Registration form for Polish scientific institution

1. Research institution data (name and address):

Institute of Biochemistry and Biophysics
Polish Academy of Sciences,
Pawińskiego 5A, 02-106 Warsaw, Poland

2. Type of research institution:
Research unit of the Polish Academy of Sciences

3. Head of the institution:

Prof. dr hab. Piotr Zielenkiewicz

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

Prof. dr hab. Jarosław Poznański
General Affairs Director IBB PAS
e-mail: GAD@ibb.waw.pl; jarek@ibb.waw.pl
tel: +48 22 592 2145
Pawińskiego 5a, 02-106 Warsaw, POLAND

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

Life Sciences
molecular biology, structural biology, 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*):

The scientific interests of the Institute have evolved over the years from classical biochemistry, biophysics and physiological chemistry towards up-to-date molecular biology. The topics of special attention are: epigenetics and RNA biology, DNA repair, plant molecular biology, structural biology, protein-ligand interactions and bioinformatics. During the last 5 years research at the Institute led to a number of findings which resulted in over 700 publications cited more than 5000 times, and 31/34 pending and 23/19 granted national/international patents. At present, seven TEAM projects are being carried out at the Institute: TEAM CORE-TECH (Prof. Michał Dadlez and Prof. Andrzej Dziembowski), TEAM (Prof. Andrzej Dziembowski and Dr. Szymon Świeżewski) and FIRST TEAM (Dr. Dominik Domański, Dr. Roman Szczęsny and Dr. Damian Graczyk).
The group lead by Andrzej Dziembowski, which focuses on posttranscriptional regulation of gene expression in humans, contributed significantly to our understanding of the mechanisms of RNA maintenance.[1-8] The group of Szymon Świeżewski, which focuses on regulation of seed dormancy - a crucial developmental transition in plants, described a novel mechanism of

epigenetic regulation based on a cis-acting noncoding antisense transcript,[9,10] and further discovered transcription elongation checkpoints at alternative exons in *Arabidopsis thaliana*.[11] Ewa Świeżewska and Tomasz Sarnowski groups, also working on *Arabidopsis thaliana,* study the mechanism and physiological role of polyprenol synthesis[12-15] and epigenetic regulation by the SWI/SNF chromatin remodeling complexes.[16-20] The group of Michal Dadlez is developing application of HDX-MS in studies on protein assemblies,[21-27] with a special afford to Aβ peptide.[28-31] The group of Wojciech Bal focuses on biological impact of metals,[32,33] including role of the interactions between the Aβ4-42 peptide with copper ions in the context of Alzheimer's disease.[34,35] The group of Piotr Zielenkiewicz identified novel potent small molecule correctors for CFTR-ΔF508 with great potential for future treatments of cystic fibrosis,[36] and pointed the application of plant miRNA in medicine.[37,38] Finally, scientific and technical knowledge of IBB employees and well established core facilities allowed the Institute to establish numerous international collaborations, some of which resulted in important scientific discoveries.[39-46]

1 Lubas, M. *et al. The EMBO journal* **32**, 1855-1868 (2013). | 2 Labno, A. *et al. Nucleic acids research* **44**, 10437-10453 (2016). | 3 Warkocki, Z. *et al. Cell* **174**, 1537-1548 (2018). | 4 Dhir, A. *et al. Nature* **560**, 238-242 (2018). | 5 Pietras, Z. *et al. Nature Communications* **9** (2018). | 6 Szczepinska, T. *et al. Genome Research* **25**, 1622-1633 (2015). | 7 Lubas, M. *et al. Cell Reports* **10**, 178-192 (2015). | 8 Mroczek, S. *et al. Nature Communications* **8** (2017). | 9 Fedak, H. *et al. PNAS* **113**, E7846-E7855 (2016). | 10 Yatusevich, R. *et al. Embo Reports* **18**, 2186-2196 (2017). | 11 Dolata, J. *et al. Embo Journal* **34**, 544-558 (2015). | 12 Akhtar, T. A. *et al. The Plant cell* **29**, 1709-1725 (2017). | 13 Jozwiak, A. *et al. Plant Physiology* **174**, 857-874 (2017). | 14 Lipko, A. & Swiezewska, E. *Progress in Lipid Research* **63**, 70-92 (2016). | 15 Jozwiak, A. *et al. Plant Cell* **27**, 3336-3353 (2015). | 16 Sacharowski, S. P. *et al. Plant cell* **27**, 1889-1906 (2015). | 17 Archacki, R. *et al. Nucleic acids research* **45**, 3116-3129 (2017). | 18 Sacharowski, S. P. *et al. Plant Cell* **27**, 1889-1906 (2015). | 19 Sarnowska, E. *et al. Trends in Plant Science* **21**, 594-608 (2016). | 20 Sarnowska, E. *et al. American Journal of Cancer Research* **7**, 2275-2289 (2017). | 21 Premchandar, A. *et al. Journal of Biological Chemistry* **291**, 24931-24950 (2016). | 22 Richter, M. M. *et al. Open Biology* **6** (2016). | 23 Sitkiewicz, E., *Plos One* **8** (2013). | 24 Skrajna, A. *et al. Journal of Molecular Biology* **428**, 1180-1196 (2016). | 25 Skrajna, A. *et al. Nucleic Acids Research* **46**, 4752-4770 (2018). | 26 Dzhindzhev, N. S. *et al. Current Biology* **24**, 2526-2532 (2014). | 27 Dzhindzhev, N. S. *et al. Open Biology* **7** (2017). | 28 Kloniecki, M. *et al. Journal of Molecular Biology* **407**, 110-124 (2011). | 29 Przygonska, K. *Plos One* **13** (2018). | 30 Sitkiewicz, E., *Plos One* **9** (2014). | 31 Sitkiewicz, E., *Journal of Molecular Biology* **426**, 2871-2885 (2014). | 32 Wezynfeld, N. E. *et al.* , *Coordination Chemistry Reviews* **327**, 166-187 (2016). | 33 Bossak, K. *et al. Inorganic Chemistry* **55**, 7829-7831 (2016). | 34 Wezynfeld, N. E. *et al. Angewandte Chemie* **55**, 8235-8238 (2016). | 35 Mital, M. *et al. Angewandte Chemie* **54**, 10460-10464 (2015). | 36 Odolczyk, N. *et al. EMBO molecular medicine* **5**, 1484-1501 (2013). | 37 Lukasik, A. & Zielenkiewicz, P. *International Journal of Molecular Sciences* **18** (2017). | 38 Lukasik, A., *et al. International Journal of Molecular Sciences* **19** (2018). | 39 Jarrett, R. *et al. Science translational medicine* **8**, 325ra318 (2016). | 40 Wrobel, L. *et al. Nature* **524**, 485-488 (2015). | 41 Mathys, H. *et al. Molecular cell* **54**, 751-765 (2014). | 42 Janczar, S. *et al. Blood* **123**, 4002-4004 (2014). | 43 Wojciechowski, M., *et al.* PNAS **110**, 105-110 (2013). | 44 Ukleja, M. *et al. Nature Communications* **7** (2016). | 45 Jaremko, M. *et al. Nature chemical biology* **9**, 264-270 (2013). | 46 Medeiros-Silva, J. *et al. Nature Communications* **9** (2018).

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 the years 2009 to 2015, the Institute was one of the partners of worth 100 mln € infrastructure consortium project of the Center for Preclinical Research and Technology granted by Ministry of Science and Higher Education. The project was the largest biomedical and biotechnological enterprise in Central and Eastern Europe. The aim of the project was to establish a vibrant scientific center in Warsaw, consisting of closely collaborating biomedical research centers, which would conduct research on the most

common civilization diseases, in particular: cancer, neurological diseases, cardiovascular diseases and aging diseases. This cooperation is ongoing.

- The European Research Council has awarded prof. Andrzej Dziembowski with worth 1.5 mln € ERC starting grant (2013-2018) for his project entitled: "Regulation of gene expression by non-cannonical poly(A) and poly(U) polymerases". The aim of the project was: 1) Functional analysis of FAM46 proteins from new family of active poly(A) polymerases. 2) Elucidation of the functions of all known vertebrate ncPAPs and PUPs using the chicken DT40 cell line as a model system. 3) Analysis of cytoplasmic polyA. The project is conducted with collaboration of Prof. Bertrand Seraphin (IGBMC, Strasburg, France), Prof. Torben Jensen (University of Aarhus, Denmark), Prof. Jose Maria Valpuesta (Spanish National Centre for Biotechnology, Madrid)
- In 2018, the Institute become the bioinformatics/chemistry partner site in the EU-OPENSCREEN consortium (ERIC - European Research Infrastructure Consortium), capital value of which exceeds 80 mln € (http://www.roadmap2018.esfri.eu/projects-and-landmarks/browse-the-catalogue/eu-openscreen-eric/). The primary objective of EU-OPENSCREEN is to create a distributed research infrastructure to support scientists in order to better understand how basic molecular processes affect biological functions at various levels – from the pathway up to the whole organism. EU-OPENSCREEN integrates screening platforms in Europe that share a rationally selected collection of compounds, including those commercially available or collected from international chemists.

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

Half the floor at one of the buildings of IBB PAS consisting of three laboratories (18m^2 and two 36m^2) with the adjacent 9m^2 offices, two separate offices, 9m^2 each and 18m^2 cold room will be provided for the Dioscouri Center at IBB PAS. If required, additional space could be available.

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

Equipment at the Laboratory of Recombinant Proteins:

- AKTAxpress chromatography system designed for automated, multistep protein purification. The protocols developed by us enable multistep purification of 6 proteins at the same time.
- The set of collaborating devices that use light scattering to determine the molecular weight, mass uniformity (polidispersity), size (hydrodynamic radius) and absolute molecular weight of macromolecules in solution, such as nanoparticles and proteins. The system includes three units: device for measurement of multi-angle light scattering (MALS), device for measurement of light refraction co-efficient for precise determination of concentration and device for dynamic light scattering (DLS).
- ITC calorimeter, used for determination of heat and equilibrium constants of macromolecules and ligands reaction.
- DSC Calorimeter enabling determining the temperature and energetics of phase transitions.
- Potentiometric set, enabling very precise measurement of stability constants in low molecular system.
- Circular dichroism spectropolarimeter providing structural information and reaction constants for chiral molecules.
- Spectrofluorometer, enabling measuring the strong reaction constants of fluorophores containing molecules, among others the proteins.

- Set for measuring of retained flow, used for determination of reaction kinetics.
- Two spectrophotometers enabling determination of molecular bonds constants of chromophore molecules in wide range of electromagnetic spectrum.
- Apparatus for microscale thermophoresis (MTS), innovative device enabling direct measurement of bond constants for a wide range of macromolecules and biological structures.
- HPLC and FPLC, IR microspectrometer for molecules purification and for determination of their concentrations.

Equipment at the Bioinformatics Unit:

- For all calculations the NVIDIA cluster solutions (24 Tesla K20 Graphic Cards) and INTEL co-processors (24 Xeon Phi511OP Graphic Cards) are used. It ensures over 50Tflops of theoretical computational power, placing our cluster in one line with the most efficient solutions in the country. Basing computational resources on expansion board technology made it also possible to save electrical energy consumption by 280% compared to standard solutions.
- Visualisation is provided by three stands equipped with workstations with NVIDIA Quadro and Tesla cards. Each of them is equipped with specially designed glasses with active LCD shutter and 3dConnexion manipulator .
- Data storage is provided by three dedicated database servers comprising efficient SSD disc with DiSCuS system installed on it, developed in Bioinformatics Laboratory of IBB PAN. The system is designed for storage and serving chemical data and sharing experimental results and *in silico* analyses. In addition, we have also database space on Hitachi AMS2300 matrix, where the publicly available and commercial screening data are kept. In view of the fact that introducing the
- drug to the market, from designing phase to registration process, takes usually ca 15 years, the laboratory has also tape silo for safe archiving of data that are not used currently, but must be kept for various reasons (e.g. patent related data).

Equipment at the High-Throughput analyses of siRNA Unit:

- Automatic pipetting work station JANUS.
- siRNA library covering the entire human genome.
- Auxiliary equipment: incubators, laminar chambers, and centrifuges.

Equipment at the Organic Synthesis Unit:

- Circulating thermostat.
- Apparatus for melting temperature measurement.
- Microwave synthesizer for organic compounds synthesis

Equipment at the Laboratory of high-throughput drug testing and proteomics:

- Automated set LC/MS for long series of samples Synapt G2.
- Mass spectrometer of ESI LC/MS/MS Orbitrap Velos type.
- Mass spectrometry system of MALDI TOF/TOF type.
- Sets HPLC of nano-LC type, integrated with spectrometers.
- DNA scanner HiSCanSQ, which enables simultaneous analysis of thousands DNA or RNA particles (high-throughput microarray analyses and transcriptomic analyses).

In addition, the Institute offers on-site: DNA sequencing and oligonucleotide synthesis, fluorescent and confocal microscopy, green-house, tissue-culture facilities, media preparation facilities, several cold rooms, a number of high-speed centrifuges for preparative analyses and a number of -70º C freezers. Space devoted to the activity of Dioscouri Center will be equipped with auxiliary laboratory 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*):

Institute of Biochemistry and Biophysics PAS will provide the following, cost-free personal benefits: on-site medical and dental care, multi-sport admission cards to gyms and to the next-door Olympic size swimming pool, accommodation at the Institute's hotel for the first three months of stay.

11. 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*):

In the last 5 years the Institute organized seven different international conferences: COST meeting *How can plant metabolomics research benefit from the systems biology revolution*? (IX 2014), Inhibitors of Protein Kinases IPK (8^{th}: IX 2014 and 9^{th}: IX 2017), *Challenges in Molecular Biology, Biophysics, and Biomedicine* (IX 2015), *Virulence mechanisms of bacteria - diverse hosts, common strategies* (X 2015), *Interdisciplinary Polar Studies in Poland* (co-organizer XI 2017) and 9^{th} *Central European Genome Stability and Dynamics Meeting* (IX 2018). 10^{th} IPK conference will be organized in IX 2019 as IUBMB Focused Meeting.

Scientists from IBB PAS have well established, ongoing collaboration with a number of researchers from the well-recognized international institution such as Max-Planck Institute for Plant Breeding Research, Max-Planck Institute for Plant Molecular Physiology, Karlsruhe Institute of Technology, Institute of Biochemistry and Pathobiochemistry, Ruhr-Universität, Bielefeld University, University of Cambridge, University of Oxford, Institute of Biochemistry and Cellular Genetics du CNRS Bordeaux, CNRS/Université de Strasbourg, Institut Le Bel, Radboud University Medical Centre, Braun Laboratories at California Institute of Technology, National Institute of Environmental Biology (NIEHS), Genome Integrity and Structural Biology Laboratory, Research Triangle Park, Laboratory of Genomic Integrity, National Institute of Child Health and Human Development at NIH, University of Texas MD Anderson Cancer Center, Division of Microbial Genetics National Institute of Genetics Japan, University of Queensland, University of Melbourne, University of Saskatchewan, Australian Antarctic Division, Instituto de Ciencias Biológicas, Universidad de Talca and others.

In addition, the Institute has a polar station located on King George Island, off the coast of Antarctica (Polish Antarctic Station Henryk Arctowski) where research is conducted not only by our Department of Antarctic Biology but also by scientists from all over the world.