



Поиски карты.

**Открытия лауреатов Нобелевской
премии по физиологии или
медицине 2014 г.**

Press Release

2014-10-06

The Nobel Assembly at Karolinska Institutet has today
decided to award

The 2014 Nobel Prize in Physiology or Medicine
with one half to
John O'Keefe

and the other half jointly to
May-Britt Moser and Edvard I. Moser

**for their discoveries of cells that constitute
a positioning system in the brain**

Nobel Prizes and Laureates

Medicine Prizes ▾



2014



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► [John O'Keefe](#)

► [May-Britt Moser](#)

► [Edvard Moser](#)

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The Nobel Prize in Physiology or Medicine 2014

John O'Keefe, May-Britt Moser, Edvard Moser

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Nobelförsamlingen

The Nobel Assembly at Karolinska Institutet

Advanced Information

→ [Scientific Background: The Brain's Navigational Place and Grid Cell System](#)

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Key publications:

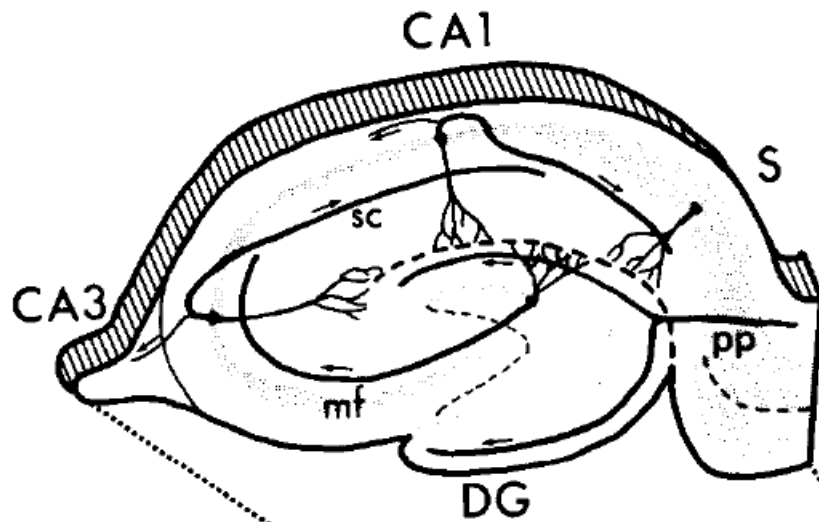
O'Keefe, J., and Dostrovsky, J. (1971). The hippocampus as a spatial map. Preliminary evidence from unit activity in the freely-moving rat. *Brain Research* 34, 171-175.

O'Keefe, J. (1976). Place units in the hippocampus of the freely moving rat. *Experimental Neurology* 51, 78-109.

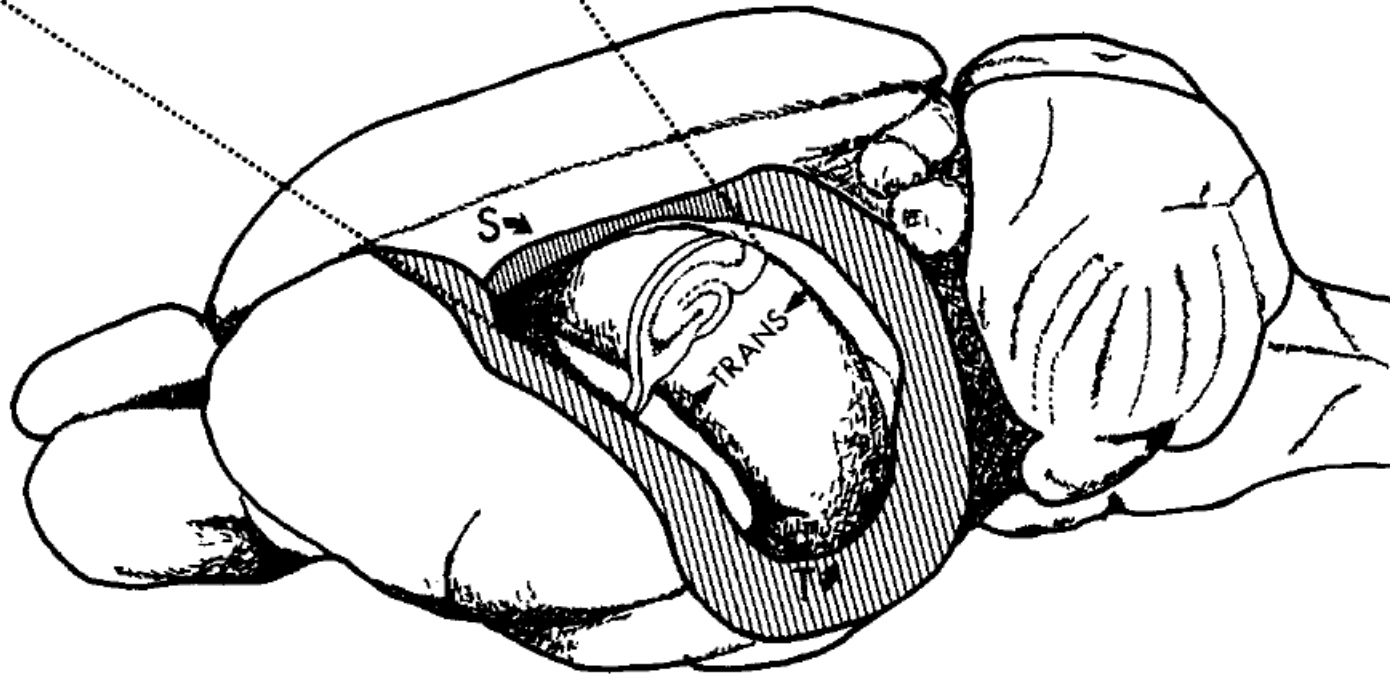
Fyhn, M., Molden, S., Witter, M.P., **Moser, E.I., Moser, M.B.** (2004) Spatial representation in the entorhinal cortex. *Science* 305, 1258-1264.

Hafting, T., Fyhn, M., Molden, S., **Moser, M.B., and Moser, E.I.** (2005). Microstructure of spatial map in the entorhinal cortex. *Nature* 436, 801-806.

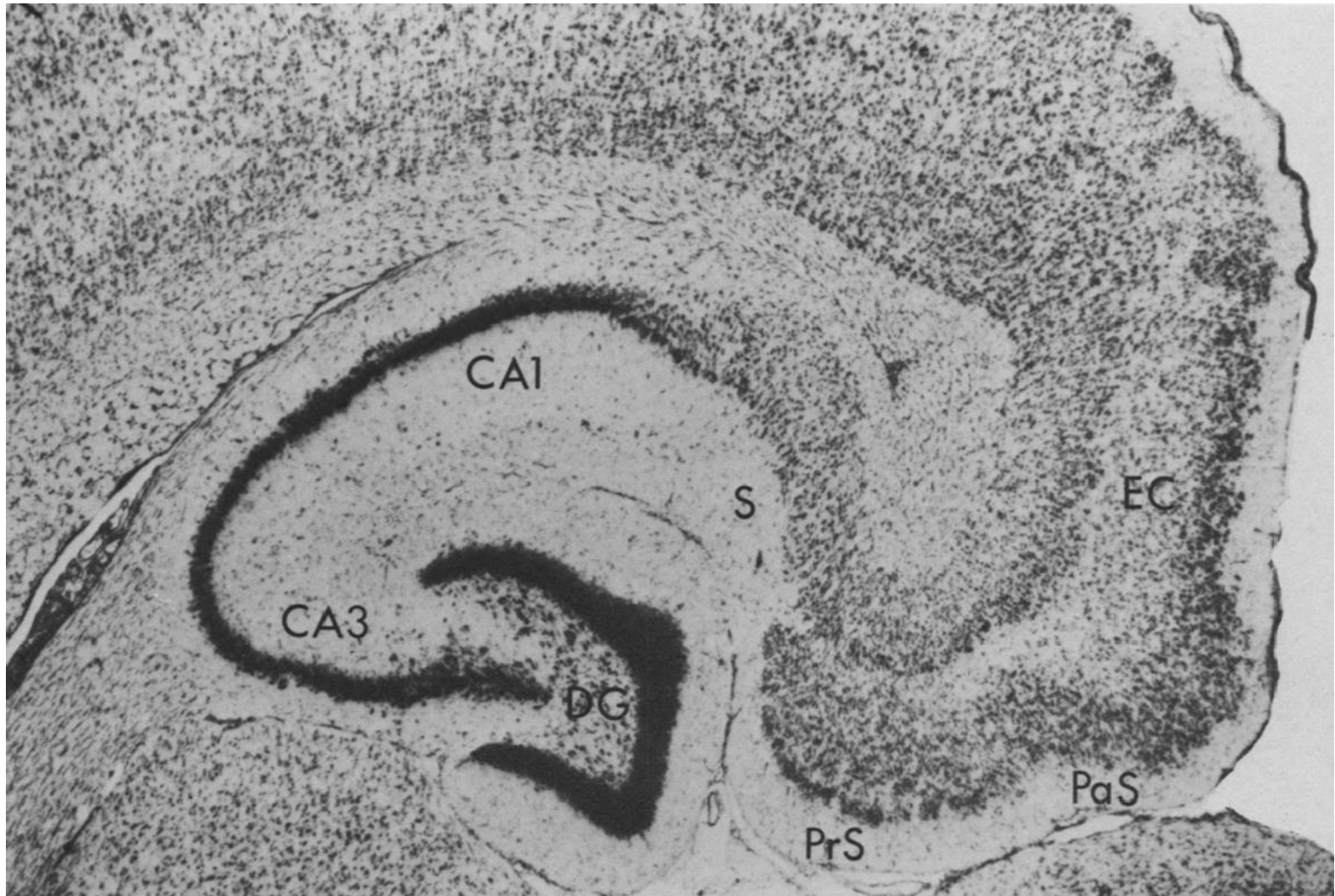
Sargolini, F., Fyhn, M., Hafting, T., McNaughton, B.L., Witter, M.P., **Moser, M.B., and Moser, E.I.** (2006). Conjunctive representation of position, direction, and velocity in the entorhinal cortex. *Science* 312, 758-762.



Amaral D.G., Witter M.P. The three-dimensional organization of the hippocampal formation: a review of anatomical data.
Neuroscience. 1989. 31(3): 571-591.



Amaral D.G., Witter M.P. The three-dimensional organization of the hippocampal formation: a review of anatomical data. *Neuroscience*. 1989. 31(3): 571-591.



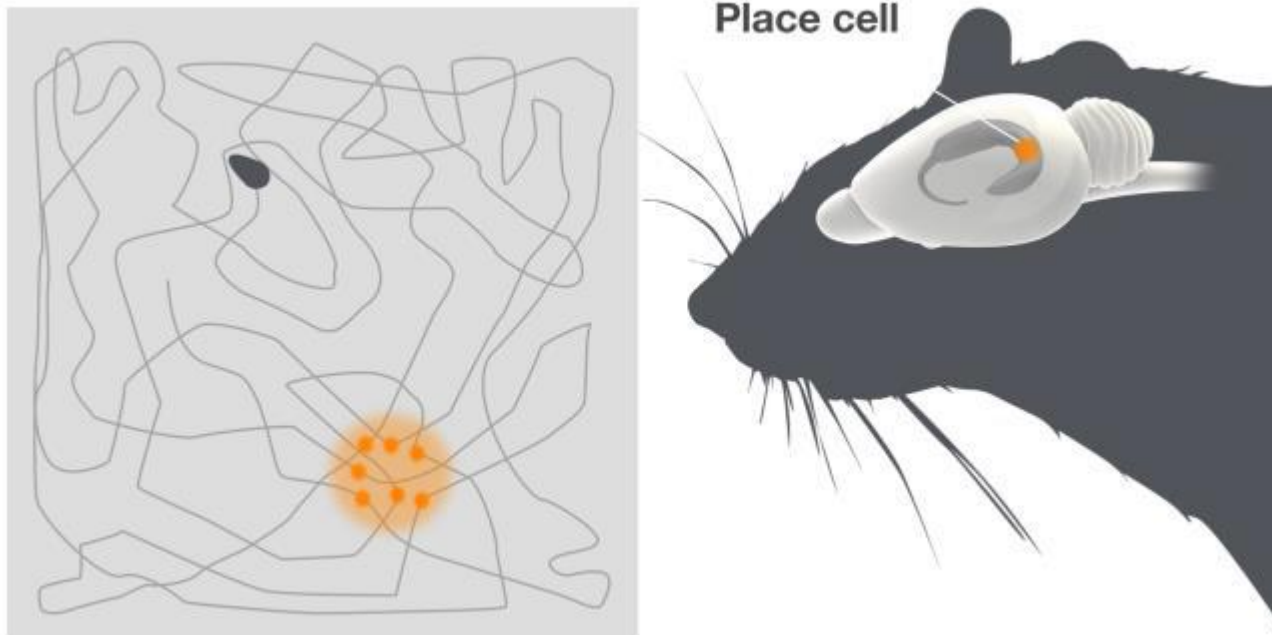
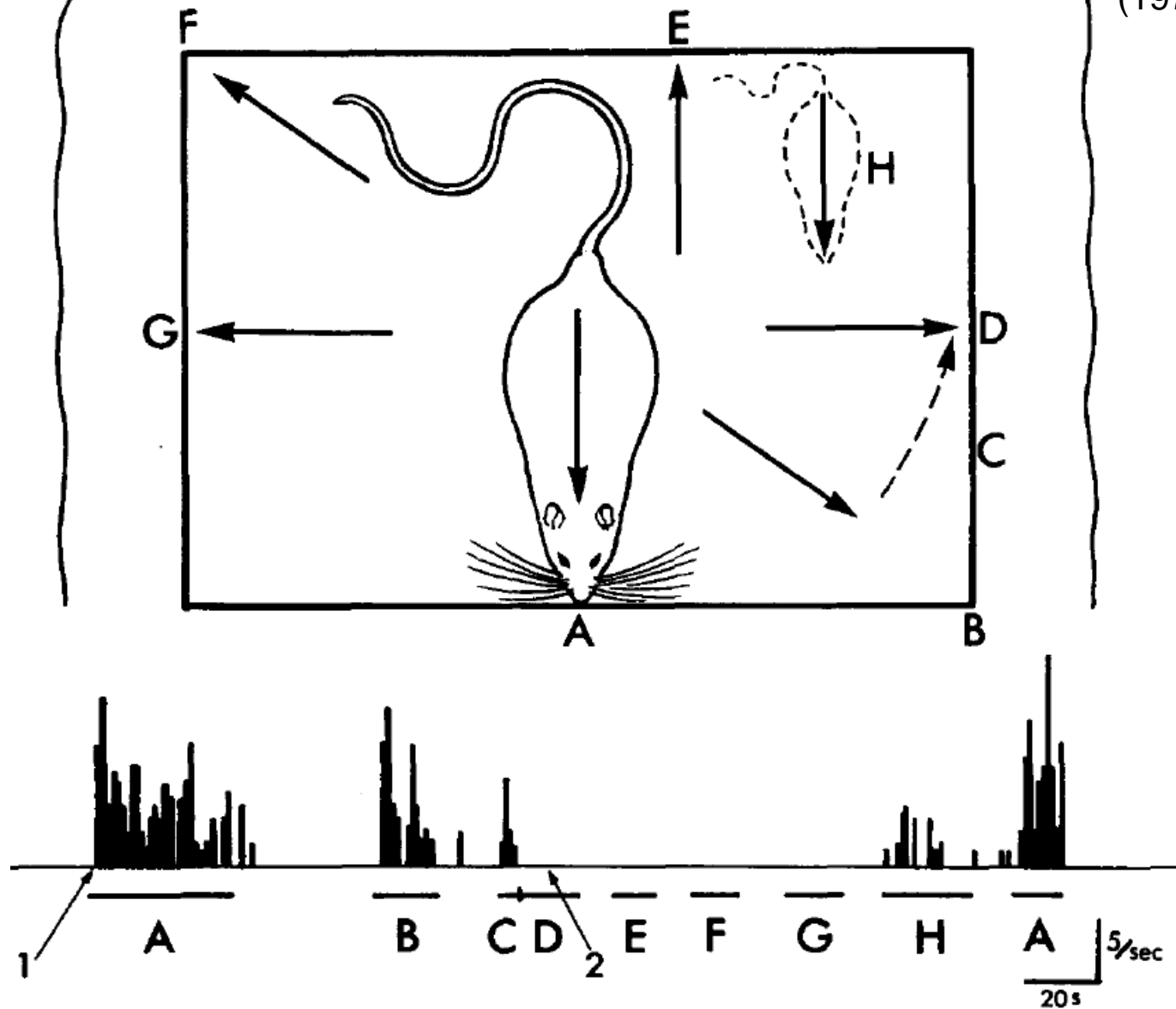


Figure 1. Place cells. Place cells fire when the animal reaches a particular location in the environment. The dots indicate the rat's location in the arena when the place cell is active. Different place cells in the hippocampus fire at different places in the arena.

curtain

O'Keefe J.,
Dostrovsky J.
(1971).

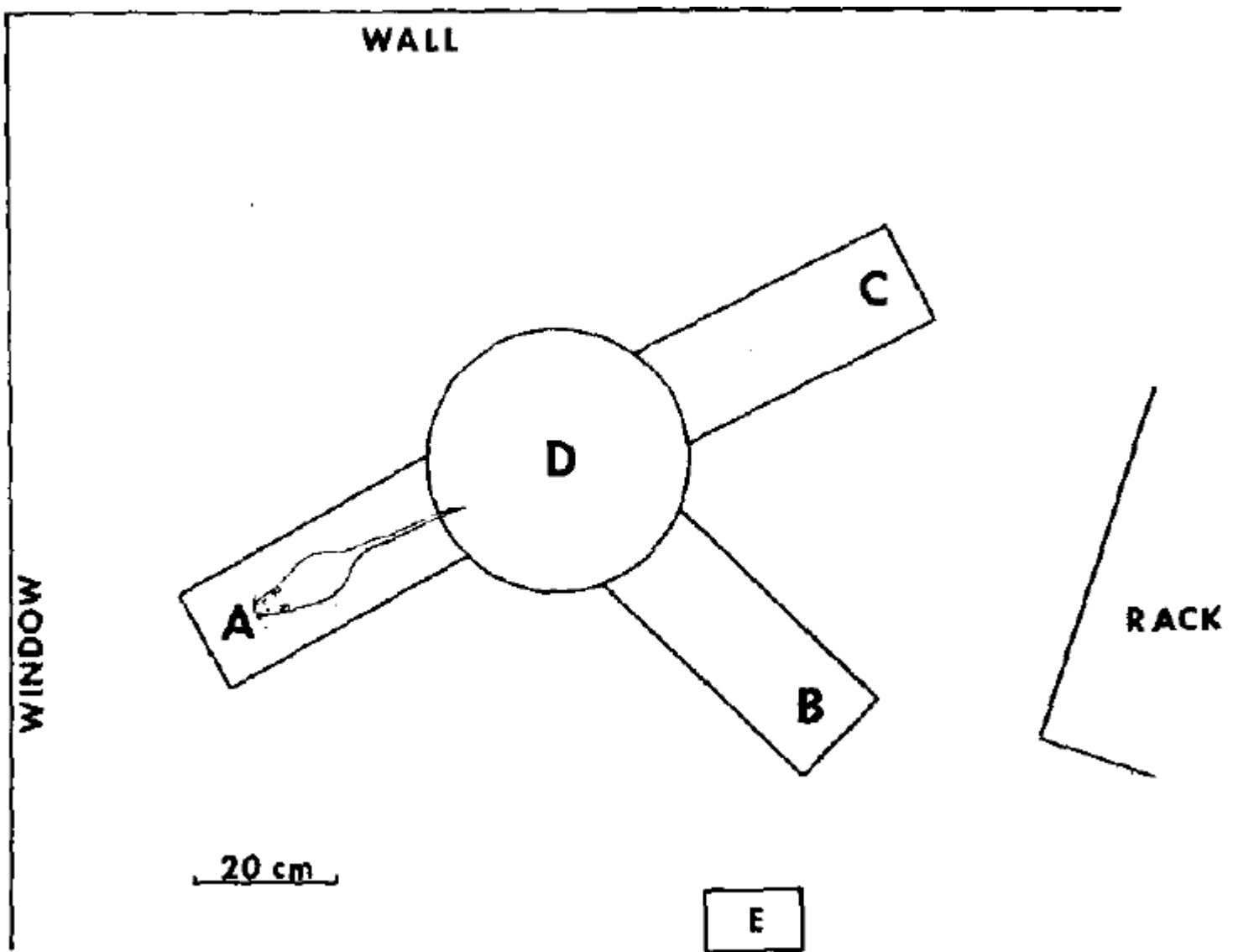


These ... units responded solely or maximally when the rat was *situated in a particular part of the testing platform facing in a particular direction.*

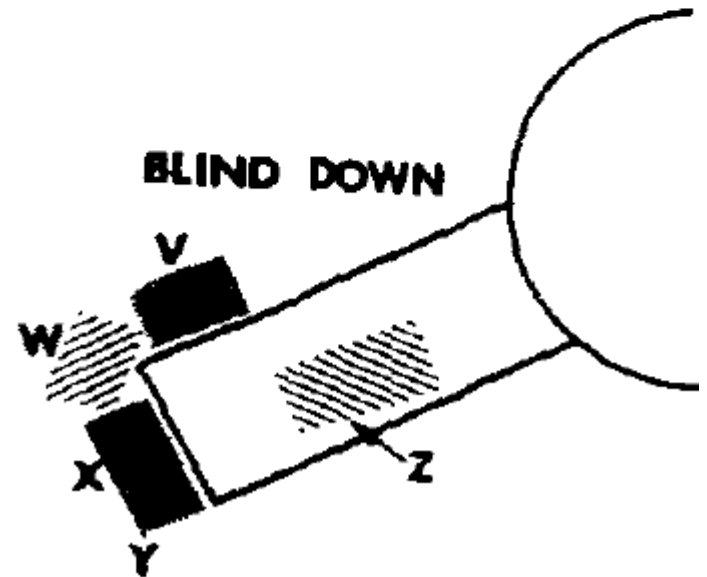
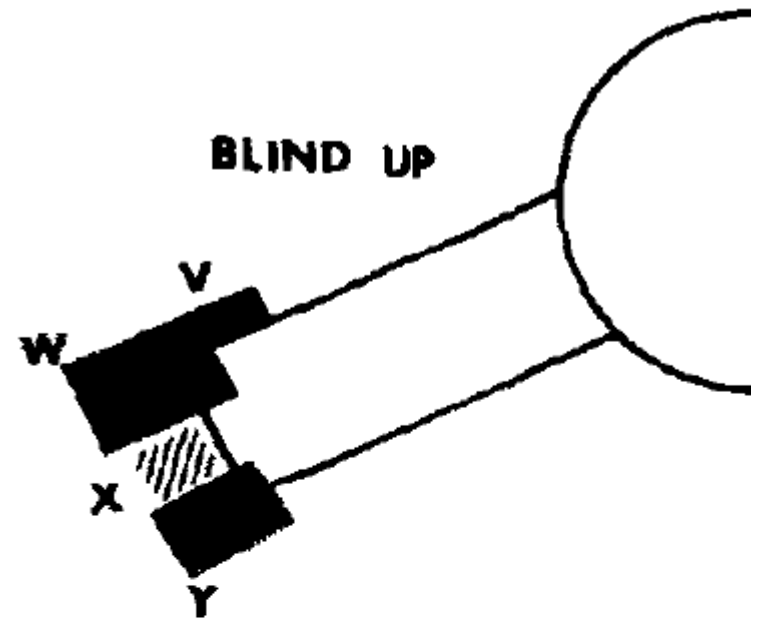
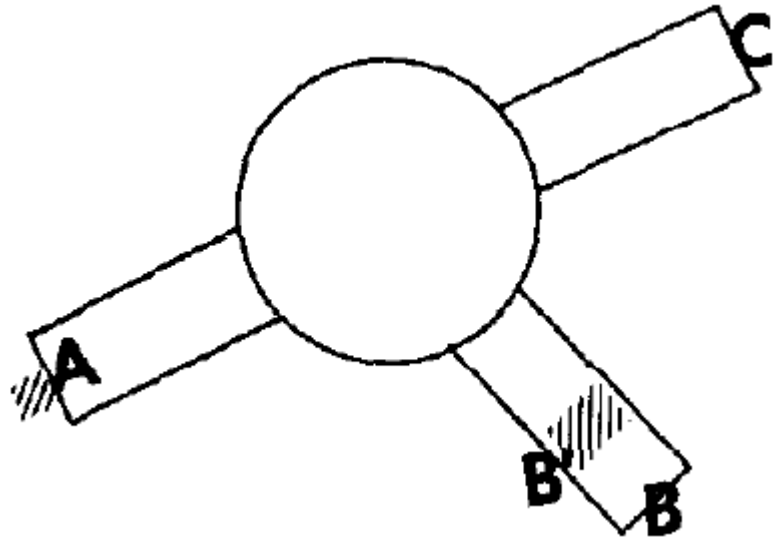
Other units responded to different sensory inputs and different orientations. For example, the unit ... responded to any moving visual stimulus when the rat was between positions G and A.

...the spatial orientation of two units was eventually disrupted after several radical changes in the environment (such as removing the curtain).

O'Keefe J.
(1976).



O'Keefe J. (1976).



J Neurosci. 1992 May;12(5):1945-1963.

**The positional firing properties of
medial entorhinal neurons: description
and comparison with hippocampal
place cells.**

Quirk GJ, Muller RU, Kubie JL, Ranck JB Jr.

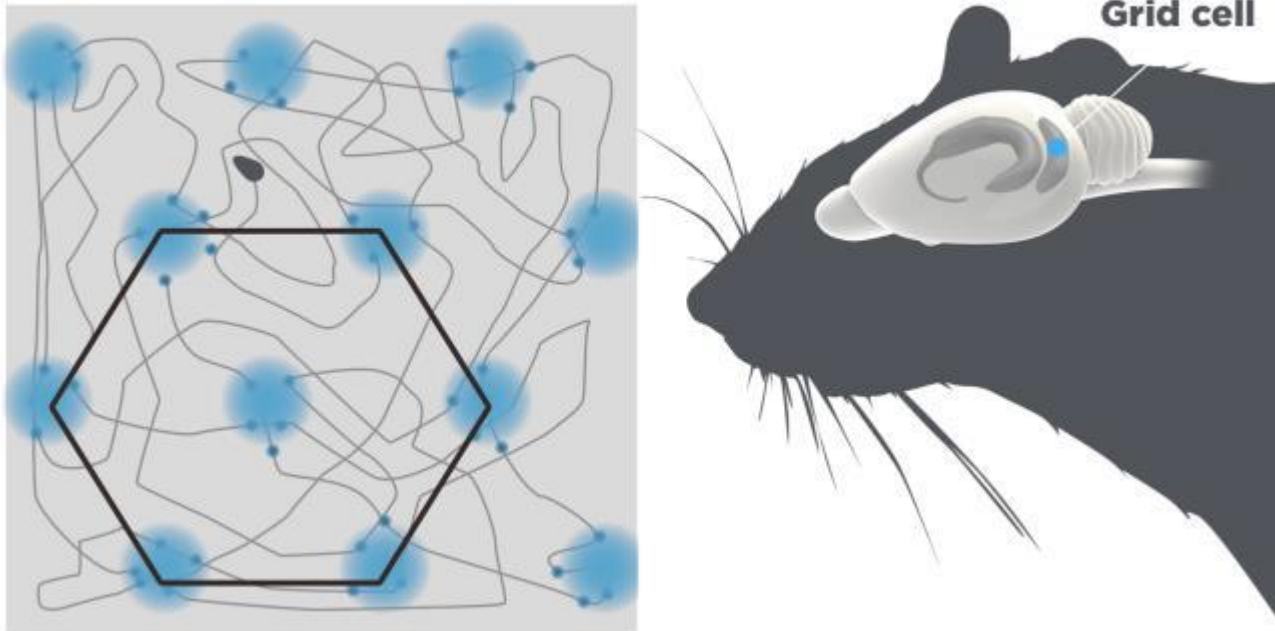
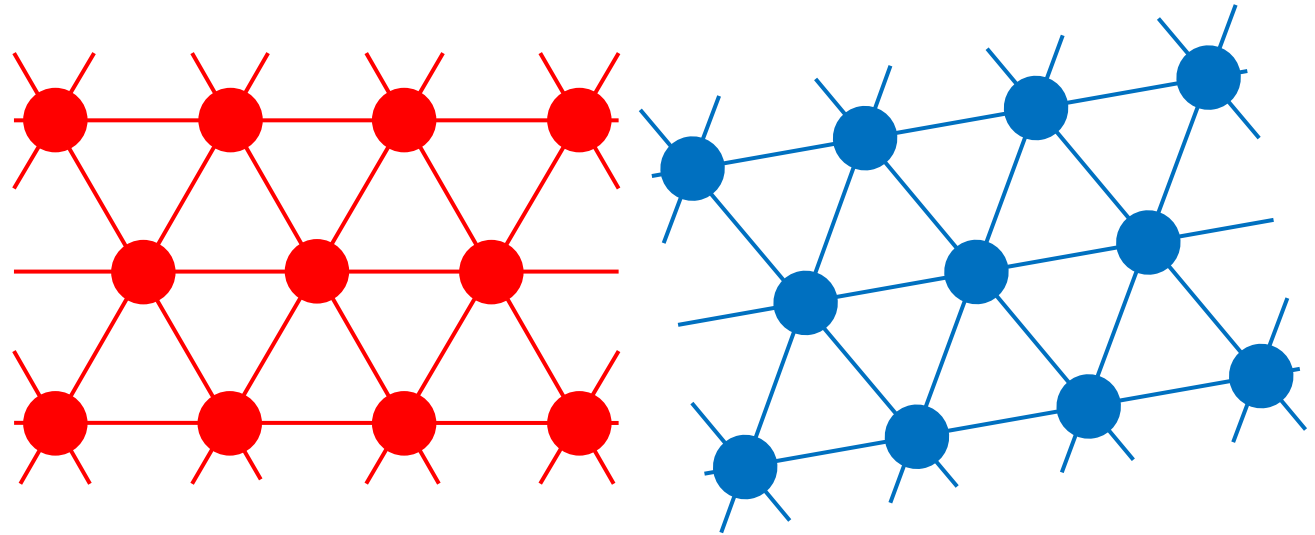
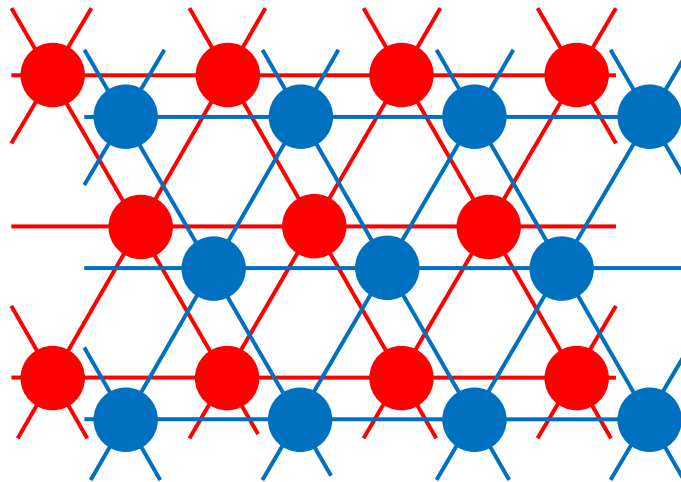


Figure 2. Grid cells. The grid cells are located in the entorhinal cortex depicted in blue. A single grid cell fires when the animal reaches particular locations in the arena. These locations are arranged in a hexagonal pattern.

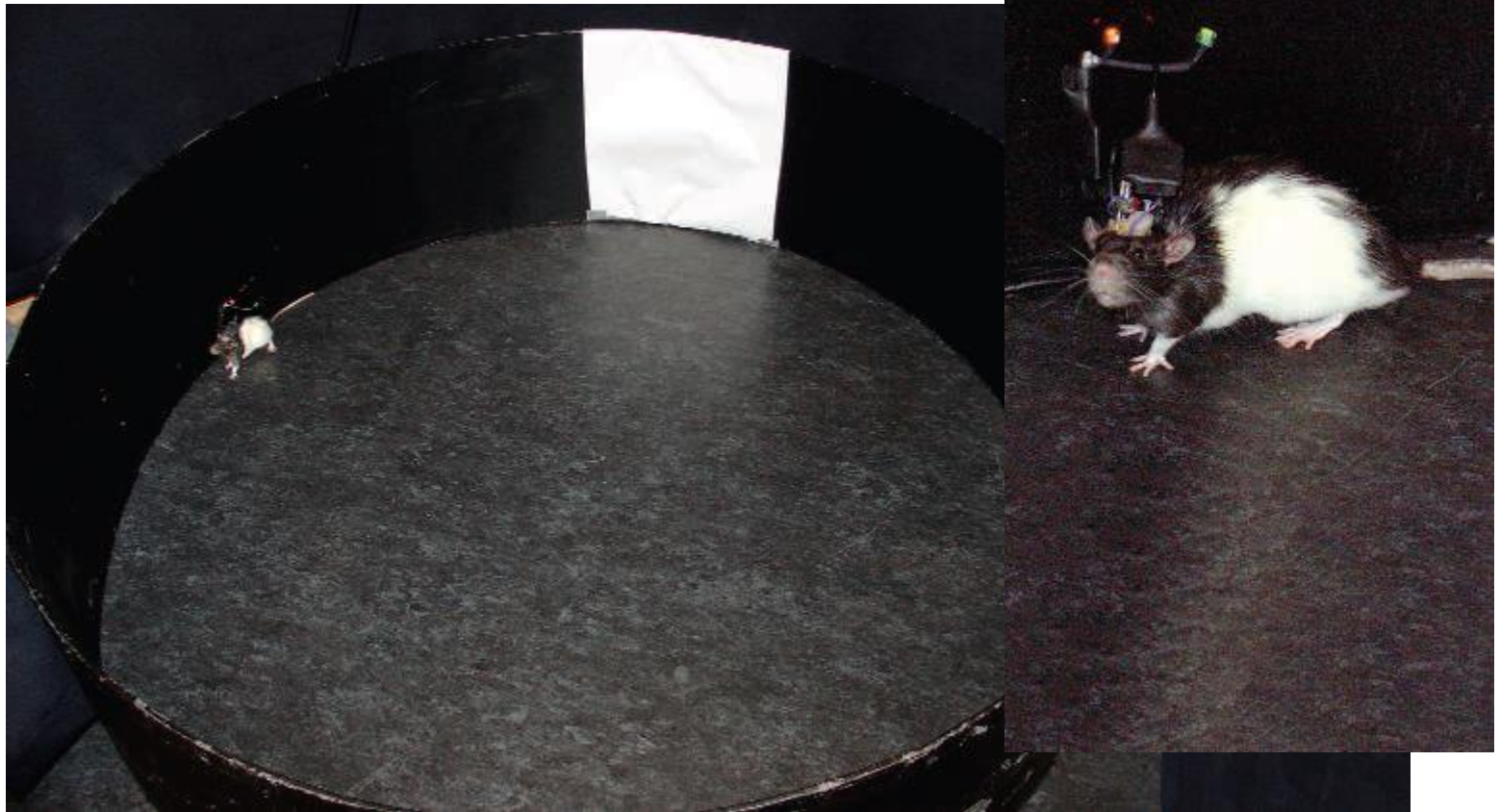
Ориентация



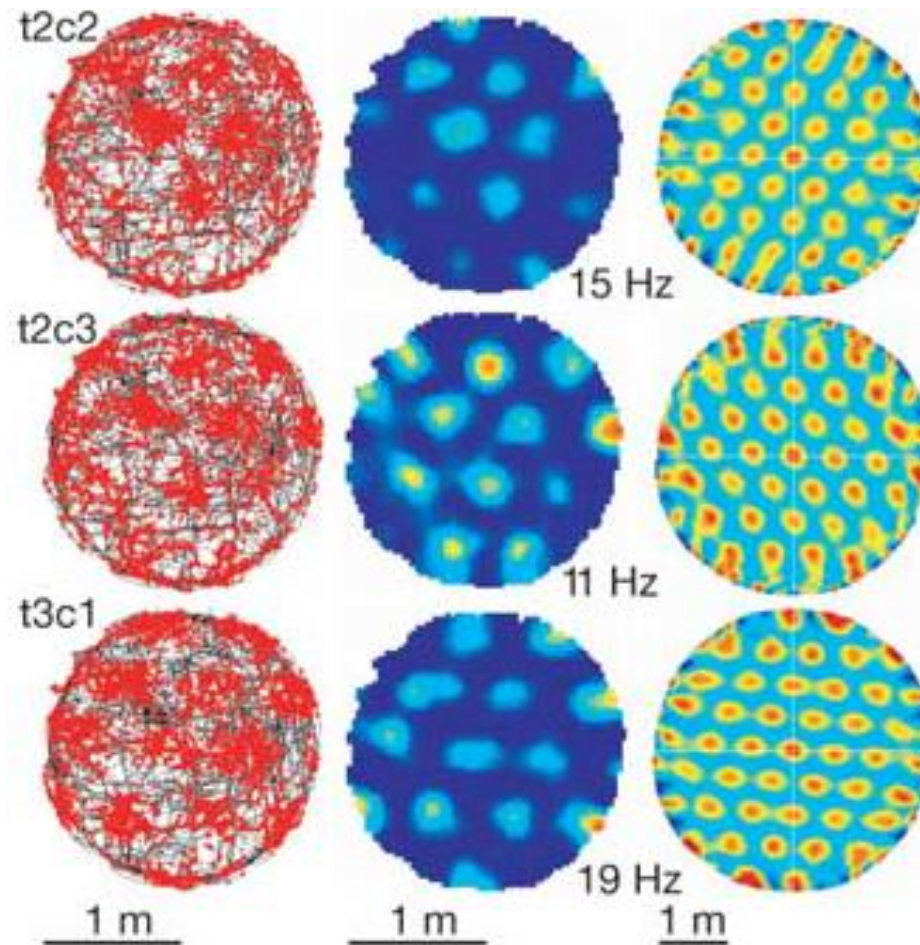
Фаза



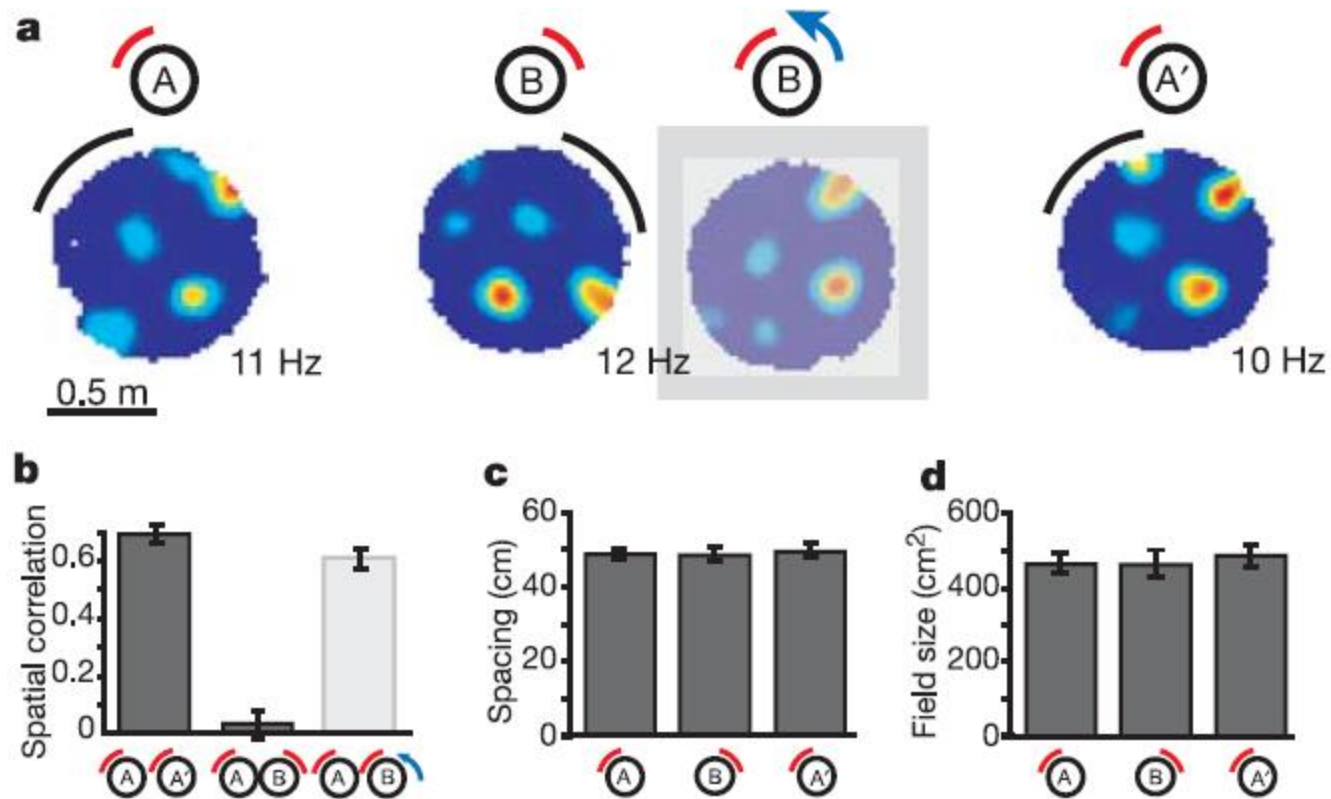
Heyman K. Neuroscience. The map in the brain: grid cells may help us navigate.
Science. 2006. 312: 680-681.



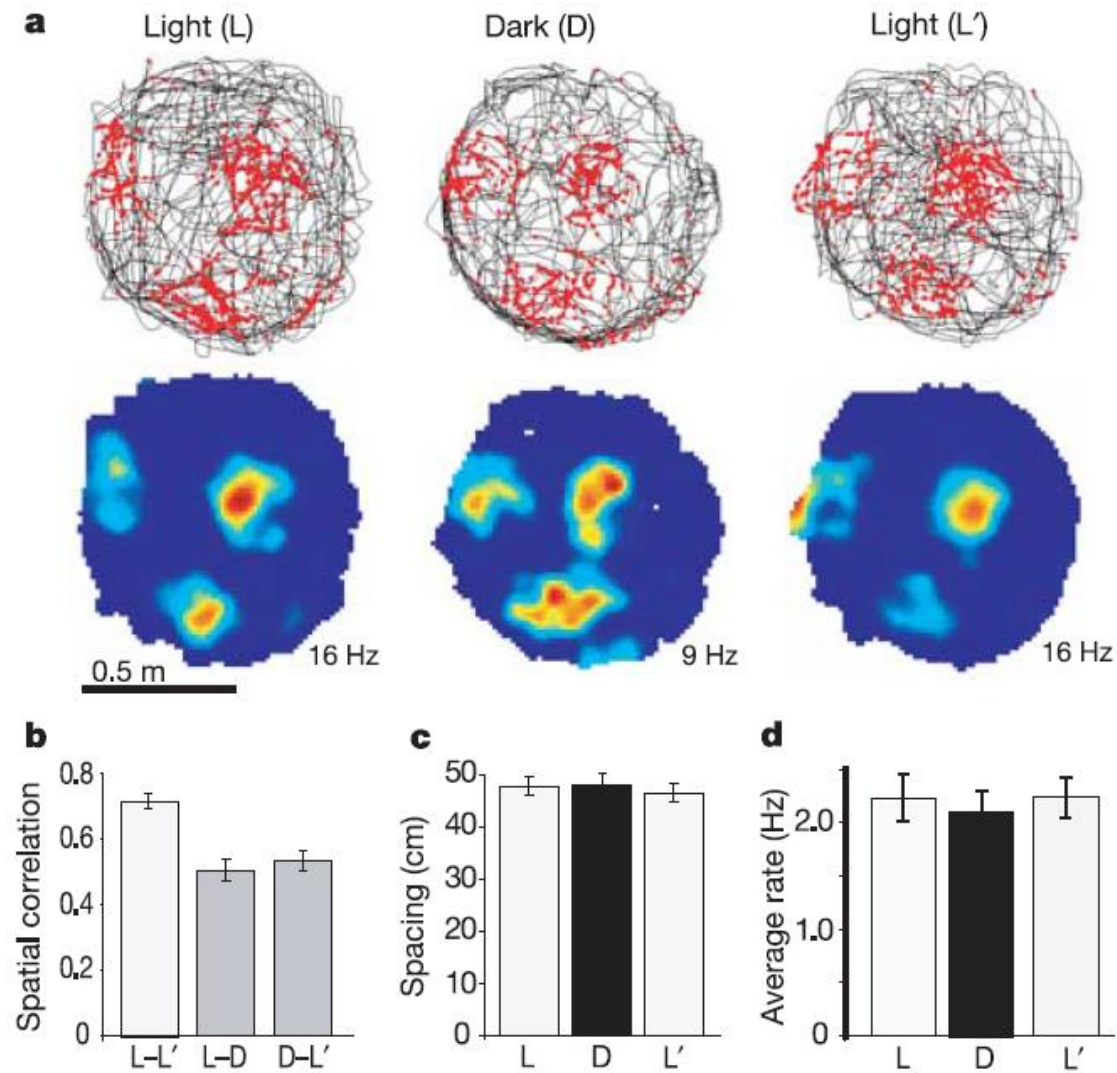
Hafting T. et al. Microstructure of spatial map in the entorhinal cortex. *Nature*. 2005. 436: 801-806.



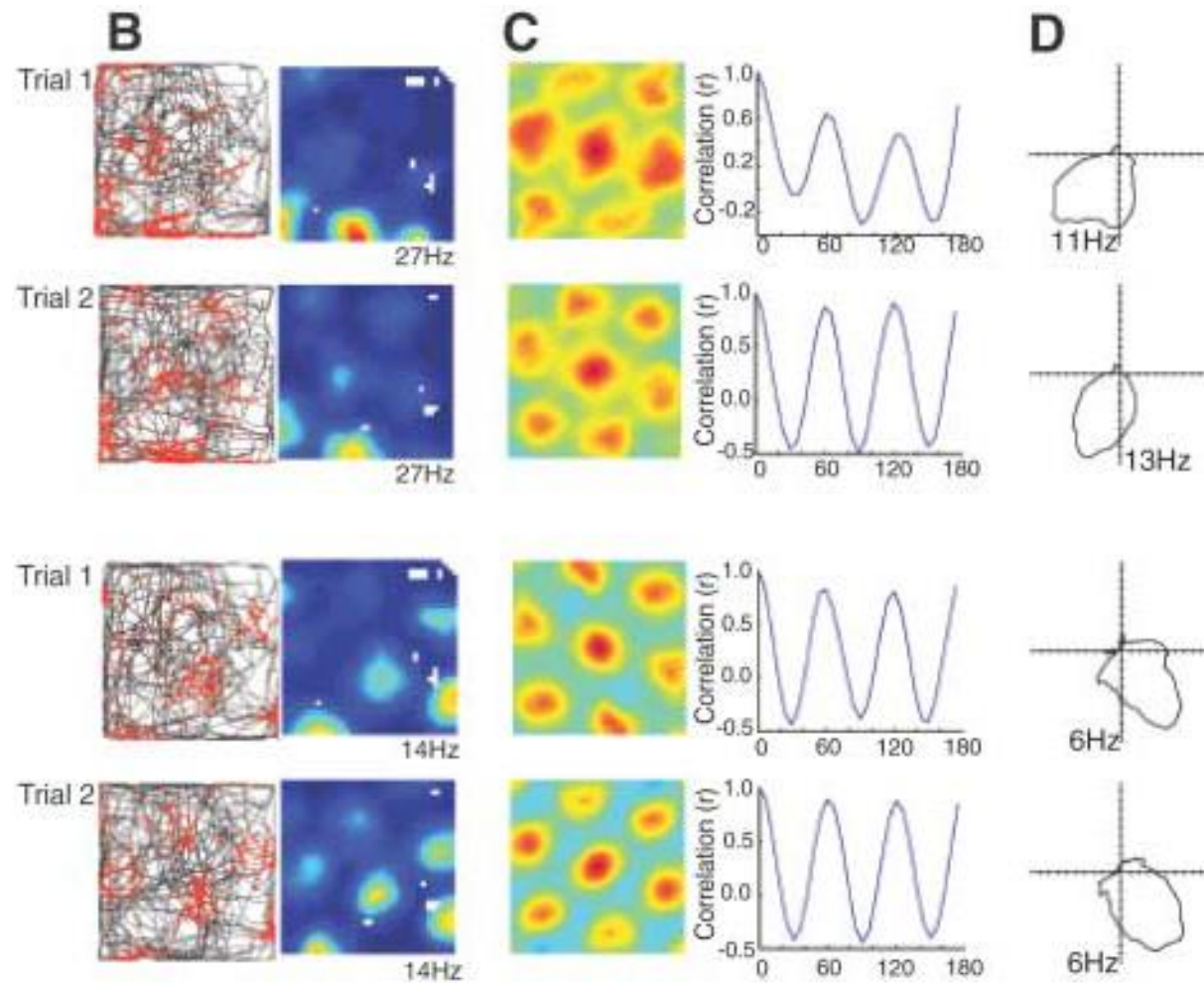
Hafting T. et al. Microstructure of spatial map in the entorhinal cortex. *Nature*. 2005. 436: 801-806.



Hafting T. et al. Microstructure of spatial map in the entorhinal cortex. *Nature*. 2005. 436: 801-806.



Sargolini F. et al. Conjunctive representation of position, direction, and velocity in entorhinal cortex. *Science*. 2006. 312: 758-762.



Neuron. 2014. 82(1):71-78.

Representation of geometric borders in the developing rat.

Bjerknes TL, Moser EI, Moser MB.

Local space is represented by ... *place cells* in the hippocampus and *grid cells*, *head direction cells*, and *border cells* in the medial entorhinal cortex. These cells form a functional map of external space already at the time when rat pups leave the nest for the first time in their life, at the age of 2.5 weeks. However, while *place cells* have adult-like firing fields from the outset, ***grid cells have irregular and variable fields until the fourth week...***

Philos Trans R Soc Lond B Biol Sci. 2013. 369(1635): 20120511.

Network mechanisms of grid cells.

Moser EI, Moser MB, Roudi Y.

"The discovery of grid cells,

and their functional organization,

opens the door to some of the first insights

into the workings of the association cortices..."