REGISTRATION FORM FOR CZECH SCIENTIFIC INSTITUTION

1. Research institution data (name and address):

Institute of Biophysics of the Czech Academy of Sciences
Královopolská 135
612 00 Brno

2. Type of research institution:

Public research institution – Czech Academy of Sciences (veřejná výzkumná instituce – Akademie věd České republiky)

3. Head of the institution: Assoc. prof. Eva Bártová, Ph.D., DSc.

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

Eva Bártová – director
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Královopolská 135, 61265, Brno, Czech Republic

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

Life Sciences: *Molecular biology, structural biology, biotechnology* - 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, or other results:

The Institute of Biophysics (IBP) is one of the internationally recognized institutes of the Czech Academy of Sciences. The scientists of the Institute contribute to the formation of the national-cultural wealth, to which science undoubtedly belongs, and in this sense, the research activities should also be presented to the general public. The Institute, as a modern scientific-educational institution, is introduced on various social networks, for example, see https://www.youtube.com/watch?v=2gGHPffteGg. The quality of the research of the IBP scientists has long been manifested by high publication activity. Scientists publish the original results of their work in highly prestigious journals, including Nature Communications, Nucleic Acids Research or Nature Plants, etc. Researchers are PI of many national and international projects and are members of many scientific boards' research consortia. Scientists from ten departments are interested in conformation and functional studies of nucleic acids and their modifications. Now, many of them are focused on the role of DNA methylation or co-transcription modifications of RNAs. Highly recognized are also results published by scientists interested in *in silico* analysis of nucleic acid conformation. Our aim is to establish a new research team working on epigenetics and epitranscriptomic features of nucleic acids and their role in regulation replication, transcription, or DNA repair. From the pathophysiological point of view, a newly established group should be interested in epigenetic/epitranscriptomic changes in tumor cells; thus, they can co-operate with colleagues from present departments. Also, the scientific management of the Institute seeks to establish a new methodological center, with the potential to establish an innovative analysis of nucleic acids and their conformation or epitranscriptomic profiles.

The list of selected papers, published 2021-2022 and originated from the Institute of Biophysics

- Zajac, J.; Novohradsky, V.; Markova, L.; Brabec, V.; Kasparkova, J. Platinum(IV) derivatives with cinnamate axial ligands are potent agents against both differentiated and tumorigenic cancer stem Rhabdomyosarcoma cells. Angew. Chem. Int. Ed. 2020, 59, 3329-3335.
- Roman Matyášek and Aleš Kovařík (2020) Mutation patterns of human SARS-COV-2 and bat RaTG13 coronaviruses genomes are strongly biased towards C-U indicating rapid evolution in their hosts. Genes 2020, 11, 761; doi:10.3390/genes11070761.
- Novohradsky, V., Rovira, A., Hally, C., Galindo, A., Vigueras, G., Gandioso, A., Svitelova, M., Bresolí-Obach, R., Kostrhunova, H., Markova, L., Kasparkova, J., Nonell, S., Ruiz, J., Brabec, V., Marchán, V. (2019) Towards novel photodynamic anticancer agents generating superoxide anion radicals: A cyclometalated Ir^{III} complex conjugated to a far-red emitting coumarin. Angew. Chem. Int. Ed., 58, 6311-6315.
- Fajkus P., Peška V. et al. Telomerase RNAs in land plants. Nucleic Acids Res, 47(18), 2019. doi: 10.1093/nar/gkz695
- Legartova S, Lochmanova G, Zdrahal Z, Kozubek S, Sponer J, Krepl M, Pokorna P, Bartova E. 2019. DNA Damage Changes Distribution Pattern and Levels of HP1 Protein Isoforms in the Nucleolus and Increases Phosphorylation of HP1beta-Ser88. Cells **8**, pii: E1097. doi: 10.3390/cells8091097

- Szabla R, Zdrowowicz M, Spisz P, Green NJ, Stadlbauer P, Kruse H, **Šponer J**, Rak J.2,6-diaminopurine promotes repair of DNA lesions under prebiotic conditions. Nat Commun. 2021 May 21;12(1):3018. doi: 10.1038/s41467-021-23300-y.
- Pokorná P, Krepl M, **Šponer J.** Residues flanking the ARK^{me3}T/S motif allow binding of diverse targets to the HP1 chromodomain: Insights from molecular dynamics simulations. Biochim Biophys Acta Gen Subj. 2021 Jan;1865(1):129771. doi: 10.1016/j.bbagen.2020.129771. Epub 2020
- Malina J, Kostrhunova H, Novohradsky V, Scott P, **Brabec V.** Metallohelix vectors for efficient gene delivery via cationic DNA nanoparticles. Nucleic Acids Res. 2022 Jan 25;50(2):674-683. doi: 10.1093/nar/gkab1277.
- Kostrhunova H, Zajac J, Markova L, **Brabec V**, Kasparkova J.A Multi-action Pt^{IV} Conjugate with Oleate and Cinnamate Ligands Targets Human Epithelial Growth Factor Receptor HER2 in Aggressive Breast Cancer Cells. Angew Chem Int Ed Engl. 2020 Nov 16;59(47):21157-21162. doi: 10.1002/anie.202009491. Epub 2020 Sep 8.

7. List of no more than 3 important research projects in the selected discipline awarded in national and international calls to the institution in the last 5 years:

The Czech-Norwegian Research Program CZ09

Project title: Nuclear architecture in the regulation of autophagy, DNA repair and gene expression (NuArch)

No of the project: 7F14369

Cooperation between the IBP and University in Oslo.

Czech-Norwegian Research Program CZ09

Project title: Czech-Norwegian networking (CzeNoNet)

No.: 7F16012

Cooperation between the IBP and University in Oslo

Structural gymnastics of nucleic acids: from molecular principles through biological functions to therapeutic targets. Support of integrated research team. SYMBIT, supported by MEYS, CR, No.: CZ.02.1.01/0.0/0.0/15_003/0000477. A key scientist, prof. Jean-Luis Mergny (cooperation between Biophysicist and Inserm Research Director at the Optics and Biosciences Laboratory, Paris and the IBP)

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

We offer an office with standard equipment, PC, and technical support. For the researcher, the following core facilities are available: microscopes Leica SP5, SP8, spinning disc microscopy, quantitative fluorescence microscopy, micromanipulation, sequencing, flow cytometry units, laboratory for work with viral vectors, animal facility with the possibility to breed knockout animals, irradiation source 60-Co, and the additional laboratory devices available for recruited investigators:

Device/equipment	**Description/usage**
Typhoon FLA 9000	Radioactivity and Fluorescence Scanner
	Chemiluminiscence and Fluorescence
Amersham 380	Imager
Real time cycler Q Tower3 JennaSci.	Quantitative PCR
Beckman XL80	Ultracentrifuge
Beckman Optima LE80K	Ultracentrifuge
Beckman Avanti J30 I	High speed centrifuge for large volumes
Amersham PFGE	Electrophoresis for separation of long DNA fragments
CLC genomics WB	Software for the analysis of high throughput data
Lyophilisator JOUAN	Lyophylisator and speedvac
Electrophoresis Hoefer	Vertical electrophoresis for sequencing
Centrifuge Eppendorf	Cooled centrifuge for micro and midi (50 ml) volumes
Sonicators	can be used for WB and ChIP-PCR

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

Institute of Biophysics is one of the institutes of the Czech Academy of Sciences. Institute disposes of good infrastructure, including technical support, economy management, and scientific management. We have a good relationship with the Faculty of Sciences, Masaryk University, Brno. Many students carry out their practical parts of Bc., MS., and Ph.D. thesis in our Institute. Laboratories are equipped with devices for fluorescence in situ hybridization (FISH), immunofluorescence, flow cytometry, PCR, western blots, cell cultivation, and animal breeding. Also, a fluorescence microscope, based on a spinning disc (Leica DMXA), with possibilities of confocal mode, is available. We also have the option to use confocal microscopes Leica TSC SP5-X and SC SP8-X, equipped with white laser (470-670 nm in 1 nm increments); argon laser (488 nm), and two UV lasers (355 nm and 405 nm). For students, we organize courses on Advanced microscopy and FRAP/FRET techniques. For such experiments, we are highly experienced with living cell studies and GFP technology. Computer clusters at the Department of Structure and Dynamics of Nucleic Acids are also available when cooperation between a new investigator and this department is established.

10. List of the additional benefits (other than listed in the conditions for hosting a DC, see invitation) that the Institution declares to provide for a Dioscuri Centre (i.e.: additional funds, personal benefits, dual career options, relocation support or other):

We promote academic freedom in terms of free research and free access to methodological procedures. In the future, our aim is to build new laboratories and establish an application laboratory for advanced sequencing and biophysical methods. We support grant applications of PI and young scientists, e.g., Lumina quaeruntur of the Czech Academy of Sciences, CSF Junior Star, ERC Consolidator / Installation Grants, etc. We organize HR (HRS4R) activities in the spirit of the HR Award strategy. We organize courses in rhetoric, statistics, graphics; we have an active approach to HR implementation. We organize institutional seminars; for example, methodological seminars will be launched in 2022. We support parents with small children – e.g., expansion of the children's corner and summer schools. We provide several financial bonuses for Research Specialist Award (high-tech methodology) and Research Application Award (application science), and financial bonuses for highly prestigious scientific papers.

For the general public, it is still essential to present science in the Institute and remind those scientific applications cannot be created without high-quality basic research. We extend the existing PR activities by participating in the events of the Mendel Museum in Brno and continue with the presentation of the Institute at the Open Day, the Night of Scientists, or the Festival of Science. We intend to introduce the spirit of the HR Award by the publication of new positions of researchers on the European portal EURAXESS, according to the principles of OTM-R (Open-Transparent-and-Merit-based Recruitment). We initiate cooperation between departments. We will establish the so-called Cooperation Award associated with a financial bonus. In the past, we established the concept of a "scientific incubator," which should make the IBP more attractive in the eyes of young researchers in the Czech Republic and abroad. Also, we will establish the Czech Biophysical Association, which would coordinate biophysicists from all over the Czech Republic. Via this activity, we hope to make biophysics more visible, and we want to strengthen a general interest in biophysics.

11. Other information about the internationalization of the research institution, international researchers employed at the institution, the availability of English language seminars etc.:

Institute of Biophysics, Czech Academy of Sciences were granted by HR Award on November 30, 2021, by the European Commission. By this approach, we aim to consolidate our position as a national center for excellent research, while at the same time, we are working on bolstering our position internationally. Every year more than 50 scientists of IBP participate (as principal investigators) in national grant projects and educate more than 70 pre-graduate and post-graduate students. Also, many scientists are (were) principal investigators of international projects.

Also, we support the mobility of scientists and students. Currently, they can obtain institutional financial support for the mobility of research team members. We are also going to establish a new IBP-internal program focused on the support of international mobility of university students who realize their Ph.D. study at the Institute. We plan to provide this support in parallel with several activities offered by universities (e.g., Erasmus+, CEEPUS, ISEP, Stella Junior, etc.).

We also award students with the best diploma thesis, and we established the best paper of the year and other awards. We will also strengthen and more specific rules for the recruitment of research scientists and department leaders. An Open call for a new position will be advertised in scientific journals, EURAXESS, and on institutional web pages. We also encourage women in science; the IBP has the possibility to use children's corners (nursery).

In order to ensure further education of our scientists, we are organizing courses in management, biostatistics, language courses, advanced graphics, etc. Our aim is also to strengthen the so-called scientific incubator, recruit talented scientists with the potential to build a new perspective team, and submit their projects to the CSF, ERC agency, or others.