

PRESS RELEASE

Focus on the Guardians of the Antibody Response

Researchers in Bonn Develop New Model for Studying Follicular Regulatory T Cells

Bonn, June 25 – For the immune system to effectively combat pathogens, antibody responses must be precisely controlled. So-called follicular regulatory T cells (Tfr cells) play a key role in this process by limiting excessive immune responses and helping to maintain immune tolerance. Researchers at the University Hospital Bonn (UKB) and the University of Bonn have now developed a robust laboratory method that allows Tfr cells to be generated from precursor cells and studied in a targeted manner. The results were recently published in the journal Cellular & Molecular Immunology.

Tfr cells control the development and function of so-called germinal centers in lymphoid organs such as the lymph nodes, tonsils, or spleen. There, they regulate the activity of follicular T helper cells (Tfh cells) and B cells, ensuring that antibody responses remain effective without getting out of control. An imbalance between activating and regulatory immune cells is associated with autoimmune diseases and misdirected antibody responses.

“Tfr cells have been difficult to study until now. With our model, we can now specifically track their development in the laboratory and investigate the molecular mechanisms that control their properties and functions,” says first author Dr. Luisa Bach, scientist at the University Hospital Bonn.

How follicular regulatory T cells develop

For their research, the scientists developed a new in vitro model that allows Tfr cells to be generated from certain CD4⁺ T helper cells of the immune system. Using this system, they were able to identify key molecular signaling pathways that control the development of these cells.

It turned out that the growth factor TGF- β plays a key role: It is both necessary and sufficient to trigger the characteristic program of Tfr cells. At the same time, the signaling molecule IL-2 influences the development of the cells in an opposing manner. Only the finely tuned interaction of both signaling pathways enables the formation of functional Tfr cells.

Furthermore, the research team identified the transcription factor c-Maf as an important regulator of the differentiation of Tfr cells. If this factor is absent, the cells cannot fully develop the characteristics typical of Tfr cells.

Control of the antibody response demonstrated in the laboratory

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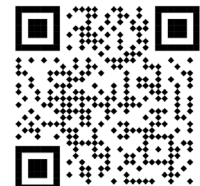
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The researchers were also able to show that the Tfr cells generated in the laboratory are functionally similar to natural Tfr cells. In cell culture experiments, they suppressed the Tfh-cell-mediated activation of B cells and limited the formation of certain antibody classes.

“Tfr cells are among the most important regulators of the antibody response. The fact that their characteristic properties can now be specifically investigated in cell cultures opens up new possibilities for researching their biological function,” explains corresponding author Prof. Dirk Baumjohann from the Department of Hematology, Oncology, Immuno-Oncology, and Rheumatology at UKB, who is a member of the steering committees of the Cluster of Excellence ImmunoSensation³ and the Transdisciplinary Research Area (TRA) “Life & Health” at the University of Bonn. “This allows us to better understand how antibody responses are regulated and how misdirected immune reactions arise.”

New Tool for Immunological Research

The work provides fundamental insights into the biology of regulatory immune cells and simultaneously offers an important tool for immunological research. The newly developed model will enable researchers to specifically investigate the development and function of Tfr cells and to analyze their role in immune responses in greater detail.

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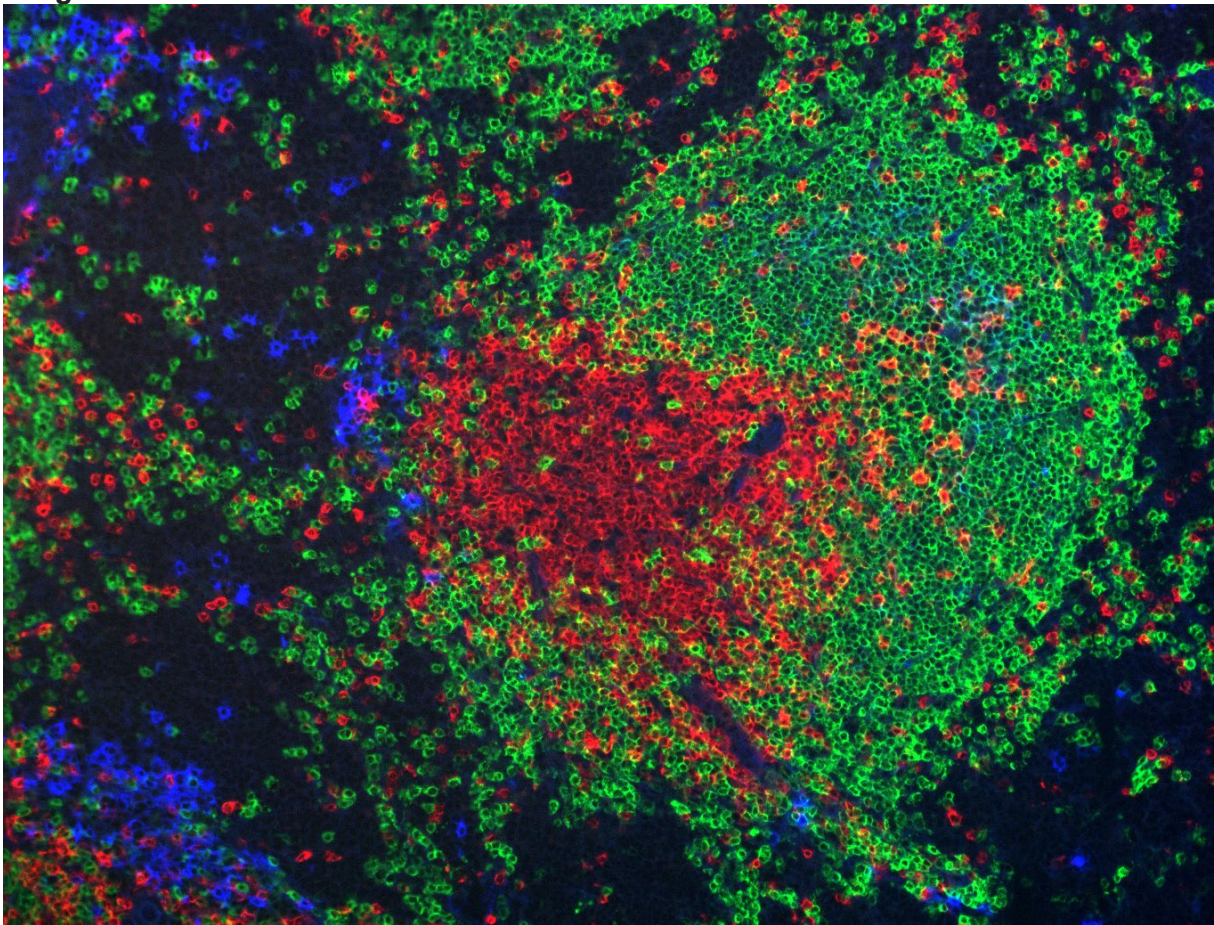
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Image material:



Caption: Immunofluorescence image showing T cells (red), B cells (green), and IgG1-positive B cells/plasma cells (blue) in the spleen of an immunized mouse.

Image credit: University Hospital Bonn / D. Baumjohann

Image material:



Caption: First author Luisa Bach and corresponding author Prof. Dirk Baumjohann developed a new model that enables the targeted investigation of T follicular regulatory (Tfr) cells in the laboratory.

Image credit: University Hospital Bonn / A. Winkler

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About the University Hospital Bonn: As one of Germany's top-performing university hospitals, the UKB combines excellence in medicine and research with outstanding teaching. Each year, the UKB treats over half a million patients on an outpatient and inpatient basis. Approximately 3,500 people study medicine and dentistry here, and over 600 individuals are trained annually in healthcare professions. With approximately 9,900 employees, the UKB is the third-largest employer in the Bonn/Rhein-Sieg region. In the Focus hospital rankings, the UKB ranks first among university hospitals in North Rhine-Westphalia and has the second-highest case-mix index (case severity) among university hospitals nationwide. In 2025, the UKB secured nearly €100 million in third-party funding for research, knowledge transfer, and teaching. The F.A.Z. Institute recognized the UKB for the fourth consecutive year as "Germany's Training Champion" and "Germany's Most Desirable Employer." Current figures can be found in the annual report at: [geschaeftsbericht.ukbonn.de](https://www.ukbonn.de/geschaeftsbericht)