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Press release

When inflammation attacks your nerves: new insights into the role of nerve cells in gastrointestinal complaints

Gastrointestinal inflammation can cause long-term gastrointestinal disorders. An international research team led by the Charité – Universitätsmedizin Berlin, the Inselspital, Bern University Hospital, and the University of Bern has shown for the first time that inflammation damages nerve cells in the intestine. This causes intestinal function to deteriorate, which exacerbates the disorders. The team's findings could lead to new approaches for treating long-term gastrointestinal disorders.

In 40 percent of the world´s population, gastrointestinal inflammation causes chronic gastrointestinal disorders, such as persistent abdominal pain, discomfort or irritable bowel syndrome. Experts suspect that the inflammation directly damages specific nerve cells in the intestine, which could increase the likelihood of chronic complaints. Until now, however, it has been difficult to scientifically prove this link, since it is difficult to isolate nerve cells from the gastrointestinal tract, particularly during inflammation.

Study examines nerve cells in the gut for the first time

In the current study, an international research team led by the Charité and the Inselspital, Bern University Hospital, and the University of Bern was able to demonstrate for the first time at a molecular level that inflammation damages nerve cells in the gut and impair their function. To scientifically prove this, the researchers developed a special method in which they labeled the nerve cells of the digestive system with a fluorescent marker. In this way, it was possible to specifically isolate the nerve cells from tissues and to analyze them during health as well as inflammation. Employing modern gene analysis, the researchers then examined the gene activity of these cells and detected distinct changes associated with inflammation.

Possible key mechanisms for long-term complaints

The study showed that during gastrointestinal inflammation, two central biological processes were activated in nerve cells. On the one hand, the interferon signaling cascade: it plays an important role in immune defense, but can also damage nerve cells. And on the other hand, ferroptosis: a special form of cell death triggered by iron ions, which led to the death of nerve cells in the gut. These two processes cause intestinal function to deteriorate, which could lead to chronic complaints. In further experiments, the researchers specifically deleted the interferon signaling cascade in nerve cells and were able to show that inflammation and cell death improved leading to altered intestinal motility.

Hope for new treatment possibilities for chronic gastrointestinal complaints

“This study provides new insights into how nerve cells in the intestine adapt towards inflammation and which signaling pathways play a key role in this process. In particular, it shows that the interferon system and ferroptosis are important factors that are activated in the nerve cells during an inflammation,” explains Dr. Manuel Jakob from the Department of Visceral Surgery and Medicine at Inselspital, Research Associate at the Department for BioMedical Research (DBMR) at the University of Bern, and one of the lead authors of the study. He adds:”In the future, these processes could be targeted by means of a specific therapy in the case of long-term gastrointestinal complaints.” In a next step, the team will test whether inhibiting the interferon signaling can influence the course of chronic gastrointestinal complaints. If this turns out to be true, the targeted inhibition of interferon signals or ferroptosis signaling pathways could open new avenues for the treatment of chronic gastrointestinal complaints.

Link

Inselspital Bern - Universitätsklinik für Viszerale Chirurgie und Medizin

Charité – Universitätsmedizin Berlin - Institut für Mikrobiologie und Infektionsimmunologie

Publication

Forster PM*, Jakob MO* et al. A transcriptional atlas of gut-innervating neurons reveals activation of interferon signaling and ferroptosis during intestinal inflammation. *Neuron* (2025). Doi: Online ahead of print. https://doi.org/10.1016/j.neuron.2025.02.018

Expert

Dr. med. Manuel Jakob, Department of Visceral Surgery and Medicine, Inselspital, Bern University Hospital and University of Bern

Contact

Media office Insel Gruppe AG

+41 31 632 79 25 / kommunikation@insel.ch

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