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How does the immune system age?

MHH research team shows very precise and comprehensive correlation between immune profiles and age, gender, smoking, obesity and diseases

Why are older people more susceptible to infections than younger people? Why do vaccinations sometimes have less of an effect on them? In order to better understand the mechanisms of the ageing immune system, the RESIST-Senior Individuals Cohort was set up as part of the Cluster of Excellence RESIST - a study with 550 citizens over the age of 60 and 100 younger participants aged between 20 and 40, all of whom come from the Hannover Region. The participants were comprehensively questioned about their lifestyle, previous illnesses and medication intake and underwent physical examinations.

A research team led by Prof. Reinhold Förster from the Institute of Immunology at Hannover Medical School (MHH), together with staff from the MHH Clinic for Dermatology, the MHH Institute of Virology and the MHH Clinic for Paediatric Pneumology, Allergology and Neonatology, used blood samples to analyse the number, type and activation status of the immune cells and created detailed immune profiles that are more precise and comprehensive than any previous ones. The results of this groundbreaking study were published in the journal EBioMedicine.

It showed a clear correlation between age, gender, smoking, obesity and diseases such as osteoporosis, heart failure and gout with certain immune signatures. It was particularly striking that people with a latent cytomegalovirus infection had an increased proportion of certain memory T cells. "Our results highlight relevant immune signatures that expand the understanding of age-related changes in the immune system and their connection to diseases," explains Dr Riemann, first author of the study. At the same time, he emphasises: "The immune system is extremely complex and varies greatly from person to person, which makes it difficult to make generalised statements."

Broader, deeper, more precise than ever before

The research team was able to map the changes in the immune system across a broader age spectrum in more detail than in previous studies - even subtle changes became visible. The large number of participants in the cohort enabled not only a comparison between young and older people, but also differentiated analyses within the older group. The high-resolution analyses of the immune cells were particularly impressive: Using 60 different markers for surface proteins, even the smallest subgroups of cell populations could be precisely characterised. For example, the team succeeded in dividing the CD4+ T cells (T helper cells) into 18 different subgroups.

Another highlight was the use of objective, computer-based clustering methods for cell typing. Instead of subjectively deciding which cells belong to which population based on visualised data, an algorithm took over this assignment - more precisely and reproducibly than is possible manually. "We analysed 97 innate and adaptive immune cell clusters and uncovered complex, age- and sex-specific changes in the immune system of older people," explains co-first author Rodrigo Gutierrez, PhD.

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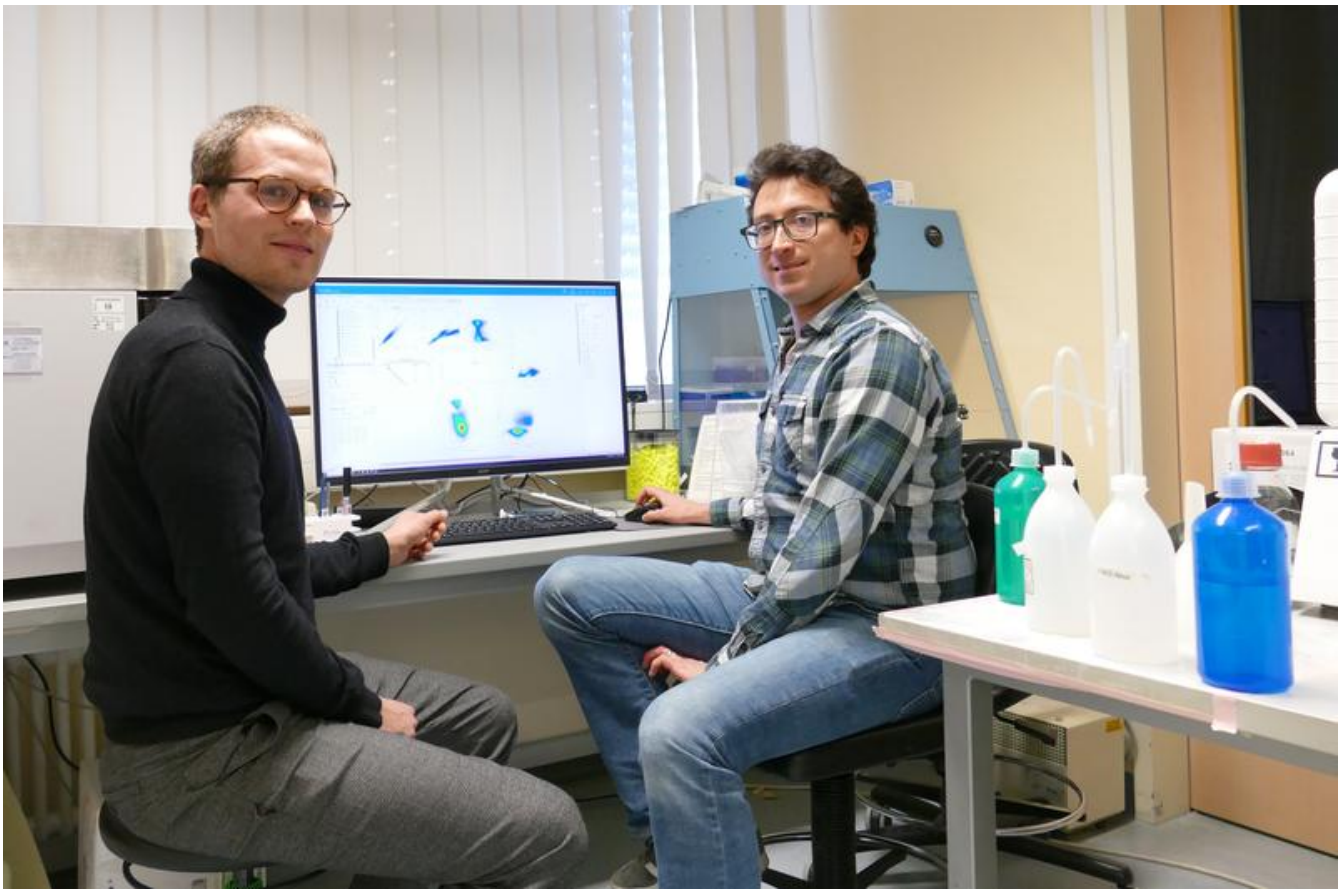
You can find the original publication here: https://pubmed.ncbi.nlm.nih.gov/39862806/



At the MHH Institute of Immunology: Dr Lennart Riemann (left) and Rodrigo Gutierrez, PhD, have used multicolour spectral flow cytometry to accurately visualise different cell types.
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