

COMS30017

Computational Neuroscience

**Week 5 / Video 5 / Continuous attractors and
navigation**

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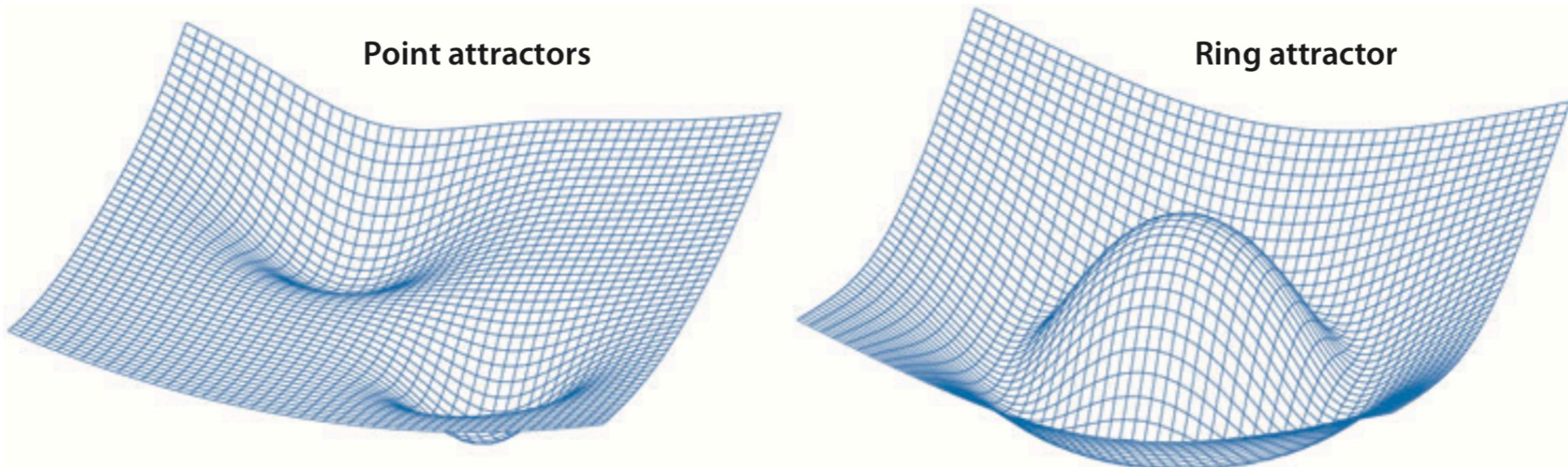
Intended Learning Outcomes

- Head-direction cell attractors
- Grid-cell attractors

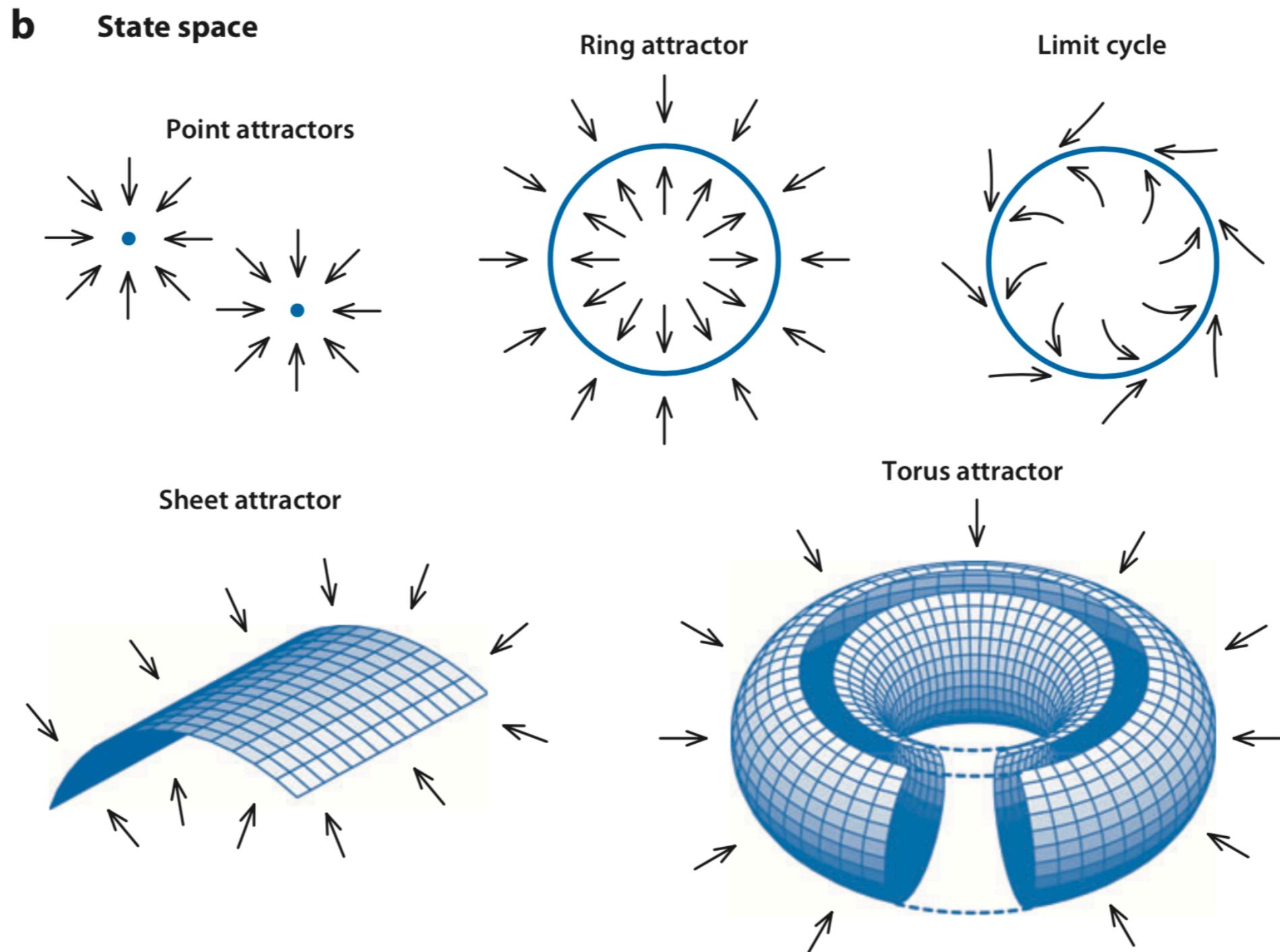
Attractor networks

- Attractor networks are recurrent neural networks where the internal dynamics evolves towards a stable pattern.

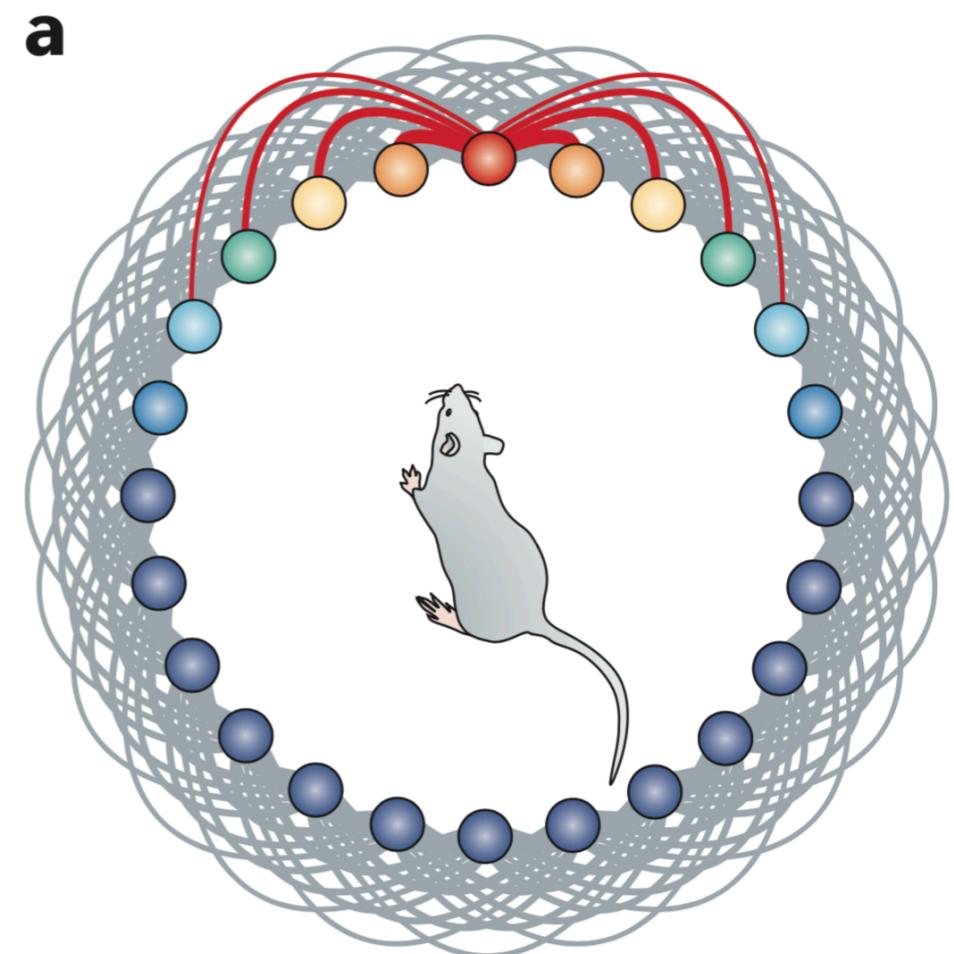
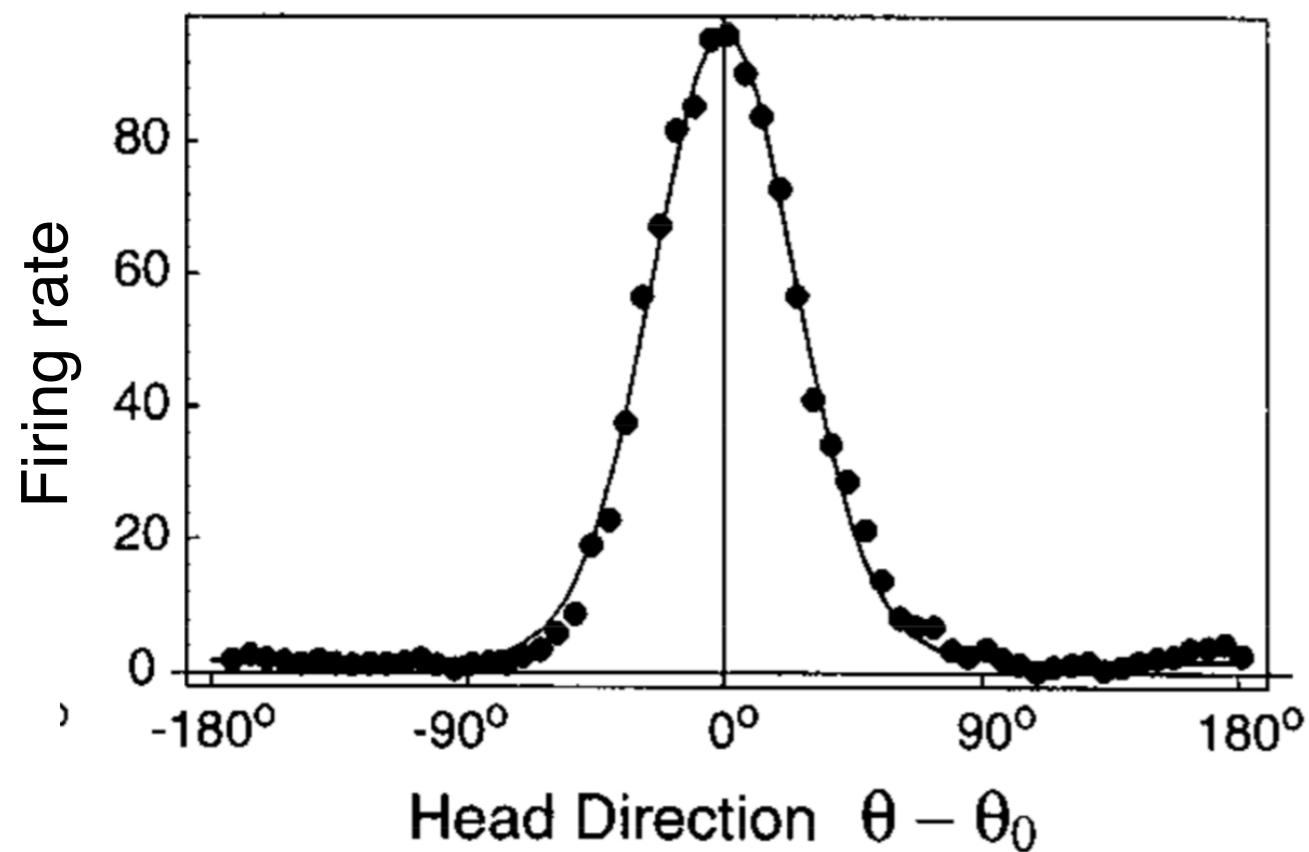
a Energy landscape



Attractor networks

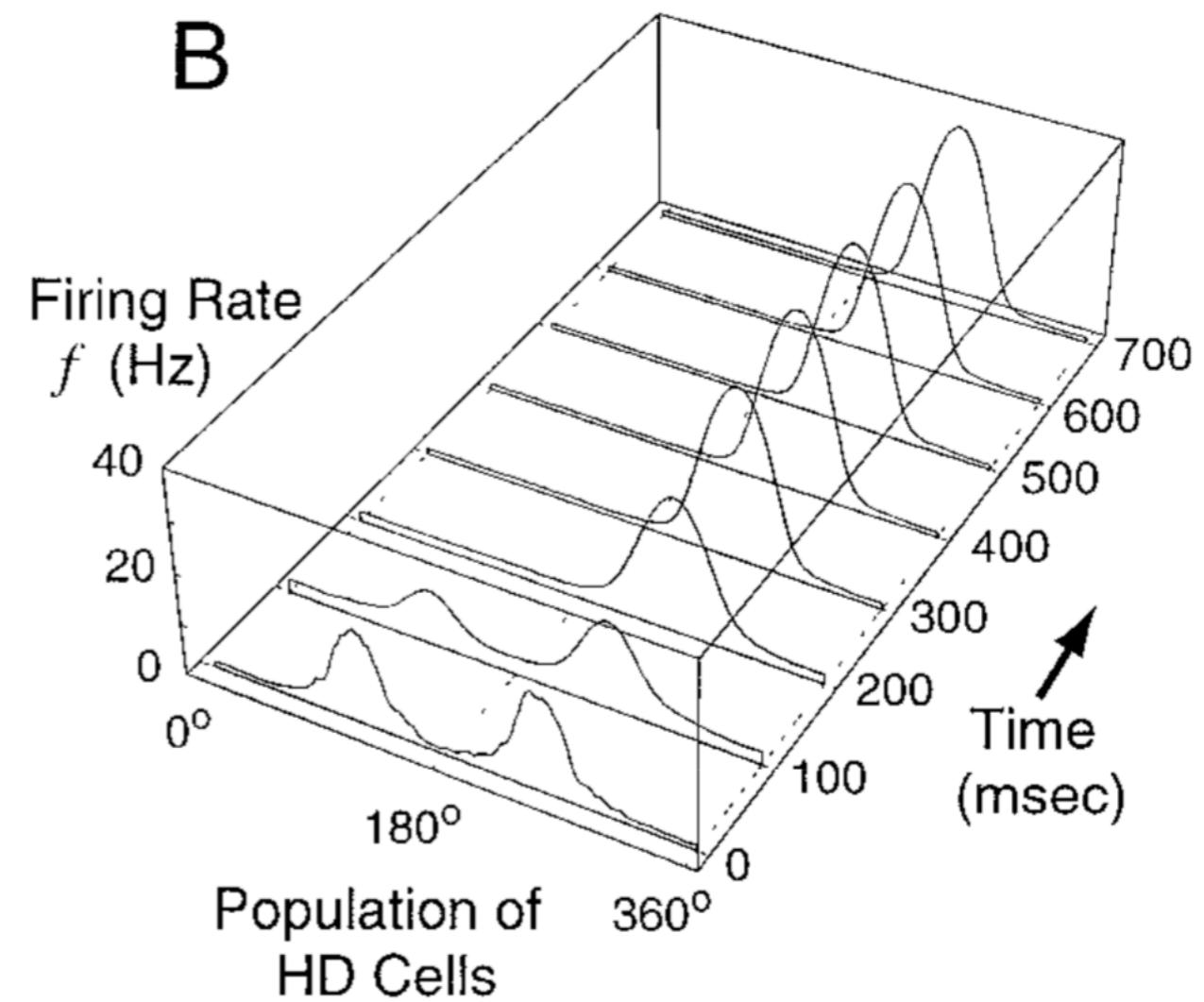
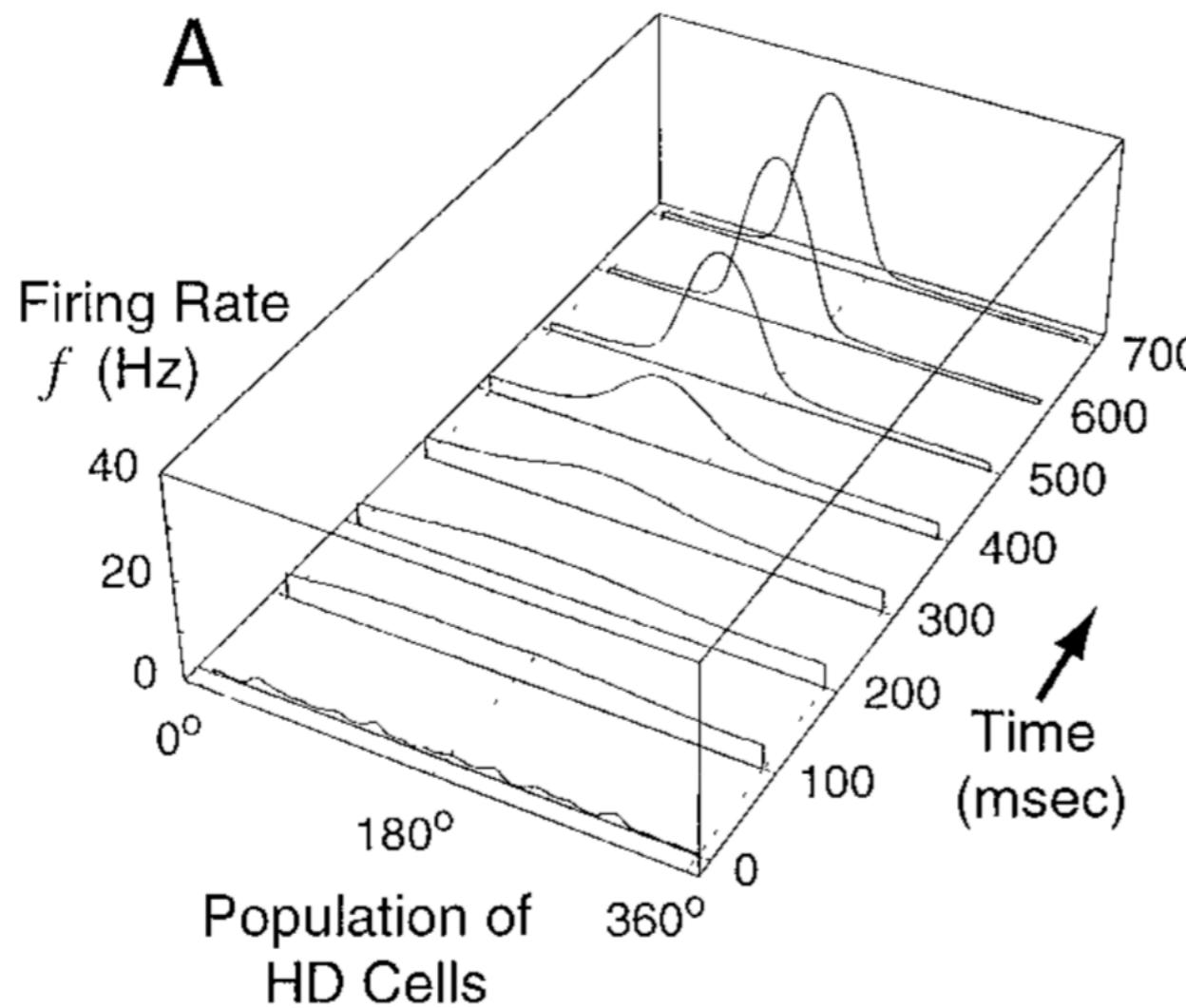


Continuous attractors in subiculum

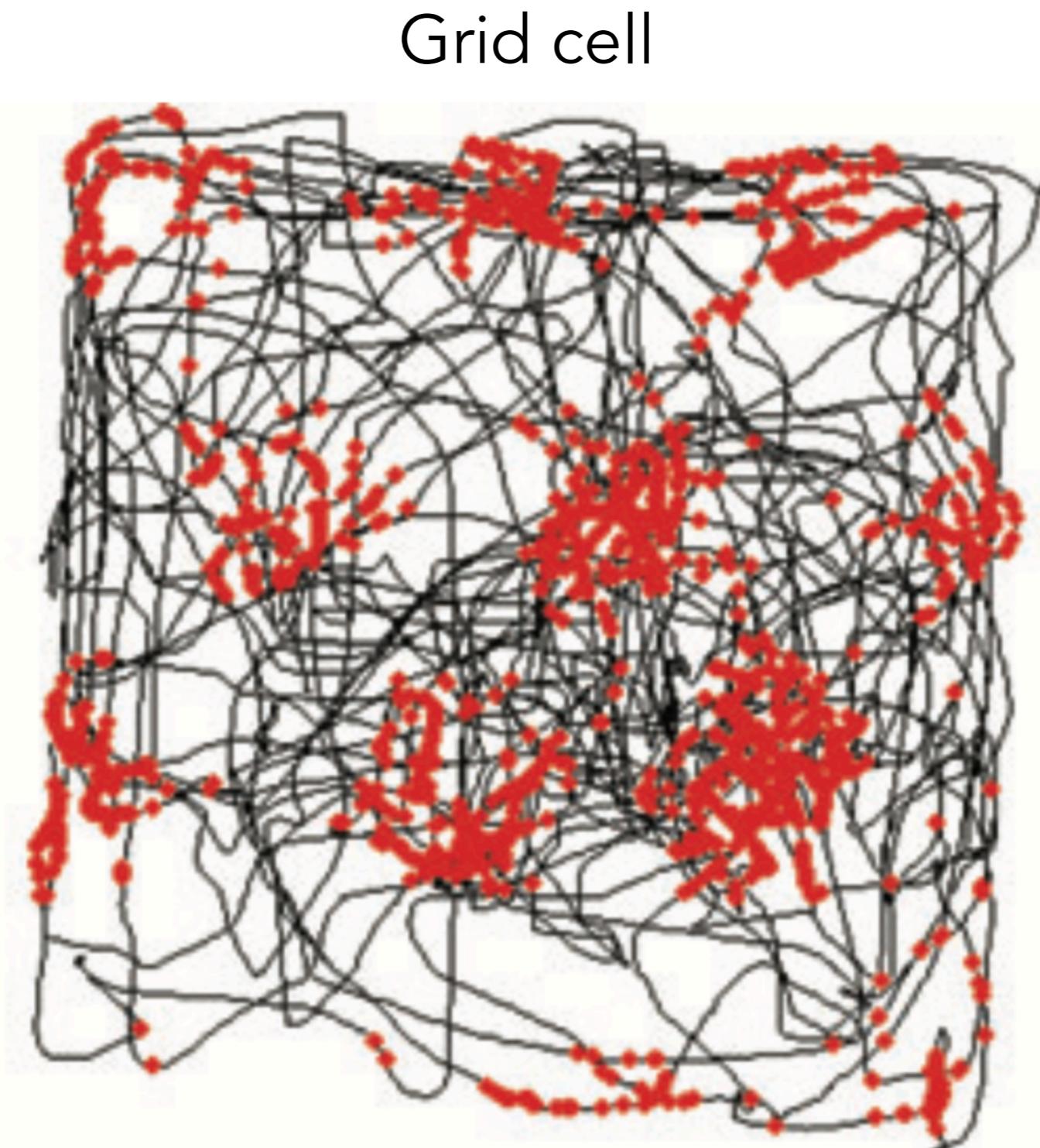


McNaughton, et al. (2006). Nat Rev Neurosci 7, 663–678
Zhang, K (1996). Journal of Neuroscience 16, 2112–2126.

Continuous attractors in subiculum

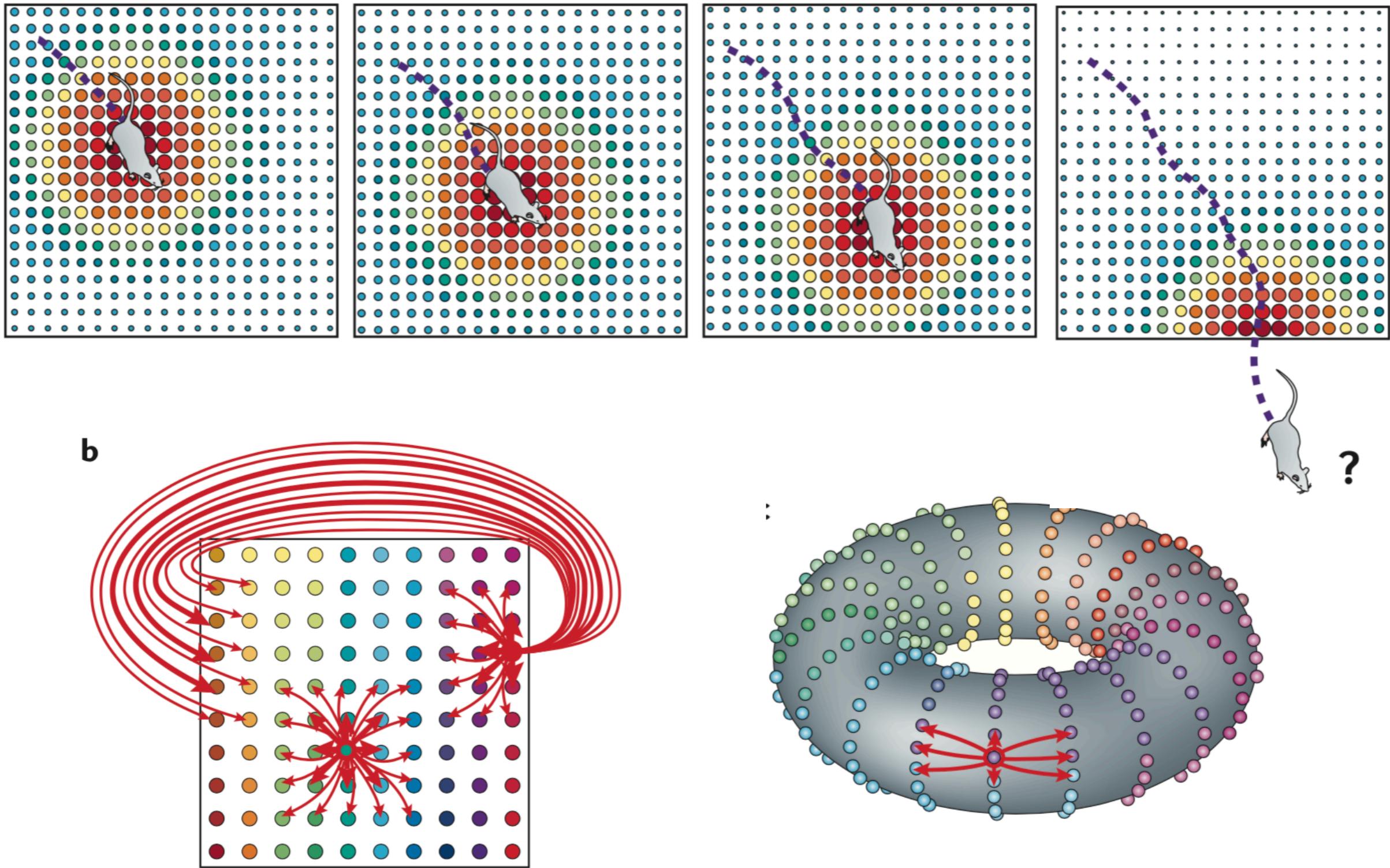


Continuous attractors in entorhinal cortex



McNaughton, et al. (2006). Nat Rev Neurosci 7, 663–678

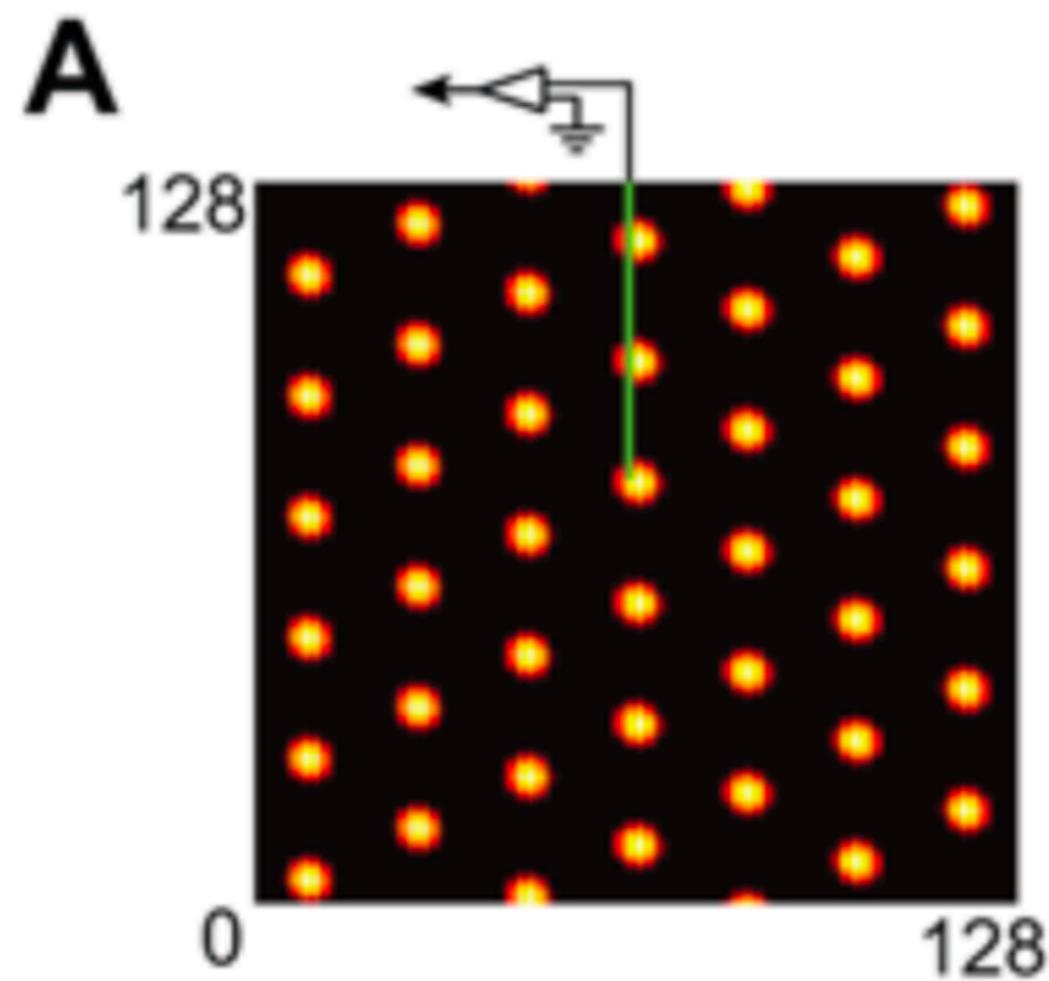
Continuous attractors in entorhinal cortex



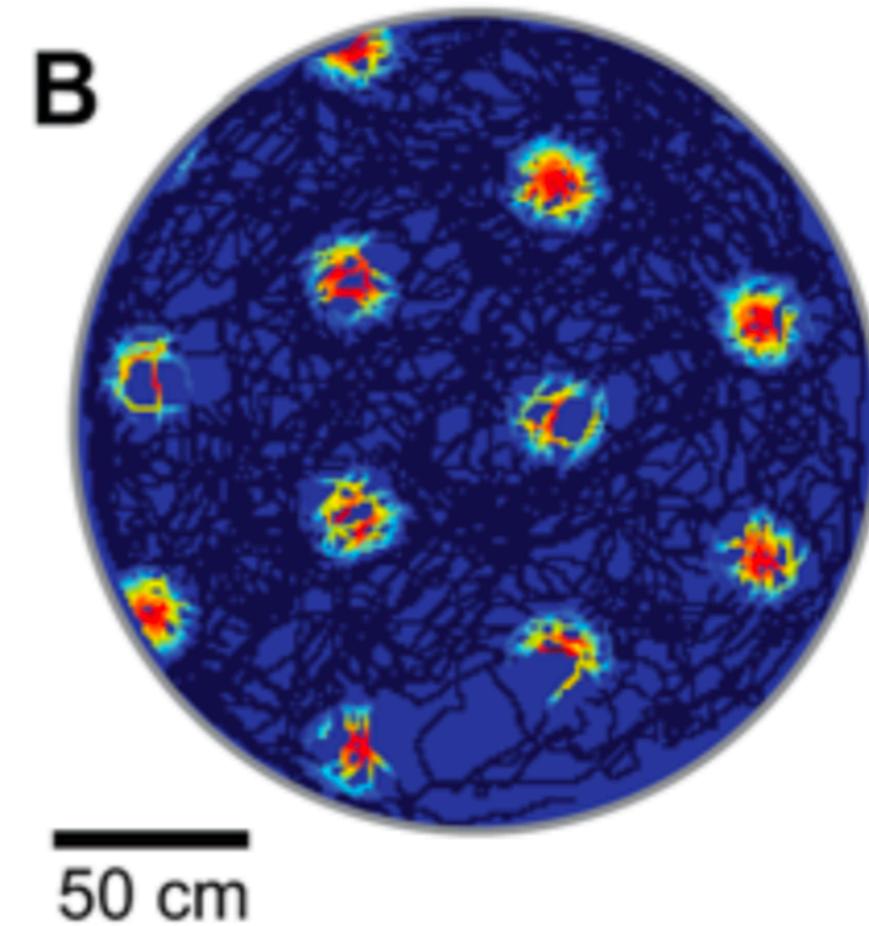
McNaughton, et al. (2006). Nat Rev Neurosci 7, 663–678

Continuous attractors in entorhinal cortex

Network activity



Single cell activity as a
function of animal
location



References

- Burak, Y., Fiete, I.R., 2009. Accurate path integration in continuous attractor network models of grid cells. PLoS Comput Biol 5, e1000291.
- McNaughton, B.L., Battaglia, F.P., Jensen, O., Moser, E.I., Moser, M.-B., 2006. Path integration and the neural basis of the 'cognitive map'. Nat Rev Neurosci 7, 663–678.
- O'Reilly, R.C., McClelland, J.L., 1994. Hippocampal conjunctive encoding, storage, and recall: avoiding a trade-off. 4, 661–682.
- Zhang, K., 1996. Representation of spatial orientation by the intrinsic dynamics of the head-direction cell ensemble: a theory. Journal of Neuroscience 16, 2112–2126.

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