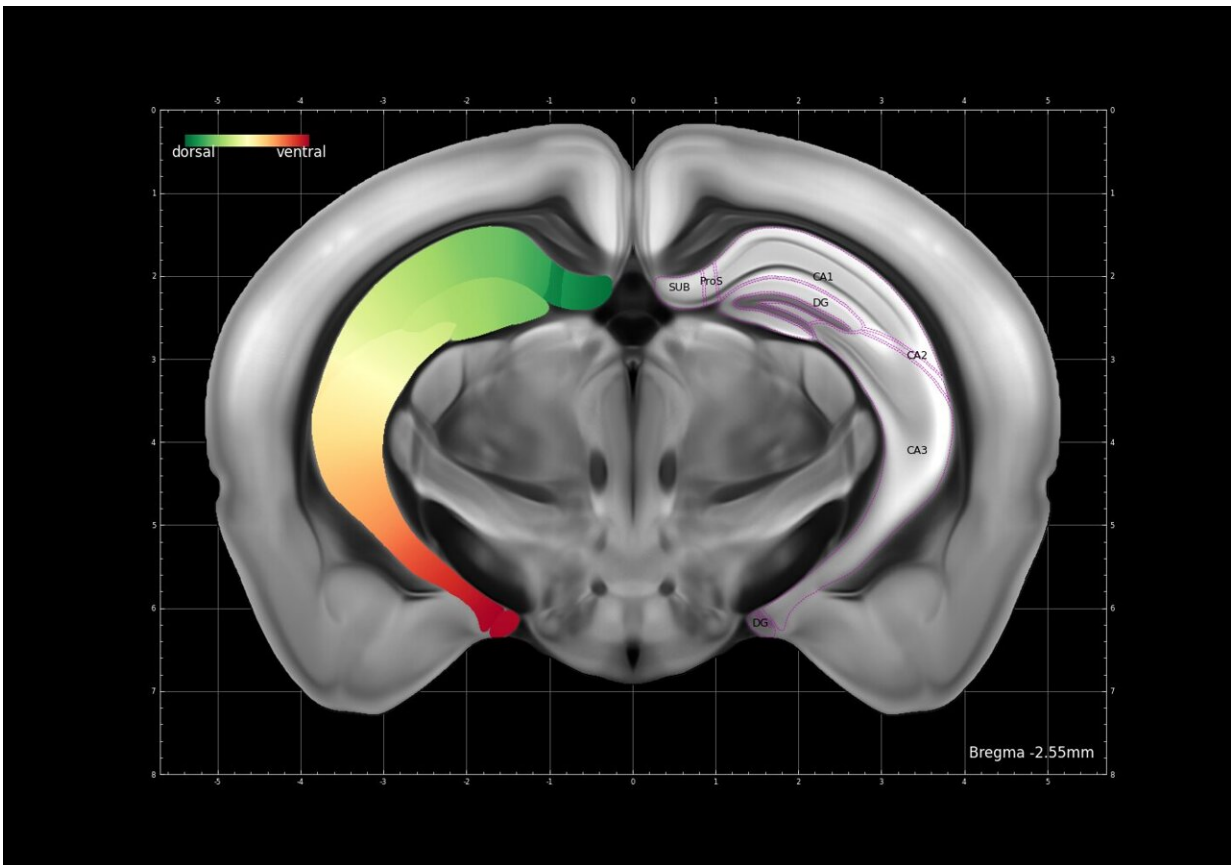


Whole-brain projection patterns of single neurons in mouse hippocampus unveiled

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Coronal sections of hippocampal longitudinal axis. Credit: Digital Brain CEBSIT

A study [published](#) in *Science* reports a comprehensive database of single-neuron projectomes consisting of over 10,000 mouse hippocampal

neurons, thus revealing the spatial connectivity patterns of mouse hippocampal neurons at the mesoscopic level.

The study was conducted by teams from the Center for Excellence in Brain Science and Intelligence Technology (CEBSIT), the Institute of Neuroscience of the Chinese Academy of Sciences (CAS), the HUST-Suzhou Institute for Brainsmatics, Hainan University, the Kunming Institute of Zoology of CAS, Lingang Laboratory, and the Shanghai Center for Brain Science and Brain-Inspired Technology.

The hippocampus serves as an essential brain region for learning and memory as well as various brain functions such as spatial cognition and emotional processing. It is one of the most extensively studied brain regions. Hippocampal neurons project widely to the brain-wide targets; thus, it is critical to investigate the projection patterns of hippocampal neurons at the single-neuron level.

The study reconstructed the whole-brain axonal morphology of over 10,000 neurons in the mouse hippocampus at a [single-cell resolution](#) with the neuronal cell bodies covering all subregions and multiple locations along different hippocampal axes, making this the most extensive single-neuron projectome database in the world.

The study took an innovative approach to categorize axonal trajectories with machine learning algorithms, thus allowing for a more efficient analysis of the morphological similarities among 341 projection patterns for mouse hippocampal neurons and ultimately identifying 43 distinct projectome cell types. It also incorporated the spatial transcriptome of mouse CA1 areas.

Based on these analyses, the study was able to elucidate the axonal projection pathways of hippocampal neurons along the anterior-posterior axis and reveal new projection patterns of [hippocampal neurons](#). It also

outlined the correspondence between hippocampal neuron soma locations and projection targets, and revealed basic organization principles of bilateral projections.

Furthermore, correlation analysis of projectome cell types and spatial transcriptome data identified spatial correspondence between various genes and projectome subtypes, providing potential molecular and circuit targets for hippocampal functions.

Taken together, this study provides a structural basis for future studies of hippocampal functions and deciphers the potential correspondences between their soma locations, [gene expression](#), and circuitry functions.

The database for the hippocampal single-neuron projectomes, along with the database on the hippocampal longitudinal axis and spatial transcriptomes, are now publicly accessible through the [Digital Brain CEBSIT portal](#).

To facilitate broader usage of the databases, a team from the Computing and Data Center of CEBSIT has developed a website to integrate [data visualization](#), [user interface](#), online analysis, and data downloads.

More information: Shou Qiu et al, Whole-brain spatial organization of hippocampal single-neuron projectomes, *Science* (2024). [DOI: 10.1126/science.adj9198](#).
www.science.org/doi/10.1126/science.adj9198

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