

# Hippocampus - biological data

## List of important papers for this tutorial. – still in construction

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NB: This list is still in construction. If you feel that a paper should be added to this list, please send me a mail mentioning a link to the paper with a two lines summary. Thank you.

**(Scoville and Milner, 1957)**: seminal paper showing the importance of the hippocampus for episodic memory. This report the famous case of the patient H.M. who lost most of its hippocampus after surgery.

**(OKeefe and Dostrovsky, 1971)**: in rats, hippocampal neurons are well characterized as ‘place cells’ firing at specific locations in the environment, the place fields .

**(Bliss and Lomo, 1973)**: neurophysiological evidences of LTP;

**(OKeefe and Nadel, 1978)**: elaboration of the cognitive map theory;

**(Levy and Steward, 1983)**: the temporal coding (in term of phase precession) of the behavioral sequence at the theta timescale is adequate for synaptic plasticity.

**(Rank, 1985)**: Discovery of the head direction cells in the postsubiculum and the anterior thalamic nuclei (see also (Taube et al., 1990) for more quantitative results).

**(Buzsáki, 1986),(Buzsáki, 1989)**: rat hippocampus exhibits two very distinctive temporal patterns of the local field potential: rhythmic theta oscillation (4-12 Hz) during exploratory behavior and REM sleep and large irregular transient burst of CA3–CA1 pyramidal cells associated with sharp waves (SPWs) during sleep and awake immobility.

**(Bostock et al., 1991)**: the ability of hippocampal place cells to undergo remapping in response to small changes in environmental conditions;

**(Squire, 1992)**: nice paper clarifying what are the different types of memory.

**(OKeefe and Recce, 1993; Skaggs et al., 1996)**: when crossing a place field, the firing rate of place cells is modulated by theta oscillation of local field potential (LFP) in term of ‘theta phase precession’ : the relative firing phase unidirectionally shifts to earlier theta phases when the rat crosses a place field.

**(Wilson and McNaughton, 1994)**: during SPWs, the activated cells are representative of previous behavioral activity.

**(Jung et al., 1994)**: the ventral hippocampus is characterized by place cells with spatial selectivity.

**(Kolb and Whishaw, 1996)**: based on the world famous patient HM (who lost part of its hippocampus after surgery), this book provides good insights on the importance of the hippocampus in memory formation.

**(Cash and Yuste, 1998), (Gasparini and Magee, 2006)**: hippocampal neurons can perform linear summation of their inputs.

**(Dolorfo and Amaral, 1998)**: mECII grid cells constitute the main source of inputs to the dentate gyrus (DG).

**(Bi and Poo, 1999)**: asymmetric time window of synaptic plasticity;

**(Csicsvari et al., 2000)**: quantitative information of CA3-CA1 hippocampal sharp waves.

**(Fortin et al., 2002)**: nice paper showing the importance played by the hippocampus in memory of sequences and path navigation from lesioned rats.

**(Pouille and Scanziani, 2001)**: due to a balance of inhibition, hippocampal pyramidal act as coincident detectors (2ms). Similarly, it has been shown that purkinje cells in the cerebellum acts also as coincident detectors (**Brunel et al., 2004**).

**(Lee and Wilson, 2002)**: 1D experienced sequences of place cells are replayed in the same order but in a compressed time scale (~msec) during sleep SWS.

**(Malkova and Mishkin, 2003)**: evidence from lesion studies of the important role played by the hippocampus in object place associations.

**(Fyhn et al., 2004; Hafting et al., 2005)**: layer II-III cells of the medial entorhinal cortex (mEC), which mediate the majority of the cortical input to the hippocampus, have a different spatial pattern of activity; these cells, so-called 'grid cells', fire at several locations in any environment the animal visits, with the locations forming a regular triangular grid-like pattern.

**(Zugaro et al., 2005)**: hippocampal phase precession persists after transient intrahippocampal perturbations resulting in a reset of the theta rhythm.

**(O'Neill et al., 2006)**: sharp waves occur also during exploratory behavior, as a small part of theta cycles.

**(Foster and Wilson, 2006)**: 1D experienced sequences of place cells are replayed in the reverse order but in a compressed time scale (~msec) during consummatory behavior SWS.

**(Maurer et al., 2006)**: data suggesting that a single place cell may express multiple place fields partially overlapping.

**(Hafting et al., 2006)**: theta phase precession is observed when the rat traverses any receptive field of a grid cell.

**(Buzsáki, 2006)**: nice book discussing the different rhythms appearing in the hippocampus, their roles and their characteristics.

**(Leutgeb et al., 2007)**: global remapping of the DG-CA3 place cells. Furthermore, the different regions of the trisynaptic hippocampal loop are characterized by different spatial representations: CA1 and CA3 place cells are characterized by the presence of unique place fields, and at the gate of the hippocampus, the dentate gyrus (DG) is characterized by a large number of place cells having two or more place fields, each field having similar size than the CA3 place fields.

**(Fyhn et al., 2007)**: hippocampal global remapping could be predicted by a coherent realignment of the mEC grid fields.

**(McHugh et al., 2007)**: the important role played by the NMDA receptors in the dentate cells for pattern separation

**(Ge et al., 2007)**: synaptic plasticity is enhanced in newly generated neurons.

**(Molter et al., 2008a)**: firing activity of place cells in their place fields are trajectory dependent. This poster aimed to test a computational hypotheses of the place field formation from the grid fields.

**(Molter et al., 2008b)**: theta rhythm plays a major role in the rat hippocampus. This poster aims to show how this theta is slow modulated and how it affects the cells' firing properties.

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