

People with increased risk of Alzheimer's have deficits in navigating

31 August 2020



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Animals and humans have the ability to follow their own position in space through self-motion cues, even in the absence of any other sensory information. "If you get up at night and want to find your way to the bathroom in the dark, you need—in addition to knowing the arrangement of your own home—a mechanism that tracks your own position in the room without using external cues," says Anne Bierbrauer. This ability is known as path integration.

Researchers assume that the activity of so-called [grid cells](#) in the [entorhinal cortex](#) is responsible for this ability. When navigating a spatial environment, these [cells](#) display a unique, regular activity pattern. It has long been known that the entorhinal cortex is crucial for [spatial navigation](#). It is also one of the first regions of the brain affected by Alzheimer's disease.

Previous study showed changes in grid cell activity

In a previous study, the researchers had shown that grid cells exhibit altered functioning in people

at genetic risk for developing Alzheimer's disease. However, the test persons did not show any obvious navigation problems. "We assume that they used compensatory mechanisms to find their way," explains Nikolai Axmacher, "presumably via external cues in their surroundings. In Bochum, for example, the winding tower of the Bergbau-Museum can be seen in many places, as it is often visible over the rooftops of other buildings."

Alzheimer's risk and navigation problems go hand in hand

In the current study, the team therefore used a computerized navigation task in which the participants couldn't use external landmarks to find their way. The researchers compared the navigation performance of 202 volunteers without genetic Alzheimer's risk and 65 volunteers with increased genetic risk. The latter had a specific expression of the gene for apolipoprotein E, the APOE- ϵ 4 allele.

Participants with a [genetic risk](#) of Alzheimer's disease didn't perform as well as the [control group](#).

Insights into grid cell activity

An additional group of test persons performed the same task while the researchers recorded their brain activity with functional magnetic resonance imaging. The objective of this experiment was to find out which brain processes play a role in path integration. The team found grid cell representations in the entorhinal cortex to be specifically associated with navigation without external cues, which highlights the role of this brain region for path integration.

"In this study, we demonstrated a very specific deficit in healthy people with a genetically increased risk for Alzheimer's," concludes Lukas Kunz. "In the future, such behavioral changes might perhaps help diagnose Alzheimer's disease earlier,

before any serious symptoms appear." Researchers believe that drug therapies for Alzheimer's disease have so far failed, because the diagnosis is made too late.

More information: Anne Bierbrauer et al. Unmasking selective path integration deficits in Alzheimer's disease risk carriers, *Science Advances* (2020). [DOI: 10.1126/sciadv.aba1394](https://doi.org/10.1126/sciadv.aba1394)

Provided by Ruhr-Universitaet-Bochum

APA citation: People with increased risk of Alzheimer's have deficits in navigating (2020, August 31) retrieved 22 May 2021 from <https://medicalxpress.com/news/2020-08-people-alzheimer-deficits.html>

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