

**Spokesperson-Coordinator**

**ADAM Stéphane**

**Research Unit (UR)**

**ARCh Research Unit (Adaptation, Resilience and Change)**

## Partners

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*Outside ULiege*

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## Acronym

HABITAGE

## Key words

Habitat

Physical activity

Aging

Rest-activity cycle

## Title

**An integrative approach of habitat and health for aged people**

The identification of novel factors associated with inter-individual variability ' which may be considered protective or conversely precipitant ' of the decline of physical and associated autonomy status is a promising area in aging research. Previous studies have shown that the living environment (including the home per se, but also its proximal environment) is clearly identified as impacting one's health and well-being. Even though directly impacting the individual's quality of life, a predictive model of the impact of housing typology on the loss of autonomy and changes in health status is still missing. We argue that each home can be positioned on a continuum, ranging from "over protective" to "over stimulating". When considering aging, seniors (and those around them) may be tempted to (over-)adapt the home in which they live. By reflecting a major environmental and putatively modifiable factor, this home has the potential to interact with intrinsic biological, psychological predispositions of the individual. Both physical activity and a consolidated sleep-wake cycle are amongst those variables, most strongly dependent on the individual's built environment and hallmarked by increasing difficulties occurring when growing in age. The HABITAGE project aims at assessing the association and potential predictive value of the home environment on physical activity and sleep change over time, these two factors being strong predictors of the individual's autonomy trajectory. To do so, a cohort of 300 older adults (aged 75 and over) living independently will be recruited and followed for up to two years with respect to their habitat, their everyday life physical activity and rest-activity cycle integrity. For all subjects of the cohort, changes in health status, health outcomes, health-related quality of life and loss of autonomy will be collected through regular surveys, with validated questionnaires. A deeper assessment of architectural conditions, physical activity and sleep-wake cycle integrity will be tracked longitudinally every 4 months over a period of 2 years in a subset of 120 older adults thanks to on-site data collection. Those 120 subjects will be selected on basis of their home typologies, in order to contrast extreme housing with 60 older people living in an 'over protective' house vs. 60 older people living in an 'over stimulating' house. We will then be able to compare the changes in the determinants of autonomy between the two groups. The project will capitalize on the experience of the four PIs to implement and follow cohort studies in their respective field of expertise, centered here around the built environment. Thus, with the complementary parameters assessed for the very first time in this study, this project will be unique in constructing an integrative database. By unraveling the impact of built environments on quantitative (actimetry-derived physical and rest-activity distribution) and qualitative (questionnaire-based; interview-based) outcomes, statistical analysis will seek the best combination for the prediction of an individual's physical and rest-activity trajectories, as main drivers of the quality of life and autonomy. The latter reflects a major determinant for institutionalization and is thereby of important societal relevance.

**Spokesperson-Coordinator**

**BINDELLE Jérôme**

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## Acronym

EXPLORE

## Key words

agroecology

integrated crop-livestock systems

food systems

co-creation

## Title

EXPLoring innovative crOpping management for sustainable futuRE-proof food systems

EXPLORE aims to design innovative agro-ecological cropping systems based on integrated crop and livestock systems (ICLS) targeting sustainable and healthy dietary regimes. Taking Wallonia as a case-study, these cropping systems will be locally adapted for four key agricultural regions of Wallonia while being compliant with socio-economic considerations based on the three pillars of sustainable agriculture.

The project will lean on 3 complementary work packages to

- (1) work with stakeholders to redesign cropping systems and identify potential lock-ins and ways to overcome them, to
- (2) mathematically simulate the desired innovative cropping systems and assess their different yields and trade-offs in terms of environmental impacts in the face of present-day and future climatic conditions and to
- (3) investigate how agroecological levers empower regulation mechanisms for pests and weeds.

To reach this goal, the project leans on three major strengths an experimental farm hosting long term experiments, a network of farmers and their fields, and an interdisciplinary consortium covering the three pillars of sustainability.

**Spokesperson-Coordinator**

**COLLETTE Fabienne**

**Research Unit (UR)**

**GIGA-CRC IVI**

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-

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## Acronym

EntCogFlex

## Key words

neuroentrepreneurship

brain imaging

cognition

cognitive flexibility

## Title

How entrepreneurial expertise influences cognitive flexibility and brain activity

Previous research on entrepreneurship focused on personality traits. However, efforts to identify a consistent set of personality markers that might predict emergence and success in new ventures have yielded inconclusive results. As an alternative to asking "who" is an entrepreneur, the field of entrepreneurial cognition emerged to address the question: How do entrepreneurs think and act?

We capitalize here on a cognitive neuroscience approach to investigate the role of cognitive flexibility in the entrepreneurial process. Our main hypothesis is that cognitive flexibility progressively increases with entrepreneurial experience, and that environmental uncertainty and mental well-being will moderate this relationship.

This hypothesis will be investigated in four work packages (WP). In WP1, self-assessment of cognitive flexibility in around 500 participants will be related to entrepreneurial experience, perceived environmental uncertainty, personality traits, and measures of mental well-being. From this sample, 120 entrepreneurs at different career stages, and 30 control participants will be administered cognitive tasks outside (WP2) and inside (WP3) an MRI scanner to determine changes in cognitive processes and brain-related substrates that can be associated with entrepreneurial experience. In WP4, we will longitudinally characterize changes in cognitive flexibility in nascent entrepreneurs, and relate them with gestational activities accomplished during the period.

## Proposal References

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### Acronym

VariGraph

### Key words

Palaeography

digital humanities

grapholinguistics

antiquity

### Title

Comprendre la variation graphique dans les cultures manuscrites antiques : l'Iran, la Mésopotamie et l'Égypte comme laboratoires typologiques

## Abstract

The VariGraph project proposes to resort to the exceptional written material of three ancient civilizations, namely Iran (with the proto-Elamite script), Mesopotamia (with the cuneiform script), and Egypt (with the hieroglyphic script), in order to analyze the causes and motivations of paleographic variations in synchrony.

In a second step, the relationships between the different types of synchronic variation, on the one hand, and the internal evolutionary dynamics of these writing systems over the long term, on the other hand, will be assessed.

This project is supported by an innovative and open-source digital platform, which allows us to encode, contextualize and analyze paleographic variations in any scribal cultures.

In addition to theoretical and methodological advances, VariGraph will lead to the publication of the first digital repertoires for the three written corpora.

**Spokesperson-Coordinator**

**D'ARGEMBEAU Arnaud**

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## Acronym

COMPRESS

## Key words

episodic memory

time

space

attention

## Title

Spatio-temporal compression in memory for real-world events

Most of the current knowledge on episodic memory comes from laboratory studies in which participants memorize stimuli under artificial conditions. Yet, a new line of research suggests that information processing can manifest in dramatically different ways in the lab and in the real world.

Here, we aim to determine how real-life events, and people and objects that populate these events, are represented parsimoniously to deal with storage limitations inherent to the human cognitive system.

We hypothesize that the complexity of real-world events is summarized and compressed in episodic memory along the two crucial dimensions of space and time. In WP1, we will identify the determinants of memory compression along these two dimensions. In WP2, we will delve into the attentional mechanisms underlying these compression processes. Finally, in WP3, we will examine how individual differences manifest on memory compression along the space and time dimensions. These three lines of research will be investigated using a novel experimental paradigm that leverages information gathered by wearable camera technology and mobile eye-tracking.

**Spokesperson-Coordinator**

**DEWALQUE Arnaud**

**Research Unit (UR)**

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## Partners

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## Acronym

MIND

## Key words

History of Analytic Philosophy

Analysis

## Title

The British Sources of Philosophy of Mind 1888-1949

MIND is a collaborative research project that aims to investigate the sources of present-day philosophy of mind in British analytic philosophy. According to a standard narrative, philosophy of mind was officially kicked off as a full-blown research program in the 1950s with the rise of the mind-brain identity theory (Place, Feigl, Smart) and its subsequent functionalist criticism. A closer look at the history of analytic philosophy, however, reveals that this narrative is fraught with problems. Among other things, it overlooks the fact that most groundbreaking intuitions that later became game-changers in the field - such as the transparency intuition, the zombie intuition or the intuition underlying the knowledge argument - can in fact be traced to a family of British philosophers - the "Cambridge family" - who published quite extensively on the nature of the mind before 1950. This intellectual family includes most notably G.F. Stout, the editor of *Mind* from 1892 to 1920, his two outstanding students in Cambridge, G.E. Moore and B. Russell, and his assistant at the University of St. Andrews, C.D. Broad.

MIND's primary objective is to put those authors on the map by reconstructing their original views on the relation between :

- (1) mind and consciousness,
- (2) mind and body, and
- (3) mind and matter.

Its secondary objective is to assess the potential of these views to advance current-day discussions relating to these topics.

**Spokesperson-Coordinator**

**FRÈRE Bruno**

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## Acronym

HACAB

## Key words

critic

capitalocene

politic

interspecism

## Title

Human-Animal Collectives Assisting the Biosphere Building an emancipatory common world :  
Towards a critical (and intersectional) interspecies theory in time global exploitation

Is it possible, in time of global warming to contribute to build political collectives of all subaltern beings who are the first victims?

In the Capitalocene, the long-term survival of many species is under threat. Those who are already suffering from global warming and the rising cost of raw materials are those whom modernity has tended to subalternize and reduce to the status of 'productive resources': racialized people, women, working poor, and also animals, plants and ecosystems. While subaltern human critics (working class at the crossroad of the 19th and 20th century; women and racial minorities in the 20th century) found ways to take part in public debates because they could rely on a common language to communicate, these critical perspectives didn't really consider how modernity affected non-human subaltern individuals and groups, such as animals.

The present project takes on the challenge to ask if it is possible to establish a joint inter-species voice in order to draw the outlines of a political and ecological collective able to hold a project shared in common in the public space. The goal of the project is to investigate the possibilities of a political discourse together with animals, and work towards a multispecies politics. As such, it aims at articulating animal studies and human-animal communication studies together with intersectionality and former critical theories of domination, in order to build an interspecies critical theory and methodology as well as exploring empiric points of departures that could contribute to resisting the global subjection (and destruction) of earth.

**Spokesperson-Coordinator**

**GEUZAINÉ Christophe**

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## Acronym

Discrete-IGA

## Key words

Finite Element Method

Self-healing metallic systems

## Title

Discrete IsoGeometric Analysis

Mesh Generation

Biological heterogeneous

The Discrete-IGA project will develop an innovative approach to overcome a major difficulty associated with engineering analysis: we aim to provide a revolutionary way to process the ill-conditioned geometrical inputs that are a recurring obstacle in the daily life of thousands of engineers. Discrete-IGA proposes a new paradigm with i) a surface reconstruction approach that uses noisy/incomplete/overlapping data, ii) a new type of meshes that are discretely isogeometric and multiscale and iii) a new type of finite element solver that takes into account the isogeometric and multiscale nature of the new meshes. We want Discrete-IGA to be a success and we know what it takes to go from a good idea to a game changer. In this goal, it seemed to us essential that applications are at the heart of the action. Discrete-IGA targets two applications in emerging scientific domains ' self-healing metallic systems and biological heterogeneous microarchitectures. For the finite element simulation of the mechanical behavior of these architected structures, it is mandatory to extract their complex geometry from real 3D X-ray tomography data, which are inherently discrete, noisy and multiscale.



**Spokesperson-Coordinator**

**HANSON Julien**

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**JOURET François**, GIGA

*Outside ULiege*

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**Acronym**

SUCCESS

**Key words**

Succinate

kidney transplantation

Ischemia

SUCNR1

**Title**

Succinate receptor as an Emerging target in ischemic Stress

Renal ischemia/reperfusion (I/R) is the leading cause of acute kidney injury (AKI), and it necessarily occurs at the time of kidney transplantation or cardiovascular surgery, with well-established poor consequences on renal outcomes. Currently, there is no treatment for renal I/R, and most efforts are focused on the prevention of the ischemic insult by mechanical or pharmacological maneuvers regrouped under the term 'renal ischemic preconditioning (RIP)'. Based on recent observations made by us and others, the Succinate Receptor (SUCNR1) has emerged as an ischemic stress sensor, which may represent an innovative drug target for a pharmacological RIP.

Our proposal is based on a stepwise translational approach from the in vitro development and evaluation of SUCNR1 agonists/antagonists to the in vivo characterization of the specific contribution of the SUCNR1 expressed by the macrophages in the cascade of renal I/R and the impact of the pharmacological modulation of SUCNR1 before renal I/R (i.e. RIP) in mice. Finally, we will investigate the genetic susceptibility to the ischemic insult associated with single nucleotide variations (SNVs) of the SUCNR1 gene in cohorts of patients at risk for I/R-related AKI, i.e. kidney transplant recipients and patients in the ICU post cardiovascular surgery. Our experimental strategy is based on a combination of

- (i) pharmacological approach using mutants of SUCNR1 and small molecules modulators developed by our consortium,
- (ii) mouse models (including transgenic SUCNR1 full KO mice readily available and conditional SUCNR1 KO), and
- (iii) cohorts of patients followed at ULiège CHU.

Our project will advance the validation of the succinate receptor system as a source of novel therapies.

**Spokesperson-Coordinator**

**LUMAY Geoffroy**

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## Acronym

DustInTheWind

## Key words

triboelectric effect

aerodynamics

granular materials

particle-laden flows

## Title

Tribo-electric charging of granular materials in airflows

When two objects are rubbed against one another, electric charges are exchanged at the surfaces. This contact electrification is called triboelectric effect.

Despite the numerous problems induced by these triboelectric charges (dust explosions, grain adhesion on solar panels, ...) and the applications using them (coatings, electrophotography, ...), the fundamental mechanisms behind the triboelectric effect are not fully understood. Even the nature of the transferred charge between two isolating material is still the subject of debates.

The main motivation of the present project is to better understand the fundamental mechanisms leading to electrostatic charge build-up in granular materials carried by airflow. Since the electrostatic charges accumulated on the grains modify the interactions between the grains and between the grains and surfaces, we will consider the coupling between the tribo-electrostatic charging mechanisms, the airflow characteristics, and the adhesion to surfaces.

Our study will combine an experimental approach with original and exceptional set-ups (wind tunnel facility of Liège University), a numerical approach based on in-house codes (collaboration ULiège-UClouvain) and a confrontation with the theoretical models developed very recently.

**Spokesperson-Coordinator**

**MERTENS Anne**

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## Acronym

Sensam+

## Key words

Additive manufacturing

Numerical simulations

Metallic materials

Mechanical properties

## Title

Smart enhancement of Ni-based superalloys "for-additive-manufacturing" towards improved creep resistance at high temperature

Ni-based superalloys are used for high-temperature applications where both creep and corrosion resistance are required.

Recently, Additive Manufacturing (AM) processes characterised by high thermal gradients and non-equilibrium structures have offered the possibility to produce parts with complex shapes that were not attainable so far by conventional processes. Yet, a major challenge remains to produce defect-free AM parts, with usage properties equivalent or higher than those obtained from conventional processes.

Sensam+ aims at a major contribution in this regard, by modifying the well-known alloy IN718 to reach both a good printability by Laser Powder Bed Fusion and superior creep properties (in as-built and/or heat treated conditions). To this goal, Sensam+ relies on a rigorous methodology and on a well-balanced scientific consortium built on 3 multidisciplinary and complementary teams to combine experimental and modelling approaches.

**Spokesperson-Coordinator**

**MIHAYLOV Boyan**

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## Partners

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## Acronym

EsPOIR

## Key words

concrete

recycling

multiscale

durability

## Title

Eco-friendly high Performance cOncrete for sustainable InfrastructuRes

The full recovery of mineral construction and demolition wastes as recycled raw materials for concrete production is a yet pending, challenging societal goal due to durability and mechanical requirements.

EsPOIR aims to create deep scientific knowledge to foster the reduction of landfilling and CO2 emissions, as well as depletion of non-renewable resources by the concrete industry. New solutions will prevent further downcycling by the design for long lasting concrete structures.

Complementary valorization pathways for waste concrete will include advanced applications for fine aggregate as a substitute for sand and raw material for alternative binders. The interdisciplinary approach will cover the improvement of service life of sustainable structures, transport properties, eco-efficiency and mechanical performances.

Multi-physical and multi-scale studies of the materials and structures are thus at the heart of this effort to develop sustainable and durable solutions.

**Spokesperson-Coordinator**

**PEERS Bernard**

**Research Unit (UR)**

**GIGA -Stem Cells (Zebrafish Development and Disease Models)**

## Partners

*Within ULiege*

*Outside ULiege*

**PEERS Bernard** (coordinator), GIGA -Stem Cells (Zebrafish Development and Disease Models)

**BOURS Vincent** , GIGA - Cancer (Human Genetic Lab)

## Acronym

DiseaZebra

## Key words

Kidney

zebrafish

genetic diseases

CRISPR/Cas9

## Title

GENETIC DIAGNOSIS OF INHERITED KIDNEY DISEASES BY MODELIZATION IN ZEBRAFISH

In Europe, about 70 per 100 000 individuals suffer from inherited kidney diseases, often associated with multisystemic complications.

The patient's quality of life could be improved with an accurate genetic diagnosis that can better define the prognosis and allows personalized treatment. While next generation sequencing (NGS) testing allows detection of genetic variants, the demonstration of their causal role remains a real challenge.

In this project, we are developing a moderate-throughput disease modeling pipeline where patients with suspected genetic kidney conditions are selected for NGS-analyses. Once identified, likely pathogenic variants will be introduced in zebrafish genome thanks to CRISPR/Cas9 technology. This model organism allows for an overview of the disease-associated phenotypes and will help clarifying phenotype-genotype relationships. Moreover, in selected cases, a deeper analysis will enable to decipher the underlying molecular basis of disease progression.

Our project, bridging clinical and basic biological research, will determine variant pathogenicity and uncover novel disease-causing genes while providing the assets to decipher pathophysiology mechanisms enabling development of new therapies.

## Proposal References

**Spokesperson-Coordinator**

**VAN LINDEN An**

**Research Unit (UR)**

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### Acronym

SPACEGRAM

### Key words

applicatives

spatial meaning

grammaticalization

verb-particle constructions

### Title

Grammar from space: How spatial elements become applicatives

## Abstract

This project will investigate how elements with spatial meaning develop into applicatives from a typological and Germanic perspective, with extensions into applied research, viz. translation studies.

From a typological perspective, it will examine a new source of applicatives, viz. spatial verb morphology, like associated motion markers and directionals. In doing so, we will adopt a broad definition of applicatives, including also non-direct and valency-rearranging applicatives.

We will use a world-wide sample as well as in-depth analysis of text and audio data from a single language (Harakmbut). From a Germanic perspective, we will investigate the well-established adposition-to-applicative pathway on the basis of historical data, adopting a new, valency-centred approach to verb-particle constructions in Dutch and English.

Finally, we will also take a contrastive Dutch-English perspective, and use translation studies methods to contribute to translator education.

**Spokesperson-Coordinator**

**VANDERPLASSCHEN Alain**

**Research Unit (UR)**

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**VANDERPLASSCHEN Alain** (coordinator), UR FARAH

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**SADZOT Catherine**, Virology and Immunology GIGA

**LEBRUN Marielle**, Virology and Immunology GIGA

**Acronym**

**Key words**

Stressless

Anti-viral Innate Immunity

Herpesviruses

**Title**

Stress Granules

Immune evasion by viruses

Inhibition of stress granule formation by two phylogenetically distant herpesviruses

Stress granules (SGs) are dynamic cytoplasmic membrane-less organelles that form in response to many stresses. SGs sit at the crossroads between translation control, intracellular signaling and the antiviral innate immune response. A large number of studies have reported the inhibition of SG formation by viruses belonging to different orders and families. However, this topic of research has been extremely limited for members of the Herpesvirales.

The goal of this application is to study, using two phylogenetically distant host-virus models (human cells-Varicella Zoster Virus, Carp cells and carp/Cyprinid herpesvirus 3), the inhibition of SG formation by herpesviruses and to identify the cytosolic dsRNA expressed in herpesvirus infected cells.

The important phylogenetic distance existing both at the host (primates versus teleosts) and virus (Herpesviridae versus Alloherpesviridae) level, confer to this project, a very interesting aspect of comparative immunology and virology, maximising the potential for the unveiling of fundamental biological processes or players.

Moreover, based on the identification of the cellular and viral proteins involved in these interactions, we aim to investigate the use of this knowledge in the rational design of new replication-deficient and safer attenuated vaccines involving the use of cutting-edge genome editing techniques to alter both the host cell and the virus.

**Spokesperson-Coordinator**

**VANDEWALLE Gilles**

**Research Unit (UR)**

**GIGA-CRC-In Vivo Imaging**

## Partners

*Within ULiege*

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**SACRÉ Pierre**, Montefiore Institute of Electrical Engineering and Computer Science

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## Acronym

IN-RHYTHM

## Key words

Alzheimer's disease

Stem cells

7 Tesla MRI

Biophysical models

## Title

In vivo, in vitro and in silico rhythms to unravel the contribution of the hypothalamus to Alzheimer's disease

Alterations in the regulation of sleep and wakefulness are linked to the neuropathology of Alzheimer's disease (AD). They may provide novel early detection and intervention means against the disease. The hypothalamus governs the rhythmic regulation sleep and wakefulness and shows early signs of AD pathology.

We posit therefore that the association between sleep-wake regulation and AD arises at least in part from altered microstructure of the hypothalamus nuclei driving daily rhythmicity and from molecular alterations in hypothalamus neuron.

These hypotheses will be tested in an original and ambitious multidisciplinary project involving in vivo electrophysiology, activity measurement and ultra-high-resolution 7 Tesla MRI, in silico signal modelling of neuronal networks and in vitro stem cells organoids and assembloids. IN-RHYTHM gather a unique combination of expertise and approaches that may provide some of the breakthrough needed to face the foreseen rise of AD.