Medizinische Universität Graz

Rector's Office
Auenbruggerplatz 2, A-8036 Graz

Thomas Edlinger, BA
Public relations and event management

thomas.edlinger@medunigraz.at
Tel. +43 / 316 / 385-72055
Fax +43 / 316 / 385-72030

Press release
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Immune cells in the skin: Protector and problem
A study in cooperation with Med Uni Graz clarifies their origin

Graz, 16 May 2022: Our immune system is influenced/controlled by a variety of complex and interconnected processes. Mechanical barriers such as the skin or biochemical mechanisms such as enzymes in tears or saliva and immune cells such as killer cells or T cells are only parts of a gigantic system that ensures that our body can protect itself from foreign substances and pathogens. Different parts of this system often work together seamlessly to protect us as best as they can. This cooperation becomes obvious in the case of tissue-resident memory T cells, which are located in the skin and other barrier tissues. These T cells that have a memory were examined in a paper authored by international colleagues and Theresa Benezeder. In the paper, which recently appeared in the prestigious Science Immunology journal, the young Med Uni Graz researcher described how cells enter into the skin (or other barrier tissue) and differentiate.

The body's response

After the body has recovered from infection, tissue-resident memory T cells (T_{RM}) concentrate in the barrier tissue—for example in the skin or mucous membranes. They go through a differentiation process and help the tissue fend off further attacks by the pathogen it recently overcame. Although it is known that they develop out of T cells, the type of T cells from which these guardians originate was not clear for a long time. It was also unknown if only a subset of T cells can further differentiate into T_{RM} or if this is a more widespread ability. Since these cells play an important role in resistance to infection yet are also involved in the emergence of autoimmune disease, it is important to better understand them in order to develop new, better vaccination strategies and new treatment options for certain diseases.

All-rounder T cells

The results of the paper indicate that all memory T cells circulating in the human body have the ability to migrate into the skin and differentiate into T_{RM} cells there. There is not just one precursor type that can produce these cells. Instead, it appears that all human T cells possess this ability. The study also identified differences between the types of T cells. Central memory T cells (T_{CM}) seem to be the most effective precursors of T_{RM} cells. Compared to other types of cells, they remain in peripheral regions such as the skin for a longer time and thus lead to an increased number of T_{RM}. Other types of T cells such as migratory memory T cells (T_{MM}) and effector memory T cells (T_{EM}) were less effective in building up a higher number of T_{RM} cells in the tissue.

Further goals

The research findings could be used to develop more effective vaccination strategies in the future. T_{CM} cells present in the tissue and circulating in the human body can create long-lasting immunity to pathogens and thus become an important pillar of disease prevention. Future research can build on these findings.

While the majority of existing vaccines rely on circulating antibodies for protection, new strategies aim to produce memory T cells for robust antiviral control. Along with their important role as part of the adaptive immune system, T_{RM} cells might play a pathogenic—and thus disease-causing—role in skin diseases such as psoriasis. Following successful therapy, psoriatic skin lesions may heal well from a clinical perspective, yet after some time they return at the exact same locations on the body. Different studies in recent years have shown that these pathogenic T_{RM} cells remain in the skin and may trigger a renewed flare-up of psoriasis. In her current research project at Med Uni Graz, Theresa Benezeder is investigating which triggers can provoke psoriasis and which cells (for example T_{RM} and mast cells) play a role in this process.

Further information and contact
Theresa Helena Benezeder
Medical University of Graz
Department of Dermatology and Venereology
theresa.benezeder@medunigraz.at
Tel.: +43 316 385 72829

Profile: Theresa Benezeder

Theresa Benezeder studied biochemistry and molecular biomedicine at the University of Graz and completed the PhD program Molecular Fundamentals of Inflammation (DK-MOLIN) at Med Uni Graz in 2021. As part of her doctoral studies, she completed an eight-month research stay at Prof. Rachael Clark's lab at Harvard Medical School in Boston. During this time, she also collaborated on the Science Immunology publication. Since October of last year, she has conducted research on inflammatory skin disease (Derm^{Inflamm}, Center of Expertise) as a post doctoral research fellow in the working group of Peter Wolf at the Department of Dermatology and Venereology, Med Uni Graz.

Link to the publication:
https://www.science.org/doi/10.1126/sciimmunol.abn1889?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed