Fellows 2019

Hanse-Wissenschaftskolleg
Institute for Advanced Study

Fellows 2019

Hanse-Wissenschaftskolleg
Institute for Advanced Study

Brain

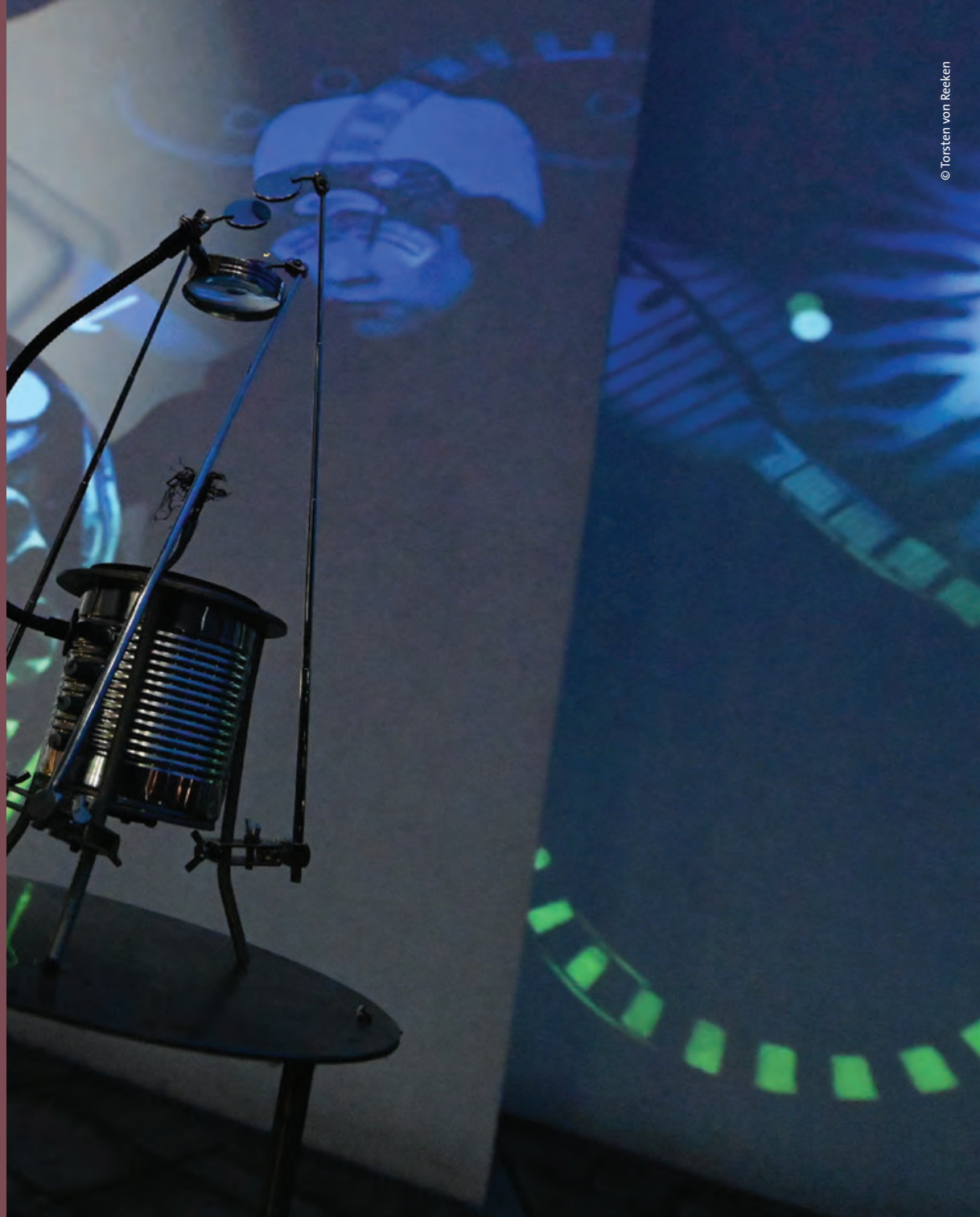
Earth

Energy

Society

Arts and Literature

Future Fellows – a selection



Brain 2019

Dr. Bernhard Fink

HWK Fellow

Fellowship
05/2018 – 02/2019

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The Evolution and Function of Human Dance

I propose that humans have evolved cognitive mechanisms for the assessment of social information from body movement. These adaptations, together with language and music skills, may then have been used to share information beyond the mating context, thus facilitating ritualized forms of social exchange to build coalitions and strengthen social cohesion through synchronous activity. Social bonding through dance thus could have evolved as a consequence of the adaptive problem of identifying honest cues of quality from body movement.

During my fellowship I review and evaluate evidence for conflicting theories on the evolution and social function of human dance. I aim to elucidate why dance has such a prominent role in human society and develop strategies for investigation of remaining questions. I also use insights for the formulation of future research directions and strategies with an emphasize on the importance of considering motor behavior in the investigation of human social perception.

Dr. Harmen Gudde

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Object-location Memory and Object Knowledge: Underlying Mechanisms and Neural Correlates

Remembering where objects are located is essential in everyday life (without it we would be continually engaged in looking for our keys, phone, or glasses) and may hold one of the keys to understanding healthy vs. pathological ageing. However, the mechanisms of object-location memory are not well-understood. My programme of work focuses on the underlying mechanisms of memory for object location, concentrating on how information about *what* objects are affects the memory for *where* they are. Previous research has shown that memory for where an object is located is affected by knowledge about that object, including information about its ownership, familiarity, or how it has been previously described. For example, owned objects are remembered to be closer by than objects that are not owned by the remembering individual.

Most models of object location memory assume that object properties are bound to object location and can therefore only affect location memory at retrieval (but not encoding). In contrast, consistent with models of predictive coding, the expectation model suggests that memory for object location is a concatenation of where an object was and where it was expected to be, as a function of object knowledge.

My project examines how and when object knowledge affects the representation of object location, using fMRI, to tease apart these different models, help with an understanding of neural system underlying object-location memory, and test whether effects occur at encoding or retrieval.

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01/2019 – 03/2019

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MRI-based Parcellation of the Human Brainstem

Our brain constantly monitors our bodily functions and the outside world through its dual connection with our internal world on the one hand, and the external environment on the other. It is through this dual connection that our brain mediates efficiently between vital vegetative requirements of the body and the continuously changing world around us. How the brain is anatomically and physiologically equipped to carry out this very complex activity is a critically important field of investigation in current neuroscience and medicine in general. Importantly, neurochemical, functional and metabolic studies have shown that one part of the brain, namely the brainstem, plays an important role in numerous other than vegetative brain functions such as awareness, fear, pleasure, attention and memory.

Brainstem organisation and integration within the brain is related to its anatomic connections. Recently, these conceptual neurobiological and behavioral developments have been put to experimental testing using cutting-edge advancements in neuroimaging technology which enable a more detailed study of brain anatomy, physiology and metabolism. Arguably, the brainstem has been the least-studied so far among the intracranial brain structures albeit its undisputed relevance in autonomic, affective and cognitive functions, and, most importantly, states of consciousness.

The goal of my work is to elucidate the detailed structural anatomy and especially the connections of the human brainstem.

Assoc. Prof. Dr. Asma Naz

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Perception-based Interactive Architecture

The research focuses on designing a new form of human-space interaction pertinent to architecture. It explores a real-world concept of an adaptive, interactive, spatially optimized living space for the rapidly growing generation of mobile tech professionals, such as Silicon Valley employees, freelancers, and global expatriates. It is meant to act as a response to the acute housing crisis they currently face in high-density cities, such as San Francisco, New York, London, and Hongkong. Through interaction, the user may modify architectural design elements such as their light, color, texture or material to change their emotional or spatial qualities. Interaction is regulated by a set of design principles formulated from correlations between design elements and space perception.

The objective of my work is to investigate the adaptive process of the interactive living space involving neural networks and "deep learning". Neural networks mimic how the brain works and can be trained to learn from examples. In artificial intelligence, deep learning is a way of training neural networks through application of image recognition techniques. The purpose is to enable a given space to "learn" to make spatial modifications that better suit its occupants' needs.

The research scope involves the design of an interaction interface. A virtual environment can be used as a potential evaluation tool for the space.

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Foundations of Higher Cognition With Applications to the Trolley Problem in Autonomous Vehicles

With several accidents caused by semi-autonomous vehicles in the US, artificial intelligence may once again become subject to public debate, and we want to ensure that these powerful systems, as we increasingly trust them with our lives, will act ethically in a human sense. Asimov's robot laws, e.g., may seem to be a good choice, but there is a problem. Our most powerful systems, today, have a very rudimentary understanding of the world, much like an animal, which is far away from understanding "Do's" and "Don'ts" in a moral sense. To go from that stage to being able to receive abstract knowledge and transfer it to other agents, is one of the key abilities of human beings no other animal developed.

Building upon a previous cognitive system, enabled to understand and picture spatial, temporal, and also other similar relations given in a quasi-natural language format, my project goes one step further. I propose to implement a simple ethical coordinate system, at the boundary between human and animal intelligence, and test it on a widely debated problem, the so-called "trolley dilemma": imagine a trolley is running down a railway track onto which a group of people has been tied; you are standing at a switch and could redirect the trolley to a side track, where only a single person is tied to the tracks; would you pull the lever? The answer people give varies depending on ethical, spatial, temporal, and social factors. A trustworthy AI would be one that has a similar 'gut feeling' as we do.

Dr. Monika Turk

Joint Research Fellow
funded by Medical Faculty Oldenburg

Fellowship
10/2019 – 04/2020

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Cognitive Deficits in Patients With Parkinson's Disease

Parkinson's disease is a frequent and severe disorder. Patients with Parkinson's disease have not only difficulties with certain movements, but often also difficulties with cognitive functions. When Parkinson's disease is diagnosed, already 35% of patients have cognitive difficulties. Later on, 20-30% of patients develop severe cognitive deficits (dementia). In patients with Parkinson's disease, mainly functions of the frontal part of the brain are impaired. Researchers believe that changes in the brain's neurotransmitter systems cause these cognitive deficits.

1. Which cognitive functions are mainly affected in patients with Parkinson's disease?
2. When do cognitive deficits appear in the course of the disease?
3. What is the effect of therapy on cognitive deficits?

I will use a data set, consisting of 70 patients with Parkinson's disease and 30 age-matched healthy controls, that has already been collected at the University of Kiel. All participants have been tested with different cognitive tests: the Ultimatum game, reversal learning test, Iowa gambling task and Wisconsin card sorting test. These tests assess the ability to make decisions and to perform higher cognitive functions that involve planning and problem solving.

During my 6-month project, I analyze the data, interpret and discuss the results and write a manuscript to be submitted to a respected (peer-reviewed) scientific journal.

Dr. Myat Su Yin

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Fellowship
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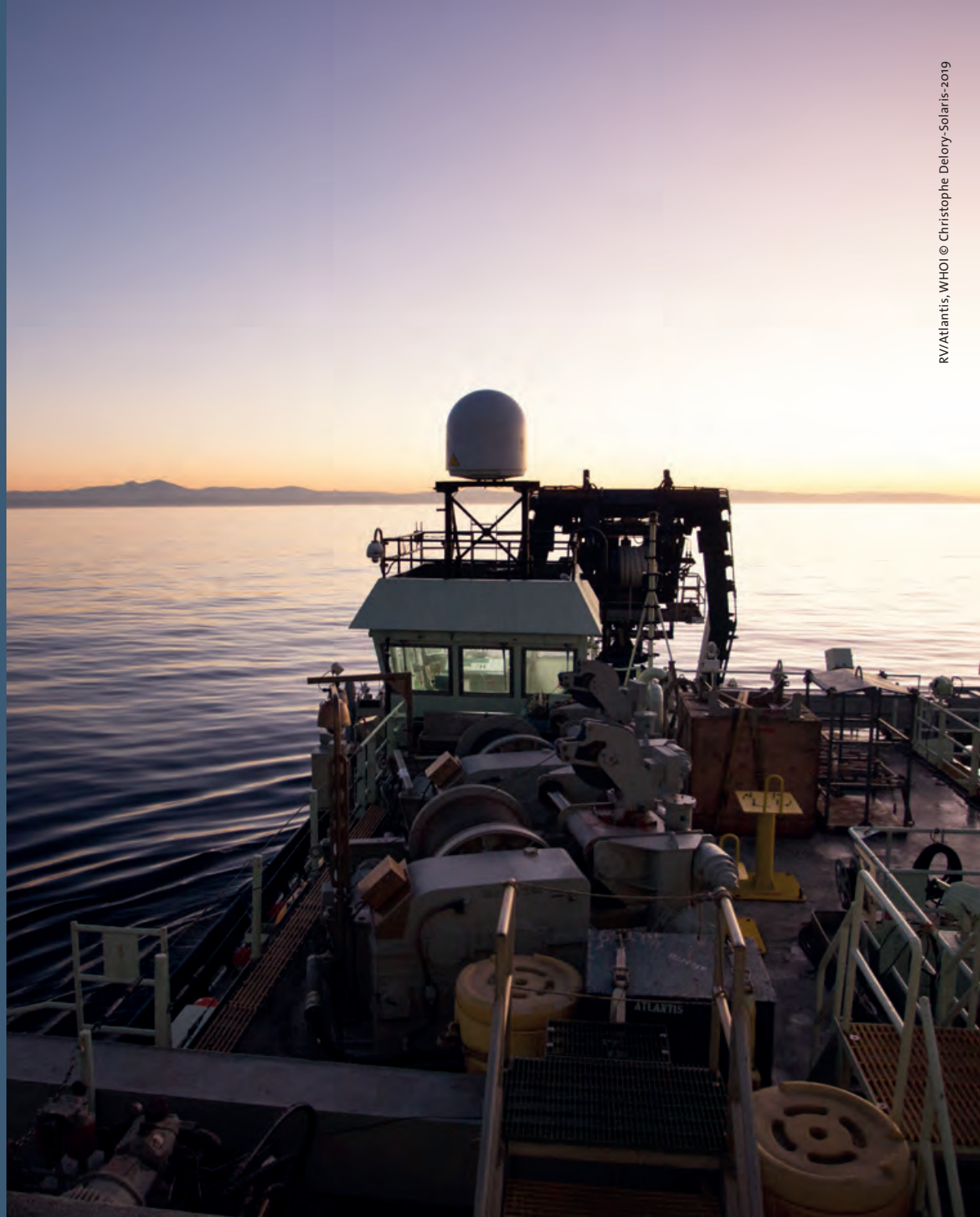
Representation and Reasoning About Surgical Procedures for Intelligent Virtual Training Environments

It is essential for a surgical skill training system to understand the sources of errors in surgical procedure to devise effective tutoring strategies. Errors can arise due to a variety of reasons, including lack of technical ability, lack of knowledge of anatomy, and lack of understanding of the task. Diagnosis of causes of errors requires knowledge of what actions were taken, how they were carried out, and what effects they had. This requires the simultaneous representation of low-level motion data and high-level symbolic information, as well as the relation between them.

Once the performance errors have been identified, generation of formative feedback also requires representation of information at these two levels. Communication with the student should occur using the language that surgeons commonly use in discussing surgery and to which the students are accustomed.

My work focuses on representing surgical procedures at multiple levels to capture the symbolic and kinematic description of the procedure and the relation between them with the purpose to effectively analyze procedures and to communicate about them.



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Earth 2019

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10/2019 – 02/2020

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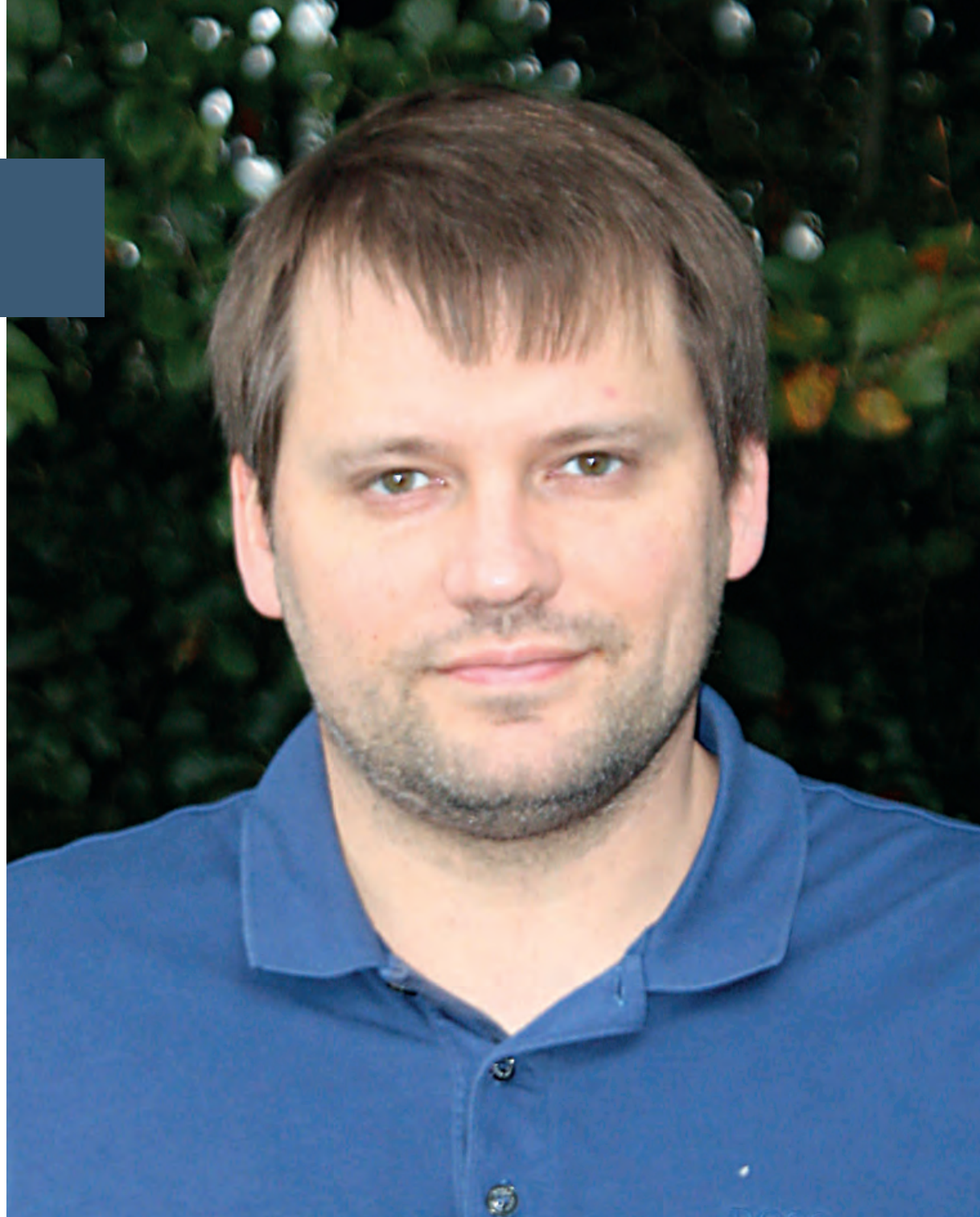

A Highly Resolved Spatial Analysis of the Biogeochemistry of a Common Salt Marsh Grass Rhizosphere

Coastal areas are very important globally for storing carbon, but are also very susceptible to environmental change (e.g. sea-level rise). We are still learning a great deal about natural coastal areas that are often dominated by the presence of marsh grasses. In the sediment where marsh grass grows a diverse group of microbes have been identified; we have observed them respiring carbon dioxide and methane, both important greenhouse gases. However, important features of how marsh grasses, or their roots and microbes interact are not yet understood. A complication to progress in understanding how roots and microbes interact is driven by their size, with plant roots in the millimeter scale and microbes in the micrometer scale. Any technique used to describe the interaction between roots and microbes must be able to work over very small spatial scales.

A newly developed technique called Mass Spectrometry Imaging allows microbes to be identified in two dimensional space so we can see how groups of microbes interact with roots. My project applies this technique using natural samples and, through experiments, simulates the effects of global climate change, i.e. increasing salt concentrations related to sea-level rise. The goal is to determine how greenhouse gas emissions and plant-microbe interactions are influenced by high-resolution, two dimensional analysis.

The HWK fellowship and unique expertise at MARUM enable this work; it is one of the few places where imaging of this type may be done.

Prof. Dr. Carl J. Carrano

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Fellowship
04/2019 – 11/2019

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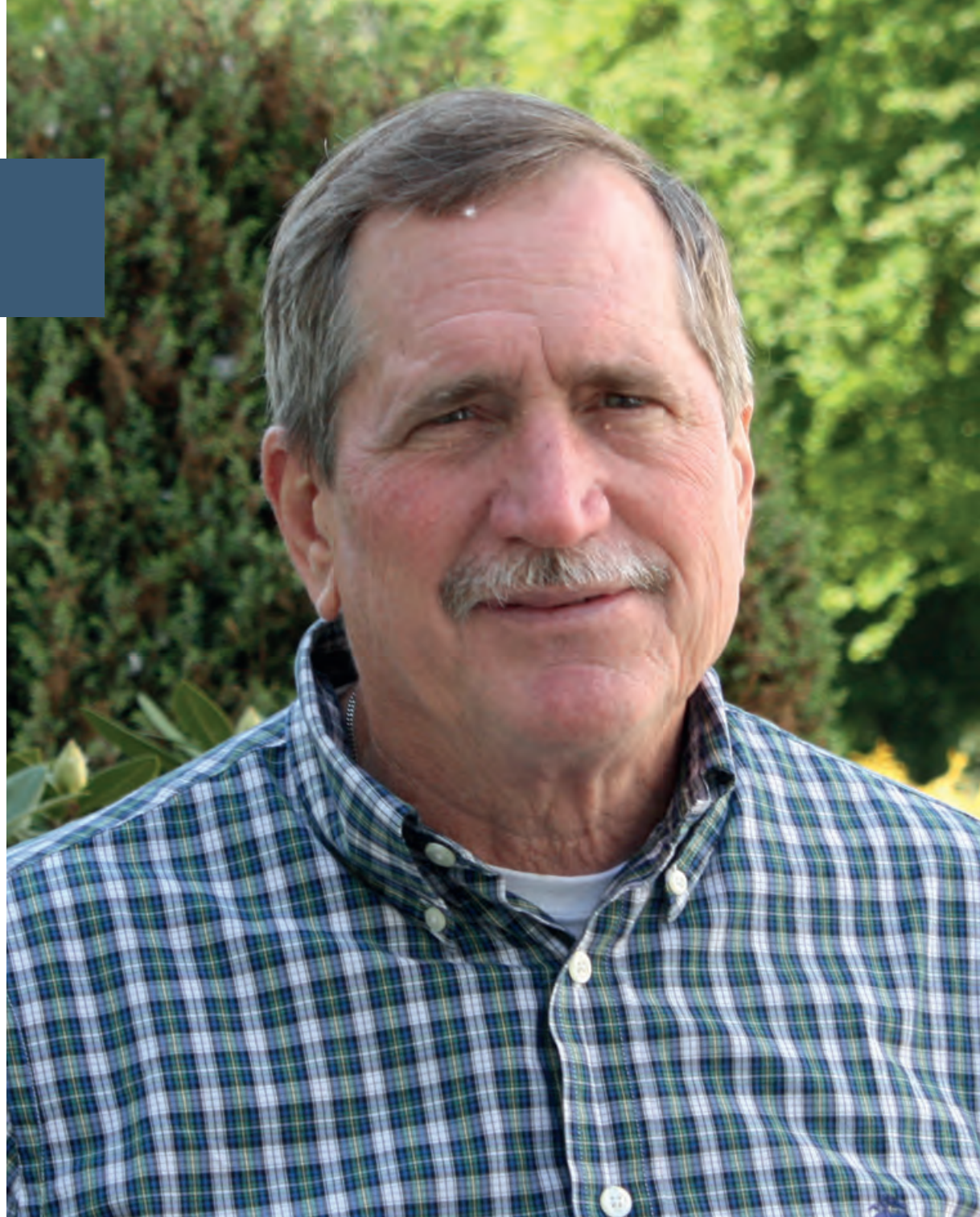

The Role of Trace Elements on Bacterial-Algal Interactions in the Marine Environment

Marine algae are critically important plant-like members of the ocean community which not only drive primary productivity, but also influence climate. In addition, many microalgae can form blooms containing toxic or harmful species that have occurred with increasing frequency in recent decades, and have caused substantial ecological and economic damage worldwide. Likewise the macroalgae or seaweeds can be the dominant organisms, in terms of biomass, of the marine coastal environment often forming extensive kelp forests.

The industrial exploitation of marine algae is also expanding partially due to interest in their use for production of alginate but increasingly for their potential as biofuel where they have the advantage of not competing with terrestrial crops for farmland.

Marine bacteria are also fundamental regulators of marine biogeochemical cycles and hence directly or indirectly affect climate. In addition it is known that optimal growth and survival of many algae requires the close association of specific bacterial species. Thus the two groups of organisms are closely tied together.

In my project I examine the effects that several essential, but poorly studied trace elements (boron, iron and iodine) have on the biology of selected model algae and their associated bacteria.

Dr. Hayley C. Cawthra

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04/2019 – 06/2019

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Sea-Level Fluctuations, Submerged Landscapes on the South African Continental Shelf, and the Implications for Human Evolution

The sea level changes constantly, in accordance with glacial-interglacial cycles every ~100,000 years. A certain consequence is that during the glacials, what is now seafloor becomes exposed subaerially as a coastal plain.

My project aims to understand a submerged terrestrial landscape on the continental shelf of the South African South Coast. This region has one of the richest Middle Stone Age archaeological records in the world, holding rich archives of early modern humans. During the time of occupation, sea level has been significantly lower than it is at present for about 90% of this time, so understanding this shelf is critically important. The bilateral German-South African RAiN (Regional Archives for Integrated iNvestigations) project aims to expand the current state of knowledge on the dynamics of South African Late Quaternary climate change by comparing marine and terrestrial proxy-records. The link between the palaeoclimate research in RAiN, and this approach of considering human evolution at a regional hotspot, is where the novel approach of this collaborative work lies. The South Coast is situated at the juncture of winter- and summer rainfall zones and, as well as the Benguela and Agulhas Currents, contains rich palaeoenvironmental archives, and is ideally located to study past sea level change.

The anticipated benefits of the project include geological information which will be fed into holistic models for changing ecosystems and how it may have affected human use of this landscape.

Dr. Colleen M. Hansel

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Fellowship
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Unraveling the Complex Role of Reactive Oxygen Species in the Health and Activity of Marine Microorganisms

The health and function of the ocean is controlled by the production and consumption of a broad spectrum of chemicals. There is an emerging recognition that highly reactive and hence low-abundance and short-lived chemicals are at the hub of many biogeochemical cycles. These short-lived chemicals include partially reduced forms of oxygen, referred to as reactive oxygen species (ROS) or oxygen radicals. Due to their fast formation and consumption, these ROS are notoriously difficult to measure, and yet are key to the biogeochemistry and health of the ocean. While ROS, including superoxide, are known for causing stress and even death in organisms, recent findings indicate that these same chemicals may also be essential for life.

Accordingly, the overarching goal of my fellowship is to obtain a better understanding of the distributions of ROS within the ocean and the underlying processes responsible for their formation. The role of superoxide in microbial health is investigated in controlled laboratory incubations of common marine microorganisms. New instruments are also developed and deployed to make novel observations of the levels and distributions of superoxide within coastal waters and sediments.

Enabled by a cross-institution collaboration between the fellow and complementary HWK-affiliated research groups, this research provides key insight into the role of ROS in shaping the health and biogeochemistry of the ocean.

Dr. Cajetan Neubauer

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Fellowship
06/2019 – 09/2019

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Studying the Biosynthesis of Unusual Archaeal Lipids With New Tools for Isotope Quantification

How do microbes live in their natural habitat? This question becomes important every time we want to kill a pathogen or need to predict how a changing environment will affect microbial processes, for example production of the potent greenhouse gas methane. Today, we can closely examine living things by weighing the masses of molecules with a mass spectrometer. Particularly useful for answering our question are isotopes, variants of the chemical elements that differ only in the number of their neutrons. Biological processes lead to ordering of the isotopes in biomolecules. These small variations then can tell us much about what microbes are doing in an environment.

During my fellowship, I access new types of information about microbial metabolism by measuring isotopes. I add rare isotopes to microbes and determine how much of it gets incorporated into certain lipid metabolites. By doing so I want to better understand a type of methane-producing microbe that has only recently been discovered in marine sediments.

In a similar way I also wish to measure natural isotope differences in lipids extracted from deep-sea sediments, which harbor a vast biosphere of poorly understood microorganisms. This can tell us how microorganisms live when they have severely limited access to nutrients and energy.

Dr. Beth N. Orcutt

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11/2019 – 02/2020

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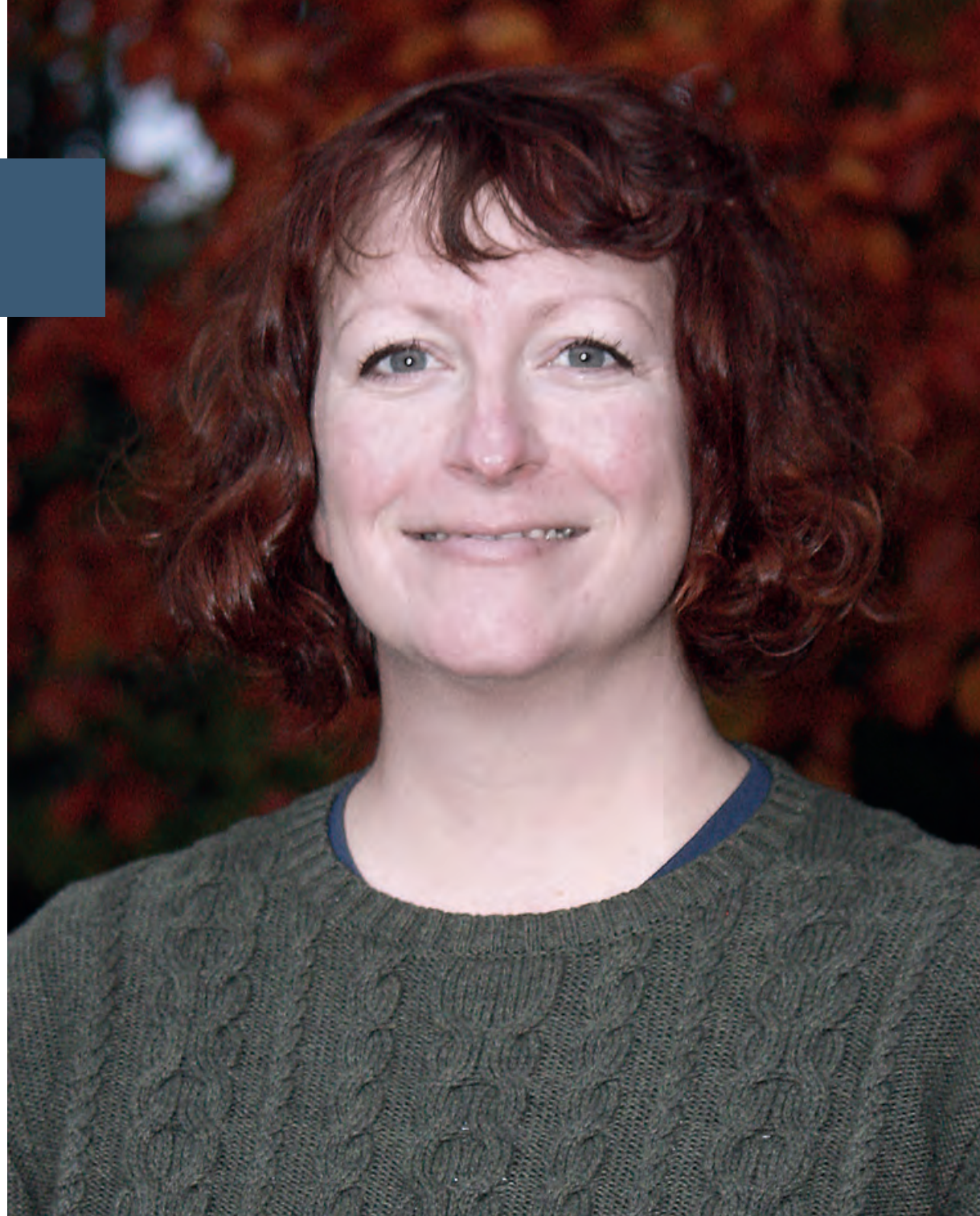

Microbe-Mineral Interactions in Subsurface Oceanic Crust

Underneath the ocean, roughly 70% of the Earth's surface is covered by marine sediments and oceanic crust. Microscopic life—"microbes" like bacteria and archaea—exist in this dark, deep sea environment, cycling elements and eating carbon. Below the seafloor, there is a vast reservoir of life on Earth, yet we do not fully understand how all of the microbes get their energy to grow, the full impact of their activity on chemical cycling, and even how many microbes there are. In particular, knowledge of the extent, diversity, and function of life in the sub-seafloor rocky oceanic crust is poorly understood. For the past several years, I have been conducting novel sampling and incubation experiments within the sub-seafloor to examine how microbes interact with rocks.

For this HWK project, I collaborate with scientists at the University of Bremen to examine the change in mineral chemistry associated with microbial growth, to figure out which rock types microbes prefer to colonize, and how they may alter the rocks that they grow on. I also work with these scientists to determine the amount and types of microbial life colonising these rocks, to figure how much life can be supported by these fluid-rock interactions.

Ultimately, these analyzes will help us to figure out which microbes are "rusting the crust" of Earth and inform us of the possibility for life to exist on other planets with liquid water and crustal rocks.

Assoc. Prof. Dr. Hendrik Schäfer

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Fellowship
06/2019 – 09/2019

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Probing the Fate of Dimethylsulfide and Dimethylsulfoxide and Their Role in Organic Matter Degradation in Coastal Marine Sediments

Dimethylsulfide (DMS) is a smelly sulfur gas of wide environmental significance. It has been described as the "smell of the sea". DMS is viewed as a climate-cooling gas. Its emission into the atmosphere from the oceans affects cloud formation and the heat balance of the Earth. DMS is also the only significant agent for sulfur transfer between the oceans and the continents where deposition of DMS-sulfur into soils provides sulfur fertilisation.

DMS cycling is dependent on bacteria. One of the many processes involved, and likely a dominant one, is its oxidation to dimethylsulfoxide (DMSO). In anoxic marine sediments, DMSO can be used by bacteria for respiration as an alternative to oxygen, thereby driving carbon remineralisation to CO_2. In doing so, it is reduced back to DMS. If DMS-oxidising and DMSO-respiring bacteria live in close association, this could provide a cyclic pathway where the product of one process is the input for the other. Alternatively, DMS cycling in anoxic sediments can lead to formation of methane, which acts as a strong greenhouse gas contributing to climate warming.

My project helps to understand the fate of DMS in marine sediments, whether there is a DMS/DMSO cycle, and, if so, which bacteria are driving it. In doing so, it helps to assess the processes that determine the balance between climate-cooling and climate-warming trace gas emissions from marine sediments, which is important for future modelling of the climate system.

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Controls on Fungal Nitrogen Metabolisms in Coastal Ecosystems

Nitrogen often plays a central role in controlling the productivity of ecosystems. Indeed human recognition of this fact lead to the "green revolution"—the industrial production of fertilizer, expansion of agriculture, and an explosion of human population growth. Over the past century, however, this revolution has come at a cost as the impact of human activity has lead to the degradation of aquatic ecosystems worldwide, especially coastal ecosystems where rivers continually deliver nitrogen from agricultural run-off, sewage effluent and industrial waste, and where population growth is most intense.

Towards better understanding the fate of nitrogen in coastal systems my research group recently discovered that an important amount of nitrogen was being converted into nitrous oxide (N_2O), a powerful greenhouse gas—and further, that unexpected organisms were involved: fungi. Fungi are not widely recognized as important contributors to nitrogen cycling, yet I propose that their importance in some processes may have been overlooked.

In this project, I explore the potential for fungi (including yeasts) in coastal ecosystems to catalyze important transformations of nitrogen. My approach involves collaborating with a number of experts in the Bremen area to make fine-scale geochemical measurements, quantify chemical signatures of fungi in sediments and determine how different types of conditions influence the cycling of nitrogen by fungi.

Prof. Dr. Michael J. Whiticar

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Fellowship
03/2019 – 06/2019

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Methane on Earth—Understanding and Tracking Methane Occurrence and Interactions Between the Bio-, Geo-, Hydro-, Cryo- and Atmospheres

Methane (CH_4) is the most abundant organic molecule on Earth, with 5,000 to 10,000 GtC in the upper lithosphere, including the 5,000-10,000 GtC gas hydrates and 600 GtC natural gas deposits. This equals the summed total of carbon in the atmosphere (850 GtC), land biota (830 GtC), peat (250 GtC), soil (1,400 GtC), dissolved organic matter (980 GtC), petroleum (290 GtC) and coal (3,500 GtC).

Methane is important for energy and the environment. We consume ~3 GtC/yr of natural gas (mostly CH_4)—comparable with oil (4,179 MT) and coal (3,867 MTOE). It thus represents a key fossil fuel that will continue to be used in the near future. Environmentally, CH_4 is a strong greenhouse gas with a Global Warming Potential on the decadal, human dimension timeframe, that is 104 times that of CO_2. As such, methane tropospheric emissions are just as important to understand and control as CO_2.

CH_4 is principally derived from organic matter by biological, diagenetic or thermogenic maturation mechanisms. We have extensive knowledge on formation, fates and importance of CH_4 on Earth. However, there are ambiguous, controversial and unanswered questions. The substantial advances made in understanding CH_4 in established and new fields of research are in disparate locations with no recent unifying publication.

During my fellowship, I harmonize and collate the diverse knowledge about CH_4 on Earth, together with an international, HWK-lead symposium into a book, volume and/or series of papers.

Prof. Dr. Horacio E. Zagarese

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Fellowship
01/2019 – 11/2019

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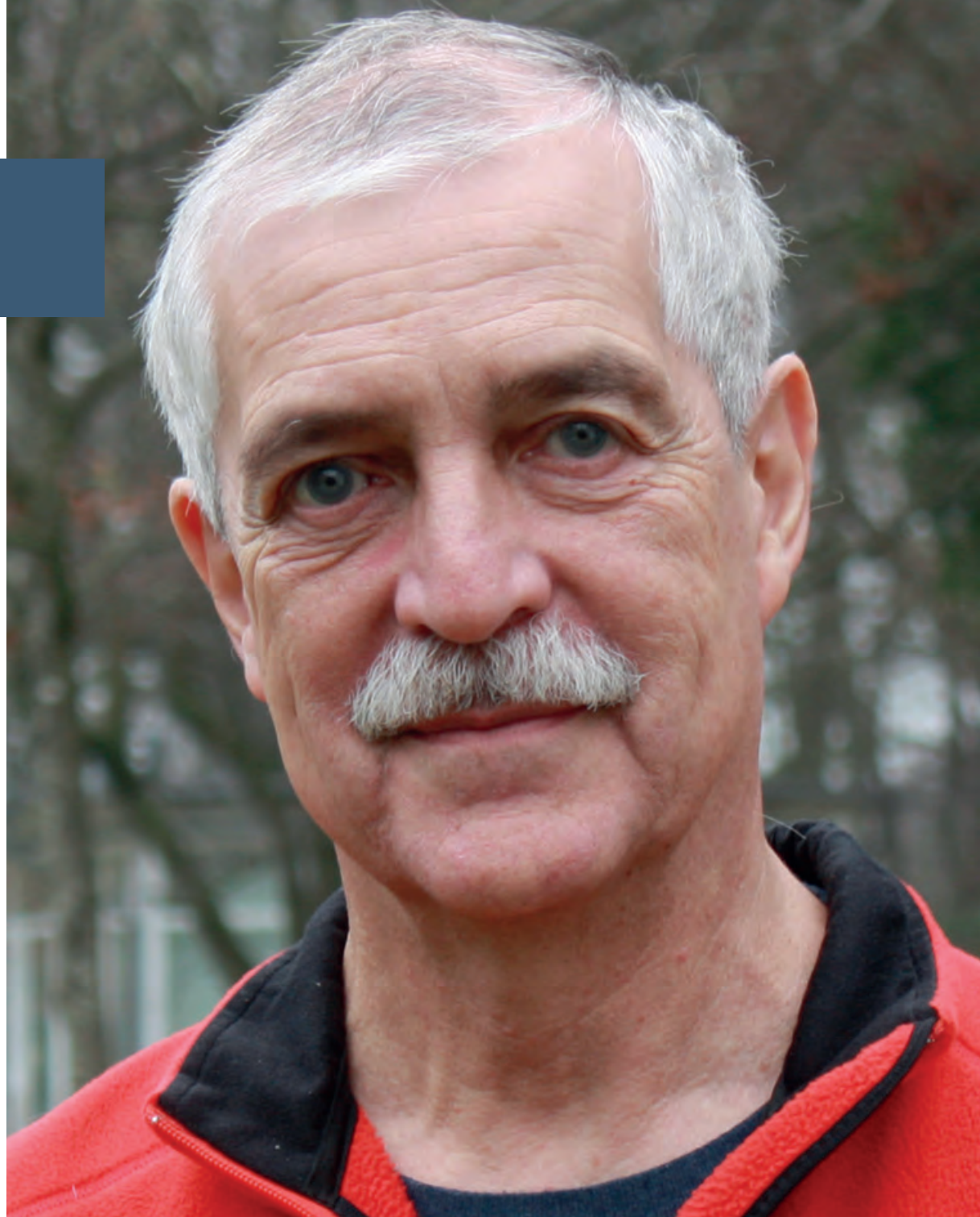

Inorganic Carbon Limitation of Primary Production in Eutrophic Waters: Implications of Contemporary Increases in Atmospheric CO_2 Concentration for Marine and Freshwater Environments

Atmospheric CO_2 is converted into plant biomass through photosynthesis. This process is called primary production (PP). In addition to carbon, PP requires water, additional chemical elements (nutrients, particularly N and P) and sun energy (as fuel). Shortage of either one of these elements could limit PP. In aquatic environments, water is never an issue, but because N and P are often in short supply, they commonly limit PP. However, natural or anthropogenic eutrophication may increase N and P availability to the point that they are no longer limiting, and so inorganic carbon becomes the limiting factor. Conversely, increases in CO_2 concentration may release carbon limitation in eutrophic waters.

The work plan for my project addresses the following guiding questions:

1. How common is nutrient vs. light vs. inorganic carbon limitation in shallow waters?
2. How does the nature of PP limitation change over the year or inter-annually?
3. Is it possible to identify a set of conditions that would favor inorganic carbon limitation?
4. What are the consequences of different limiting factors to herbivores?
5. Do the net fluxes of carbon change depending on the nature of primary production limitation?

Assoc. Prof. Dr. Wiebke Ziebis

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07/2018 – 04/2019

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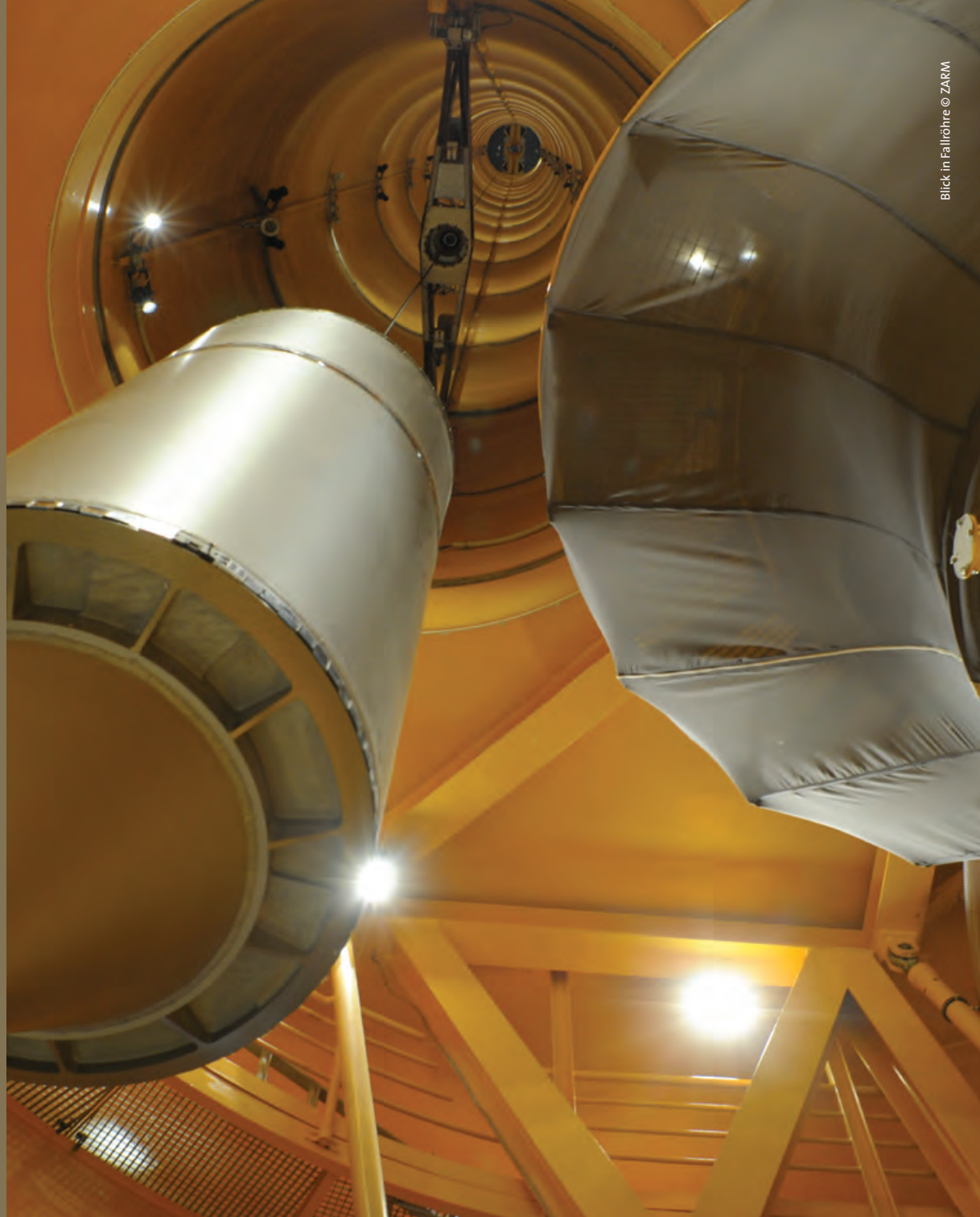
1. Oxygen in Deep-Sea Sediments Underlying Oligotrophic Ocean Gyres: A Changing Perspective on Deep-Subsurface Biogeochemical Processes
2. Variations of N_2O Production as a Response to a Changing and Dynamic Environment

1. Investigations in oligotrophic open ocean regions revealed that, in contrast to the better-studied ocean margin regions, the seafloor is oxic down to tens of meters, and in some areas oxygen reaches the Earth's crust. These largely unexplored areas seem to be very different from previously studied subsurface environments, yet they may be representative for vast areas underlying open ocean surfaces. The deep penetration of oxygen has a large effect on the biogeochemistry of the ocean floor and the discovery of a largely oxic subsurface impacts global element cycling.

The discovery of a completely oxic deep biosphere, and an emerging role of the nitrogen cycle in sediments underlying open ocean regions changed the way we view basic geochemical processes in major parts of our ocean, and certainly will change textbooks on the importance of seafloor processes. The central ocean gyres cover roughly half of the ocean's seafloor, thus their reaction rates importantly contribute to global elemental balances. Furthermore, these reactions may fuel a deep and active biosphere that still needs to be discovered.

2. Recent estimates by the Intergovernmental Panel on Climate Change suggest that nitrous oxide (N_2O) contributes approximately 20% of the global warming effect caused by increases of the various greenhouse gases (IPCC 2007). 55% of the total global N_2O emissions are from natural ecosystems and marine sediments, especially in coastal regions, are recognized as important sources of N_2O, yet the factors influencing the production and emission, especially under changing condition of temperature, nutrient input and organic loading are not well understood. To understand the impact of a changing environment on benthic N_2O production and fluxes, we need to gain a better understanding of the mechanisms controlling these. Given for example the large intertidal area of the German Wadden Sea, there is an urgency to understand these dynamics of an important greenhouse gas. It is still not well-understood, whether marine sediments act as a source or sink for N_2O, and how changing environmental parameters affect this.



Blick in Fallröhre © ZARM

Energy 2019

Assoc. Prof. Dr. Kyle Vincent Camarda

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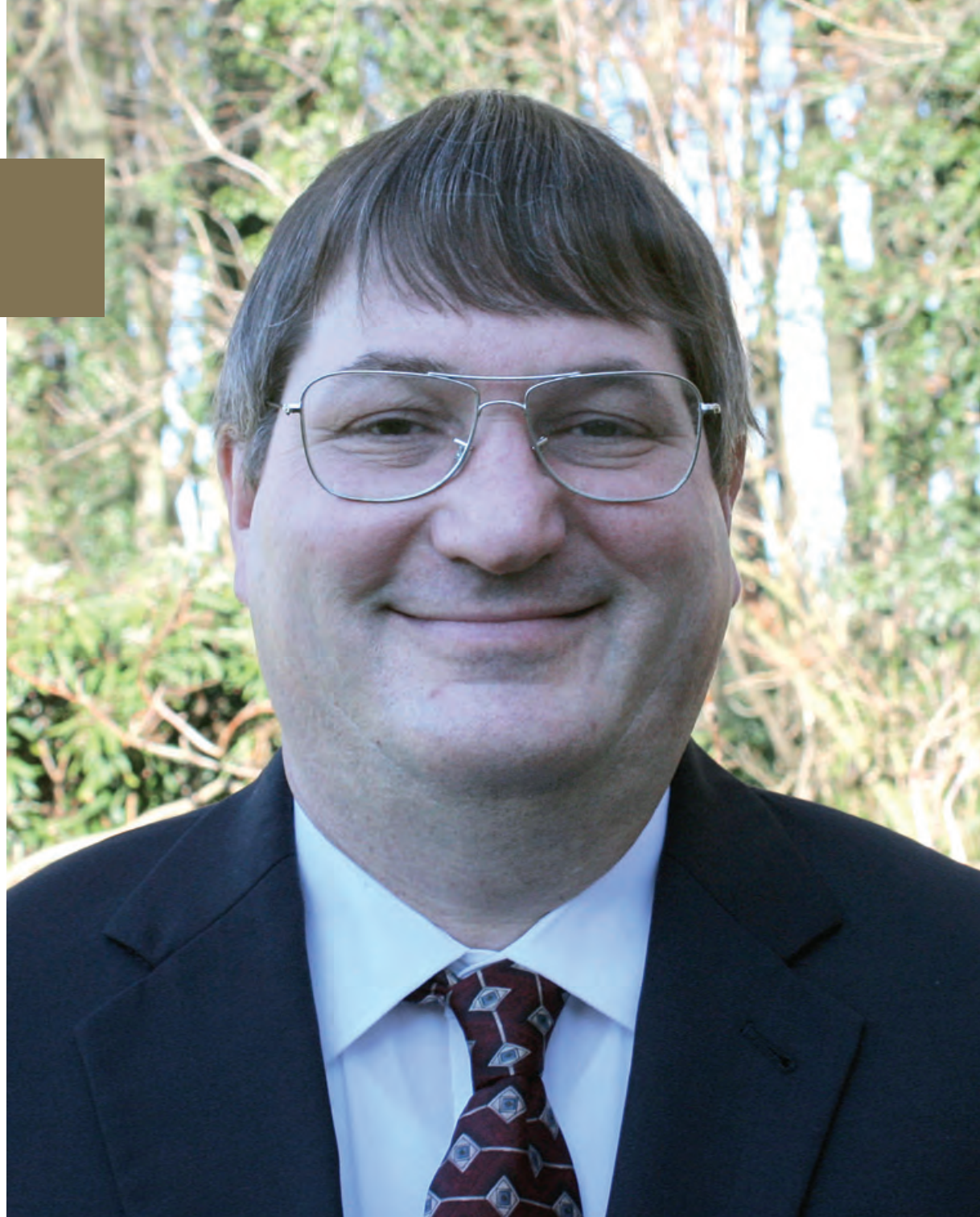

Multiobjective Optimization for Global-Scale Energy Infrastructures

Perhaps the most pressing issue facing today's society is the problem of the provision of energy. Demand for energy is rising, yet the use of fossil fuels threatens catastrophic climate change.

My project applies modern techniques in process systems engineering to the problem of redesigning power grids to fully utilize renewable sources while still providing the needed energy to power the world.

The problem of selecting locations, types and sizes of renewable power plants and energy storage equipment is a very complex problem which includes thousands of decision variables. Since many of the equations involved are also highly non-linear, and often involve uncertainty, traditional optimisation techniques are often ineffective. New algorithms, known as stochastic because they involve a random search function, are particularly suited to these complex non-linear optimisation problems. They are able to define the trade-offs between various objectives, and allow many scenarios to be evaluated quickly and efficiently.

In my project, models for energy production and distribution systems already developed in Prof. Zondervan's group at the University of Bremen are enhanced to include uncertainty in demands and production capabilities. These more complex models are then solved using those stochastic algorithms on parallel computing hardware. Our results may provide guidance to governments and regulatory agencies on how to best operate energy grids for minimum environmental impact.

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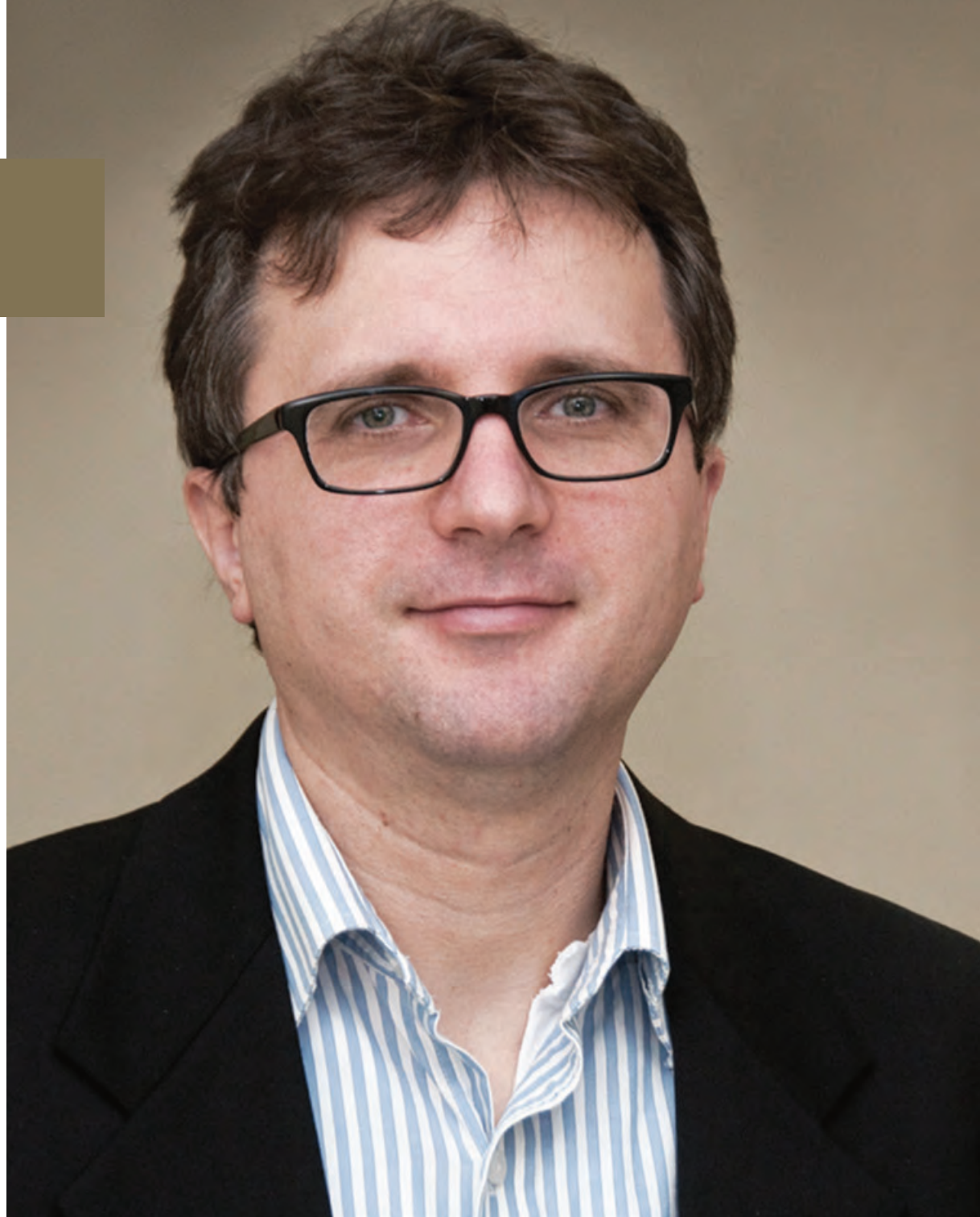

SCC-DFTB Objective Molecular Dynamics Investigations of Zinc Oxide Nano-Materials Targeting Thermoelectricity and Energy Conversion Applications

The advancements brought by nano-technology enable the development of novel energy applications. However, the scale itself—so small that individual atoms matter—poses inherent experimental difficulties. To make progress, the development of theoretical models is essential.

Because of the small scale, nanostructures are most accurately modeled using atomistic simulations—computer simulations that consider individual atoms. Until recently, atomistic simulations could only be easily carried out on structures that are straight—that possess translational atomic symmetry. A recently developed method termed Objective Molecular Dynamics (OMD) generalizes this treatment to angular and helical symmetries. Thus, OMD allows for efficient and accurate simulation of nanostructures that are twisted or helical, whether by an external force or inherently.

My project concerns the development of new OMD capabilities by coupling OMD into the popular DFTB+ code developed at University of Bremen, and the application of the developed numerical capability to uncover the thermoelectricity and energy harvesting capabilities of twisted and helical nanostructures.

The proposed OMD simulations break new grounds in exploring the emerging space of screw-dislocated twisted zinc oxide (ZnO) nanostructures in order to understand their ability to convert heat into electric energy, as well as in exploring the capabilities of ZnO nanobelts to transfer mechanical deformations into electric energy.

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Dr. Bernhard Stoevesandt
Fraunhofer Institute for Wind Energy Systems, Oldenburg

Understanding of Fluid-Boundary Interactions: A Unique Challenge

Given foreseeable developments, there is a very strong demand for the more efficient use of wind energy. By far the most promising approach to address this problem is the use of computational methods for the analysis and performance evaluation of wind turbine designs, and the optimisation and control of wind farms. However, such computational methods suffer from an insufficient understanding and computational reflection of boundary effects—the dampening of turbulent flow by the ground or obstacles—which significantly reduces the predictive power of the methods.

Over the last ten years, significant progress towards developing a solution to this problem has been made by our research group at the University of Wyoming. However, we are a small group having rather limited resources (which are, given the complexity of the problem, insufficient to present generally accepted break-through solutions). The groups of Prof. J. Peinke (University Oldenburg) and Dr. B. Stoevesandt (Fraunhofer-Institut für Windenergie und Energiesystemtechnik, IWES) basically have the same goals as our group in this regard. Therefore, the fundamental goal of my project is to use the opportunity to work as a fellow at the HWK to combine the research efforts of our group and the groups of Prof. J. Peinke and Dr. B. Stoevesandt.

Prof. Dr. Lucy Pao

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Control of Wind Turbines and Wind Farms

The United States, the European Union, and many other countries and regions around the world are working to increase the amount of electrical power generated from renewable energy sources in an effort to combat climate change. In the wind energy area, despite the amazing growth in global wind power installations in recent years, science and engineering challenges still exist. Megawatt wind turbines are large, flexible structures that operate in uncertain and continually changing wind and weather conditions.

I investigate methods that can enable wind turbines and wind farms to be operated more efficiently and reliably. The techniques I propose to develop can help increase efficiencies and thus enable more energy capture in wind turbines and wind farms, and also can reduce structural wear and tear and hence yield longer lifetimes of the components and turbine structures.

During my project, I carry out research in the advanced control of (i) wind turbines that will enable extreme-scale 50 MW wind turbines that may provide reductions in the cost of energy of offshore wind, and (ii) wind farms to track power reference signals to ensure the reliability of utility grids even in the presence of large amounts of renewables on the grid. Both conceptual and simulation studies as well as experimental campaigns are pursued collaboratively with fellows at HWK and colleagues at nearby institutions.

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Possibilities of Inorganic Compounds and Biomolecules in Moletronics

The emerging human demand for miniaturising the dimensions of electronic gadgets with more efficiency introduced the field of Molecular Electronics or Moletronics in place of conventional silicon-based technology. The primary purpose of these technologies is to create the capacity to fabricate a greater number of electronic units (switches, IC's etc.) in smaller spaces in a cost-effective manner.

Conventional silicon technology has reached a limit to meet such demands due to its high fabrication cost and miniaturization limit. In this direction, molecular transport-based technology promises great development potential.

For a number of years organic molecules have been explored almost exclusively. Very recently researchers started exploring useful inorganic compounds (analogues to their organic counterparts) as well as biomolecules like DNA base pairs for better potential, cost-effectiveness, and easy synthesis advantages. In the recent past, my research group has investigated inorganic aluminium nitride (of organic biphenyl analogue) and parallel DNA base pairs, and observed their better candidature compared to respective organic counterparts. The promising aspects for the proposed novel approach are expected to lead to a breakthrough with regard to the future of moletronics.

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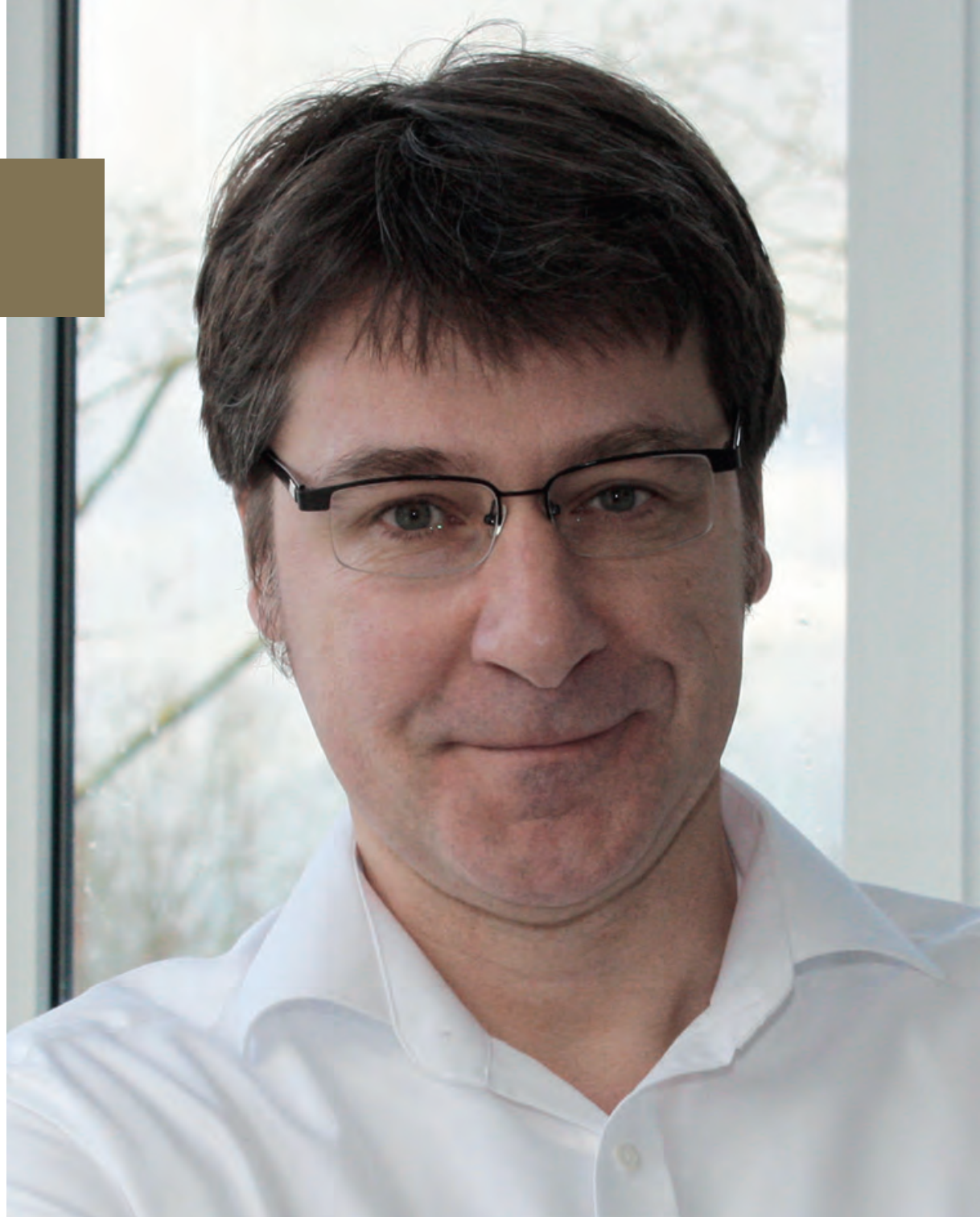


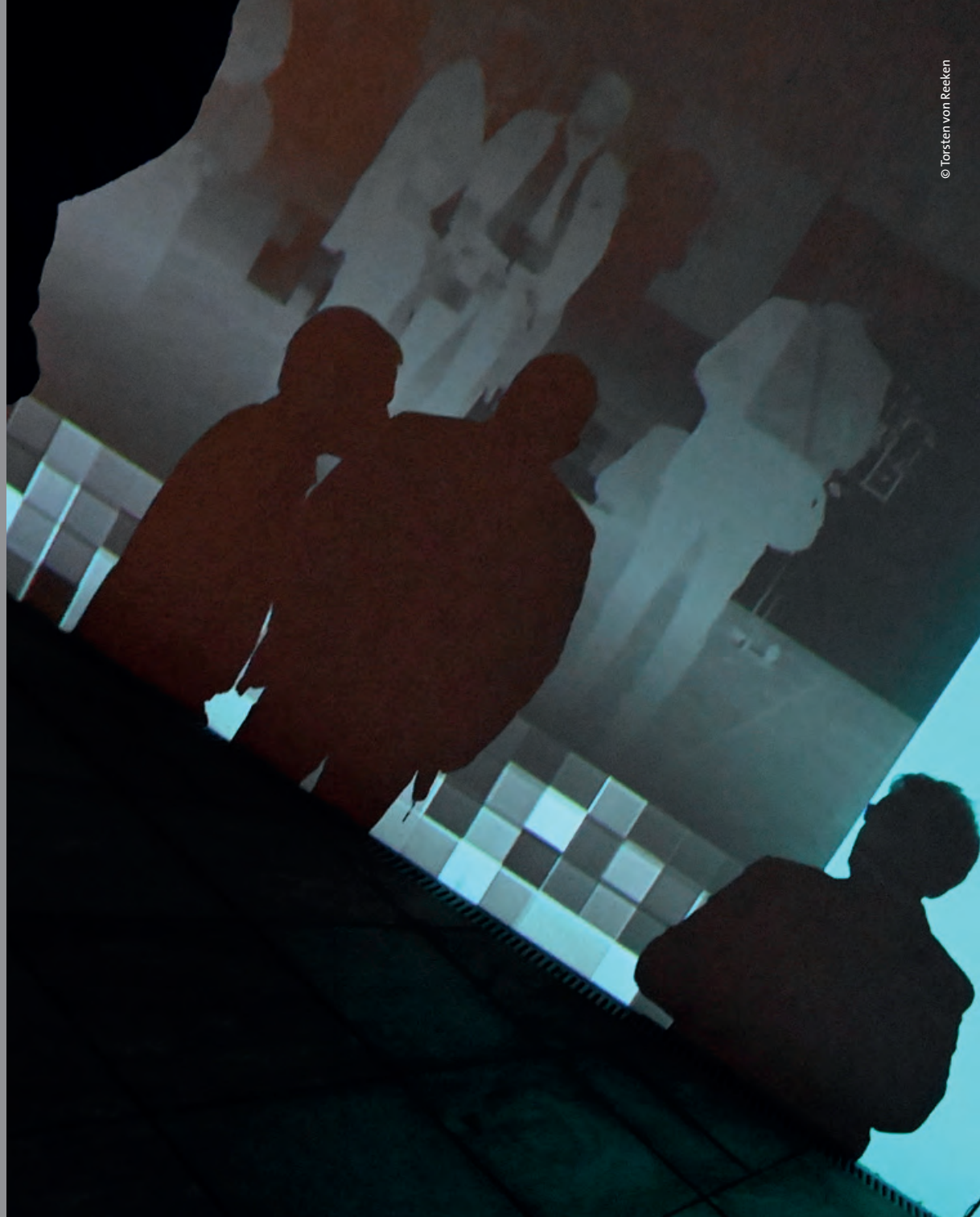
Flow Physics of Wind Turbine Wakes

Wind energy plays a key role in achieving renewable energy targets and has seen a tremendous increase in installed capacity, both on- and off-shore. However, many science and engineering challenges still exist. One of them is to understand, model, and control how wind turbines and the wake flows they generate interact with the atmosphere and with other turbines downwind. In large wind farms, these interactions can cause a significant decrease in energy yield and lead to increased wear on wind turbine components, thereby reducing turbine service life. The flow physics of wind turbine wakes, in particular with complex inflows, are not well-understood.

My project initiates and conducts collaborative studies of wind turbine wakes in two large scale experimental facilities, at WindLab at Oldenburg University and at the University of New Hampshire.

Specifically, wind turbine wakes are investigated using model turbines under different inflow and boundary conditions to study flow phenomena that have high importance at the application level.

Combined with field observations in wind farms these experiments will guide the development of flow-physics-based models. My project helps establish generally applicable results regarding wake flow-physics and wind turbine wake development. The insights will be transferable to the practice of design, operation and maintenance of wind farms, thereby increasing energy yield and turbine service life, and reducing energy cost.



Society 2019

Assoc. Prof. Dr. Ayten Alkan

HWK Fellow
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Fellowship
08/2018 – 06/2019

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Revisiting the "Right to the City" From the Perspective of Non-Humans: The Case of (Stray) Dogs

The ideal of and discourse on rights-based thinking, reinvented by the philosophers of the Enlightenment by revitalising the antique concept of natural rights, had created an epistemological terrain to introduce also non-human animals to this progressive and expansionist debate in the course of time. Since H.S. Salt's Animals' Rights: Considered in Relation to Social Progress (1894), the literature on the issue, albeit from different epistemological standpoints, has expanded greatly. Academic and philosophical debate was particularly revived during the 1970s, following certain avant-garde works on speciesism.

Simultaneously, specific rights allocated to urbanity, which were finally categorized under third-generation (solidarity-based) rights, would be a consequence of the embodiment and particularization of rights-based thinking as per the city and urban life. They now are widely known as urban rights within a rather liberal context, and the right to the city from a critical and/or neo-Marxist approach. However, until now, there has not been a theoretical effort to intertwine these two progressive debates on animal rights and the right to the city. This study is an attempt to bridge this gap from an interdisciplinary perspective. The specific focus of the research is stray animals, who silently tell the oldest story of co-habitation and co-adaptation between two species, yet who have, in the end, been structurally disregarded.

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Viral Fear: The Global Ebola Response

Research in the social sciences on epidemics has detailed the emotions of those directly impacted by a disease. Yet as the Ebola panic in the global North spread over the course of the 2014-16 outbreak, airline travel was restricted, recruitment of health workers hampered, and the possibility of solving the outbreak—the very source of such fear—became intractable. Fear spread beyond the reach of the virus itself. But how? Building on work in sociology and media studies, this interdisciplinary project examines epidemic emotions from the perspective of international organisations and remote publics.

Emotion scholarship has predominantly focused on individual states, with less attention to collective, digital, and cross-cultural processes. Tracing viral fear is key to understanding how a rising death toll in West Africa connects disparate events across the globe. From an infected nurse in Spain to a schoolyard attack in the Bronx—viral fear connotes both a fear of the Ebola virus and its virus-like spread during an outbreak.

Through cross-national comparisons and innovative digital data sources, the project findings move the study of emotion out of the laboratory and into the global, digital fray. In a hyper-connected world, understanding viral fear is critical to creating effective global health policies.

Christophe Delory

HWK Fellow

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3/2019 – 10/2019

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U-Boot-Bunker Valentin—to Photograph the Absence

My topic at the HWK is to have a look at the Bunker Valentin. This bunker is in a suburb of Bremen and was built between 1943 and 1945 by 12,000 workers: forced civilian labourers from Eastern and Western Europe, Soviet prisoners of war, Italian military internees, concentration camp prisoners, and inmates of the labor re-education camps of the Bremen Gestapo. All of them were working under extreme pressure day and night.

The shipyard was to eventually produce one German U-boat submarine type XXI every two days. Approximatly 2,000 men died during the construction phase. In 2015 the bunker became the "Denkort Bunker Valentin". The purpose of my study is to reflect on the lasting connection between the Bunker, the neighbourhood, and direct and indirect witnesses still alive today.

The goal is to present the history of the bunker using photos as well as portraits of and interviews with the people who live in Bremen's Farge quarter today. The subtitle "to photograph the absence" is to reflect on the present absence of workers and submarines, thus the tragic conclusion of a factory that was never put to work to produce what it initially had been constructed for (in March 1945, the bunker was 90% complete and most of the equipment had been installed. The production of U-boats was to start within two months).

A study comparing the Bunker Valentin to the shipyards in Brest or St Nazaire, or any other place in the world, is planned to be produced at the end of the stay.

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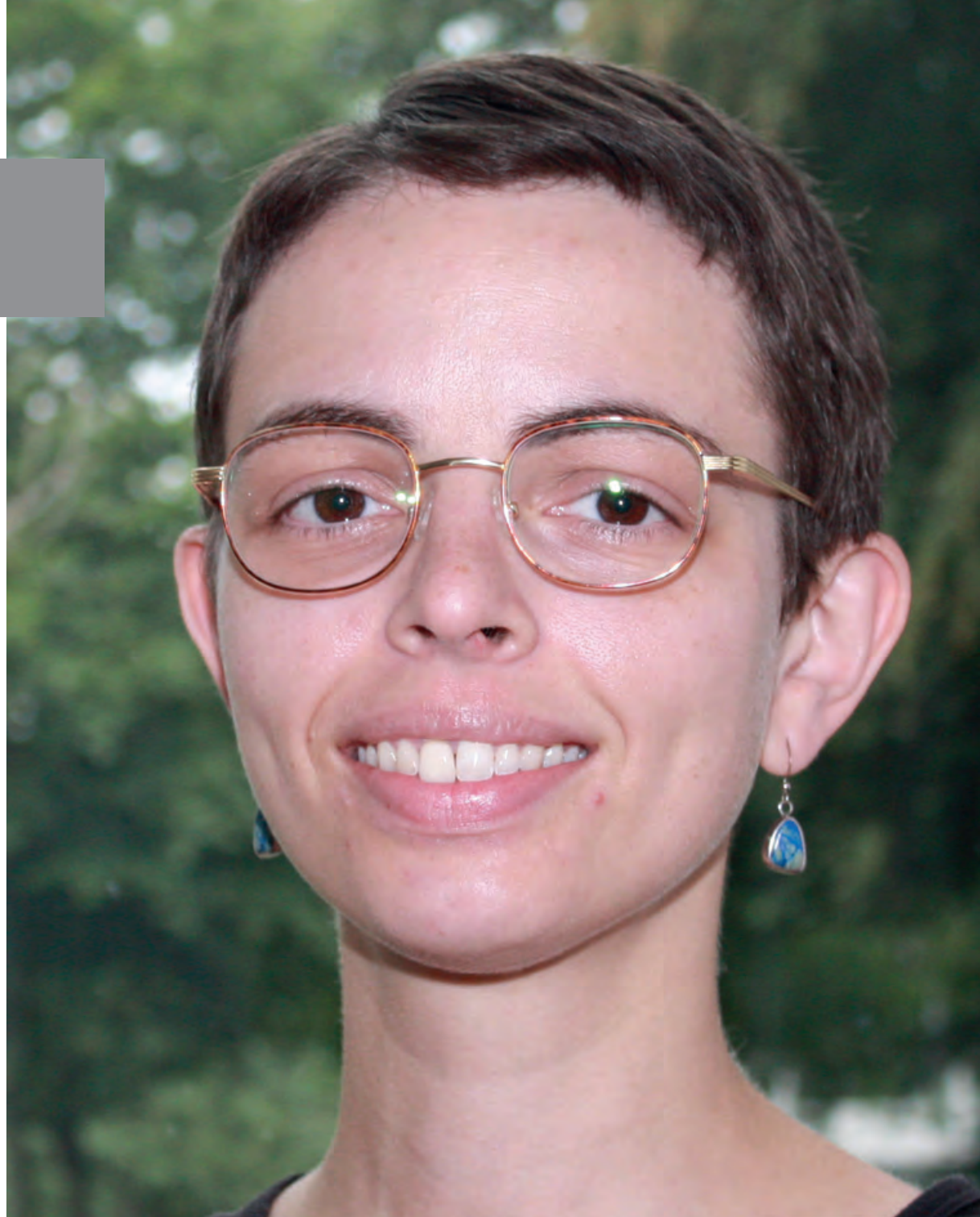

Revenge Porn and Community Accountability: Design Interventions

Sexting is relatively common: around one-third of older teens and well over half of young adults choose to share personal sexual images with partners. While most respect one another's privacy, some people choose to share or post another person's private sexual images without permission; this online abuse is popularly known as revenge porn. The current legal, social, and technological responses to revenge porn do not address the root causes of sexual violence or the fact that it often occurs within intimate relationships. Instead, in this project I look for ways to address revenge porn by turning to community accountability models of justice. These models recognize that violence committed by an individual emerges out of a social context and a community—and that the community is both responsible for and capable of addressing it.

While the unique harms of revenge porn rely on familiar issues of sexism and sexual shaming, what is new is the way these images can rapidly travel through digital social networks.

This project asks: How could those networks also be used to address revenge porn? Using interviews with victims, perpetrators, designers, and activists, this project will develop ideas for how the design of social media platforms and mobile phones could help both communities and perpetrators address revenge porn. Ultimately, this project argues that social media and communication systems should include better ways to prevent and address online harm in their design.

Prof. Dr. Ward Keeler

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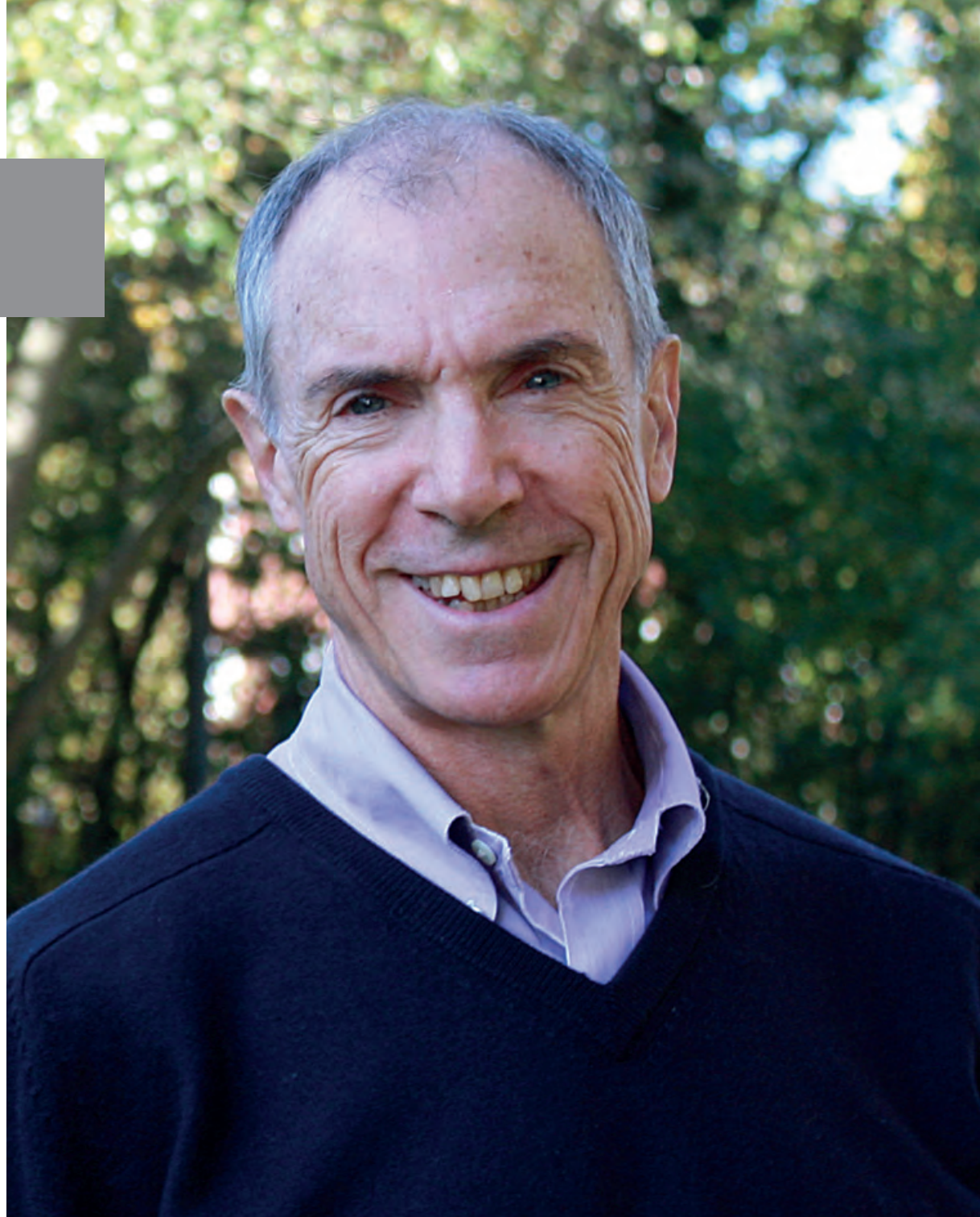

The Aesthetics of Restraint in Tumultuous Times

I intend to write a book entitled *The Aesthetics of Restraint in Tumultuous Times* that analyzes developments in the performing arts in the three Southeast Asian societies (Java, Bali, and Burma) where I have done extensive fieldwork. In all three, the classical arts have suffered serious declines in popularity. My intention is to consider how these developments fit into the larger context of the many changes taking place in Southeast Asia today.

Classical genres in Southeast Asia reflect hierarchical concerns by focusing on style more than narrative, and on fostering emotional restraint rather than engagement. Aristocratic ideals favor physical and emotional restraint in the arts because self-control—the ability to vanquish impulses—implies the ability to control not only the self but also others and indeed the world.

Hierarchical ideology has lost its persuasiveness for many Southeast Asians. Yet that has led only to a greater emphasis upon material wealth and reformist religious practices. Status concerns, still dominant, are now justified with reference to consumerist and spiritual modernity. These changes are reflected aesthetically in the rise in popularity of religious performances and of highly gendered and simplifying genres in which style matters little and melodramatic narratives come to the fore.

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The February Days, 1917: The Downfall of the Old Regime and the Politics of Russia's Failed Attempt at Democracy

The Russian Revolution of February 1917 was a defining event of the twentieth century. In nine short days, the centuries-old tsarist regime was overthrown, and a chain of events was set in motion that led to the disintegration of the Russian empire and the rise of the Soviet regime that would come to dominate the world stage. The February Revolution also constitutes one of the most exciting, innovative, and formative events in all of Russian history.

The lessons of the revolution transcend the year of 1917, since many of the institutions, practices, and attitudes it introduced lasted through much of the Soviet period, with ramifications until the present day.

The book I intend to write will rely on a wide range of previously unavailable archival sources to explore how pre-revolutionary ideas shaped revolutionary politics in February 1917 and defined the form and composition of the Russian Provisional Government.

More broadly, the book will focus on ideas and elite politics to explain Russia's failed transition to democracy in 1917, with global implications for modern and contemporary revolutions, including Eastern Europe and the Arab Spring.

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Sexual Ageing in the History of Medicine

The project is about the different historical periods in changing medical concepts of menopause, andropause, sex-specific aging and longevity from the 1600s to the 2020s. It will reveal how ideas about aging, longevity and the sexes have changed across history and nuance our current views of old age, relevant to an increasing number of people in aging populations. This project will expose the importance of a massive body of overlooked nineteenth-century sources that have shaped modern views of sex-differentiated aging and longevity. It will identify how the various biomedical concepts of aging emerged and will identify the origins of common contemporary expectations that sexual desire declines with age. It will consider both historical and contemporary forms of medical evidence, exploring how changing ideas and individual experiences of sex-specific aging may be a product of both cultural attitudes and of the new bodily experiences of everyday life in Western modernity. The project will have a high impact as a result of being a global history of modern concepts that combines rigorous survey of overlooked historical sources with consultation of current scientific evidence. It will produce the first ever monograph on *Sex, Gender and Aging in the Global History of Biomedicine*.

Assoc. Prof. Dr. Philipp Rehm

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Lifting the Veil of Ignorance: Information and the Welfare State

One of the most important purposes of the welfare state is to provide insurance and it is well known that information critically shapes its provision. Yet, rather than playing the central role it warrants, information barely makes an appearance in the contemporary literature of welfare states in advanced industrialized countries. This is all the more surprising as we are living in an age of transformative changes in private insurance markets, spurred by the information revolution. These developments will reshape the politics of the welfare state, too.

There are two aspects of the information revolution that are consequential for welfare state politics. First, more information deepens the redistributive conflict of social insurance because it more clearly cleaves winners and losers. Second, the increased ability to share information allows for accurate individual risk assessments. This solves the adverse selection problem, a key obstacle for private insurance markets, making such markets potentially feasible and attractive to "good risks" currently covered by mandatory public programs that subsidize “bad risks.” This would undermine the broad support welfare states historically enjoy.

In my project I explore the relationship between "Information and the Welfare State" theoretically and empirically in order to understand the challenges ahead.

Assoc. Prof. Dr. Melanie Tanielian

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"HUNGERTOD!" The History of "Civilian Insane" During World War I

"HUNGERTOD!" From 1914 to 1920, around the globe, the death rate of civilians in mental health institutions was truly staggering. During these six years, 70,000 civilians died in Germany's psychiatric hospitals of starvation and malnutrition. In Britain, the death rate of civilians in "insane asylums" rose to twenty percent in one year, 1918.

Examining the socioeconomic, cultural, and legal contexts, this project interrogates the treatment of so-called civilian lunatics in Germany and Great Britain and their respective allies in the Ottoman Empire and the United States during World War I.

Through archival work and comparative analysis of psychiatric hospitals and the treatment of their patients in times of crisis, this project sheds light on inequitable national policies of entitlements based on civilians' positionality in the hierarchy of citizenship. Therein, the project contributes to an increasingly global history of World War I while paying close attention to local contexts.

Assoc. Prof. Dr. Inés Valdez Tappatá

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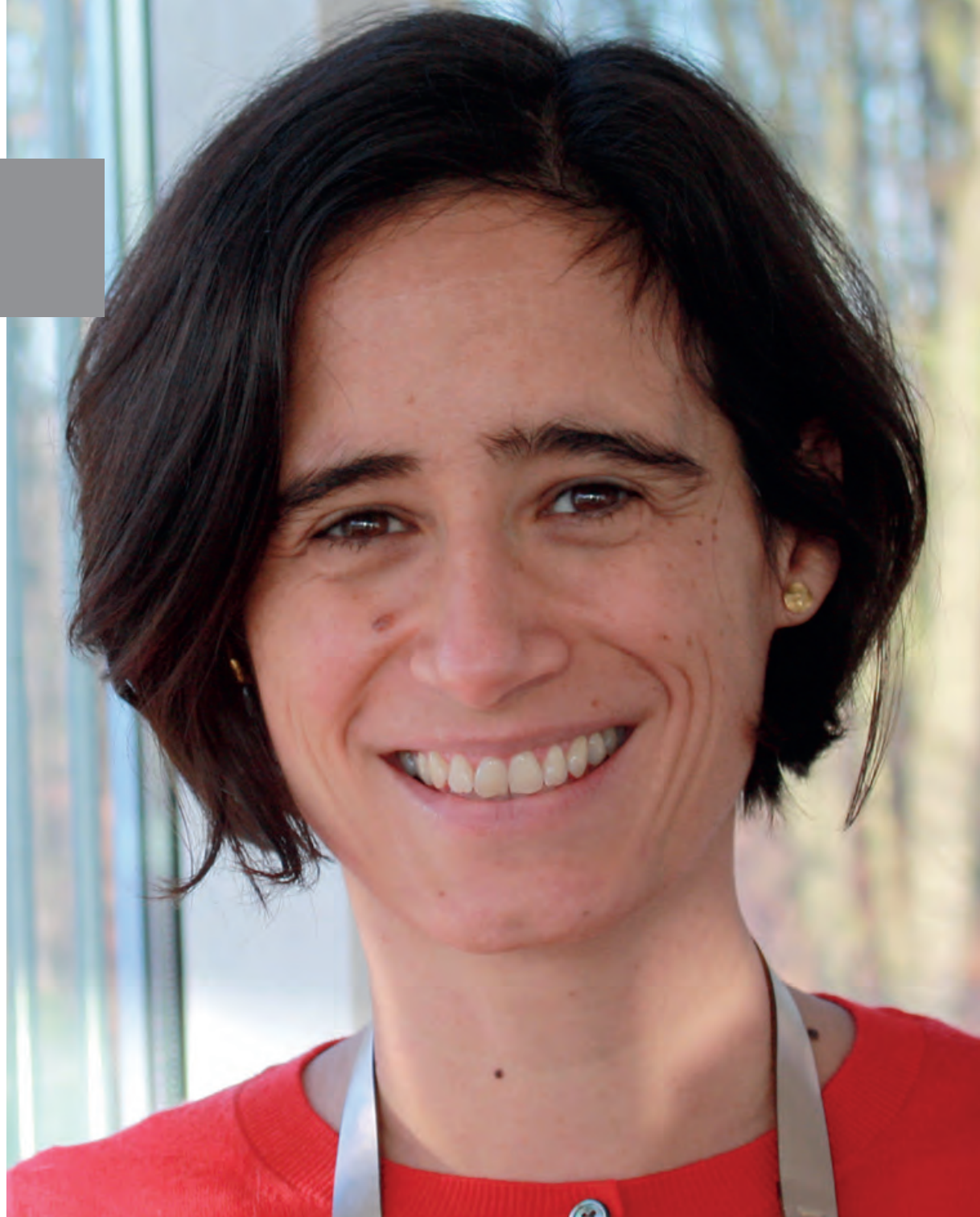
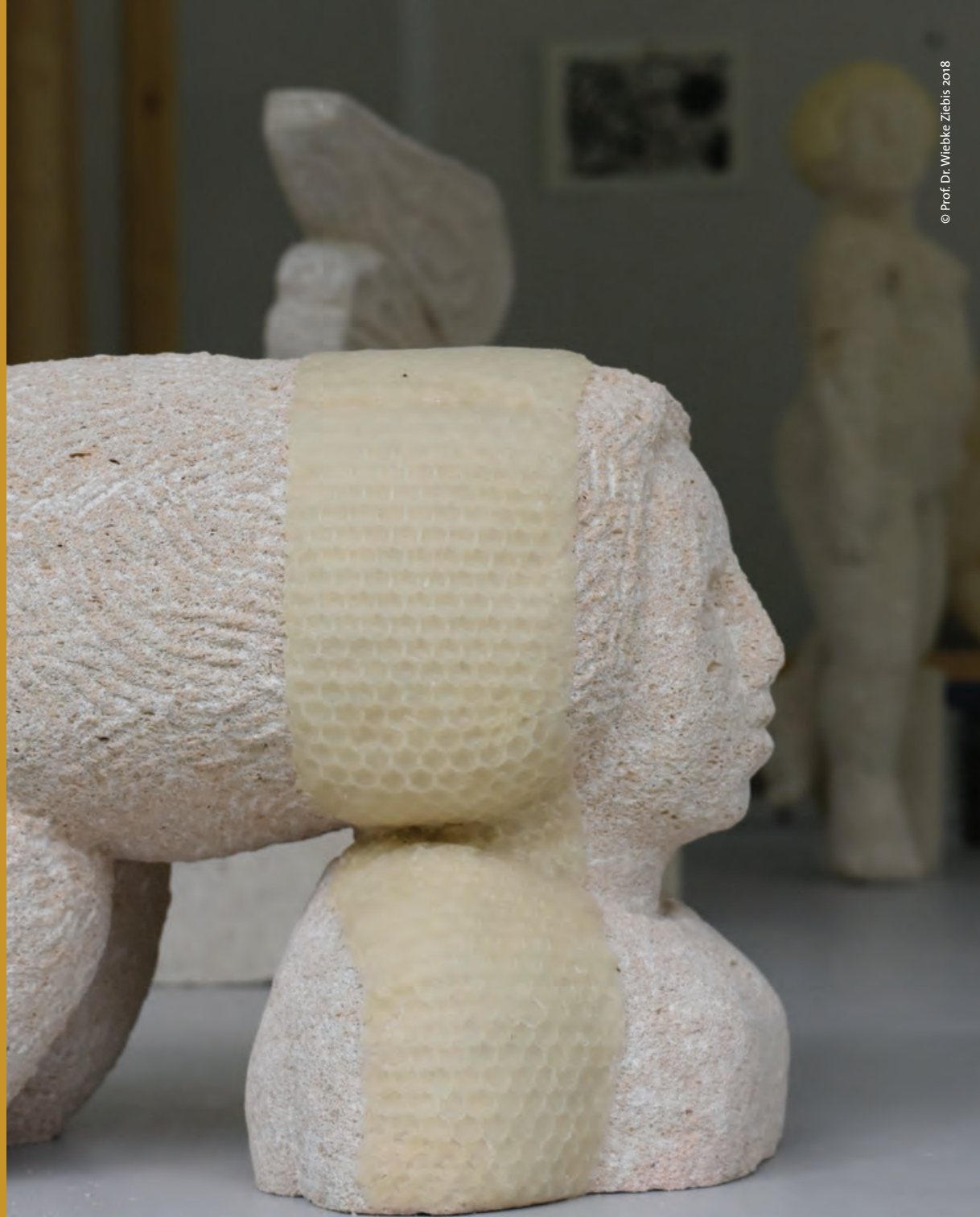


Kant, Du Bois, and Cosmopolitanism in a New Color

The literature on cosmopolitanism—roughly defined as the idea that all human beings belong to a single political community so that certain responsibilities apply beyond national borders—has enjoyed a resurgence in the last three decades. This is likely due to the increasingly interconnected character of human social, political, and economic relations and the questions of justice that inevitably emerge.

Given the contemporary concerns of this literature, it might sound odd that Immanuel Kant's late eighteenth century cosmopolitanism is one of the most influential framings for this tradition. My book project, *Cosmopolitanism in a New Color*, examines critically this predominance and argues that a more thorough examination of Kant's thought is necessary to assess its ability to inform our thinking today. Through a novel historical reading I show that one of Kant's cosmopolitanism prime motivations was to guarantee peace in Europe, thus making his framework ill-equipped to cope with the challenges that a highly unequal world poses. While I retain certain Kantian insights, I complement them with the intellectual resources of W. E. B. Du Bois, a black American intellectual that wrote in the first half of the twentieth century, opposing colonialism and connecting racial domination within the United States to that of the colonies. This focus on transnational domination, and unequal access to sovereignty is a valuable resource to think through contemporary challenges.



Arts & Literature 2019

Assoc. Prof. Dr. Catherine Bush

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Elemental (Novel)

After speaking out about the extremities of arctic melting, a prominent climate change scientist finds himself set upon by climate change deniers and ousted from his university position in the US. His life overturned, he flees with his young daughter to a remote island in the north Atlantic. Years later, as a massive hurricane churns up the North American east coast, he lures three men to the island with the promise of a geo-engineering experiment that may help lower planetary temperatures: a flamboyant airline magnate interested in supporting such a project through his tech innovation fund; the magnate's corporate-world brother; and a notorious climate-change denier.

The novel, which takes place over thirty-six hours, alternately follows the scientist's daughter, nineteen-year-old Miranda Wells, and Caleb Borders, a local youth who works for scientist Michael Wells and whose life has become inextricably and painfully entangled with that of Wells and his daughter. Miranda and Caleb are both desperately trying to figure out what her father is up to: has he really been working on a secret climate-engineering project to alter the weather? Frank Hansen, the young man who falls into Miranda's life after washing up in the cove where she lives, is also set on discovering the identity of the three visitors and why they have come to the island. This is a contemporary retelling of Shakespeare's *The Tempest*, set on a fictionalized version of Fogo Island off the coast of Newfoundland.

The novel is an exploration of climate change as a form of intergenerational struggle, the moral implications of intervening to forestall further temperature rise and runaway feedback loops, and a story that asks questions about how we live in this already changed world we've created for ourselves.

Björn SC Deigner

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02/2019 – 05/2019

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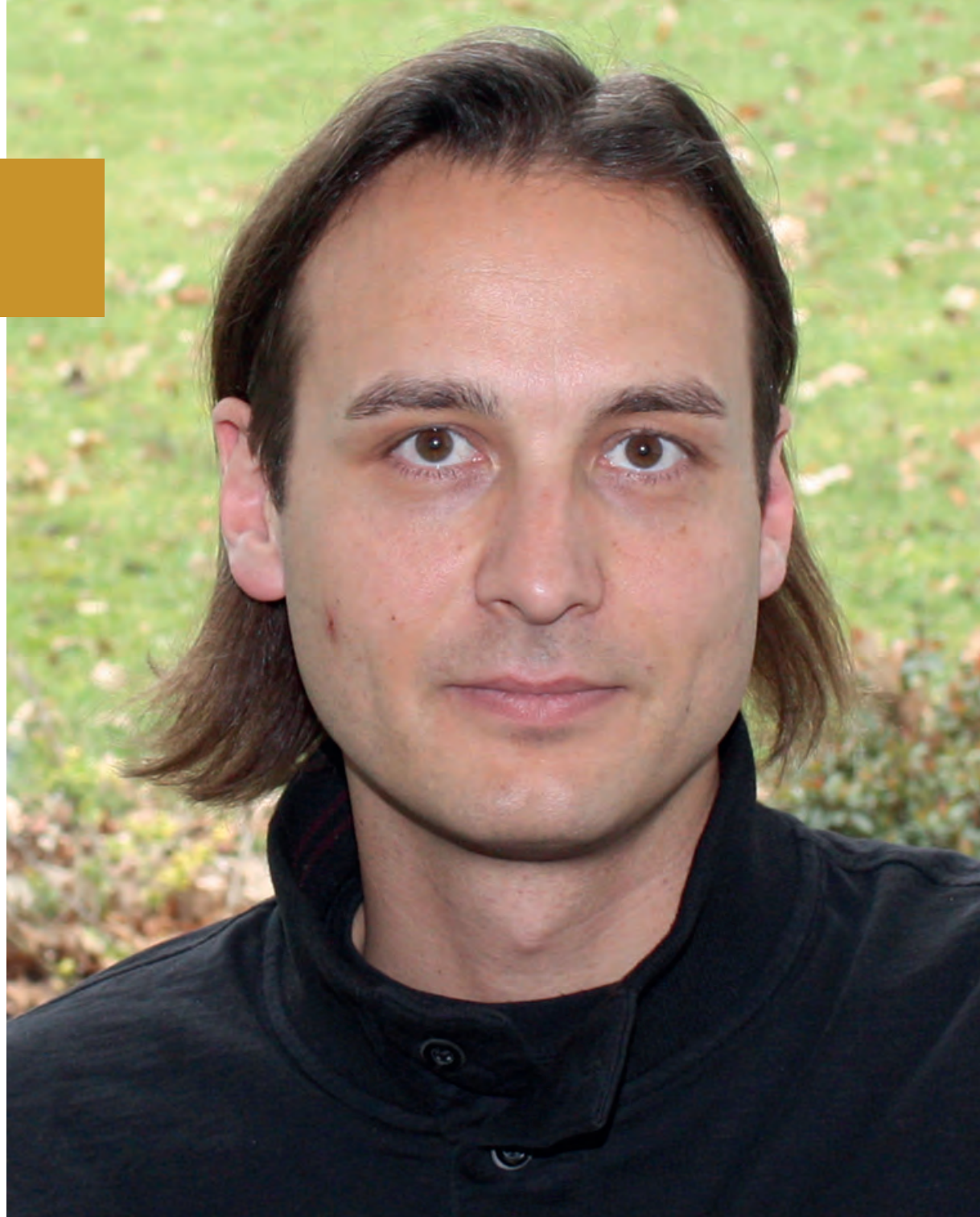
Staatstheater Oldenburg
Fiction Meets Science Project



Mission Mars (Theatre Play)

Mission Mars is a playful way of dealing with the question if we are rather a species that will learn to live sustainably and find ways of life in harmony with the capacities of our planet, or if we are nomads who expand while we exist: across continents, the whole planet, and in the end even into space. The question if we will one day live on Mars is not only a scientific one; it is a question about who we are and who we want to be as a species.

The first part of the theatre play is a TED talk planting the idea in the heads of the audience that it might be quite realistic —even more: necessary—not only to visit Mars but to live there. With that in mind, we switch the scene: three people in space suits walk over a rocky area: the female commander Alex and the two astronauts Christian and Ulf, performing tasks that Mission Support sends them via video message.

They are challenged by even the easiest things, like taking rock samples with the huge gloves of their space suits. As they get caught in a sandstorm they lose contact and Alex is trying to reach the habitat with oxygen running out. When a guy from Mission Support appears to deliver food and other supplies to the habitat it becomes clear that this is in fact a long-term simulation of a mission to Mars.

During the second part of the simulation, outside excursions are cut down, food supplies dwindle, and mental stress reaches its peak. Reality for Alex starts to blur as days become indistinguishable and conversations seem to repeat themselves. With a critical situation at hand but nobody at Mission Control who can be reached, the terranauts find themselves in a Mars-like situation, in the end having to generate water and grow plants to survive.

Lida Sherafatmand

HWK Fellow
Artist in Residence

Fellowship
06/2019 – 09/2019
12/2019 – 01/2020

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Neuroscientific Aesthetics

After 20 years of steady painting and research, I have developed an artistic concept which I am calling "florescence". This artistic concept focuses on an expression of florescence, of flourishing and blooming, that is. I explore organic forms in my paintings and integrate results from the social sciences in the works in order to link the paintings with the social realities that we live in as humans on earth.

At the HWK, I take a step further in my work, by exploring organic forms and patterns which are not externally visible to our eye. These would be patterns inside the body's neurological functions. I believe the forms and shapes created by nature are all interconnected at some level, and I would like to explore this interconnectedness further through experimentation to bring out those forms/patterns in my paintings and see whether the viewers experience deeper connections with them as a result; to explore how far such patterns can create a resonance in the body and mind of the viewers.

In an age of digital life and artificial intelligence, it is important not to lose too much touch with our human connections and I would like my paintings to be a connecting point in that regard, to contribute to us keeping our balance and human warmth in society.

Dr. Padma Venkatraman

HWK Fellow
Writer in Residence

Fellowship
12/2018 – 01/2019
07/2019 – 09/2019

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Susan Gaines
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Ocean Crossings (Novel)

In the semi-autobiographical novel, I intend to write vignettes that explore aspects of oceanography intermeshed with the story of a young Indian immigrant in the United States who is an oceanographer. When she is called away to attend her mother's funeral, she is forced, not only to literally fly across the ocean but also to face other oceanic divides that she is crossing: gender gaps, racial prejudices, and culture clashes.

In parallel, and in preparation for the novel, I am also writing a series of loosely connected essays that form a memoir of my experience at the HWK and are inspired by questions that explore how certain voices have been suppressed both in terms of the literature and science of the oceans. For example: How does culture shape science? What assumptions about gender, race, ethnicity etc. shape our attitudes toward scientific progress and how do they inform our narrative of the history of science? In what ways do our paradigms of scientific history, notions of feminism and cultural frameworks shape the language we use to communicate scientific thought? How is one's personal history informed by social, historical and cultural contexts, and when do such contexts intersect? How have these forces informed the study of literature related to and inspired by the oceans? What voices and viewpoints remain underrepresented, understudied, or unrecognized in marine-themed literary collections and our narratives of the history of ocean science?

Future Fellows

- a selection

2020

Dr. Marianna Anichini

HWK Junior Fellow

Fellowship
01/20 – 10/20

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Being a Selfish Soloist or a Cooperative Chorister? Rhythmic Tuning and Turn-Taking in Seal Pups' Choruses.

Imagine you are shopping in a crowded market with your daughter. Many chatting people are crossing your path and she gets lost in the crowd. Although she is trying to call you, her voice is drowned out by the noisy environment. Now imagine being a female seal looking for her pup within a colony of seals. The pup's call is lost in a mixture of hundreds of other conspecifics, which are all trying to attract their mothers. In both contests, individuals have to deal with a common problem: analyze different acoustic inputs and adjust their signals to increase their detectability.

In this project, I investigate whether and how individuals vary their vocal rhythm in response to conspecifics' calls. I suggest that harbour seals are ideal species to test these predictions, thanks to promising previous findings on vocal production and temporal tuning abilities. Living in large colonies, the timing plasticity of the pups' call could be a crucial socio-ecological trait to increase the survival chances of the pups' themselves.

Therefore, I test whether pups of harbour seals 1) interact vocally during the silence of the neighbours' calls; 2) maintain their timing strategy, independently of the group's size and composition; 3) and display an inter-individual variation in calls' timing.

With this project, I aim to provide insights into the functional meaning of rhythmic behaviours and their connections to vocal production and social cognition in a noisy environment.

Assoc. Prof. Dr. Shauna A. Murray

HWK Fellow

Fellowship
06/2020 –08/2020

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PD Dr. Mona Hoppenrath
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The Role of Selection in the Evolution of Toxin-Producing Dinoflagellates in the Sea

Phytoplankton, or marine single-celled algae, inhabit marine and freshwaters. One group of microalgae, the dinoflagellates, can occasionally dominate an ecosystem under certain conditions. Dinoflagellates can produce highly toxic compounds, which cause damage to aquaculture and fishing industries if they accumulate into seafood, as part of a harmful algal bloom (HAB). Saxitoxin (STX), produced by species of the dinoflagellate Alexandrium, is considered a "Schedule 1 Chemical Weapon" under a United Nations Convention, and acts as a neurotoxin. Along the east coast of Australia, the major boundary current is the East Australian Current. In this region, STXs occur in seafood, and can lead to substantial economic and health impacts. For example, a single bloom of Alexandrium led to a loss of ~$ AUD 23 million to the Tasmanian seafood industry.

In the species Alexandrium pacificum, large differences in toxicity can occur in strains from the NSW south coast region compared to other areas.

In my project, I examine the genetic and population ecological basis for differences among strains. I also examine the role of evolution via selection in the evolution of differences among strains, including differences in toxicity. If targeted genetic tools can be developed as an early warning system for HABs in this region, the information gained will be important in order to accurately predict harmful algal related toxicity in Australia's largest shellfish aquaculture region.

Prof. Dr. Andreas Teske

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Fellowship
01/20 – 07/20

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Institute for Chemistry and Biology of the Marine Environment (ICBM), University of Oldenburg

Microbial Processing of Fossil Organic Carbon in Hydrothermal Sediments of the Guaymas Basin

Fossil carbon, for example petroleum and gas, is not only used by human civilization but also by microorganisms and entire ecosystems that rely on these unusual carbon sources. We are learning more on the unusual microorganisms that are using hydrocarbons as a nutrition and energy source thanks to their novel biochemical capabilities and pathways, and how these organisms are influencing the fate of petroleum and gas in nature. By the same token, such knowledge should be useful to deal with the consequences of releasing hydrocarbons into the biosphere.

Studying these microorganisms and processes requires an ecosystem where hydrocarbon-processing organisms are consistently abundant and the processes active; the oil-rich hydrothermal vent site of Guaymas Basin in the Gulf of California is an excellent candidate. No other marine oil seep has already yielded such promising discoveries on all aspects of microbial hydrocarbon utilization, from identifying and cultivating the organisms themselves, to tracing the hydrothermal and microbial changes in organic material within the sediments, and to track the fate of hydrocarbons under microbial attack.

Having joined my research cruises to Guaymas Basin, or doing so in late 2019, my research partners at the Max Planck Institute for Marine Microbiology, the University of Bremen, and the University of Oldenburg have set the stage for a multi-disciplinary investigation of the Guaymas Basin oil-processing ecosystem.

Dr. Kamal Hajian

HWK Junior Fellow

Fellowship
11/2020 – 08/2021

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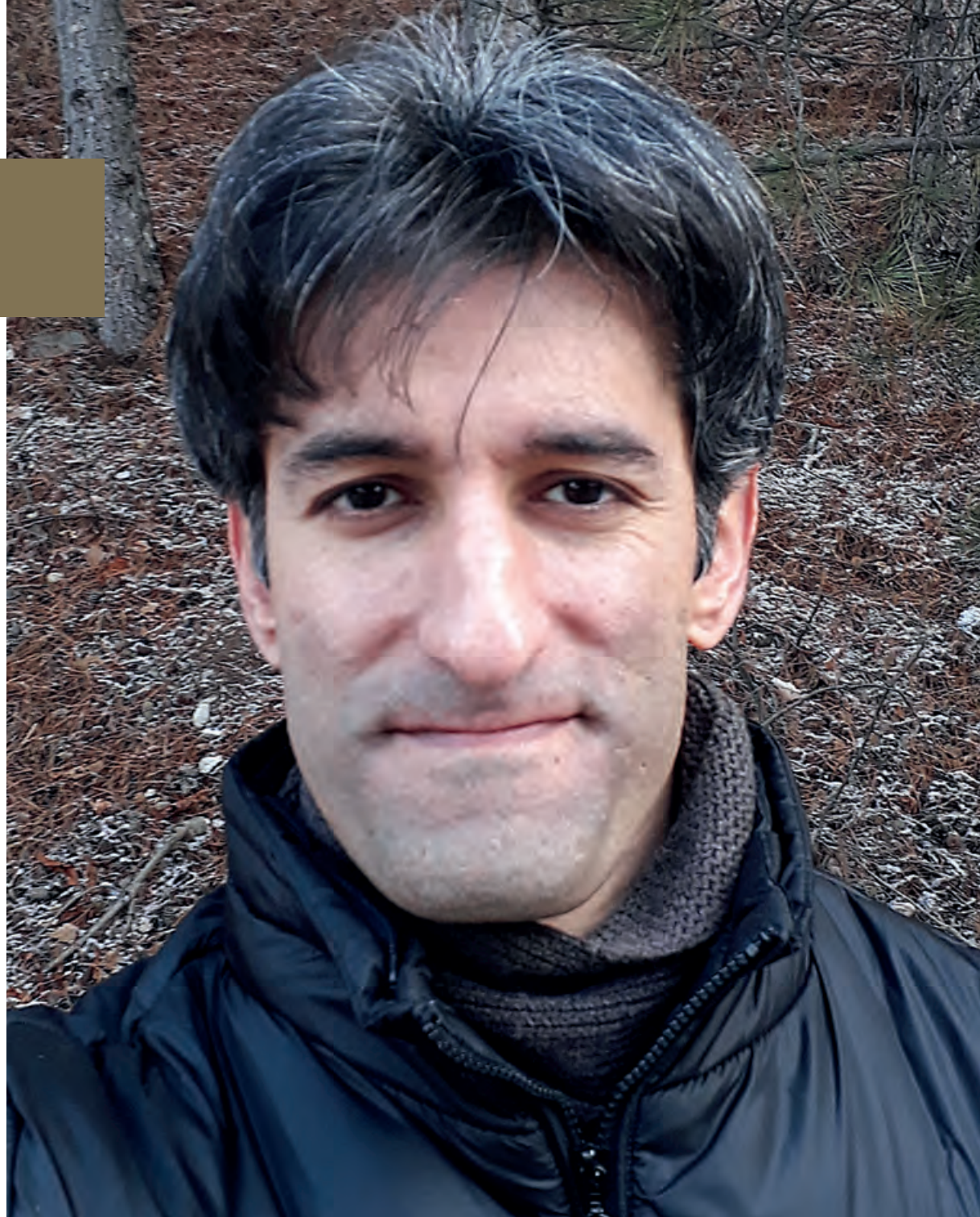

Gravitational Waves, Memory Effect, and Black Hole Microstates

After observation of gravitational waves in 2015, investigation of different aspects of this interesting phenomenon has been an active line of research in physics. One important aspect of these waves is the memory effect: when such a wave passes through an empty region of space, it affects the empty space and leaves a memory imprint behind. This effect is different from other such imprints (e.g. on hard disks in our computers). This memory imprint is saved in an empty region of space where no matter is present. The data in the gravitational memory effect is encoded in some conserved charges which are called "soft hairs". This amazing feature of the nature opens a gate to our understanding of the nature of spacetime. Specifically, the memory effect is related to black hole physics.

About 40 years ago, physicists discovered that black holes exhibit interesting features: they have some (yet unknown) microstates which can carry and save information. In fact, black holes are known to have the highest capacity-to-volume ratio for saving information. Nonetheless, it is still a mystery how to identify the physical entities which are responsible for carrying such information. Recently, there has been progress in this interesting line of research by identifying the soft hairs of black holes. The soft hairs exist close to its horizon, and are called "horizon fluffs". Studying soft hairs sheds light on some long-standing problems in black hole physics.

Assoc. Prof. Dr. Martin Obligado

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Fellowship
04/20 – 08/20

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Cooperation partner
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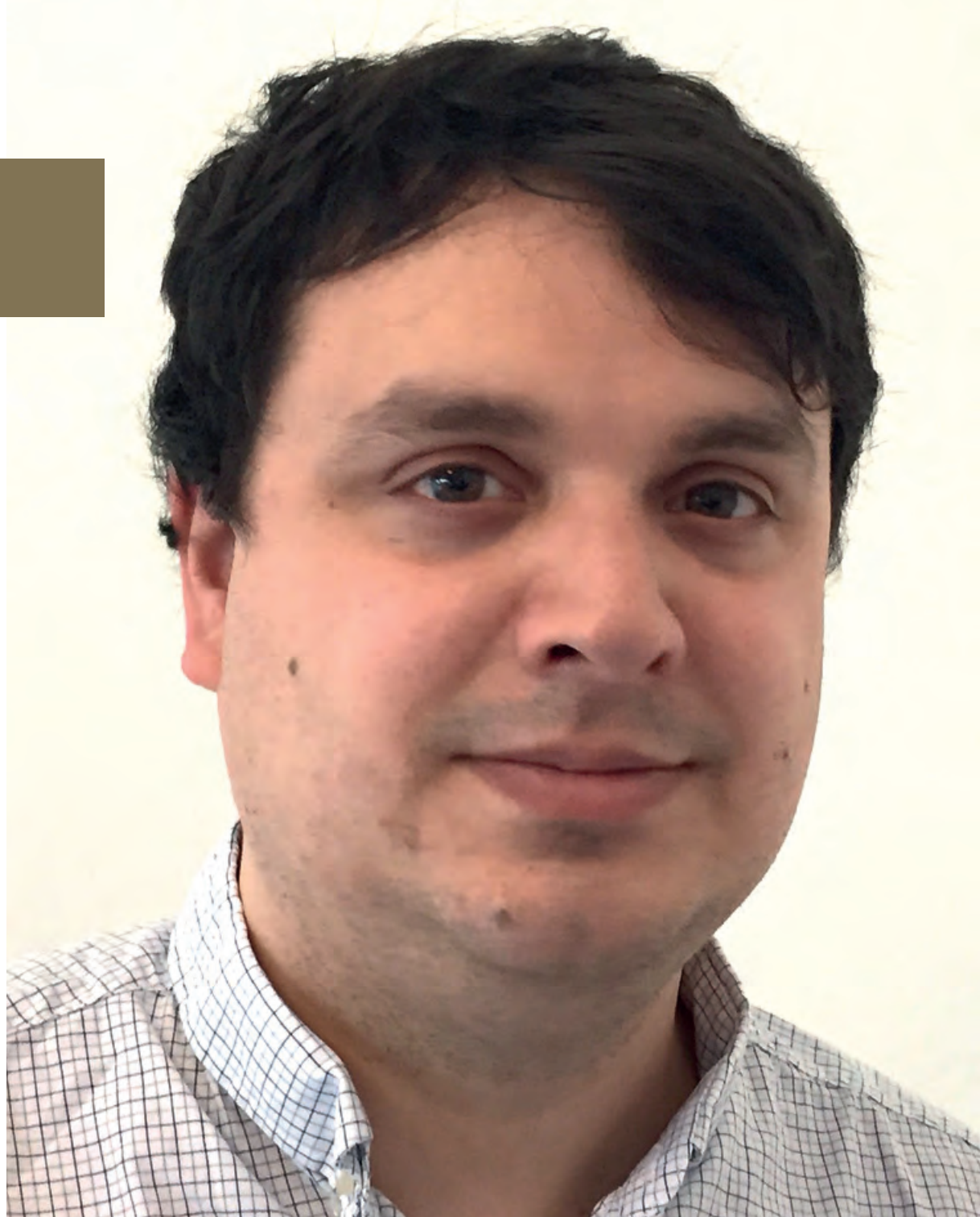

A Benchmark Study on the Role of Turbulent Dissipation in Wind Energy Applications

Over the last years, wind energy research has experienced exponential growth worldwide. In particular, the study of the flow downstream of one or several turbines has captured the attention of the turbulence research community. It is a fascinating problem that involves turbulent wakes, interactions between them, and their coupling with the background turbulent flow.

Despite this growing interest, many recent advances in the modelling of turbulent flows have not yet been adapted to such studies. They concern the understanding of the inner structure of turbulence: the energy cascade. The models show how energy is transferred among large to small scales and how the energy of the flow is dissipated. This complicated phenomenon has been found to ultimately define important properties of turbulent wakes, such as their velocity deficit and how they spread in the direction of the air stream. It has been recently discovered that the standard model, developed by Kolmogorov in the 1940s is not the only one relevant to wind energy applications. Over the last years, a new type of cascade has been identified in these flows. Because the conception and modelling of wind turbines and of wind farms relies on the standard model, it is key to study and characterize the presence of this new cascade in scenarios related to wind energy generation.

In my project I carry out a fundamental study on the energy cascade of the turbulent wakes, and how they are coupled to the background turbulent flow, shedding light on the relevance of the energy cascade on wind energy.

Dr. Tim Dorlach

HWK Junior Fellow

Fellowship
04/20 – 09/20

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The Causes of Regulatory Welfare State Development: Lessons from Nutrition Labeling in Latin America

Chronic diseases, such as cancer and heart disease, have become the world's leading cause of death, responsible for no less than 71% of all 56 million global deaths in 2015. Given that unhealthy diets and the resulting overweight and obesity are major causes of most chronic diseases, public health experts have urged governments to introduce stricter regulations, in particular front-of-package nutrition labeling.

While several attempts to introduce effective nutrition labeling in Europe were defeated by food industry opposition, Chile and several other Latin American countries have become global leaders in the field of nutrition labeling policy. Building on research conducted in Chile, Ecuador, Peru, and Uruguay, my fellowship project examines why and how Latin American governments have been able to address the global obesity crisis so decisively. Specifically, I explain why front-of-package nutrition labeling first emerged in Chile and then spread throughout Latin America over the past decade.

Assoc. Prof. Dr. Carsten Levisen

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The Anglo Order of Knowledge: A View from Postcolonial Semantics

English has become the default language of international collaboration, theorizing, and scientific publication. Yet, this anglicisation of academia, its consequences and complications, is only rarely studied in its own right. All too often English is believed to be transparent—a pure language of human thought and communication. Recently, linguistic research has begun to unravel the shadowy side of international academia's reliance on English, and this project launches a new cross-linguistic and interdisciplinary investigation of Anglocentric concepts, using new techniques from linguistic semantics, and with a postcolonial perspective that allows a critical exploration into "the Anglo order of knowledge".

The goal of the project is to identify and challenge some of the most insidious Anglocentric biases in current global scholarship, but ultimately, the goal is preventive: with cross-linguistic evidence, the project seeks to establish new guidelines for how to improve "the language of knowledge" in globalising academia.

Asst. Prof. Chrissy Kolaya

HWK Fellow
Writer in Residence

Fellowship
01/20 – 05/20

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The Second Voyage of Audley Worthington (Novel)

Based on real conflicts that occurred in the late 1980s in many of the communities under consideration as the site for the Superconducting Super Collider, the world's largest particle accelerator (a project that was eventually begun in Texas, but never completed), *Charmed Particles*, my last novel, tells the stories of a community that finds itself deeply divided. The book received a starred review from Booklist and praise from *Kirkus*; it was one of the American Library Association's best books of 2016, and was featured on the cover of the *Chicago Tribune's* Books Section, *Printer's Row*.

My plan for the Fiction Meets Science Residency is to complete my new and second novel, *The Second Voyage of Audley Worthington*, a book about the disappearance of a 19th Century naturalist. The novel tells the stories of a varied group of characters across time and place, each connected by their shared fascination with the mystery of Worthington's disappearance and his search for the "yu mau", the strange creature said to exist in the island's interior.

In *The Second Voyage of Audley Worthington*, I am working with new narrative techniques and subject matter. My roots are in literary fiction, but in this book, I am experimenting with techniques from the mystery genre and from 19th Century adventure fiction to explore themes that include the relationship of wonder to science, the psychology of cryptozoology (the study of animals not recognized by science), what Gregory Forth, author of *Images of the Wildman in Southeast Asia* calls "the human-animal boundary," and the idea that it is only through "Western experience" that we confirm a phenomenon's "empirical reality".

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