

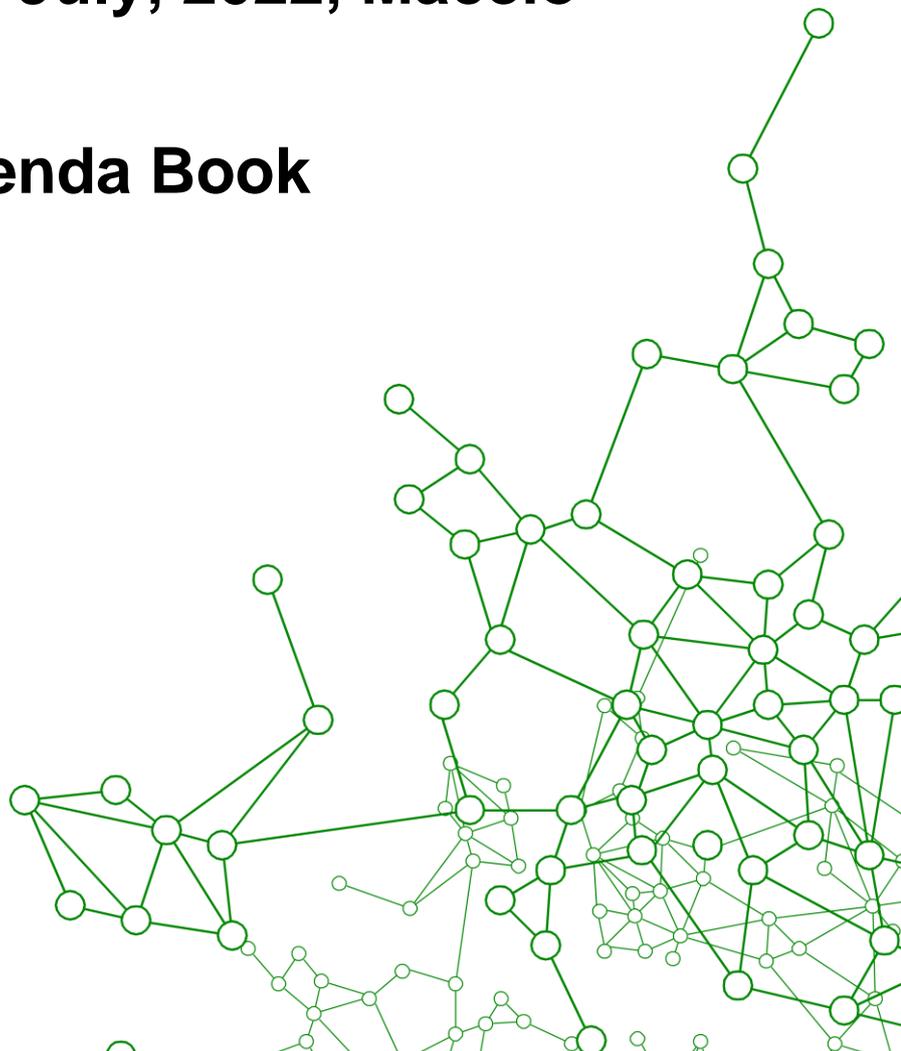


Alexander von Humboldt  
Stiftung/Foundation

# **12<sup>th</sup> Brazilian – German Frontiers of Science and Technology Symposium**

**29 June to 2 July, 2022, Maceió**

**Agenda Book**



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## FOREWORD TO THE 12TH BRAGFOST SYMPOSIUM

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Welcome to the 12th Brazilian-German Frontiers of Science and Technology Symposium. This is the first face to face BRAGFOST symposium after the cases of COVID-19 arose on the planet. The pandemic caused negative impacts in all the areas, from education to health and economy. We need to face old and new challenges and perhaps in different ways. In spite of focusing only on the inefficiencies of the planet as well as in the hegemony of misery, we also need to shed the light on the strengths and the positive aspects of the planet and humankind. This year, the focus of BRAGFOST is well-being. Well-being is not only the absence of illness, misery and inefficiencies, but also the presence of health, growth, strengths, values, positive aspects, prevention, and promotion of awareness of sustainability, fairness, accountability, transparency and ethics.

In our 2022 BRAGFOST, we aim at transversality connecting researchers from different fields of science and technology under the backbone focus on well-being, by addressing and reflecting on different challenges, from small molecules to global behavior. Some key questions we should shed light on are: What are the positive and negative implications of artificial intelligence and machine behavior on the sustainable development of the planet? How global human behavior impacts the world and is impacted by machines? How small molecules impact our perception, mind self-awareness, and neuronal stimulus processing? How endogenous and exogenous bioactive molecules help in constituting “well-being”? With a great inspiring atmosphere, we will bring researchers to the beautiful city of Maceió, Alagoas, Brazil to connect among four different topics that share the theme of well-being as an ultimate goal.

# ORGANIZING COMMITTEE

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## Co-Chairs:

**Ig Ibert Bittencourt**

NEES - Center of Excellence for Social Technologies, Universidade Federal de Alagoas - UFAL

**Stefan Schiller**

Center for Biological Systems Analysis (ZBSA), University of Freiburg

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## Members of the Organizing Committee

### Ethics and Epistemology for Artificial Intelligence and Machine Behavior

**Miriam Wimmer**

Brazilian Institute of Education, Development and Research (IDP)

**Mrinalini Kochupillai**

Technical University of Munich, TUM School of Engineering and Design, Department of Data Science in Earth Observation

### Global Human Behavior and Big Data

**Rafael Ferreira**

Cesar School and Universidade Federal Rural de Pernambuco (UFRPE)

**Slava Jankin**

Data Science Lab, Hertie School Berlin

### Psychopharmacology and Perception

**Fernanda Palhano-Fontes**

Brain Institute, Federal University of Rio Grande do Norte

**Hamid Noori**

McGovern Institute for Brain Research, Massachusetts Institute of Technology

## **Bioactives and Resources from Remote and Endangered Natural Environments**

**Paula Bueno**

Department of Chemistry, Federal University of Alfenas

**Serhat Sezai Cicek**

Department of Pharmaceutical Biology, Kiel University

## **LIST OF SESSIONS**

(Session speakers in alphabetical order)

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### **Ethics and Epistemology for Artificial Intelligence and Machine Behavior**

**Organizers:** Miriam Wimmer & Mrinalini Kochupillai

#### **SPEAKERS:**

#### **Challenges in AI policy: learning from soft law perspectives**

*Anna Jobin, Alexander von Humboldt Institut for Internet and Society*

#### **Challenges to the regulation of artificial intelligence**

*Caitlin Mulholland, Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio)*

#### **Large-Scale Geo-Data Mining for Good**

*Conrad Albrecht, Remote Sensing Technology Institute, German Aerospace Center Wessling*

#### **Towards legally compliant and ethically responsible information systems**

*João Paulo Almeida, Department of Informatics, Universidade Federal do Espírito Santo (UFES)*

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## Global Human Behavior and Big Data

**Organizers:** Rafael Ferreira & Slava Jankin

**SPEAKERS:**

**AMIGO – Algorithmic Method for Improved Group Formation Online**

*Henrik Bellhäuser, Institute of Psychology, Johannes Gutenberg-University Mainz*

**Eating behavior and sustainable diets: the impact on human health and environmental sustainability**

*Ilana Nogueira, Universidade Estadual do Ceará (UECE)*

**Preclinical Cell and Tissue Models for the Pharmacological Characterization of Nature-based Medicines in the Context of Inflammatory Bowel Diseases**

*Mirco Schonfeld, University of Bayreuth*

**Understanding Societies from their Digital Records**

*Pedro O.S Vaz de Melo, Universidade Federal de Minas Gerais – UFMG*

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## Psychopharmacology and Perception

**Organizers:** Fernanda Palhano-Fontes & Hamid Noori

**SPEAKERS:**

**Project DevelopmentAL: Identifying targets and elaborating strategies for the prevention of developmental disorders**

*Danielle Macedo, Neuropsychopharmacology Laboratory, Drug Research and Development Center, Faculty of Medicine, Universidade Federal do Ceará.*

**A clinical and cognitive neuroscience approach to the study of self-awareness**

*Daniel Mograbi, Pontifícia Universidade Católica do Rio de Janeiro – PUC-Rio*

**Preventive approaches and new technologies - future directions in psychiatric treatment**

*Nadine Bernhardt, Department of Psychiatry and Psychotherapy, Medical Faculty Carl Gustav Carus, TU Dresden, Dresden, Germany,*

## **Towards capturing the neurobiological basis of perception in the design of artificial intelligence systems**

*Marcel Oberlaender, Max Planck Institute for Neurobiology of Behavior*

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## **Bioactives & Resources from Remote & Endangered Natural Environments**

**Organizers:** Paula Bueno & Serhat Sezai Cicek

### **SPEAKERS:**

#### **Combining natural product's synthesis with sustainable CO<sub>2</sub> utilization**

*Daniel Garbe, Werner Siemens-Chair of Synthetic Biotechnology, Technical University of Munich*

#### **Computational Chemical Biology: perspective on bioactive compound discovery**

*Ricardo Roberto Silva, School of Pharmaceutical Sciences of Ribeirão Preto, Universidade de São Paulo (USP)*

#### **The chemistry hidden in the biological interactions found in the citrus host**

*Taícia Pacheco Fill, Chemistry Institute, Universidade Estadual de Campinas (Unicamp)*

#### **Exploiting Biological and Chemical Diversity of Fungi from Different Sources**

*Yasmina Marin-Felix, Department Microbial Drugs, Helmholtz Centre for Infection Research*

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## SESSION ABSTRACTS

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### **Ethics and Epistemology of AI and Machine Behavior**

*Miriam Wimmer, Institute of Education, Development and Research (IDP)*

*Mrinalini Kochupillai, Technical University of Munich, TUM School of Engineering and Design,  
Department of Data Science in Earth Observation*

Ethics is about understanding and distinguishing between right and wrong, good and bad. Ethics is also about emphasizing constructive and “appropriate conduct associated with” basic human “values” such as honesty, responsibility, and integrity, and not merely about “discover(ing) inappropriate conduct.” As a discipline, ethics is partially pre-occupied with identifying and finding ways of resolving values that come into conflict in various contexts of human life, including scientific and academic research.

Epistemology involves studying and understanding the nature, origin, and limits of human knowledge, as well as the methods, scope and validity of this knowledge. Both ethics and epistemology are heavily dependent on context and on the subject matter being scrutinized.

The session on *Ethics and Epistemology of AI and Machine Behavior* looks at the ethics and epistemology of AI and Machine behavior in the broader context of “wellbeing”. Specifically, the session looks at how focusing on the ethics and epistemology of AI and ML – whether it be in relation to AI regulation or specific AI use cases – can enhance human and/or environmental wellbeing. As a corollary, we discuss how the failure to engage in discussions of AI ethics and epistemology can lead to several negative consequences, going against the ideal of wellbeing.

The session delves into this topic in four aspects:

1. Understanding how different perspectives and interests influence and are influenced by AI and its regulation, the importance of soft law in the policy-making process, and what policymakers need to be aware of while formulating AI regulation (Anna Jobin)
2. Examining the development of AI regulation in Brazil with emphasis on AI’s (potential) impact on human rights - both positive and negative (Caitlin Mulholland);
3. Studying the ontological foundations of conceptual and enterprise modelling to make underlying world views more explicit, thereby supporting better software and systems design, while also recognizing the challenges inherent in converting ethics principles into software code/system design, (Joao Paulo Almeida); and
4. Delving into concrete real-world uses of AI in combination with Earth Observation data to understand how discussions on ethics and epistemology can enrich AI-led research endeavors, and make the research findings more acceptable and accessible to the individuals and communities concerned (Conrad Albrecht).

## **Psychopharmacology and Perception**

***Fernanda Palhano-Fontes, Brain Institute, Federal University of Rio Grande do Norte***

***Hamid Noor, McGovern Institute for Brain Research and MIT***

Molecular aspects of mind and consciousness, as well as the control of neuronal activity by small molecules, constitute a borderline between matter and mind. Functional aspects of complex neuronal systems and the dynamic interchanges of its molecular states, might be further modulated by bioactive molecules impacting physiological and psychological processes and influencing our mood, feelings and even consciousness as a whole.

The state of mind and its molecular correlations from the cellular basis of the neuronal network, over the brain as functional organ to the body, are important to be reflected in the context of our consciousness, feelings and the perception of phenomenological states of the environment, acting together in creating what we experience and describe as mind.

The Psychopharmacology and Perception session seeks to reveal the impact of small molecules on our perception, self-awareness and neuronal stimulus processing. In this context, we question how endogenous and exogenous bioactive molecules help to promote “well-being” and how neurology, neurophysiology, psychopharmacology and psychology current models can address the phenomena and aspects depicted above.

To shed light on those questions, this session is structured in a top-down perspective. First, Daniel Mograbi will introduce the concept of self-awareness and how this concept relates to neurological/psychiatric conditions in clinical groups using behavioral and physiological measures. Second, Nadine Bernhardt will delve into the development and course of psychiatric disorders, discussing the effects of pharmacological and psychotherapeutic treatments, and presenting new approaches for treatment-resistant patients as well as prevention approaches. Next, Daniele Macedo will bring a preclinical research perspective using animal models for understanding the development of psychiatric disorders and presenting translational research towards neuropsychiatric disorder preventing strategies during pregnancies. To close the session, Marcel Oberlaender will present the neurobiology of perception at cellular and circuit levels, further discussing how to conceptualize algorithms and incorporate neurobiological insights into neuronal network models using AI and machine learning techniques.

## **Global Human Behavior and Big Data**

*Rafael Ferreira, Cesar School and Universidade Federal Rural de Pernambuco*

*Slava Jankin, Data Science Lab, Hertie School Berlin*

The rapid technological development has led to the growth in the number of digital applications in various areas such as health, education, security, and public transport. This development led to a massive increase in the amount of data generated, which created the term Big Data. Big Data enable the use of a new generation of algorithms and models that could benefit the world population in different fields.

On the one hand, Big Data could be used to detect and assess inefficiencies of the planet, such as poverty, lack of education, detect the presence of natural disasters and wars. On the other side, it can also be used to shape a better future influencing Global Human Behavior. In 2015 the United Nations (UN) presented the 2030 Agenda for Sustainable Development, with 17 goals that should be reached to improve the world population's quality of life (<https://sdgs.un.org/goals>). These goals include topics related to health, education, prevention, and promotion of awareness of sustainability, fairness, accountability, transparency and ethics.

A recent study published in Nature (<https://www.nature.com/articles/s41467-019-14108-y>) demonstrated the benefits (and possible pitfalls) of using Big Data and Artificial Intelligence to contribute to global wellbeing and how these techniques could help governments to promote the UN Sustainable Development goals.

In this context, the Big Data & Global Human Behavior session intends to present state-of-the-art research and practical applications of Big Data analysis to address critical issues related to Global Human Behavior. More specifically, the presentations in this session will discuss topics related to education, health, politics and psychology. Researchers in the session utilise a wide range of data sources – from national surveys to social networks, – to propose models and analyses to address global societal challenges and contribute to sustainable development goals.

## Bioactives & Resources from Remote and Endangered Natural Environments

*Paula C. P. Bueno, Department of Chemistry, Federal University of Alfenas (Brazil)*

*Serhat S. Çiçek, Department of Pharmaceutical Biology, Kiel University (Germany)*

Natural products and preparations thereof ever since played an important role in people's health care and for a long time constituted the only kind of medicine. In the last century, these valuable resources have been the target of extensive chemical and pharmacological studies resulting in the discovery of new bioactive molecules, such as antimicrobial, anti-inflammatory, cytotoxic or psychoactive compounds. Such studies corroborated the enormous potential of herbs and medicinal plants, confirming the ethnopharmacological knowledge by establishing the relationship between their chemical profiles and the corresponding biological activities.

After focusing on terrestrial plants and microorganisms, research widened its scope to marine organisms and endobionts within the last decades, also thanks to modern technologies. Thus, classical bioprospecting approaches extended the knowledge on a geographical scale as well as on cellular and symbiotic levels, respectively. However, bioprospecting not only concentrates on human health. Following the growing consciousness for our environment and the extensive use of pesticides, also new ecologically friendly agents for treating plant diseases came into focus recently. Additionally, the development of greener approaches, especially those associated with the replacement of hazardous consumables for compound extraction and purification, both in micro or large scales, has been an asset in natural product research.

Furthermore, the development of powerful techniques, equipment, and approaches busted a new era in this field by involving state-of-the-art *omics* strategies. Altogether, genomics, transcriptomics, proteomics, and metabolomics have been significantly contributing to the discovery of bioactive compounds. These high-throughput and high-resolution techniques enabled the study of several samples at a time, together with faster compound annotation, even for those present in very low concentrations. Consequently, the acquisition of multidimensional data, promoted significant advances in the improvement of algorithms, along with molecular modeling, cheminformatics and bioinformatics. Remarkably, such approaches have been used not only for the discovery of bioactive natural products, but also for elucidating chemical and ecological interactions in nature, and for studying complex processes in natural environments. As a result, all this knowledge can lead to relevant improvements in the protection of remote and endangered environments, as well as to the sustainable exploration of biodiversity, also bringing the valorization and standardization of bioproducts.

Bearing this background in mind, the Bioactives & Resources from Remote and Endangered Natural Environments session will deal with some of the Sustainable Development Goals (SDGs) topics, such as good health, life below water, and life on land. Additionally, several aspects of human well-being, terrestrial life and economy will be discussed, including ecosystem services, agriculture and biosafety. In the first part of our session, we will talk about bioactive compounds isolated from microorganisms and their potential applications

will be regarded from two perspectives: (i) the use of bio-fungicides as bioactive agents to control or mitigate plant diseases, and (ii) their relevance in drug discovery aiming at human health. The second part will focus on the advances in the field of biotechnology, biotransformation, data science, computational biology and bioinformatics, providing possible solutions for the sustainable use of natural resources.

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## PROGRAM SCHEDULE

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### Wednesday, June 29

17:30 – 19:00 BRT	Session Coordination Meeting (for chairs and speakers only)
19:00 – 21:30 BRT	Welcome Reception/Dinner

### Thursday, June 30

07:30 – 08:45 BRT	Breakfast
08:45 – 09:15 BRT	Opening Remarks
09:15 – 10:30 BRT	Session I – Bioactives & Bioresources (45 minutes)
10:30 – 11:00 BRT	Coffee Break
11:00 – 12:15 BRT	Session I - continuation - Bioactives & Bioresources (75 minutes)
12:15 – 12:45 BRT	AvH & CAPES presentations on funding opportunities
12:45 -13:45 BRT	Lunch (1 hour)
13:45 – 14:45 BRT	Poster Flash Talks (1 hour)
14:45 – 15:30 BRT	Poster Session I (45 minutes)
15:30 – 16:15 BRT	Poster Session II (45 minutes)
16:15 – 16:30 BRT	Break
16:30 – 17:15 BRT	Kick-off Workshop - A frontline dispatch from the War on Science (45 minutes)
17:15 – 17:30 BRT	Break
17:30 – 18:45 BRT	Session II - Big Data & Global Human Behavior (75 minutes)
18:45 – 20:45 BRT	Dinner at the hotel

## **Friday, July 1**

07:30 – 08:45 BRT	Breakfast
08:45 – 10:00 BRT	Session II – continuation - Big Data & Global Human Behavior (75 minutes)
10:00 – 10:30 BRT	Coffee Break
10:30 – 11:15 BRT	Workshop II – Q&A Living on the other end of the Atlantic (45 minutes)
11:15 – 11:30 BRT	Break
11:30 – 12:45 BRT	Session III - Psychopharmacology & Perception (75 minutes)
12:45 – 13:45 BRT	Lunch
13:45 – 15:00 BRT	Session III – continuation - Psychopharmacology & Perception (75 minutes)
15:00 – 15:15 BRT	Break
15:15 – 18:45 BRT	Cultural Tour
18:45 – 20:45 BRT	Dinner at restaurant

## **Saturday, July 2**

07:30 – 08:45 BRT	Breakfast
08:45 – 10:00 BRT	Session IV – AI - Ethics & Epistemology (75 minutes)
10:00 – 10:30 BRT	Coffee Break
10:30 – 11:45 BRT	Session IV – continuation - AI - Ethics & Epistemology (75 minutes)
11:45 – 12:00 BRT	Break
12:00 – 12:45 BRT	Workshop III – Start writing CONNECT proposals (45 minutes)
12:45 – 13:15 BRT	Wrap-up & Concluding Remarks
13:15 – 14:15 BRT	Farewell Lunch (1 hour)

#### Challenges in AI policy: learning from soft law perspectives

Anna Jobin

Alexander von Humboldt Institute for Internet and Society, Berlin

Artificial Intelligence is a sociotechnical phenomenon still very much in formation, as diverse sets of actors and institutions shape various narratives (Bareis & Katzenbach 2021, Schiff et al. 2021). If the promises are to believe, AI will revolutionize science, automatically detect various health issues, eliminate hate speech and misinformation, and prevent crimes. However, simultaneously to being hyped, 21st century Artificial Intelligence is also an object of controversy and contestation (Ulinicane et al. 2021). Even disputes around the very definition of AI are not settled, because there is no consensus over which different technologies and techniques actually fall under its label. Beyond any single claim of hype or contestation lies the contingent future of AI, which is not yet fully established. One important field where the claims are being staked is AI governance, a field comprising various modes, initiatives, and implementations (Schmitt, 2021). Because the policy agenda setting process is still relatively open, it is important to observe closely what is happening in AI policy on the different political levels (Smuha 2021, Jobin et al. 2021). As with other emerging technologies, a proliferation of soft law efforts mark the important first stage in the governance of artificial intelligence. Opposed to binding hard law, soft law is non-binding. It often precedes the potential establishment of hard law because of its flexibility in time, space, and scope. Whereas laws and regulations are made in an authoritative manner by the state, soft law can also be driven by actors from economy & society such as private companies, NGOs, or research institutes. Moreover, soft law can take various forms, be adaptive to different applications, different types of risks, and even accommodate new risks that may emerge. It can be made to work differences across sectors and national borders. Ethical guidelines are a prime example of such soft law initiatives. Analyses of AI ethics guidelines have shown repeatedly that there is no consensus among the issuer on which ethical principles are mentioned, how they are defined, which stakeholders they pertain to, and how principles should be implemented (e.g. Jobin et al. 2019, Hagendorff 2020, Attard-Frost 2022). From a policy perspective, ethics guidelines are not necessarily binding. However, they surface implications for that may serve as inspirations during the entire policy-making cycle. These implications fall into three main areas: (1) the definition of public value, because it is unclear what exactly public interest AI would look like (Züger & Asghari 2022); (2) the scope of stakeholders that are in the focus of policies, because

AI also affects non-users; (3) the locus of regulation in the AI life cycle. In summary, when it comes to the governance of an emerging technology with the impact at the scale of AI, different perspectives and interests abound. Empirical evidence from soft law initiatives can give early indications of the practical issues that policy makers will need to resolve. Divergences among ethical guidelines, for instance, reveal not only philosophical differences discussed, but also point towards very practical policy problems. In doing so, they highlight policy challenges that need to be addressed by current policy initiatives that aim at regulating AI for the public good.

## References

- [1] Attard-Frost, B., De los Ríos, A. & Walters, D. R. The ethics of AI business practices: a review of 47 AI ethics guidelines. *AI Ethics* (2022) doi:10.1007/s43681-022-00156-6.
- [2] Bareis, J. & Katzenbach, C. Talking AI into Being: The Narratives and Imaginaries of National AI Strategies and Their Performative Politics. *Science, Technology, & Human Values* (2021) doi:10.1177/01622439211030007.
- [3] Hagendorff, T. The Ethics of AI Ethics: An Evaluation of Guidelines. *Minds & Machines* (2020) doi:10.1007/s11023-020-09517-8.
- [4] Jobin, A., Guettel, L., Liebig, L. & Katzenbach, C. AI Federalism: Shaping AI Policy within States in Germany. arXiv:2111.04454 [cs] (2021).
- [5] Jobin, A., Ienca, M. & Vayena, E. The global landscape of AI ethics guidelines. *Nat Mach Intell* 389–399 (2019) doi:10.1038/s42256-019-0088-2.
- [6] Schiff, D., Borenstein, J., Biddle, J. & Laas, K. AI Ethics in the Public, Private, and NGO Sectors: A Review of a Global Document Collection. *IEEE Transactions on Technology and Society* 2, 31–42 (2021).
- [7] Schmitt, L. Mapping global AI governance: a nascent regime in a fragmented landscape. *AI Ethics* (2021) doi:10.1007/s43681-021-00083-y.
- [8] Smuha, N. A. From a ‘race to AI’ to a ‘race to AI regulation’: regulatory competition for artificial intelligence. *Law, Innovation and Technology* 13, 57–84 (2021).
- [9] Ulicane, I., Knight, W., Leach, T., Stahl, B. C. & Wanjiku, W.-G. Framing governance for a contested emerging technology: insights from AI policy. *Policy and Society* 40, 158–177 (2021).
- [10] Züger, T. & Asghari, H. AI for the public. How public interest theory shifts the discourse on AI. *AI & Soc* (2022) doi:10.1007/s00146-022-01480-5

## **Challenges to the regulation of artificial intelligence**

*Caitlin Mulholland*

*Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio)*

With the increasing development and application of technologies that use artificial intelligence systems, questions arise about the need to regulate technologies and what kind of regulation. It can be seen that there are two regulatory forces that stand out: (i) regulation through ethical principles, recognized through declarations of an unenforceable nature; (ii) bills that contain legal concepts and principles that contribute little to adequate regulation. What I propose is that there are already sufficient legal regulatory instruments to allow the development and monitoring of the effects of the application of AI systems. Existing laws that provide for market regulation (competition laws and consumer protection), protection of fundamental rights, protection of personal data, administrative, civil, and criminal liability, etc. are already sufficient to account for the effects of the application and development of AI in our society

# **Large-Scale Geo-Data Mining for Good**

*Conrad Albrecht,*

*Remote Sensing Technology Institute, German Aerospace Center Wessling*

The ever-increasing amount of earth observation data provides us an ample basis to sense, understand, and visualize the health of our planet. Machine learning enables us to value our home through mining massive amounts of geo-information provided by satellites and airborne measurements once curated for scalable access by a Big Geospatial Data "digital twin" platform. My presentation intends to bridge the "AI Ethics" to the "Big Data & Global Human Behavior" session through a technical overview of remote sensor technologies demonstrating their value for applications in archaeology, urban mapping, and biomass estimation relevant to various ethical aspects. I invite you to enter a vital, interdisciplinary discussion on a. How to leverage machine learning and remote sensing improving upon the local climate in (mega)cities for the well-being of its urban population; and how to embrace ethical concerns related? b. How artificial intelligence and earth observation have capacity to help protect the Amazon rainforest led by fair principles incorporating the "perspectives of all stakeholders" such as endangered species, local farmers, archaeologists, and governments? What are the current limitations of these technologies vis-a-vis protection of human rights and ethics; and what may render solutions to overcome such limitations? c. How do we transparently implement AI-based environmental management for governance inspired by the United Nation's Sustainable Development Goals?

# **Towards legally compliant and ethically responsible information systems**

*João Paulo Almeida*

*Department of Informatics, Universidade Federal do Espírito Santo (UFES)*

Information systems permeate our lives, and the way in which they are designed and operated has direct implications for our well-being. It is not surprising then that we are becoming increasingly aware of the need to incorporate legal and ethical considerations in their development and usage, a concern which has become even more acute with the recent boom of machine learning approaches. Despite that, there is still a lack of techniques and design methods that take into account legal and ethical requirements. An important problem in this area concerns the representation of legal and ethical demands on information systems and of the various elements that need to be taken into account to pursue legal compliance and ethical responsibility. These include, among others, the complex and multifaceted notions of "rights" and "principles", but also "goals", "risk", "value" and "trust". In my talk, I will briefly discuss an approach to the explicit representation of some of these "subjective" elements, in order to take them seriously in systems development and usage. This approach requires interdisciplinary research beyond computer science and logics, and an understanding that we are dealing with the design of socio-technical systems. I will also discuss how we need to bring to the surface the concepts that form a "world view" embodied in a system, as they shape system behavior and the outcomes of machine learning.

### **AMIGO – Algorithmic Method for Improved Group Formation Online**

***Dr. Henrik Bellhäuser<sup>1</sup>, René Röpke, M.Sc.<sup>2</sup> & Prof. Dr. Johannes Konert<sup>3</sup>***

***<sup>1</sup> Universität Mainz, Psychologie in den Bildungswissenschaften***

***<sup>2</sup> RWTH Aachen University, Informatik 9 (Learning Technologies)***

***<sup>3</sup> Hochschule Fulda - University of Applied Sciences***

Collaborative learning has been proven to be a very effective method in a variety of empirical studies (Kyndt et al., 2013). Less intensively researched is the question of the criteria according to which the study group members should be selected for collaborative learning, although group composition is related to group success (Bell, 2007). Correlative studies have shown that demographic characteristics such as gender, age, or educational attainment have a relatively weak correlation with the success of groups (Harrison, Price, Gavin, & Florey, 2002). In contrast, stronger relations were uncovered between psychological attributes such as personality traits, attitude, and group performance. Out of the widely established Big Five personality traits (Rammstedt & John, 2005), it is primarily extraversion and conscientiousness that are considered relevant to the group formation (Humphrey, Hollenbeck, Meyer, & Ilgen, 2007). Beyond the Big Five, various other psychological traits were observed to be relevant to group formation such as team orientation (preference to work in group settings for task accomplishment), motivation and goal orientation (Nederveen Pieterse, van Knippenberg, & van Ginkel, 2011), leadership (Lykourantzou, 2016), as well as general cognitive abilities and prior knowledge (Horwitz, 2005). However, these findings come from correlational studies with restricted causal interpretation. In the context of an interdisciplinary project between psychology and computer science, we employ a software (MoodlePeers; <https://github.com/moodlepeers>), which allows for conducting randomized controlled field studies with homogeneous or heterogeneous group formation based on questionnaire data. In this talk, I will provide an overview of the work that we conducted in the AMIGO (Algorithmic Method for Improved Group Formation Online) project between 2019 and 2022. Several empirical studies investigated a wide range of research questions such as whether students accept being grouped by an algorithm, which students choose an algorithm over picking their own group members, and what are the learning outcomes for groups that are formed by algorithm. I will also present an outlook on future work that we intend to carry out.

# **Eating behavior and sustainable diets: the impact on human health and environmental sustainability**

*Ilana Nogueira*

*Universidade Estadual do Ceará (UECE)*

Eating behavior is an important link between human health and environmental sustainability. Therefore, it is urgently needed to understand its impact on sustainability and the possibility of developing public health strategies that undermine the harm of unhealthy eating patterns. In recent years, we have gained insights into the influence of diet on human health, carbon, water, and ecological footprints with many survey data on food intake in a representative sample of the country's population. Many of these data have been used by the food industry to change the behavior of specific population subgroups to increase ultra-processed food consumption. However, the evaluation of critical points to change in diet practices for substantial improvements in diet quality and reductions in environmental impacts is still misunderstood. Mathematical models applying optimization and prediction based on a real-life scenario of what people eat can help predict dietary changes with a practical impact on human health and environmental sustainability. The application of these models needs to consider the four dimensions of sustainable healthy diets (nutritional, sociocultural, environmental, and economic) and to include combinations of big data from different countries' populations to bring strategies in a global health perspective.

# Context-Aware Social Network Analysis

*Mirco Schönfeld*

*University of Bayreuth*

We are surrounded by networks. Often we are part of these networks ourselves, for example with our personal relationships. Often the networks are not visible per se, for example because the structures first have to be extracted from other data to be accessible.

Regardless of the domains from which the networks originate, structural information is only one part of the model of reality: each network, each node, and each connection within are subject to highly individual contextual circumstances. Such contextual information contains rich knowledge. They can enrich the structural data with explanations and provide access to semantics of structural connections.

This contrasts with the classical methods of network analysis, which indeed produce easily accessible and easily understandable results. But, so far, little attention can be paid to contextual information. This contextual information has yet to be made accessible to algorithms of network analysis.

This talk therefore presents methods for processing contextual information in network analysis using small and big data as examples. On the level of manageable data sets, for example, new types of centrality rankings can be derived. Here, context introduces possible constraints and acts as an inhibitor for the detection of paths. Consequently, individual views of single nodes on the global network emerge.

On the level of very large data sets, the analysis of contextually attributed networks offers new approaches in the field of network embedding. The resulting embeddings contain valuable information about the semantics of relationships.

The goal of context-aware social network analysis is, on the one hand, to benefit from the diverse knowledge that lies dormant in contextual information. On the other hand, novel explanations for analysis results are to be opened up and made accessible.

# Understanding Societies from their Digital Records

*Pedro O.S Vaz de Melo*

*Universidade Federal de Minas Gerais (UFMG)*

The immense availability of mobile computing technologies such as smartphones and tablets and the worldwide adoption of social applications such as Facebook and Twitter have allowed people to be continuously connected to the Internet. In this scenario, people act as social sensors, voluntarily providing data that captures their daily experiences from observations of the physical and online world. In addition, open data initiatives from various sectors of society, such as the Open Data portal of the Chamber of Deputies of Brazil, publish structured data that can be freely used by anyone to foster the development of intelligent tools. In today's world, every movement or action generates a digital record and this gigantic database can be seen as a digital and structured representation of the world and its societies. In this talk, I will describe some computational methods that make use of this public data to discover knowledge in large-scale complex social systems. In particular, I will show how this data can be used to promote the transparency of political systems and activities. I show that these methods are capable of discovering surprising features and patterns, at a lower cost and faster than traditional methods.

### **Project DevelopMENTAL: Identifying targets and elaborating strategies for the prevention of developmental disorders**

*Danielle Macedo*

*Neuropsychopharmacology Laboratory, Drug Research and Development Center, Faculty of Medicine, Universidade Federal do Ceará*

In the last decades, preclinical and clinical studies evaluating the long-term consequences of prenatal exposure to risk factors such as infections, pollution, and stress on brain development helped us establish these risk factors as causes of neurodevelopmental disorders. Despite this, the molecular basis of these alterations is still elusive. Neurodevelopmental disorders are a group of disorders that affect the development of the nervous system, leading to abnormal brain function. These disorders include, for example, autism, schizophrenia, intellectual disability, and attention-deficit/hyperactivity disorder. As observed in preclinical studies, one important mechanism associated with these neurodevelopmental disorders is prenatal inflammation. However, evidence that prenatal inflammation influences fetal neural systems in humans is lacking, as is evidence that inflammation-related changes in the fetal brain predict altered neurobehavioral development in childhood. Furthermore, sex is also a significant risk factor for neurodevelopmental disorders, being men at greater risk of developing these disorders than women. Accordingly, female hormones, especially estrogen, seem to have a protective effect. In the last years, my research group has been dedicated to the study of the sex influences on the neurobehavior and molecular changes along life induced by the neonatal exposure to Pathogen-associated molecular patterns (PAMPS), such as Polyinosinic:polycytidylic acid (Poly I:C), a viral mimetic, and Lipopolysaccharide (LPS), a bacterial endotoxin. The results showed us that male mice exposed to poly I:C (first hit) combined or not with peripubertal unpredictable stress (PUS) (second hit) present behavioral alterations like schizophrenia earlier than females. On the other hand, when neonatally exposed to poly I:C and PUS (two-hit model), adult females present behavioral alterations that are influenced by the estrous cycle phase. Indeed, in the high estrogen levels (proestrus) phase, females exposed to two-hit do not present behavior alterations. In contrast, during low estrogen levels (diestrus), behavioral alterations resemble schizophrenia. Another important observation is that males presented increased brain proinflammatory alterations, while females presented more oxidative ones. This means that despite showing the same behavioral alterations, the underlying molecular mechanisms are distinct in males and females. The best preventive strategy during adolescence for both sexes was omega 3. Regarding neonatal exposure to LPS, we have found autism-like alterations in these animals early in life. Contrary to poly I:C findings, LPS-induced behavioral alterations are dependent on sex, being the alterations observed in females are utterly different from those observed in males. During the COVID pandemic, we had the opportunity to translate this research to humans. Currently, we are following children born from

mothers infected with SARS-CoV-2 at the end of pregnancy (>36 weeks) and before 35 weeks, as well as controls aiming to assess behavioral alterations related to this risk factor and molecular markers. By knowing these molecular alterations, we hope to contribute to developing preventive strategies for mitigating this risk.

# **A clinical and cognitive neuroscience approach to the study of self-awareness**

*Daniel Mograbi*

*Pontifícia Universidade Católica do Rio de Janeiro – PUC-Rio*

Self-awareness can be defined as the capacity of becoming the object of one's own awareness. Although distinct philosophical and religious traditions have grappled with the subject for centuries, only recently scientific approaches to the theme have advanced. The study of self-awareness has various important implications. Recognising and understanding alterations in self-awareness within patient groups may enhance clinical management of neurological and psychiatric conditions and inform novel therapeutic interventions. Additionally, exploring the neurobiological mechanisms of self-awareness and its distinct components may shed light on fundamental principles of brain functioning. Moreover, a better understanding of self-awareness may also have broader social relevance, helping to quantify the extent to which certain individuals, patient groups, species, and devices are self-aware. In the talk, a definition and taxonomy of self-awareness processes will be presented. This will be followed by an overview of studies employing different empirical approaches in neurological and psychiatric disorders, as part of a research programme that departs from clinical questions to generate theoretical models with testable empirical hypotheses. Finally, future perspectives in the scientific study of self-awareness will be discussed, including the use of psychopharmacological approaches, computational models and the investigation of self-awareness mechanisms across the evolutionary spectrum.

## **Preventive approaches and new technologies - future directions in psychiatric treatment**

***Nadine Bernhardt***

***Department of Psychiatry and Psychotherapy, Medical Faculty Carl Gustav Carus, TU Dresden***

Psychiatric disorders such as affective disorders, schizophrenia and substance use disorders are characterised by marked disturbances of cognition, emotion and behaviour. They affect more than one in six people worldwide, with enormous individual and economic consequences. State-of-the-art treatment considers a combination of medications, cognitive therapies and social support. However, up to 60% of patients do not respond to these measures, and even with successful initial treatment, up to 80% of patients relapse. In such cases, the disorder is chronic and recurs throughout life, leading to long-term inability to work, social withdrawal, self-neglect and, in severe cases, suicide. In my presentation, I will explain the current findings and concepts about the development and lifelong course of psychiatric disorders. I will highlight critical periods of profound brain (re)organisation associated with increased vulnerability to the development of severe psychiatric disorders. However, these periods also offer significant opportunities for interventions aimed at stopping or even preventing disruptive symptoms with negligible side effects. Proof of concept is provided by recent studies using the maternal immune stimulation animal model of schizophrenia. Preventive treatment strategies include electrical brain stimulation and pharmacological approaches during i) perinatal development and ii) adolescence. Based on the clinical need and the recognition that psychiatric disorders are due to physiological and therefore measurable dysfunction in higher brain centres, we envision that a novel line of medical treatments based on neurotechnology can have a tremendous impact on the most severe refractory cases. The realization of this vision depends on overcoming fundamental technological and neuroscientific barriers alongside ethical considerations. My research group is working with colleagues in materials science and engineering to develop reliable, multimodal and long-term neurotechnical interfaces capable i) of converting 'brain' signals into disease-relevant, interpretable information and ii) deploying adaptable and precise neuromodulation to alleviate disease symptoms. However, this technology is still in its infancy and a critical discussion of the existing challenges, benefits and risks is essential

# Interfaces between neuroscience, technology, and education

*Marcel Oberlaender*

*Max Planck Institute for Neurobiology of Behavior, Bonn*

Artificial intelligence has undergone a revolution, particularly due to impressive advances in “deep learning”. In contrast to the brain, however, artificial neural networks (ANNs) require enormous amounts of training data and often fail to generalize to other even related tasks. While current ANNs are inspired by the design of the nervous system, the crucial questions of how artificial systems could ever achieve animal – or even human – intelligence, and whether additional neurobiological principles would be needed for this, remain open. To address these questions, my research group at the Max Planck Institute for Neurobiology of Behavior (Bonn) investigates the neural basis of sensory perception in rodents. Unraveling the cellular and circuit mechanisms that underlie perception is, however, extremely challenging, because even the simplest stimulus activates hundreds of thousands of neurons distributed throughout the entire brain. Moreover, the data provided by the sensory systems, representing the state of the world, is noisy. Yet, the brain is able to classify this noisy input across the hierarchy of cortical processing stages, triggering flexible and nuanced behaviors – a hallmark of higher cognition. This is why understanding the neural basis of perception will represent a crucial step for capturing design principles of the nervous system that could generate artificial systems with improved ability to generalize across tasks and less reliance on training data. For this purpose, my group has developed a multi-disciplinary approach that allows bridging across the different levels of abstraction of brain function. At the “implementational” level, we build realistic models of the brain by systematically collecting anatomical and physiological data from experiments that we perform in the living animal (in vivo). At the “algorithmic” level, we use these models to perform simulations (in silico) that mimic the conditions of our in vivo experiments, and thereby predict which mechanisms could account for the activity patterns that we observe, and which then allows us to test these predictions experimentally, for example via optogenetic and pharmacological in vivo manipulations. At the “computational” level, we reduce these algorithms into mathematical models, which we can then capture in the design of ANNs. On the example of our most recent findings, I will demonstrate that our approach provides unmatched understanding of how the interplay between cellular and circuit mechanisms gives rise to sensory perception – and I will showcase how artificial intelligence systems can benefit from these neurobiological principles.

## Combining natural products' synthesis with sustainable CO<sub>2</sub> utilization

Daniel Garbe

Werner Siemens-Chair of Synthetic Biotechnology, Technical University of Munich

Biotechnology is an interdisciplinary field combining Microbiology, Biochemistry, Molecular Biology, Bioinformatics, Systems Biology and Bioengineering to convert biomass and its residues, like straw or sugarcane bagasse, into high-value products ranging from biofuel and chemicals via biological or biobased polymers and nutraceuticals to pharmacological active substances. The conversion process can either be accomplished by microorganisms or isolated enzyme moieties, which are the “catalytic machines” running cellular processes. The motivation to establish sustainable biotechnological processes is to reduce dependence on fossil resources as well as implementing circular, waste free industrial processes that enable a net reduction of greenhouse gases.

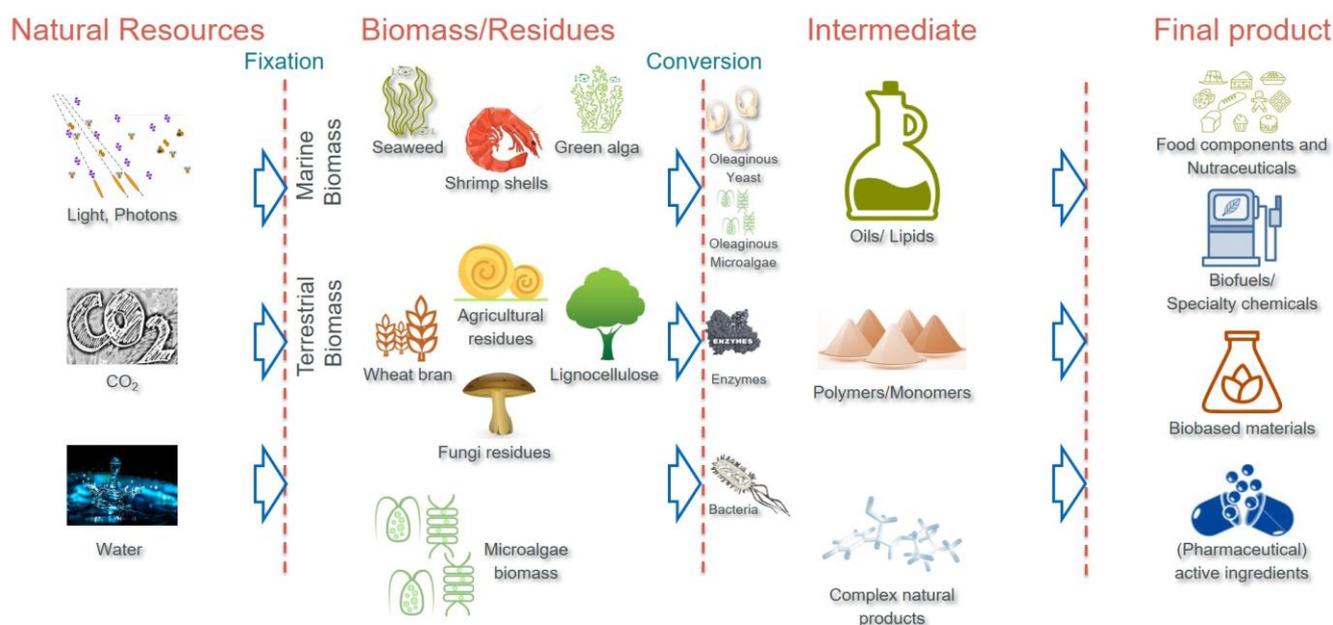


Figure: From biomass and its residues to high-value products by biotechnological means.

To establish these goals, the following scenarios are essential: 1) The transfer of native natural product synthesis pathways from its original source, which could be a fungus or plant into a genetically tractable and process adaptable production host that can be cultivated at scale. 2) The conversion of CO<sub>2</sub> into a high-value product preferably with a stable fixation of carbon to reduce its content in the environment. In example 1 the synthesis of iso-Elisabethatriene A an intermediate on route to the very promising marine natural product

Pseudopterosin originating from the soft coral *Antillologorgia elisabethae* by a bacterial production system will be demonstrated. It will be explained how iso-Elisabethatriene A turned from side to main product [1] and how the overall yield of this target product could be doubled to 1 mg per g dried production organism. Example 2 will deal with the stable fixation of CO<sub>2</sub> in the oil of special microalgae as part of a CCUconcept (carbon capture and utilization). The oil will be converted by established chemical process steps into a sustainable carbon fibre. As part of an innovative new material the carbon fibre is combined with thin granite plates. This composite material has the potential to replace steel in the construction sector and if so, will have an impact on global carbon balance as depicted in the IPCC special report "Global Warming of 1.5°C" [2].

## References

[1] Ringel, M., M. Reinbold, M. Hirte et al. Towards a sustainable generation of pseudopterosin-type bioactives. *Green Chemistry* (2020), 22, 6033.

[2] <https://www.ipcc.ch/sr15/>, chapter 4.3.4.2

# Computational Chemical Biology: Perspective on bioactive compound discovery

*Ricardo Roberto da Silva*

*School of Pharmaceutical Sciences of Ribeirão Preto, Universidade de São Paulo - USP*

In recent years all fields of science have been experiencing an accelerated increase in the amount of available information, be it by new analytical technologies, with new sensors and detectors, or by the increase of the related scientific literature. Processing large data volumes is becoming the bottleneck in many fields. To face this challenge, data science arose as a key tool, allowing data processing and interpretation. Data science uses knowledge from statistics and computer science to create methods that allow the in depth exploration of large datasets. Most data science techniques are agnostic from data origin, depending only on measure scale (binary, count, measure) and dimensionality (how many characteristics of the samples are measured, in how many samples). However, what differentiates data science from traditional statistics is the use of domain specific knowledge to improve data processing. Natural sources have always been a source of useful substances for human kind, from plant extracted remedies to food fermented by microbes. The evolution of chemistry enabled the development of advanced techniques, such as chromatography, which allows the separation of complex mixtures of substances. A tea from plant leaves, for example, is a complex mixture of chemicals produced by that plant. Once we separate the chemicals in the plant, we have now to discover the chemical formula and structure, from where we can understand its properties. One technique that allows the discovery of chemicals' formulas is mass spectrometry. We also have witnessed great advances in biology. The modern synthesis, which combined the ideas of heredity and evolution in the 20th century, provided the knowledge framework to understand why organisms in nature evolved to create specialized chemicals to enable them to compete and survive. The information to produce these specialized chemicals is stored in the genomes of these organisms, and this information can be recovered through DNA sequencing. These 'molecular detection' techniques, chromatography, mass spectroscopy and sequencing, produce large amounts of data. With this data, we can use data science techniques combined with our knowledge of chemistry and biology, which we call computational chemical biology, an emerging field that makes intensive use of data science to help interdisciplinary groups to study problems in the interface of biology and chemistry. Traditional bioinformatics techniques, such as DNA sequence alignment and gene prediction, and chemoinformatics techniques, such as molecular interaction detection or sub-structure search, are combined with techniques to support efficient processing of data from new 'molecular detectors'. The presentation will illustrate these concepts, showing how chemical information recovered from specialized literature can be used to help chemists to compare the chemical structures previously described, with known properties, to new chemicals detected in samples with desired properties (pharmacological, agricultural, etc). Once recovered, the challenge to search large volumes of data is illustrated by searching a list of chemical

structures using an algorithm similar to Google's page ranking. In summary, the presentation will show key concepts of how computational models can help interdisciplinary groups to explore natural sources of bioactive compounds.

# The chemistry hidden in the biological interactions found in the citrus host

*Taícia Pacheco Fill*

*Chemistry Institute, Universidade Estadual de Campinas*

Phytopathogens have developed a variety of specialized virulence strategies to facilitate colonization of plant tissue and successfully modulate the host's physiology, including the production of low molecular weight phytotoxins (natural products). Brazil is the world's largest citrus producer, however citriculture is susceptible to several diseases that cause significant losses to our economy. *Penicillium digitatum* is the most aggressive pathogen of citrus fruits and causes the green mold disease, which is responsible for up to 90% of total citrus losses. Tryptoquialanines are major indole alkaloids produced by this fungus and is unknown if tryptoquialanines are involved in the damage of citrus fruits caused by *P. digitatum*. To investigate the pathogenic roles of tryptoquialanines, we initially asked if tryptoquialanines could affect the germination of *Citrus sinensis* seeds. Exposure of the citrus seeds to tryptoquialanine A resulted in a complete inhibition of germination and an altered metabolic response. Since this phytotoxic effect requires the extracellular export of tryptoquialanine A, we investigated the mechanisms of extracellular delivery of this alkaloid in *P. digitatum*. We detected extracellular vesicles (EVs) released by *P. digitatum* both in culture and during infection of citrus fruits. Compositional analysis of EVs produced during infection revealed the presence of a complex cargo, which included tryptoquialanines and the mycotoxin fungisporin. The EVs also presented phytotoxicity activity in vitro and caused damage to the tissues of citrus seeds. Through molecular networking, it was observed that the metabolites present in the *P. digitatum* EVs are produced in all of its possible hosts. Our results reveal a novel phytopathogenic role of *P. digitatum* EVs and tryptoquialanine A, implying that this alkaloid is exported in EVs during plant infection. Understanding this host-pathogen interaction could lead to the development of new, specific, efficient and safer antifungal compounds to be used in the fields.

## References

- [1] COSTA, JONAS HENRIQUE; et al. "Phytotoxic Tryptoquialanines Produced In Vivo by *Penicillium digitatum* Are Exported in Extracellular Vesicles". *mBio*, v. 12, p. 1, 2021.
- [2] PONTES, JOÃO G. M.; et al "Virulence Factors in the Phytopathogen-Host Interactions: An Overview". *JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY*, 2020.
- [3] HENRIQUE COSTA, JONAS; et al "Exploring the interaction between citrus flavonoids and phytopathogenic fungi through enzymatic activities". *BIOORGANIC CHEMISTRY*, v. 1, p. 104126-159, 2020.

# Exploiting Biological and Chemical Diversity of Fungi from Different Sources

*Yasmina Marin-Felix*

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Fungi are one of the most diverse groups of organisms, containing the largest number of species after insects. To date, around 140 000 to 150 000 fungal species have been described. However, recently generated data from fungal biodiversity studies suggest that there may be up to 2.2-3.8 million species (Lücking et al. 2020). Therefore, there is a vast number of taxa awaiting discovery. Fungi can have a bad facet for human life since they cause serious human, animal and plant diseases. On the other hand, fungi hold an incredible broad application in biotechnology and industry (Hyde et al. 2019). Our group aims to exploit the potential of fungi in producing bioactive compounds that can be used as anti-infective drugs. This is especially important nowadays, considering the steady increase of drug resistance by bacterial and fungi pathogens (Miethke et al. 2021). Therefore, it is necessary to increase the chemical diversity of the current drugs. Historically, most antibiotics are derived from microbial and fungal secondary metabolites. While the common soil molds such as *Penicillium* seem to have been explored exhaustively, fungi whose secondary metabolism remains poorly studied such as Basidiomycota are excellent solutions for new chemistry (Sandargo et al. 2019). The fungi that are awaiting to be discovered are also potential producers of these new drugs that could overcome our increasing problems in health. For this reason, the isolation of rare and new fungi is other of our main objectives to be able to translate this biodiversity into chemical diversity. One of our recent lines of research is focused in the fungi associated with the dung of the animals, which are known as coprophilous. Fungi are cosmopolitan organisms that can be found in almost all kinds of substrata. While some substrata have been widely explored, e.g. animals, plants and soil, others have remained poorly studied, as it is the case of dung. However, recently studies in that group of fungi demonstrated its potential as reservoir of fungal biodiversity and new taxa, as it is the case of the study of Melo et al. (2020) in the coprophilous fungi from Brazil. Therefore, we expect to exploit the fungal diversity in this substrate from different geographical regions with the final goal of translating this into chemical diversity. Through collaborations around the world, the fungal diversity of different substrate and geographical regions is under study in many interdisciplinary projects. A prominent example is the study of fungi associated with plants from Cameroon through a project with the University of Yaounde I, awarded by the Alexander von Humboldt Foundation. Five new species of *Diaporthe* (Ascomycota) have been found from a single fungal collection, and already new bioactive compounds have been isolated from these new taxa (Matio Kemkuignou et al. 2022). It is also important to note that the metabolites we found are also tested as beneficial therapeutic agents in a broad spectrum of applications through collaboration with groups in different disciplines. For instance, the cyathane diterpenoids from the medicinal mushroom genus *Hericium* (Basidiomycota) can be used to treat neurodegenerative diseases (Rupcic et al. 2018). In the last years, it is increasing the generation of genome sequence data to complement the chemistry-driven and bioactivity-driven screenings for novel antimicrobial compounds (Miethke et al. 2021). In this sense, using

genome mining techniques, we could identify fungal taxa able to produce compounds with innovative chemical structures. Our project based on coprophilous fungi is aiming to generate 20 different genomes of taxa belonging to the Sordariales, which proved to be prolific producers of bioactive compounds (Charria-Girón et al. 2022). However, the prediction of chemical structures from genome data is still in development and a great challenge for the future of the discovery and development of new therapeutic agents. Other ongoing project in our department also includes the generation of 50 genomes and the link of these data with metabolomics techniques to identify the natural product biosynthetic origins and metabolite structures.

## References

- [1] Charria-Girón E, Surup F, Marin-Felix Y. 2022. Diversity of biologically active secondary metabolites in the ascomycete order Sordariales. *Mycological Progress* 21: 43.
- [2] Hyde KD, Xu J, Rapior S, et al. 2019. The amazing potential of fungi: 50 ways we can exploit fungi industrially. *Fungal Diversity* 97: 1–136.
- [3] Lücking R, Aime MC, Robbertse B, et al. 2020. Unambiguous identification of fungi: where do we stand and how accurate and precise is fungal DNA barcoding?. *IMA Fungus* 11:14.
- [4] Matio Kemkuignou B, Schweizer L, Lambert C, et al. 2022. New polyketides from the liquid culture of *Diaporthe breyniae* sp. nov. (Diaporthales, Diaporthaceae). *MycKeys* 90: 85-118.
- [5] Melo RFR, Gondim NHDB, Cabral AL, et al. 2020. Coprophilous fungi from Brazil: updated identification keys to all recorded species. *Phytotaxa* 436: 104–124.
- [6] Miethke M, Pieroni M, Weber T, et al. 2021. Towards the sustainable discovery and development of new antibiotics. *Nature Reviews Chemistry* 5: 726–749.
- [7] Rupcic Z, Rascher M, Kanaki S, et al. 2018. Two new cyathane diterpenoids from mycelial cultures of the medicinal mushroom *Herichium erinaceus* and the rare species, *Herichium flagellum*. *International Journal of Molecular Sciences* 19: 740.
- [8] Sandargo B, Chepkirui C, Cheng T, et al. 2019. Biological and chemical diversity go hand in hand: Basidiomycota as source of new pharmaceuticals and agrochemicals. *Biotechnology Advances* 37: 107344.

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## **WORKSHOP I – PRESENTATION**

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### **A frontline dispatch from the War on Science**

*Reinaldo José Lopes – Folha de São Paulo*

In case you haven't noticed, we are at war. The past few years have shown that powerful financial and political interest groups are behind a more or less concerted effort to discredit science, and even a global pandemic wasn't enough to make them back down. This means science communication has never been more important than it is now. My talk is a plea to get you involved, especially when it comes to talk to the public about the specific ethical imperatives that underlie the scientific endeavor – and about how to use scientific principles to create a more decent and truthful global conversation online.

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## **WORKSHOP II – Q&A**

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### **Q&A Living on the other end of the Atlantic**

*Fernando Buarque – BRAGFOST Ambassador*

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## **WORKSHOP III – CONNECT**

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### **Start writing CONNECT proposals**

*Fernando Buarque – BRAGFOST Ambassador*

*Matthias Hergenhan - Alexander von Humboldt Foundation*

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## **Bioprospecting-based UPLC-ESI-QTOF/MS metabolomics studies of psychedelic and bioactive plants of threatened biomes in Brazil**

*Albert Katchborian, Chemistry Institute, Federal University of Alfenas*

Ayahuasca is a psychedelic tea produced through the decoction of Amazonian plants that has been used for centuries by the indigenous people of South America for spiritual and ritualistic purposes, and as a medicine for physical and mental healing. Neuroprotective candidates for medical treatment are utterly needed to develop therapies that can prevent the natural progression of neurodegenerative diseases, such as Parkinson's disease (PD). Likewise, anti-inflammatory drugs are among the most used therapeutic agents worldwide, although the relevant undesired effect of the currently approved drugs causes therapeutical limitations to several inflammatory diseases that consequently still do not have a satisfactory treatment. New drugs able to inhibit PGE<sub>2</sub> release in the COX pathway are also substantial targets of the current drug discovery and development. In that context, the screening for bioactive metabolites is frequently carried out in pharmaceutical drug discovery, and metabolomics arises as a modernized technique that can be applied in the Natural Products (NP) research field for accessing bioactive plant metabolites through faster real-time analyses. Based on that scenario, Brazil is one of the richest countries in biodiversity and natural resources, although most of the biomes are currently under threat or already endangered, e.g. the Amazon and the Atlantic forest respectively. In this sense, the *Ocotea* (Lauraceae) stands as a complex botanical genus, mainly encountered in the Atlantic forest and Cerrado biomes in Brazil, with reports of high potential for biological activities. However, only a few species were studied in the literature, while several are on the list of threatened species to extinction. In this research, for the biological activity assessment, an ex-vivo anti-inflammatory screening was realised using human blood LPS-induced inflammation for quantitative PGE<sub>2</sub> determination in plasma by UPLC-MS/MS. For the neuroprotective evaluation, the Ayahuasca beverage, the extracts from its matrix plants, fractions and its main isolated alkaloids were evaluated in an in vitro PD model using SH-SY5Y neuroblastoma cells. Therefore, my research line aims to perform high-resolution LC/MS-based metabolomics studies of the anti-inflammatory potential of renewable parts of *Ocotea* (Lauraceae) species as well as explore the neuroprotective activity of Ayahuasca. This research is important to support traditional knowledge and promote sustainability and biodiversity protection with pharmacological benefit to society, with potential applicability for inflammatory and neurodegenerative diseases by supporting faster drug candidates to drug discovery and aid the promotion of human well-being. The bioactive markers pointed out by the multivariate statistical analysis indicated potential neuroprotective or anti-inflammatory lead structures of pharmaceutical interest. In addition, this is the first report regarding the chemical composition and bioactivity of several endemic *Ocotea* spp. of endangered environments in the Brazilian territory.

## **Mitigating racial algorithmic bias: building equitable and accountable AI in Brazil**

*Bianca Kremer, Faculty of Law, Department of Digital Rights & Brazilian Institute of Education,  
Development and Research (IDP)*

Large public financial resources and investments in digital solutions/ AI systems have been developed in Brazil since 2018, in order to raise the standards of public services provided. Some of the most expressive examples are the adoption of facial recognition systems for public safety, data automation for demographic statistics, Exams request based on public health data, identification of employment trends from structured and unstructured data, among others.

Artificial intelligence systems have been presented by public authorities as an expressive solution for some of the oldest cyclical problems we face in Brazil, such as poverty, educational gap and violence.

Data are indispensable for the effectiveness of governmental programs committed to public interests. Within a global scenario of intense connectivity, associated with sophisticated AI techniques and predatory use of personal data, discrimination dynamics have been reproduced, reinforced and hidden in surveillance policies and governmental programs.

One of the biggest problems of the public sector in Brazil lies in credibility. We experience a historical, social and political crisis of intense corruption and lack of credibility in the public sector. The incidence of AI technologies for the improvement of the public system face a double opacity: technological and cultural.

Building ethical auditing methods for AI in Brazil could allow the development of bias test and tools that challenges power imbalances in the public sector, increasing accountability, transparency and explainability in the use and development of artificial intelligence technologies by the public sector.

Brazil is developing rapidly its Digital infrastructure and calls for innovative approaches to the governance challenges in matter of accountability that takes into account the particularities of its historical, political and cultural trajectory. An example of this is the widespread use of facial recognition technologies in public safety in a country marked by the over-incarceration of the Afro-descendant population.

Brazil is the third country that incarcerates more people in the whole world, losing only to the United States in 1st, and China in 2nd place. We currently have more than 770.000 people imprisoned, and approximately 67% (two out of three) of them are afro descendant. Both the African descent and LGBT+ community are constantly watched and persecuted by public security forces. Brazil is considered a country with the highest mortality rate for transgender people. Only in 2020, 175 trans women were murdered: a 41% increase over the previous year.

The African descent in Brazil experience exclusion and lack of opportunities in several aspects. In 2020 the unemployment rate among us was 71% higher compared to White people. It is estimated that unemployment can reach 40% in the LGBT+ community, 70% of them only for trans people. After COVID-19 pandemic it got

even worse: 33 million people today face hunger in Brazil. The year 2022 marks the return of food insecurity to the same level of hunger as almost 30 years ago.

The increase of surveillance technologies in public spaces in the last five years has been intensifying exclusion for marginalized population in Brazil, a matter of great concern. Digital technologies based on artificial intelligence have escalated in public and private spaces in a way that facial recognition and other biometric technologies are being used as powerful tools of mass surveillance and incarceration, under an alleged discourse of modernization and collective security. It has led to several episodes of discrimination against our historically vulnerable and marginalized population. In 2019, 90,5% of those arrested by facial recognition systems in Brazil were afro descendant, a number that only increases day-by-day. There are several cases of improper detention, especially of afro-descendant population.

The reality of the prison system in Brazil is degrading. Women use breadcrumbs to contain menstrual flow, due to the lack of basic personal hygiene materials. Transgender women are forced into prostitution within prison units. The hydraulic, sanitary and electrical structures are precarious. There is neither lighting nor ventilation.

No water for bathing and hydration. The food is expired. There is drainage of sewage with urine and feces in the areas intended for sunbathing. In 2021 the Brazilian Supreme Court upheld an unconstitutional state of affairs: the public recognition of an intense and massive violation of prisoner's fundamental rights.

Facial recognition technologies have been widely adopted in different regions of Brazil, with emphasis on Rio de Janeiro, São Paulo and Salvador since 2018. Both in terms of identity verification and public security. Brazil is undergoing severe human rights violation for minority groups, and facial recognition systems reinforces African descent population as public enemies, based on racist stereotypes.

This empirical project proposal intends to build ethical auditing methods for accountable and equitable AI in Brazil, mitigating algorithmic racial bias and discrimination in the public sector through accountable tools for different public services based on risk assessment: health, public safety, education and finance.

## References

[1] ALMEIDA, Silvio. O que é racismo estrutural. Coleção Feminismos Plurais. Djamilia Ribeiro (Org.) São Paulo: Sueli Carneiro; Pólen, 2019.

[2] ALMEIDA, Virgílio A. F.; DONEDA, Danilo. O que é a governança dos algoritmos? In: Tecnopolíticas de vigilância: perspectivas da margem. BRUNO, Fernanda; CARDOSO, Bruno; KANASHIRO, Marta; GUILHON, Luciana; MELGAÇO, Lucas (Org.). São Paulo: Ed. Boitempo, 2018

[3] BAYAMLIOĞLU, Emre; LEENES, Ronald. The 'rule of law' implication of data-driven decision making: a techno-regulatory perspective. Law, Innovation and technology. V. 10, Issue 2, 30 mar 2018. <<https://www.tandfonline.com/doi/full/10.1080/17579961.2018.1527475>>

[4] COPPIN, Ben. Inteligência Artificial. Trad, e Rev. Jorge Duarte Pires Valério. Rio de Janeiro: LTC, 2017.

[5] DZIDZIENYO, Anani. The position of blacks in Brazilian society. London: Minory Rights Group, 1971

[6] FLORIDI, Luciano; MITTELSTADT, Brent Daniel; ALLO, Patrick; et al. The ethics of algorithms: mapping the debate. Oxford Internet Institute. Big Data and society: Londres, Jul-Dec 2016, p. 1-21.

- [7] GONZALEZ, Lélia. A categoria político-cultural de amefricanidade. In: Tempo Brasileiro. Rio de Janeiro, nº. 92/93 (jan/jun). 1988, pp.69-82.
- [8] GROSFÖGEL, Ramón. BERNARDINO-COSTA, Joaze. MALDONADO-TORRES, Nelson. Introdução: Decolonialidade e pensamento afrodiaspórico. In: Decolonialidade e pensamento afrodiaspórico. GROSFÖGEL, Ramón et. al. (Org.) Belo Horizonte. Ed. Autêntica. Coleção Cultura Negra e Identidades. 2018.
- [9] QUAN-HAASE, Anabel; WELLMAN, Barry. Hyperconnected net work: computer-mediated community in a high-tech organization. In: The firm as a collaborative community: reconstructing trust in the knowledge economy. Oxford: Oxford University Press, 2006, p. 281-333.
- [10] MULHOLLAND, Caitlin. Responsabilidade civil e processos decisórios autônomos. In: Inteligência artificial e direito. 2ª Ed. São Paulo: Ed. Revista dos Tribunais, 2020, p. 327-350..
- [11] NOBLE, Safiya Umoja. Algorithms of oppression: how search engines reinforce racism. New York: NYU Press, 2018.
- [12] PASQUALE, Frank. The Black Box Society. Harvard University Press, 2005.
- [13] WATCHER, S; MITTELSTADT, B.; RUSSEL, C. Counterfactual explanations without opening the black box: automated decisions and the GDPR. Harvard Journal of Law and Technology, v. 31, n. 2, Spring 2018, p. 841-887.

# Preclinical Cell and Tissue Models for the Pharmacological Characterization of Nature-based Medicines in the Context of Inflammatory Bowel Diseases

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Herbal medicines play an important role in traditional and contemporary healthcare worldwide especially for the treatment of diseases with a complex pathophysiology that cannot be cured by allopathic medicine so far. Of these, inflammatory bowel diseases (IBD) are an immense life-long burden to a large and growing number of patients worldwide and many IBD patients rely on phytotherapy in addition to conventional therapy. Unfortunately, many herbal medicinal products lack scientific data to support their application in line with evidence-based medicine. Clinical trials and case studies on a traditional herbal medicinal product consisting of myrrh, coffee charcoal, and chamomile flower dry extract suggest its use in IBD maintenance therapy, but the pharmacological profile rationalizing symptom improvement is not complete.

In pharmacological research of nature-based therapies, suitable models which enable targeted investigation of the clinically described symptom improvement are needed to investigate these complex mixtures containing a multitude of individual plant substances, which have the potential to act on multiple targets and exert synergistic interaction.

Thus, tissue cultures from IBD patients and multi-component cell models of the inflamed intestinal mucosa (enterocytic Caco-2, goblet-cell like HT29-MTX and LPS-activated macrophages) which are able to model the three-dimensional, multicellular architecture and microenvironment were utilized to investigate effects of the plant extract mixtures on pathophysiologically relevant functions such as immune and barrier function. Single cell models using immune effector cells and enterocytes can subsequently be used to detect biologically active compounds and underlying mechanisms of action.

The herbal extracts reduced the secretion of inflammatory mediators (IL-6, TNF, MCP-1, IL8, PGE2) from intestinal epithelial cells and macrophages to a varying extent. The herbal combination as well as myrrh and coffee charcoal extract individually additionally increased inflammation impaired barrier function measured as transepithelial electrical resistance. Additive and synergistic effects were observed for the inhibition of pro-inflammatory cell-cell signaling from activated macrophages and intestinal epithelial cells as well as barrier stabilization.

With a view to identify bioactive plant-substances in coffee charcoal extract, phytochemical characterization revealed a spectrum of secondary plant metabolites of which chlorogenic acids and especially cryptochlorogenic acid elicited the most prominent effects on pro-inflammatory cytokine (TNF, IL-6, MCP-1) release in a single cell model of human LPS-challenged macrophages.

In conclusion, tailored tissue and cell culture models can be utilized to assess multiple pharmacological features and cooperative effects between herbal ingredients, which rationalize clinically observed symptom improvement of herbal medicines in the treatment of chronic inflammatory intestinal diseases.

# Applying Green Chemistry Principles in Phytochemistry

*Cristiano Soleo de Funari, SGreen Biotech Network, São Paulo State University (UNESP)*

Chemistry has developed from a reductionist definition of performance and function, leading to environmentally threatening processes and products [1]. The same can be observed in phytochemistry, where non-optimized processes which employ energy consuming and environmentally undesirable solvents such as chloroform, dichloromethane, hexane, pentane, and acetonitrile have been regularly employed [2]. Our approaches over the last 12 years includes increasing extraction and separation efficiency by adopting design of experiments rather than a trial-and-error approach; greening metabolite profiling by using a response function that considers environmental parameters together with traditional parameters; substitution of alcohols, such as the potentially health threatening methanol from petrochemical origin, with food-grade bioethanol [3–5], substitution of acetonitrile with acetone (including in HPLC) [6,7]; measuring the environmental impact of phytochemical processes using free software (multi-parameter metrics) [8–10]; exploring agricultural by-products as sources of bioactive natural products, etc. [8,10–12]. None of these examples required greater investments than traditional approaches. Although some advances have been achieved in greening phytochemistry since 1990, these can be considered modest when compared to those achieved by our colleagues in organic synthesis or even in analytical chemistry. We advocate that our community should play a major role in developing a novel ecological paradigm in chemistry. It seems to be essential for natural products chemistry to recapture its preeminent role in drug discovery. Otherwise, it would be disconnected from the pharmaceutical industry which is strongly investing on greening their products and processes. If getting “green” samples from nature is not enough to make our research green by-default, it could serve as an additional inspiration for promoting real green chemistry practices in natural products research [2].

## References

- [1] Science 2020, 367 (6476), 397–400 (<https://doi.org/10.1126/science.aay3060>);
- [2] Funari et al. Submitted to J. Nat. Prod. 2022.;
- [3] ACS Sustain. Chem. Eng. 2016, 4 (12), 7110–7117 (<https://10.1021/acssuschemeng.6b02005>);
- [4] J. Sep. Sci. 2014, 37 (1–2), 37–44 (<https://doi.org/10.1002/jssc.201300955>);
- [5] J. Chromatogr. A 2014, 1354 (11), 34–42 (<https://doi.org/10.1016/j.chroma.2014.05.018>);
- [6] J. Sep. Sci. 2015, 38 (9), 1458–1465 (<https://doi.org/10.1002/jssc.201401324>);
- [7] Anal. Bioanal. Chem. 2018, 410, 3705–3713 (<https://doi.org/https://doi.org/10.1007/s00216-018-1027-5>);
- [8] J. Chromatogr. A 2020, 1634, 1–10 (<https://doi.org/10.1016/j.chroma.2020.461693>);
- [9] Food Chem. 2022, 373, 131323 (<https://doi.org/10.1016/j.foodchem.2021.131323>);
- [10] Food Chem. 2022, 369, 130753 (<https://doi.org/10.1016/j.foodchem.2021.130753>);
- [11] Food Res. Int. 2020, 130 (December 2019), 108949 (<https://doi.org/10.1016/j.foodres.2019.108949>);
- [12] J. Agric. Food Chem. 2022, 70, 7321–7341 (<https://doi.org/10.1021/acs.jafc.2c01050>).

## **The technical and ethical challenges of AI in Affective Computing and Artificial Intimacy**

***Diogo Cortiz, Pontificia Universidade Católica de São Paulo (PUC-SP) & Brazilian Network Information Center (NIC.br)***

This research is focused to understand the role of AI in Affective computing and Artificial Intimacy as well as its technical and ethical challenges. In this sense, we propose two main research questions. RQ1: How can we use AI to detect and understand emotional discourse in social media? and RQ2: How do users interact with AI interfaces (voice assistants, robots) and what are the subjective consequences for them? To answer those questions, we use different methods and approaches: developing AI experiments (AI/NLP models to detect emotional discourse in Portuguese), applying those models to identify patterns and trends in social media and investigating how emotional interfaces impact user's interaction and subjectivity.

# Biotechnological syntheses of maritime high-value diterpene type natural products

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The marine diterpene glucoside family of Pseudopterins (PS), conventionally extracted from soft coral *Antilloporgia elisabethae* is commercially used as an anti-irritant additive in high-end cosmetics. Additionally, this compound class is in clinical trials for its wound healing capacity of diabetes' lesions. However, harvesting the necessary soft coral biomass causes severe damages to the coral reefs, whereby the Pseudopterin content of the biomass can vary substantially between nearby locations.

The Canadian/German OMCBP project was the starting point to establish a sustainable, biotechnological production route, to protect the coral reefs and to provide a sufficient PS supply. In a first attempt, the recently discovered Hydroxyterpene synthase from *Streptomyces clavuligerus* (HPS) was used to generate the bicyclic PS scaffold, termed iso-Elisabethatriene A [1]. Unfortunately, the desired iso-Elisabethatriene A, a structural PS analogue accounted for only 9% (w/w) of the four main terpene products generated by this enzyme in a bacterial production system. Guided by a homology model derived from the x-ray structure of the diterpene synthase CotB2 [2], selected amino acids were mutated and analysed for their impact on the product distribution of said HPS. Interestingly, one mutant could be identified that showed a significant change in general product distribution, increasing the desired iso-Elisabethatriene A yield by a factor of more than three [3]. The synthase mutant was termed iso-Elisabethatriene synthase (IES).

Furthermore, an alignment with the CotB2 amino acid sequence showed a longer C terminal lid region following a conserved catalytic motive compared to the one of the IES. To verify, if a longer lid region leads to beneficial aspects in diterpene synthases a chimera of IES with C terminus of CotB2 was cloned and evaluated. Upon introduction in the bacterial production system the overall diterpene yield of IES could be doubled by the chimera. Additionally, the side product Hydroxyterpenol vanished completely from the product spectrum. This can be a hint that the chimera is more tight in the catalytic state as the presence of water leads to unintended abortions in formation of the diterpene scaffold by hydroxylated side products. Further research together with our partners from Israel, Canada and Germany shall clarify this question.

## References

[1] Yamada, Y., S. Arima, T. Nagamitsu, et al. Novel terpenes generated by heterologous expression of bacterial terpene synthase genes in an engineered *Streptomyces* host. *The Journal of antibiotics* (2015), 68 (6), 385.

[2] Driller, R., S. Jahnke, M. Fuchs et al. Towards a comprehensive understanding of the structural dynamics of a bacterial diterpene synthase during catalysis. *Nature Communications* (2018), 9, 3971.

[3] Ringel, M., M. Reinbold, M. Hirte et al. Towards a sustainable generation of pseudopterosin-type bioactives. *Green Chemistry* (2020), 22, 6033.

## **Complex networks techniques for analyzing temporal social media data**

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The reach power of social networks is known and undeniable. In fact, social media data contributes to the Big Data movement, in which a large volume of varied and unstructured data is generated at every moment. Complex network analysis is a powerful tool that provides us a fruitful framework to describe phenomena related to social, behavioral, technological, judicial, biological and many other real-world complex systems. The literature is rich in models and metrics associated with networked-data, but lacks models and techniques that combine temporal, textual and relationship dimensions under the same analytical perspective. These are dimensions that make up the Big Data movement. In this work the goal is to use complex networks in the form of textual temporal networks, to apply in different contexts, such as: harassment detection in social media, misinformation detection in social media, user preference change and text data correlation with phenomenon such as COVID-19 pandemic. Pre-liminary results have shown the potential of modeling social media data through textual temporal networks, especially rich in interpretability.

## The antidepressant effects of ayahuasca

*Fernanda Palhano-Fontes, Brain Institute, Federal University of Rio Grande do Norte (UFRN)*

The World Health Organization estimates that more than 300 million people suffer from depression, and about one-third do not respond to appropriate courses of at least two different antidepressant medications (Conway et al. 2017). Most currently available antidepressants have a similar efficacy profile and mechanisms of action, based on the modulation of brain monoamines, and usually, take about 2 weeks to start working (Conway et al., 2017). Recent open-label trials show that psychedelic substances, such as ayahuasca and psilocybin, hold promise as fast-onset antidepressants in treatment-resistant depression (Galvão-Coelho et al., 2021).

Ayahuasca is a brew traditionally used for healing and spiritual purposes by indigenous populations of the Amazon Basin. In the 1930s, it began to be used in religious settings of Brazilian small urban centers, reaching large cities in the 1980s and expanding since then to several other parts of the world. In Brazil, ayahuasca has a legal status for ritual use since 1987. Ayahuasca is most often prepared by decoction of two plants: *Psychotria viridis* that contains the psychedelic N,N-dimethyltryptamine (N,N-DMT), a serotonin and sigma-1 receptors agonist, and *Banisteriopsis caapi*, rich in reversible monoamine oxidase inhibitors (MAOI) such as harmine, harmaline, and tetrahydroharmine (Palhano-Fontes et al., 2021).

In order to test the antidepressant effects of ayahuasca, we conducted a double-blind randomized placebo-controlled trial in 35 patients with treatment-resistant depression. The results suggest a significant antidepressant effect of ayahuasca with rapid onset, already one day after a single dosing session. Compared to placebo, between-groups differences increased from one day (Cohen's  $d = 0.8$ ) to seven days (Cohen's  $d = 1.4$ ) after dosing (Palhano-Fontes et al., 2019).

In addition, we also explored the sub-acute effects of ayahuasca on a number of markers such as psychiatric scales, neuropsychological tests, functional magnetic resonance imaging (fMRI), electroencephalography (EEG), and, saliva and blood tests. All assessments occurred one day before and one day after the dosing session with ayahuasca or placebo, in all patients with depression as well as in a group of 50 healthy individuals (Palhano-Fontes et al., 2021).

The findings suggest that the origin of ayahuasca antidepressant effects are the result of a combination between the subjective changes experienced during the acute effects of the substance and the modulation of neuroimmune, neuroendocrine, and neuroplasticity pathways important for homeostatic regulation.

### References

[1] Conway, CR, George, MS and Sackeim, HA (2017) Toward an evidence-based, operational definition of treatment-resistant depression: when enough is enough. *JAMA Psychiatry* 74, 9–10.

[2] Galvão-Coelho NL, Marx W, Gonzalez M, et al (2021) Classic serotonergic psychedelics for mood and depressive symptoms: a meta-analysis of mood disorder patients and healthy participants. *Psychopharmacology* 238:341–354

[3] Palhano-Fontes F, Barreto D, Onias H, et al (2019) Rapid antidepressant effects of the psychedelic ayahuasca in treatment-resistant depression: a randomized placebo-controlled trial. *Psychol Med* 49:655–663

[4] Palhano-Fontes, F., Soares, B.L., Galvão-Coelho, N.L., Arcoverde, E., Araujo, D.B. (2021). Ayahuasca for the Treatment of Depression. In: *Current Topics in Behavioral Neurosciences*. Springer, Berlin, Heidelberg.

# **Translational investigation of the molecular mechanisms contributing to mental disorders**

***Florian Freudenberg, Department of Psychiatry, Psychosomatic Medicine and Psychotherapy, University Hospital, Goethe University Frankfurt***

With an estimated prevalence of ~38% in the European Union mental disorders are the leading cause of disability. These disorders cause a heavy burden on the affected patients and their kin and represent the main factor for the economic cost of brain disorders. Mental disorders are caused by a complex interplay of genetic risk factors and environmental impacts, including stress, inflammation, and nutrition. Despite this knowledge, currently available pharmacotherapy often suffers from insufficient response rates (40-60%), limited or reduced efficacy, and response delays. Therefore, investigations into the neurobiological mechanisms underlying these disorders are of high scientific, clinical, and socioeconomic relevance.

I am a research group leader in the Laboratory of Translational Psychiatry at the Department of Psychiatry, Psychosomatic Medicine and Psychotherapy at the University Hospital of the Goethe University Frankfurt. My group aims at identifying the molecular mechanisms involved in the development of mental disorders utilizing a wide range of behavioural, molecular, and pharmacological methods. Together with psychiatrists and psychologists from the Department, we translate our findings from and to human patients.

Our main project in recent years, revolved around the scaffolding protein NOS1AP, which has been linked to different mental disorders, and whose expression has been shown to be increased in brains of patients with schizophrenia and depression. To mimic this increased expression, we made use of viral gene transfer to overexpress NOS1AP in the hippocampus or medial prefrontal cortex of mice. In these mice, we found selective deficits which are akin to those observed in different mental disorder. We are now working on a substance identified in a large molecule screen, to target interactions of NOS1AP and thus potentially treat those conditions, where increased NOS1AP might contribute to symptoms. Preliminary findings from cell cultures are very promising.

In addition, we have investigated the role of maternal inflammation on the progression of neurodevelopmental disorders in the offspring (i.e. maternal immune activation, MIA). We were able to replicate the behavioural deficits caused by poly(I:C) induced MIA and showed related alteration in brain morphology. Moreover, we investigated proteomic changes of hippocampal synaptoneurosomes from embryos (E18) or adult (3 months of age) MIA mice. In adults our proteomic screen revealed sex-specific changes in proteins linked to synapse formation and signalling. In contrast, changes in embryos were largely sex-independent and mostly involved proteins involved in development.

In the future we have planned to investigate genetically diverse mice (diversity outbred, DO) to identify the complex molecular mechanisms leading to mental disorder related phenotypes. These findings will be compared to the genetic findings from human patients and will help to improve the translatability of preclinical models and thereby advance bench-to-bedside development. Moreover, in the context of a collaborative research centre application on lipid signalling, we are planning a project investigating the link between soluble epoxide hydrolase (sEH) related lipid metabolism, inflammation/MIA and their impact on mental disorders in both mice and human patients.

## **Neurovespina- a bioinspired antiepileptic**

***Gabriel Avohay, Neuropharmacology Lab, Department of Physiological Sciences, University of Brasilia***

Epilepsy is a complex neurological disease, diversified both etiologically and clinically, being characterized by the hyperactivity of neurons and brain circuits capable of generating synchronized electrical discharges. Like other chronic diseases, refractory epilepsy is a socially disabling condition for patients. In addition to stigma and discrimination, it brings limitations in terms of independence, autonomy, problems of social interaction, cognitive difficulties, behavioral disorders, depression, suicide, and a higher risk of sudden death compared to the general population. The temporal lobes are the most common brain region to develop epileptogenicity, thus temporal lobe epilepsy (TLE) is the most prevalent type of epilepsy in adults, reaching up to 70% of patients. Many of the patients with TLE have a greater tendency to become pharmacoresistant (less than 25% of patients remained seizure-free for more than one year), so the development of new antiepileptic medications improves quality of life of patients with epilepsy by reducing seizure frequency.

Neurotoxins are abundant in wasp venom, being predominantly from the acylpolyamine or peptide classes. The peptides affect with high affinity and specificity the excitatory or inhibitory synaptic functions of neurons of mammals and insects, being able to interact with sodium, potassium, and calcium ion channels and as well as ionotropic or metabotropic receptors, such as glutamate excitatory neurotransmitter. In this sense, these toxins represent a rich resource of novel molecules able to modulate neuronal activity.

The aim of the present study was identified a new treatment for refractory epilepsies by evaluating a new bioinspired peptide in acute and chronic models of epilepsy, the pharmacological safety in rodents and evaluating its mechanism of action.

# The challenges of designing educational systems to promote an optimal learning experience

*Ig Ibert Bittencourt, Universidade Federal de Alagoas - UFAL*

It is still very common that students become disengaged or bored during the learning process by using an educational system. On the other hand, several studies from Positive Psychology, more specifically from Flow Theory, show that there is a commonsense about what makes a person interested on certain subject, even if they are not rewarded: they do something because it is fun! Successful people from different areas shared that what keep them motivated and engaged when they are involved within an activity is called Flow. Once a person is immersed in such activity, it becomes autotelic, which means that it is an end in itself. However, it is still a challenge to design activities that can lead students to an optimal learning experience. Some studies propose the use of gamification and AI techniques. Indeed, we argue that there is a need for a pedagogical shift in a way we can build a bridge between pedagogical practices with scientific approaches to better understand how to improve education and psychological foundations to provide ways to make the learning process more enjoyable. In order to do that, it is intended to build a tutoring systems that combine AI Techniques (i.e. to detect affective states and knowledge of students about concepts), Persuasive Computing (i.e. reified with gamification) and Psychological Theories (i.e. stereotype threats and positive psychology approaches) to drive students to an autotelic learning experience. The goal of this talk is to present challenges of designing educational systems to promote an optimal learning experience.

# Embedding Ethics into the Software Development Process

*Dr. Jan Gogoll (jww Severin Kacianka, Niina Zuber, Alexander Pretschner, Julian Nida-Rümelin),  
Bavarian Research Institute for Digital Transformation*

Over the past years, software development has increasingly gained importance in economic as well as societal terms. Big Tech companies are among the most valuable firms on the planet. Especially due to the breakthroughs in machine learning and the availability of huge amounts of data, we are able to employ the help of software in important cases that used to be a prerogative for humans, e.g., hiring decisions and credit (i.e., Eubanks 2018 or O'Neil 2016) or mortgage evaluation (Kearns and Roth 2019). In fact, software impacts every area of our lives and will most likely be embedded into the fabric of society in the future.

Ethically designed software products are based precisely on the imperative to evaluate and understand the product from multiple perspectives: A horizontal extension of the technical reflection requires taking cultural, social, ecological and political perspectives into account. A hermeneutic-analytic understanding captures a digital system, which in turn is vertically composed of different levels of abstraction (i.e. Floridi 2014). This is what we call an ethical deliberation: To introduce different points of view and evaluate these situations for their moral goodness. Those moral criteria must take into account the individual, intersubjective, and collective effects on the common good (i.e. Vallor 2016, Reijers and Coeckelbergh 2020). Therefore, it cannot be enough to just assess the use of a system and alter its unwanted effects ex-post. Rather, it is of the utmost importance that potential ethical pitfalls are addressed ex-ante and thus -if possible- avoided (i.e. Friedman and Kahn 2019). Considering unwanted outcomes due to inappropriate software systems is surely a difficult task that certainly is not exclusively the sole responsibility of software engineers (i.e. Grunwald 2015). As an analogy, system safety engineering uses processes to shift the burden from single engineers to the whole company. To expect a single engineer (or even a team) to address and decide on ethical relevant questions on their own is both unrealistic and too demanding. More often than not the decision to develop or to employ a software tool in a certain scenario is a decision made on the executive level and falls within the domain of business ethics. It is beyond the competence of a single software developer at, for example, AirBnB to stop her work in order to ponder on the fact that the service might have implications on rent prices some years down the road (Gogoll et al. 2021).

This leaves us with the question of what a single engineer can do and ought to do. This precise location of relevant issues will foster ethically informed software development and thus may introduce a cultural change where ethical deliberation is an integral part of the decision making. Structurally, this needs to be embedded into the larger space of a the (agile) software development processes (Zuber et al. 2020). We show how ethical deliberation can be embedded into one such agile methodology, Scrum, and thus empower and enable the engineers to explicate their ethical deliberations. With their focus on the individual developers and the iterative

nature of product development, we argue that agile methodologies are uniquely suitable to support ethical deliberation.

Explicit deliberations have the advantage that they can be understood and evaluated by others, thus creating accountability by introducing moral responsibility. Thus, reducing moral distress on the individual. Our approach tries to stay lightweight and will reserve complex deliberations for the most difficult problems. Similar to everyday decisions like buying organic or industrial food, developers should be empowered to take many decisions by themselves.

## References:

- [1] Grunwald, A. (2015). Technology assessment and Design for Values. Handbook of ethics, values, and technological design, 67-86.
- [2] Eubanks, V.: Automating inequality (2018). How high-tech tools profile, police, and punish the poor. St. Martin's Press
- [3] Floridi, L., & Taddeo, M. (Eds.). (2014). The ethics of information warfare (Vol. 14). Springer Science & Business Media.
- [4] Friedman, B., & Hendry, D. G. (2019). Value sensitive design: Shaping technology with moral imagination. Mit Press.
- [5] Gogoll, J., Zuber, N., Kacianka, S. et al. Ethics in the Software Development Process: from Codes of Conduct to Ethical Deliberation. Philos. Technol. <https://doi.org/10.1007/s13347-021-00451-w>
- [6] Kearns, M., Roth, A.: The ethical algorithm: The science of socially aware algorithm design. Oxford University Press (2019)
- [7] Reijers, W., & Coeckelbergh, M. (2020). A Narrative Theory of Technology. In Narrative and Technology Ethics (pp. 79-111). Palgrave Macmillan, Cham.
- [8] O'Neil, C. (2016). Weapons of math destruction: How big data increases inequality and threatens democracy. Broadway Books
- [9] Vallor, S. (2016). Technology and the virtues: A philosophical guide to a future worth wanting. Oxford University Press.
- [10] Zuber, N., Kacianka, S., Nida-Rümelin, J. & Pretschner, A. (2020): Ethical deliberation for Agile software processes: EDAP manual. Hengstschläger, M (ed.): Digital Transformation and Ethics.

## **Intimacy with and through Technologies**

*Jessica Szczuka, University Duisburg-Essen*

Digitization is having an impact on the most diverse areas of life. This also includes sexuality as a basic human need. Various technological achievements have already been used for sexual gratification in the past (e.g., photography and videography for pornography, chatbots, sexualized robots, VR technology, social media platforms). In my empirical research, I explore the potential of various technologies within intimate interactions. These can take place with technologies themselves (with non-embodied technical objects or artificial interaction partners such as virtual agents or robots) or be mediated by technologies (e.g., interactions between humans via platforms). Fields of application include digitized sexuality, but also the communication of sensitive information (e.g., communication about taboo topics or information that should not be disclosed to third parties).

Key questions that I aim to address are “Is digitalization affecting human sexuality?”, “Does digitized sexuality affect how people perceive and bond with technologies?” and “Is there an appropriate technological and legal basis for digitized sexuality?”.

In particular, the different motivations within sexualized interactions make them an important topic of research, as the need for sexual gratification affects other control mechanisms, such as the ability to think about potential risks, which may be important in these very intimate interactions.

Since the topic is strongly influenced by social desirability, I include mainly indirect measures such as eye-tracking, affective priming, behavioral data, or hormone measurements.

The topic is very interdisciplinary. The key questions mentioned above are too complex to consider individually. Therefore, digitized sexuality touches different research areas such as psychology, computer science, cognitive science, law and ethics.

# Humanized Question Answering Systems

*Julio Cesar dos Reis, Institute of Computing, University of Campinas (UNICAMP)*

Question Answering (Q&A) systems play a central role for organizations. They are relevant for customer services because companies have sought new conversational channels to minimize human-to-human physical interaction. An alternative corresponds to conversational systems, which simulate conversations between human-to-machine. The construction of Q&A systems usually rely on knowledge models for querying answers from user questions. Similar to other real-world phenomena, knowledge may be represented in graphs. Knowledge Graphs (KGs) [1] provide a graph-based data model as a way for knowledge representation. KGs use a graph-based data model to capture knowledge from diversified data sources at a large scale. KG-based analyses are often applied to support various systems, such as, information searching [2], question answering [3], etc.

The core of this investigation is how to generate KGs from unstructured texts and how to explore KGs for the recommendation and automatic Q&A systems. Our study follows three distinct research venues: (i) automatic generation of ontology-linked KGs from unstructured texts, using Natural Language Processing (NLP) techniques; (ii) characterization of knowledge evolution in temporal texts represented in Temporal Knowledge Graphs (TKGs) [7], by analysing complex network measurements; and (iii) proposal of a visualization method based on TKGs and the analyses of complex network measurements to represent knowledge evolution.

We propose the use of KGs [4] to represent knowledge conveyed in unstructured NL texts. KGs are composed of a finite set of triples, constituted of a subject, a predicate, and an object. For instance, (John, knows, Jane) constitutes a simple triple. KGs are denoted as regular graphs, i.e, a set of nodes (the triple's subjects and objects) linked by a set of edges (the triple's predicates). We propose linking the generated KGs to computational ontologies [5]. This enables the comparison of nodes either within a given KG, or even between different KGs. The objective is to help with the identification of entities and relationships from texts.

In our investigation, generated KGs are used for Q&A systems via queries. In this line, we study the humanization of Q&A systems, further focused on chatbots. Some characteristics are generally expected of a chatbot, such as naturalness. A chatbot is expected to build meaningful, personalized, and friendly dialogues through a conversational system. Such a conversational system must evolve with each interaction and offer alternative answers to similar questions, answering the interlocutor's questions as another human person would meet user expectations more naturally and fluidly [6]. From this perspective, the humanization aspects of chatbots are essential. We contribute with the study of impact factors affecting humanization and on evaluation instruments for assessing the level of humanization of chatbots.

## References

- [1] A. Hogan, E. Blomqvist, M. Cochez, C. D'amato, G. D. Melo, C. Gutierrez, S. Kirrane, J. E. L. Gayo, R. Navigli, S. Neumaier, A.-C. N. Ngomo, A. Polleres, S. M. Rashid, A. Rula, L. Schmelzeisen, J. Sequeda, S. Staab, A. Zimmermann. 2021. Knowledge graphs, ACM
- [2] H. Arnaout, S. Elbassuoni, Effective searching of rdf knowledge graphs. 2018. Journal of Web Semantics. 48 66–84. doi:<https://doi.org/10.1016/j.websem.2017.12.001>. URL <https://www.sciencedirect.com/science/article/pii/S1570826817300677>
- [3] K. Singh, I. Lytra, A. S. Radhakrishna, S. Shekarpour, M. E. Vidal, J. Lehmann. 2020 No one is perfect: Analysing the performance of question answering components over the dbpedia knowledge graph. Journal of Web Semantics. doi:<https://doi.org/10.1016/j.websem.2020.100594>.
- [4] Lisa Ehrlinger and Wolfram Wöß. Towards a definition of knowledge graphs. In 12th International Conference on Semantic Systems (SEMANTICS 2016), 2016
- [5] Thomas R. Gruber. Toward principles for the design of ontologies used for knowledge sharing. International Journal of Human-Computer Studies, 43:907 – 928, 1995.
- [6] Divyaa Balaji. Assessing user satisfaction with information chatbots: a preliminary investigation. Master's thesis, University of Twente, 2019.
- [7] Rossanez, A.; Torres, R. S.; Dos Reis, J. C. 2020. Representing Scientific Literature Evolution via Temporal Knowledge Graphs. 6th Managing the Evolution and Preservation of the Data Web (MEPDaW' 20) co-located at the 19th International Semantic Web Conference (ISWC'20), virtual event, p. 33-33

## **Impacts of disasters in Brazil and population's risk perception**

*Luciana Londe, Cemaden – Brazilian Centre for Monitoring and Early Warnings of Disasters*

From 2013 to 2015, the São Paulo state population, in Brazil, had to deal with the lack of water for many months, due to a severe drought in the region. This kind of problem is recurrent in the semi-arid Northeastern Brazil, where many families do not have pumped water in their houses and the crops are frequently lost due to lower rates of rainfall. The dry weather also contributes for the spreading of wildfires in the North and Central-West regions. On the other hand, floods and flash floods are common in many parts of the country, blocking roads and highways and destroying houses and belongings. Furthermore, landslides can be triggered by rainfalls and cause deaths and serious injuries, damages and losses.

Droughts, floods, landslides and wildfires may be associated with recurrent disasters in Brazil. The United Nations strategy for Disaster Risk Reduction defines Disaster as “a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts” (UNISDR, 2017).

This definition suggest that a wide range of events can be characterized as disasters. For example, large hydraulic enterprises can trigger disasters - those associated to technological hazards instead of natural ones. Brazilians used feel safe regarding the engineering and technical efficiency of buildings, but this kind of belief was weakened after the dam bursts at the municipalities Mariana and Brumadinho. Also, Hydroelectric Plants at the Brazilian states Acre and Rondônia, cause floods which may last for many months with impacts on transportation and commerce in the region.

All these disasters are related to Brazilian historical/political process, characterized by social exclusion, with roots on slavery system, migrations from northeast to southeast because of drought and famine and other social dysfunctions, joined to a massive and badly-planned exploitation of natural resources. These facts impact the rights to safe housing, health and education services and job offers, in a non-desirable chain of problems and consequences.

In my poster I will discuss some results on disasters' impacts in Brazil and some findings on the population's risk perception.

# **Towards capturing the neurobiological basis of perception in the design of artificial intelligence systems**

***Marcel Oberlaender, Max Planck Institute for Neurobiology of Behavior, Bonn***

Artificial intelligence has undergone a revolution, particularly due to impressive advances in “deep learning”. In contrast to the brain, however, artificial neural networks (ANNs) require enormous amounts of training data and often fail to generalize to other even related tasks. While current ANNs are inspired by the design of the nervous system, the crucial questions of how artificial systems could ever achieve animal – or even human – intelligence, and whether additional neurobiological principles would be needed for this, remain open.

To address these questions, my research group at the Max Planck Institute for Neurobiology of Behavior (Bonn) investigates the neural basis of sensory perception in rodents. Unraveling the cellular and circuit mechanisms that underlie perception is, however, extremely challenging, because even the simplest stimulus activates hundreds of thousands of neurons distributed throughout the entire brain. Moreover, the data provided by the sensory systems, representing the state of the world, is noisy. Yet, the brain is able to classify this noisy input across the hierarchy of cortical processing stages, triggering flexible and nuanced behaviors – a hallmark of higher cognition. This is why understanding the neural basis of perception will represent a crucial step for capturing design principles of the nervous system that could generate artificial systems with improved ability to generalize across tasks and less reliance on training data.

For this purpose, my group has developed a multi-disciplinary approach that allows bridging across the different levels of abstraction of brain function. At the “implementational” level, we build realistic models of the brain by systematically collecting anatomical and physiological data from experiments that we perform in the living animal (in vivo). At the “algorithmic” level, we use these models to perform simulations (in silico) that mimic the conditions of our in vivo experiments, and thereby predict which mechanisms could account for the activity patterns that we observe, and which then allows us to test these predictions experimentally, for example via optogenetic and pharmacological in vivo manipulations. At the “computational” level, we reduce these algorithms into mathematical models, which we can then capture in the design of ANNs. On the example of our most recent findings, I will demonstrate that our approach provides unmatched understanding of how the interplay between cellular and circuit mechanisms gives rise to sensory perception – and I will showcase how artificial intelligence systems can benefit from these neurobiological principles.

## On the role of dopamine in memory integration

*Maria Carolina Gonzalez, Edmond and Lily Safra International Institute of Neuroscience, Santos Dumont Institute*

New memories are initially unstable and must undergo a stabilization process known as consolidation to persist. When recalled, memories can become destabilized again and a reconsolidation process is needed to re-stabilize them. Because novelty and prediction error signals perceived at recall are necessary to destabilize reactivated memories, one main hypothesis is that this destabilization/reconsolidation cycle serves to maintain our memories updated. It is also known that the hippocampus is a brain region that integrates new and old memories to form networks of knowledge, but the neurobiological basis of this process remains unknown. In this respect, we recently discovered that memory reconsolidation is a process that actually binds memories from different experiences and that hippocampal D1/D5 dopamine receptors couple novelty and salience detection to memory destabilization to control whether new memories are linked to old ones through reconsolidation or consolidated as independent memory traces instead. We also found that only when the new memory is linked to old representations, its recall reactivates other components of the network, making them susceptible to modification.

In the lab, we are now studying the neural mechanisms underlying memory integration to better understand how our brain links new incoming information with prior knowledge, how past experiences influence subsequent memory storage and how indirect reactivation affects the fidelity of dormant memories. To that end, we use Wistar rats and combine animal behavior with multi-scale electrophysiology and pharmacological and optogenetic interventions.

Our research may have major implications in psychotherapies designed to mitigate the nondeclarative aspects of traumatic experiences. Because it is unethical to induce direct recall of the distressing memory that lies at the root of the trauma, indirect reactivation of traumatic memories utilizing symbolic reminders could be a helpful strategy to change or disrupt the original memory avoiding the reliving of the disturbing event. Also, our results may help to identify molecular targets to enhance, prevent and treat memory-related disorders, such as Alzheimer's disease where content-specific information of past events is lost, or schizophrenia where coherent relationships between items and context are lost.

## Shortest-path based centrality under context constraints

*Mirco Schönfeld, University of Bayreuth*

Social interaction is happening in computer-assisted environments more and more - humans cultivate their friendships, organizations collaborate professionally, and customers are approached interactively via automated call-centers or chat-bots. Regardless of what entities are communicating, online social interaction is mediated by computer processes. Such systems offer implicit access to social networks and the content that is shared in such networks. Such systems increasingly gain access to metadata of communication that describes context of entities, their actions, and interactions. Such context information is yet to be considered for network analysis tasks.

Centrality measurements, as an important task of network analysis, are a well-known method to assess the importance of actors in networks. They are easy to obtain and provide a versatile interpretability adaptable to the meaning of nodes and edges. The current centrality measurements use structural information alone. In real-world situations, however, actors and the connections between them are subject to contextual settings and can be significantly influenced by these settings.

In fact, such real-world observations are often modeled using attributed networks in which contextual information can be associated as attributes to nodes and edges. In interpersonal networks, for example, the mere existence of an edge between two humans contains very little information about the quality or intensity of a relationship. Assessing that is only possible if information about time, location, type, degree of kindness, or even warmth is considered - all of which are descriptions of the context in which interaction takes place. However, this information is disregarded when evaluating the importance of actors in terms of network centrality measurements.

Hence, we propose a method for obtaining shortest path-based centrality measurements for attributed networks that exploit attribute information on nodes for shortest path calculations. We add abstracts of scientific publications to a co-publishing network and use topic models to create node-individual context constraints for shortest path calculations.

This creates additional analytic opportunities and can aid in gaining a detailed understanding of complex social networks. The goal is to enable algorithms to operate beyond the mere structural dimension of the network on a richer set of data that more closely resembles the real-world setting that is being modelled. Ultimately, this allows researchers to investigate the interrelation between structural information and contextual settings of entities, and paves the way to a truly context-aware social network analysis.

## **Human Intervention in AI Decisions**

***Miriam Wimmer, Brazilian Institute of Education, Development and Research (IDP)***

In a context in which different countries have come to recognize a right to human intervention in automated decision-making, the research aims to investigate the elements that may attract the need for human parameters in decision-making supported by artificial intelligence, exploring different categories of problems that may result from such decisions. Furthermore, the research aims to examine elements that could mitigate the risks associated with the "lack of humanity" of AI decisions and thereby enable the modulation of human participation at different levels of intensity, while meeting the ethical requirements of legitimate, trustworthy, and fair decisions, that can be understood by humans in their main elements.

# Implementation of Intelligent Multimodal Neural Interfaces for Neuropsychiatric Disorders

*Bettina Habel<sup>1,2</sup>, Mahnaz Arvaneh<sup>3</sup>, Ivan R. Minev<sup>2,3</sup>, Nadine Bernhardt<sup>1</sup>*

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**Introduction** Despite the successes of pharmacological and cognitive therapies, psychiatric diseases remain challenging to treat. High relapse rates, low patient compliance, stigma and associated societal and individual costs motivate the search for new treatments. Based on the understanding that psychiatric conditions result from measurable and actionable physiological dysfunction, we advocate a new rehabilitation strategy enabled by interfaces to higher cognitive centres of the nervous system.

**Methods** Applying 3D-bioprinting of soft silicones and a conductive platinum composite, we fabricated flexible multielectrode arrays for neural recording and electrical brain stimulation. A microfluidic channel further allowed the cortical application of pharmacological substances. We implanted the neuroprosthesis epidurally above the medial prefrontal cortex of rats, a critical region for top-down control of behaviour and cognition. An auditory oddball paradigm was employed to elicit neural activity patterns indicative of stimulus perception, early attentive processing, and decision making, which are known to be affected in neuropsychiatric disorders. In awake animals, we obtained auditory event-related brain potentials (ERPs) under treatment-naïve conditions and following acute alcohol intake, electrical pulse stimulation of the cortical surface and local application of the anti-relapse medication naltrexone. Finally, we developed machine learning algorithms based on stepwise linear discriminant analysis for single-trial ERP data for advanced identification of treatment effects.

**Results** The neuroprosthesis acquired sound-specific neural responses and captured alcohol-induced neural depression indicated by diminished ERP components. Implant-driven electrical stimulation and naltrexone application resulted in increased ERP amplitudes. These treatment-induced neural modifications were also identified with high accuracy through the developed machine learning approach.

**Conclusion:** Here we provide proof-of-concept for soft, multimodal neuroprosthetics to record higher-order prefrontal neural activity reflecting intact stimulus processing in the healthy state and neural impairments following alcohol intoxication. We further demonstrated neuroenhancing effects of epicortical electrical and pharmacological interventions. In combination with advanced computational modelling this technology will enable the detection of disease dependent biomarkers and closed-loop feedback control, providing an innovative, comprehensive approach for diagnosing and treating neuropsychiatric symptoms.

# **Brazilian Judicial process and the human being in a scenario of decisions made by AI**

*Paloma Saldanha, Catholic University of Pernambuco (UNICAP)*

Brazilian Judicial process and the human being on a scenario of decisions made by AIs. This research is about what is the real role of the human being in the Brazilian judicial process regarding the automation of procedures and the use of artificial intelligence for decision making. It's relevant because, on general and global context, judiciary has been influenced by the information technologies growth and wideness, and this may cause a range of transformations on its dynamics. Among these possible changes are some like jurisdictional velocity, decisions effectiveness and procedural adequation, and, furthermore, some changes on how constitutional guarantees and principles may be faced contemporary. The works resulted from this research may enrich debates, not intending to solve it, about the future of judicial procedures, including the theme of how information technologies interfere on human beings preservation at judicial issues, considering its automation and the use of artificial intelligence. It aims to verify if Brazilian current technological status can make possible to modify the Brazilian jurisdiction composition in different degrees, considering automations and the use of artificial intelligence on decisions making, without violating ethical principles.

In order to reach these goals, it will be used approaches as: making diagnosis of Brazilian Judiciary activities that already are automated; verifying at which stage of IT development the systems used by the Brazilian Judiciary are; identifying procedural steps of civil 1st jurisdiction degree (called ordinary procedure) that, nowadays, could use some available technologies, but that it's not yet adopted by public institutions; identifying the justification for existing a second degree of jurisdiction and it's necessity.

As result, this research intend to find how we can dehumanize the jurisdiction procedure, in order to humanize the Brazilian judicial process, guaranteeing greater effectiveness for ours judicial decisions, by automating some procedure acts and using artificial intelligence, in a way compatible with ethical values and guarantees protected by our federal constitution.

## **Integrated metabolomics for the study of adaptive and signaling responses of medicinal and edible plant species**

***Paula Bueno, Federal University of Alfenas - UNIFAL-MG, Department of Chemistry***

Our current medicinal and food systems are based on a finite number of domesticated species, which were selected over the centuries. Although this approach allowed the selection of the most interesting varieties in terms of yield or pharmacological properties, the productivity, nutritional quality or biological activities of many plant species have already been negatively impacted by both the unpredictable and dynamic nature of global climatic conditions, and the reduced genetic variation. Considering the increasing demand for food and new pharmacological agents to support an increasing population, the understanding about how and in which extension plant species adapt to stresses and to different environments is critical to develop improved cultivars and to discover new sources of bioactive molecules. Although challenging, this knowledge can be accomplished by the study of their micromolecular chemical profiles, combined with the phenotypic study of wild relatives conserved either in nature or in germplasm banks. The identification and annotation of molecular traits that vary in response to stress events provide an advantage because they integrate over many genes and environmental effects. Therefore, my research line is based on the identification of such molecular markers, especially secondary metabolites using metabolomics. It includes target and non-target sample preparation and analysis, application and integration of multi-dimensional data obtained by NMR, GC-MS and/or LC-MS/MS, and multivariate data analysis of wild, genetically modified or cultivated plant species. As an example, herewith I present some of the results concerning the identification and quantitation of water stress-responsive specialized metabolites from wild and genetically modified soybean genotypes subjected to controlled, drought and flooding conditions. Soybean, as a legume crop, was used as a model not only because of its nutritional relevance, but also because of its unique phytochemical pattern characterized by health-promoting compounds such as carotenoids, isoflavones and triterpenoid saponins.

## **Agent-based Modeling to understand Human Behavior**

*Péricles Miranda, Universidade Federal Rural de Pernambuco*

Information management from a decision-making perspective involves the ability to capture and represent significant information to human modelers to make effective and efficient decisions. Nevertheless, real-world problems are usually extremely difficult to solve/model due to their intrinsic complexity and typical high dimensionality. One of the most prominent modeling techniques that takes advantage of the great amount of data and accurately represents emergent phenomena is agent-based modeling (ABM). ABM focuses on large-scale systems such as mobile phone calls, social networks, political systems, or commercial activities and is more appropriate than other tools such as analytical or statistical modeling when a complex and dynamic environment, such as a social network, is involved and when the modeling measure of interest is an emergent result of consumer interactions [Chi17a]. ABM is especially powerful in demand-side forecasting cases when social interaction and/or cognitive biases are relevant, when consumer behavior is complex and market behavior volatile, when equation-based modeling would impose too many restrictions, and when controlled experimentation is desirable yet infeasible.

This speech focuses on ABM for marketing applications. Particularly, ABM is suitable to understand how relations among customers, brands, and media drive the whole market dynamics. Nowadays, ABM can increase the understanding of how the marketplace works as the model's basic units directly correspond to the real-world entities that we are interested in, consumers and businesses. Marketers can study how word of mouth and social influence travel in a consumer network at negligible cost, thus testing the effects of micro-campaigns and marketing strategies on macro-level innovation diffusion. The ABM and complexity science technology have been used in academia and business. Several large firms, such as Procter & Gamble, have successfully applied ABM to improve revenues. American companies such as Concentric, Icosystem, and Ignite Tech. (Thinkvine) provide MK services to firms using this technology.

# Offline Artificial Intelligence in Education to Promote Inclusion in Global South

*Rafael Ferreira, Cesar School and Universidade Federal Rural de Pernambuco (UFRPE)*

Over the years, the Artificial Intelligence in Education (AIED) field has developed several tools and techniques that benefited many instructors, students, and managers in the last decades. AIED could, for instance, support students' dropout and success prediction, the provision of personalized feedback, group formation to support collaborative learning, analysis of the textual data produced by students, data visualization, among others.

In addition, digital learning platforms have become popular in recent years to support online learning and face-to-face teaching. This growth results from multiple factors, such as the number of systems and functionalities that could support instructors and students in different learning contexts and students' broad use of technology. Moreover, the COVID-19 pandemic accelerated the need to use technology in educational settings.

Although the benefits of AIED, in the global south, many educational institutions do not have access to the adequate infrastructure to explore the technologies developed in this field. It results in an increase of inequity and unjustness in the access to quality education in many countries. For instance, in Brazil, many public schools shortfall internet access and devices required to enable AIED.

However, many difficulties are related to acquiring and analyzing educational data in places where it is difficult to access technological devices and the internet, mainly due to scarcity of financial resources. In these scenarios, many teachers and students are offline and apart from the rest of the world since they cannot participate in the benefits of data analysis.

In this context, this presentation will describe a project developed in partnership with the ministry of education to build a platform using AIED to support a program to recover the students learning due to the effects of the COVID-19 pandemic. More specifically, this project focuses on analyzing textual productions of students from 11 to 15 years enrolled in public schools in Brazil. To reach this goal, we developed an approach that uses low-cost equipment (cell phone) used by the teachers to capture images of the students' essays in order to be processed by state-of-the-art computer vision and natural language processing models specifically created to analyze texts in Brazilian Portuguese. Our results demonstrated the efficacy of this strategy.

## "NO" endocannabinoids: Fear?

*Sabrina Lisboa, School of Pharmaceutical Sciences of Ribeirão Preto, University of São Paulo*

Introduction: Intense stress exposure can result in long-term changes, such as exaggerated fear response and long-term impairment in fear processing. These changes are observed in posttraumatic stress disorder (PTSD) patients. Antidepressant drugs promote an insufficient rate of response. Therefore, a better understanding of the neurobiological mechanisms involved in PTSD-like responses is needed to provide therapeutical alternatives. Nitric oxide (NO) and endocannabinoid (eCB) systems are involved in stress response, learning, and memory, including aversive memories, in opposite directions. Moreover, they can modulate each other. Considering that eCBs and cannabidiol (CBD), a non-psychotomimetic phytocannabinoid, modulate anxiety and stress response, we first investigated if CBD could prevent changes in fear processing in the contextual fear conditioning (CFC) induced by severe stress exposure (single prolonged stress-SPS) in rats. Moreover, we investigated if in a genetic model (iNOS knockout mice), fear processing changes are related to eCBs system dysfunction and if modulating the eCB system could attenuate these changes.

Methods: Male Wistar rats were exposed to single prolonged stress (SPS), a model of PTSD. Fear sensitization and impaired extinction of conditioned fear were evaluated one week later. The brain levels of phosphorylated neuronal nitric oxide synthase enzyme (pnNOS) were measured at different time points after SPS stress. Starting 2h after SPS, the animals were treated daily with vehicle, paroxetine (PRX; 5-20mg/kg) or CBD (2.5-10mg/kg) for 7 days. In another experiment, a 5-HT<sub>1A</sub> (WAY100635, 0.3 mg/kg) or CB<sub>1</sub> (AM281, 0.5mg/kg) receptor antagonist was administered 30 minutes before CBD (5 mg/kg). 24h after the last drug injection, the rats were submitted to the contextual fear conditioning (CFC) procedure (three random electric footshocks, 0.35mA/2s). Fear sensitization and extinction were assessed in two distinct sessions over the next 48h. Another group of rats received a single injection of the neuronal NO synthase enzyme inhibitor (7-NI; 150-60 mg/Kg) or a high dose of CBD (30 mg/Kg, 2h after SPS) and were evaluated one week later in the CFC. For experiments involving the iNOS KO mice, male WT and KO mice were submitted to a similar CFC paradigm, but with different footshock intensity (3 x 0.75 mA/2s). 24h later mice were evaluated for fear extinction acquisition and, after an additional 24h the extinction recall was evaluated. Some mice had their brain collected 24h after conditioning for evaluation of NO metabolites (NO<sub>x</sub>) or mRNA levels of NO- and eCB-related genes in the PFC and hippocampus. In another experiment, mice received a systemic injection of an eCB degrading enzyme (FAAH) inhibitor (URB597), a TRPV1 antagonist (SB366791), or a drug that inhibits FAAH and blocks TRPV1 (arachidonic acid - AA-5HT), all at 0.1 mg/Kg based on previous studies, 30 min before the first re-exposure to the conditioning chamber, without footshocks. In a different protocol of extinction evaluation (4 shorter sessions after fear conditioning), different groups of mice were evaluated after a dose-response curve of 7-NI (15-60 mg/Kg) or after a high dose of URB597 (3 mg/Kg).

Results: SPS induced fear sensitization (increased freezing in the first context re-exposure) and impaired fear extinction ( $p < 0.05$ ). Increased pNOS expression in the ventral hippocampus-vHIPP was observed 1h after SPS ( $p < 0.05$ ), but not later. In the prelimbic prefrontal cortex (PL-PFC), increased pNOS was observed after evaluation of extinction retention. Acute 7-NI, but not acute CBD at low doses, facilitated fear extinction. Repeated PRX (10mg/kg) and CBD (5 and 10mg/kg) facilitated fear extinction. CBD differently affected pNOS in vHIPP or PL-PFC after extinction. Behavioral CBD effect was abolished by pre-treatment with WAY100635 or AM281. An acute high dose of CBD (30 mg/Kg) also attenuated fear response and the increased pNOS in the PL-PFC. iNOS KO mice present impaired fear extinction in the CFC. These mice have higher NOx in the PFC, but not HIPP. Moreover, KO mice exposed to conditioning have higher nNOS mRNA in the PFC. They also presented signs of eCB dysfunction, with increased mRNA of synthesis (NAPE-PLD) and degradation enzymes (FAAH and DAGL), and TRPV1 receptors, whereas there was decreased mRNA of CB1 and CB2 receptors. The impaired extinction of iNOS KO mice was attenuated by 7-NI, by a high dose of URB597, or by a low dose of AA-5HT.

Conclusion: These results suggest that eCBs, CBD or nitrgic interventions could be useful in the treatment of stress-associated disorders such as PTSD, and that iNOS KO mice are a suitable model to investigate mechanisms involved in resistance to fear extinction. Financial support: FAPESP (2017/19731-6), CNPq.

# Systematic evaluation of Amazonian medicinal plants

*Serhat Cicek, Institute of Pharmacy, Department of Pharmaceutical Biology, Kiel University*

Natural products often constitute the basis for the development of effective therapies and account for more than half of all approved drugs. Therefore, drug discovery from nature is still the most common way for the development of novel therapeutics. Ethnopharmacological research represents one approach in drug discovery, investigating traditionally used medicinal plant species and preparations. However, in many cases ethnopharmacological studies only show preliminary findings or lack reproducibility, which leads to unsatisfactory and inconsistent results. Our research thus aims to systematically evaluate traditional medicinal plant species, including detailed analysis of the plants' taxonomic status as well as comprehensive analytical and pharmacological investigations.

One successful evaluation was accomplished with the oleoresin of *Copaifera reticulata* (Fabaceae), commonly known as copaiba. Copaiba, which is also obtained from other *Copaifera* species, is used as a panacea in the tropical regions of Latin America. Due to its popularity it has been extensively studied for its pharmacological properties. These studies, however, revealed partly contradicting results especially with regard to the oleoresin's anticancer effects. Distinct analysis of the metabolite pattern yielded possible explanations for the partly missing cytotoxic effects, which seem to depend on the chemotype and the concentration on  $\beta$ -caryophyllene. Moreover, the ethnomedicinal use for the treatment of skin and urinary tract infection was confirmed in our studies and the compounds responsible for the antibacterial and antidermatophytic effects were characterized.

A second approach for a systematic evaluation was conducted with the leaves of *Vatairea guianensis* (Fabaceae), also known as fava de impingem. Here, previous studies found pronounced antioxidant and anti-*Candida* effects for leaf extracts. However, in both studies the effects were not corroborated by the isolated constituents, which showed much lower activities. With regard to the antioxidant activities, we found that the leaves contain considerable amounts of apigenin and luteolin that are both known for their radical scavenging properties. Furthermore, also for *V. guianensis* the use in folk medicine for treating dermatological disorders could be confirmed and a broad antimicrobial agent as well as six new isoflavones were discovered.

## References

- [1] Çiçek, S.S., Pfeifer Barbosa, A.L., Girreser, U., Quantification of diterpene acids in Copaiba oleoresin by UHPLC-ELSD and heteronuclear two-dimensional qNMR. *J. Pharm. Biomed. Anal.* 2018 160, 126-134.
- [2] Pfeifer Barbosa, A.L., Wenzel-Storjohann, A., Barbosa, J.D., Zidorn, C., Pfeifer, C., Tasdemir, D., Çiçek, S.S., Antimicrobial and cytotoxic effects of the *Copaifera reticulata* oleoresin and its main diterpene acids. *J. Ethnopharmacol.* 2019 233, 94-100.
- [3] Çiçek, S.S., Wenzel-Storjohann, A., Girreser, U., Tasdemir, D., Biological activities of two major copaiba diterpenoids and their semi-synthetic derivatives. *Rev. Bras. Farmacogn.* 2020 30, 18-27.

[4] Çiçek, S.S., Galarza Pérez, M., Wenzel-Storjohann, A., Bezerra, R.M., Segovia, J.F.O., Girreser, U., Kanzaki, I., Tasdemir, D., Antimicrobial Prenylated Isoflavones from the Leaves of the Amazonian Medicinal Plant *Vatairea guianensis* Aubl. *J. Nat. Prod.* 2022 85, 927–935.

# Causal Language Detection for Digital Surveillance

*Slava Jankin, Data Science Lab, Hertie School Berlin*

Establishing causal links between events is at the heart of scientific enquiry. But it is also a deep, psychological tendency in humans to look for causes and establish links that can help explain the world around us. Causal Language refers to cause-effect relationships that are established in language between parts of speech. It allows us to identify social and political assignment of causal relationships between events. Journal articles, social media and press conferences are all textual data sources where cause-effect relationships are established by the media, political leaders, and citizens. Causal Extraction refers to the natural language processing task that identifies causal relationships in text, and extracts cause-effect pairs. Causal language prediction aims to identify cause-effect associations. Causal language extraction designed to automate the analysis of causal associations established in the relevant corpora.

We introduce a new annotated data set for causal language prediction, based on a policy-relevant data. We developed a new, simpler, annotation scheme for causal language. We test the use of data augmentation to create syntactic data for testing and training the prediction models. We show that causal relationships can be successfully extracted from text.

As part of the Horizon Europe CATALYSE project, we are building a public health digital surveillance tool using causal language model as an engine. The aim is to use social media data at policy-relevant geographical resolution to derive relevant clinical and policy predictions.

# Biogenic (Meta)material Systems & Advanced 3D Manufacturing to Acquire Life-Like Functions for Novel Pharmaceutical, Biotechnological and Medical Applications

*Stefan Schiller, Center for Biological Systems Analysis, Freiburg University / soon at Frankfurt University*

Complex biomolecular systems are essential for many aspects of life. We strive for the highest molecular precision in creating structure and function by combining biotechnology & chemistry. We employ synthetic biology to develop new components for modular cells such as genetically encoded *de novo* organelles, the expansion of the genetic code redesigning the translational machinery with xenobiotic elements allowing the site-selectively cotranslational introduction of unnatural amino acids into proteins, designing the catalytic center of cofactor dependent enzymes and bis-bioorthogonal protein/enzyme conjugation systems for biotechnological applications. In addition to genetically encoded in vivo organelles, defined amphiphilic block-domain proteins are currently used in pharmaceutical and medical applications as novel drug-formulation and adjustable targeting system exhibiting a new level of control and biocompatibility for drug targeting and controlled release.

## Challenge:

Fight diseases and pathogenic states with novel bio-actives in combination with next generation bio-based drug formulation & targeted delivery – extracting novel bioactives

Tissue Regeneration – cell instructing environments

## Focus of applications:

- I. Infections – antimicrobials,
- II. Inflammation & Wound healing,
- III. Neuroactives – Psychoneuroimmunopharmacology

## Realization:

- I. Designer Proteins for the formulation, targeted drug delivery and release of small molecules, oligonucleotides (e.g. RNA), peptides and proteins;
- II. Novel biopharmaceutics: One step biotechnological production and formulation - Artificial Cells
- III. Artificial cellular environments as liquid tissues in wound closure
- IV. Implementation and combination of: biotechnological production,  $\mu$ -fluidic formulation & coupling of  $\mu$ -chips combining bioactive drug extraction-formulation and organ-on a chip testing formats

# Construction of Microbial Cell Factories: Biosensing, Manufacturing and Transformation of Industrial Aldehydes

*Thomas Bayer, University of Greifswald, Institute of Biochemistry*

The application of genetically encoded biosensors enables the detection of small molecules in living cells and has facilitated the characterization of enzymes, their directed evolution and the engineering of (natural) metabolic pathways. In the presented work, the LuxAB biosensor system from *Photobacterium luminescens* was implemented in a metabolically engineered *Escherichia coli* strain to monitor the enzymatic production of aldehydes from primary alcohols and carboxylic acid substrates. A simple high-throughput assay utilized the bacterial luciferase – previously reported to only accept aliphatic long-chain aldehydes – to detect structurally diverse aldehydes at low concentrations (100  $\mu\text{M}$ ), including aromatic and monoterpene aldehydes. LuxAB was used to extend the substrate scopes of three prokaryotic oxidoreductases: an alcohol dehydrogenase (*Pseudomonas putida*), a choline oxidase variant (*Arthrobacter chlorophenolicus*) and a carboxylic acid reductase (*Mycobacterium marinum*). Consequently, high-value aldehydes such as cinnamaldehyde, citral and citronellal could be produced *in vivo* in up to 80% yield. Such aldehydes are precursors for the manufacturing of active pharmaceutical ingredients. Furthermore, the dual role of LuxAB as sensor and monooxygenase, emitting bioluminescence through the oxidation of aldehydes to the corresponding carboxylates, promises implementation in artificial enzyme cascades for the synthesis of carboxylic acids. These findings advance the bio-based detection, preparation and transformation of industrially important aldehydes in living cells.

**Keywords:** biosensor, bioluminescence, luciferase, high-throughput screening, whole-cell biocatalysis, aldehyde production, enzyme cascades

## **Brain emotion regulation effects induced by ayahuasca**

*Tiago Arruda Sanchez, Universidade Federal do Rio de Janeiro*

Although ayahuasca has been proposed as potentially therapeutic as anxiolytic and antidepressant, few studies have been carried out so far investigating their effect on brain emotional processing. The aim of this study was to measure the acute and long-term effect of ayahuasca on brain response during resting and also to emotional stimuli using functional magnetic resonance imaging (fMRI). Nineteen regular ayahuasca users participated in the acute effect study and were evaluated in two fMRI sessions before and after ayahuasca intake. Nineteen paired non users control subjects also participated in the long-term effect study and were evaluated in one fMRI session without ayahuasca intake. Pictures of neutral (A) and aversive (B) faces were presented in a blocked design. They were asked just to identify the gender of the faces. Psychometric measures were evaluated during the procedures using a resilience scale and a visual analogue mood scale (VAMS). Images were acquired in a 1.5 T scanner and analysed using statistical maps obtained in a general linear model with random effects. The amygdala responded bilaterally to aversive faces of before ayahuasca intake, but reduced activation was found after. Using independent component analysis (ICA) during resting fMRI, Ayahuasca enhanced the connectivity in salience network after intake, both in acute and long-term analysis. In the psychometric VAMS subscale, ayahuasca acutely attenuated both anxiety and sedation ( $p < 0.05$ ). Also, larger resilience ( $p < 0.05$ ) was observed as a long-term effect. Brain emotional processing after ayahuasca intake to aversive stimuli had a pattern similar to emotion regulation mechanism by reducing defensive responses in the amygdala as well as anxiety and sedation, while enhancing salience network connectivity in acute effects. In long-term effects, regular users of Ayahuasca had enhancement in resilience scale as well as in salience network connectivity.

## Computer Aided Science – Germany Cooperation

*Tiago Branquinho, Universidade Federal de Sergipe*

The use of data science and data analysis in scientific research planning can contribute to best practices in science and in the optimization of resources (time, human and financial). These analyses when applied to chemistry use additional information from both chemometric and chemoinformatic areas. We propose two lines of research in this scenario. The first, proposes a virtual screening model to a defined target (fungus, bacteria, helminth, parasite, enzyme, etc.) and to build an activity prediction model based on scientific literature or unpublished laboratory data. This type of study aims to suggest new substances that are more likely to have the desired action. In the second line of research, we propose the isolation of natural compounds virtually guided. In this context, we suggest two approaches, the execution of a metabolic profile or metabolic fingerprint analysis of a plant extract to the isolation of substances related to some desired activity previously performed by biomarkers selections. In this type of study, it is also possible to know the presence of biomarkers of plant extracts and mixtures. If the laboratory is specialized in isolating compounds belonging to specific chemical groups (eg alkaloids, flavonoids, etc.) and has a standardized chromatographic method, than a QSRR model could be built. Both approaches lead to a reduction in the use of solvents, an increase in the probability to isolate compounds of interest, or a better comprehension about the biomarkers of extract activity.

## **Kicking the habit while tripping – Using psychedelics in the treatment of alcohol addiction**

***Tobias Buchborn, Institute for Psychopharmacology, Central Institute of Mental Health Mannheim***

Psychedelic drugs, such as psilocybin found in „magic mushrooms“, powerfully alter human consciousness and heave the psyche out of its habits and routines. As most psychopathology has the psyche narrowed-in and stuck in maladaptive routines, psychedelics have re-emerged as possible candidates for treatment and catalysts of psychotherapy.

In our research, we focus on alcohol addiction – a disorder where habits and routines have impoverished to make alcohol the predominant incentive. Within rodent models of addiction, we test different regimens of psychedelic drug treatment and single out those psychological and environmental factors that are most important for effective addiction treatment. Assuming that increased brain flexibility is key to the therapeutic action of psychedelics, addiction-corrupted brain circuits are followed up on for adaptations of drug targets and downstream markers of plasticity.

First results, implications for the human condition, and future applications are discussed.

## **Sensory Neurotechnology for auditory impairments**

***Tobias Reichenbach, Department Artificial Intelligence in Biomedical Engineering, Friedrich-Alexander-University (FAU)***

One in six people worldwide have some form of hearing impairment. The most common form is sensorineural hearing loss that originates in the inner ear. In addition, the neural pathways that process complex acoustic signals such as speech and music are vulnerable as well. However, despite the often debilitating effects of hearing loss, the basic neurobiological mechanisms of both the inner ear and the subsequent neural pathways remain poorly understood. Correctly diagnosing the origin of hearing difficulty is therefore still challenging. Moreover, hearing aids as the current treatment of hearing impairment often perform poorly, in particular when background noise is present.

My research group addresses these issues with through building on recent advances in artificial intelligence and computational neuroscience, combined with neuroimaging. We investigate fundamental neural mechanisms as well as translate research findings into applications in technology and medicine. As an example, we aim to develop brain-computer interfaces such as mind-controlled hearing aids for people with hearing impairments. We also work on multisensory hearing aids that combine sound processing with visual and tactile stimulation.

# Bioactive natural products from plants and their anthelmintic potential

*Verena Spiegler, University of Münster, Institute for Pharmaceutical Biology and Phytochemistry*

Soil-transmitted helminthiasis is defined as a neglected tropical disease, although approximately 1.5 billion people are affected worldwide (Pullan et al. 2014). Further, diseases caused by parasitic nematodes are not limited to humans, they are also posing a great challenge to animal farming because of a dramatic development of resistances to standard anthelmintics (Rose et al. 2015). Due to large-scale preventive treatment, concerns about increasing resistances in human parasites towards the limited number of available drugs are similarly emerging (Tinkler 2020).

I am therefore interested in finding plant derived natural products with anthelmintic activity, particularly among polyphenols and alkaloids. Tannins are a class of phenolic compounds that widely occur in plants, and tanniferous plant preparations are reported as traditional medicines or as ruminant feeds worldwide. Due to the protein-binding properties of tannins in general, they are regarded to act unspecifically, but not leading to resistances either. They have therefore been extensively investigated previously for their anthelmintic properties in vivo and in vitro (Spiegler et al. 2017). However, despite the large amount of studies, a detailed understanding of the mode of action is still lacking. Using *Caenorhabditis elegans* as a model nematode, we confirmed that the collagenous cuticle is a main target for the anthelmintic activity of tannins. Disruptions of the regular surface structure and astringent effects lead to a reduced flexibility of the cuticle, which could explain reduced motility, but also molting defects in larvae. Transcriptome analysis of treated versus untreated worms did not directly reveal functions impaired by the treatment, however, up-regulation of a gene encoding for a unique protein that might act as a defense against tannins, similar to salivary proteins in humans. Further investigations include the influence of structural features on the anthelmintic activity.

Alkaloids also comprise an enormous variety of structures, but in contrast to tannins, they act at rather distinct targets. Although there are many examples of alkaloids as active ingredients of approved drugs, reports assessing their anthelmintic activities are comparatively rare. I am therefore focusing on plant species which are used as medicinal plants for the treatment of helminthiasis. This led to the identification of certain species from the family of Apocynaceae and to isolation of several indole alkaloids, some of which possessed nematicidal activity against *C. elegans* in a preliminary screening. Besides more detailed investigations on the anthelmintic effects, further steps will also involve an exploration of alternative plant resources as the accessibility and phytochemical variability of plant material not locally available poses additional challenges.

## References

- [1] Pullan, R.L., Smith, J.L., Jasrasaria, R., Brooker, Simon J. (2014): Global numbers of infection and disease burden of soil transmitted helminth infections in 2010. *Parasites & vectors* 7, 37.
- [2] Rose, H., Rinaldi, L., Bosco, A., Mavrot, F., de Waal, T., Skuce, P. et al. (2015): Widespread anthelmintic resistance in European farmed ruminants: a systematic review. *The Veterinary record* 176, 546.
- [3] Tinkler, S.H. (2020): Preventive chemotherapy and anthelmintic resistance of soil-transmitted helminths – Can we learn nothing from veterinary medicine? *One Health* 9, 100106.
- [4] Spiegler, V., Liebau, E., Hensel, A. (2017): Medicinal plant extracts and plant-derived polyphenols with anthelmintic activity against intestinal nematodes. *Natural Product Reports* 34, 627.

## **Antibiotic potential of environmental microorganisms from Brazil**

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Drug discovery from uncultured microorganisms has been well recognized, and environmental DNA expression for antibiotic production has been extensively tested. Antimicrobial compounds have been isolated using these approaches, but the yield is low. A straightforward approach to circumventing the problem was adopted and uncultured bacteria could be cultured. Thus, this study aimed to explore the diversity of microorganisms on the USP campus in Ribeirão Preto, through the iCHIP (isolation chip) technique, which allows the isolation of microorganisms that are not cultivable by the techniques currently used. The isolated microorganisms were tested for their biological activities against three known pathogens (*Candida albicans*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*). Two hundred and sixty-seven microorganisms were isolated of which 213 were bacteria (non-actinobacteria), 41 were actinobacteria and 13 were fungi. Forty-two microorganisms were active against the tested pathogens. The largest number of active microorganisms belonged to the phylum Actinobacteria. Also, the sequencing of the metabarcoding of the 16S gene of the V3/V4 regions of the soil samples collected on the USP campus was carried out, and thus it was possible to observe that there is a great wealth of microorganisms belonging to the bacteria domain, with Actinobacteria, Proteobacteria, and Acidobacteria being the ones most abundant phyla within the studied soil samples.

Keywords: Bacteria, soil, diversity, metabarcoding, secondary metabolites

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Cica Vissiennon has an educational background in pharmacy with a PhD in pharmacology. Past professional involvement focused on research activities in the field of pharmacology and pharmacokinetics of herbal medicines and phytochemicals at the University of Florida and University of Leipzig, and regulatory activities in the field of traditional herbal medicines in Europe at the European Medicines Agency – ‘Committee on Herbal Medicinal Products’ secretariat and the Commission E for Herbal Medicinal Products at the Federal Institute for Drugs and Medical Devices. As an Advisory Board member of the “Society for Medicinal Plant and Natural Product Research”, she is responsible for internationalization strategies (chair of the ‘Global Engagement working group’).

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Broadly speaking, my research interconnects physical modeling and numerical analysis. Specifically, my work contributes to:

1. Machine learning and numerical optimization to advance artificial intelligence for spatio-temporal data
2. Development of scalable algorithms and compute pipelines for scientific big data analytics
3. Remote sensing archeology, and contribution to open-source software.

I am home in Europe and the United States. My work intends to initiate, foster, and strengthen long-term transatlantic scientific collaboration with academia, the public sector and industry aboard to make a difference for social good.

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I am a Brazilian Professor of Neurophysiology at the Faculty of Medicine of the Federal University of Ceara and a researcher at the Drug Research and Development Center (NPDM). I have fifteen years of experience in designing and conducting preclinical research. In the last nine years, I have dedicated my efforts to the study of short- and long-term behavioral and neurochemical consequences of rodent exposure in different neurodevelopmental ages (ranging from neonatal life to adulthood) to pathogen-associated molecular patterns (PAMPs), namely lipopolysaccharide (LPS) and poly I:C, respectively from gram-negative bacteria and RNA viruses alone or combined with stress. I am also interested in the influence of sex in these alterations. Our results revealed that neonatal exposure to Poly I:C leads to schizophrenia-like alterations in adulthood, whereas LPS neonatal exposure leads to autism-like alterations in mice's infancy. My primary goal in determining sex-influences in behavioral and neurochemical consequences of PAMP neonatal exposure in rodents is the discovery of new windows of opportunity and targets for drug repurposing, contributing to the prevention of severe neuropsychiatric disorders. During the pandemic, we had the chance to translate this research to pregnant women with COVID and their babies.

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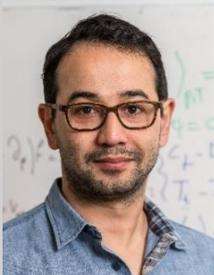


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My main research involves the use of natural products from wasp venom as potential therapeutics for neurologic disorders such as epilepsy, Parkinson's disease, Alzheimer's disease and chronic pain. I characterized the antiparkinsonian activity of a bioinspired peptide by using multiple assays including animal behaviour, microscopy and receptor binding techniques. The ability of venom-derived peptides to disrupt physiological processes in mammals provides an exciting source for pharmacological development. Our research group has identified neuroactive peptides from the venom of Brazilian social wasps, with the potential pharmacological profile to treat epilepsy. Also, motor and cognitive behavior were not adversely affected, and a potential neuroprotective effect was observed. Future projects include the development of nano-formulations to be administered intranasally in order to improve treatment bioavailability.

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I am an adjunct professor at the State University of Ceará, and my main research interest is to understand consumer behavior regarding the consumption of foods prepared away from home, food acquisitions through food delivery Apps, and the relationship with weight gain. As a researcher, I am also a member of the technical board responsible for coordinating the Brazilian National Dietary Surveys, which evaluate the Brazilian population's food acquisition and consumption and its relation to obesity. I plan to advance my studies by simulating modifications in population consumption favoring healthier diets to evaluate the impact of specific interventions on family expenditures and individuals' health. Furthermore, I plan to analyze how the virtual environment is organized and displayed from a consumer perspective and how it can influence food intake and contribution to obesity.

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Marcel Oberlaender studied Physics at the Universities of Heidelberg (Germany) and Melbourne (Australia). In 2009, he finished his PhD in Neuroscience under the supervision of Prof. Dr. Bert Sakmann at the Max Planck Institute (MPI) of Neurobiology in Munich. Thereafter, he worked as a postdoctoral fellow at Max Planck Florida Institute for Neuroscience (USA). In 2012, he established the 'Computational Neuroanatomy' group at the MPI for Biological Cybernetics in Tübingen. Since August 2016, he is head of the Max Planck Research Group 'In Silico Brain Sciences' at the MPI for Neurobiology of Behavior in Bonn. Located at the junction between theoretical and experimental systems neuroscience, his research aims to elucidate how the cerebral cortex transforms sensory information into perception.

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## Mirco Schoenfeld



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## Miriam Wimmer



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I hold a PhD in Communication and a Master's Degree in Law, and teach Law and Technology at IDP - Brasília. I am also currently a Director at the Brazilian Data Protection Authority and a member of the committee of Legal Experts created by the Federal Senate to propose legislation on AI. My research interests focus on the regulation of new technologies, and currently revolve around the intersection of personal data protection and AI. My most recent research deals with the issue of human intervention in AI decisions, aiming to identify parameters to define how, when and why human intervention may be necessary, considering the different contexts in which AI is used.

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Mrinalini obtained an LL.M in intellectual property, commerce and technology from the University of New Hampshire, and a PhD in law, which she completed as a full scholar of the Max Planck Institute (MPI) for Innovation and Competition, Munich. Thereafter, she served as senior research fellow at the MPI and at the Chair for Business Ethics, Technical University of Munich (TUM). Since June 2020, she is a guest professor at the international future lab: Artificial Intelligence for Earth Observation (AI4EO), TUM, where she leads the Ethics Group.

Her present research, situated at the interface of law, ethics, eastern philosophy, and emerging technologies, focusses on designing novel frameworks to help scientists identify ethical issues and opportunities in early stages of their AI research. The specific focus is on two AI use cases, namely, AI4EO and AI for mental health apps.

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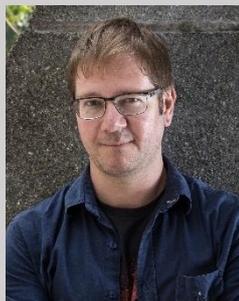


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## Taicia Pacheco Fill



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I received my PhD at Federal University of São Carlos in 2014 with a one-year internship at the University of Cambridge. Just after 6 months that I finished my PhD (2015), I became an assistant professor at the Chemistry institutes in Brazil at UNICAMP (University of Campinas). In 2016 I joined the group of Prof. Dr. Christian Hertweck at the Leibniz Institute for Natural Product Research and Infection Biology as an Alexander von Humboldt fellow, and returned in 2018 and 2020 as a visiting professor. I coordinate the Microbial Chemical Biology laboratory, which is funded by FAPESP, the Alexander von Humboldt Foundation and the Serrapilheira Institute (grantee 2020). In 2019, I was the winner in the chemical sciences category of the For Women in Science award granted by LOreal-UNESCO-ABC.

I develop research in the area of natural products chemistry. In particular, microorganisms that cause diseases in the Brazilian citrus industry and that are associated with annual economic losses estimated at \$1.5 billion. In my group, we study the pathogen-host interactions and the role of natural products in these interactions, aiming to obtain a better understanding of the disease and the virulence factors of these pathogenic organisms. The knowledge of the chemical and biochemical mechanisms of the disease is the first step towards the development of efficient control strategies for the Brazilian citrus industry. We also develop studies related to the search for new bioactive microbial natural products to combat these main pathogens. We use tools that combine biology and chemistry, such as molecular biology and state of the art analytical techniques such as imaging mass spectrometry.

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Professor at the Universidade Federal do Rio de Janeiro (UFRJ), at Medical School, Department of Radiology. He is head of the 'Laboratory of Neuroimaging and Psychophysiology'. Medical physicist with a doctorate studying emotion regulation and using functional magnetic resonance imaging (fMRI) under the supervision of professor Draulio Araújo at University of São Paulo (2009). He did a post-doctorate in physiology (2010) at UFRJ. He has experience in the human cognitive neuroscience using neuroimaging (fMRI), heart rate variability (HRV), cognitive tasks, biofeedback and psychometric scales. He works with a special interest in: cognitive resources, attention, emotion regulation\*, affective states, mental imagery. His research address mental health studying the nervous and cardiorespiratory systems including chronic pain, depression and anxiety disorders, psychopharmacology studies and the brain effects of Ayahuasca.

### Tiago Branquinho Oliveira



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Tiago Branquinho Oliveira is a pharmacist, and in 2015, he obtained the title of Doctor of Science in the area of natural and synthetic products from Faculty of Pharmaceutical Sciences of Ribeirão Preto, University of São Paulo. Part of the doctorate was carried out at the Institut für Pharmazeutische Biologie und Phytochemie of the WWU-Münster. Since December 2015, he has been a professor at the Federal University of Sergipe (UFS) and head of the Computer-aided Science Research Group of the Food and Beverage Analysis Laboratory. His current research is focused on the application of data science tools to search for active compounds of interest in health (QSAR/Docking/Virtual Screening), safe foods (Foodinformatics), and chemistry (Chemoinformatics).

## Tobias Buchborn



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Tobias Buchborn holds a diploma in Psychology from the Otto-von-Guericke University Magdeburg. He received his PhD in Neurobiology for his research about tolerance to psychedelic drugs at the *Institute of Pharmacology and Toxicology* in Magdeburg. In 2016, Tobias was awarded an individual *Marie-Curie-Skłodowska* Fellowship and joined the Laboratory for *Neuronal Circuit Dynamics* at Imperial College London. Here, he used refined techniques of optogenetic voltage-imaging to investigate how pyramidal cells of the brain cortex orchestrate as mice respond to psychedelic serotonin-2A receptor activation. Since early 2021, Tobias is with the Laboratory for *Translational Psychopharmacology* at CIMH Mannheim, where he combines behavioural, molecular biological as well as chemo- and optogenetic methods to evaluate the applicability of psychedelics in the treatment of addiction.

## Tobias Reichenbach



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Prof. Dr. Tobias Reichenbach (MSc Physics, Leipzig University; PhD Physics, LMU Munich) is a Professor in Sensor Neuroengineering in the Department Artificial Intelligence in Biomedical Engineering at the Friedrich-Alexander-University Erlangen-Nürnberg, as well as a Visiting Professor at the Department of Bioengineering at Imperial College London. His multidisciplinary research combines methods from artificial intelligence with computational neuroscience and neuroimaging to advance our understanding of the neural processing of complex natural signals, with applications in medicine and technology. In the last five years he has attracted funding of more than 2M EUR. He has published more than 50 peer-reviewed articles, some of which have appeared in leading multidisciplinary journals such as Nature, Neuron and PNAS.

## Verena Spiegler



University of Münster,  
Institute for  
Pharmaceutical Biology  
and Phytochemistry

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URL: <https://www.uni-muenster.de/Chemie.pb/forschung/spiegler/index.html>

Verena Spiegler studied Pharmacy at the University of Münster where she also obtained her PhD under supervision of Prof. Dr. Andreas Hensel at the Institute of Pharmaceutical Biology and Phytochemistry. She continued as a Research Fellow and since September 2019 she is head of a Junior Research group at the Institute of Pharmaceutical Biology and Phytochemistry in Münster. Her research interests include the exploration of selected classes of natural products, mainly polyphenols and alkaloids, and their mode of action. Particularly she is interested in anthelmintic activities of these compounds and to investigate the molecular processes affected by the treatment in the model organism *Caenorhabditis elegans*.

## Weilan Gomes da Paixão Melo



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I am a dedicated and enthusiastic researcher with excellent academic performance and more than 18 years of laboratory experience. Degree in Biological Science, Master in Environmental Sciences and Ph.D. in Applied Microbiology. Background in microbiology, molecular biology, taxonomy, ecology, and evolution. Expert in isolation and cultivation of microorganisms associated with insects, soil, screening of biological activity, and phylogenetic analysis. So, I am very interested in research that addresses these areas.

## Yasmina Marin Felix



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Yasmina Marín Félix holds a diploma degree in Biotechnology from the University of Rovira i Virgili (Tarragona, Spain). She finished her PhD in fungal taxonomy at the same university in 2015. Thereafter, she worked as postdoc focusing on the taxonomy of phytopathogenic fungi in the Westerdijk Fungal Biodiversity Institute (Utrecht, the Netherlands) and in FABI (Pretoria, South Africa) until 2019. Since May 2019, she started to work in the Department of Microbial Drugs in the Helmholtz Center for Infection Research (Braunschweig, Germany) as a postdoc with an Alexander von Humboldt (AvH) fellowship. The project focused on the isolation of bioactive compounds from the fungi that she isolated in the past. Recently, she got awarded a project as principal investigator from the DFG that is based on the exploitation of biological and chemistry diversity of fungi from dung. She is involved in different projects about drug discovery from fungal metabolites, including an AvH Research Hub project with the University of Yaounde I (Cameroon) and the EU-H2020-MSCA-RISE project “Mycobiomics”.

## CAPES AND AVH REPRESENTATIVES

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### FEDERAL AGENCY FOR SUPPORT AND EVALUATION OF GRADUATE EDUCATION (CAPES)



**Cláudia Mansani Queda de Toledo**

President

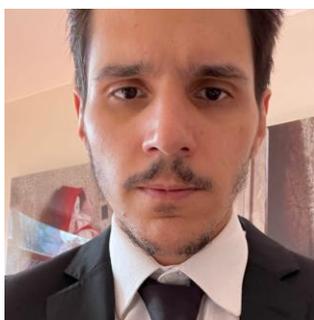
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## ALEXANDER VON HUMBOLDT FOUNDATION



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## ABOUT AVH AND CAPES

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### ALEXANDER VON HUMBOLDT FOUNDATION

The Alexander von Humboldt (AvH) Foundation promotes academic cooperation between excellent scientists and scholars from abroad and from Germany. To this end it grants more than 700 research fellowships and research awards annually. These allow foreign scientists and scholars to conduct a research stay in Germany and to collaborate closely with their hosts and partners. Scientists or scholars from Germany can carry out a research project abroad as a guest of one of well over 30.000 Humboldt Foundation alumni around the globe – the Humboldtians. Nowadays the foundation's network embraces scientists and scholars from all disciplines in more than 140 countries - including 57 Nobel Laureates.

Each year, the Alexander von Humboldt Foundation grants

- *Humboldt Research Fellowships* to highly qualified foreign scholars and scientists who have either completed their doctorates in the last four years (postdoctoral researchers) or less than twelve years ago (experienced researchers), enabling them to undertake long-term periods of research in Germany;
- *Georg Forster Research Fellowships* to postdoctoral and experienced researchers from transition and developing countries;
- *Humboldt Research Awards* to internationally recognized foreign scholars and scientists (nominations by German scholars/scientists);
- *Friedrich Wilhelm Bessel Research Awards* to outstanding scholars and scientists from abroad who have completed their doctorates less than eighteen years ago;
- *Feodor Lynen Research Fellowships* to highly qualified German scholars and scientists who have either completed their doctorates in the last four years (postdoctoral researchers) or less than twelve years ago (experienced researchers), enabling them to spend periods of research abroad;
- *Alexander von Humboldt Professorships* to top-rank researchers of all disciplines working abroad who are eligible to be appointed to full professorships in Germany to carry out ground-breaking and long-term research (nominations by German universities);
- *German Chancellor Fellowships* for prospective leaders in fields such as politics, public administration and business as well as society and culture from the United States of America, the Russian Federation, the People's Republic of China, Brazil, India and South Africa.

For more information please refer to our web page <http://www.humboldt-foundation.de> or contact our main office at [info@avh.de](mailto:info@avh.de).

## **BRAZILIAN FEDERAL AGENCY FOR SUPPORT AND EVALUATION OF GRADUATE EDUCATION (CAPES)**

A Public Foundation of the Ministry of Education (MEC), Capes plays a fundamental role in the expansion and consolidation of the *stricto sensu* (master and doctorate levels) graduate courses in Brazil. Furthermore, it sponsors the training of basic education teachers and of highly qualified personnel abroad, thus contributing to the internationalization of Brazilian higher education.

CAPES activities can be grouped in the following lines of action, each developed by a structured set of programs:

IV. **Postgraduate Evaluation.** The National Graduate System evaluation is conducted by Capes every 4 years with the participation of the academic-scientific community. Academic and professional postgraduate courses are graded with a 3 to 7 scale, being 3 the minimum required for a course to be considered recognized by Capes, therefore authorized to operate at a national level.

V. **Scholarship Opportunities.** The domestic *stricto sensu* master and doctoral postgraduate scholarships from Capes are institutional, that is, they are managed by the Higher Education Institutions (HEI) and postgraduate courses, which are responsible for the selection and monitoring of the scholarship holders. The fellowships abroad are primarily directed towards doctorate level and postgraduate research. All grants are awarded through competitive selection processes and public calls, which are widely disclosed to the Academic Community.

VI. **Financial Grants.** Capes provides resources to graduate courses in order to foster projects regarded as strategic for the development of knowledge as Engineering, National Defense, Nanobiotechnology, Oceanography and Marine Sciences, Medical Research, Morphology, Gender Studies (with emphasis in studies on violence against women), Educational themes (including Special Needs issues), Bio-energy and Bio-fuels, among others.

VII. **International Cooperation.** It is a strategic component of Capes' mission. Thus it is directed to the scientific-technological capacity building towards the Excellency of Brazilian Higher Education. As a valuable component of modern higher education, internationalization is encouraged in a comprehensive way, not only through the mobility of students and faculty, but also the exchange of ideas, the integrating of an international dimension into the teaching, research and service functions of higher education institutions.

**Broad Access to Scientific Content (Periodical Portal).** It is a virtual library that provides access to international scientific production for education and research institutions in Brazil, It has a collection of more than 37 thousand titles with full text, 128 reference bases, 11 bases dedicated exclusively to patents, as well as books, encyclopedias and reference works, technical standards, statistics and

audiovisual content. The Portal was created to overcome the lack of access of Brazilian libraries to international scientific information. It supports the growth of national scientific production as well as the Brazilian academic recognition abroad. Therefore, it is a fundamental tool within Capes mission, in the support and development of postgraduate education in Brazil.

VIII. **Teacher Training for Basic Education.** Training efforts are directed at supporting studies, research and innovation projects for strengthening the teaching profession. This action also counts on the Open University of Brazil (UAB), a system composed of public universities that offers higher education courses for the population that have difficulty accessing university education, through the use of distance learning.

Find out more about CAPES on the website: <http://www.capes.gov.br>

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## CONNECT FOLLOW-UP FUNDING PROGRAM

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### Follow-up program for participants of Frontiers of Research Symposia

- **Brazilian-German Frontiers of Science and Technology Symposium**
- **British-German Frontiers of Science Symposium**
- **German-American Frontiers of Engineering Symposium**
- **German-American Frontiers of Humanities Symposium**
- **German-American Frontiers of Science Symposium**
- **German-Israeli Frontiers of Humanities Symposium**
- **Indo-German Frontiers of Engineering Symposium**
- **Japanese-American-German Frontiers of Science Symposium**
- **Japanese-German Frontiers of Science Symposium**
- **Sino-German Frontiers of Science Symposium**
- **Turkish-German Frontiers of Research Symposium**
- **UK-German Frontiers of Humanities Symposium**

### Allowances for short working visits in Germany or Brazil

The Frontiers of Research Symposia enable scholars and scientists to establish long-term bi-national cooperations that strengthen the scientific relationship between Germany and the respective partner country. Every Frontiers participant can apply to the dedicated follow-up program CONNECT to conduct **working visits** in the partner country **for up to 30 days per conference** to prepare joint research projects or articles.

### Application requirements

The applicant has participated in a Brazilian-German Frontiers of Science & Technology Symposium and seeks to further deepen cooperation with at least one participant of the partner country. **Cooperating partners must have attended the same conference. Either the applicant or the hosting partner must be based in Germany.** The applicant shall submit a short **report** (max. 3 pages) to the Alexander von Humboldt Foundation within **2 months** after termination of the working visit.

### Allowance rates

For working visits lasting **up to 22 days** the allowance is calculated on the basis of **daily rates** valid at the time of the application. There are three different grades according to the position held by the applicant:

Grade A	EUR	112 / day	Assistant Professor, Lecturer, Researcher, Junior Professor, Post-Doc
Grade B:	EUR	135 / day	Associate Professor, Senior Lecturer, Reader
Grade C:	EUR	162 / day	Full Professor, Head of Research Institute

For working visits lasting **longer than 22 days** a **monthly lump sum** is granted:

Grade A:	EUR	2.500 / month	Assistant Professor, Lecturer, Researcher, Junior Professor, Post-Doc
Grade B:	EUR	3.000 / month	Associate Professor, Senior Lecturer, Reader
Grade C:	EUR	3.600 / month	Full Professor, Head of Research Institute

**The Alexander von Humboldt Foundation does not cover any additional costs (e.g. travel costs).** Grants for applicants from Germany are transferred to their bank accounts in Germany whereas grants for applicants from a partner country are transferred either to a private bank account in Germany or to the host university`s or institute`s bank account in Germany, from where the allowance is paid to the applicant.

### **Online application**

Please find further information on the online application at: <https://www.humboldt-foundation.de/connect>

#### **Please note the following points:**

- Submit your online application well in advance of your planned working visit.
- Please discuss all details (including the dates) of your planned working visit with your academic host before applying.

**Complete applications** for residence allowances in the CONNECT program **shall include the following documents** in **English**:

- application form
- curriculum vitae of the applicant
- description (3 to max. 5 pages) of the joint collaboration project on the basis of their research intersections including objectives and possible outcomes, milestones, anticipated timetable, possible visits of the cooperating partners to conferences or lectures at the partner institute
- invitation letter of the academic host
- list of key publications (max. one page)

**Upon receipt of your application, the processing takes up to four weeks. Retrospective approval is not possible.**

The Alexander von Humboldt Foundation requires applicants to follow the [Rules of Good Scientific Practice](#) and the legally binding principles of scientific ethics.

Researchers who have participated in a BRAFOST Symposium can address questions on the application process to:

Matthias Hergenhan  
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*[Last update: April 2022](#)*





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Stiftung/Foundation

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