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Biomaterials to regenerate the nervous system: Carl Zeiss Foundation sponsors InteReg project at Mainz University

Collaborative project involving Johannes Gutenberg University Mainz, the Max Planck Institute for Polymer Research, and the Leibniz Institute for Resilience Research will receive EUR 6 million

The Carl Zeiss Foundation is contributing EUR 6 million to a research project on the regeneration of the nervous system at Johannes Gutenberg University Mainz (JGU). The new Interactive Biomaterials for Neural Regeneration (InteReg) project will bring together researchers from the fields of neurobiology, neuroimmunology, chemistry, and polymer research to develop precision engineered synthetic biomaterials for the treatment of neurological disorders. "We will create interactive biomaterials that instruct the cells of the central nervous system to regenerate after a traumatic injury of the brain or spinal cord and in diseases such as multiple sclerosis," stated project coordinator Professor Claire Jacob of the JGU Faculty of Biology. Cooperating partners include the Max Planck Institute for Polymer Research (MPI-P) and the Leibniz Institute for Resilience Research (LIR), both also based in Mainz. InteReg will be funded for five years starting from January 2025.

Neurological diseases cause disabilities and increased mortality

Neurological disorders can cause severe disabilities, and they are the fastest growing cause of mortality among non-transmittable diseases. Multiple sclerosis (MS) is the most common neurodegenerative disease of the central nervous system in young adults. In MS, the myelin sheath protecting neurons is mistakenly attacked by the body's immune cells. The resulting damage can subsequently lead to degeneration of the axons and permanent loss of central nervous system functions. Around three million individuals throughout the world suffer from MS.

In case of traumatic injuries of the brain or spinal cord due, for example, to a car or sport accident, both axons and myelin are damaged. Spontaneous regeneration following a traumatic injury is extremely inefficient and often results in severe and permanent disabilities. There are currently 64 million people worldwide living with a brain or spinal cord injury.

Combining expertise in biology, chemistry, medicine, and polymer research to develop new therapeutic solutions

Very few strategies are currently available to promote the repair of the nervous system, and there are also no drugs for effective regenerative treatment. The InteReg project aims to change this through precision engineering of interactive biomaterials with programmable functions. "Programmable means that the materials can be easily adapted to provide the necessary support at the appropriate time with a high level of specificity," said Professor Claire Jacob. For this purpose, the project will combine two strongholds of research in Mainz: the extensive expertise in soft biomaterials and the deep understanding of brain and spinal cord injuries and multiple sclerosis in the field of neuroregeneration. "By bridging these two areas of specialization and combining the disciplines of biology, chemistry, medicine, and polymer research, we will make significant impacts in the development of therapeutic solutions," said neurobiologist Claire

Jacob.

Specific projects include, for instance, the production of programmable extracellular matrix biomaterials to repair spinal cord injuries and the development of nanocarriers that specifically target oligodendrocyte precursor cells to repair MS lesions.

From fundamental research to clinical trials

The InteReg team expects that first therapeutic approaches will become available within the next five years. "Our interdisciplinary research consortium has great potential to go the entire journey from fundamental research to implementation in clinical trials," said Jacob. Members of the research team have filed more than 55 patents and founded two start-ups, while the Interdisciplinary Center for Clinical Trials (IZKS) of the Mainz University Medical Center could also provide assistance.

Supporting three junior research groups

InteReg coordinator Claire Jacob has been studying the lesion and regeneration of axons and myelin for more than 20 years. Since 2018, she is head of the Cellular Neurobiology group at Mainz University. She is also a member of the research initiative Communicating Biomaterials: Convergence Center for Life-Like Soft Materials and Biological Systems (CoM2Life). Currently, JGU is applying for funding of CoM2Life as a Cluster of Excellence in Germany's Excellence Strategy program. Professor Andreas Walther of JGU's Department of Chemistry is leading the CoM2Life initiative and is also co-coordinator of InteReg together with Professor Ari Waisman, Director of the Institute for Molecular Medicine at the Mainz University Medical Center. InteReg will also support three junior groups across disciplines, thus promoting early-career researchers in the field.

Carl Zeiss Foundation funds top-level research within its CZS Breakthroughs program

In its Life Science Technologies program, the Carl Zeiss Foundation is supporting research at the interface between engineering and life sciences, aiming to make key contributions to personalized healthcare. The call for proposals in the Synthetics line of the CZS Breakthroughs program focused on interdisciplinary research in the design of new biological systems. The projects to be funded were selected through competition and based on a two-phase review of excellence criteria.

Images:
https://download.uni-mainz.de/presse/10_idn_neurobiologie_intereg_czs_01.jpg
Research group of Professor Claire Jacob (standing, 2nd from right) at the Institute of Developmental Biology and Neurobiology of JGU
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https://download.uni-mainz.de/presse/10_idn_neurobiologie_intereg_czs_02.jpg
Plasma cleaning step for the production of microfluidic chambers
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InteReg coordinator Professor Claire Jacob together with Professor Andreas Walther (left) and Professor Ari Waisman (right), co-coordinators of InteReg
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Related links:
- https://intereg.uni-mainz.de/czs-initiative/ – Interactive Biomaterials for Neural Regeneration (InteReg)
- https://cnb-idn.biologie.uni-mainz.de/research/ – Research group of Professor Claire Jacob at the JGU Faculty of Biology
- https://www.walther-group.com/ – Research lab of Professor Andreas Walther at the JGU Department of Chemistry
- https://www.unimedizin-mainz.de/molekulare-medizin/en/research-groups/ag-waisman.html – Research group of Professor Ari Waisman at the Mainz University Medical Center
- https://www.carl-zeiss-stiftung.de/en/ – Carl Zeiss Foundation

Read more:
- https://press.uni-mainz.de/andreas-walther-receives-erc-consolidator-grant-for-the-development-of-intelligent-materials/ – press release "Andreas Walther receives ERC Consolidator Grant for the development of intelligent materials" (23 Dec. 2020)
- https://press.uni-mainz.de/mechanisms-identified-to-restore-myelin-sheaths-after-injury-or-in-multiple-sclerosis/ – press release "Mechanisms identified to restore myelin sheaths after injury or in multiple sclerosis" (24 Aug. 2020)
- https://press.uni-mainz.de/first-step-to-induce-self-repair-in-the-central-nervous-system/ – press release "First step to induce self-repair in the central nervous system" (11 July 2019)

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InteReg coordinator Professor Claire Jacob together with Professor Andreas Walther (left) and Professor Ari Waisman (right), co-coordinators of InteReg
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Plasma cleaning step for the production of microfluidic chambers
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