Website address:
https://www.gesundheitsindustrie-bw.de/en/article/press-release/microbial-heritage-against-stress-study-points-cross-generational-protection-provided-environmental-bacterium

Microbial heritage against stress Study points to cross-generational protection provided by an environmental bacterium

An environmental bacterium could protect against the effects of stress right through to the next generation. Evidence of this emerged in a study using a mouse model carried out by researchers from Ulm and Frankfurt, the results of which were published in the journal `Molecular Psychiatry´. According to the study, the offspring of treated mothers were better protected against the effects of stress in adulthood than control animals, even though they had never been given the bacterium themselves. The gut microbiome, which was altered in the offspring, may play a role in this.

"Stress doesn't end in the mind. It affects the whole body, the hormones, the immune system and, presumably, the interaction with gut bacteria," says Professor Stefan O. Reber, Head of the Section for Molecular Psychosomatics at the Department of Psychosomatic Medicine and Psychotherapy at Ulm University Hospital. Reber coordinated the study together with his colleague Professor David A. Slattery from Goethe University Frankfurt. "We are interested in why the same stressor has serious health consequences for some organisms, whilst others remain resilient." Reber's section is investigating this question at the interface between stress research, immunology and microbiome research.

A new aspect of the current study is its focus on the next generation: can a microbial stimulus affecting the mother's generation influence the stress resilience of her offspring? In doing so, the team is building on the so-called 'Old Friends' hypothesis. The term 'old friends' refers to microorganisms from the environment that have coexisted with humans and animals over long periods of evolution. Because the immune system has also developed in the presence of such microorganisms, their signals may still help to mitigate the effects of stress today. For example, by helping the immune system to distinguish between harmless stimuli and genuine threats, and to regulate inflammatory responses appropriately.

In modern, highly urbanised environments, however, contact with such microorganisms is often limited, which could contribute to a lack of important stimuli for immune regulation. This is particularly relevant for stress-associated psychosomatic conditions, including anxiety disorders, depression, cardiovascular disorders and inflammatory bowel diseases. This is because many of these are associated with an overreaction of the immune system and persistent, low-grade inflammatory processes.

In the current study, the researchers treated female mice with an environmental bacterium. Prior to pregnancy, the animals were given a heat-inactivated preparation of the non-pathogenic soil bacterium Mycobacterium vaccae ATCC 15483^{T}. The researchers then investigated how the offspring responded to chronic psychosocial stress in adulthood. To this end, they analysed the animals' behaviour, physical stress responses, immune system and microbiome. Among other things, they recorded general and social anxiety, skeletal growth, immunological changes – for example in the thymus or spleen – and changes in the gut microbiome.

"The results showed that the offspring of the treated mothers were better protected against typical consequences of stress in adulthood than the offspring of untreated animals," says Jessica Schiele, a PhD student in the Section for Molecular Psychosomatics at Ulm University Hospital and lead author of the study. This effect was particularly pronounced in male offspring: in these animals, several physical consequences of stress were less severe, such as changes to the spleen, thymus and bones. Signs of strain on the immune system were also less pronounced.

The findings for females were more difficult to interpret, as the stress procedure triggered less clear signs of stress in female offspring. "Fundamentally, however, we can see that treating the mother's generation can trigger a biological effect in the next generation," said Professor Reber. "What makes the findings so interesting is that the effect is evident in the offspring, even though they themselves had not been treated with the bacterium." The gut microbiome could also play a role here. The researchers found evidence that, following treatment of the mothers, the composition of gut bacteria in the offspring also changed. Among other things, the microbiome was more diverse. In addition, certain groups of bacteria that can contribute to gut health and immune regulation were more prevalent – for example, because they produce metabolites such as short-chain fatty acids.

"Although the results cannot be directly extrapolated to humans," explains Schiele. "But our data suggest that the microbiome could be a potential mediator of these cross-generational effects." The study thus provides new insights into how

microbial environmental exposure, the immune system, the gut microbiome and stress resilience are interrelated.

In the long term, their findings could help to improve our understanding of stress-related psychosomatic disorders and lead to the development of new prevention strategies that support a healthy and diverse gut microbiome. In addition to probiotics – that is, preparations containing beneficial microorganisms – prebiotics, which are dietary components that promote beneficial gut bacteria, could also be considered. Another possibility would be so-called postbiotics, such as components of heat-inactivated 'Alter Freunde', which could be used as dietary supplements. The study was funded by the German Research Foundation (DFG). Researchers from several departments at Ulm University Hospital, Goethe University Frankfurt and the University of Colorado Boulder in the USA were involved in the work.

Reference:

Schiele, J., Tsai, P. L., et al. (2026). Microbial Legacy: Mycobacterium vaccae ATCC 15483^{T} intergenerationally diversifies the microbiome and enhances stress resilience in male mice. Molecular Psychiatry.
DOI: 10.1038/s41380-026-03638-9

Press release

02-Jul-2026
Source: Ulm University

Further information

Prof. Dr. Stefan O. Reber,
Head of the Section for Molecular Psychosomatics at the Department of Psychosomatic Medicine and Psychotherapy, Ulm University Hospital,
Email: stefan.reber(at)uni-ulm.de

- Ulm University