Matrix remodeling study reveals the influence of the cellular environment on vision

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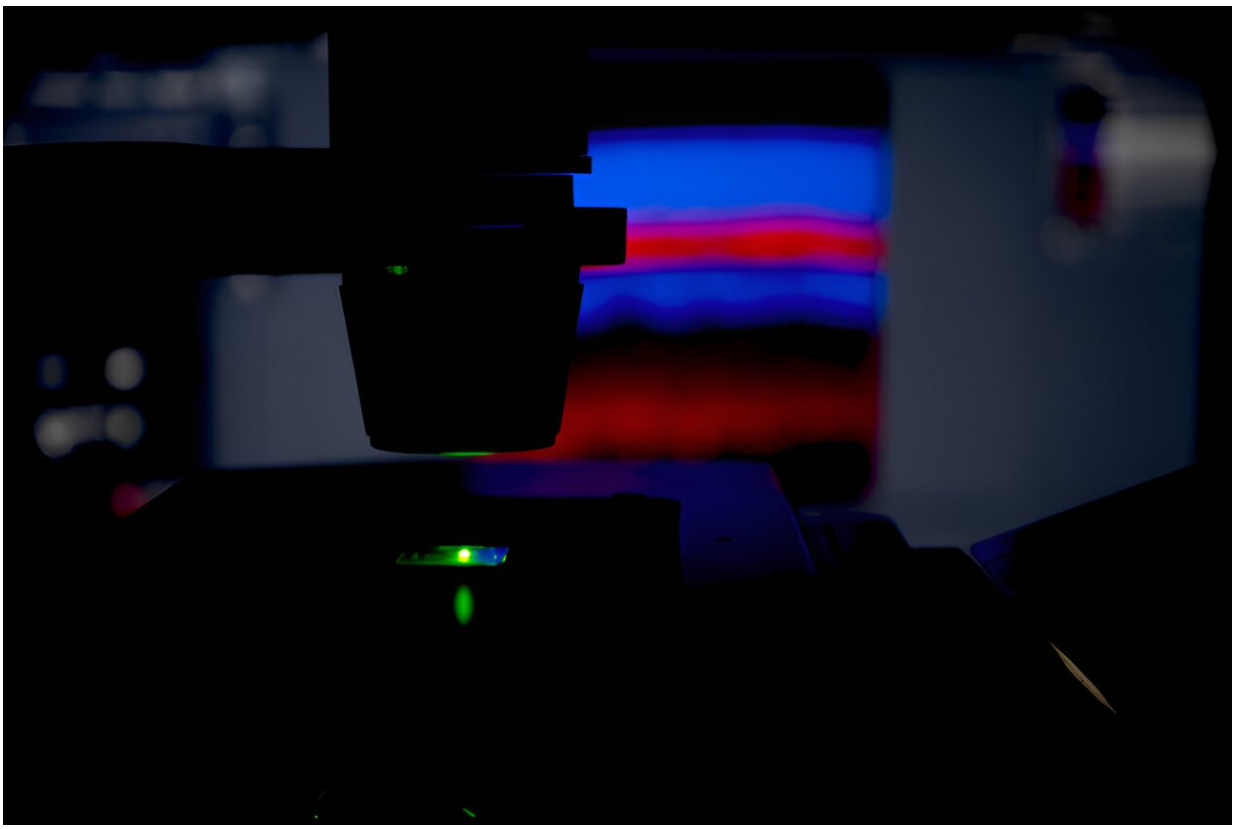

The researchers examine tissue sections of the retina under the microscope. Credit: Ruhr-Universitaet-Bochum, Marquard

The environment of retinal nerve cells plays a crucial role in the

processing of visual signals. The processing of visual information begins with a targeted and balanced communication between nerve cells in the retina via synapses. Proteins in the vicinity of nerve cells play an important role in the development, maturation, and function of these synapses.

A research team from Ruhr University Bochum, together with other research groups, has been able to show that the combined loss of four proteins leads to a severe impairment of the function of the retina, reduced visual movement processing and significant synaptic changes. The researchers, led by Assistant Professor Dr. Jacqueline Reinhard-Recht and Professor Andreas Faissner, report their findings in the journal *iScience*.

Impaired retinal function in matrix-deficient mice

The research team investigated the four extracellular matrix proteins brevican, neurocan, tenascin-C and tenascin-R, which occur in the cell environment of nerve cells of the retina.

"Their precise role in the retina has not yet been sufficiently investigated," explains Dr. Reinhard-Recht. The researchers therefore studied the visual function of so-called knockout mice, which were genetically modified in such a way that their bodies could not produce the four mentioned proteins.

Through electroretinogram analyses, the research team was able to show that rod photoreceptors and bipolar cells in the knockout mice exhibit functional deficits in visual processing.

"Interestingly, we were also able to find significant limitations in visual movement processing in the knockout mice compared to control animals," says Dr. Reinhard-Recht. Mice lacking only the proteins

tenascin-C or tenascin-R also display losses in visual motion processing, but much weaker. "This shows that the cumulative loss of four matrix proteins reinforces optomotor limitations," says the researcher.

Matrix remodeling and imbalance in synaptic signaling

Studies on the retina of knockout mice also revealed changes in various matrix molecules and synapses. "In particular, there was an imbalance of inhibitory and excitatory synapses," says Dr. Reinhard-Recht. "Overall, the research data indicate that the four matrix proteins brevican, neurocan, tenascin-C and tenascin-R are important modulators of synaptic signaling in the retina.

"The research data contribute to a much better understanding of the complex molecular mechanisms of visual processing. In the future, these findings could offer new approaches for the development of therapeutic interventions for visual function disorders."

More information: Jacqueline Reinhard et al, Neural extracellular matrix regulates visual sensory motor integration, *iScience* (2024). DOI: 10.1016/j.isci.2024.108846

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