wojda is a polish expert on the Management Board of EU JPND (2013-present).

SELECTED PUBLICATIONS

- Zdioruk M, Want A, Mietelska-Porowska A, Laskowska-Kaszub K, Wojsiat J, Klejman A, Użarowska E, Koza P, Olejniczak S, Pikula S, Konopka W, Golab J, Wojda U. (2020) A New Inhibitor of Tubulin Polymerization Kills Multiple Cancer Cell Types and Reveals p21-Mediated Mechanism Determining Cell Death after Mitotic Catastrophe. Cancers 12:2161.
- Nagaraj S, Zoltowska KM, Laskowska-Kaszub K, Wojda U. (2019) microRNA diagnostic panel for Alzheimer's disease and epigenetic trade-off between neurodegeneration and cancer. Ageing Res. Rev. 49:125-143.
- Cieślak M, Kaźmierczak-Barańska J, Królewska-Golińska K, Napiórkowska M, Stukan I, Wojda U, Nawrot B. (2019) New Thalidomide-Resembling Dicarboximides Target ABC50 Protein and Show Antileukemic and Immunomodulatory Activities. Biomolecules 9(9), E446.
- Dowjat K, Adayev T, Wojda U, Brzozowska K, Barczak A, Gabryelewicz T, Hwang YW. (2019) Abnormalities of DYRK1A-Cytoskeleton Complexes in the Blood Cells as Potential Biomarkers of Alzheimer's Disease. J Alzheimers Dis.72(4):1059-1075.
- Wojsiat J, Zoltowska KM, Laskowska-Kaszub K, Wojda U. (2018) Oxidant/antioxidant imbalance in Alzheimer's disease: therapeutic and diagnostic prospects. Oxid Med Cell Longev. Jan 31;2018:6435861.

nencki institute
research station
– Mikołajki

RESEARCH STATION IN MIKOŁAJKI

The Research Station in Mikołajki was established in 1951 as a hydrobiological field station of the Institute. In 1960 it was handed over to the Department of Ecology, and then to the Institute of Ecology, Polish Academy of Sciences, to return to the Nencki Institute after more than fifty years, in 2014.

Today the Mikołajki Research Station is a field base of the Institute for behavioural, metabolic, biochemical and molecular research as well as for educational activities. It offers access to modern, well-equipped laboratories and conference rooms.

The station is also the location for National Centre for Advanced Analysis of Biological and Biomedical Imaging, created within the NEBI project, obtained under the Intelligent Development Operational Programme and offering a state-of-the-art integrated platform for multidimensional imaging of biological processes, as well as an advanced IT infrastructure for data collection and processing.

RESEARCH STATION IN MIKOŁAJKI

Taking advantage of the unique potential of the Research Station infrastructure, we conduct experimental research in natural or semi-natural habitats.

The research group of Dr. Ulf Bauchinger investigates the fundamental links between metabolism and environment. Metabolic demands differ considerably over the annual cycle, the day / night rhythm or even between short resting bouts and peak physical performance of animals. Shifts between anabolic and catabolic processes, the extensive and fast switches in energy use, and the engagement of different organs and tissues are fundamental, and strongly driven by the abiotic environment. We are interested in how modulation of energy metabolism, antioxidant capacity, and autophagic responses are linked to the different levels of energy metabolism, and how they are coordinated to minimize the risk of oxidative stress. To understand how animals maintain metabolic integrity is directly linked to our understanding of the ageing process.

The research group of prof. Ewelina Knapska investigates the social behavior of mice. Core impairments in social behaviors are among the defining characteristics of many diseases such as autism spectrum disorder, Social Anxiety Disorder or social phobia. When it comes to the neuronal background of impairments of social behavior, behavioral tests performed in rodents are an important source of knowledge. To overcome the confounding factors leading to irreproducible assessment of murine social behavior we have constructed the automatic system Eco-Hab, that closely follows murine ethology and requires no contact between a human experimenter and tested animals. The testing environment is spacious, resembles the natural habitat of mice, and exploits innate behavioral patterns of this species to test relevant aspects of sociability.

Metabolic flexibility depicted on the level of organ mass changes that occur in animals under specific conditions; for example migration in birds.

HEAD
Tomasz Janecki

SELECTED EXPERIENCE

MSc in Biology, 1995, University of Warsaw; PhD in Biology, 2006, University of Warsaw; Chief of Logistic of Department of Antarctic Biology, PAS (2003-05); Deputy Head of Department of Antarctic Biology, PAS (2006-11); Researcher, Wigry National Park, (2011-15) Head of The Research Station in Mikołajki, Nencki Institute of Experimental Biology, PAS (2015-present);
Dr Tomasz Janecki was a member of six Polish Antarctic Expeditions (3 times leader of expedition), two expeditions to Spitsbergen and two Russian expeditions to the North Pole (1997-2017).

SELECTED PUBLICATIONS

- Olsson A, Knapska E, Lindström B. (2020) The neural and computational systems of social learning. Nat. Rev. Neurosci. 21(4): 197-212.
- Casagrande S, DeMoranville K, Trost L, Pierce B, Bryła A, Działo M, Sadowska ET, Bauchinger U, McWilliams SR. (2020) Dietary antioxidants modulate glucocorticoids during prolonged flight activity. Proc. R. Soc. B.28720200744.
- Bury S, Cierniak A, Jakóbik J, Sadowska ET, Cichon M, Bauchinger U. (2020) Cellular turnover – a potential metabolic rate-driven mechanism to mitigate accumulation of DNA damage. Physiol. Biochem. Zool. 93(2):90-96.
- Lipowska MM, Sadowska ET, Bauchinger U, Koteja P. (2019) Stress coping and evolution of aerobic exercise performance: corticosterone levels in voles from a selection experiment. J. Exp. Biol. jeb.209593.
- Horváthová T, Babik W, Kozlowski J, Bauchinger U. (2019) Vanishing benefits – The loss of actinobacterial symbionts at elevated temperatures. J. Therm. Biol. 82: 222-228.
- Puścian A, Łęski S, Kasprowicz G, Winiarski M, Borowska J, Nikolaev T, Knapska E. (2016) Eco-HAB as a fully automated and ecologically relevant assessment of social impairments in mouse models of autism.eLife, 5, e19532.

SUPPORTING AND ADMINISTRATIVE UNITS

Conducting science nowadays is not only about properly devoting time to research but also managing administrative tasks. Therefore, top level administrative support can have a remarkable impact on the scientific productivity of research groups by contributing to a more efficient and effective work environment that allows the scientists to focus mainly on the science. The scientific activity of the Nencki Institute scientists is supported by qualified and devoted employees of Administration and Supporting Units.

INFORMATION TECHNOLOGY UNIT

HEAD AGNIESZKA KOWALUK

The IT Unit provides the Institute's employees with front line support in all aspects of IT activities starting with guidance in device purchase and disposal, through assistance with server backup services and high-speed file transfer, up to data storage and software development.

LIBRARY

HEAD JAN BIENIAS

The Library of the Nencki Institute offers an extensive collection of print and electronic resources including books, periodicals, CD-s, microfilms, and old prints. The collection has now over 75 000 volumes covers a wide range of topics related to biology, neuroscience and human diseases.

ANIMAL HOUSE

HEAD ANNA ZAJFERT

The Animal House provides direct support and consultation for scientific and compliance issues related to animal-based research. The team's responsibilities include clinical veterinary services, animal breeding, procurement and enrichment, investigator support, training, and compliance oversight. The Animal House team is available for consultation on the principles underpinning the humane use of animals in scientific research, animal-based research protocols and laboratory animal management.

OFFICE OF INTERNATIONAL RELATIONS AND PROJECT MANAGEMENT

HEAD ANNA SADLIK-PASKALEC

The Office team assists Institute scientists in applying for external funding from national and international sources and they monitor the financial and administrative aspects of submitted proposals and on-going projects. The Office acts as a liaison with the European Commission, and with the coordinators of other funding agencies, for large scale investment and R&D projects.

TECHNOLOGY TRANSFER UNIT

HEAD DOROTA GIEREJ-CZERKIES

The Technology Unit supports innovative research and safeguards scientist's interests while building commercialization strategy, and maintaining relationships with clinicians, industry and other academic institutions. Their goal is to identify novel discoveries and support the inventors in the intellectual property along the product development pathway.

ADMINISTRATION

Experienced and committed administrative resources help scientific teams to successfully navigate the research policy landscape. They provide career mentoring and management of employee's benefits. Providing financial expertise and services related to the management of research funds they help to conduct scientific projects with transparency and governance and in accordance with public procurement law. They also support the scientific infrastructure of the Institute and provide research space management. Institute administration includes following departments:

HUMAN RESOURCES AND RECRUITMENT HEAD URSZULA DZIEWULSKA
FINANCE AND ACCOUNTING HEAD AGATA PIOTROWSKA
SUPPLY AND PUBLIC PROCUREMENT HEAD WOJCIECH BOGUTA
BUILDING MAINTENANCE AND INFRASTRUCTURE HEAD DARIUSZ WALASZCZYK

RESEARCH LABORATORIES

- CENTER FOR BASIC AND TRANSLATIONAL RESEARCH IN BIOLOGY AND BIOMEDICINE
- CENTER FOR NEURAL PLASTICITY AND BRAIN DISORDERS, **BRAINCITY**
- RESEARCH STATION IN MIKOŁAJKI

CORE-FACILITIES

- BIOIMAGING (LIGHT AND ELECTRON MICROSCOPY)
- FMRI
- GENE SEQUENCING
- FLOW CYTOMETRY
- PRECLINICAL STUDIES
- TRANSGENIC ANIMAL PRODUCTION
- BEHAVIORAL METHODS
- ELECTROPHYSIOLOGY

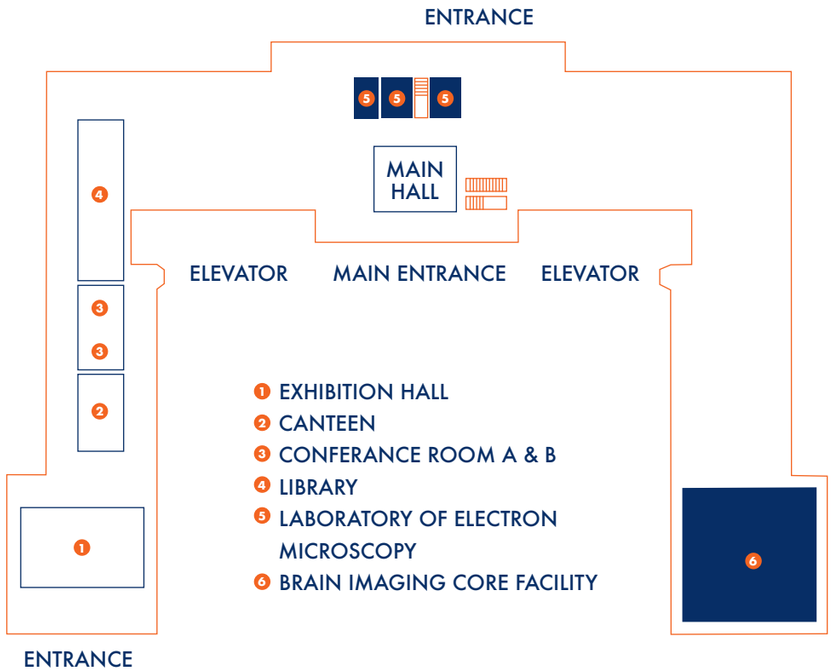
SUPPORTING UNITS

- OFFICE OF INTERNATIONAL RELATIONS AND PROJECT MANAGEMENT
- TECHNOLOGY TRANSFER UNIT
- INFORMATION AND TECHNOLOGY UNIT
- LIBRARY
- PUBLICATIONS OFFICE
- ANIMAL HOUSE

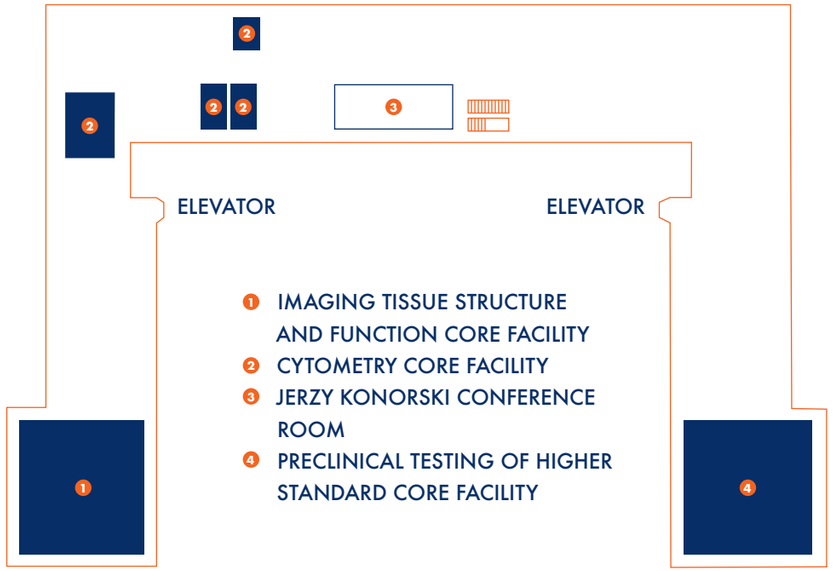
ADMINISTRATION UNITS

- HUMAN RESOURCES AND RECRUITMENT
- FINANCE AND ACCOUNTING
- SUPPLY AND PUBLIC PROCUREMENT
- BUILDING MAINTENANCE AND INFRASTRUCTURE
- ARCHIVE
- HEALTH AND SAFETY OFFICER

GROUND FLOOR



SECOND FLOOR



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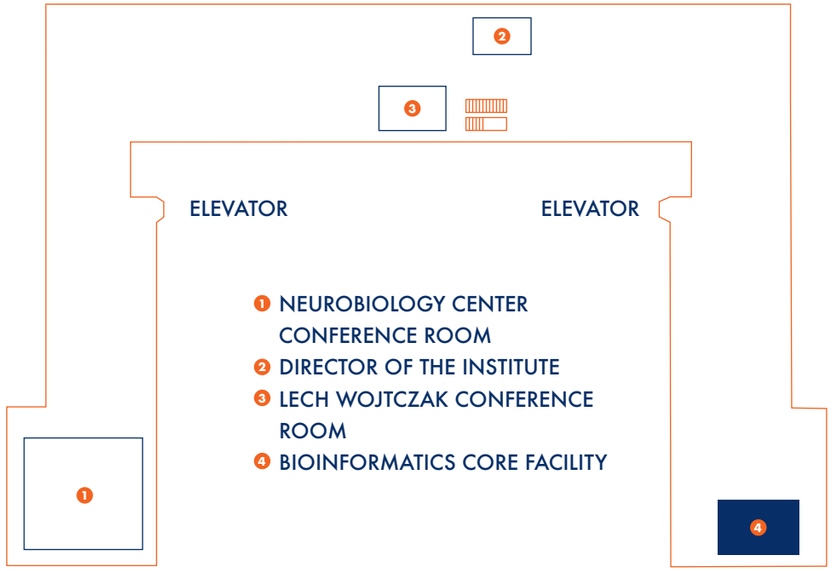

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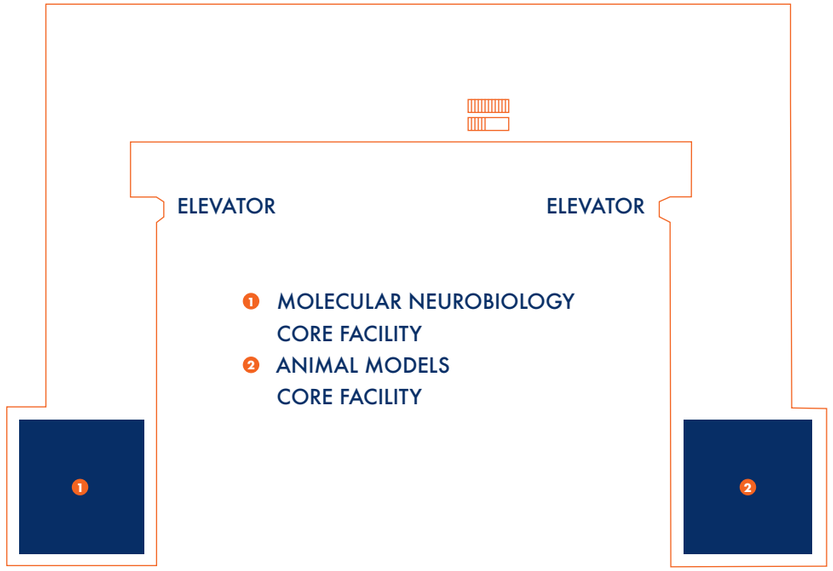


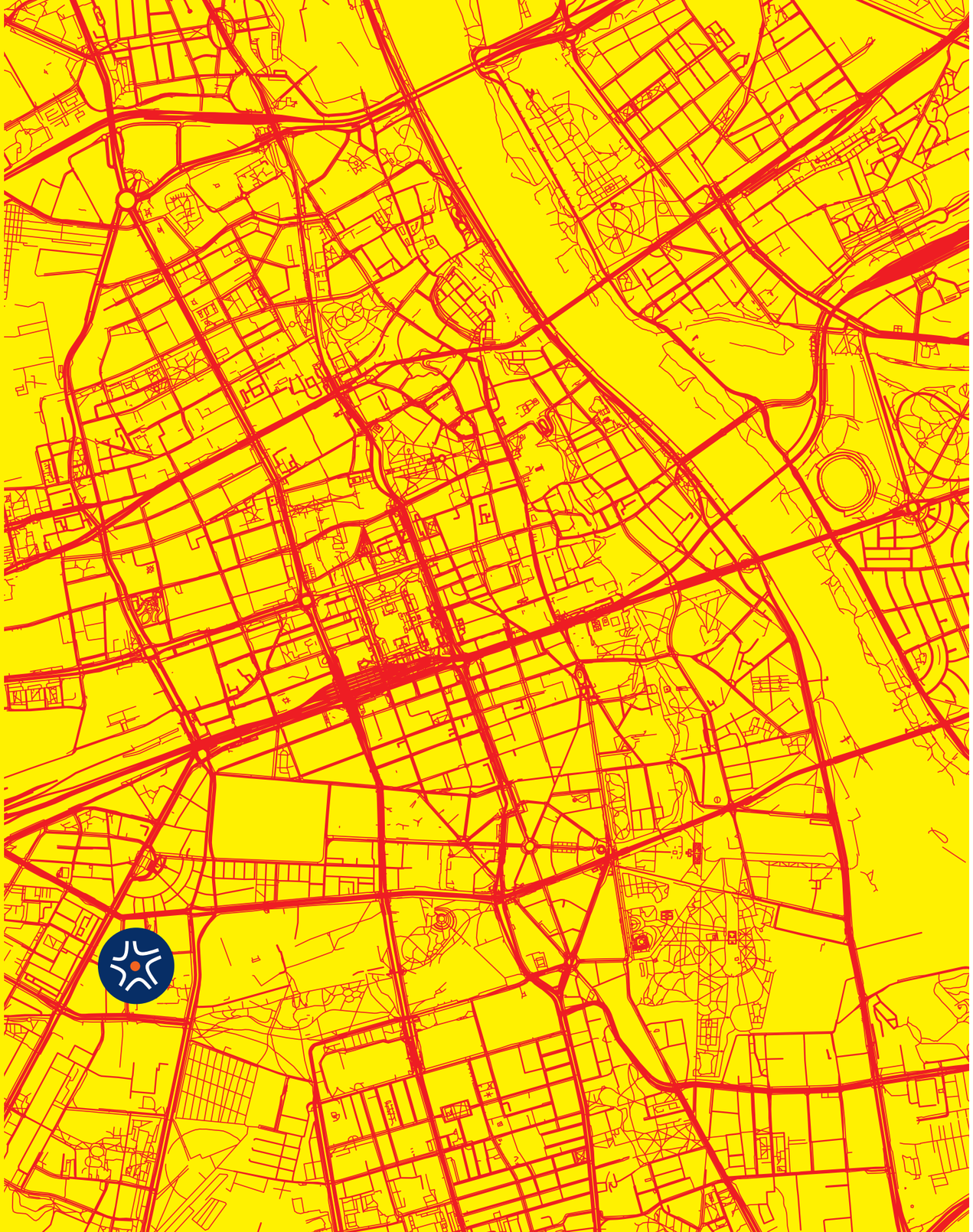
WARSAW PHD SCHOOL
IN NATURAL AND BIOMEDICAL SCIENCES

The Warsaw PhD School in Natural and BioMedical Sciences (Warsaw-4-PhD) started its activities on October 1st, 2019 and educates doctoral students in 4 scientific disciplines: biology, chemistry, physics, medicine.

It is possible due to the involvement and cooperation of 9 independent scientific institutions: Nencki Institute of Experimental Biology PAS (Warsaw-4-PhD Lider), Institute of Organic Chemistry PAS, Institute of Physical Chemistry PAS, Institute of Physics PAS, Center for Theoretical Physics PAS, Institute of High Pressure Physics PAS, Maria Sklodowska-Curie National Research Institute of Oncology, Institute of Psychiatry and Neurology and International Institute of Molecular and Cell Biology in Warsaw.

Apart from domestic students the school educates doctoral students from all over the world, among others from Italy, Ukraine, Brazil, Portugal, Turkey, India, Iran and China. Students have the opportunity to participate in international conferences and exchange programs, as well as in many interesting scientific projects.

The school offers doctoral fellowships during four years of study. In addition, the School offers the opportunity to cooperate with the best international and domestic research centers. Students have access and opportunities to work in modern laboratories with high-quality research equipment. Students also have the chance to develop their academic career and research interests under the supervision of the outstanding researchers, whose competence and openness will help the students to fulfil their ambitions. The graduates of the School have the opportunity to work in scientific centers in Poland and abroad.



WARSAW
A DYNAMIC CITY OPEN TO EXPATS

LIVE IN POLAND!
Good news. Poland has moved up from 25th position to 13th place in the HSBC Expat Annual League's specialized ranking which evaluates places where it is worth moving to in order to live well, start a family and have a good job. In Warsaw, the capital city of Poland, where the Nencki Institute is located, the chances for career and professional development as well as economic stability and the so-called work life balance were highly rated. And what does it look like from the perspective of a Varsovian?

A CITY AT THE HEART OF POLAND
From Warsaw it is also relatively close to all kinds of nature you may want to have at hand. In 4 hours you can comfortably reach the Polish seaside or the Polish mountains by train. Even closer is the phenomenal Masuria, the land of Polish lakes, known all over the world. Just outside Warsaw there is also Kampinos Forest where you can meet wild animals and real, untouched by people nature.

A CITY FULL OF POSSIBILITIES
Want broad access to culture? Great news – in Polish cinemas all movies are screened in their original languages, and instead of dubbing you get Polish subtitles on the screen! There are also museums with foreign language guides, theaters with transcriptions of actors' dialogues in English, opera, and dozens of underground stages with concerts, performances and events worth visiting.

A CITY EASY TO GET AROUND
The advantages of Warsaw itself certainly include excellent public transportation. There may be only two subway lines but the network of buses, trams, trains, airport, train stations, city bicycles and scooters is impressive.

A CITY CHEAP TO LIVE IN
Still friendly for foreigners are the costs of living in the Polish capital. Warsaw ranks 158th out of 230 European cities surveyed on the cost of living in the Numbeo ranking.

LOOK HOW MUCH ART THERE IS!

Warsaw boasts the fantastic collections of **THE NATIONAL MUSEUM**. There is also the famous **MUSEUM OF THE HISTORY OF POLISH JEWS (POLIN)** and amazing **WARSAW RISING MUSEUM** which are definitely worth visiting at least once during your stay in Warsaw. There are also many surprising galleries and places where contemporary art reigns. It is worth to visit the **UJAZDOWSKI CASTLE CENTER FOR CONTEMPORARY ART, ZACHĘTA – NATIONAL GALLERY OF ART, PHOTOPLASTIKON, POSTER MUSEUM** and **CAPITOL THEATER** which performs live in English.

WARSAW FESTIVALS

Warsaw is vibrant with music. Especially around the summer, when so many different festivals take place in the city that it is impossible to describe them all. You just have to listen to them.
The most popular ones include:

ORANGE WARSAW FESTIWAL
You'll love this if you love anything trendy, world-renowned and respected in music.
SINGER'S WARSAW FESTIVAL
It is a feast of fine and culinary arts, klezmer music and Jewish theater.
THE CROSS CULTURE FESTIVAL
It is a festival where all musical cultures of the world cross.
CHOPIN COMPETITION
It is one of the oldest and most famous music competitions in the world. It attracts the best piano virtuosos from around the world.
WARSAW AUTUMN
International Festival of Contemporary Music.

EAT WHATEVER YOU WANT

In Poland, you'll fall in love with żurek (sour soup), pierogi (dumplings), pork chops and sour, pickled cucumbers. And if you miss French, Italian, Asian or any other cuisine, you'll find great places here too. Warsaw also has one of the largest vegan culinary scenes in Europe.

TAKE A BREAK FROM THE CITY WITHIN THE CITY

Warsaw is a city that is still under construction. As many as a dozen skyscrapers are being built here right now, including the tallest in the entire European Union. But... there is also a plenty of green areas, which constitute as much as 25% of the city area, and among them there are several to which you are especially invited.

THE ROYAL ŁAZIENKI

The famous park with the Palace on the Isle, hundreds of tame squirrels and proudly strutting peacocks. There are streamlets, ponds, hills, glades and Chopin's monument at the magnificent fountain (in the summer magical piano concerts are held here).

MOKOTÓW FIELD

A huge green area, the central point of which is a magnificent pond with an island and fountains. A place full of sport and recreation activities.

BUW GARDEN

Sooner or later every citizen will come to the garden on the roof of the University of Warsaw Library, because it's worth it. It is one of the largest and most beautiful roof gardens in Europe. In peace and quiet, you can admire the panorama of the city

VISTULA BOULEVARDS

It is here where Varsovians like to relax at the weekends, because the Vistula Boulevards is a unique club and party scene located on the bank of the river.

ZEGRZE RESERVOIR

Warsaw suffers from a shortage of urban lakes, but in less than an hour you can get to the huge Zegrze Reservoir (41 km long and 3.5 km wide) with attractions for lovers of all kinds of water sports and other forms of recreation.

YOU DON'T HAVE TO MISS YOUR HOME CULTURE

Take it easy, Warsaw is home to cultural institutions from most countries of the world. The most important ones include the British Council, the Danish Cultural Institute, the Goethe Institute, the Cervantes Institute, the Italian Cultural Institute and the Polish-Japanese Academy of Information Technology.

Warsaw is also home to schools dedicated to the children of expats who want their children to be educated in their home educational systems.

NENCKI PROVIDES ASSISTANCE

Nearly 50 foreigners from 12 countries work and study at our Institute. They are an excellent source of information. Write to phdoffice@warsaw4phd.eu and we will help you get in touch with someone from us.

nencki institute
of experimental biology

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