MedicalXpress

Study highlights brain cells' role in navigating environment

February 5 2015

A new Dartmouth College study sheds light on the brain cells that function in establishing one's location and direction. The findings contribute to our understanding of the neural mechanisms underlying our abilities to successfully navigate our environment, which may be crucial to dealing with brain damage due to trauma or a stroke and the onset of diseases such as Alzheimer's.

"Knowing what direction you are facing, where you are, how to navigate and your spatial orientation at a given moment are really fundamental to survival," says Professor Jeffrey Taube, the study's senior author.

The study appears in the journal *Science Express*. The study's co-lead authors are Shawn Winter, a Dartmouth postdoctoral fellow in Psychological and Brain Sciences, and Benjamin Clark, an assistant professor at the University of New Mexico who received his PhD in Psychological and Brain Sciences from Dartmouth.

The Dartmouth researchers study the neural mechanisms underlying our sense of location and directional heading, which forms the basis of our perceived spatial orientation in the environment. Knowing your spatial orientation is essential for being able to navigate to a goal. In the past few decades, researchers have discovered a number of cell types in the brain that respond in relation to where you are (so-called place cells) and your perceived directional heading (so-called head direction cells).

More recently, a third cell type was discovered that is activated at

multiple places in the environment: If you monitored the location of all these active places, you would find that they formed a repeating, grid-like pattern in a hexagonal array. These "grid cells" were identified in a different brain area, the entorhinal cortex. Researchers were excited about this discovery because theoretically these grid cells could account for how we can keep track of where we are at any given moment and how we update this perception as we move through our environment. Based on how these cells fire, they could also inform us of how far we have traveled and our precise path. The 2014 Nobel Prize in physiology/medicine was awarded to the two laboratories that discovered place cells and grid cells.

Scientists have been investigating how the grid cell signal is generated. The Dartmouth experiments addressed what types of information go into forming this signal. They use microelectrodes to record the activity of cells in a rat's brain that make possible spatial navigation. They found that if they inactivate or turn off a key brain area that contains head direction cells, then the grid cell signal in the entorhinal cortex is disrupted, without affecting the place cell signal in the hippocampus.

"These results indicate for the first time that although the grid cell signal is about places, the head direction cell information is critical for generating the grid signal," Taube says. "These findings contribute to our understanding of the neural mechanisms underlying our abilities to successfully navigate our environment."

More information: www.sciencemag.org/lookup/doi/ … 1126/science.1259591

Provided by Dartmouth College