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Katrin Piecha

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Mathematician and Biochemist Win Transdisciplinary Research Prize

The Transdisciplinary Research Areas (TRAs) Modelling and Life and Health at the University of Bonn have presented their €100,000 research prize, entitled "Modelling for Life and Health," for the second time. The winners—Argelander Professor Ana Ivonne Vazquez-Armendariz and Schlegel Professor Jan Hasenauer—will be using their prize money to study the functions of "scavenger cells" in the lungs at the interface between mathematics and medicine.

The lung's very own scavenger cells, known as alveolar macrophages, are responsible for clearing it of attackers such as bacteria and viruses. Some are produced while we are still embryos and others from certain bone marrow cells later in our lives. While the cells from our mother's womb help to preserve the tissue over the long term, those from our bone marrow combat inflammation and heal injuries to the pulmonary tissue. However, the extent to which the differing origins of these immune cells influences how they behave inside the lung is not yet clear.

New findings on the role of scavenger cells in the lung

Ana Ivonne Vazquez-Armendariz and Jan Hasenauer, both holders of an Excellence Professorship at the University of Bonn, are now devising new models to examine the behavior of alveolar macrophages more closely to try and find out whether the lung's scavenger cells move around randomly or in a targeted way.

To study this behavior, the researchers are creating a mathematical model based on experiments done using "mini" lungs from the laboratory. This involves obtaining scavenger cells from various sources and inserting them into special lung systems known as 3D organoids, which are made from stem cells grown in such a way as to imitate the structure and function of a human organ. Hasenauer and Vazquez-Armendariz are using state-of-the-art imaging techniques to track the movements of the cells within these organoids and investigating them using their mathematical model. In the long term, their findings could help unlock a better understanding of the defense mechanisms inside the lung.

Transdisciplinary research at the University of Bonn

The main focus of the TRA Life and Health at the University of Bonn—a University of Excellence—lies on understanding life, from the level of the tiniest particles through to how complex systems interact with the environment. One of its primary objectives is to come up with new strategies for improving and maintaining health. For its part, the TRA Modelling aims to help us understand the functioning of complex systems that are made up of many different components and that all interact with one another. To do so, it employs creative combinations of traditional observational methods and computer-aided simulations. With mathematical modeling being increasingly required in the life sciences as one way of analyzing complex structures and datasets, there are numerous overlaps between the TRA Life and Health and the subjects covered by the TRA Modelling. This was what prompted the idea of a joint research prize to encourage collaborative research where mathematics and computer science meet medicine and the life sciences.

The prize is worth up to €100,000 and this year was open to pairs of researchers who are members of the TRA Modelling and TRA Life and Health. The steering committees of the two TRAs came together to crown Jan Hasenauer and Ana Ivonne Vazquez-Armendariz as the winners after considering criteria such as innovativeness, transdisciplinarity, scientific quality and the applicants' credentials as well as the potential for collaborative research offered by the project being proposed.

About the prizewinners

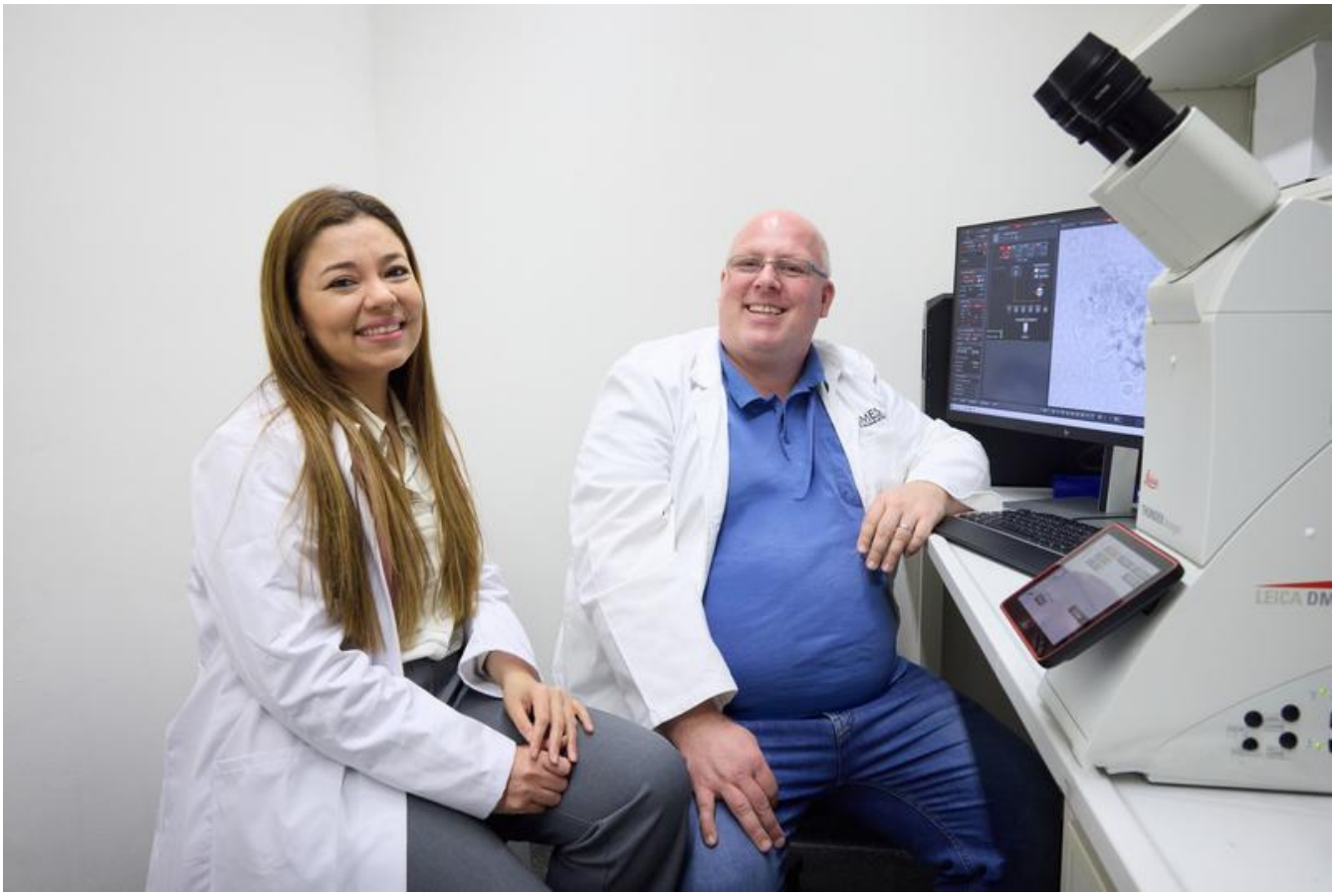
Ana Ivonne Vazquez-Armendariz studied clinical biochemistry at the University of Nuevo León in Mexico and molecular medicine at Charité in Berlin. She gained her doctorate from Justus Liebig University Giessen before going on to work as a postdoctoral researcher at the University Hospital of Giessen and Marburg. Vazquez-Armendariz established and headed up her first research unit at the University of Giessen's Institute for Lung Health in 2021. She is continuing the work on lung organoids and disease modeling that she began there in her current position of Argelander Professor at the University of Bonn. Her research has already been published in a number of illustrious journals and has won multiple awards, including from the American Thoracic Society. Vazquez-Armendariz is a member of the TRA Life and Health and the ImmunoSensation2 Cluster of Excellence.

Jan Hasenauer studied technical cybernetics at the University of Stuttgart, where he earned a doctorate in engineering. After working at Helmholtz Munich and the Technical University of Munich, he became Professor of Mathematics and Life Sciences at the University of Bonn in 2017. Since 2022, he has held one of the illustrious Schlegel Professorships, established as part of the Excellence Strategy. Jan Hasenauer is a member of the TRAs Modelling and Life and Health and of the Hausdorff Center for Mathematics and ImmunoSensation2 Clusters of Excellence.

wissenschaftliche Ansprechpartner:

Jun.-Prof. Dr. Ana Ivonne Vazquez-Armendariz
Argelander Professorship, LIMES Institute at the University of Bonn
TRA Life and Health
ImmunoSensation2 Cluster of Excellence
Phone: +49 228 73-62777
Email: vazquez@uni-bonn.de

Prof. Dr. Jan Hasenauer
Schlegel Professorship, LIMES Institute at the University of Bonn
TRAs Modelling and Life and Health
Hausdorff Center for Mathematics and ImmunoSensation2 Clusters of Excellence
Phone: +49 228 73-69446
Email: jan.hasenauer@uni-bonn.de



The winners of the 'Modelling for Life and Health' research prize at the University of Bonn: Prof. Dr Ana Ivonne Vazquez-Armendariz and Prof. Dr Jan Hasenauer are researching the functions of 'scavenger cells' in the lungs.
Volker Lannert
Volker Lannert / University of Bonn