

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 the Faculty of Biology AMU

email: beata.messyasz@amu.edu.pl

phone: +48 829 55 51

Correspondence address:

Collegium Biologicum AMU, 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 including a list of the most important publications, patents, other**

Evolutionary biology: (i) A study of major histocompatibility genes in a guppy fish demonstrated the fundamental process hypothesised to driving evolution of this key element of vertebrate immune system, i.e. selective advantage of novel alleles¹. (ii) An evolutionary trade-off between the number of expressed MCH genes and repertoire of T-cell receptors has been demonstrated²; These studies built on development of NGS-based methodologies to study highly polymorphic immune gene families (MHC, TCR)^{3,4} that are now widely used by other researchers.

Evolutionary genomics: Genome assembly and resequencing of a fish ectoparasite revealed the role of hybridisation and recombination in producing invasive parasites^{5,6}.

Behavioural ecology: (i) Experimental evolution study demonstrated that kin selection can modulate the intensity of the conflict between the sexes⁷. (ii) The application of robotics to the study of multimodal signalling helped to decode avian deception⁸. (iii) Field study interspecific social information use in habitat selection decisions among migrant songbirds⁹

Ecology: (i) A theoretical framework for incorporating the effects of individual variation on animal-mediated seed dispersal has been developed¹⁰. (ii) Assessment of multiple impacts of anthropogenic global changes on tree reproduction revealed fundamentally different mechanisms of pollen limitation in driving masting tree reproduction¹¹ and documented how climate warming reduces tree fitness, but also how selection can act to re-establish lost masting benefits¹²⁻¹⁴. (iii) Interspecific competition between closely related species results in changes in habitat use across geographic range accompanied with divergence in habitat preferences and bill morphology in sympatry¹⁵.

Phylogenetics: Reconstruction of higher-level phylogeny of water mites (Hydrachnidiae), the largest group of arachnids that have invaded and extensively diversified in freshwater habitats¹⁶.

References: 1. Phillips, K. P. et al. *Proceedings of the National Academy of Sciences USA* 115, 1552-1557, (2018); 2. Migalska, M., et al. *Proceedings of the National Academy of Sciences USA* 116, 5021-5026, (2019). 3. Sebastian, A. et al. *Molecular Ecology Resources* 16, 498-510; 5. Konczal, M. et al. *Molecular Ecology* 29, 1494-1507 (2020). 6. Konczal, M. et al. *Molecular Ecology*, doi:10.1111/mec.15781 (in press). 7. Lukaszewicz, A., Szubert-Kruszynska, A. & Radwan, J. *Science Advances* 3, 16 02262 (2017); 8. Ręk, P. & Magrath, R. D. *Proceedings of the Royal Society B: Biological Sciences* 284. 2017.1774 (2017); 9. Szymkowiak, J., Thomson, R. L. & Kuczynski, L. *Behavioral Ecology* 28, 767-775 (2017); 10. Zwolak, R. *Biological Reviews* 93, 897-913 (2018); 11. Zwolak, R., & Sih, A. (2020). *Functional Ecology*, 34(7), 1294-1310. 12. Bogdziewicz, M. et al. *Ecology Letters* 23, 210-220 (2020a); 13. Bogdziewicz, M. et al. *Ecology Letters*, 23, 1820-1826 (2020b). 14. Bogdziewicz, M. et al. *Nature Plants*, 6(2), 88-94. (2020); 15. Reif, J., et al. *Journal of Animal Ecology* 87, 774-789. 16. Dabert, M., Proctor, H. & Dabert, J. *Molecular Phylogenetics and Evolution* 101, 75-90, (2016).

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):

Host-pathogen co-evolution across a secondary contact zone: consequences for gene flow and epidemiology, PI: Jacek Radwan, NCN MAESTRO, 4 929 220 PLN

Functions and mechanisms of acoustic and visual signalling coordination in animals, PI: Paweł Ręć, NCN SONATA BIS, 1 997 768 PLN

The role of resource dynamics in shaping seed production in masting plants, PI: Michał Bogdziewicz, NCN SONATA 1 024 049 PLN

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

FB AMU is located in Collegium Biologicum at the AMU Morasko campus. The newly-built campus (constructed between 1999 and 2016) hosts all science faculties of the University (Chemistry, Geographical and Geological Sciences, Mathematics and Informatics, Physics) together with two research centres: the NanoBioMedical Centre and the Wielkopolska Centre for Advanced Technologies (WCAT).

Collegium Biologicum is the seat of the Faculty of Biology. The functional life of the building started in 2003. The surface area of the building amounts to 23 500 m², while the cubature reaches 106 400 m³, 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. The access to electronic publications in journals and books as well as to various databases is provided via a membership in University Library. Apart from countrywide access to journal collections, the library offers access to additional journal collections and databases subscribed by the University.

The research part of Collegium Biologicum is characterized by an open plan, with no distinct limits set between four institutes constituting FB AMU. This allows for a flexible organization of research. This flexibility allows finding space for new research group and indeed, in since FB moved to a new building, 15 such new research groups have been created at FB.

In addition, the building hosts seven core facilities dedicated to the provision of specialized services to the Faculty members. These core facilities, most of which potentially useful for evolutionary or ecological research (e.g. Core Facility for Molecular Biology Techniques, Bioinformatics cluster for processor-time-demanding computation, BioGIS Core Facility, Core Phytotron Facility which contains four walk-in phytotrons (Conviron): one for high light, two for low light) They are described in detail in p. 9 (pages 8-9).

The prospective leader of the Centre would be located in Collegium Biologicum. For the Centre it is envisioned that one standard research lab (ca. 35 m²) and one standard office room (ca. 16 m²) will be allocated for a start. Additionally, space for PhD students and post-docs will be allocated in dedicated office space at IEB. All office and laboratory rooms have wired access to Internet administered by AMU Computer Centre. In line with the development of the potential Dioscuri Centre, further space will be allocated, including access additional research labs and offices in WCAT. Important core facilities located at WCAT include greenhouse and animal house, and both are described in detail in p. 9 (next page). The space available for biological research is located within 1-2 floors, and the research labs and offices are fully furnished and equipped.

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 Dioscuri Centre. Our capabilities are further extended by access to other important pieces of equipment available at the AMU Morasko campus, particularly at two AMU research centres: Wielkopolska Centre for Advanced Technologies (WCAT) and the NanoBioMedical Centre.

At FB AMU researchers have access to specialized equipment in several core facilities

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

Core Phytotron Facility. This facility contains four walk-in phytotrons (Conviron): one for high light, two for low light, and one exclusively for work with Arabidopsis. It contains space for planting and harvesting.

BioGIS Core Facility supports development of GIS-based research methods, to projects requiring application of GIS and teledetection in ecological and biodiversity studies.

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 Jeol12Ex. It also provides access to basic Zeiss confocal microscope with 5 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 includes a cold-room. The head of the facility is a licensed isotope work inspector.

In addition to core facilities, FB researchers can access equipment based at IEB and other institutes. This includes a range of spectrophotometers (Schimadzu UV-1240, SpectroDirect, Sp 830 Metertech, . DR 2800 lange, DREL 2010), a range of microscopes,

image analysis system ColorView, Noldus system for behavioural research). **The Laboratory for High-throughput Techniques** located in Institute of Molecular Biology and Biotechnology provides access to Next Generation Sequencing based on Illumina MiSeq and HiScan SQ system with cBot.

Additional resources available at the AMU Morasko campus

Wielkopolska Centre for Advanced Technologies

Among several important facilities at WCAT of particular interest for molecular biology studies are a greenhouse and an animal facility, which are described below. WCAT also has laboratories dedicated for 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 facility can house about five thousands of mice in individually ventilated cage system and about six thousands of mice in conventional cages, rats (about three thousands in individually ventilated cage system) and rabbits. Surgery rooms include equipment for computer tomography (Argus CT, Sedecal), in vivo visualization system (either fluorescence or luminescence readout – PhotonImager Optima Basic, Biospace Lab), X-ray machine (RS 2000 X-Ray Biological Irradiator, RadSource) and equipment for behavioral experiments (IntelliCage by New Behavior and ActiMot2 System, TSE Systems). Additionally it contains: i) hematological and biochemical laboratory for analysis of blood and urine, equipped with two modern chromatographs working in both gas (GC – 2010 Plus, Shimadzu) and high performance liquid chromatography formats (HPLC Prominence Shimadzu); ii) histological laboratory with a high quality microscope and equipment for automatic processing of histological samples.

NanoBioMedical Centre

This research centre has several high-end pieces of equipment, which are available for use in biological applications. Among them are: i) *Electron microscopes*: 1. HRTEM Jeol ARM 200F, and 2. 120kV SEM Jeol 7001TTLS; electron microscopes are equipped for work with cryoTEM and cryoSEM techniques; ii) *atomic force microscopes*: 1. Innova Bruker, and 2. Icon Bruker; iii) *Raman spectrometer and scanning microscopes*: 1. Catalyst, and 2. NT_MDT SNOM; and iv) *confocal microscopes*, including 1. Zeiss LSM 780 NLO with 6 laser lines and 2-photon excitation laser (Chameleon 680-1080nm, 140 fs), spectral detection and FCS (ConfoCor 3), and 2. confocal microscope Leica SP5 with 7 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) 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.
- 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 centres, 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.

English is a common language for communication at FB AMU. At the Institute of Environmental Biology (IEB) of FB AMU, to which new PI will most likely be linked, IEB organises weekly seminars in English on Evolution, Ecology and Behaviour, hosting many speakers from abroad (see <http://popecol.home.amu.edu.pl/seeb/>).

Postdocs and PhD students are routinely recruited in open international calls, and post-docs employed over recent years at IEB were recruited from several countries, including Spain (dr Alvaro Sebastian), UK (dr Jonathan Parrett, dr Karl Phillips) Germany (Sophie von Merten), Netherlands (dr Freerk Molleman). Furthermore, two fellowships were recently held at IEB by foreigners (Czech Republic, dr Pavel Linhart, NCN POLONEZ); USA, Prof. Shawn Meagher, Fullbright Teaching Fellowship). Foreigners currently constitute ca. 20% of students at FB AMU doctoral school. Options for international collaboration are now being extended under national excellence initiative IDUB started in 2020, which facilitate international exchange and recruitment of outstanding researchers from abroad within visiting professorship program.

Active international cooperation of FB AMU includes the implementation of a number of international programs. Currently, international programs held at FB AMU include EMBO Installation Grant; EMBC CEMB/05/17 “; Understanding the mechanisms of crossover control in plants with the prospect of their application in crop improvement”, H2020 -Maria Skłodowska Curie Actions - Individual Fellowship; COST PERIAMAR nr CA 18221 “Pesticide risk assessment for amphibians and reptiles”; COST CA18201 “An integrated approach to conservation of threatened plants for the 21st century”, COST ACTION CA18226 „New approaches in detection of pathogens and aeroallergens”; LIFE17 ENV/LT/000407 “Algae – economy based ecological service of aquatic ecosystems. Informal international collaboration is also reflected in numerous publications with authors from other countries” (<https://researchportal.amu.edu.pl>).

Teaching programs in English are offered to PhD and MSc students, which are open to students from abroad. The programs are 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 FB-AMU PhD students run by outstanding researchers invited for this purpose from abroad. At the level of post-graduate studies, two MSc programmes are offered in English by FB AMU: Environmental Protection, and Biotechnology. FB AMU organises 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. Students and PhD students can also take advantage a number of different courses taught in English, organized by AMU-PIE and hosted at FB.