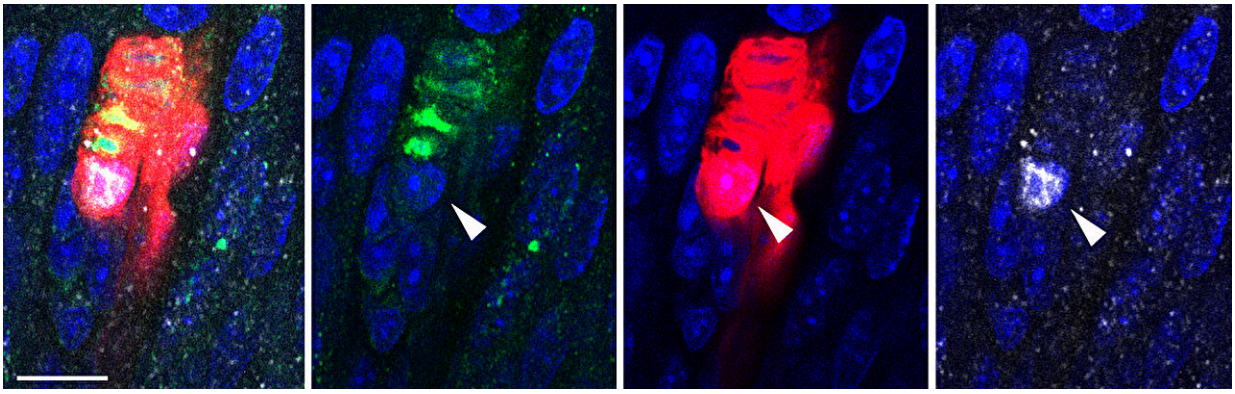
Study finds Schwann cells play a vital role in pain and touch sensations

February 6 2024



Sensory Schwann cells positive for SOX10 shown in red, sensory-ending within the Meissner corpuscle in green, SOX2-postive cell at the base of the Meissner corpuscle shown in silver. Credit: Lewin Lab, Max Delbrück Center

Special receptor cells under the skin enable us to feel pain and touch. But Schwann cells also play a key role in detecting such stimuli, researchers at the Max Delbrück Center report in *Nature Communications*. This discovery opens new avenues for pain therapy.

The skin contains many sensory receptor endings that detect touch, heat, and cold, but also potential dangers such as harmful mechanical and chemical stimuli. These sensory cells then send a corresponding signal to the spinal cord and brain. Scientists had previously thought that sensory neurons alone were responsible for this task. However, it turns out that

Schwann cells also play a vital role, as the groups of Professor Gary Lewin and Professor James Poulet from the Max Delbrück Center, along with an international research team, now report.

Schwann cells are known to act as an insulating layer around nerve fibers . They protect and provide nutrients to neurons. Yet new research has shown that specific types of Schwann cells are also actively involved in detecting sensory stimuli. These Schwann cells form a network-like structure just a few micrometers below the epidermis and are connected to the free nerve endings of sensory receptors that detect mechanical pressure.

"We were surprised at the extent to which the Schwann cells participate in stimulus detection," says Gary Lewin, head of the Molecular Physiology of Somatic Sensation Lab at the Max Delbrück Center.

The first indications of the importance of Schwann cells in pain perception (nociception) came from earlier studies by Lewin's Swedish collaborators.

This prompted Julia Ojeda-Alonso from the Lewin lab and Poulet's lab to team up with international colleagues like Dr. Laura Calvo-Enrique from the Karolinska Institutet in Stockholm—in order to get to the bottom of the matter. Using a technique called optogenetics, the researchers bred mice in which they were able to switch different types of Schwann cells on and off with different colors of light.

Without Schwann cells, the mice could not sense vibrations

All it took to convey pain sensations to the brain was to activate the Schwann cells with a light stimulus. It was not necessary to stimulate the

actual nociceptors. When the Schwann cells were blocked, the transmission of stimuli by nociceptors was reduced by at least half. "We assume that technical limitations prevented us from being able to fully map the role of Schwann cells and that, in some cases, they actually perform most of the stimulus detection," says Lewin.

The team next ran experiments with tactile stimuli. They focused on the Meissner corpuscles, which are vibration receptors in the skin that are closely associated with Schwann cells. The team led by James Poulet, who heads the Neural Circuits and Behavior Lab at the Max Delbrück Center, trained the mice to sense tiny vibrations with their forepaw and to report detection of these stimuli.

"When the Schwann cells were switched off, it was much more difficult for mice to do this," explains Poulet. After the optogenetic blockade was removed, their ability to sense tiny skin vibrations returned.

New approaches for pain therapy

The researchers showed that the Schwann cells primarily influence the transmission of mechanical stimuli but not heat or cold stimuli. "It may be that polymodal nociceptors, which react to mechanical, thermal, and chemical stimuli, only function properly with the help of Schwann cells," says Lewin.

The results open new avenues for understanding and treating pain and impaired touch perception. "The Schwann cells just below the surface of the skin are easily accessible to therapeutic agents," says Lewin. "This makes them an attractive target for tackling the problem right at the root."

More information: Julia Ojeda-Alonso et al, Sensory Schwann cells set perceptual thresholds for touch and selectively regulate mechanical

nociception, *Nature Communications* (2024). DOI: 10.1038/s41467-024-44845-8

Provided by Max Delbrück Center for Molecular Medicine