Registration Form - declaration of willingness for establishing interdisciplinary Dioscuri Centres of Scientific Excellence

This is a registration form for Host Institutions wanting to establish an interdisciplinary Dioscuri Centre of Scientific Excellence within Dioscuri 5 call.

Registration form for Polish research institution

1. Research institution data (name and address):

   University of Gdansk, prof. Marii Janion Str. 7, 80-309 Gdańsk, Poland.

2. Type of research institution[1]:

   higher education institutions

3. Head of the Institution:

   Professor Piotr Stepnowski - Rector of the University of Gdańsk.

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

   dr Jakub Neumann, prof. UG; jakub.neumann@ug.edu.pl,+48 58 523 20 56, Faculty of Mathematics, Physics and Informatics, Wita Stwosza Str. 57, 80-308 Gdańsk, Poland.

5. Research disciplines in which the institution ensures establishing of an interdisciplinary Dioscuri Centre (select two (and if necessary three) of the domains that should be combined; select two (or if necessary three) from the 25 listed

auxiliary panels of disciplines). Provide two (and if necessary three) specific NCN subpanels according to the list[2].

[2] Lists of the disciplines for each auxiliary panel of disciplines to be found here: https://www.ncn.gov.pl/en/finansowanie-nauki/panele-ncn

X **DOMAIN: Humanities, Social Sciences and Art Sciences** [3]

☐ Fundamental questions about human existence and the nature of reality

☐ Culture and cultural production

☐ The study of the human past

☐ Institutions, markets, space

☐ Law and political science

X **Human nature and human society**

HS6_06 Evolutionary and comparative psychology, behavioral genetics, psychophysiology, neuropsychology

☐ **DOMAIN: Life Sciences**[4]

☐ Molecules of Life: Biological Mechanisms, Structures and Functions

☐ Integrative Biology: from Genes and Genomes to Systems

☐ Cellular, Developmental and Regenerative Biology

☐ Physiology in Health, Disease and Ageing

☐ Neuroscience and Disorders of the Nervous System

☐ Immunity, Infection and Immunotherapy

☐ Prevention, Diagnosis and Treatment of Human Diseases

☐ Environmental Biology, Ecology and Evolution

☐ Biotechnology and Biosystems Engineering

X **DOMAIN: Physical Sciences and Engineering**[5]

[3] Lists of the disciplines for each auxiliary panel of disciplines to be found here: https://www.ncn.gov.pl/en/finansowanie-nauki/panele-ncn

[4] Lists of the disciplines for each auxiliary panel of disciplines to be found here: https://www.ncn.gov.pl/en/finansowanie-nauki/panele-ncn

[5] Lists of the disciplines for each auxiliary panel of disciplines to be found here: https://www.ncn.gov.pl/en/finansowanie-nauki/panele-ncn

☐ Mathematics

☐ Fundamental constituents of matter

☐ Condensed matter physics

☐ Chemistry

☐ Synthetic Chemistry and Materials Science

X <u>Computer science and informatics</u>

ST6_07 Artificial intelligence, intelligent systems, multi-agent systems

☐ Systems Engineering

☐ Production and processes engineering

☐ Earth sciences

☐ Materials Engineering

6. Description of important research achievements from the selected disciplines from the last 5 years including a list of the most important publications, data bases, series of workshops, patents, policy briefs, field work/ field site, exhibitions, other:

<u>HS6_06</u>

Krukow, P., Jonak, K., Karakuła-Juchnowicz, H., Podkowiński, A., Jonak, K., Borys, M., Harciarek, M. (2018). **Disturbed functional connectivity within the left prefrontal cortex and sensorimotor areas predicts impaired cognitive speed in patients with first-episode schizophrenia**. Psychiatry Research. Neuroimaging, 275, 28-35.

This study aimed at identifying abnormal cortico-cortical functional connectivity patterns that could predict cognitive slowing in patients with schizophrenia. A group of thirty-two patients with the first-episode schizophrenia and comparable healthy controls underwent resting-state qEEG and cognitive assessment. Phase Lag Index (PLI) was calculated for intra-regional connectivity and between-regions connectivity. Computer version processing speed tests were applied. Overall, in comparison to healthy controls, patients had significantly higher PLI values in theta frequency, especially in the posterior areas and decreased PLI in low-alpha frequency within the frontal regions. Mean PLI in gamma frequency was also lower in the patients group. Regression analysis showed that lower intra-regional PLI for left frontal cortex and higher PLI within somatosensory cortex in theta band, together with the duration of untreated psychosis, proved to be significant predictors of impaired processing speed in first-episode patients. Our investigation shows that disrupted cortico-cortical synchronization contributes to cognitive slowing in schizophrenia

Walczak-Kozłowska, T., Mańkowska, A., Chrzan-Dętkoś, M., Harciarek, M. (2020). **Attentional system of very prematurely born preschoolers**. Developmental Psychology, 56, 251-260.

This longitudinal study examined changes in the efficiency of the attentional system during the transition from preschool to school in children born very prematurely. Our research findings show that, at age 5, very preterm children showed reduced efficiency in alerting and orienting compared to full-term children. Further, by age 6, alerting efficiency improved in the preterm group, and no longer differed from the control group. However, group differences in attentional orienting persisted at the follow-up assessment at age 6.

Michałowski, J.M., Mańkowska, A., Heilman, K.M., Biedunkiewicz, B., Dębska-Ślizień, A., Harciarek, M. (2021). **Kidney transplantation and action-intentional improvements: Evidence from an ERP study**. International Journal of Psychophysiology, 70, 51-58.

This present study aimed at investigating whether these deficits are reversible following successful kidney transplantation. To achieve this goal, behavioral and electrophysiological (EEG) data were assessed from healthy control participants as well as kidney transplant and dialyzed patients performing a series of reaction time tasks. The results demonstrated that in patients who received kidney transplant a normalization of response latencies and brain preparatory activity was observed. At the same time, when compared to healthy individuals, increased attention engagement was observed in both clinical groups of patients. No behavioral and electrophysiological indices of impaired monitoring were observed in any of the clinical groups.

Domagała, A., Domagała, L., Kopis-Posiej, N, Harciarek, M., Krukow, P. (2023). **Differentiation of the retinal morphology aging trajectories in schizophrenia and their associations with cognitive dysfunctions,** Frontiers in Psychiatry, 14, 1-10.

In this research article, we aimed to determine whether the thinning of the retinal layers assessed with the optic coherence tomography (OCT) in a group of schizophrenia patients presents a significant age-related decrease exceeding potential changes noted in the control group. Overall, associations between retinal parameters, age, and selected cognitive functions were evaluated. Analyses revealed that macular thickness and volume in patients undergo significant age-dependent thinning, which was not observed in the control group. Also, selected speed-dependent cognitive functions in patients decreased significantly with age, and these features were also significantly associated with some OCT outcomes also after controlling for antipsychotic treatment. Our results suggest that reduced measures of retinal structure detected in schizophrenia may be an effect of accelerated aging

Tyburski EM, Zawadzka E, Bober A, Karabanowicz E, Podwalski P, Samochowiec J, Michalczyk A, Sagan L, Jansari A, Mueller ST, Harciarek M, Misiak B, Lutkiewicz K, Wietrzyński K, Kucharska-Mazur J, Reginia A, Mak M. (2026). **Executive functioning in schizophrenia using anovel virtual reality-simulated workplace: validity, test-retest reliability, and links to competitive employment**. Scientific Reports, 16,1-14.

The main aim of the study was to investigate mediation models and identify whether relationships between negative and disorganization symptoms and verbal fluency in schizophrenia are mediated by cognitive flexibility and processing speed. Our research experiments using virtual reality showed that individuals with schizophrenia are characterized by a specific performance profile on verbal fluency tasks. They manifest poor productivity and problems using cognitive strategies for semantic fluency. Referring to executive functioning, schizophrenia patients exhibit decreased cognitive flexibility, problem-solving, and formulating concepts, as well as slow processing speed.

ST6_07

Przewocki, J., Kossiński, D., Łukaszuk, A., Jakiel, G., Wocławek-Potocka, I., et al. **Follicular Fluid Proteomic Analysis to Identify Predictive Markers of Normal Embryonic Development.** *International Journal of Molecular Sciences*, 25(15), 8431, 2024.

Application of machine learning and statistical analysis to high-dimensional proteomic data from human follicular fluid collected during IVF. The study identified protein patterns associated with embryo developmental quality, including immunoglobulin heavy constant alpha 1 and dickkopf-related protein 3 as promising biomarkers.

Przewocki, J., Łukaszuk, A., Jakiel, G., Wocławek-Potocka, I., Kłosińska, K., et al. **Proteomic Analysis of Follicular Fluid in Polycystic Ovary Syndrome: Insights into Protein Composition and Metabolic** Pathway Alterations. *International Journal of Molecular Sciences*, 25(21), 11749, 2024.

iApplication of machine learning methods to analyse proteomic differences between follicular fluid samples from patients with PCOS and controls. The study identified 20 proteins with altered abundance and indicated immune-related processes, inflammation, protease inhibitors, and HDL assembly as relevant biological mechanisms. Myosin light polypeptide 6 was proposed as a potential independent biomarker of PCOS

Przewocki, J., Marchwicka, M., Wąsik, A., Reichel, B., Sieklicki, W., Goch, K., & Łukaszuk, K. **Detection of Daily Activities from Ear-Worn Accelerometer Signals: A Pilot Study with Topological Data Analysis.** *Archive of Mechanical Engineering*, 195–215, 2026.

Development of a pipeline involving topological data analysis (TDA) for recognising daily activities from accelerometer signals recorded by a custom ear-worn device. The method combined time-delay embeddings, persistent homology, topological descriptors, and a random forest classifier. On 47,658 labelled signal windows, the model achieved 89% balanced accuracy in detecting activities such as eating, drinking, smoking, speaking, and other behaviours.

Zofia Wrona, Maria Ganzha, Marcin Paprzycki, Wiesław Pawłowski, Angelo Ferrando, Giacomo Cabri, Costin Bădică, ***Comparison of Multi-Agent Platform Usability for Industrial-Grade Applications*** (http://dx.doi.org/10.3390/app142210124). Applied Sciences vol. 14, Issue 22, © MDPI, 2024

Despite their obvious advantages and the continuous efforts of the scientific community, agents are rarely used in industrial-grade applications, even though multi-agent systems (MAS) concepts emerged more than 40 years ago. The paper aims to analyze the reasons for the lack of adoption of agent solutions in the real world. The analysis compares all relevant aspects of the modern software development life cycle with what is currently available in the MAS domain.

Katarzyna Wasielewska-Michniewska, Maria Ganzha, Marcin Paprzycki, Wiesław Pawłowski, ***Review and Critical Analysis of Ontologies for Artificial Intelligence Systems*** (DOI: http://dx.doi.org/10.1007/978-981-97-0855-0_70). Proceedings of International Conference on Image, Vision and Intelligent Systems 2023 (ICIVIS 2023), LNEE, vol. 1163, pp 729–744, © Springer, Singapore, 2024.

As artificial intelligence-based solutions become more popular, it is important not only to deploy machine learning models and pipelines, but also to be able to control and manage their metadata. The paper investigates the state of the art in related ontologies, as well as several important non-ontological approaches to representing knowledge about artificial intelligence models, components, related processes and data.

7. List of no more than 4 important research projects from the selected disciplines awarded in national and international calls to the institution in the last 5 years (title, name of PI, source of funding, amount of funding)

1) (C)ombinatorial (O)ptimisation for (V)ersatile Applications to (E)merging (R)eal urban problems
   PI: dr Hanna Furmańczyk, dr hab. Paweł Żyliński
   Source: HORIZON – MSCA-2023-SE-01
   Amount of funding: 395 600 EUR including UG: 64 400 EUR

2) The parity problem for cellular automata
   PI: dr Anna Nenca
   Source: National Science Centre, Sonata 47
   Amount of funding: 175 680 PLN

3) Does coronavirus SARS-CoV-2 predominantly impact the functioning of the right hemisphere and the anterior attentional system? A prospective study of neuropsychological and neurophysiological sequelae of COVID-19
   PI: Professor Michał Harciarek
   Source: National Science Centre, OPUS 21
   Amount of funding: 941 551 PLN

4) AI-based Bulk Surveillance: Emerging Threat to Privacy or Gold Standard for Compliance?
   PI: dr hab. Marcin Rojszczak
   Source: National Science Centre, SONATA 19
   Amount of funding: 1 086 634 PLN

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

The Faculty of Mathematics, Physics and Informatics and the Faculty of Social Sciences of the University of Gdańsk are located at the Oliwa campus in Gdańsk.

The following spaces will be made available for the Dioscuri Center:

- standard office room, fully furnished, with Internet access;
- social facilities: coffee machine, fridge, and microwave;
- access to seminar rooms and auditoriums for project meetings and discussions;
- access to the Main Library of the University of Gdańsk.

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

- 2 x AI workstation NVidia GB10 (GDX Spark),
- Cisco UCS C220 and C240 M5-generation rack servers, optimized for high-performance clustering. The cluster consists of 4 storage nodes and 3 compute nodes, providing a total of 252 processor cores, 3 TB of RAM, and 25 TB of disk space,
- 300 desktop computers, Intel i7-8700 processor, 16 GB of RAM and a 512 GB SSD drive.

10. List of the additional benefits (other than listed in invitation call) that the Institution declares to provide for the Dioscuri Centre (i.e.: additional funds, personal benefits, other):

The University of Gdańsk remains open to discussing and adapting working conditions in order to ensure the most effective and supportive environment for the Dioscuri Centre Leader and the research team. Examples of additional support that may be provided by the Institution include:

- Administrative, financial, and project-management support provided by dedicated University offices, including assistance with grant management, reporting, and recruitment procedures.
- Support from the University's Technology Transfer Office in intellectual property protection and commercialisation activities.
- Collaboration opportunities within the FarU alliance (The Fahrenheit Universities: University of Gdansk, Technical University of Gdańsk, Medical University of Gdańsk), including access to interdisciplinary scientific networks, joint initiatives, research infrastructure, and academic cooperation with partner institutions.
- Possibility of additional support for PhD scholarships.
- Possibility to provide a fully furnished apartment for the Dioscuri Centre Leader and family on preferential rental terms for the entire duration of the project.
- Access to language courses and University social benefits.

- Access to sports and recreation programmes, including Multisport/Benefit Systems cards, as well as cultural and recreational activities

11. Other information about the internationalization of the research institution e.g. international environment (international researchers' community at the institution, internationalization of the management and administration), didactic in English, availability of Polish course for Foreigners etc.:

International cooperation includes research projects, conducting joint scientific studies, organizing seminars and conferences, as well as co-publishing scientific articles. Students and academic and administrative staff take advantage of the academic exchange offer. The University of Gdańsk is visited by hundreds of students, PhD students, research collaborators, and visiting professors every year.

Currently, the Faculty of Mathematics, Physics and Informatics employs 8 foreigners, who receive full administrative support. The staff communicates fluently in English and assists with work-related matters, residence legalization, and accommodation. English is the language of instruction during most of the workshops, classes, public lectures and conferences. Annually, there are 2 or 3 workshops organized for students and young researchers from all over the world. Each year a few international conferences are held at both Faculties.

The Doctoral School at the Faculty of Mathematics, Physics and Informatics of the University of Gdansk brings together doctoral students from the disciplines of mathematics and physical sciences. More than 50% of students are from abroad.

The full- time master course Quantum Information Technology, innovative and rapidly developing global field of study fully taught in English, is popular among foreign students.

Załącznik nr 1.

Informacja o przetwarzaniu danych osobowych osoby wyznaczonej do kontaktu z NCN. Na podstawie art. 14 ust. 1, 2 i 3 rozporządzenia Parlamentu Europejskiego i Rady (UE) 2016/679 z dnia 27 kwietnia 2016 r. w sprawie ochrony osób fizycznych w związku z przetwarzaniem danych osobowych i w sprawie swobodnego przepływu takich danych oraz uchylenia dyrektywy 95/46/WE (ogólne rozporządzenie o ochronie danych) (Dz. Urz. UE L 2016, Nr 119, s. 1).

1. Narodowe Centrum Nauki z siedzibą w Krakowie przy ul. Twardowskiego 16, 30-312 Kraków (dalej też: Centrum) jest administratorem danych osobowych wymienianych w pkt 4 zgłoszenia, pozyskanych w formularzu rejestracyjnym, a przekazanych Centrum przez instytucję naukową.
2. Kontakt z wyznaczonym Inspektorem Ochrony Danych w Centrum jest możliwy za pomocą poczty elektronicznej (e-mail: iod@ncn.gov.pl), telefonicznie pod numerem +48 12 341 91 13 lub bezpośrednio w siedzibie administratora danych osobowych.
3. Podstawę prawną przetwarzania danych osobowych przez Narodowe Centrum Nauki stanowi art. 6 ust. 1 lit. c) ogólnego rozporządzenia o ochronie danych w zw. z art. 20 ustawy z dnia 30 kwietnia 2010 r. o Narodowym Centrum Nauki (t.j. Dz. U. 2018 r. poz. 947).
4. Narodowe Centrum Nauki będzie przetwarzać dane osobowe takie jak imię albo imiona i nazwisko, stanowisko, numer telefonu i adres poczty elektronicznej, nazwę i dane adresowe podmiotu zatrudniającego.
5. Pozyskiwane dane osobowe będą przetwarzane w celu umożliwienia kontaktu aplikanta z przedstawicielem jednostki uczestniczącej w programie Dioscuri, do czasu zakończenia programu, przeprowadzenie ewaluacji realizacji zadań Centrum oraz sprawozdawczości. Ponadto dane osobowe będą przetwarzane w celu upowszechnienia w środowisku naukowym informacji o ogłaszanych konkursach, w celu wykonywania innych czynności regulowanych przepisami prawa i do celów archiwalnych.
6. Dane osobowe będą przetwarzane przez okres niezbędny do realizacji celów wskazanych w pkt. 5, okres wymagany przez przepisy prawa oraz przez okres przechowywania zgodny z instrukcją kancelaryjną Centrum i Jednolitym Rzeczowym Wykazem Akt.
7. Osoba, której dane dotyczą ma prawo dostępu do treści swoich danych, sprostowania swoich danych osobowych, ograniczenia przetwarzania swoich danych osobowych.
8. Osoba, której dane dotyczą ma prawo wniesienia skargi do Prezesa Urzędu Ochrony Danych Osobowych, w przypadku gdy uzna, że przetwarzanie narusza przepisy ogólnego rozporządzenia o ochronie danych.
9. Pozyskiwane dane osobowe będą dostępne dla osób zainteresowanych realizacją projektów w ramach konkursów ogłaszanych przez Centrum.
10. Odbiorcami danych osobowych będą wyłącznie podmioty uprawnione do uzyskania danych osobowych na podstawie przepisów prawa.
11. Pozyskiwane dane osobowe mogą być powierzone do przetwarzania podmiotom zewnętrznym w ramach realizowanych przez nie usług, na podstawie umów o powierzenie danych osobowych, a podmioty te również zobowiązane są do zachowania poufności przetwarzanych danych.