

Registration form for Polish scientific institution

1. Scientific institution data (name and address):

Nencki Institute of Experimental Biology of the Polish Academy of Sciences
3 Pasteur St.
02-093 Warsaw
Poland

2. Type of scientific institution:

Scientific unit of the Polish Academy of Sciences

3. Head of the institution:

Prof. Adam Szewczyk, Director

4. Contact information of designated person(s) for applicants and NCN: first and last name, position, e-mail address, phone number, correspondence address):

Marta Rucinska, Project Manager

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5. Science discipline in which strong international position of the institution ensures establishing a Dioscuri Centre (select one out of 25 listed disciplines):

14) Biology of tissues, organs and organisms

6. Description of important research achievements from the selected discipline from the last 5 years including list of the most important publications, patents, other (up to one page in A4 format):

The long-term strategy the [Nencki Institute of Experimental Biology of the Polish Academy of Sciences](#) is to significantly strengthen its research capacity as a center of excellence in the field of **neurobiology, mammalian cell biology and bioimaging**. Our research focuses mainly on the biological aspects related to a variety of disorders ranging from neurological conditions to diabetes or cancer:

1. Molecular and cellular underpinnings of human and animal behavior in health and disease

The Kaczmarek lab, in collaboration with C. Sandi from Lausanne have shown that activation of extracellular enzyme, MMP-9 (matrix metalloproteinase) contributes to post-chronic stress depression in rats ([van der Kooij et al., Nat. Commun., 2014](#)). Next, Kaczmarek lab in collaboration with J. Samochowiec (Szczecin) have revealed that MMP-9 plays a major role in motivation to alcohol addiction in humans and mice and discovered that this phenomenon depends on the enzyme activity in the central nucleus of the amygdala ([Stefaniuk et al., Biol. Psych., 2017](#)). The same Kaczmarek lab, in collaboration with H. Ehrenreich (Goettingen) and R. Adamiak (Poznan) have discovered that MMP-9 contributes to delusional symptoms in schizophrenia patients and surprisingly linked this phenomenon to morphology of so called dendritic spines harboring excitatory synapses in the brain ([Lepeta et al., EMBO Mol. Med., 2017](#)). In addition, Knapska laboratory (with H.P. Lipp from Zurich) has developed novel experimental system to investigate social impairments in mouse models of autism ([Puscian et al., eLife, 2016](#)). Knapska and Kaczmarek lab have also produced a novel animal experimental model, i.e., the transgenic rat with *c-fos* regulatory region driving expression of a chimeric PSD95-Venus fluorescent protein to label neurons involved in synaptic plasticity and the they showed specific neuronal circuitry supporting fear conditioning vs. extinction ([Knapska et al., PNAS, 2012](#)).

2. Understanding the cellular and molecular bases of Major and Chronic Diseases

The Dobrzyn Lab's main priority is to understand the role of lipid mediators and epigenetic modifications of gene expression in the development of insulin resistance and pancreatic beta-cell dysfunction in type 2 diabetes. Together with T. Harkany from Stockholm they have discovered new molecular mechanism of the regulation of insulin secretion that involves activation of focal adhesion kinase, downstream from CB1 receptor, and cytoskeletal reorganization required for the exocytosis of secretory vesicles ([Malenczyk et al. J Biol. Chem, 2013](#)). By combining molecular pharmacology and genetic tools the Dobrzyn's group also showed that differential activation of TRPV1 and CB1 receptors impact both the determination of islet size and α/β cell sorting, thereby mechanistically linked endocannabinoids to cell proliferation and sorting during pancreatic islet formation, as well as to life-long programming of hormonal determinants of glucose homeostasis ([Malenczyk et al., PNAS, 2015](#)). The Kaminska group found that an ER stress response develops prior to autophagy which has a cytoprotective role in glioma cells. This indicated that autophagy can play a dual role in cancer cells and could be implicated in cell protection and cell death ([Ciechomska et al., Oncogene, 2013](#)). The Kaminska group dissected molecular and cellular mechanisms that regulate innate immune cell recruitment into neoplastic tissue. Using proteomics they identified several factors responsible for polarization of microglia into protumorigenic cells ([Ellert-Miklaszewska et al., Oncogene, 2016](#)).

3. Bioimaging for understanding the molecular orchestration of cells, tissues and organism

Spatial genome organization and its effect on transcription is a new research field actively explored by the Wilczynski lab. Together with Y. Ruan (Farmington) and A. Barco (Alicante) they found that disruption of neuronal chromatin organization and dynamics in vivo caused chromocenter declustering and the association of heterochromatin with the nuclear lamina. The loss of these structures was associated with specific transcriptional and behavioural deficits ([Ito et al., Nat. Commun., 2014](#)). They also applied an advanced chromatin interaction analysis by paired-end tag sequencing (ChIA-PET) strategy to map higher-order chromosome folding and specific chromatin interactions mediated by CCCTC-binding factor ([Tang et al., Cell, 2015](#)). Their 3D genome strategy thus provides unique insights in the topological mechanism of human variations and diseases. Moreover, a very sophisticated, genetically encoded Förster Resonance Energy Transfer (FRET)-based biosensor that continuously monitors enzymes activity was developed in the Nencki Institute ([Stawarski et al., Biomaterials, 2014](#)).

7. List of no more than 3 important research projects from the selected discipline awarded in national and international calls to the institution in the last 5 years (title, name of PI, source of funding, amount of funding):

In recent years the Nencki Institute has been very active in applying for external funding. The leading Nencki research groups have been involved in more than 30 EU-funded grants, including two FP5, seven FP6, seventeen FP7 and 7 H2020 grants, as well as projects supported by other funding bodies, such as EMBO and HFSP. In the EC Innovation Union Competitiveness Report of 2011 Nencki was listed as one of the top five institutions in Poland based on the amount of funding secured in Framework Programme 7 projects. In July 2017 the Institute was ranked no. 7 in the top 10 beneficiaries in Poland in terms of the EC financial contribution granted in H2020.

The most important projects currently implemented at Nencki include the following:

1. Title: **'Functional connectomics of the amygdala in social interactions of different valence - CoSI'**

Name of PI: Prof. Ewelina Knapska

Source of funding: EU HORIZON2020 ERC STG (GA No.: 715148)

Amount of funding: EUR 1,312,500

The grant aims at understanding how the brain controls socially transferred emotions. Whereas social interactions and their effects on the emotional state of an individual are relatively well described at the behavioral level, much less is known about neural mechanisms involved in these very complex phenomena, especially in the amygdala, a key structure processing emotions in the brain. The main goal of the project is answering two questions: whether there exist – within the amygdala – different neuronal circuits mediating social interactions of different valence (of positive or negative affective significance) and whether circuits controlling social and non-social emotions differ; in other words, whether there is something like a specialized social brain. The project started in 2016 will last 5 years.

2. Title: **'3D genome organization and transcription regulation in hippocampal circuits'**

Name of PI: Prof. Grzegorz Wilczynski

Source of funding: Human Frontier Science Program Organization (GA No.: RGP 0039/2017)

Amount of funding: USD 300,000

The aim of this ambitious project is to characterize long-range chromatin interactions in 3D and genom wide in the mouse hippocampus under normal memory formation physiology and in disease conditions (epilepsy), and thereby test an exciting hypothesis that there is a chromatin “topology code” for neuroplasticity. The project has just been launched and will last 3 years.

3. Title: **'International Doctoral Programme in Biological Bases of Human Diseases – Bio4Med'**

Name of PI: Prof. Adam Szewczyk

Source of funding: EU HORIZON2020 / MSCA COFUND (GA No.: 665735)

Amount of funding: EUR 2,302,080

The major aim of Bio4Med (Biology for Medicine) programme is to provide unique, international, inter-disciplinary and inter-sectoral doctoral training for 22 Early Stage Researchers (ESRs) in the domain of biological bases of human diseases. The Project combines 22 leading research groups at the Nencki Institute and their scientific partners from world-class laboratories located in EU Member States, Switzerland, Ukraine, Japan, Canada and US. Research programme includes basic science PhD-projects focused on molecular basis of neurodegeneration, neurological disorders, cancer and metabolic diseases. The project started in 2015 and will last 5 years.

8. Description of the available laboratory and office space for Dioscuri Centre (up to one page in A4 format):

The Nencki Institute in Warsaw at 3 Pasteur St. offers an excellent research environment for development of a new, independent research program related to any branch of neuroscience.

The Institute is equipped with sophisticated and technologically advanced appliances and devices sufficient to meet all the needs and requirements of researchers. The laboratories at the Nencki Institute include the facilities for conducting research on cellular and molecular biology, biochemistry, neurobiology and neurophysiology at the molecular, cellular, tissue and the whole organisms levels.

The Dioscuri Centre **start-up package** from the Nencki Institute will include:

Laboratory space of 100 sq m; with a possibility to expand in the future. This space will be divided into 3-4 rooms, renovated and furnished by the Nencki Institute, ensuring both laboratory and office support space. All the rooms at the Nencki Institute are air conditioned, with access to internet, equipped with standard equipment for molecular biology and biochemistry research, such as laminar flow hoods, PCR thermocyclers, etc.

Equipment: the Nencki Institute will cover the cost of all basic equipment requested by the Dioscuri Centre.

The Nencki Institute will provide free access to the Institute shared facilities including the equipment for behavioral studies, electron microscopy lab, cytometry lab, confocal microscope, laser scanning microscope, real time PCR, isotope laboratory, histology laboratory, other.

The Institute also offers full access to its Animal House and animal surgery facilities. The Animal House modernized according to the directive 86/609 EU enables breeding of experimental animals (also transgenic) according to the highest standards. Some of the labs have permission from the Ministry of Environment to be used for research with GMO. The Institute has been licensed by the Polish Ministry of the Environment for closed using of GMO in III degree of hermeticity with respect to modulating expression of genes in the brain by adeno and lentiviruses (in order to investigate processes of learning and memory).

Staff: The Nencki Institute will provide administrative and financial support to the Dioscuri Centre for the whole duration of the project. A full time administrative assistant will be hired by the Nencki Institute to work solely for the Dioscuri Centre for the whole duration of its operation.

Duration of appointment and career prospects: the Institute will ensure full time employment contract with a 5 year appointment for the head of the Dioscuri Centre position, which may be further extended following successful evaluation and extension of the initial 5-year period.

9. List of the available scientific equipment for Dioscuri Centre:

The Nencki Institute is housed in a 10,000 sq m research buildings with laboratories, animal house facilities, offices, conference and seminar rooms. The laboratory capacities at Nencki are predominantly equipped with modern research infrastructures and cutting-edge imaging equipment for conducting experimental biological work. A number of core facilities were established at the Institute within the frame of the Neurobiology Centre (CN) investment which provide services to researchers working at the Nencki Institute, but also to scientists from other research centres or business partners in Poland and abroad. The cluster of core facilities within the CN includes the following items:

LABORATORY OF ANIMAL MODELS: Transgenic animals husbandry room (equipped with racks, intelicage automate cages etc.) for mice and rats;

LABORATORY OF BRAIN IMAGING: 3T MRI scanner Siemens TRIO equipped with a 32 channel head coil compatible with iPAT, 12 channel head coil compatible with iPAT, circular polarized transmit/receive coil for spectroscopy (Tx/Rx CP Head), hardware and software for presentation of visual and auditory stimuli, fMRI compatible: EEG, EMG (electromyography), GSR (galvanic skin response) and transcranial magnetic stimulator (TMS) with neuronavigation system;

LABORATORY OF MOLECULAR NEUROBIOLOGY: a laser microdissection system, Personal Affymetrix Microarray Gene Analyzer, 4 laminar flows and cell culture incubators, Real-time PCRs (Quantum Studio and Step one), automated equipment for nucleic acids separation Qiacube (Qiagen), Agilent Bio-analyzer for RNA, DNAs, next generation sequencing apparatus Illumina 1500 and agilent analytical HPLC;

LABORATORY OF IMAGING TISSUE STRUCTURE AND FUNCTION: Leica TCS SP5 Confocal, Leica TCS SP8 Confocal SMD, Zeiss LSM 780 Confocal Spectral Detector, Zeiss Spinning Disc Fast Confocal SMD, Zeiss MP Photomanipulation MultiPhoton, Zeiss MP InVivo MultiPhoton, Leica with ANDOR DSD2 Fast Confocal, Zeiss SBF-SEM SigmaVP 3View Electron Microscope 3d Sectioning and Imaging and Zeiss LSM800 with AIRYSCAN Fast Confocal;

LABORATORY OF PRECLINICAL TESTING OF HIGHER STANDARD: automated equipment for nucleic acids separation and Bio-analyzer for RNA, DNA and proteins (Bio-Rad ChemiDoc MP Imaging System), automated histology and cytology workstation equipped with apparatus for automatic dehydration and embedding of tissue, rapid submerging in paraffin, and automated process of staining for quality microscope slides (Thermo Shandon);

LABORATORY OF BIOINFORMATICS: Nencki Genomics Database – a database of cis-regulatory regions and motifs integrating Ensembl Funcgen with user data, the first cis-regulatory database for the rat in the world, Supermicro SeperServer 4048B-TR4FT, 48 cores Intel Xeon, 1 TB RAM.

Apart from the Neurobiology Centre there are 34 fully equipped laboratories at the Nencki Institute, as well as the Mikolajki field station. The highest quality labs of the Nencki, other than the Neurobiology Centre units, include:

- **Laboratory of Cytometry** with a FACSAria cell sorter, three flow cytometers including 4-laser LSR Fortessa and a scanning cytometer;
- **Laboratory of Electron Microscopy**, equipped with a transmission electron microscope JEM-1400 enabling full quantitative X-ray microanalysis (EDS) and mapping of the elements in the analyzed sample;
- **Spectrophotometry Unit** equipped with a SpectraMax M5E multimodal reader for reading absorbance, fluorescence and luminescence; and an Aequorynometr Infinite F200 (luminometer adapted to the in-vivo measurements of calcium homeostasis in cell cultures);
- **Behavioral Tests Unit** equipped with a complete set of automated and computerized tests used for complex scientific assessment of rodent behavior. The equipment, purchased with CoE MIND project funds, allows for research on various aspects of animal behavior including emotional and cognitive functioning, learning and memory performance, mechanisms of attention and information selection, physical ability, locomotion capacity and activity, spatial navigation, social interactions, depression and addiction phenomenon.
- modernized **Animal House** with animal surgery facilities
- **Germplasm bank.**

10. List of the additional benefits that the Institution declares to provide for Dioscuri Centre (i.e.: additional funds, personal benefits, other) (up to one in page A4 format):

The Dioscuri Centre team will have access to the expertise and services of the Nencki core facilities, i.e. Laboratory Of Animal Models, Laboratory of Brain Imaging, Laboratory of Molecular Neurobiology, Laboratory of Imaging Tissue Structure and Function, Laboratory of Preclinical Testing of Higher Standard and Laboratory Of Bioinformatics, but also of the units supporting the work of researchers, including:

- Laboratory of Electron Microscopy
- Laboratory of Cytometry
- Animal House
- Germplasm Bank
- Library
- Technology Transfer Unit
- Office of International Relations and Project Management
- Finance and Accounting
- Human Resources
- PhD Studies

Greatly advantageous for the research environment and infrastructure of the Institute is its location on the so-called *Ochota Research Campus*, with 14 scientific institutions in one square kilometer: 5 institutes of the Polish Academy of Sciences, 5 faculties of the Warsaw University, the Interdisciplinary Centre for Mathematical and Computational Modelling, the Heavy Ion Laboratory and the Medical University of Warsaw with the largest clinical hospital in Poland.

This ensures extensive collaboration possibilities, both locally - with other groups at the Institute and on the Ochota Research Campus - and externally, with numerous research groups from the scientific institutions collaborating with the Institute on regular basis.

Particularly beneficial for the Institute is its collaboration within various consortia, including those established to implement projects funded from the Structural Funds or the research and training networks co-financed by the EC under the FP7 and H2020.

Collaboration with the technology transfer platform within the established bio-tech-med (BTM) cluster (www.btm-mazovia.pl) provides for early stage and experienced researchers support and training in innovation management. Starting from training seminars and workshops, through intellectual property management and project development, Nencki researchers can benefit from professional advice, access to private funding as well as legal and negotiations support in licensing and start-up formation.

Since 2014 the Nencki Institute has been governing the Hydrobiological Station located in Mikolajki in the Great Masurian Lakes district. The main task of the Station is to enable researchers in various fields, not only hydrobiologists, from Poland and abroad, to conduct their research by offering year-long stay guest rooms and summer cottages and by providing access to its state-of-the-art laboratories of bio-imaging and molecular biology. The Station may serve as a great venue for mini-symposia, workshops or scientific meetings.

The vast collection of the Nencki Institute Library includes manuscripts, atlases, old prints, 19th and early 20th century prints and magazines from XIX and XX century. In total, 989 items have been published in the Institute's Repository and are available on the public platform at <http://rcin.org.pl/ibd/dlibra>.

In addition to standard benefits required by law, other benefits are provided by the Nencki Institute to its employees, which will also be available to the Dioscuri Centre staff. These benefits include additional health insurance (ENEL-MED), Employee Benefit Fund, child care (MARCELKI child day care) or fitness (MULTISPORT Benefit System programme).

11. Other information about internationalization of the scientific institution, foreign scientists employed at the institution, availability of the English language seminars etc. (up to one page in A4 format):

The Nencki Institute fully recognizes the need for internationalization of the process of research and education. Constant striving to create an international potential and to build the Institute's international image has become an integral part of its strategy of development.

The management of the Institute includes a Representative for Strategic European Programmes. In addition, its organizational structure contains the Office of International Cooperation and Project Management, dealing with international cooperation. The Office facilitates all formal and organizational aspects of international relations, including organization of international conferences and workshops, supporting scientific exchange programmes, managing organizational, legal, and financial aspects of hosting foreign visitors at the Institute as well as aiding Institute employees in their missions abroad. Its staff assist Institute's scientists in development and preparation of proposals for external funding from national and international sources, monitor the financial and administrative aspects of submitted proposals and all on-going projects. The Office employees act in the capacity of project managers for large and complex projects financed from the European Funds and the Framework Programmes. The Office also acts as a liaison with the European Commission (Marta Rucinska is the designated LEAR for H2020) and with the coordinators and funding agencies for large scale investment and R&D projects.

The Nencki Institute currently cooperates with 97 scientific institutions in 35 countries from all around the world. 12 official contracts on cooperation with entities from other countries have been concluded.

In recent years the leading Nencki research groups have been involved in more than 30 externally funded international projects, including 1 ERC STG project, 12 FP7 and H2020 Marie Skłodowska Curie actions, 6 FP7 Cooperation projects, 2 FP7 Capacities projects, 1 FP7 REGPOT, 1 H2020 FETOPEN, 3 EMBO and 2 HFSP projects. At the moment the Institute is the home of seven H2020 projects (1 ERC, 2 ITNs, 1 RISE, 1 COFUND, 1 INFRADEV and 1 FETOPEN), one HFSP project and 2 ERA-NET NEURON COFUNDs.

The Nencki scientists publish their works in international magazines. In fact, the excellent publication record (well over 100 peer-reviewed publications on the ISI list and over 2000 citations annually; 10 of 35 Polish most-cited biologists) place the Institute among the leading biological institutions in Central Europe.

Nencki representatives are the members of prestigious associations which are international in character, such as EMBO, EMBC and FEBS.

Since 2013 the Nencki Institute participated in the organization of 34 international conferences with over 3700 participants. During the conferences 654 presentations were delivered, of which 426 were presented by foreigners. In the last 4 years the Nencki Institute was the organizer or co-organizer of 15 national conferences, attended by over 1900 researchers who heard c.a. 290 presentations.

The Institute participates in international education fairs and publishes informative and promotional materials in foreign languages.

Currently there are 35 foreign scientists working at the Institute. In recent years Nencki internal administrative procedures have been upgraded to suit the needs of international staff. The support units at the Institute have international experience and language skills. The Institute offers an interdisciplinary PhD programme with all the lectures and seminars in English.

The Nencki Institute is the first research institution in Poland to be awarded the prestigious HR Excellence in Research badge, which signifies that the Institute complies with the guidelines of the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers.