

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):

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ul. Bankowa 12, 40-007 Katowice, Poland **University of Silesia in Katowice**
ph: +48 32 359 22 22,
e-mail: rektor@us.edu.pl

2. Type of research institution¹:

1) higher education institution

3. Head of the institution: prof. dr hab. Ryszard Koziółek

4. Contact information of designated person(s) for applicants and the NCN: first and last name, position, e-mail address, phone number, correspondence address: prof. dr hab. Piotr Świątek, Vice-Dean or Scientific Research at the Faculty of Natural Sciences of the University of Silesia in Katowice, piotr.swiatek@us.edu.pl: + 48 32 359 1361, ul. Bankowa 9, 40-007 Katowice, Room 6

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

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 (up to one page in A4 format):

1 As specified in "Addressees of the call"

Żur J. et al. 2021. Degradation of diclofenac by new bacterial strains and its influence on the physiological status of cells. *Journal of Hazardous Materials*, Vol. 403, 124000.

Sułowicz S. et al. 2020. Microbial communities from subglacial water of naled ice bodies in the forefield of Werenskioldbreen, Svalbard. *Science of the total Environment*- Vol. 723, 138025.

Anna Milewska-Hendel et al. 2020. Cell wall epitopes in grasses on different novel ecosystem habitats of post-industrial sites. *Land Degradation & Development*. Vol. 31, s. 1-44

Jing Zhang, Ewa Mazur, et al. 2020 Strigolactones inhibit auxin feedback on PIN-dependent auxin transport canalization. *Nature Communications*. 11, 3508

Marzec M. et al. 2020. Barley strigolactone signalling mutant hvd14.d reveals the role of strigolactones in abscisic acid-dependent response to drought. *Plant, Cell Environment* 13815, s. 1-15.

The scientific interest of the Plant and Microorganisms Biologist at the Institute of Biology, Biotechnology, and Environmental Protection has changed over the years, and the application of systems theory of biological studies associated with recent progress in the development of molecular techniques (mainly omics – genomics, proteomics, metabolomics) have enabled scientist to get understand of plants and microorganism functioning in the environment at the unprecedented scale. The interaction of plants and microorganisms with the environment, their functioning in changing climate conditions, studies of the mechanisms of stress tolerance and yield production in case of plants or the possibility to implement microorganism models in environmental protection are in the spotlight of the Plant and Microorganisms research groups. During the last 5 years, research focused on plants and microorganisms at the Institute led to many crucial findings, which resulted in circa 300 publications in JCR indexed journals. At present 40 of NCN (National Science Centre) projects are being conducted and other prestigious projects such as EU H2020 SusCrop (to Dr. Daszkowska-Golec), BEETHOVENLIFE 1 (to Dr. Szurman-Zubrzycka, and Dr. Marzec), SHENG 1 (to Dr. Borowska-Wykręt).

Regarding the plant functional genomics, scientists at the Institute are focused on barley as an object and take advantage of a model plant – Arabidopsis and transfer achievements to crops. Such an approach in climate change is of utmost importance leading to a better understanding of plants' response to environmental cues. Further functional genomics and detailed physiological studies at both cellular and whole organism level allowed to describe novel mechanisms of the regulatory role of highly conserved regulators of plant phytohormone signaling and synthesis pathways in terms of abiotic stresses. It gives an additional advantage – the possibility of using that knowledge and translating it to other crops for both – better understanding and further developing better drought-adapted crops. That point is already in the scope of scientists at the Institute while strengthening cooperation with breeder companies in Poland and other European countries is established. The patent to Dr. Gajecka in applying the doubled haploid barley lines for speed breeding demonstrated the importance of narrowing the gap between fundamental plant science and more application-oriented research.

Moreover, we also developed and maintained the world's unique TILLING platform consisting of more than 10 000 barley plants as a source for functional genomics and forward and reverse genetics studies.

Moreover, the research teams of the Institute are interested in research on plant-microorganism interactions and the mechanisms of biocontrol. These works have a very strong application potential because knowledge about the mechanisms of biocontrol allows for the elimination of pesticides that are highly harmful to the environment while maintaining an efficient crop of plants, which not only contributes to obtaining high-quality bio-food but also reduces environmental degradation as a result of agricultural activities. The Institute has also been researching bioremediation, biodegradation, and biodeterioration for many years. The research results are rich collections of microorganisms with increased ability to degrade xenobiotics with a particularly stable structure, such as pesticides, contrast agents, non-steroidal anti-inflammatory drugs, and polycyclic

aromatic hydrocarbons. Research is currently underway on the construction of biopreparations based on strains immobilized on natural carriers with increased degradation potential, stimulating the action of activated sludge in sewage treatment plants and supporting the reclamation of post-industrial wasteland soils. These studies are part of the Institute's research strategy on counteracting climate warming by creating ecological agriculture and the recovery of industrially degraded areas. **We propose to create a world-class research center dedicated to 'Biology and biotechnology of plants and microorganisms in the face of climate changes'**. Considering the dynamics of climate changes, such a scientific center offered by well-experienced scientists will be unique in the Central Eastern part of Europe. We are planning to establish a modern and dynamic center to orchestrate biology systems (genomics, proteomics, metabolomics), biotechnology, and bioinformatics within a single project.

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 2019, the Institute became the partner site in the **BARISTA consortium** intended to develop tools that enable to optimize of the cultivation of this plant, particularly in the context of climate changes, in the project entitled Advanced tools for breeding BARley for Intensive and SusTainable Agriculture under climate change scenarios.

Twelve partners from eight countries contribute complementary scientific and technological expertise. The partners have internationally recognized experience in crop modelling, plant genomics, plant physiology, barley pre-breeding and breeding, environmental sciences, and agricultural advisory services. The impact will be assured through the involvement of private companies and agricultural advisory services or public breeding stations.

Total costs of the project 2.319.000 €, amount of funding Polish part 200.000 €, PI of Polish team dr Agata Daszkowska-Golec, prof UŚ, source of funding ERA-NET SusCrop –the European Union's Horizon 2020

In 2016 as part of the FACCE SURPLUS, an ERA-NET Cofund, Institute started collaboration between the European Commission and a partnership of 15 countries in the frame of the Joint Programming Initiative on Agriculture, Food Security and Climate Change.

The international nature of the project ensured the mutual exchange of knowledge and experience in applying the latest research strategies in genetics, molecular biology and plant physiology. The Institute joined the FACCE SURPLUS program, in a consortium with four other European Universities to conduct a **BarPLUS project**, which delivered knowledge and tools to develop a new barley ideotype that provides farmers with more biomass without compromising grain yield.

Project title "*BarPLUS: Modifying canopy architecture and photosynthesis to maximize barley biomass and yield for different end-uses*"

Total costs of the project 1.089.000 € amount of funding Polish part 255.000 €, source of funding the FACCE SURPLUS ERA-NET the European Union's Horizon 2020, PI of Polish team dr Agnieszka Janiak

Since 2020 Institute takes part in collaboration with German Partner from The Leibniz Institute of Plant Genetics and Crop Plant Research as a part of the BEETHOVEN LIFE project, funded by the National Science Center. The project is a continuation of earlier studies focused on plant response to drought and it is concentrated on strigolactones, which are considered as a factor involved in this physiological process.

Project title "**Investigation of the role of strigolactones in response to drought using a barley mutant collection**"

Total costs of the project 303.315 € amount of funding Polish part 232.565 €, PI of the project dr Marek Marzec

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

The Institute of Biology, Biotechnology and Environmental Protection can offer a 20 m² office space for the Dioscuri Centre and the space of several laboratories dedicated for various analytical procedures related to the molecular biology, biotechnology, biochemistry and microbiology, including:

- Laboratory of Biochemical Analysis, Protein Biochemistry and Environmental Biotechnology,
- Laboratory of Microbiology
- Laboratory of Gas Chromatography,
- Laboratory of Immunochemistry,
- Laboratory of Plant Biotechnology,
- Laboratory of Molecular Biology.

Up to date, these laboratories were dedicated to the studies from the area of:

- degradation pathways of various compounds, mostly environmental pollutants, by selected bacterial strains,
- the function and characterization of soil microbiome,
- phytoremediation of soils supported by plant-growth-promoting bacteria,
- genetics and functional genomics of crop and model plants, including identification and characterization of genes involved in abiotic stress response, root system development, metabolism and signaling of plant hormones and DNA repair,
- regulatory mechanisms of plant somatic embryogenesis,
- the mechanisms controlling efficient regeneration of crop plants from microspore cultures, targeted to double haploid production in breeding.

The space and equipment of these laboratories will be shared with other entities of the Institute on the basis of scheduled time agreed between the Institute and the Dioscuri Centre.

In addition, the Dioscuri Centre may have an access to green house space (37 m² and 44 m²), five growth chambers for plant growth, plant in vitro cultures and microorganisms cultures (with area varying from 10 m² to 15 m²), a cold room of 6.7 m² and 4 ha of experimental field, which is located in a distance of 33 km from Katowice.

An important recourse that may also be available for the projects of Dioscuri Centre constitutes of a barley TILLING population *HorTILLUS*, which currently represents a collection of 7000 M₂ plants and more than 10 000 of M₃ and more advanced generations of mutagenized barley lines. The population is continuously maintained and developed and may be used for identification of mutants in any of genes of interested in barley.

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

The main equipment available for Dioscuri Centre includes:

- Dual-channel gas chromatograph with hydrogen generator LC-H2 Hewlett-Packard 6890
- HPLC chromatograph equipped with an Ascentis[®] Express C18 HPLC Column (100 9 4.6 mm) Opti-Solv[®] EXP precolumn and a DAD detector Merck Hitachi
- Ultracentrifuges
- Ettan IPGPhor3 apparatus for protein isoelectrofocusing and SDS-PAGE Ettan DaltSix gel system with MultiTemp III water bath
- Blotters
- Sonicators
- MicroPulser Electroporator for genetic transformation
- GENE PULSER XCELL Electroporator for genetic transformation

- VIS and UV-VIS Spectrophotometers operating with cells and cuvettes
- DeNovix DS-11 and Nano-Drop spectrophotometers
- Plate readers
- Digital tensiometer
- Refractometer detector
- Surface Insulation Resistance testing equipment
- Voltametric analysis system
- Bioreactors for microorganism cultures
- qPCR QuantStudio 3 apparatus
- qPCR LightCycler 480 apparatus
- Fragment Analyzer (Advanced Analytical) for the capillary electrophoresis of nucleic acids and Li-Cor sequencers for polyacrylamide electrophoresis
- Agilent Bioanalyzer
- Termocyklers
- Thermomixers and water baths
- Retch MM400 mill mixers and MP FastPrep 24 homogenizer for biological material homogenization,
- Gel documentation systems and gel scanners,
- Laboratory centrifuges, vacuum evaporator and vacuum concentrators
- Incubators for cell and tissue cultures
- Pocket PEA chlorophyll fluorimeters for the evaluation of photosystem II performance
- AP4 porometer for stomatal conductance or stomatal resistance measurement and gas exchange analysis in plants
- Laminar flows dedicated for the preparation of plant in vitro cultures
- Biohazard laminar flows

In addition, the Institute may also provide an access to other facilities, including Laboratory of Transmission and Scanning Electron Microscopy, Confocal and Fluorescent Microscopy, the Laboratory of Flow Cytometry or to the Laboratory of Histology and Immunohistology, which are equipped with Ultra-high Resolution Cold Field Emission Scanning Electron Microscope with energy dispersive X-ray spectrometer and PolarPrep 2000 Cryo Transfer System, Transmission Electron Microscope Hitachi H-500, Nikon Eclipse Ni-U fluorescent microscope, Olympus FV-1000 confocal system equipped with an Olympus IX81 inverted microscope and Flow Cytometer Sysmex CyFlow.

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) (*up to one page in A4 format*):

Personal benefits

- Free of charge accommodation for the researcher and his/her family, including assistance in formalities
- Assistance in residence formalities for the researcher and his/her family, school and/or nursery arrangements for children, employment formalities for spouse/partner (if applicable)
- Additional health insurance and private medical package for the researcher and his/her family
- Polish language course for the researcher and his/her family
- Public transport card for the researcher and his/her family
- Benefit Systems sports cards for the researcher and his/her family
- Entry cards for cultural and educational facilities, e.g.: the National Symphonic Orchestra of the Polish Radio, the Silesian Philharmonic, cinemas, museums, galleries and theatres
- Study Visit Poland – programme of exploring Polish heritage sites
- Participation in local events and networking with key stakeholders

11. Other information about the internationalisation of the research institution, international researchers employed at the institution, the availability of English language seminars etc. (up to one page in A4 format): _____

Institute of Biology, Biotechnology, and Environmental Protection has ongoing cooperation in the field of plant and microorganisms biology with the following foreign institutions:

Research centre for genomics and bioinformatics(CREA) Fiorenzuola d'Arda Italy, Department of Agricultural and Environmental Sciences - Production, Landscape, Agroenergy (DiSAA) Milano Italy,

Martin-Luther-University Halle/Wittenberg Institute of Agricultural and Nutritional Sciences Germany,

University of Goettingen Department of Crop Sciences Goettingen Germany,

University of Copenhagen Department of Plant and Environmental Sciences Denmark,

James Hutton Institute United Kingdom,

University of Tartu Institute of Technology Estonia, Estonian Crop Research Institute Estonia

Leibniz Institute of Plant Genetics and Crop Plant Research

Università degli Studi di Milano, Italy

Consiglio per la Ricerca in Agricoltura e l'analisi dell'economia agraria Italy

Universidad de Lleida, Spain, University of Potsdam, Germany

In Institute of Biology, Biotechnology, and Environmental Protection foreign specialist are employed, including post-docs (e.g. due to The Ulam programme founded by NAWA)

International cooperation and exchange are essential aspects of the activity of the University of Silesia in Katowice. The intensive international collaboration conducted by the University of Silesia allows for academic exchange and undertaking various educational and scientific projects together with partners from over 90 countries around the world.

Annually, the offer of academic exchange is used by approximately 700 students and doctoral students of the University of Silesia and approximately 2,000 employees whose trips are related to the implementation of research, international projects, and participation in conferences as educational and didactic activities. At the same time, our university is visited by approximately 2,800 research, teaching, and administrative staff representing partner institutions.

Collaboration under international research projects includes the implementation of joint research and the dissemination of its results through the organization of seminars and conferences, as well as publishing activities. Scientists benefit from scholarships and internships in prestigious research centers worldwide, which significantly influences the shaping and development of their scientific careers.

A significant factor contributing to universities' internationalization is the number of foreigners completing their studies there. The University of Silesia, in cooperation with foreign partners, conducts study programs, the graduates of which obtain double diplomas.

The University of Silesia in Katowice, together with six universities from abroad, forms a prestigious European University as part of Transform4Europe alliance. The universities have got together to conduct joint scientific research at the highest level and educate young people within international study programmes. They will also create a common multilingual campus in order to take care of the future of their own regions, countries, and entire Europe.

The University of Silesia is a member of many international academic organizations. University representatives sit on steering committees and act as experts in networks and associations associating the academic community worldwide.

The university cooperates with key organizations, including the European University Association (EUA), L'Agence Universitaire de la Francophonie (AUF), and the European University Information System (EUNIS).