

1. Research institution data:

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2. Type of research institution:

- 1) basic organisational unit of higher education institution

3. Head of the institution:

Prof. dr hab. Stanisław Kistryn, Vice-Rector for Research and Structural Funds

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

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

Life sciences

Evolutionary and environmental biology

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 in *Evolutionary and environmental biology*):

Ecotoxicology: A model explaining the equilibrium concentration of toxic metals in an organism as the net result of gut cell death and replacement rates [1].

Evolution of the Major Histocompatibility genes: critical evaluation of the role of MHC supertypes in promoting trans-species polymorphism [2]; modeling showed that both Red Queen dynamics and sexual selection drive the adaptive evolution of the MHC genes [3,4].

Evolutionary ecology: metaanalysis found that that genetic similarity to the social mate correlates positively with extra-pair paternity in birds [5]; the family living was identified as a key factor in the evolution of cooperative breeding and ecological resilience in birds [6].

Evolutionary genetics: balancing selection promotes introgression [7], estimation of fitness costs of minimal sequence alterations causing protein instability and toxicity [8] and found that genetic robustness depends on the capacity to generate energy [9].

Genomics of adaptation: a comparison of the genomic response to artificial selection for increased metabolism and for predatory behavior demonstrated differences in the genetic architecture of these traits, contrary to the results from model organisms [10, 11].

Hybridization and speciation: analysis of contemporary and ancient DNA showed that complex admixture preceded and followed the extinction of wisent in the wild [12].

Life history evolution: modelling of resource allocation showed that seasonality in offspring value and trade-offs with growth explain the origin of capital breeding [13]; cell size was identified as an organismal trait with an adaptive value [14, 15].

Plant Microbe Interaction: fungal endophytes improve host plants growth by upregulating PSII efficiency and altering the composition of PSII pigment protein complexes [16]; mechanism of plant protection by mycorrhizal fungi against metal toxicity [17].

Sexual selection and its evolutionary significance: experimental evolution suggests that sexual selection protects small populations against extinction [18]; metaanalysis challenged the notion of biases towards female-biased immunity and the role of testosterone [19].

Evolutionary physiology: an experimental-evolution project supports the aerobic capacity model of evolution of endothermy in mammals [20], and the "hologenome" concept [21].

Influential reviews on: balancing selection [22]; conservation genomics [23], global change and pollinators [24], hybridization and speciation [25].

Two **international patents** describing methods of reducing excessive growth of filamentous bacteria in activated sludge using rotifers: EP 08848179.1 EP 14731401.7.

References

- [1] Bednarska et al (2016) *Env Sci Poll Res*, 23, 22047-22058; [2] Ejsmond et al (2018) *Nature Comm*, 9,4362; [3] Ejsmond et al (2014). *Proc R Soc B*, 20141662; [4] Ejsmond & Radwan (2015) *PLoS Comput Biol*, 11, e1004627; [5] Arct et al (2015) *Behav Ecol*, 26, 959-968; [6] Griesser et al (2017) *PLoS Biol*, 15, e2000483; [7] Fijarczyk et al. (2018) *Proc R Soc B*, 285: 20180819; [8] Tomala et al (2013) *Mol Biol Evol*, 31, 703-707; [9] Plech et al (2017) *PLoS Genet*, 13, e1006768; [10] Konczal et al (2015) *Mol Biol Evol*, 32, 1461-1473; [11] Konczal et al (2016) *Mol Biol Evol*, 33, 2429-2440; [12] Węcek et al (2016) *Mol Biol Evol*, 34, 598-612; [13] Ejsmond et al (2015) *Am Nat*, 186, E111-E125; [14] Maciak et al (2014) *J Evol Biol*, 27, 478-487; [15] Czarnołęski et al (2015) *Ecosphere*, 6, 1-5; [16] Rozpądek et al (2015) *Planta*, 242, 1025-1035; [17] Rozpądek et al (2014) *Chemosphere*, 112, 217-224; [18] Lumley, Michalczyk et al (2015) *Nature*, 522, 470-473; [19] Kelly et al (2018) *Ecol Lett*, in press; [20] Sadowska et al. 2015 *Proc R Soc B*, 282, 20150025; [21] Kohl et al (2016) *Front Microbiol*, 7, 1-10; [22] Fijarczyk & Babik (2015) *Mol Ecol*, 24, 3529-3545; [23] Shafer et al (2015) *Trends Ecol Evol*, 30, 78-87; [24] González-Varo et al (2013) *Trends Ecol Evol*, 28, 524-530; [25] Abbott et al (2013) *J Evol Biol*, 26, 229-246.

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:

2017 Global, local or fussy? An integrative test of the 'Everything is Everywhere' hypothesis, PI Łukasz Michalczyk, Polish National Science Centre (Sonata Bis), 2 955 850 PLN

2016 *A multivariate feather: quantitative genetics and comparative phylogenetics of bird feathers*, PI Szymon Drobniak, Polish National Science Centre (Sonata Bis), 2 068 100 PLN,

2014 *ACTIFER An integrated system for activated sludge bulking control in wastewater treatment plants*, PI Janusz Fyda , Polish National Centre for Research and Development (GEKON), 1 967 502 PLN,

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

The faculty will provide the following office space:

- PI office,
- Office space for at least 4 researchers (students, PhD students, postdocs) in at least two offices,
- Office space for the person providing the administrative support for the Dioscuri Centre,
- The faculty can also accommodate further requests for additional office space if needed.

The faculty will provide the following laboratory space:

- Within the faculty policies regarding the access to the laboratories differ between institutes,
- The Dioscuri Centre in *Evolutionary and environmental biology* will most likely be closely associated with the Institute of Environmental Sciences,
- At the Institute of Environmental Sciences , it is the policy of the institute that laboratories (each laboratory has its head and lab manager) are not assigned to individual research groups. Each research group can obtain access to the laboratory space as needed. This allows efficient use of laboratory space and allows better integration of researchers within the Institute.
- The Dioscuri Centre will also have access to the laboratories in other institutes of the faculty – the detailed conditions will be discussed when needed under the guidance of the Dean,
- In addition to the regular laboratory specie the faculty guarantees access to:
 - laboratories dedicated to work with genetically modified organisms and microorganisms,
 - several animal facilities (small mammals, fish)
 - temperature and humidity-controlled rooms (walk-in climatic chambers)

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

The faculty provides access to diverse scientific equipment. The list below includes only the major systems and in all cases accessory equipment and expertise are also provided:

- multiple PCR and real-time PCR instruments,
- equipment for DNA and RNA extraction from a variety of sources,
- biosafety cabinets for DNA/RNA work,
- DNA and RNA agarose and acrylamide electrophoresis;
- spectrophotometric, fluorometric and lab-on-chip DNA/RNA quantitation
- gel image analysis and documentation systems,
- tube and plate centrifuges and microcentrifuges with temperature control
- DNA and RNA-based genomic analyses including library preparation from various sources, target enrichment, Illumina sequencing and fragment analysis,
- SDS-PAGE, Western Blotting, zymography,
- High-performance liquid chromatography (HPLC),
- Linux-based computer cluster: > 140 cores, > 700 GB RAM, >120 TB storage
- Elementary analyzer,
- Atomic absorption spectrometer with flame and graphite furnace,
- Atomic emission spectrometer,
- Microplate readers (absorbance, fluorometry etc.),
- Equipment for comprehensive behavioural and acoustic studies including ultrasounds,
- Various types of light microscopy including dark field, phase and Nomarski's contrast, fluorescence and image analysis solutions,
- Microscopy core:
 - Confocal Microscopy,
 - Transmission Electron Microscopy,
 - Scanning Electron Microscopy and X-ray Microanalysis,
 - Cryostat chamber,
- Flow cytometry and cell sorting,
- Computerized respirometry and microrespirometry systems for small vertebrates and invertebrates,
- Multichannel oxygen analysis and regulation systems,
- Equipment dedicated to neurological studies (rodents):
 - Four setups for electrophysiological studies of rodent brain in vivo
 - Three patch-clamp setups for electrophysiological studies of rodent brain in vitro
 - Equipment for studies of rodent behavior and physiology
- Thermal chambers with humidity and photoperiod regulation
- Freezers and deep freezers
- Small fish ZebTEC units
- Cell labs with appropriate equipment

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):

The Faculty of Biology is located at the new campus of the Jagiellonian University (the so called "Campus of the 600th Anniversary of the Jagiellonian University Revival"). Therefore the facilities located at the campus are brand new (e.g. Institute of Zoology and Biomedical Research was relocated to the new building in 2011) and were designed to provide state of the art laboratories and office space designated for life sciences. All life and biomedical sciences-oriented institutes/facilities of the Jagiellonian University are located close by (within 1 km radius) which facilitates personal contacts and communication. Most importantly, location of the Faculty allows easy access to facilities/scientific equipment located at the Faculty of Biochemistry, Biophysics and Biotechnology, Faculty of Chemistry, Faculty of Physics. Moreover, Małopolska Biotechnology Centre and Jagiellonian Center for Innovation are located within a walking distance from our faculty. The facilities are dedicated to research and direct application of life sciences/biomedical research.

Additional benefits and assets include:

- As a benefit for Dioscuri Centre JU may provide additional financial support in amount of 25 000 EUR annually.
- Access to two field stations (properties of the Faculty) in the Carpathians, equipped with laboratories for biodiversity studies: i) Ochotnica Górna (49.522 N, 20.222 E) and ii) Kremarna (49.494 N, 21.482 E). Both stations are indispensable for biodiversity. Each station is also an excellent location for (annual) retreat meetings of the scientific groups within the Faculty.
- Guest accommodation at the faculty (three en-suite rooms).
- Support and venues for organization of workshops and conferences (JU Conference unit).
- Access to and experience in using PL-Grid – high-performance computing infrastructure.
- Expert support in intellectual property protection rights.
- Location on the Science campus together with several other JU faculties and units: Faculty of Biochemistry, Biophysics and Biotechnology, Małopolska Biotechnology Centre, Faculty of Chemistry, Faculty of Physics, Faculty of Mathematics and Computer Sciences.
- Proximity of R&D units: i) Jagiellonian Centre for Experimental Therapeutics (JCET), ii) Life Science Park (hosting a number of biotech companies).

Moreover Dioscuri Centre employees will have an access to social benefits offered by JU:

- Access to Multisport programme (50% cost coverage by JU),
- JU resort hotel rooms (Zakopane, Rabka, Ustroń k. Wisły) on preferable prices,
- Loans for buying/renovation of flat/house available on preferable financial conditions,
- Loans from JU social allowance and benefit fund available on preferable financial conditions,
- Trips organized by JU on preferable financial conditions,
- Financing support for self-arranged summer and winter holidays,
- One month additional salary so called thirteen salary,
- Access to JU kindergarten and nursery,
- Language courses at Jagiellonian Language Centre on preferable prices.
- Last but not least, Kraków is a lively and vibrant city, both a top-class tourist destination and a huge university centre with more than 200 thousand students.

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 offers a vibrant scientific atmosphere and places a strong emphasis on internationalization. Because of the long tradition of collaboration and teaching in English, foreign researchers would seamlessly integrate themselves into the working environment of the faculty. The most important aspects of internationalization include:

- English-only PhD programmes: two international PhD programmes were initiated in 2010 and so far 8 foreign researchers obtained their PhD degrees; currently the regular English language PhD programme in Biology accepts applications of prospective PhD students from around the world and the faculty has 12 active foreign PhD students; most PhD theses in *Evolutionary and environmental biology* are prepared in English,
- Master Programme in Ecology & Evolution: since 2014, 2-year studies in English open for candidates from all countries,
- Dozens of Erasmus students and Erasmus Plus and other EU-co-funded programs (e.g. ARGO program co-funded by EU and the Spanish Ministry of Education, Culture and Sports) trainees from multiple countries have been hosted at the faculty,
- Four foreign researchers (not including students or PhD students) are currently employed full time at the faculty,
- English is the obligatory language of the weekly seminars in *Evolutionary and environmental biology* at the Institute of Environmental Sciences, regularly featuring invited foreign speakers,
- English is the obligatory language of the bi-monthly seminars run by the Institute of Zoology and Biomedical Research entitled “Distinguished Lecture” to which most prominent scientist are invited. For example, we hosted Dr. Paul Kubes from the University of Calgary in Canada, Dr. Alain Vanderplasschen Faculty of Veterinary Medicine of the University of Liège, Belgium and Dr. John S. Pezaris from Massachusetts General Hospital, Harvard Medical School, Boston, USA.
- MSc and PhD seminars in *Evolutionary and environmental biology* in several research groups are in English,
- Four prestigious international cooperation HARMONIA grants have been awarded to the Faculty since 2012,
- A prestigious POLONEZ grant (a funding programme addressed to incoming researchers who apply for fellowships in host institutions in Poland), is currently hosted at the Faculty,
- The administrative personnel is used to work together with international researchers, helping in all administrative tasks.