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. UAM dr hab. Sławomir Borek

Prof. dr hab. Beata Messyasz
Dean of Faculty of Biology, AMU
email: messyasz@amu.edu.pl
phone: +48 61 829 55 51, +48 61 829 57 61

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**

Research conducted in the Institute of Experimental Biology covers three areas related to the biology of plants, animals (including human cell lines and tissues), and bacteria and viruses (including bacteriophages).

Biology of PLANT tissues, organs and organisms

Osmopriming of *Brassica napus* seeds changes the architecture of the seed coat and the embryo cells [1]. Pyridine nucleotides and their redox status contribute to orthodox and recalcitrant phenotype differentiation in *Acer* seeds [2]. Melatonin plays a regulatory role in sugar metabolism in etiolated BY-2 cells [3]. During 'Dark Induces Leave Senescence' (DILS) in *Hordeum vulgare* occurs up-regulation of recycling processes and the mega-autophagy and programmed cell death processes symptoms are observed [4]. Nitrogen resorption is activated in senescent *Populus trichocarpa* roots [5]. In lianas, resources are allocated from roots to above-ground organs [6]. *Tilia cordata* root architecture, especially root apices, can be an indicator of mining sludge toxicity [7]. Cadmium causes the induction of RNA oxidations in *Glycine max* [8]. Potato immunity against *Phytophthora infestans* is accompanied by boosted $ONOO^-$ formation [9]. *Aneura pinguis* (liverworts) is differentiated and forms three distinct clades [10]. Ultrastructural and physiological trait variation was described during dehydration and rehydration in *Sphagnum denticulatum* (mosses) [11].

[1] Lechowska K et al. ***Int J Mol Sci*** 2019, 20, 540. [2] Alipour S et al. ***Plant Cell Physiol*** 2020 61(6): 1158-1167. [3] Kobylińska A et al. ***J Pineal Res*** 2018, 64(4), 2018;e12466. [4] Sobieszczuk-Nowicka E et al. ***Plant Physiol*** 2018, 178: 654-671. [5]. Wojciechowska N et al. ***Tree Physiol*** 2020, 40(8), 987-1000. [6] Wyka TP et al. ***Ann Bot*** 2019, 124(5), 777-790. [7] Krzesłowska M et al. ***Environ Poll*** 2019, 248, 247-259. [8] Chmielowska-Bąk J et al. ***Front Plant Sci*** 2018, 8: 2219. [9] Izbiańska K et al. ***Front Plant Sci*** 2018, 9, 672. [10] Myszczyński K et al. ***Sci Rep*** 2017, 7, 9804. [11] Winnicka et al. ***Plant Physiol Biochem*** 2018, 132: 363-374.

Biology of ANIMAL tissues, organs and organisms

Protoberberine fraction (BBR-F) extracted from *Chelidonium majus* represent promising novel photosensitive agents and can be applied in cancer photodynamic therapy [12]. A single mutation in human Krüppel-like factor 1 (KLF1/EKLF) zinc finger exerts effects on erythroid physiology in congenital dyserythropoietic anemia (CDA) type IV [13]. Hexagonal boron nitride (h-BN) functionalized with hydroxyl groups (h-BN-OH-n) induced low cytotoxicity in insect hemocytes, human erythrocytes, and mouse fibroblasts [14]. Nanodiamonds can easily transmigrate through the cuticle in *Tenebrio molitor* and be a carrier for *Neb*-colloostatin [15]. Glycoalkaloids and glucosinolates from *Solanum nigrum* and *Armoracia rusticana* extracts revealed may be used as insecticides [16]. Moderately freeze-tolerant cockroach *Gromphadorinha coquereliana* may possess an efficient DNA repair system [17].

[12] Warowicka et al. ***Phytomedicine*** 2019, 64:152919. [13] Kulczynska et al. ***Mol Cell Biol*** 2020, 40(5) e00444-19. [14] Czarniewska E et al. ***Sci Rep*** 2019, 9, 14027. [15] Czarniewska et al. ***Sci Rep*** 2019, 9:10330. [16] Chowanski S et al. ***Ecotox Environ Safe*** 2018, 162: 454-463. [17] Lubawy J et al. ***J Exp Biol*** 2019, 222: jeb21374.

Biology of MICROORGANISMS

To define an entirely new meaning of regulation of the human papillomavirus (HPV) L2 proteins in the infectious entry pathway [18]. The frequency of genes conferring resistance to β-lactam and carbapenem antibiotics increase in bacteria during the wastewater treatment [19]. TOXiTAXi - a web database for the toxicity of *Bacillus thuringiensis* proteins was created [20]. The use of the insecticidal activity of a mixture of *Bacillus thuringiensis* toxins and thymol protein crystals was patented [21]. The phylogenies of the group of Bacillus phage SPO1-related viruses was revised [22].

[18] Broniarczyk J et al. ***J Vir*** 2019, 93(13):e00128-19. [19] Nicoletta M et al. ***Water Res*** 2020, 170, 115277. [20] Baranek J et al. ***Sci Rep*** 2020, 10, 19767. [21] Konecka et al. **Patent no 228067**, 2018. [22] Barylski J et al. ***Syst Biol*** 2020, 69(1):110-123.

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):

Epigenetic dissection of induced barley leaf senescence and its utilization in crop improvement; PI: Ewa Sobieszczuk-Nowicka, NCN SONATA BIS, 2 807 020 PLN (ca. 624 000 €)

Nitroxyl as an alternative or competitive to nitric oxide metabolic link in plants in the model *Arabidopsis thaliana*; PI: Magdalena Arasimowicz-Jelonek, NCN SONATA BIS, 2 394 600 PLN (ca. 532 000 €)

Research on molecular mechanisms of functions of pathogenesis-related proteins of *Chelidonium majus* latex; PI: Robert Nawrot, NCN OPUS, 1 712 520 PLN (ca 381 000 €)

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

The Faculty of Biology of Adam Mickiewicz University is located in Collegium Biologicum at the AMU Morasko campus. The newly-built and still growing campus hosts all science faculties of AMU (Faculty of Chemistry, Faculty of Geographical and Geological Sciences, Faculty of Mathematics and Informatics, and Faculty of Physics). Coll. Biologicum is also located between two research centres: the Centre for Advanced Technologies (CAT) and the NanoBioMedical Centre.

The active life of 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 Coll. 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 created. 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.

Most of these core facilities are useful for research concerning the biology of 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 Experimental Biology. For the Centre, it is envisioned that one standard research lab (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 of Experimental Biology. 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. Coll. Biologicum also has its own dedicated optical fibre 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 created and approved by the Minister of the Environment in accordance with the appropriate Acts. Within those Departments, the Institut of Experimental Biology is allowed to carry out experiments involving genetic modifications.

Core facility for confocal and electron microscopy provides equipment and expertise to perform all steps of the sample preparation and microscopical 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, several basic fluorescence microscopes, and binoculars.

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.

In addition to core facilities of the Faculty of Biology, researchers can access equipment based at the Institute of Experimental Biology and other institutes. Shared equipment for specific applications is listed below.

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 Faculty of Biology 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 thaliana*, 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. 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. WCAT also has laboratories dedicated to molecular biology studies with appropriate equipment.

<u>*Greenhouse.*</u> 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.

<u>*Animal Facility*</u>. 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).

<u>*Microbiological facility*</u>. 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 cryoSEM 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 (i.e.: additional funds, personal benefits, other)**

As an additional offer, Adam Mickiewicz University and Faculty of Biology declare the following:

- In addition to the University funding mentioned above, 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.
- 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.
- 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).
- 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.
- 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.
- Guidance and help in finding suitable job offer for the spouse of the group leader will also be provided.
- 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 centres, etc.
- 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.
- 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 is a basic organizational unit of the Adam Mickiewicz University - a university distinguished by the **HR Excellence in Research award** (since 2016).
- The Adam Mickiewicz University is a signatory of the **EPICUR consortium** (European Partnership for an Innovative Campus Unifying Regions). Its partners are: The University of Strasburg (project leader, France), The University of Amsterdam (Netherlands), the Albert-Ludwigs-University of Freiburg (Germany), Karlsruhe Institute of Technology (Germany), The University of Upper Alsace (France), the University of Natural Resources and Life Sciences, Vienna (Austria), and the University of Thessaloniki (Greece).
- Active international cooperation of the Faculty of Biology AMU includes the implementation of a number of international programs. Currently, international programs held at the Faculty include EMBO Installation Grant; COST, COST PERIAMAR, COST ACTION, LIFE17, or CANALETTO (financed by NAWA).
- International cooperation of the Faculty of Biology is also carried out independently of official research projects and is reflected in numerous publications with authors from other countries.
- The Faculty of Biology 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.
- Options for international collaboration are now being extended under “Initiative of Excellence - Research University” (ID-UB) started in 2020, which facilitate international exchange and recruitment of outstanding researchers from abroad within visiting professorship program.
- The Faculty of Biology conducts a program of PhD studies in English. The program is enhanced by two programs funded from EU structural funds (POWER 03.02-00-I022/16 and POWR.03.02.00-00-I022/16-01), which support international exchange and funding courses for PhD students run by outstanding researchers invited for this purpose from abroad (POWER 03.02-00-I022/16). Foreigners currently constitute ca. 20% of students at the Faculty of Biology AMU doctoral school.
- At the level of post-graduate studies, two MSc programs are offered in English by the Faculty of Biology: Environmental Protection, and Biotechnology.
- Students and PhD students can take advantage a number of different courses taught in English, organized by AMU-PIE and hosted at the Faculty of Biology AMU.
- The Faculty of Biology AMU organizes recurring international summer schools: Poznań Bioinformatics Summer School, and Summer School RESTLAKE, and Summer School of Molecular and Theoretical Biology (with Zimin Foundation), which involve international staff and students.