Registration form

This is a registration form for Host Institutions wanting to establish a Dioscuri Centre of Scientific Excellence within Dioscuri 4 call.

1. **Research institution data** (name and address):

Adam Mickiewicz University, Poznań (AMU)
Wieniawskiego 1
61-712 Poznań

Faculty of Biology (FB AMU)
Uniwersytetu Poznańskiego 6
61-614 Poznań

2. **Type of research institution**
   1) higher education institution

3. **Head of the institution:**

AMU Rector – prof. dr hab. Bogumiła Kaniewska

4. **Contact information of designated person(s) for applicants and the NCN:**

Prof. dr hab. Beata Messyasz
Dean of Faculty of Biology, AMU
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Correspondence address:
Collegium Biologicum
Uniwersytetu Poznańskiego 6, 61-614 Poznań

5. **Research discipline in which the strong international position of the institution ensures establishing a Dioscuri Centre**:

Life Sciences

☑ **Molecular biology, structural biology, biotechnology**

☐ Genetics, genomics

☐ Cellular and developmental biology

☐ Biology of tissues, organs and organisms

☐ Human and animal non-infectious diseases

☐ Human and animal immunology and infection

☐ Diagnostic tools, therapies and public health

☐ Evolutionary and environmental biology

☐ Applied life sciences and biotechnology

6. Description of important research achievements from the selected discipline from the last 5 years

The Faculty of Biology AMU was granted by the Minister of Science and Higher Education with a prestigious status of a Leading National Research Centre (KNOW). Acting within KNOW, the Institute of Molecular Biology and Biotechnology (**IMBB**) created the **RNA Research Centre** (grant ~8,500 k€). The expertise of IMBB encompasses four major fields of modern biology with main focus on **RNA biology**.

(1) Plant molecular biology and biotechnology. We showed that histone H2A.Z in gene bodies has a strong repressive effect on transcription; We revealed an unexpected pro-crossover role for MSH2 in regions of higher sequence diversity in *A. thaliana*; The secondary structure of miRNA precursors induced by m^6A methylation influence the recruitment of Microprocessor and stimulates miRNA biogenesis; Serrate protein regulates miRNA biogenesis through its double contribution in promoting miRNA processing and pri-miRNA degradation; Expression of exonic and intronic miRNAs is regulated by splicing of precursors.

Blackwell AR, et al. (2020) *MSH2 shapes the meiotic crossover landscape in relation to interhomolog polymorphism in* Arabidopsis. ***EMBO J***. 39:e104858. Bhat SS, et al. (2020) *mRNA adenosine methylase (MTA) deposits m6A on pri-miRNAs to modulate miRNA biogenesis in Arabidopsis thaliana*. **Proc Natl Acad Sci U S A.** 117:21785. Bajczyk M et al. (2020) *SERRATE interacts with the nuclear exosome targeting (NEXT) complex to degrade primary miRNA precursors in Arabidopsis*. ***Nucleic Acids Res.*** 48:6839. Sura W et al. (2017) *Dual role of the histone variant H2A.Z in transcriptional regulation of stress-response genes.* **Plant Cell** 29:791-807; Ziółkowski PA et al (2017) *Natural variation and dosage of the HEI10 meiotic E3 ligase control Arabidopsis crossover recombination.* **Genes Dev** 31:306-317; Knop K et al. (2017) *Active 5' splice sites regulate the biogenesis efficiency of Arabidopsis microRNAs derived from intron-containing genes.* ***Nucleic Acids Res*** 45:2757–2775.

(2) Molecular medicine and gene therapy: We revealed that MBNL paralogs and splicing isoforms have a different effects on regulation of alternative splicing and alternative polyadenylation in myotonic dystrophy; Antisense oligonucleotides can ameliorate toxic effect of RNA with expanded CUG and CGG repeats in cell and animal models of diseases. Our research uncovered genome-wide and mechanistic insight of the STAT-, IRF- and NF-kB-dependent signal integration between TLR4 and IFNs (Type I and II) in vascular and immune cells in experimental and clinical atherosclerosis, with important potential applications in diagnostics, prognostics and novel treatment strategies.

Derbis M. et al. (2021) *Short antisense oligonucleotides alleviate the pleiotropic toxicity of RNA containing/harboring expanded CGG repeats.* ***Nat Commun.*** (in press); Stepniak-Konieczna E. et al. (2020) *AON-induced splice-switching and DMPK pre-mRNA degradation as potential therapeutic approaches for Myotonic Dystrophy type 1*. ***Nucleic Acids Res.***;48(5):2531; Taylor K et al. (2018) *MBNL splicing activity depends on RNA binding site structural context*. ***Nucleic Acids Res.*** 46:9119-9133; Sznajder LJ et al. (2018) *Intron retention induced by microsatellite expansions as a disease biomarker*. ***Proc Natl Acad Sci U S A.*** 115:4234-4239; Piaszyk-Borychowska A. et al. (2019) *Signal Integration of IFN-I and IFN-II with TLR4 involves sequential recruitment of STAT1-complexes and NFκB to enhance proinflammatory transcription.* ***Frontiers in Immunology.*** 10:1253; Plens-Galaska M. et al. (2018) *Genome-Wide Inhibition of Pro-Atherogenic Gene Expression by Multi-STAT Targeting Compounds as a Novel Treatment Strategy of CVD.* ***Frontiers in Immunology.*** doi:10.3389/fimmu.2018.02141.

(3) Molecular microbiology: Studies are focused on global RNA-binding proteins, ProQ and Hfq, which contribute to posttranscriptional gene expression regulation by small RNAs in bacteria. They explained the roles of three distinct RNA binding sites of Hfq in annealing of sRNA to mRNAs. We showed that the FinO domain of ProQ specifically recognizes intrinsic transcription terminators.

Stein EM. et al. (2020) *Determinants of RNA recognition by the FinO domain of the Escherichia coli ProQ protein.* ***Nucleic Acids Res.*** 48:7502-7519; Kwiatkowska J et al. (2018) The binding of Class II sRNA MgrR to two different sites on matchmaker protein Hfq enables efficient competition for Hfq and annealing to regulated mRNAs. ***RNA*** 24:1761-1784; Ukleja M et al. (2016) *The architecture of the Schizosaccharomyces pombe CCR4-NOT complex.* ***Nat Commun.*** 7:10433.

(4) Bioinformatics and molecular evolution. We provide a guide to the currently available alignment-free sequence analysis tools and introduce a web-based meta-server for real-time identification and functional annotation of orthologous genes.

Zielezinski A. et al. (2019) Benchmarking of alignment-free sequence comparison methods. ***Genome Biol.*** 20:144; Zielezinski A. et al. (2017) *ORCAN-a web-based meta-server for real-time detection and functional annotation of orthologs*. ***Bioinformatics.*** 33:1224-1226.

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):

The crosstalk between the microRNA biogenesis complex, splicing and polyadenylation machineries in plants; PI: Artur Jarmołowski, NCN MAESTRO, 3,000,000.00 PLN (ca. 670,000 €)

Identification of chromatin factors affecting meiotic crossover formation in plants; PI: Piotr Ziółkowski, Foundation for Polish Science – TEAM, 3,499,750.00 PLN (ca. 780,000 €)

Pathogenesis driven by RNAs with expansion of trinucleotide repeats: mechanisms and therapeutic strategies; PI: Krzysztof Sobczak, Foundation for Polish Science – TEAM, 3,499,222.00 PLN (ca. 780,000 €)

8. **Description of the available laboratory and office space for the Dioscuri Centre**

The Faculty of Biology of Adam Mickiewicz University (FB AMU) localizes in Collegium Biologicum at the AMU Morasko campus. The newly-built and still growing campus hosts all science faculties of AMU (Faculty of Chemistry, Geographical and Geological Sciences, Mathematics and Informatics, and Physics). Collegium Biologicum is also located between two research centers: the NanoBioMedical Centre and the Centre for Advanced Technologies (CAT), which offer specialized equipment, research infrastructure and space for laboratories for new research groups.

The active life of a new Coll. Biologicum started in 2003. The building's surface area amounts to 23 500 m^2, and the cubature reaches 106 400 m^3. It is functionally subdivided into two parts: the research and didactic ones. It also includes the social and administrative facilities as well as the storage areas. Part of the building is allocated to the library, hosting ca. 20 000 books and journals useful for biological studies. Access to electronic publications in journals and books, as well as to various databases subscribed by the University, is provided via membership in University Library.

The research part of Collegium Biologicum is characterized by an open plan, with no specific limits set between four institutes constituting the Faculty of Biology. It allows for a flexible organization of research. This flexibility enables finding space for the new research group, and indeed, since the Faculty moved to a new building, several new research groups have been established. The building hosts core facilities dedicated to the provision of specialized services to the Faculty members. They are:

- Core phytotron facility,
- Core facility for genetic engineering,
- Core facility for confocal and electron microscopy,
- Core facility for imaging and radioisotope work,
- Core facility for molecular biology techniques,
- Bioinformatics cluster for processor time-demanding computation,
- The laboratory for high-throughput techniques,
- BioGIS core facility.

Most of these core facilities are useful for research concerning biochemistry, molecular biology, genetics/genomics, biology of cell, tissues, organs, and organisms. All of them are described in detail in point 9.

The prospective leader and the research group will be primarily affiliated with the Faculty of Biology AMU, particularly with the Institute of Molecular Biology and Biotechnology. For the Centre, it is envisioned that one standard research laboratory (ca. 35 m^2) and one standard office room (ca. 16 m^2) will be allocated for a start. Additionally, space for Ph.D. students and post-docs will be allocated in dedicated office space at the Institute. The area available for biological research is situated in 1-2 floors, and the research labs and offices are fully furnished and equipped. All office and laboratory rooms have wired access to the Internet administered by AMU Computer Centre. Collegium Biologicum also has its own dedicated optical fiber connection to the infrastructure of Poznan Supercomputing and Networking Centre – principal administrator and provider of network infrastructure. In line with the development of the potential Dioscuri Centre, additional space will be administered, including access to other research labs and offices in CAT. Essential core facilities located at CAT include a greenhouse, animal house, and microbiological laboratories. Both are described in detail in point 9.

9. **List of the available research equipment for the Dioscuri Centre**:

The equipment available at the Faculty of Biology encompasses a range of applications, which will be available to the Dioscuri Centre. Our capabilities are further extended by access to other essential pieces of equipment available at the AMU Morasko Campus, particularly at two AMU research centers: the Centre for Advanced Technologies (CAT) and the NanoBioMedical Centre.

At the Faculty of Biology, researchers have access to specialized equipment in the following core facilities.

Core phytotron facility. This facility contains four walk-in phytotrons (Conviron). One phytotron is dedicated for high light, two for low light, and one exclusively for work with *Arabidopsis*. It contains space for planting and harvesting. Apart phytotrns, there are growing rooms and growing chambers dispersed in Collegium Biologicum.

Core facility for genetic engineering. The functioning of the laboratories is fully controlled and legally approved. For the work with genetically modified organisms (GMO) and microorganisms (GMM), respective Departments for Genetic Engineering have been established and approved by the Minister of the Environment in accordance with the appropriate Acts. Within those Departments, the Institute of Molecular Biology and Biotechnology is allowed to carry out experiments involving genetic modifications.

Core facility for confocal, superresolution and electron microscopy provides equipment and expertise to perform all steps of the sample preparation and microscopy analysis, starting from embedding, cutting (microtomes and ultramicrotomes), and up to final image analysis. It has a scanning electron microscope SEM Zeiss EVO40 and transmission electron microscope JEOL 12Ex. It also provides access to a basic Zeiss confocal microscope with five laser lines,

Core facility for imaging and radioisotope work. This facility has two phosphorimagers: Typhoon 9500 and FLA-5000, which are available for scanning either radioisotope-labeled or fluorescently labeled samples. The facility also includes two appropriately equipped and protected labs with controlled access for work with radioactivity. It also consists of a cold-room. The head of the facility is a licensed isotope work inspector.

Core facility for molecular biology techniques provides access to equipment and services mostly related to DNA/RNA sequencing and analysis. These include *i*) Ion Torrent PGM System (Life Technologies) for high throughput sequencing; *ii*) two ABI PRISM 3130xl sequencers (Applied Biosystems) for Sanger DNA sequencing; *iii*) 2200 TapeStation Nucleic Acid System (Agilent Technologies) for DNA analysis and Ion Torrent library preparation, and *iv*) CHEF Mapper® XA system for pulsed-field gel electrophoresis with superior resolution in the range of 100 bp to 10 Mb (BioRad). It also includes specialized cleanrooms for work with ancient DNA.

Bioinformatics cluster for processor time-demanding computation. The computational resources of the Faculty of Biology include a cluster built of 55 nodes (32 threads and 128GB RAM each) connected with a 1PB storage array. The resources are integrated with the infrastructure of Poznan Supercomputing and Networking Centre (PSNC) and can be rescaled to include the computational potential of PSNC. The cluster is connected via a direct and independent optical fibre network with Collegium Biologicum at the AMU Morasko campus.

The laboratory for high-throughput techniques. The laboratory provides access to Next Generation Sequencing based on Illumina MiSeq and HiScan SQ system with cBot and Real-time PCR systems.

BioGIS core facility supports GIS-based research methods to projects requiring GIS and remote sensing in ecological and biodiversity studies.

In addition to core facilities of the Faculty of Biology, researchers can access equipment based at the Institute of Molecular Biology and Biotechnology and other institutes. Shared equipment for specific applications is listed below and available at http://ibmib.amu.edu.pl/pl/start/.

Shared spectrometers and imaging equipment. These include two microplate readers (M200, F200, Tecan), several spectrophotometers, including nanodrops, and gel imaging systems (G-box).

Shared clean rooms. These include specialized cleanrooms for work with animal cell cultures, with plant cultures, with protists, slime molds, yeasts, and bacteria.

Shared equipment for preparation and analysis of macromolecules. For such purposes, the IMBB has equipment for preparative scale bacterial growth, including shakers-incubators with heating and cooling systems. This is complemented by shared centrifuges, from preparative scale to ultracentrifuges. The chromatography lab is equipped with three Acta FPLC and HPLC systems enabling purification procedures with the use of affinity chromatography, size exclusion, and other techniques.

Shared equipment for plant molecular biology. The facility includes clean rooms, shaker-incubators specific for plant work, and about 20 cabinets for plant cultivation in controlled conditions (Panasonic, Conviron). It also has specialized workplaces for the transformation of *Arabidopsis*, potato, *Nicotiana benthamiana*, barley*, Brachypodium, Physcomitrella,* and *Marchantia.*

Additional shared microscopic facility. The highlight of this facility is the high-end **confocal microscope Nikon A1-R** equipped with seven laser lines and spectral detector as well as with Picoquant system for detection of single molecules (FCS, FLIM, FLIM-FRET) and TIRF (with Andor camera). NIS-elements software, Imaris software, and Huyghens deconvolution software ensure advanced image analysis. In this facility we also have **Zeiss Elyra 7 superresolution microscope** with lattice SIM (Structural Illumination Microscopy) and single molecule localization microscopy (SMLM) module for techniques such as (3D) PALM, dSTORM and PAINT and **Zeiss Lightsheet 7 fluorescence light-sheet microscope** for multiview imaging of living and cleared specimens. The facility is also equipped with optical fluorescent microscopes: Zeiss Axioimager and Zeiss Axiovert, and several binoculars (also equipped with fluorescent lamp). It also has a Leica microtome for sample preparation and a box for plant macroimaging.

Additional resources available at the AMU Morasko Campus

Centre for Advanced Technologies (CAT)

Among several important facilities at CAT of particular interest for research related to the biology of tissues, organs, and organisms are a greenhouse, an animal facility, and a microbiological facility, which are described below. CAT also has laboratories dedicated to molecular biology studies with appropriate equipment.

Greenhouse. The facility contains a block of in vitro cultures, a block of phytotrons, and a greenhouse. The greenhouse enables the studies of the effect of cold stress, high-temperature stress, and biotic stresses on plants.

Animal Facility. This is one of the most modern facilities in Poland creates the possibility of conducting in vivo and in vitro research within the framework of biomedical sciences, with particular emphasis on pharmacology, toxicology, oncology, and pathophysiology. This facility allows experiments on animals that can be hosted in a standard SPF (Specific Pathogen Free).

Microbiological facility. This facility includes laboratories in which research can be carried out in the broadly understood industrial biotechnology, environmental protection, and other fields in which microorganisms are used.

NanoBioMedical Centre

This research center has several high-end pieces of equipment, which are available for use in biological applications. Among them are:

- electron microscopes: HRTEM JEOL ARM 200F, TEM 120kV, and SEM JEOL 7001TTLS; electron microscopes are equipped for work with cryoTEM and cryo SEM techniques;
- atomic force microscopes: Innova Bruker, and Icon Bruker;
- Raman spectrometer and scanning microscopes: Catalyst, and NT_MDT SNOM;
- confocal microscopes: Zeiss LSM 780 NLO with six laser lines and 2-photon excitation laser (Chameleon 680-1080nm, 140 fs), spectral detection and FCS (ConfoCor 3), and confocal microscope Leica SP5 with seven standard laser lines and white laser 470-670 nm, spectral detection, STED superresolution, FCS (Picoquant).

10. List of the additional benefits (other than listed in call text) that the Institution declares to provide for the Dioscuri Centre

As an additional offer, AMU and FB AMU declare the following:

a) The University will add 10,000 € per year for the whole duration of the project, and when the funding would be renewed – for the following 5 years.

b) In addition to team members employed within the Dioscuri Centre from the project, the Faculty of Biology will fund the full-time position of research technician.

c) Faculty of Biology will provide access to bioinformatics cluster free of charge, and the services of the faculty core facilities for the price of chemicals (no service charges).

d) Providing successful evaluation of the Dioscuri Centre (either 5-year only or renewed for the next 5 years), the University will continue to provide full-time employment of the research group leader.

e) At the beginning of the project, the University will provide the flat for the prospective leader and his/her family. The University will also guide and help other team members to find proper accommodation.

f) Guidance and help in finding suitable job offer for the spouse of the group leader will also be provided.

g) All members of the Dioscuri Centre will have the same rights and access to University benefits for employees, including: e-sport card, University medical care as well as special medical bundles, University holiday centers, etc.

h) An institutional mentor for the DC leader will be appointed. This person will guide the Leader during the first year of funding period through the regulations and working culture of AMU.

i) AMU Project Support Centre will provide assistance in project implementation and all project-related issues.

11. **Other information about the internationalisation of the research institution, international researchers employed at the institution, the availability of English language seminars etc**.:

The Faculty of Biology (FB) is a basic organizational unit of Adam Mickiewicz University distinguished by the **HR Excellence in Research award** (since 2016). AMU is signatory of the **EPICUR Consortium** (European Partnership for an Innovative Campus Unifying Regions).

The FB AMU, together with the Institute of Bioorganic Chemistry PAS was granted by the Minister of Science and Higher Education with a prestigious status of a **Leading National Research Centre (KNOW)**. Acting within KNOW, cyclic conferences and numerous seminars in English are organized, including RNA Club organized weekly (see http://know-rna.amu.edu.pl/en/).

English is a common language for communication at FB AMU. At the Institute of Molecular Biology and Biotechnology (IMBB) of FB AMU, to which new PI will most likely be linked, weekly seminars in English are organized. They are hosting many speakers from abroad (see http://ibmib.amu.edu.pl/pl/start/). Currently, two group leaders of IMBB are foreigners.

Active international cooperation includes the implementation of a number of formal international programs. Currently, international programs held at IMBB include two EMBO Installation Grants, H2020-Maria Skłodowska Curie Actions - Individual Fellowship, two Horizon 2020 research projects in frame of ERA-NET instruments and many COST actions. Informal international collaboration is also reflected in numerous publications with authors from other countries (https://researchportal.amu.edu.pl).

Postdocs and PhD students are routinely recruited in open international calls, and post-docs employed over recent years at IMBB were recruited from several countries. Foreigners currently constitute ca. 20% of students at FB AMU doctoral school. Options for international collaboration are now being extended under national excellence initiative (ID-UB) started in 2020, which facilitate international exchange and recruitment of outstanding researchers from abroad within visiting professorship program.

Teaching programs in English are offered to PhD and MSc students, which are open to students from abroad. The programs are enhanced by two projects funded from EU structural funds (POWER), which support international exchange and funding courses for FB-AMU PhD students run by outstanding researchers invited for this purpose from abroad. At the level of post-graduate studies, two MSc programs are offered in English by FB AMU: Environmental Protection, and Biotechnology. FB AMU organizes recurring international summer schools: Poznań Bioinformatics Summer School, Summer School RESTLAKE, and Summer School of Molecular and Theoretical Biology (with Zimin Foundation), which involve international staff and students. Students and PhD students can also take advantage a number of different courses taught in English.