REGISTRATION FORM FOR CZECH SCIENTIFIC INSTITUTION

1. Research institution data (name and address):

Biologické centrum AV ČR, v. v. i. (Biology Centre CAS), Institute of Entomology
Branišovská 1160/31
370 05 České Budějovice
Czech Republic

2. Type of research institution:

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

3. Head of the institution: prof. RNDr. Libor Grubhoffer, CSc., Hon. D.Sc., dr. h. c

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

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Biologické centrum AV ČR, v. v. i.
Branišovská 1160/31, 370 05 České Budějovice, Czech Republic

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

Life Sciences: *Evolutionary and environmental biology* - evolution, ecology, population biology, biodiversity, biogeography

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:

We strive to understand ecological and evolutionary processes generating biological diversity. We study the distribution and function of biodiversity on the global scale, particularly along key ecological gradients. We have documented global trends in trophic interactions and shown that elevation gradients are generators and hotspots of biological diversity (1, 2). Our results show that these interactions fuel speciation in various groups of organisms and often contribute to the diversification of their functional traits (3). In turn, the diversification of various functional traits creates important feed-back dynamics back to the interaction networks and supports speciation of the involved organisms (4, 5). Knowing how species interactions change over time and space is critical in a changing world. Our results thus also reveal how functional traits and biotic interactions change over seasonal, successional, or disturbance gradients (6, 7, 8, 9) and identify how they further contribute to biological diversity (10). We are involved in global collaborative networks that connect researchers and organizations from Europe, Asia, Australia and the Americas, with our teams taking the lead in several global initiatives. We have supported these initiatives by building major infrastructure, including field stations and a canopy crane in Papua New Guinea. We combine our filed research and experiments with cuttingedge metabolomics and genomics. We now seek a support for **Dioscuri Centre for Bioinformatics in Macroecology** to integrate these various types of data.

Key publications

1) **Mottl O.,** et al. "Spatial covariance of herbivorous and predatory guilds of forest canopy arthropods along a latitudinal gradient." *Ecology Letters* 23.10 (2020): 1499-1510.

2) **Souto-Vilarós D.** et al. "Pollination along an elevational gradient mediated both by floral scent and pollinator compatibility in the fig and fig-wasp mutualism." *Journal of Ecology* 106.6 (2018): 2256-2273.

3) **Volf M**. et al. "Community structure of insect herbivores is driven by conservatism, escalation and divergence of defensive traits in Ficus." *Ecology Letters* 21.1 (2018): 83-92.

4) **Dijoux S.** and **D. S. Boukal.** "Community structure and collapses in multichannel food webs: Role of consumer body sizes and mesohabitat productivities." *Ecology Letters* 24.8 (2021): 1607-1618.

5) **Segar S.T.,** et al. "The role of evolution in shaping ecological networks." *Trends in Ecology & Evolution* 35.5 (2020): 454-466.

6) **Faltýnek Fric**, et al. "Phenology responses of temperate butterflies to latitude depend on ecological traits." *Ecology Letters* 23.1 (2020): 172-180.

7) **Kozel P.** et al. "Connectivity and succession of open structures as a key to sustaining light-demanding biodiversity in deciduous forests." *Journal of Applied Ecology* 58.12 (2021): 2951-2961.

8) **Sreekar R.** et al. "Land use and elevation interact to shape bird functional and phylogenetic diversity and structure: Implications for designing optimal agriculture landscapes." *Journal of Applied Ecology* 58.8 (2021): 1738-1748.

9) **Szefer P.** et al. "Impact of pathogenic fungi, herbivores and predators on secondary succession of tropical rainforest vegetation." *Journal of Ecology* 108.5 (2020): 1978-1988.

10) **Volf M**. et al. "A mosaic of induced and non-induced branches promotes variation in leaf traits, predation and insect herbivore assemblages in canopy trees." *Ecology Letters* (2022): in press

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:

Why is the world green: testing top-down control of plant-herbivore food webs by experiments with birds, bats and ants

PI: Kateřina Sam

Source of Funding: ERC

Amount of Funding: EUR 1,455,032

Testing mechanisms that maintain high species diversity in food webs by experimental manipulation of trophic cascades in a tropical rainforest

PI: Vojtěch Novotný

Source of Funding: Czech Science Foundation

Amount of Funding: CZK 49,860,000

Why is there such high diversity of chemical defences: role of insect herbivory in promoting chemical diversity in willows

PI: Martin Volf

Source of Funding: Czech Science Foundation

Amount of Funding: CZK 8,996,000

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

The Dioscuri Centre for Bioinformatics in Macroecology will primarily rely on bioinformatics analyses. There is enough office space available at the institute to accommodate the Centre leader and the team, who will work with primary data from our macroecological studies.

Our team has exceptional field facilities for large scale ecological data collection, including [i] a **ForestGEO rainforest dynamics plot Wanang** monitoring 288,000 individual plants, [ii] **Kakoba lowland rainforest canopy crane**, [iii] **Mt Wilhelm rainforest elevation gradient** (200-3700m asl) with eight field stations, and [v] **New Guinea Binatang Research Center**, a field station with 50 staff and laboratory space in Papua New Guinea (www.ngbinatang.com), as well as established field sites using canopy cranes along the latitudinal gradient from Australia via Malaysia and China to Japan, as well as an intercontinental network of forest study sites (USA, Panama, Czechia, Cameroon, PNG and Japan). This field data pipeline continues with DNA analysis in collaboration with the Barcode of Life project (Guelp University, Canada), making for instance PNG insects some of the best barcoded in the world. We have developed collaboration among various teams at our institute and with laboratories in Germany, Finland, and the US that generate metabolomics data on plant metabolites involved in trophic interaction. Locally, the centre can use a separate room and rely on the equipment in the Laboratory of Analytical Biochemistry & Metabolomics. Another part of our data pipeline focuses on providing genomics data for population and macroevolutionary studies. The institute has available a well-equipped molecular laboratory at the Department of Ecology, which has been recently upgraded to allow efficient processing of large numbers of samples. The laboratory space is divided into several sections to avoid any cross-contamination of the samples. These facilities and collaborations generate exceptional data for the proposed analytical project, using state of the art ecological and phylogenetic methods. The main aim for the Centre will be to link all these types of data to provide novel and broader perspectives on macroecology and macroevolution of biotic interactions.

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

We have access to the national **METACENTRUM cluster** that offers the necessary computational power for bioinformatics analyses. Computationally less demanding analyses and data visualization will be also supported with locally available computers.

Centre will be supported by numerous **filed facilities** as explained above. These include mainly a ForestGEO rainforest dynamics plot Wanang, Kakoba lowland rainforest canopy crane, and new Guinea Binatang Research Center.

The molecular laboratory at the Department of Ecology can provide equipment for sample preparation (**homogenizers, freeze-driers**) and long-term storage of biological samples and DNA **(-80 °C freezers**). Additionally, there is available **all standard equipment for molecular analyses** including cyclers, incubators, shakers, equipment for electrophoresis, DNA quantification, and data documentation.

Furthermore, the Laboratory of Analytical Biochemistry & Metabolomics at Biology Centre CAS (BCLAB) offers equipment for metabolomics analyses that will be an important source of the data for bioinformatics analyses: [i] **Q-Exactive Plus high-resolution mass spectrometer combined with a liquid chromatograph** used for targeted and non-targeted metabolomics studies and measurement of elemental composition of small molecules. [ii] **Agilent 6495 B triple quadrupole mass spectrometer in combination with a liquid chromatograph and a supercritical fluid chromatograph** for trace and ultratrace quantitative analyses. [iii] **LTQ XL linear ion trap mass spectrometer in combination with a liquid chromatograph** for new method development, measurement of selected metabolites, and small peptide sequencing. [iv] **Agilent 7010 B triple quadrupole mass spectrometer GC-MS /MS equipped with a triple quadrupole** for quantitative trace analysis of substances such as steroids, amino acids, organic acids, etc. [v] **ISQ GC-MS mass spectrometer equipped with EI/CI ionization, and gas chromatograph** for the analysis of fatty acids, sugars and sterols, for the chiral analysis of amino acids and organic acids. [vi] **Thermal desorption unit combined with GC-MS instruments** for volatile compound analysis. All small laboratory equipment for sample preparation including the robotic unit for automatic sample preparation (MetaboAuto).

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):

Foreign applicants will receive support in transferring to the Czech Republic. The Institute can also help secure non-commercial accommodation at the campus shared by the Biology Centre and the University of South Bohemia and provide guidance with the administration concerning the transfer of both the DC Leader and their family.

Position includes standard health and social security benefits, support for onboarding, leisure and holiday activities, coverage of required travel and SW/HW. The employees have can opt for flexible working time and 25 days of paid holiday per year. The institution also runs a children's group for employees with small children. BC also runs its own mentoring programme.

BC closely cooperates with the University of South Bohemia. There are thus excellent opportunities for deepening or obtaining teaching experience and attracting prospective students for the Centre.

Ceske Budejovice is a medium-sized town ca. 150 km south of Prague with 100,000 inhabitants, a relaxed atmosphere, and a growing expat community. Both the town and the surrounding countryside provide numerous opportunities for research and leisure activities. Living costs are low by international standards.

We closely collaborate with University of South Bohemia that we share our campus with. There are thus excellent opportunities for deepening or obtaining teaching experience and attracting prospective students for the Centre.

The Centre will intensively collaborate with the Department of Ecology. The Department of Ecology serves as an excellent platform for fundraising and obtaining primary data on biotic interactions, metabolomics, genomics and other molecular and biological data that can be used by the Centre.

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

In 2019, Biology Centre CAS was awarded a 'Human Resources Excellence in Research' Award of EU and, recently, the institution has also adopted a Gender Equality Plan. Biology Centre is an equal opportunity employer with highly developed care of Czech and a great number of foreign employees as 25 % of our researchers come from more than 30 different countries. The Department of Ecology is a diverse environment including undergrads, PhD students, postdocs and researchers from 11 nationalities.

In order to enable better communication at the institution, there are courses of English for Czech employees and courses of Czech for foreign employees available, free of charge. The institution has been translating all key documents and information into English.

The institution is also a member of the ALTER-net, ELIXIR, Czech-Bioimaging, Euro-Bioimaging and EFSA research networks.