International
Graduate School
ABINEP

ABINEP – Analysis, Imaging, and Modelling of Neuronal and Inflammatory Processes

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The international Graduate School (GS) on Analysis, Imaging, and Modelling of Neuronal and Inflammatory Processes (**ABINEP**) is based on the two internationally recognized biomedical research foci of the Otto von Guericke University Magdeburg (OVGU): Neurosciences and Immunology. ABINEP aims at educating and supporting internationally recruited PhD students from all over the world to enable them to contribute to cutting edge research projects in rising sub-disciplines of the research areas in Saxony-Anhalt, which are currently supported by several German Research Foundation (DFG)- and European Community (EU)-funded collaborative projects in Magdeburg (including the DFG-funded Collaborative Research Centers SFBs 779 and 854 and associated graduate schools, as well as DFG TRRs 31 and 62). Moreover, ABINEP is dedicated to further strengthen the international collaborations of these Magdeburg research areas, thereby allowing ABINEP fellows to build their own international network of scientific cooperations. The program includes scientists from the ›**Medical Faculty/ University Hospital Magdeburg** (https://www.ovgu.de/en/University/Faculties/MED.html) (MED) and the ›**Faculty of Natural Sciences** (https://www.ovgu.de/en/University/Faculties/NW.html) (FNW) of the OVGU, the ›**Leibniz Institute for Neurobiology** (https://www.lin-magdeburg.de/) Magdeburg (LIN) and the ›**German Center for Neurodegenerative Diseases** (https://www.dzne.de/) (DZNE), both located in Magdeburg, the ›**Helmholtz Centre of Infection Research** (https://www.helmholtz-hzi.de/en/the-hzi/) in Braunschweig as well as international collaborators.

To further strengthen the international interconnection of these research foci, 21 projects were defined to educate excellent international PhD student candidates in any of the 4 ABINEP topical modules:

1) Neuroinflammation: Inflammatory processes in neurodegeneration

2) Neurophysiology and Computational Modelling of Neuronal Networks

3) Immunosenescence: Infection and immunity in the context of aging

4) Human Brain Imaging for diagnosing neurocognitive disorders

1) Neuroinflammation: Inflammatory processes in neurodegeneration

Neuroinflammatory processes can either cause diseases of the human brain or impair already existing neurological diseases, e.g. multiple sclerosis, late stages of Alzheimer's disease. Otherwise, neuroinflammation can protect the human brain from damages e.g. stroke. Neuroinflammatory reactions are disease-specific and are induced by intensive reciprocal/ bidirectional regulation of human brain cells (e.g. astrocytes, neurons, microglia with cells of the immune system. These cellular interactions are largely unknown. The approach taken here will identify new insights into future innovative therapy concepts against stroke, infections, auto-immunity and neurodegeneration.

2) Neurophysiology and Computational Modelling of Neuronal Networks

Sport can activate protective mechanism which suppresses Dementia outbreaks. The detailed principles and possibilities to optimize therapies are not yet known. It is assumed that substances such as brain-derived neurotrophic factor (BDNF) and dopamine are mobilized in brains and increase synaptic plasticity processes and therefore to a delay in Dementia outbreaks. A systematical evaluation of the altered synaptic plasticity and the communication between different brain regions by BDNF and dopamine is currently missing and requires now scientific approaches. Computational modelling of neuronal networks should be used to predict the influence of pharmacological substances on the brain network activity and thereby the suppression of dementia outbreaks within animal models.

3. Immunosenescence: Infection and immunity in the context of aging

During older ages, infectious diseases display a unique health threat. The immune system is subjected to ageing processes ("Immunosenescence"). In comparison to the general higher susceptibility to infections during aging, a more serious problem display pathogens resistant to antibiotics. Research on inflammatory diseases of the OVGU is complementary to the work of the Helmholtz Center for Infection Research (HZI) in Braunschweig, Germany. Within this module of the ESF-GS

clinical-translational research on age-associated infectious diseases by the OVGU should be enabled.

4) Human Brain Imaging for diagnosing neurocognitive disorders

Medical imaging is an indispensable tool for the diagnosis of neurocognitive disorders, e.g. Dementia, and the evaluation of therapeutically interventions during Dementia disease. This module focusses on the further development of spatial and temporal high-resolution imaging methods using a combination of functional magnetic resonance tomography (MRT), electroencephalography (EEG), positron emission tomography (PET) and deep brain branching on humans. Multivariate pattern analysis of these imaging methods should be used, to apply them profitably during diagnosis and intervention of Dementia disease.

PhD students of ABINEP will have the opportunity within a **54 months** track to perform high-quality research on Neurosciences and Immunology and includes studies at the molecular, cellular and systemic level. Technological platforms that will be used range from advanced molecular biology approaches, electrophysiology, live-cell imaging, super-resolution microscopy at cellular levels up to brain imaging approaches in clinical human research. Each doctoral candidate will be assigned to two professorial advisers to maximize the interdisciplinary impact and the quality of supervision of their work.

The teaching program organized by ABINEP will allow students to explore research methods and topics to which they have not been exposed previously:

ABINEP specific lecture (presentation by principle investigators, at least monthly)

ABINEP retreat (once a year, organized by collegiates, including invited speaker)

Short-term fellowships for external lab visits to acquire technological skills that might not be available in Magdeburg

Travel grants for the attendance at conferences

Soft skill courses organized by the OVGU Graduate Academy (central service for all structured PhD programs at the

OVGU), e.g. on scientific writing and presentation

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2022-05-12 Ann-Kathrin Meinshausen: PhD Defense

2022-04 Alexander Pauser: PhD Submission

2022-03-17 Carla Marcia Cangalaya Lira: PhD Defense

2022-02-23 Rituparna Bhattacharjee: PhD Defense

2021-11-19 Ayse Malci

: PhD Defense

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