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AUTUMN 2017

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Aarhus Institute of Advanced Studies, AIAS

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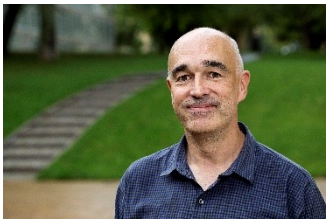
Fellows



Andrew Newby

Associate Professor
AIAS and previously University of Helsinki, Finland.
Fellowship: 01 Oct 2017 – 31 Mar 2019

Project title

Charity and Solidarity: Danish Famine Relief to Sweden, Finland and Iceland in the 1860s

Project description

This project focuses on subsistence crises that hit Sweden, Finland and Iceland in 1867-68, and the corresponding humanitarian responses from Denmark. It explores the existence of a moral economy in mid nineteenth-century Europe that was intimately linked to the civic sphere and humanitarian enterprise. Using manuscript sources, official reports, and newspapers, the leadership and membership of Danish relief committees will be reconstructed, as will the backgrounds of the donors to these fundraising programmes. Through a local study of Aarhus, the project also examines the use of aid on an international and local level in the context of "citizenship," and as a means of social and political advancement.

These themes connect the historical case studies to universal questions of disaster relief and fundraising in the twenty-first century, and particularly the "psychology of giving." Why do people respond to disaster relief appeals, and what tensions arise? Among the topics to be covered here include: constructions of the past; ethnic and religious affinities; economic, trade, academic and cultural connections; "deserving" and "undeserving" recipients of aid; and tensions between supporting "domestic" and "foreign" causes .

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Project title

A Pragmatic Theory of Social AI

Project description

Social AI are machine learning models used to create meaningful predictions and subsequent actions based on social media data and such models are becoming important engines of the data-driven society. Social AI automate what kind of news is being presented to what kind of people and the algorithms automate how people are depicted through social data. This AIAS project will critically scrutinize and discuss to what extent Social AI are able to create meaningful predictions that are sustainable both to our understanding of the social human being and to society. Through six case studies of empirical uses of different AI models, and a historical account of central AI problems, the project proposes a pragmatic theory of social AI. The emphasis is on contextualizing data as depictions of the human in which classifiers and training data and navigating conflicting ambiguity play central roles. The project proposes that making visible political dimensions of model training, reasoning and the connected interpretative workflows are together with a close eye for knowledge that can be derived from outliers, important steps that need to be taken in order to advance the further development of Social AI.

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Project title

The role of functional bacterial amyloids in alpha-synuclein misfolding and aggregation in Parkinson's disease

Project description

Parkinson's disease is a progressive movement disorder characterized by a loss of dopaminergic neurons, and accumulation of misfolded alpha-synuclein into insoluble, amyloidal aggregates in the brain. Current evidence suggests that misfolding and aggregation of alpha-synuclein starts in the gut, from where the misfolded protein spreads to the central nervous system and further seeds misfolding and aggregation of the protein in the brain.

Many bacterial species produce functional bacterial amyloids, which have been shown to induce alpha-synuclein aggregation in animal models. Patients with early Parkinson's disease have inflammation in the gut, and altered species composition of gut microbiota. At AIAS, I will work in collaboration with professor Daniel Otzen's laboratory to identify and characterize functional bacterial amyloids produced by the species prevalent in the guts of Parkinson's disease patients. Further, I will analyze whether these functional bacterial amyloids trigger inflammation, and promote alpha-synuclein misfolding, aggregation, and seeding. Understanding the factors and mechanisms that trigger and promote alpha-synuclein misfolding and aggregation could help develop therapies to delay the onset of Parkinson's disease, and/or slow down the disease progression

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Armin W. Geertz

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Project title

A Biocultural Approach to Embodiment, Ritual and Mysticism

Project description

This project deals with the growing empirical knowledge of the interaction between bodily actions and human thinking and the cultural embeddedness of human cognition. The project employs state of the art cognitive predictive models on historical material, namely the activities, techniques and reported mystical experiences of Teresa of Ávila (1515-1582), a Spanish Carmelite nun who reformed that Order and founded the Discalced Carmelites. This project involves quantitative coding and text mining of her numerous books and letters in order to test the use of cognitive models in historical studies.

This project is relevant to contemporary science for several reasons. First, it addresses the need to apply methods and insights from the natural and medical sciences to historical data, as well as the other way around: The humanities have important contributions to make to the natural and medical sciences, as my involvement in transdisciplinary and interdisciplinary projects on rituals, pain, ecstatic behavior and prayer have convinced me. Second, it applies a doubly unique approach to historical documents, namely the application of neurocognitive predictive models and the use of quantitative data techniques. Third, although the case study is historical, it deals nonetheless with highly relevant contemporary phenomena, namely, spiritual and mystical experiences, occultism and healing. Fourth, this project is a stepping-stone to a larger, more ambitious attempt to apply this proof of concept case to European spirituality and mysticism through a coordinated EU-based network of scholars.

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Asad Jan

Postdoc
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Project title

Blocking the prion-like spread of alpha-synuclein pathology as a novel therapeutic target in Parkinson disease and related synucleinopathies

Project description

Parkinson's disease (PD) is the most common neurodegenerative cause of severe motor disability and eventually cognitive dysfunction. The pathological hallmarks are intraneuronal inclusions of alpha-synuclein (AS) protein in brain and loss of midbrain dopaminergic neurons. A prion-like behavior of α-synuclein (AS) protein has been hypothesized in the pathogenesis of PD. According to this hypothesis, pathogenic forms "seeds" of AS propagate from periphery into the neurons of central nervous system (CNS), where they recruit endogenous AS in the first receiving neurons, exit the cell and enter connected neurons. The ongoing AS aggregation and cell-cell propagation are considered to induce oxidative stress, neuronal dysfunction and neuronal loss in CNS. Therefore, blocking the neuronal propagation of AS will prevent AS neurotoxicity and neurodegeneration. To understand the neuronal mechanisms in the prion-like spread of AS in the CNS, I will develop a mouse model in which I will selectively modify the genetic makeup of first receiving neurons. This will be done via viral delivery of novel CRISPR/Cas9 genome editing tools. Once the tools are developed and model is refined, I will test specific hypothesis towards mitigating AS propagation and neurotoxicity.

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Christina Kkona

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Project title

The unexpected: toward a politics and aesthetics of discontinuity

Project description

This project is based on the premise that liberal political programs are politics of hope: people strive in the present for a better world that they probably will not see, but that will be inherited by future generations. This postponement of any fulfillment enhances alienation and entraps the subjects into serving an invisible cause that may never inscribe itself in time. As an alternative, I aim to theorize a politics that would no longer be a future-oriented promise, but a present-oriented action embracing unpredictable events. Subscribing to the tradition of feminist, queer and antiracist studies, it approaches social exclusion from the perspective of temporal consciousness and posits the unexpected as the locus from which the present is organized as space-time of openness to the other. The unexpected refers to what lies behind the future as a fantasy construction and, as such, it is situated outside the usual representation of time as flow. Thus, it escapes the linearity of narrative only to appear in the fissures of artworks, as the analysis of specific literary and cinematic works aims to demonstrate.

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Cici Alexander

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Fellowship: 01 Oct 2017 – 30 Sep 2020

Project title

Innovative remote sensing techniques for developing green infrastructure strategies to support biodiversity conservation and carbon sequestration

Project description

This project will use innovative, and complementary, remote sensing techniques to study land cover dynamics, especially changes in woody vegetation cover, to support biodiversity conservation and carbon sequestration. Airborne Laser Scanning (ALS), using the technique of Light Detection and Ranging (LiDAR), has advantages over other remote sensing techniques in characterising the three-dimensional structure of vegetation. Remote sensing using low-cost Unmanned Aerial Vehicles (UAVs) is another research area which has made rapid advances in recent years. In addition, newly launched satellites provide imagery at better spectral and spatial resolutions than before, and often are free of cost.

The main objectives of the project are to develop methods for the rapid assessment of changes in woody vegetation cover, for the identification of forests of High Nature Value, and to identify indices for the quality of urban green networks, using the above datasets. This project will thus support the development of conservation strategies that give due importance to the ecosystem services provided by both grasslands and forests.

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Darin Stephanov

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Project title

Monarchic Visibility, Public Space, and Collective Identities in the Romanov and Ottoman Empires (1825-1908). A Comparative Study of the Finnish and Bulgarian Trajectories of Communal-cum-national Consciousness

Project description

This project tests the hypothesis that multiplying and escalating public ruler celebrations (imperial tours, royal birthdays, accessions, etc.) across the late Russian and Ottoman Empires a) ushered in a new era of ruler visibility, forging direct vertical ties of subject loyalty to the Russian Emperor and the Ottoman sultan in the short run, and b) created a modern public space, stimulating the rise of the horizontal ties of ethno-nationalism in the long run. It traces the origins, nature and evolution of the direct relationship between a cross-section of Finns from the Grand Duchy of Finland and the Russian Emperor, on the one hand, and a cross-section of Bulgarians from the Ottoman province of Rumelia and the Ottoman sultan, on the other. It reconstructs key historical episodes and brings to light entire chapters in the history of Finnish and Bulgarian group belonging, which have so far been excluded from mainstream narratives and historical textbooks.

This project outlines the complex, syncretic modernity of late imperial regimes, which engaged in fascinating acts of ceremonial experimentation, but also exhibited many ominous sides of the looming modern state, with its unparalleled abilities to censor, discipline and control. Although drawing on the experiences of two late empires only, it has powerful implications for a broader study of the transition from imperial to ethno-national mind-frames, and ultimately, for analyzing the constituent elements of modernity and ethno-nationalism themselves.

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Dorothee Birke

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Project title

Situating Homelessness on the Contemporary British Stage

Project description

In the context of the so-called "Great Recession" around the end of the twenty-first century's first decade, discussions and anxieties about homelessness have gained a new momentum in European countries. My project charts the ways in which plays in Britain from the mid-1990s up to the present day have contributed to raising consciousness about the issue of homelessness by examining and subverting the divide between 'homeless' and 'housed'. The medium of the play is especially well-suited for such reflections. Not only has drama as a genre been a prime medium for engaging with social and political issues, but the stage also offers the opportunity to both perform and question the spatial relations that are at the heart of the 'homeless/ housed' dichotomy itself. Such relations are staged through the mise-en-scène as well as the characterization and interactions of the characters.

The project will furnish the first sustained and systematic discussion of the representation of the central trope of homelessness in British dramatic texts. It considers a corpus of plays from the 1990s to the present day, spanning a range of dramatic traditions, from in-yer-face to verbatim to variants that have been less frequently associated with political themes, such as metadrama. The close study of the plays' formal strategies is grounded in a theoretical framework which brings together new concepts from the emerging transdisciplinary fields of studies of home and poverty studies.

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Doug Speed

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Project title

Develop statistical tools to analyze large-scale genetic datasets and improve our understanding of complex diseases

Project description

The high heritability of many human diseases indicates the great potential of personalized medicine. For example, the heritability of schizophrenia is about 75%; loosely speaking, this means that if we perfectly understood the genetic factors which affect schizophrenia risk, then given an individual's genome, we would be able to predict with 75% accuracy whether or not they would develop the condition. However, at present, we are a long way from realizing this potential (e.g., for schizophrenia, the best models have accuracy less than 20%). With an ever-increasing amount of genetic data being produced, this lack of success is not for want of trying. Instead, the problem is that we lack statistical tools to efficiently analyze these data.

My project has two main aims. The first is to develop and release statistical tools to improve our ability to analyze genetic data. The second is to apply these tools to large-scale datasets, with a particular focus on neurological diseases. I will make all my methods freely available to other researchers through my software LDAK (www.ldak.org).

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Frants H. Jensen

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Fellowship: 01 Feb 2016 – 31 Jul 2018

Project title

Movement coordination, leadership and collective foraging in matrilineal toothed whales

Project description

This project investigates group decision-making processes, social foraging and emergent search patterns of a highly social model toothed whale species, the long-finned pilot whale. These large, deep-diving delphinids live in matrilineal social groups that are stable across decades and like many other social animals, they coordinate a wide variety of behaviors within their social group. Such coordination often requires that animals with different degrees of intrinsic information and differences in motivation come to a shared decision for the entire group.

The aim is to investigate individual and collective decision rules during travel and foraging periods using data from acoustic and movement tags deployed simultaneously on closely associated, free-moving individuals combined with models of collective behavior. I will seek to answer the following questions: a) how do heterogeneous groups of toothed whales coordinate movement and reach consensus decisions? b) are specific individuals within social groups important for shaping collective decisions such as the location or timing of foraging? c) how does social information that is available to individuals during coordinated foraging, such as the echolocation or prey capture signals of nearby conspecifics, affect individual search behavior, resulting prey encounter rates, and shape emergent foraging patterns? d) do acoustic signals contain information on the individual identity of whales that can be used to inform decisions of other group members during potential conflicts-of-interests, and provide a mechanistic basis for improving decision accuracy?

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Project title

From the atomic structure to the nanocrystal morphology: a novel Unified X-ray Scattering approach for the characterization of nanomaterials

Project description

The project proposed addresses important issues related to the establishment of robust methods for the characterization of inorganic nanoparticles (NPs). These methods will be used for providing unprecedented atomistic details on a series of highly monodisperse nanocrystals, which have a broad-spectrum of applications in emerging technologies.

The only existing approaches for characterizing nanocrystals with well-determined statistical averages (in contrast to the microscopies, where individual NPs are analysed) are scattering techniques. The very small size of particles in nanosized materials can be considered as a defective representation of the corresponding bulk: the information in the powder diffraction patterns (the fingerprints of the structural features of the sample) is smeared out and reduced, while the complexity of the structure is highly increased.

Accordingly, new scattering techniques need to be developed in order to derive fundamental information, such as chemical composition, crystal structure, size and its distributions, morphology and surface effects. At this purpose, an innovative approach of *Unified Small Angle X-ray Scattering and Wide Angle X-ray Total Scattering*, **UXS**, is here proposed. This frontier method will be applied to benchmark cases, such as highly monodisperse colloidal semiconducting NPs.

Accordingly, the definition and implementation of new experimental, theoretical and analytical protocols for a full quantitative characterization of nanomaterials by *UXS* will be accomplished. Furthermore, this work will allow extracting information on an important class of materials that will be helpful in guiding future synthetic approaches.

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Iryna Mazhak

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Project title

The Social Determinants of Health and Health Inequities among Working-age Population in Ukraine

Project description

Health inequalities are one of the main challenges for public health policy. To reduce and eliminate health inequalities, we need to conduct an initial assessment of health inequalities, using appropriate indicators, and conduct systematic and long-term monitoring of health inequalities.

My research aims to analyze the social determinants of health and health inequities among working-age Ukrainian population; identify indicators for monitoring health inequities; and, develop an evidence-based model for a new approach to public health policy in Ukraine based on social determinants of health and illness. An explanatory sequential mixed methods design will be used. In the first quantitative phase of the research, I will conduct a secondary data analysis of existing Ukrainian data, as well as develop and implement a national survey of health inequalities. I will also conduct a secondary data analysis of an EU-database for analyzing country differences to compare population health outcomes in Ukraine vis-à-vis the EU. The second qualitative phase will involve in-depth interviews with people experiencing vulnerability in health. Also this phase includes developing case studies of good policy practices to tackle inequalities in health in the EU countries for potential adoption in Ukraine as well as developing a policy paper considering ways to tackle health inequalities in Ukraine. The proposed research is important not only for scientists but also useful for the national government as a base for developing strategies to reduce and eliminate health inequalities.

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Isabel Kusche

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Project title

Non-programmatic Politics in Times of Fiscal Crisis

Project description

The project is based on the assumption that in times of fiscal crisis governments must turn to something else than programmatic politics when attempting to secure a level of popular support sufficient to remain in power. It shall answer the question to what extent political parties and personnel in countries severely affected by the recent European fiscal crisis react by intensifying non-programmatic linkages with voters or particular groups of voters respectively. Non-programmatic politics is based on strategies that do either not include public criteria for the distribution of resources or violate publicly stated criteria in actual practice in favor of partisan bias. The existence of a link between fiscal crisis and non-programmatic politics has been noted in the literature on neoliberal reforms in Latin American countries. In contrast, with regard to European parties the role of such strategies for mobilizing voters has been largely neglected or relegated to specialized analyses that do not feed back into our general conception of political processes in European countries.

The project aims to close this research gap using a systems-theoretical approach to politics, which focuses on the threefold relationship between the political public, party politics and public administration. It will compare four critical cases, which have been known for variants of non-programmatic politics in the past, namely Great Britain, Ireland, Spain and Greece.

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Isabelle Torrance

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Project title

Greek Tragedy and Irish Politics

Project description

This interdisciplinary project demonstrates the significance of Irish adaptations of Greek tragedies in political discourse from the 18th to the 21st centuries. By charting productions, adaptations and translations in both English and Irish languages, by analyzing the choices of tragic subjects, the reception of performances and the circulation of published texts, it will be argued that Greek tragic models have consistently been aligned with a variety of political messages in Ireland, especially from the early 20th-century. The politics in question are various depending on the historical context of production and the content of the plays, but include nationalist, linguistic, socialist, and feminist approaches, with recent adaptations having a global political message. The political tensions of appropriating classical models in a post-colonial context do not apply to Ireland as they do to other colonized nations, due to the pre-existing familiarity of the Irish with the Classics dating back to late antiquity, and this makes Ireland a unique case for further study.

Much scholarship exists on Irish theatre and on its relationship to Irish politics, and some scholarship has examined how major Irish authors allude to classical literature. However, no sustained examination exists of the place of Greek tragic models within the historical landscape of Irish theatre and politics. This project will fill a gap in current scholarship and will explain the enduring power and popularity of Greek tragedy in Irish culture.

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Jessica Barker

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Project title

Inter-group environmental dilemmas: can we scale up from local to global cooperation?

Project description

Cooperation not only is the foundation of social behavior in humans and other organisms, but also underpins many urgent environmental and social problems resulting from over-consumption of or under-contribution to shared resources. Many of these issues, such as air pollution and overfishing, span regional or national boundaries. However, humans likely evolved to cooperate locally with members of small groups, at the expense of people in other groups. How can we overcome the limits of group favoritism to achieve cooperation on the inter-group, global scale needed to address these critical challenges?

The goal of my AIAS-COFUND junior fellowship is to leverage interdisciplinary research on within-group cooperation to advance our knowledge of inter-group cooperation, as applied to environmental dilemmas. Taking an evolutionary perspective, I will investigate when and why people confer benefits on others versus acquire more resources for themselves. I will consider four factors known to affect within-group cooperation: 1) formation of cooperative reputations, 2) punishment of non-cooperators, 3) inequality in costs associated with cooperation, and 4) threats to group success. In lab and field experiments designed to capture real-life situations, I will investigate how these factors scale up to affect inter-group cooperation over environmental resources: for example, whether punishment can function effectively across group boundaries to enforce attainment of environmental targets. The findings will provide insight into the evolution of group-level interactions, and suggest solutions to current environmental concerns.

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Jessica Wiskus

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Project title

Rhythmical Ethics (On Music and the Performance of Philosophy)

Project description

Certainly, the challenge of describing the relationship between consciousness and world has, across millennia, inspired a range of scholars. My particular interest is to examine this relationship as a *rhythmical* one, and I seek to develop this research within the field of ethics.

While a system of ethics ordinarily concerns itself with the content of propositional statements, my work tries to take into account not only what philosophical texts say about ethics but also how certain texts enact or perform their meaning. I read the texts with a focus upon *rhythmical forms* – i.e., those transcendental structures of temporality according to which consciousness constitutes its meaning. Rhythm, in this sense, describes the power through which a present, expressing a whole, coheres with an absent past and future. Indeed, I argue that, like these very texts, our lives as subjects are constituted rhythmically. It is not simply that we possess musical rhythm – that we can anticipate, remember, and perform with a steady beat; rather it is that we are *of* rhythm (through the flowing and unified character of the body and its intentions) and we are *oriented through rhythm* (insofar as operations of perception, memory and understanding depend upon temporal cohesion). What I wish to understand, by engaging with the performative aspects of philosophical works, is how this rhythmical orientation stands beneath *ethos* (i.e. as our comportment with the world).

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Katie Barclay

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Project title

The Family. What difference does it make?

Project description

The question at the heart of this project is: Can the family be used as a category of analysis?, in much the way that race, gender and class have for humanities and social science scholars. It may seem that the answer to this question is no. Gender, race and class apply to large social groups that allow for significant variation between members, as well as similarities. The family is too small a unit. However, the family is the place where the characteristics of race, class, and gender are taught and realised for most people; it is in the family that variation, as well as similarity, is enabled; and it is through the family that people become individuals as well as part of the group.

For these reasons, it is time for scholars to look more closely at the family, not only as a key site for the production of individuals, but as a lens through which we can explain broader patterns of behaviour, as a key variable that operates in intersection with gender, race, and class.

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Luís Pedro Viegas

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Project title

Green Design of CFC Alternatives: an Interdisciplinary Approach

Project description

The Montreal and Kyoto protocols embody the environmental policy arising from the deep concern on global climate change and its effect on Earth. Understanding and dealing with this problem is one of the greatest scientific and social challenges for the future.

The present proposal addresses such challenges. I will focus on reactions involving hydrofluoropolyethers (HFPEs), used as substitutes of hazardous chlorofluorocarbons and related compounds in a wide variety of applications. The main objective of this proposal is to determine the environmental impact of a promising new class of HFPEs, by using molecular modelling methods in order to investigate the mechanisms and kinetics associated with their tropospheric degradation. This new class of HFPEs is recent with practically no existing data related to its environmental chemistry. I will evaluate their claimed low environmental burden by studying the OH initiated oxidation reaction rate constants of dimethoxyfluoropolyethers (a subset of this new class) and by analyzing the degradation reactions of the only products of the previous reaction: fluorinated esters. Here, two possible loss mechanisms will be considered: reaction with OH and uptake/hydrolysis by models of water droplets.

These pioneering calculations will try to break new ground and unveil fundamental aspects of the unestablished atmospheric chemistry of such HFPEs, hopefully allowing for the discovery of new alternatives for the production of new greener replacements through eco-friendly industrial processes.

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Magnus Kjærgaard

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Project title

Can a cooked noodle store information? The mechanisms of disordered proteins in synaptic plasticity

Project description

Learning and memory depends on the ability to modulate the connections between neurons in the brain in a process called synaptic plasticity. An important mechanism in synaptic plasticity involves the proteins sensing chemical signals at synapses, neurotransmitter receptors. The NMDA receptor is a neurotransmitter receptor with a key role in learning, which depends on its large intracellular domains. The intracellular domains are intrinsically disordered, are the target of many kinases and bind to many other proteins. Despite its importance, we know little about how the intracellular domains regulate the receptor mechanistically, and little about how intrinsically disordered proteins can exert long-range regulatory effects in general. This is largely due to the almost complete lack of structural information on the intra-cellular domains.

In this project, I will study the intracellular domains of the NMDA receptor using a combination of NMR spectroscopy and single molecule FRET. Structural experiments will be complemented by functional measurements using electrophysiology in Xenopus oocytes. The goal is to identify the mechanism by which the intra-cellular domains affect synaptic plasticity on short time-scales, and how this effect is modulated by phosphorylations and ligand interactions. This will provide another piece of the enigma of how the many wonderful functions of the brain emerge from chemical and physical processes.

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Michael Voldsgaard Clausen

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Project title

How do we Sense Touch, Sound, Balance and Force?

Project description

Perception of force is a key component in our sense of touch, hearing, balance and pain as well as in regulation of blood and osmotic pressures. Fundamental to these concepts is that at some point force (newtons) is translated into electrical conductance (siemens) through the action of membrane embedded mechanosensitive channels that open or closes in response to changing forces in the lipid bilayer. Conceptually this is perfectly conceivable, but it is astonishingly little we know about the mechanism of how bilayer responses are converted into changes in channel activity. So unlike the well-described nature of taste and odorant receptors and the photoreceptors in the eye, we have not yet a clear idea of how our mechanosensitive receptors work.

When studying the relationship between lipid membrane and embedded proteins the major challenge is that, in contrast to stimulation with e.g. ligands or voltage, we don't really know the exact nature of our stimulation; we can poke or pull a cell, but we cannot quantify what the channel actually feels at a molecular level.

To increase our understanding of functional interactions between lipids and protein, we will use a minimalist approach by developing novel assays that utilize a set of molecular tools to manipulate specific forces in the membrane, while at the same time taking advantage of the detailed information available from singe channel recordings.

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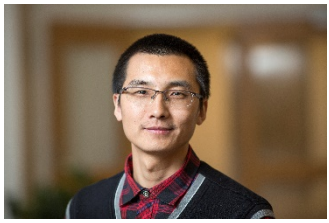

Naicheng Wu

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Fellowship: 01 Feb 2016 – 31 Jan 2019

Project title

Developing a risk assessment system to evaluate the impacts of future land use and climate scenarios on aquatic ecosystems - an interdisciplinary model-based synthesis

Project description

Global changes (including land use and climate changes) have particular threats to aquatic biodiversity. To mitigate the further decline of aquatic biodiversity and develop adaptive strategies, it is necessary to develop a novel interdisciplinary modelling approach (linking future scenarios, catchment habitat properties and ecological responses) to evaluate the impacts of land use and climate changes on aquatic ecosystems. Two Danish catchments (Gudenå 2600 km2, SkjernÅ 2300 km2) with solid long-term hydrologic and ecological data are selected to test the integrated models. The risk assessment system includes a dynamic DSSI/R approach (driver – stressor – state - impact/response), coupling the processed-based ecohydrological and biological models. Major drivers (land use and climate changes) are the model input data, and main stressors on ecosystems (water balance, flow regime, nutrients, sedimentation) are included in the algorithms of the hydrological model. Based on the multiple stressors, the dynamic changes of the states (hydrologic processes and habitat conditions) will be defined and displayed in the model outputs. The interactions between states and aquatic ecosystems will be evaluated by comparing the base and predicted biological models. This novel combination between hydrology and ecology will help to understand how multiple stressors interact with aquatic organisms and evaluate the potential risks of future land use and climate scenarios, which is essential for developing adaptive strategies for aquatic ecosystems and future environmental policy.

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Nikolaj T. Zinner

Associate Professor
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Fellowship: 01 Oct 2017 – 30 Sep 2018

Project title

Quantum few-body networks with superconducting circuits

Project description

A major goal of present day physics research is to break the ground for a transition to technologies that harness the full power of the quantum superposition principle and quantum entanglement. While there are still enormous challenges in this respect, we have nevertheless seen exponential increase in stability of quantum devices that are built using superconducting circuits over the past decade, propelling this platform to a leading quantum technology that generates enormous attention in academia and has attracted great investments from industry. For future quantum technology built from modular component, it is essential to have quantum equivalents of classical electronic components. However, in spite of these riveting developments, there is still no 'quantum equivalent' of the transistor in superconducting circuits.

In this project we want to realize the first ever quantum spin transistor using a superconducting circuit. There are many unexplored opportunities with smaller systems that are directly applicable to state-of-the-art experiments that typically have a small number of qubits. In addition, it is clear that small optimized devices necessarily yield the best starting point for building larger quantum networks.

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Project title

Effects of global changes on river ecosystem functioning: Understanding underlying mechanisms of multiple stressors using aquatic plant traits

Project description

Most of the global changes in rivers are occurring as multiple interacting stressors and lead to a chain of effects on the ecosystem structure and functioning. The aim of the project is to investigate the response of aquatic plants to multiple stressors in order to determine the effect of response biological trait composition of the plant community to ecosystem functioning by utilizing field and experimental data. The overall goal of the project is to disentangle the effect of these stressors to morphological and functional plant characteristics, and to specify the cause-effect chains at the heart of the relationships between species response strategy and stream ecosystem functioning.

I will seek to answer the following questions: a) what are the prevalent plant traits of aquatic plants to the stressors of increased nutrient loads (N, P and their combination) and high flow regime disturbance? b) what is the stoichiometry performance and variation of aquatic plants under different nutrient loading ratios (N:P)? c) how does nutrient and flow driven changes to macrophyte trait composition affect ecosystem functioning (denitrification, nutrient uptake and metabolism)?

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Project title

Precise CRISPR-mediated genomic integration of large transgenes in human cells

Project description

Genome editing is the process by which precise genetic changes can be made at exact locations in the genome in living cells. In primary human cells, the preferred method of delivering the donor template DNA, that carry the genetic changes to be introduced, is using viral vectors based on adeno-associated virus (AAV). However, a major drawback of AAV vectors is their inherent restricted carrying capacity of 4.7 kilobases (kb), which limits the applications of genome editing for large or multi-gene genomic integration.

This project aims to develop a novel genome editing platform based on multiple AAV donors that allow site-specific integration of large gene cassettes that exceed the capacity of a single AAV donor. Such a system expands the current genetic toolbox for studying gene function, and it enables therapeutic gene editing for a number of diseases.

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Samuel McCormick

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Project title

The Chattering Mind: A Conceptual History of Everyday Talk

Project description

In this book project, I consider the unexplored European tradition of philosophical commentary on the communicative practices of mass society, especially insofar as this commentary can be shown to inform ongoing discussions of collective life in the digital age. In particular, "The Chattering Mind" traces the conceptual history of ordinary conversation as it stretches from Søren Kierkegaard's inaugural theory of "chatter" (snak) to Martin Heidegger's resurgent account of "idle talk" (Gerede) to Jacques Lacan's culminating treatment of "empty speech" (parole vide)—and ultimately into our digital present, where "small talk" has become the basis for "big data."

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Shubiao Wu

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Project title

Nutrients recovery and bioremediation of polluted waters in treatment wetlands

Project description

Wastewater is often discriminated from its negative impact to the environment, since it often contains various contaminants such as organic matter, N and P which can result in eutrophication of water systems. However, these compounds cannot only be seen as waste which is just not handled properly in the right place, but are also valuable nutrients to the plants. Even though various technologies for wastewater treatment have been developed during the last decades, most of them are still focusing on the removal of these nutrients from water system by converting them into un-reusable/recoverable compounds. Moreover, wastewater generated from animals breeding systems often contains much higher contents of both N and P.

A complete and adequate treatment of these high strength waste effluents before discharge normally requires very high operational cost, which might be not affordable in some undeveloped areas. Therefore, this project is trying to investigate the possibility of using constructed wetlands as low cost but effective technique for nutrients recovery and bioremediation of polluted waters.

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Søren Dinesen Østergaard

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Fellowship: 01 Oct 2017 – 30 Sep 2018

Project title

Translational studies of mental disorder

Project description

Mental disorders are complex and for the most cases their etiology is largely unknown. Therefore, treatment remains suboptimal and the prognosis of many mental disorders is rather poor. There is however considerable agreement in the field that these challenges may be overcome by translational psychiatric research, i.e. by studies that cover the full pathway from discovery in the lab, bench to bedside, bedside to clinical applications, and from clinical applications to healthcare and global health. During his Fellowship at AIAS, Søren Dinesen Østergaard will continue his translational psychiatric research, which involves studies of genes, animals, humans and the entire Danish population.

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Thomas Tram

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Project title

Neutrino simulations under the spell of General Relativity

Project description

In 1687 Isaac Newton published the Philosophiæ Naturalis Principia Mathematica that described both the laws of motion and the law of universal gravitation. The Principa thus laid the foundation of classical mechanics. Newtons theory was unchallenged until Albert Einstein published his theories of relativity a series of papers between 1905 and 1916. According to the Special and the General theory of relativity Newtons laws are only approximate and receive corrections when objects move at large velocity or are in the vicinity of strong gravitational fields.

In 1922, soon after the publication of the theory of General Relativity, Alexander Friedmann showed that viable models of the Universe were expanding in time. This was observationally confirmed by Edwin Hubble in 1929, and this marked the beginning of physical cosmology.

It may then come as a surprise that the theoretical predictions for the large scale structure that we observe in the Universe today are computed using Newtons laws and not Einsteins relativistic theory. Going beyond this Newtonian approximation, even in the presence of massive neutrinos, is precisely the objective of my research proposal

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Tomasz Wojdacz

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Project title

Novel methylation biomarkers for breast cancer clinical management

Project description

Breast carcinoma is the most common cancer in women. Denmark has the second highest and increasing age-standardized incidence of breast cancer in the world with 105 cases per 100,000 women. Currently, performed at diagnosis pathological examination of breast tumor tissues identifies a variety of prognostic and predictive factors. However, breast cancer patients with apparently similar clinical and pathological features often have a widely varying disease course. This emphasizes the urgent need to develop novel tests that can be used to improve the treatment by better patient selection for personalized therapy.

Various environmental and lifestyle factors (e.g. smoking or use of exercise) induce epigenetic changes to the cells' genetic material. Current research clearly shows that on the one hand those changes can contribute to disease development but at the same time can be used as targets for diagnostic tests. Those tests can potentially enable disease predisposition screening as well as early diagnosis and design of patient specific treatment. However, the use of epigenetic changes to facilitate disease diagnosis and guide treatment is still marginal.

As an AIAS fellow and in collaboration with leading internationally recognized experts in breast cancer, we aim to investigate the involvement of the epigenetic changes in breast cancer development. As well as identify and clinically validate a number of tests that can potentially be used in clinical breast cancer management.

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Fellowship: 01 Feb 2015 – 31 Jan 2018

Project title

Structural Biology of Bacterial Functional Amyloids: In Biofilms, Fibril Formation and Infection

Project description

Most bacteria form biofilms to survive under stress-inducing conditions by achieving a communal living. The biofilm associated pathogenic microbes are resistant to antimicrobial agents and host immune system, as a result they are more infectious and difficult to treat. Amyloid fibrils are the most crucial components supplying the structural integrity of biofilms, so the antimicrobial resistance. However, very little structural information is known on biofilms and their amyloid proteins. Understanding the structural features forming biofilm integrity, by focusing particularly on the amyloid proteins, is an important step towards development of successful therapeutics for infectious bacteria protected in robust biofilms.

The primary goal of my project is to determine the first atomic-resolution structures of biofilm forming functional amyloids from different bacteria, by using advanced solid-state Nuclear Magnetic Resonance (ssNMR) spectroscopy. Starting from these structural insights, I aim to understand fibril formation in function and disease, the role of amyloids in biofilms, ways of controlling or preventing biofilm formation in the associated chronic diseases, and finally, the structural switch of proteins between soluble, oligomeric and fibrillar states.

The results obtained from my research will be of great importance for understanding and treating functional amyloid related diseases caused by bacterial biofilms. As a result, clever design and optimization of anti-biofilm drugs targeting fibrils can be achieved.

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Xuhui Dong

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Project title

Quantitative assessment on ecological changes and the contribution from climate in remote Greenland lakes: A multidisciplinary study

Project description

The Arctic is warming at what might be an unprecedented rate and ecosystems are undoubtedly changing. How they are changing is more moot and whether the Anthropocene will contain ecosystems unlike any that occurred over the Holocene is central to this proposed project. To answer this, I will develop and apply multidisciplinary methods to quantitatively track recent and more distant climate change and also track ecosystem response at these times based on lake sediments. The project will develop a novel method for inferring past climate change through the analysis of the stable isotopes of Oxygen (i.e. δ18O) preserved in biological remains. The technique will then be applied to sediment cores from areas of Greenland with different climate histories – in particular contrasting dynamics and speed of change of inland ice mass (e.g. Ilulisssat vs Isua, Nuuk).

An assessment of ecosystem response independent of the inference of past climate change will be gained by diatom analysis, or cladoceran and algae pigments analysis where more appropriate. It will place the current change in the context of past change and inform on ecological regime shift and resilience for Arctic lakes. Furthermore, for a global implication, the research findings in this project will serve for comparison purpose with other aquatic ecosystems (i.e. strong human impacted Yangtze shallow lakes and unique alpine lakes in Yunnan Province in China) to understand how robust the δ18O technique and different trajectory and mechanism of lake environmental changes.

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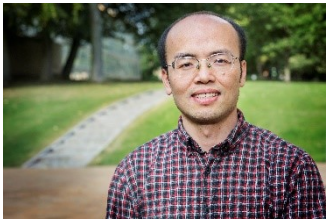

Yonghui Zeng

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Fellowship: 01 Oct 2016 - 30 Sep 2019

Project title

Ecological Genomics of Phototrophic Gemmatimonadetes Bacteria in Diverse Environments

Project description

Bacterial photosynthesis represents an extraordinary biological innovation. Mimicking/-engineering this process has long been thought to be a promising way to meet the increasing needs for energy by human society. Achieving these goals requires a deep understanding of how bacterial photosynthesis has evolved and how it functions. Recently, purple bacterial reaction centers were found in a member of the understudied bacterial phylum Gemmatimonadetes, which gives us an inspiring example as to how nature make the photosynthesis function transferrable between distantly related bacteria. However, we still know very little about phototrophic Gemmatimonadetes bacteria (PGB). This greatly limits our ability to assess their genomic properties, ecological significance and evolutionary history.

In this project, I will study the hitherto uncultured PGB dwelling in soils, active sludge and on plant surfaces by combining traditional microbiology and cutting-edge sequencing technology. I plan to: (a), assemble a highly sensitive infrared imaging system for fast identification of bacteriochlorophyll-containing bacteria; (b), conduct a quantitative study of the abundance of PGB in various types of environments; (c), isolate PGB strains and sequence their genomes to elucidate the patterns of genomic evolution in PGB; (d), develop model PGB organisms to study their physiological responses to oxygen and light availability. The results of this project will not only enhance our understanding of this long-overlooked group of phototrophic bacteria, but also lay a foundation for future exploring their biotechnological potentials.

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Photo: The AIAS Monday Lunch in the Hall on 2nd October 2017 by Anders Trærup

Photo: Fellow' commencement on 3 October 2017 by Anders Trærup

Aarhus Institute of Advanced Studies, AIAS

An AIAS fellowship provides talented researchers from all academic disciplines with unique conditions for pursuing their own research interest for a period of up to three years, completely free from other obligations than exactly their core activity: researching. As an AIAS fellow you are part of a multidisciplinary environment in which you are given the opportunity to exchange projects, ideas and key points with other researchers of the same high level from diverse academic disciplines.

Both talented junior and senior researchers from all academic areas from around the world can apply for an AIAS Fellowship. Fellows are free to choose their research topic within all academic fields and are selected according to the criterion of excellence. Applicants must hold a PhD and have a minimum of two years of postdoctoral research experience after completion of a PhD.

Three types of fellowships are offered at AIAS:

The AIAS-COFUND Marie Curie fellowship programme is co-funded by Aarhus University Research Foundation and the European Union's Seventh Framework Programme for Research and targeted at researchers from all academic disciplines from around the world. The programme contains a mobility demand, comprising both incoming fellowships as well as reintegration fellowships.

The JCS (Jens Christian Skou) fellowship programme is supported by Aarhus University Research Foundation and can be applied for by Aarhus University researchers with an existing affiliation to Aarhus University, i.e. researchers who are already employed at Aarhus University.

The EURIAS fellowship programme is initiated and managed by NetIAS, the Network of European Institutes for Advanced Study. As a NetIAS member, AIAS has two EURIAS fellowships from 2017-2019. The EURIAS fellowships are co-funded by the European Union.

Read more about AIAS, our fellows and the application process at:

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Photo: Maria Randima