HCEMM
Translational Medicine

RESEARCH GROUPS
& ADVANCED CORE FACILITIES

HUNGARIAN NATIONAL LABORATORY

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 739593.

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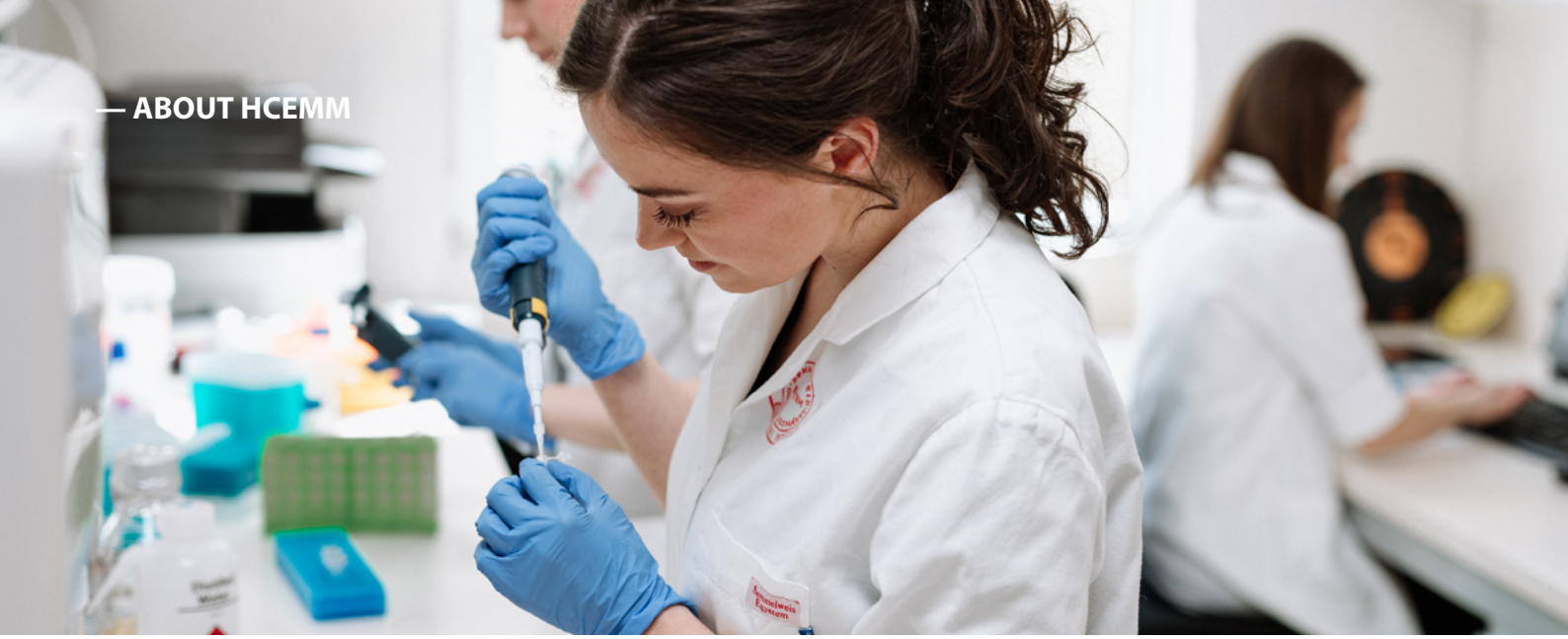

About HCEMM

The Hungarian Centre of Excellence for Molecular Medicine (HCEMM) is working on research and development related to healthy ageing. For the administration of the HCEMM program, HCEMM Kft. was incorporated by the Biological Research Centre Szeged (BRC), the Semmelweis University in Budapest and the University of Szeged. The European Molecular Biological Laboratory (EMBL) functions as the advanced partner of HCEMM. In addition to the initial E.U. Teaming Grant that led to the creation of HCEMM, the Centre of Excellence has also received National Laboratory status in Hungary in 2020.

The research and development at HCEMM are carried out by research groups and advanced core facilities. The main research and development focus is the development of molecular approaches (diagnostics as well as treatment) for healthy ageing. Three research pillars related to non-infectious ageing-related diseases have been established (Immuno-inflammatory, Metabolic and Cardiovascular Diseases as well as Genomic Instability and Cancer). In addition, a fourth pillar related to infectious diseases (co-morbidities) had been established in 2021. The research groups are supported by four ACFs (Functional Cell Biology and Immunology, Single Cell Omics, In-vivo Imaging and Scientific Computing), which work closely with EMBL.

Host institutes

SEMMELWEISS UNIVERSITY

UNIVERSITY OF SZEGED

BIOLOGICAL RESEARCH CENTRE

Advanced Partner

EMBL

EUROPEAN MOLECULAR BIOLOGY LABORATORY

OUR THEMATIC PILLARS

- Immuno-inflammatory Diseases
- Metabolic and Cardiovascular Diseases
- Genomic Instability and Cancer
- Infectious Diseases with special emphasis on Co-Morbidities

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THEMATIC PILLARS AND RESEARCH GROUPS

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THEMATIC PILLAR 1.

IMMUNO-INFLAMMATORY DISEASES

During the past decade, novel revolutionary frontiers have been opened at the immuno-inflammatory research fields. Indeed, with the help of modern, state-of-the-art technologies (immunomics and other omics, systems biology) it was identified that the immune system is much more complex than previously thought and that its proper functions are defined by multi-directional intercellular communications between cellular (and humoral) components of innate and adaptive immunity.

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Edit Buzás MD, PhD, DSc

HCEMM-SU Extracellular Vesicles Research Group
Group Leader

Immuno-inflammatory Diseases Thematic Pillar

The Buzás group focuses on the association of extracellular vesicles with viruses or lipoproteins for gene delivery and for better understanding of the pathogenesis of cardiovascular diseases.

Balázs Enyedi MD, PhD

HCEMM-SU Inflammatory Signaling Research Group
Group Leader

Immuno-inflammatory Diseases Thematic Pillar

The Enyedi group develops novel fluorescent biosensors to study the inflammatory response triggered by tissue damage.

Attila Gácser PhD

HCEMM-USZ Fungal Pathogens Research Group
Group Leader

Immuno-inflammatory Diseases Thematic Pillar

The Gácser group investigates the role of the oral mycobiome - particularly Candida species - in health and disease, with a special focus on oral squamous cell carcinoma (OSCC) initiation and progression. Yeast-oral epithel cell - OSCC interactions are studied both in vitro and in vivo, to reveal mechanisms activated during potentially fungi-driven carcinogenesis and OSCC progression events.

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Prof. Lajos Kemény MD

HCEMM-USZ Skin Research Group
Group Leader

Immuno-inflammatory Diseases Thematic Pillar

The Kemény group investigates the pathogenesis of inflammatory skin diseases with strong translational focus. The group aims to establish advanced medicinal products for psoriasis.

Bálint Kintses PhD

HCEMM-BRC Translational Microbiology Research Group
Group Leader

Immuno-inflammatory Diseases Thematic Pillar

The Kintses group combines a collection of systems and synthetic biology approaches, ranging from bioinformatics and a wide variety of genomics techniques to genome engineering working towards a new era of precision antimicrobial therapy. “We have two major interests. First, we fight against multi-drug resistant bacteria by developing molecular tools that predict the evolution of resistance by horizontal gene transfer against novel antibiotics. We believe that our approach will lead to more resistance-proof antimicrobial agents. Second, we investigate bacteriophage evolution and we utilize the knowledge we gain to develop novel phage engineering strategies for the future of more effective phage therapy.”

József Maléth MD, PhD

HCEMM-USZ Molecular Gastroenterology Research Group
Group Leader

Immuno-inflammatory Diseases Thematic Pillar

The Maléth group studies epithelial physiology and pathophysiology and intercellular communications of epithelial cells and other cell types in human tissues and in rodent models using advanced cell cultures, molecular biology and microscopy techniques.

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Karolina Pircs PhD

HCEMM-SU Neurobiology and Neurodegenerative Diseases Research Group
Group Leader

Immuno-inflammatory Diseases Thematic Pillar

The Pircs group aims are to understand using aged patient derived induced neurons directly reprogrammed from fibroblasts, how alterations in autophagy contribute to healthy ageing and the pathophysiology of age-related, chronic neurodegenerative disorders such as Parkinson's, Alzheimer's and Huntington's disease.

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THEMATIC PILLAR 2.

METABOLIC AND CARDIOVASCULAR DISEASES

Metabolic and cardiovascular (CV) diseases are among the major cause of death in Hungary and worldwide, thus impose an enormous social and economic burden. In the clinical practice there is a great need for i) the elucidation of the molecular patho-mechanism of such high-burden diseases (including obesity, diabetes, heart failure), as well as for ii) the development of novel therapies, cost-effective treatments and iii) more personalized or at least targeted therapeutic approaches.

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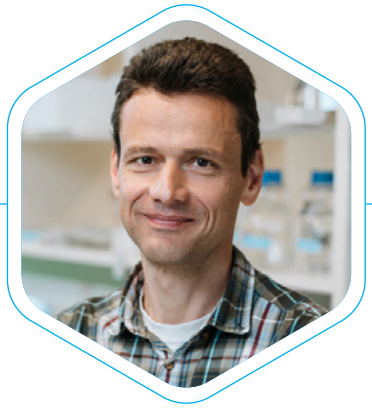

László Csanády MD, PhD, DSc

HCEMM-SU Molecular Channelopathies Research Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Csanady group studies structure, function, and pharmacology of two medically relevant ion channels, CFTR and TRPM2. Both are "chanzymes" in which ion channel and enzymatic properties are encoded within a single polypeptide chain. We combine high-resolution single-channel current recordings, enzymatic assays on purified channel proteins, cryo-electron microscopy, structure-guided mutagenesis, and specific pharmacological modulators to understand the molecular mechanisms of these channels.

Eszter Farkas PhD

HCEMM- USZ Cerebral Blood Flow and Metabolism Research Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Farkas group explores molecular mechanisms of cerebral edema in ischemic stroke, with special focus on astrocytes. They set out to identify plasma biomarkers of ischemia-linked astrocyte swelling, to inhibit reactive astrogliosis, reduce cerebral ischemia-related edema formation, and, ultimately, provide neuroprotection.

Nazha Hamdani PhD

HCEMM-SU Cardiovascular Comorbidities Research Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Hamdani Group deepen thei basic understanding to the pathophysiology of cardiovascular diseases associated with oxidative stress and co-morbidities, in order to translate our findings into novel diagnostic and clinical tools for heart failure patients and provide firm foundations for clinical innovation.

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Karri Lämsä, PhD, Dr. MTA

Human neuron physiology and therapy Core Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Lämsä group investigates human neuron phenotypes in their function, structure and molecular profile. The study aims to identify 'specific-to-human' neuronal features which help to understand human brain function in healthy ageing and pathology, and hopefully enable development of new therapeutic interventions in future.

Balázs Németh MD, PhD

HCEMM-USZ Translational Pancreatology Research Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Németh Group investigates therapeutic possibilities of acute and chronic pancreatitis using translational, bench-to-bedside approach. Another key scientific activity is the genetic study of human hereditary pancreatitis in close collaboration with the Hungarian Pancreatic Study Group.

Balázs Papp PhD

HCEMM-BRC Metabolic Systems Biology Research Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Papp group combines bioinformatics and evolutionary approaches to study metabolic networks with the ultimate aim of understanding how metabolic variations impact human health.

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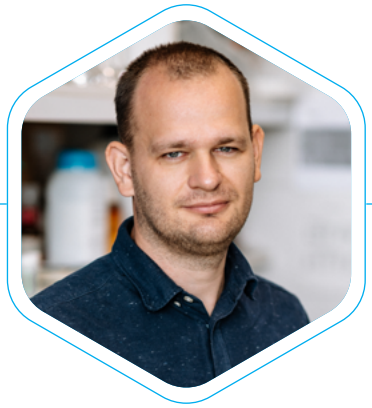

Zoltán Varga MD, PhD

HCEMM-SU Cardiometabolic Immunology Research Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Varga group aims to understand the contribution of chronic inflammatory processes to cardiac dysfunction developing due to heart failure, metabolic diseases, aging, and as a side effect of new chemotherapeutic drugs (e.g. immune checkpoint inhibitors).

Nikolett Wohner MD

HCEMM-SU Thrombosis and Hemostasis Research Group
Group Leader

Metabolic and Cardiovascular Diseases Thematic Pillar

The Wohner group focuses on translational medicine in the field of thrombosis and hemostasis investigating the pathomechanism of bleeding or thrombotic complications in hematological diseases. Our results may thoroughly affect the development of new thrombolytic therapies and help to identify new thrombotic markers.

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THEMATIC PILLAR 3.

GENOMIC INSTABILITY AND CANCER

In the EU-28, cancer accounts for 25.8% of the total number of deaths, acquiring the second position behind cardiovascular diseases. In 2012, among the EU members states, the highest standardized death rates for cancer were recorded in Hungary and Croatia, both with rates over 330 per 100 000 inhabitants (Euro Stat data). HCEMM scientists have already significantly contributed to lowering the burdens related to cancer and its complications.

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Antal Berényi MD, PhD

HCEMM-USZ Magnetotherapeutics Research Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

The Berényi group investigates the possible therapeutic use of various biophysical interactions with the neuronal tissues in animal models of brain disorders.

Balázs Bende, MD

Transaltional Medicine Development Core Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

The Bende group is a special supportive group joins to other HCEMM research groups to facilitate the translational phase of their basic research. Once, the TMDG can develop protocols for human sample collections, otherwise when a project reaches the TRL 7-8 state, the clinical evaluation of their device or diagnostic tool can be supported by the group by the provided guidance on the regulatory pathways.

Csaba Bödör PhD

HCEMM-SU Molecular Oncohematology Research Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

The Bödör group investigates the spatial and temporal heterogeneity in mature B-cell lymphomas with a focus to develop liquid biopsy based genomic profiling and minimal residual disease detection approaches in these diseases.

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Lajos Haracska PhD

HCEMM-BRC Mutagenesis and Carcinogenesis Research Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

The Haracska group is interested in DNA repair, mutagenesis, and carcinogenesis in human cells. The aim of his laboratory is to understand in molecular detail how replication can be achieved if DNA is damaged, how the involved pathways are regulated by ubiquitylation, and how the impairment of the players leads to cancer. In addition to shedding light on DNA damage bypass, his research has the potential to reveal new gene mutations for cancer predisposition and provide novel cancer therapeutic targets.

Szilvia Juhász PhD

Cancer Microbiome Core Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

The Juhász group develops an integrated framework that allows patient stratification, i.e. grouping of patients based on cancer risk and response to therapy. Additionally, these investigations will reveal novel human DNA damage response pathways involved in cancer progression. Our ultimate goal is to develop microbiome-associated biomarkers from non-malignant patients before tumors develop, thereby transforming therapeutic strategies from reactive to predictive.

Lajos Vince Kemény MD, PhD

HCEMM-SU Translational Dermatology Research Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

The Kemény Group is focused on understanding the mechanism of pigmentation, melanocyte, and melanoma biology. The Group has a particular interest in identifying novel therapeutic approaches in melanoma to overcome resistance to immunotherapies by using a combination of bioinformatics, molecular biology and in vivo mouse models.

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Máté Manczinger PhD

HCEMM-BRC Systems Immunology Research Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

The Manczinger group dominantly uses computational approaches to answer questions in immunology. They focus on the adaptive immune recognition of pathogens, cancer and self-molecules.

Tibor Pankotai PhD, habil

Genome Integrity and DNA Repair Core Group
Group Leader

Genomic Instability and Cancer Thematic Pillar

Tibor Pankotai's research team focuses on understanding the molecular background of tumorigenesis and unveiling whether this process modulates genome integrity and maintenance. Our primary interest is how DNA damage affects the ongoing physiological cellular mechanisms such as replication and transcription. As an extension of this, we address and characterize epigenetics markers that could be potentially utilized as clinical tools in cancer-related predictive diagnostics. Therefore, our project can dynamically contribute to more precise tumor detection, evaluation, and classification even in the early stage of tumor development.

Lőrinc Sándor Pongor PhD

Cancer Genomics and Epigenetics Core Group
Group Leader

Infectious Diseases with emphasis on co-morbidities Thematic Pillar

The Pongor group studies epigenetic changes during tumor evolution using next-generation sequencing techniques, integrating gene expression, microscopy and experimental data to identify potential vulnerabilities in Small Cell Lung Cancer. In addition, they will focus on non-invasive sequencing and diagnostics methods to help predict drug response of tumors and survival of patients.

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THEMATIC PILLAR 4.

INFECTIOUS DISEASES WITH SPECIAL EMPHASIS ON CO-MORBIDITIES

Three of HCEMMs Research Pillars are focused on non-infective chronic diseases, which are the main causes of non-natural death in Hungary. Often, these conditions (e.g. cancers, heart diseases or immuno-degenerative diseases) are made worse in the end stages due to infectious diseases. This includes bacterial infections, such as sepsis or pneumonia, viral infections (for example COVID-19) and fungal infections (e.g. fungal sepsis). HCEMM groups are working on the accurate and early diagnosis of such co-morbidities and on the creation of new treatment options, which complement the already established treatment regimes. This is especially important in areas, where the current treatment does not work, for example when patients are infected by antibiotic-resistant strains.

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Viktória Lázár PhD

HCEMM-BRC Pharmacodinamic Drug Interaction Research Group
Group Leader

Infectious Diseases with emphasis on co-morbidities Thematic Pillar

The Lazar group focuses on investigating drug-pathogen-microbiome interactions that may guide future efforts to design personalized antimicrobial treatment for patients with co-morbidities requiring continuous heavy non-antibiotic medications. By systematically screening drug interactions between traditional antibiotics and non-antibiotic pharmaceuticals the group is looking for novel combinations that can clear pathogen bacteria orders of magnitude more efficiently than its susceptible counterpart and maximize pathogen elimination while protecting the healthy gut-microbiota.

Dr. Christoph W. Sensen

Circulating Nucleic Acid Biomarker Core Group
Group Leader

Infectious Diseases with emphasis on co-morbidities Thematic Pillar

The Sensen group uses high-throughput DNA Sequencing and Bioinformatics to develop new PCR-based assays for the early diagnostics of chronic and infective diseases. The goal is to develop diagnostic test kits, where plasma or serum can be utilized directly in the assay.

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ADVANCED CORE FACILITIES AND FACILITY HEADS

A key component of the operational model for HCEMM is the co-development of Advanced Core Facilities (ACFs) aligned with the strengths of the founding institutions. The HCEMM ACF model follows the modus operandi of the EMBL core facilities. The main goal is to optimally support HCEMM's group competently, so that the efficiency of HCEMM's research groups is increased in terms of excellence (output of high-quality scientific papers) and sustainability (ability to generate income by competitive grants, spin-offs and technology transfer agreements.)

The ACFs present a range of services tailored to the requirements of HCEMM researchers. Simultaneously, it also serves as an EU-level infrastructural, competence and training base that offers its capacities for any Hungarian and EMBL partner researcher as well as for external users.

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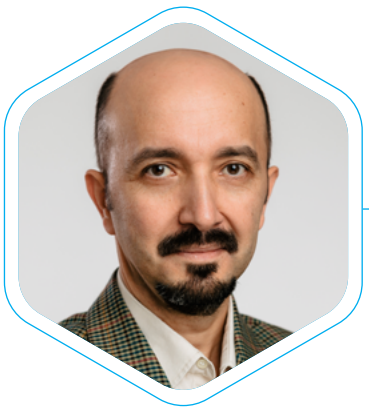

Ferhan Ayaydin PhD

HCEMM-USZ Functional Cell Biology and Immunology Advanced Core Facility
Facility Head

The Functional Cell Biology and Immunology Advanced Core Facility provides high-resolution advanced confocal laser scanning and electron microscopy imaging services, detection of cell surface markers and intracellular markers, as well as the possibility for sorting cells based on their expressed protein markers for cellular and immunology studies.

Zsuzsanna Darula PhD

HCEMM-BRC Single Cell Omics Advanced Core Facility
Facility Head

The Single Cell Omics Advanced Core Facility (HCEMM-BRC) provides mass-spectrometry based bottom-up proteomics and shotgun-lipidomics analyses of cell cultures, body fluids and tissue samples. Single cell sequencing projects are also supported by single cell partitioning and barcoding of samples.

Domokos Máthé DVM PhD

HCEMM-SU In Vivo Imaging Advanced Core Facility
Facility Head

The In Vivo Imaging Advanced Core Facility, located at Semmelweis University Budapest provides the full suite of high resolution optical (fluorescence) isotopic (SPECT, PET, Cerenkov) and radiomic (Ultrasound, CT, MRI) measurements in small and large animal models of disease, from model generation to theragnostics biodistribution, cancer, neurology and immuno-inflammatory imaging.

Gergely Röst PhD

Scientific Computing Core Facility
Senior Scientist

The Scientific Computing core facility supports research groups in their computational, modelling, and statistical needs, to make the most insights from their experimental data. We develop and implement new tools for efficient data collection, generation, storage, processing, mining, analysis, and presentation to enhance the scientific output from quantitative life science research.

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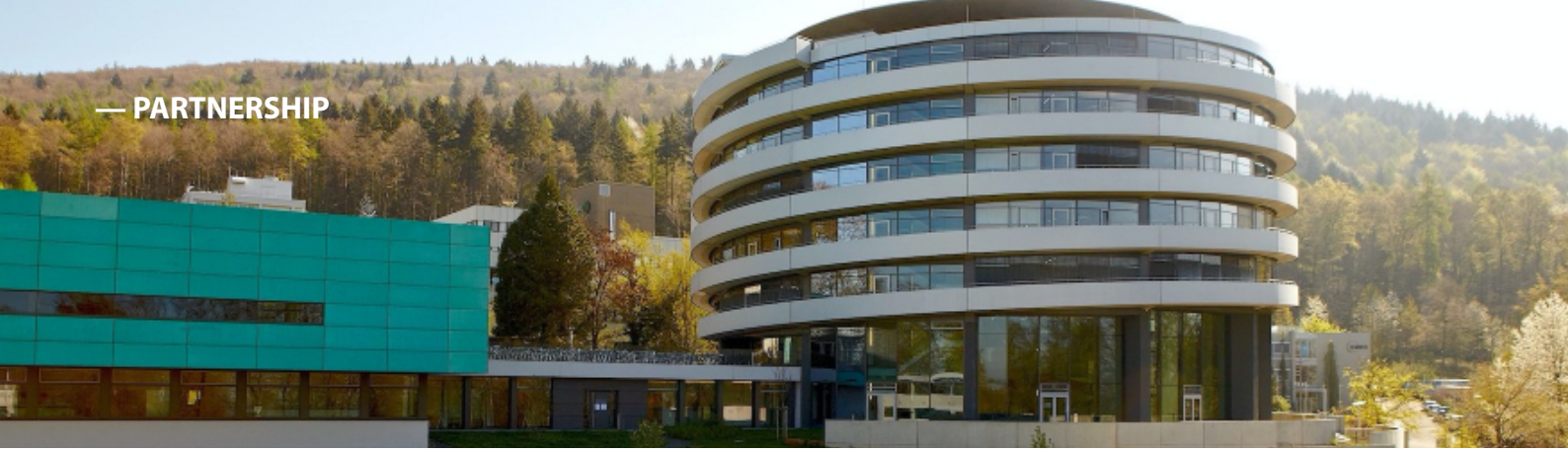

About EMBL

European Molecular Biology Laboratory (EMBL) is Europe's leading laboratory for the life sciences. Established in 1974 as an intergovernmental organisation, EMBL is supported by over 20 member states. EMBL performs fundamental research in molecular biology, seeking to better understand the molecular basis of life. The institute offers services to the scientific community, trains the next generation of scientists, and strives to integrate the life sciences across Europe. EMBL is international, innovative, and interdisciplinary. Its over 1900 staff from 96 different countries, operate across six sites in Barcelona (Spain), Grenoble (France), Hamburg (Germany), Heidelberg (Germany), Hinxton (UK), and Rome (Italy). EMBL scientists work in independent groups and conduct research and offer services in all areas of molecular biology. EMBL research drives the development of new technologies and methods in the life sciences. The institute works to transfer this knowledge for the benefit of society.

EMBL

HCEMM-EMBL Partnership

EMBL supports HCEMM towards scientific excellence, not only as an advanced partner in the Teaming project, but by establishing a formal institutional partnership with HCEMM.

The partnership agreement is an EMBL instrument already well established in Europe, which has created a network of institutes of excellence in the life sciences, including molecular medicine. The partnership with EMBL and its long-term experience fostering cooperation and excellence in molecular life sciences and medicine provides guidance and expertise, particularly bringing in a new research culture and management approaches including selection, regular evaluation and internationalization of productive research groups. Partnerships are working relationships at the institutional level, based on shared goals, and require synergy or complementarities in research. The aim is to leverage the successful EMBL model and competences and implement them nationally to create an interlinked system of excellent institutions and thus enhance the development of the molecular life sciences in Europe and the world.

For EMBL, building a partner institution in Hungary is of critical importance as the partnership with HCEMM the first in Central Europe for EMBL.

HCEMM is the third EMBL partnership in the area of molecular medicine, thus HCEMM can benefit from joining a well-established network of partner institutes. Besides the breadth of opportunities for scientific collaborations, the partnership agreement will also allow HCEMM to take part in the EMBL Partnership Conferences, which take place regularly and are open to partners only, as well as other events that take place. EMBL and HCEMM also have the possibility to organize joint scientific meetings to exchange information on current projects and stimulate future collaborations between their scientists and others.

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