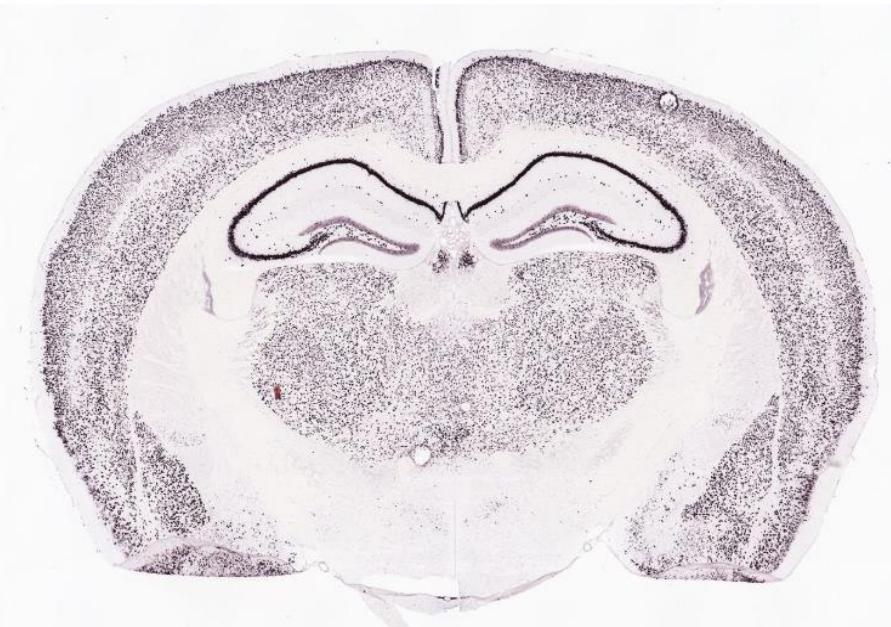


In vivo electrophysiological recording of hippocampal cells in head fixed but freely exploring mice

Jon Palacios-Filardo, Jack R. Mellor Lab [2019-02-11]



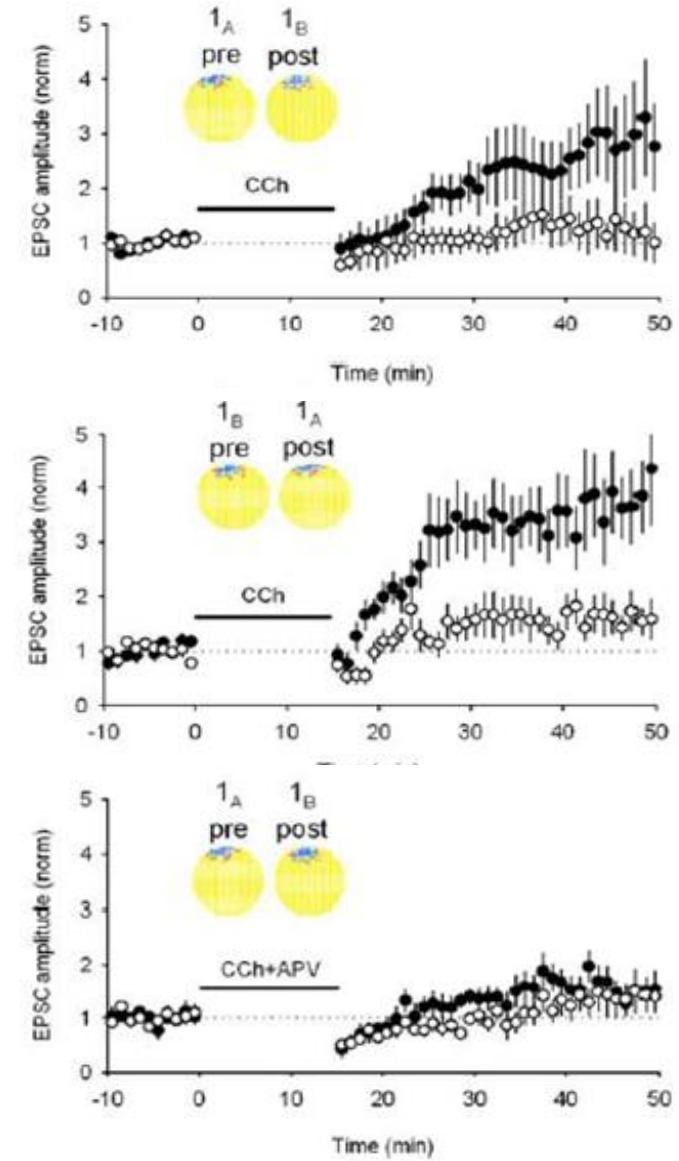
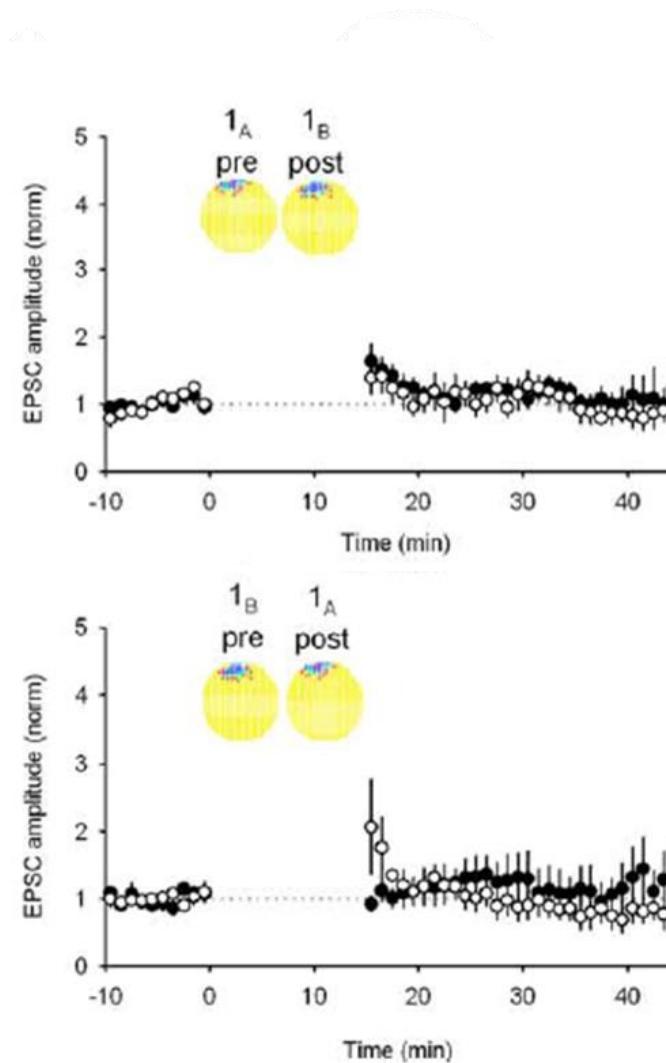
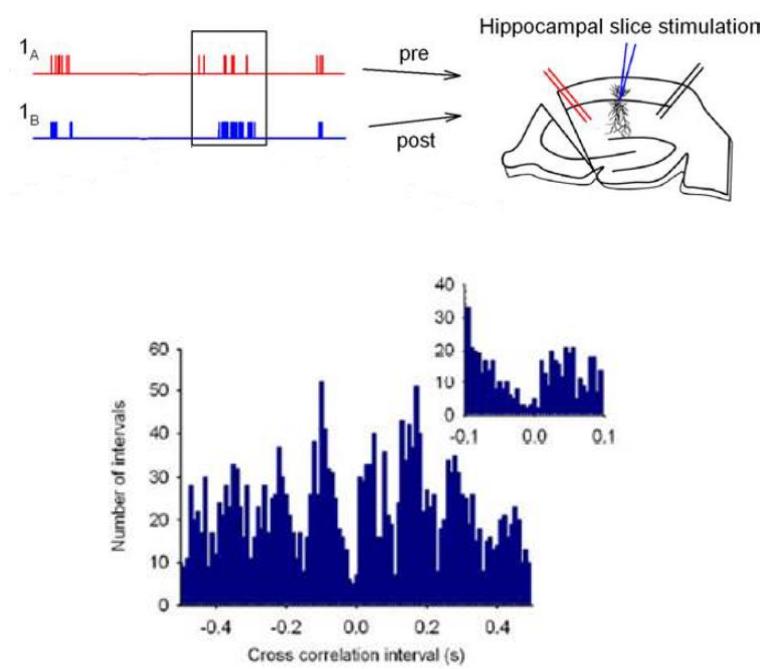
Moser et al., Annu. Rev. Neuroscience 2008

From Allen Brain Atlas

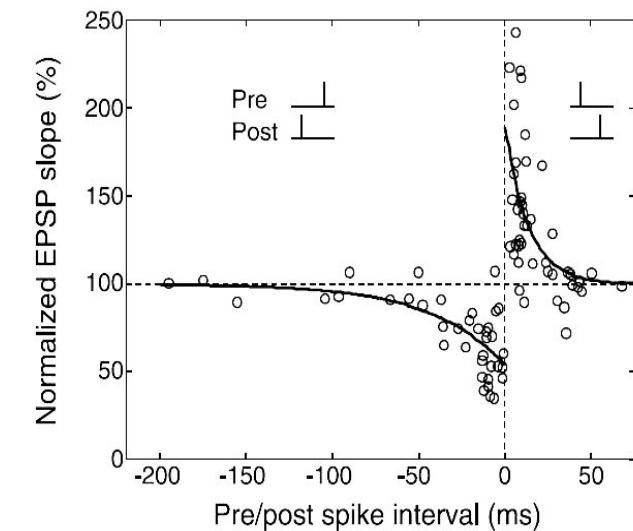
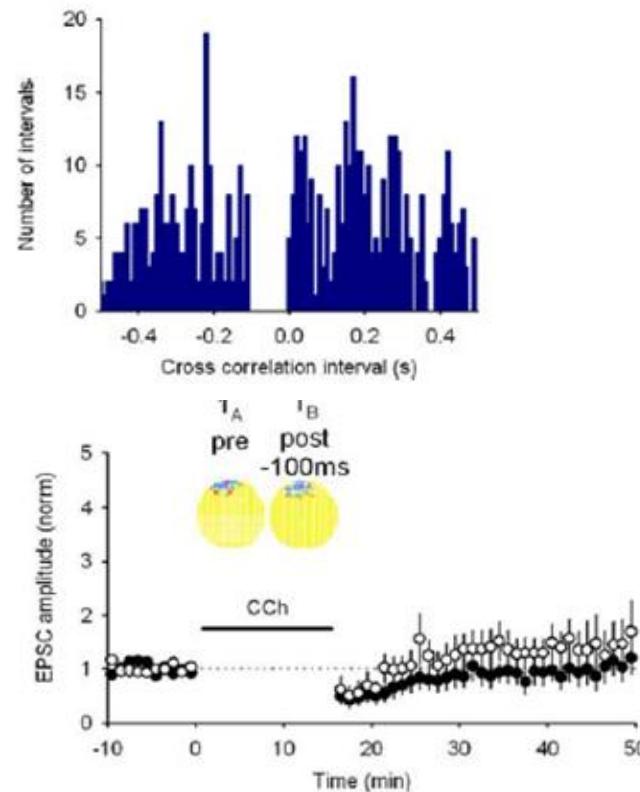
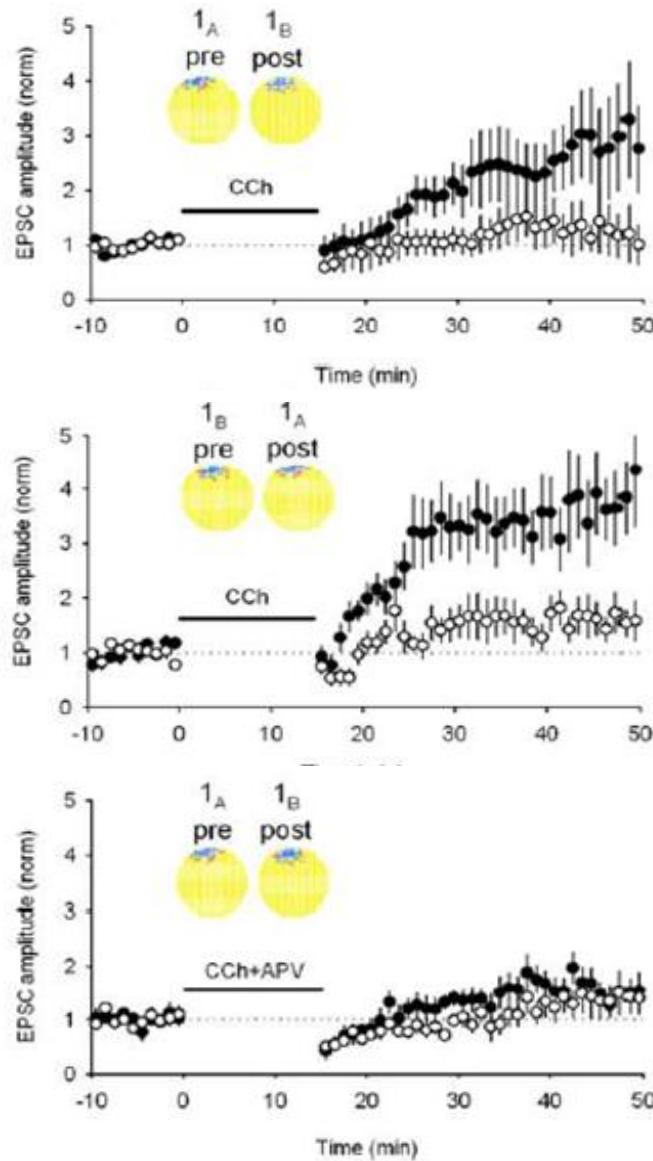
Hippocampal pathology

- Alzheimer disease.
- Schizophrenia.
- Epilepsy.
- Depression.
- Addiction.
- ...

Hippocampal plasticity and neuromodulators



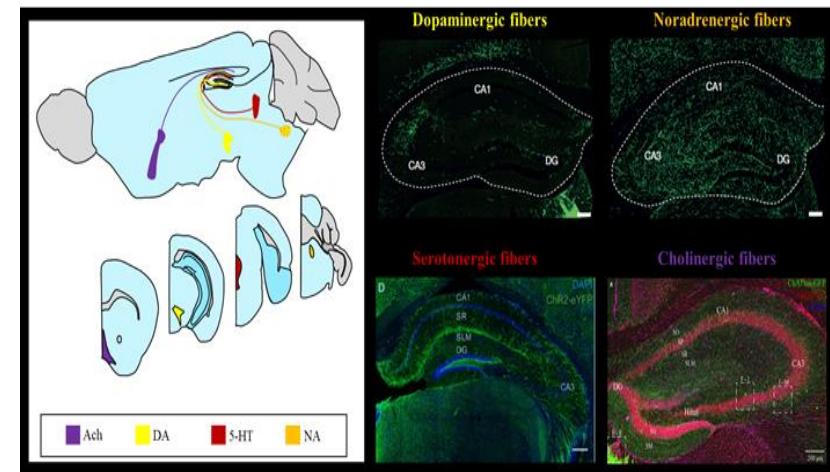
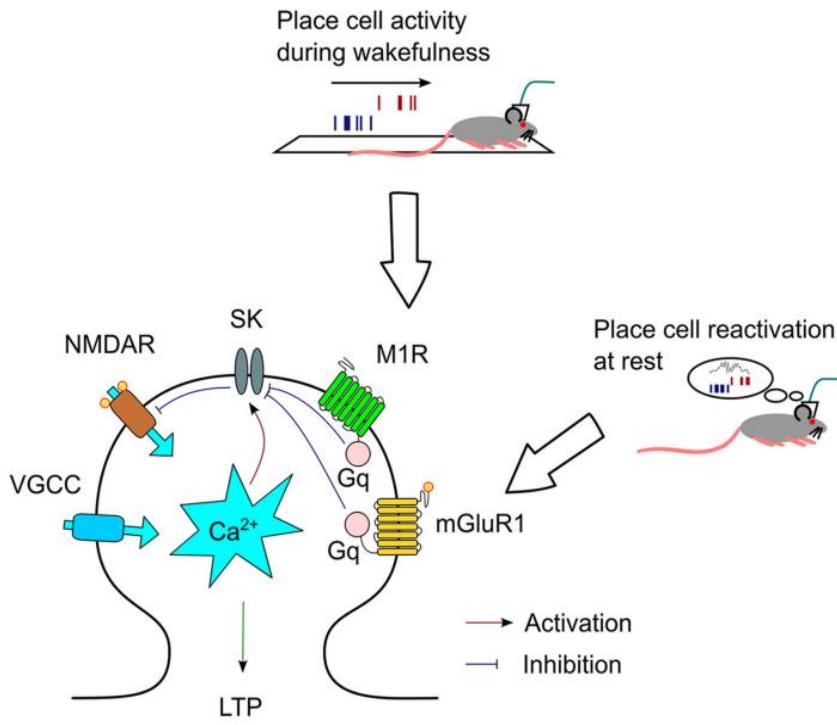
Hippocampal plasticity and neuromodulators



Bi and Poo. 1998

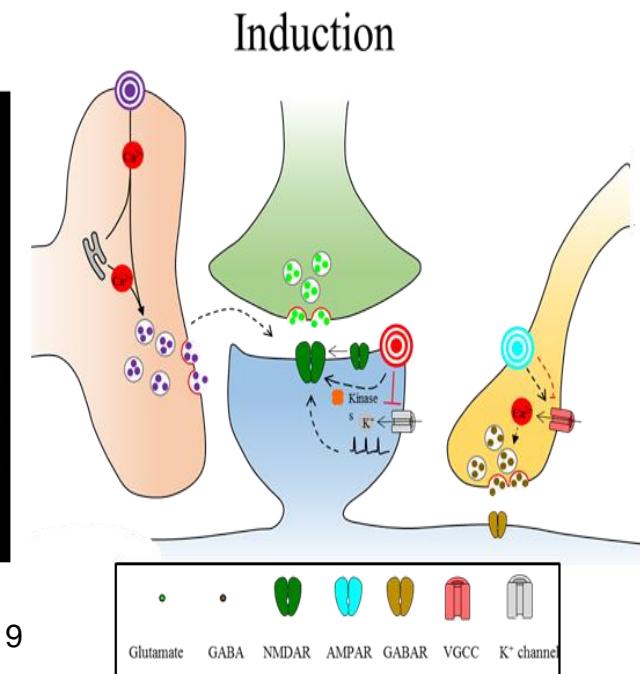
Isaac et al., 2009

Hippocampal plasticity and neuromodulators

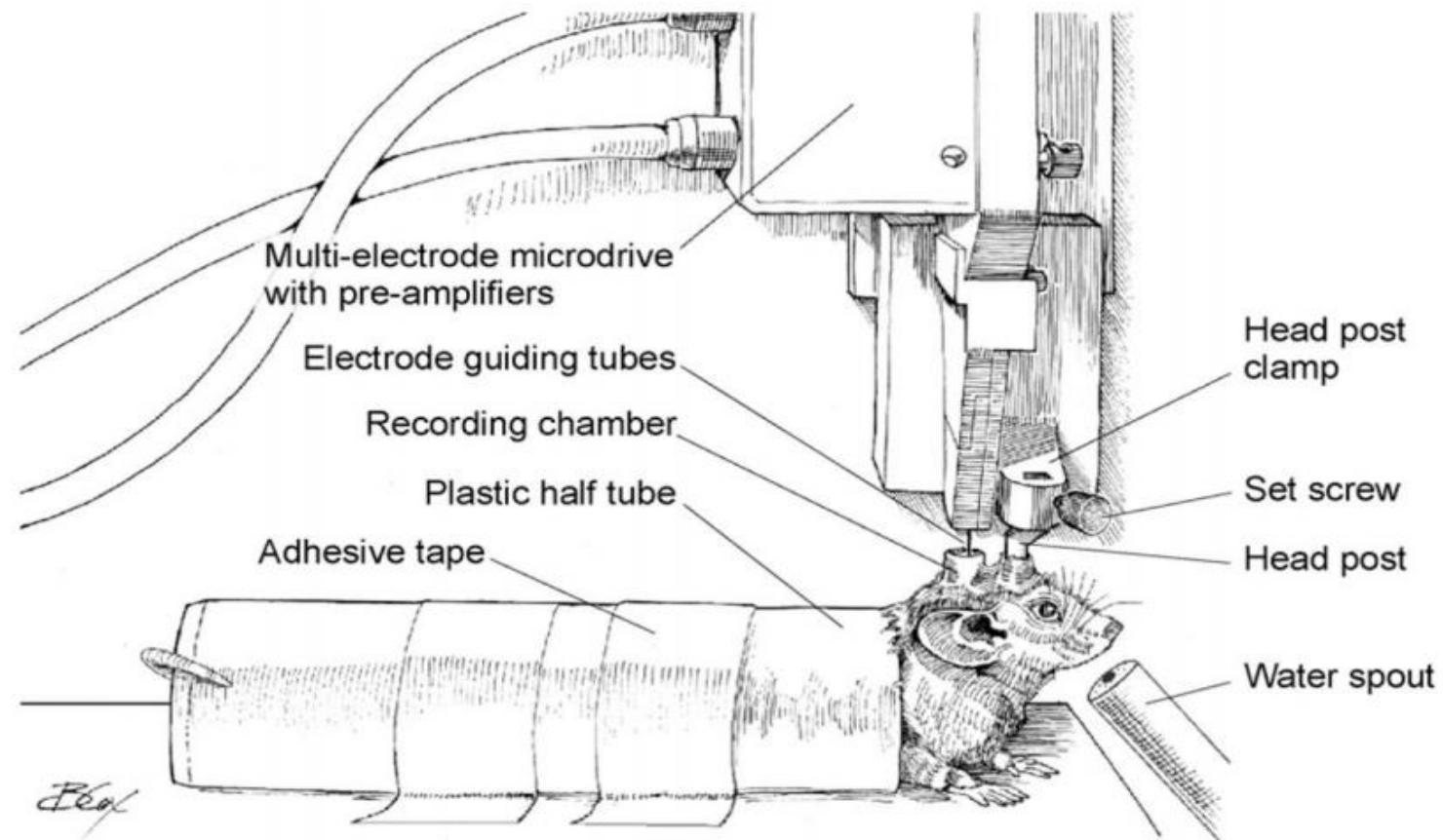


Adapted from Palacios-Filardo and Mellor, 2019

Tigaret et al., 2018

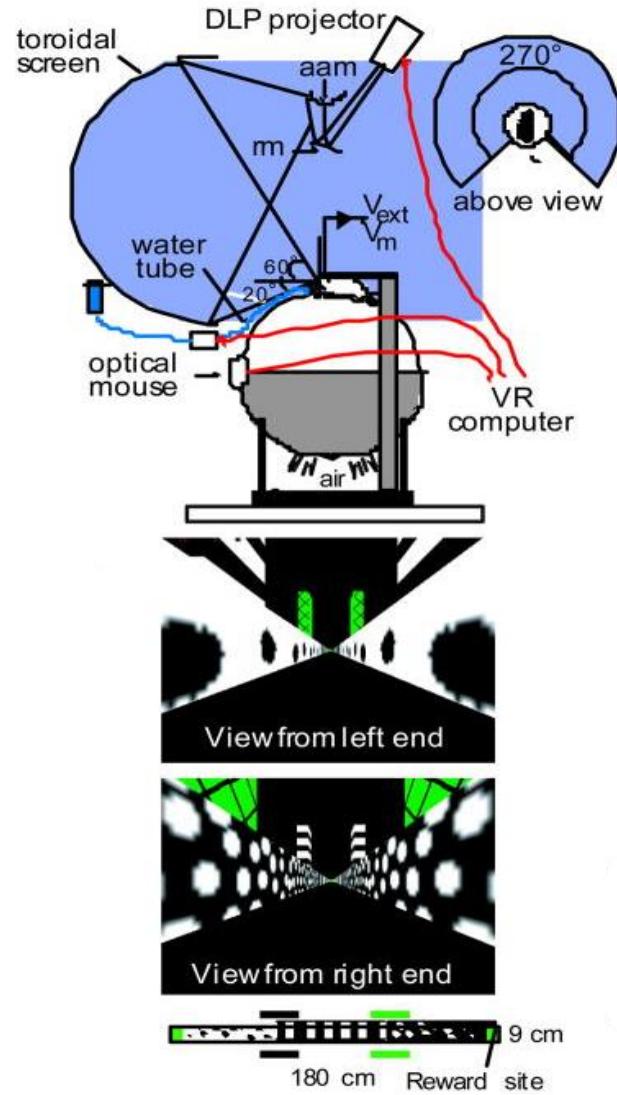


Intracellular Recording from awake moving mice

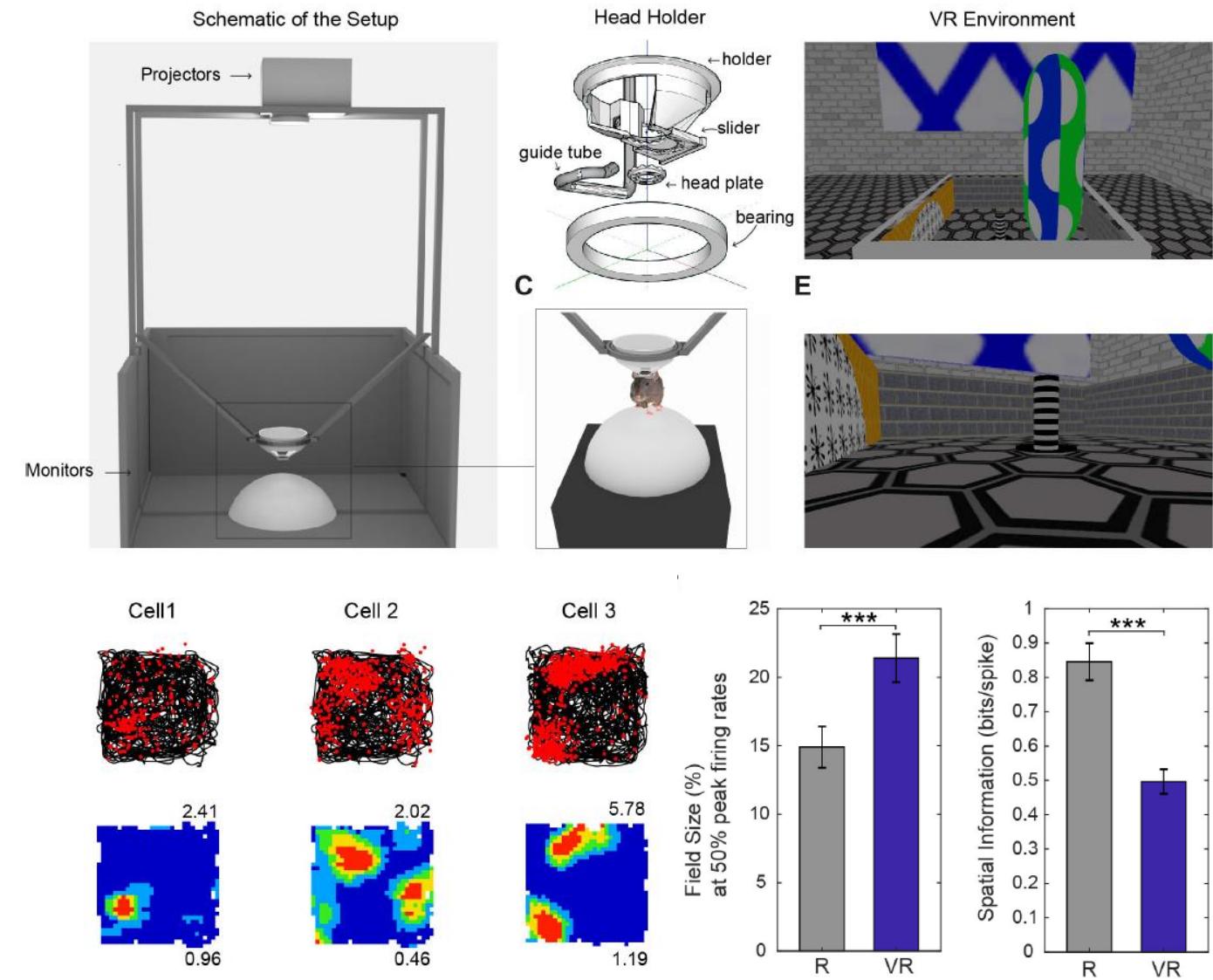


Bryant et al., 2009

Intracellular Recording from awake moving mice

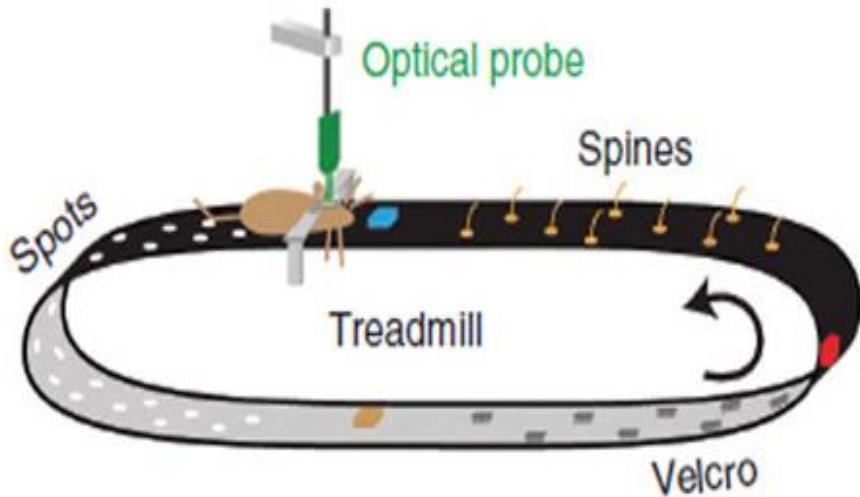


Harvey et al., 2009

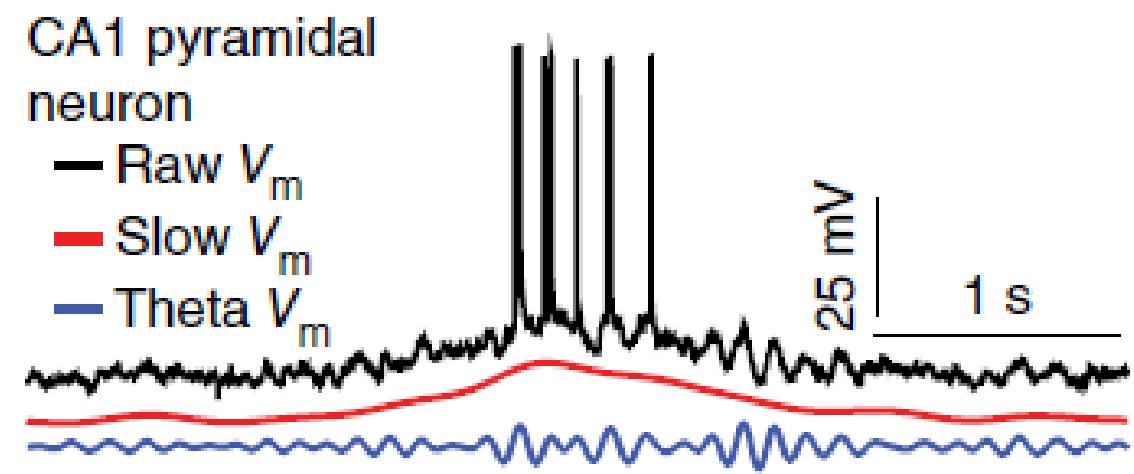


Adapted from Chen et al., 2018

Intracellular Recording from awake moving mice



Royers et al., 2012

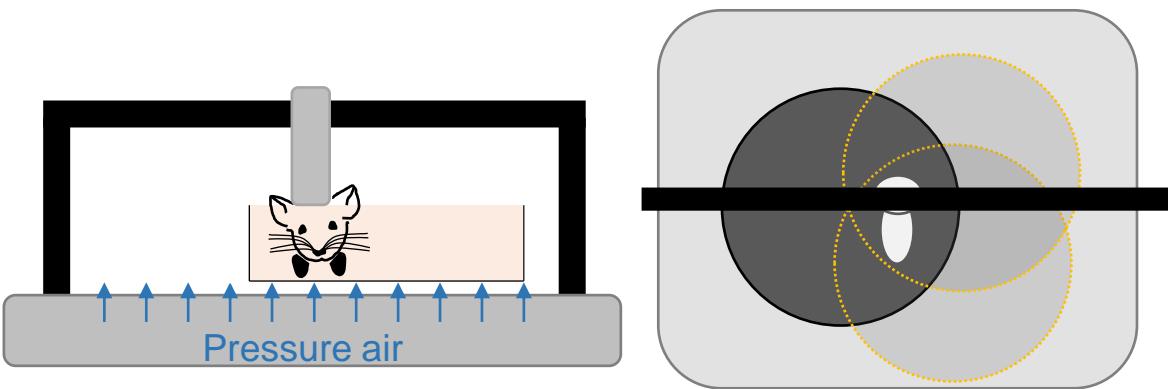


Grienberger et al., 2017

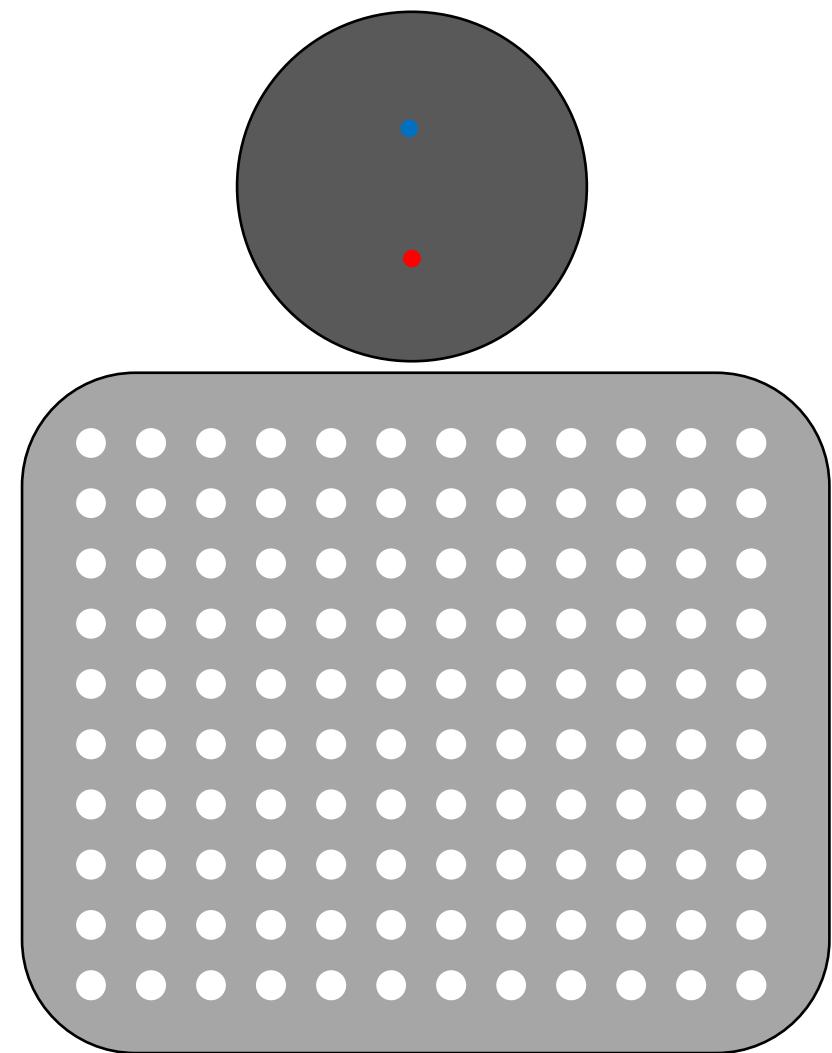
Aims:

- Obtain intracellular CA1 pyramidal neuron recordings to visualize synaptic inputs and outputs.
- Observe input/output plasticity across a spatial navigation task.
- Modulate plasticity by interfering the natural release of neuromodulators onto the hippocampus.

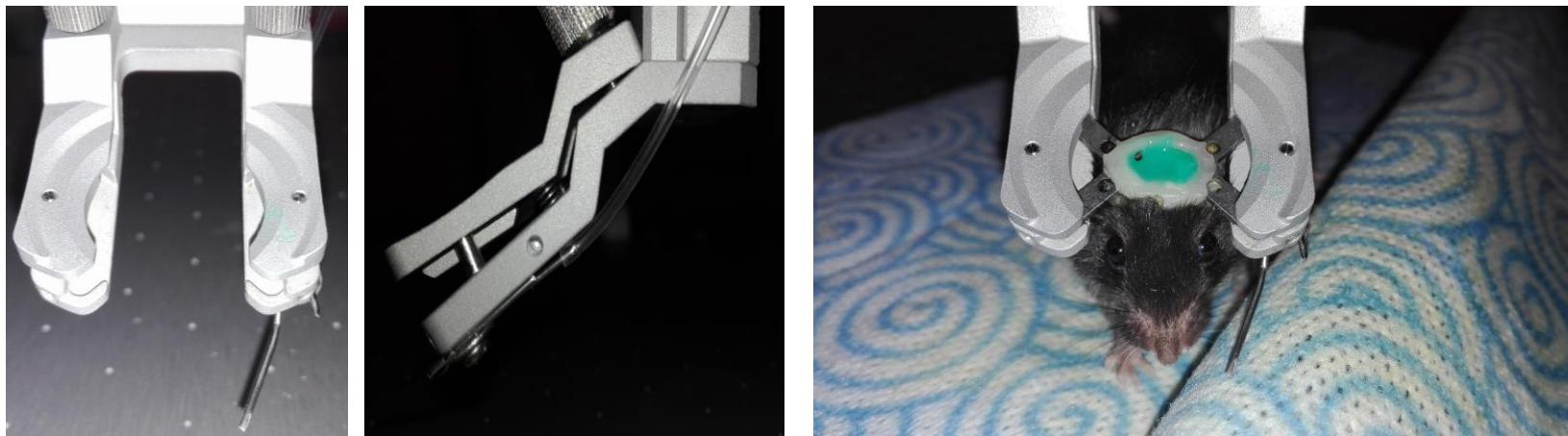
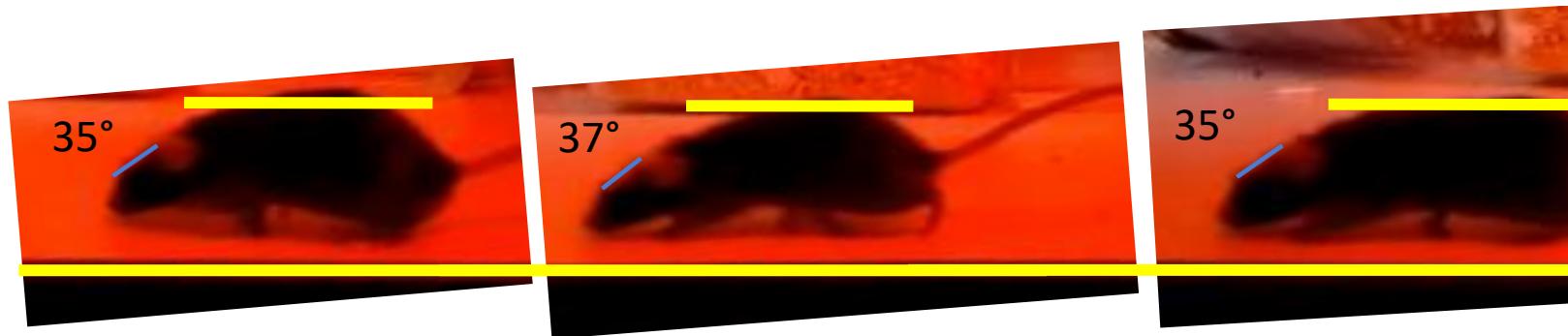
Mobile Home Cage Set up



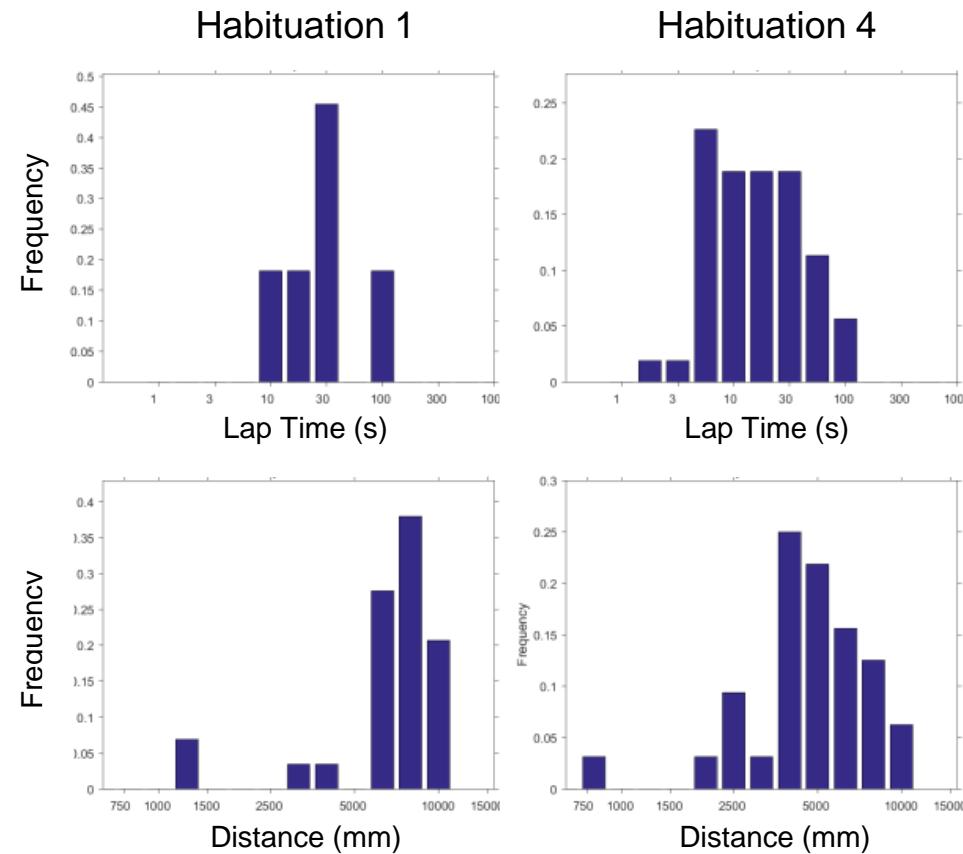
Tracking system



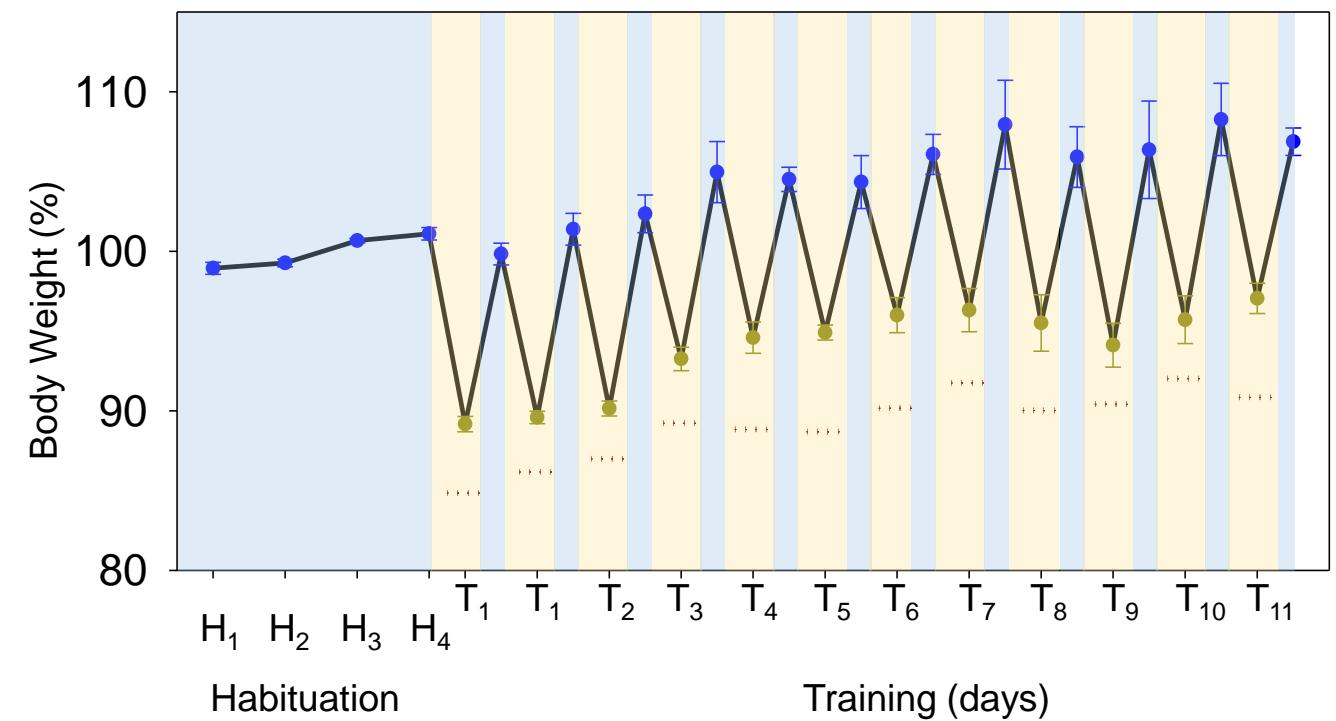
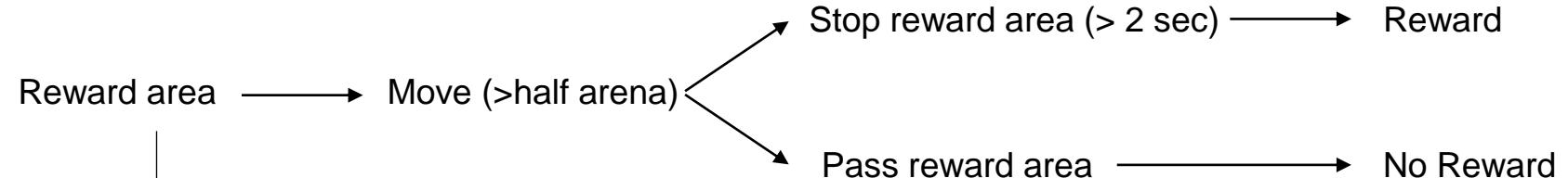
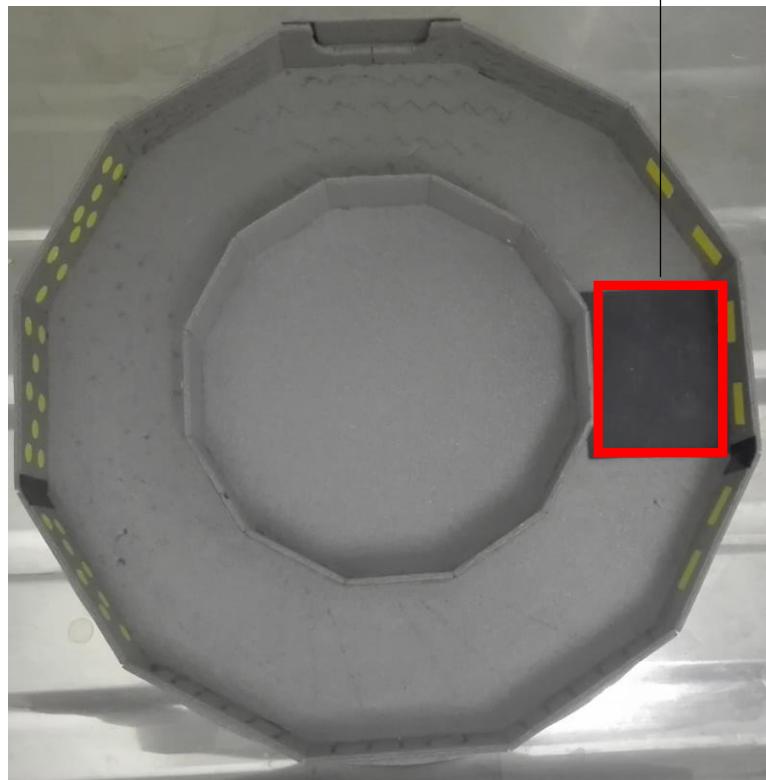
Naturalistic head posture

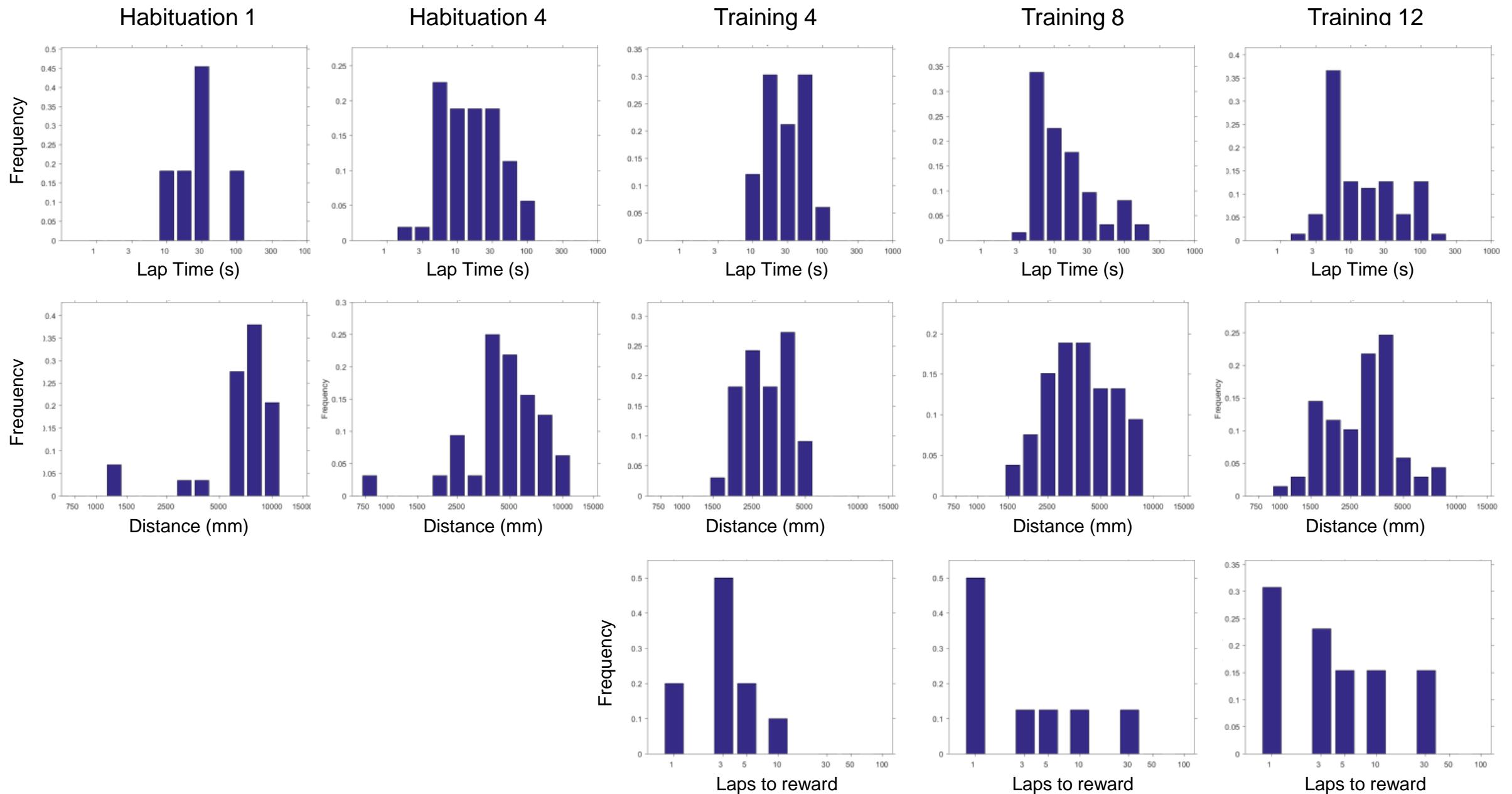


Mice habituation to Mobile Home Cage

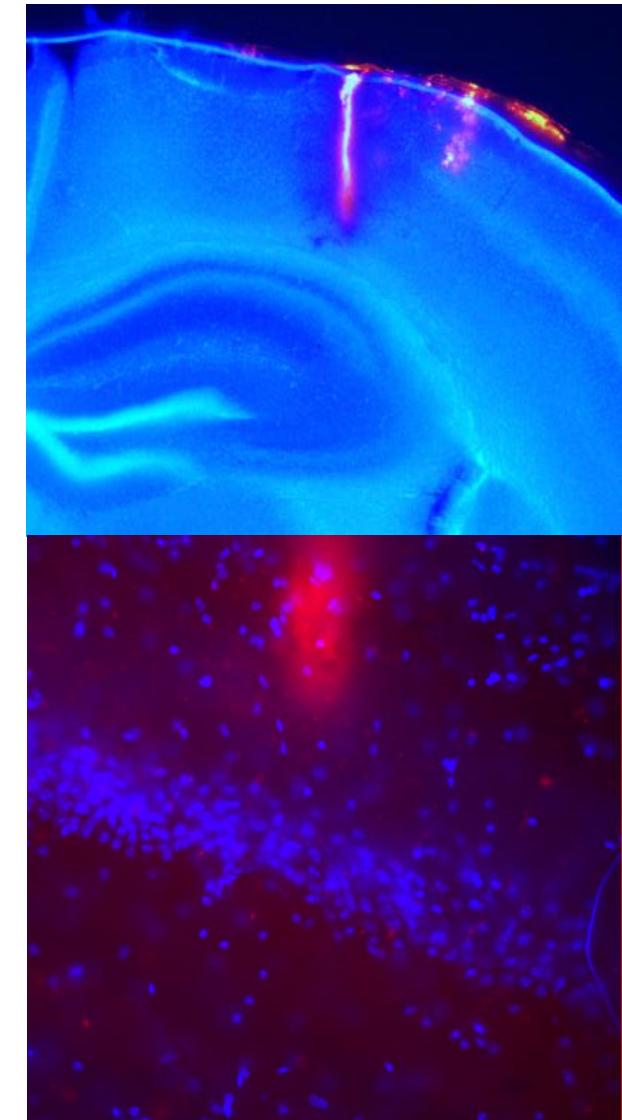
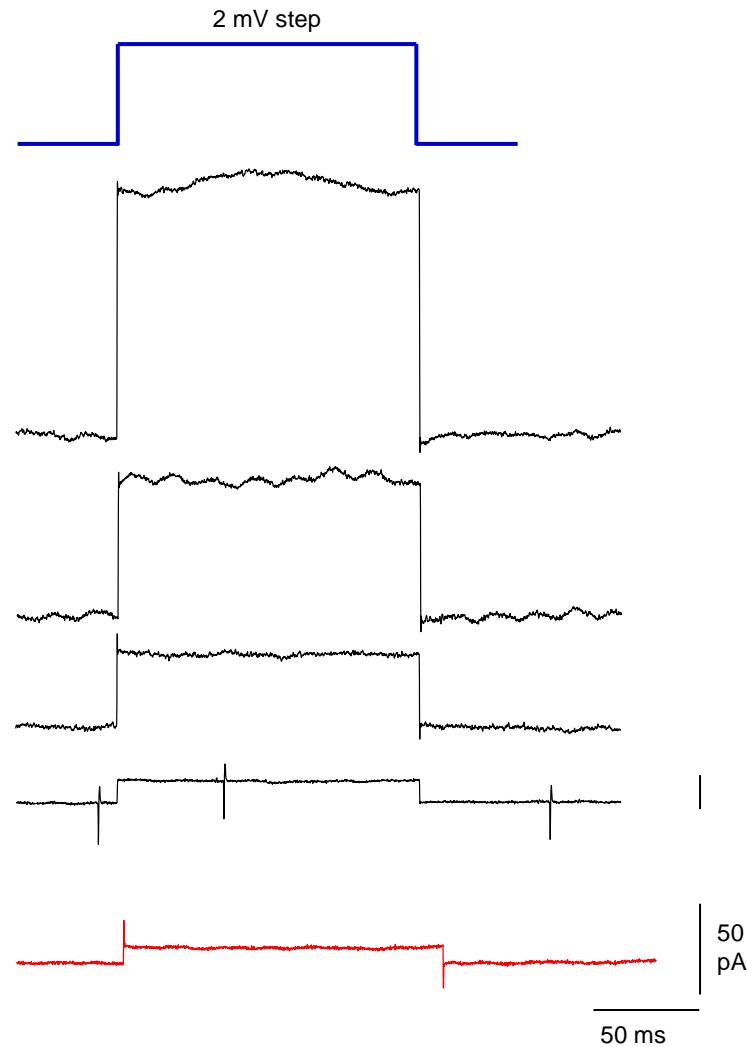
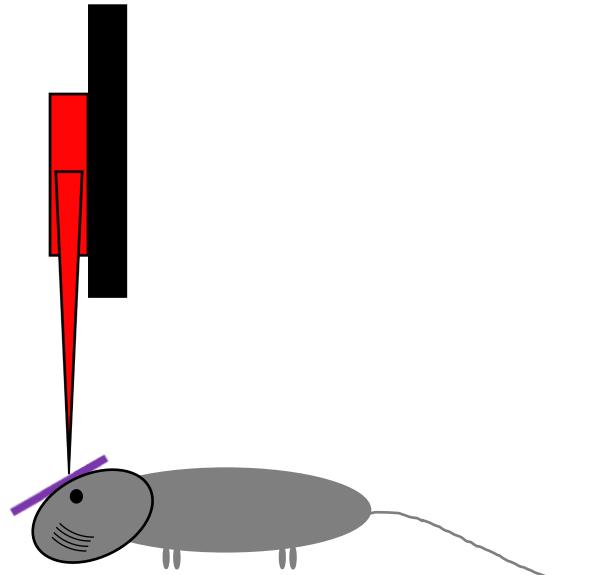


Hippocampal dependent Spatial navigation task

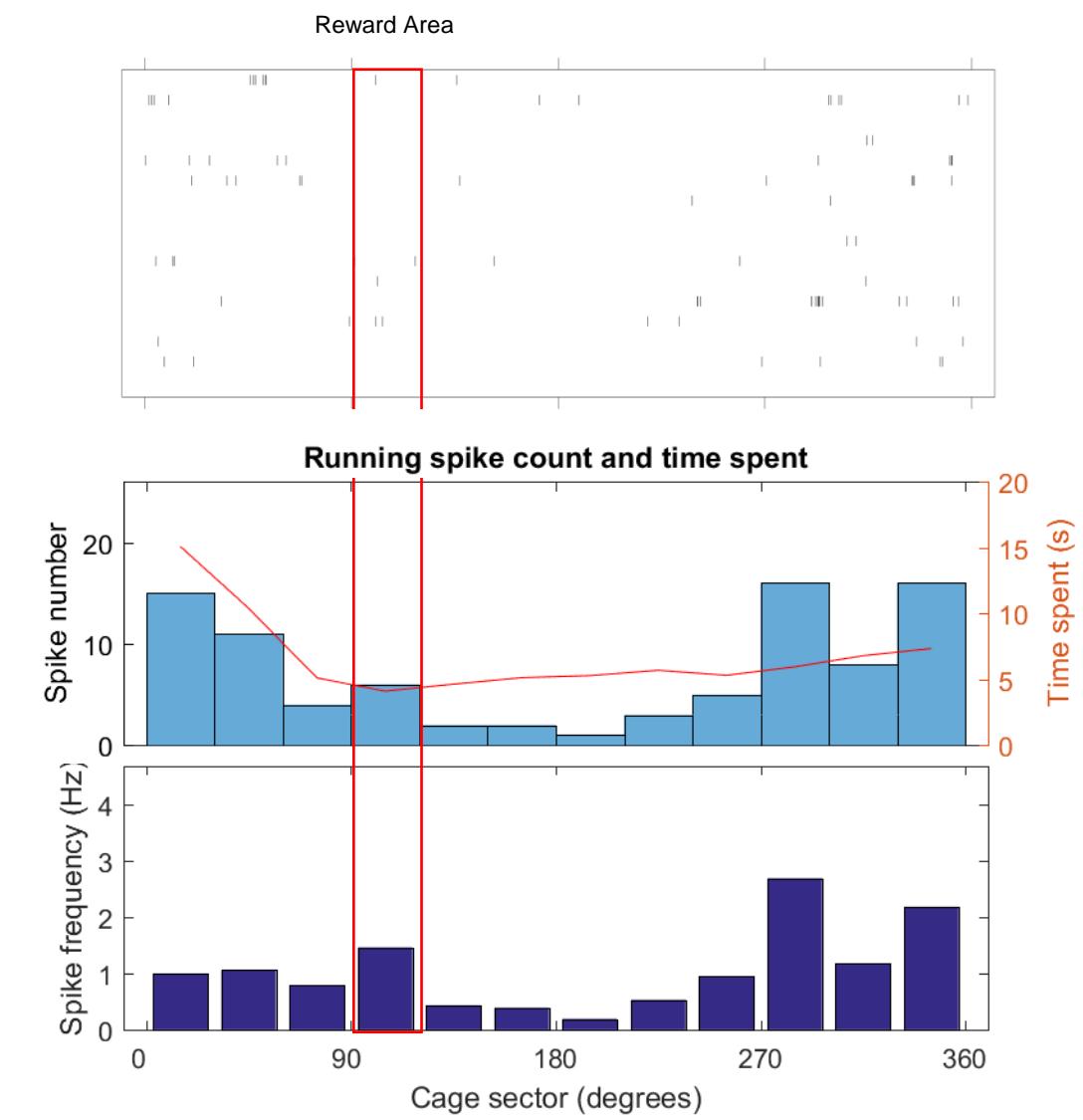
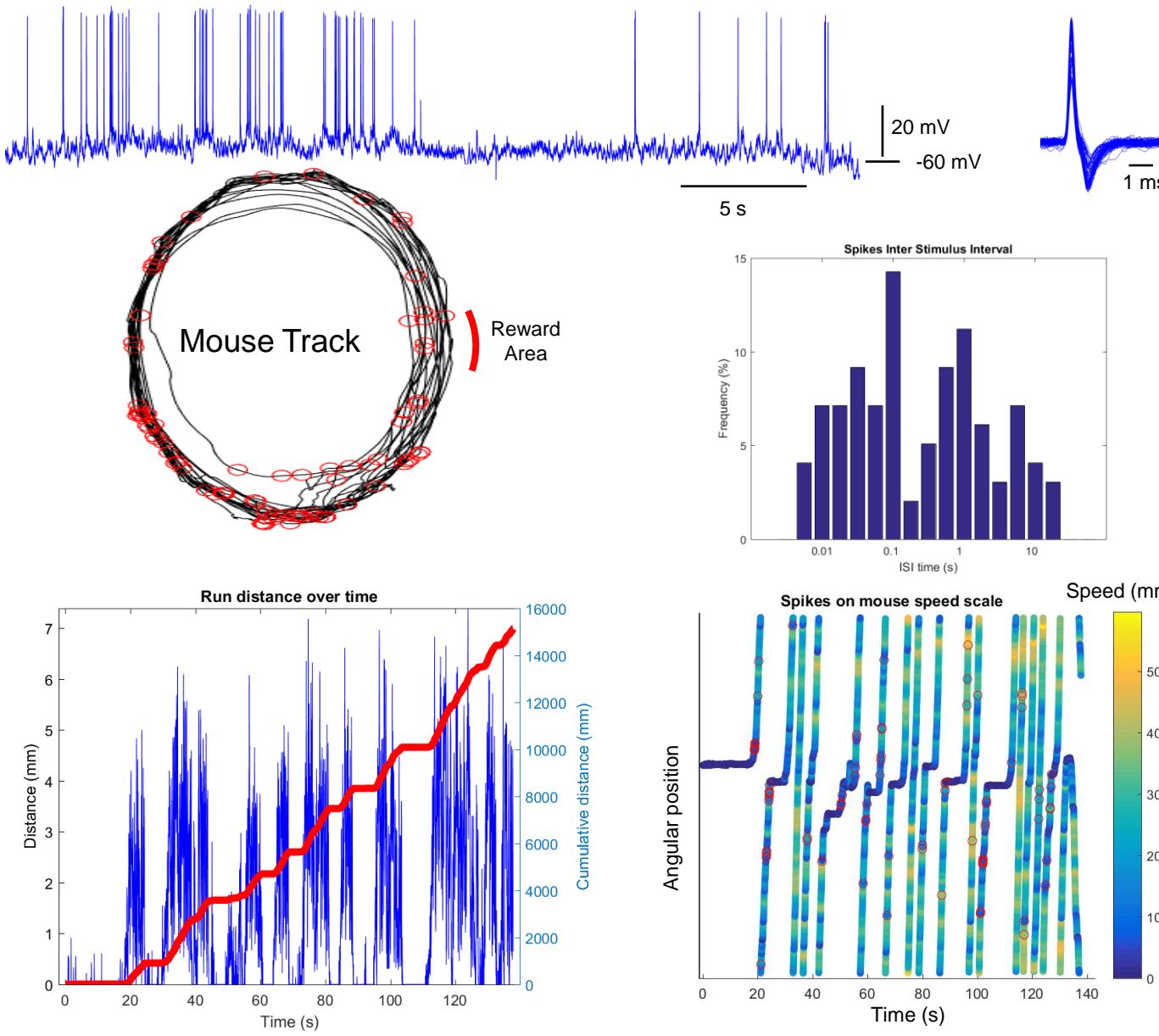




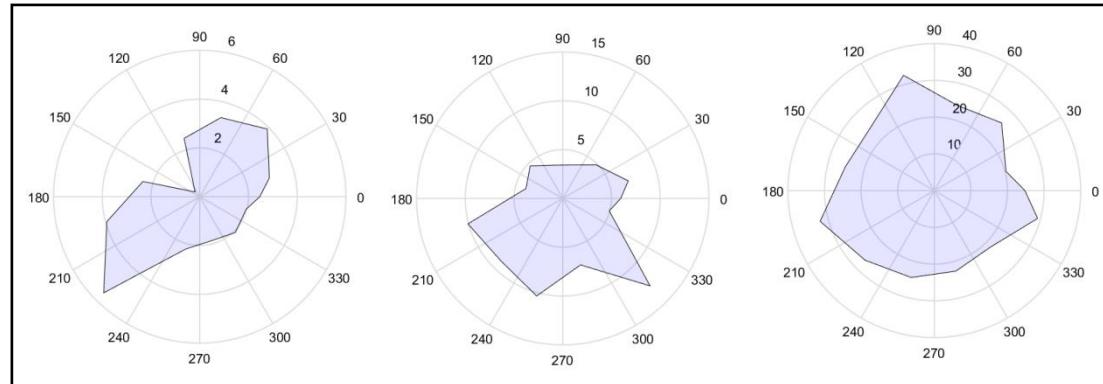
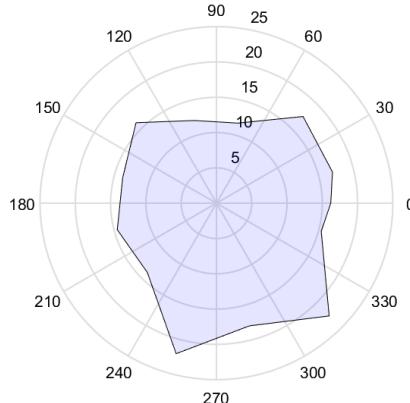
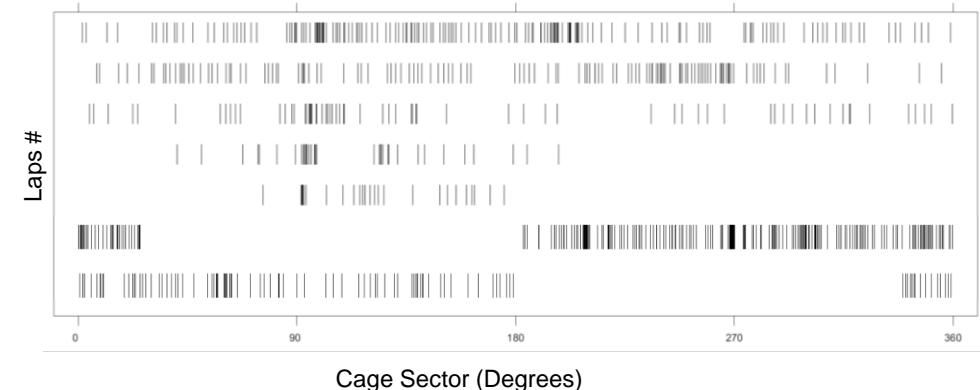
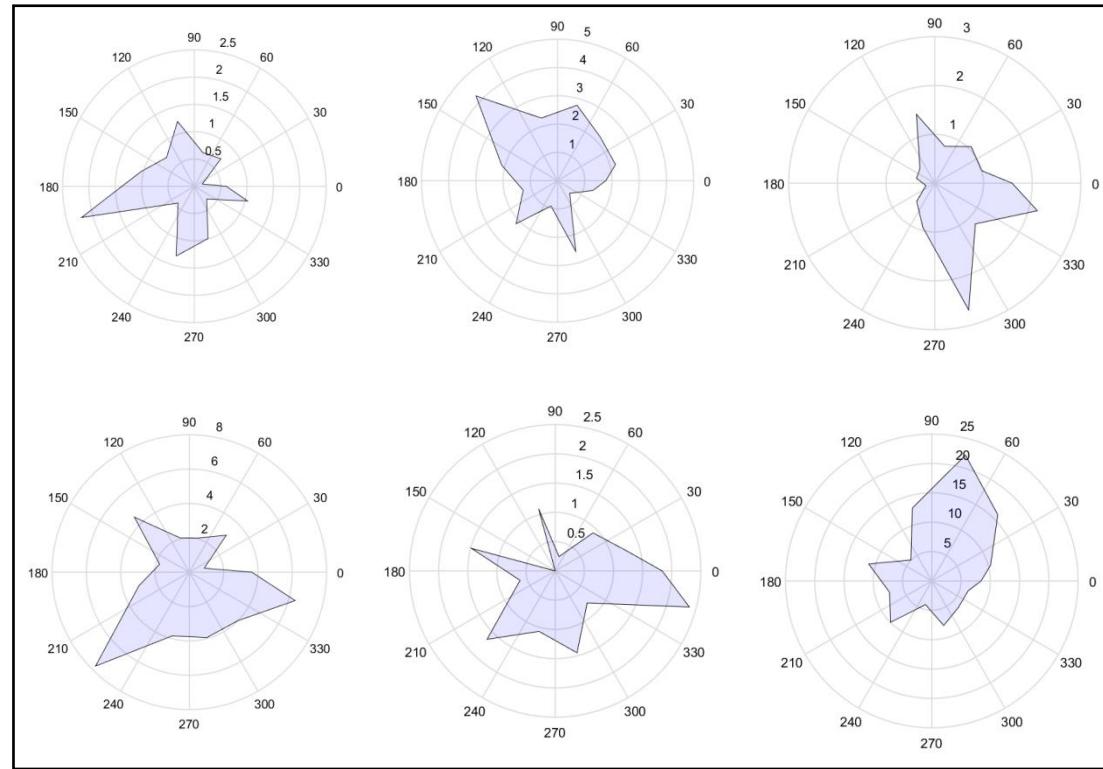
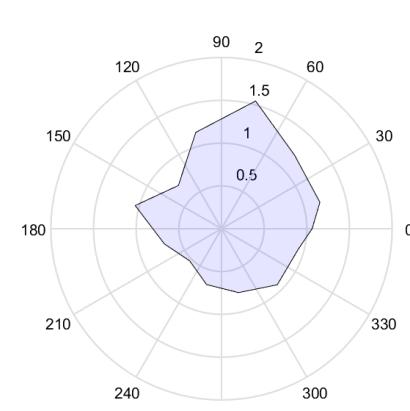
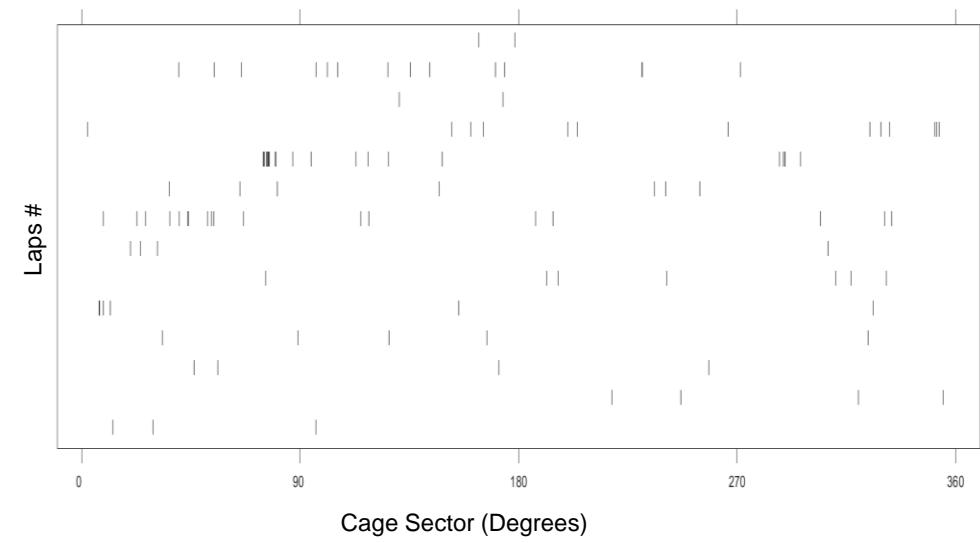
In Vivo hippocampal CA1 recordings



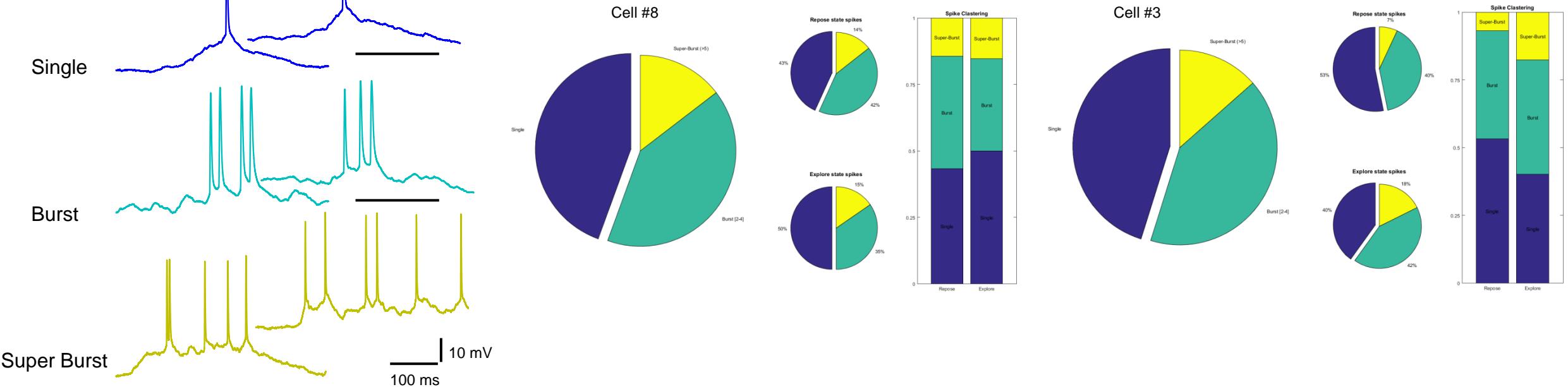
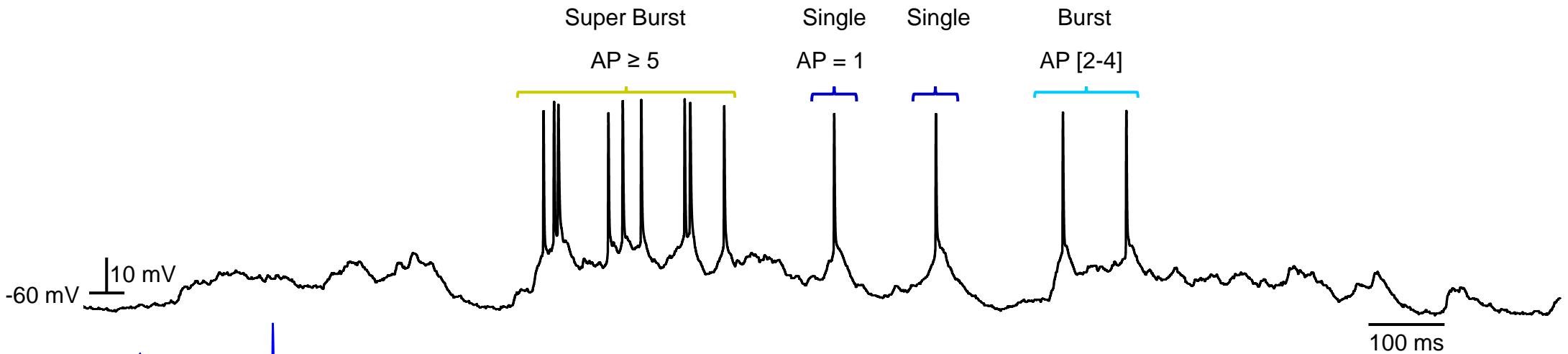
Intracellular recording from CA1 pyramidal neuron from freely exploring mouse



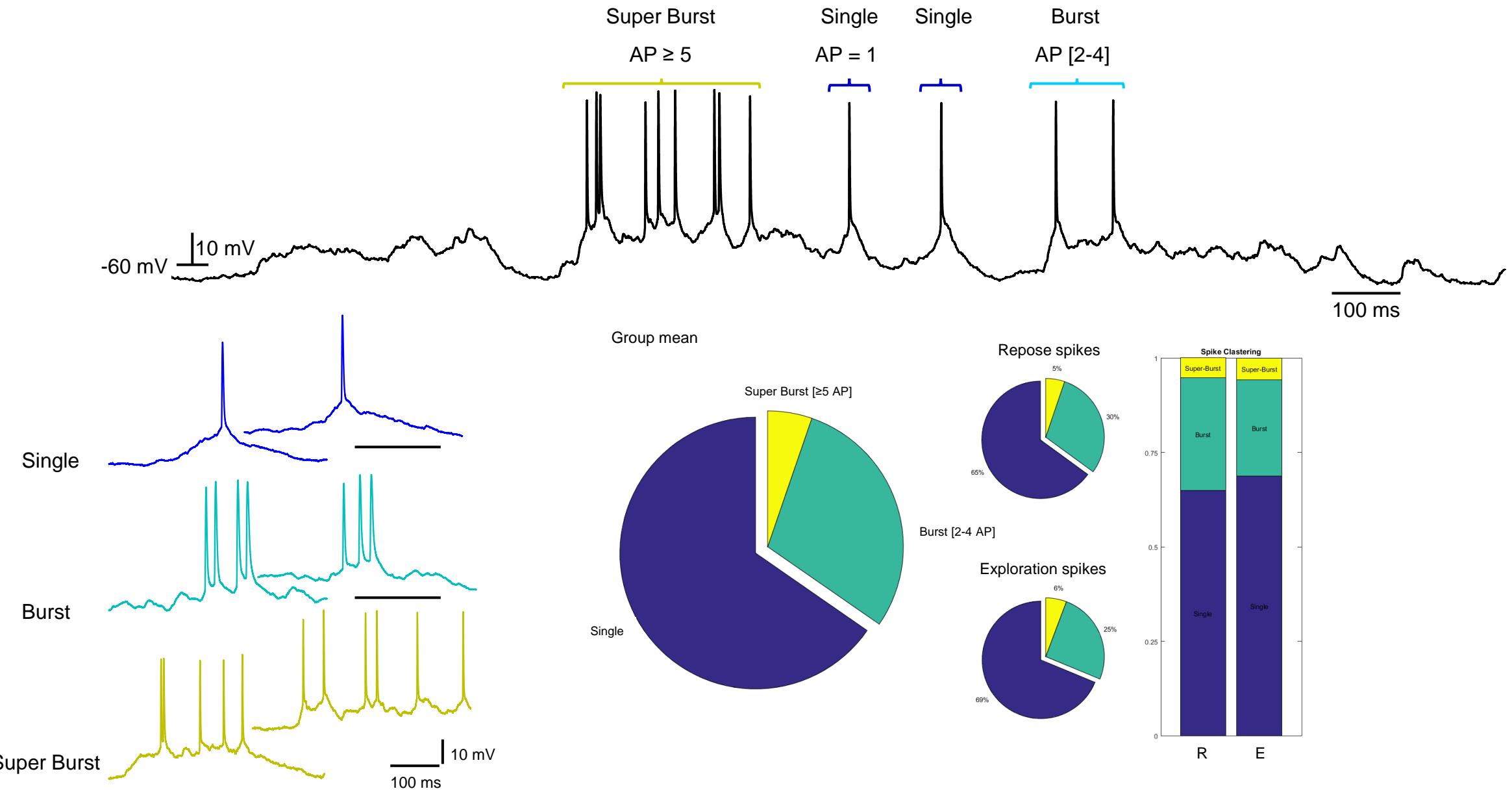
Hippocampal CA1 pyramidal neurons spatial information content



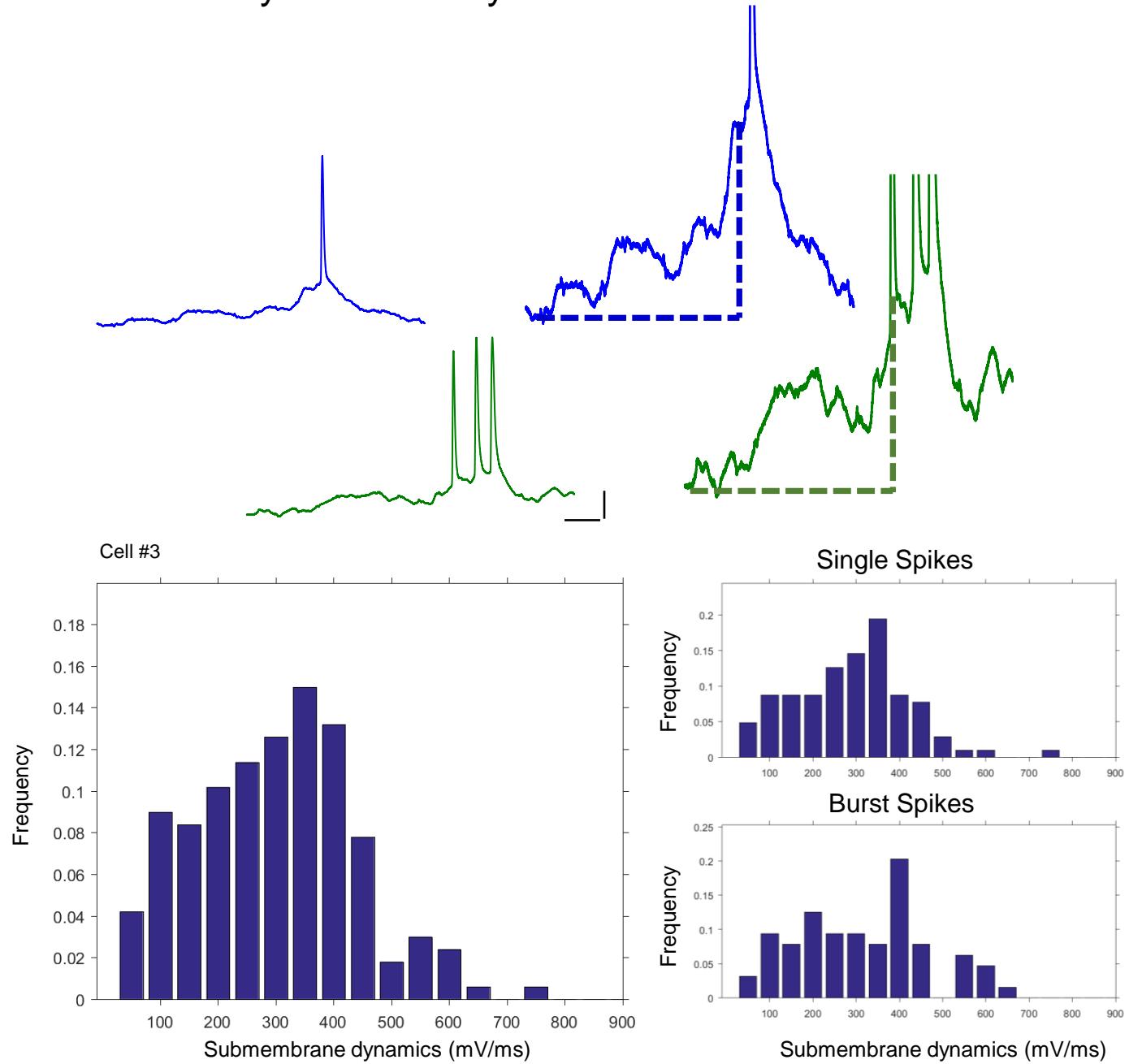
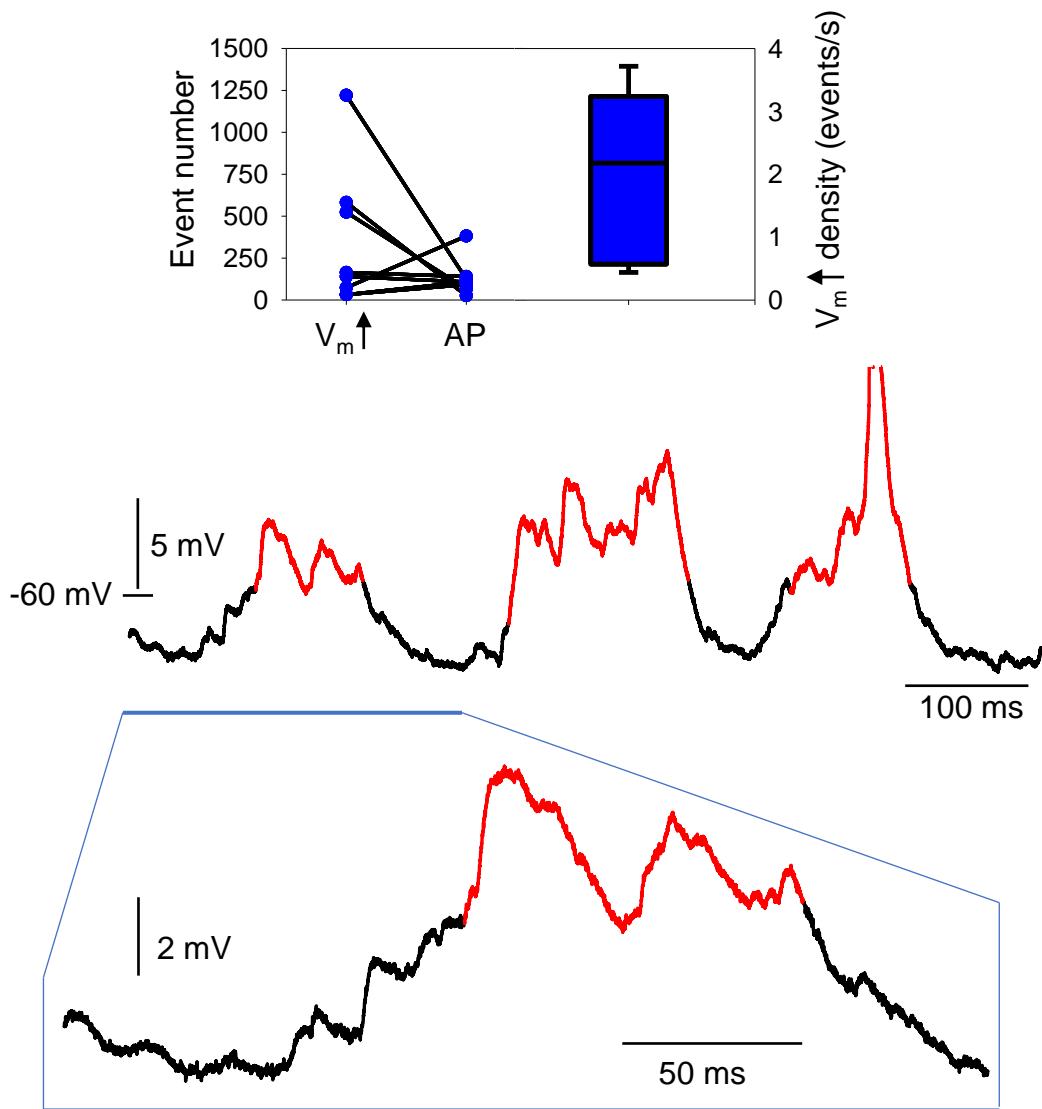
Hippocampal CA1 action potential pattern



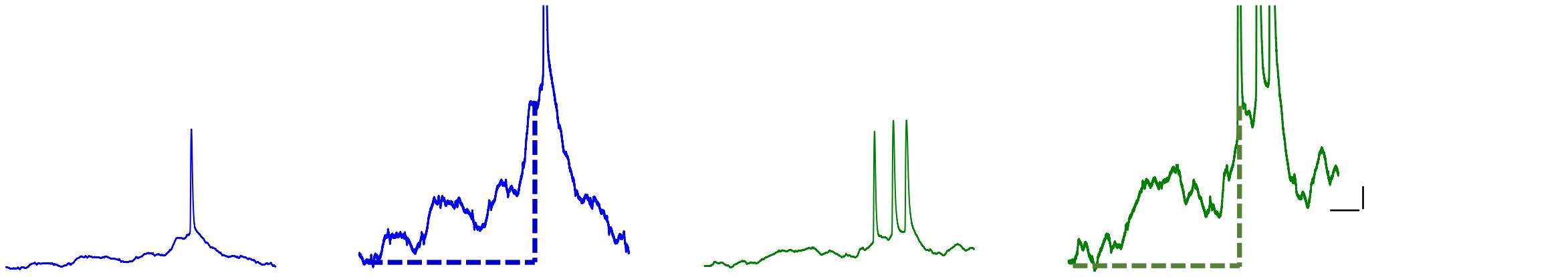
Hippocampal CA1 action potential pattern



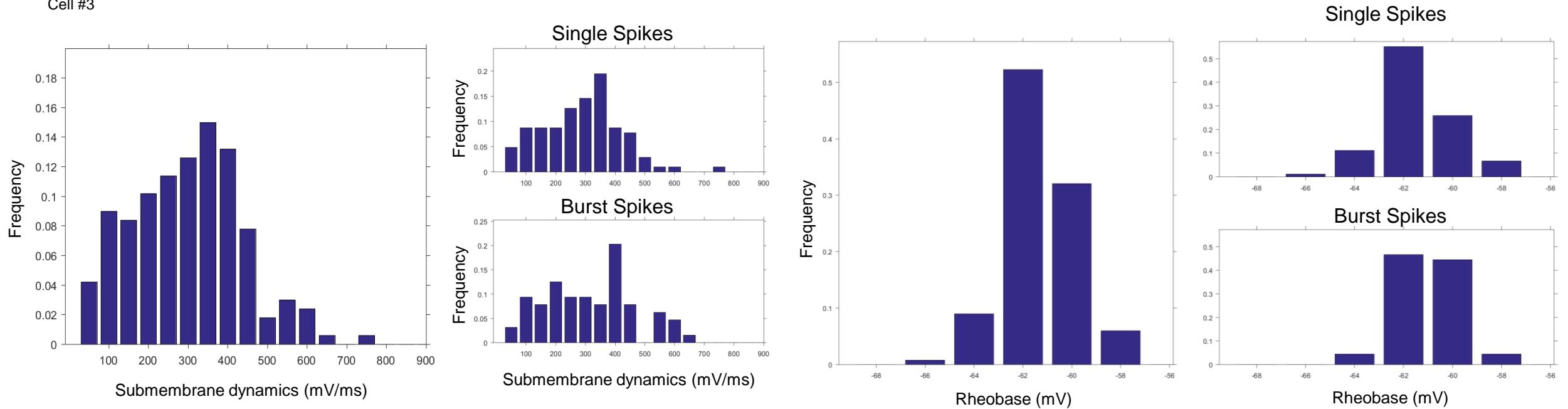
CA1 pyramidal neuron submembrane dynamics analysis



CA1 pyramidal neuron submembrane dynamics analysis

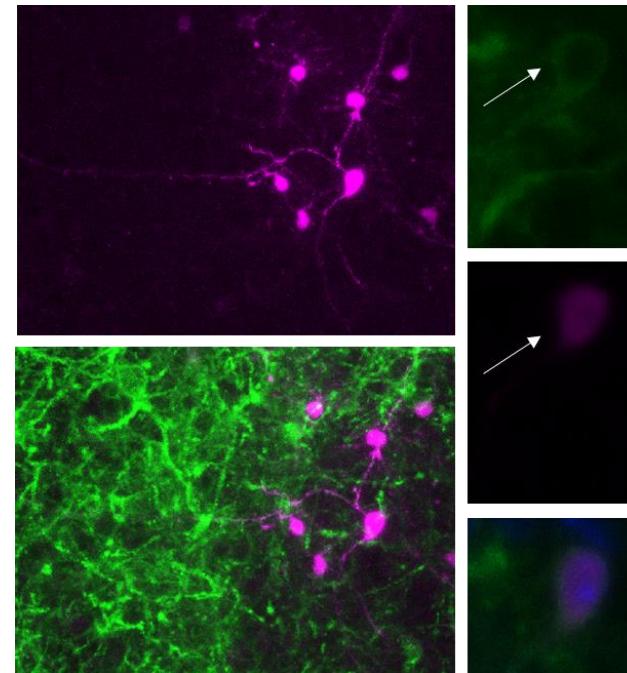
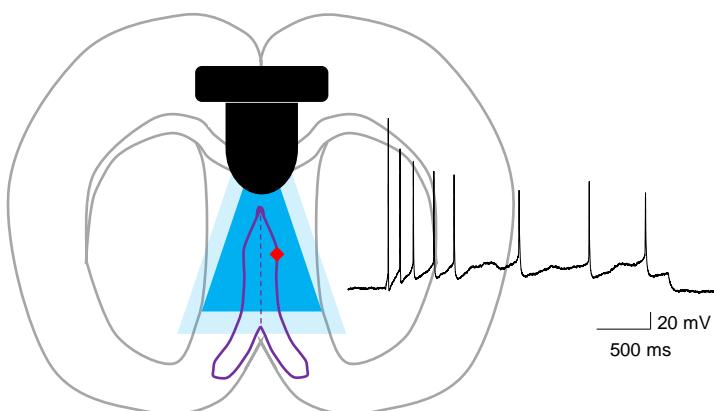


Cell #3



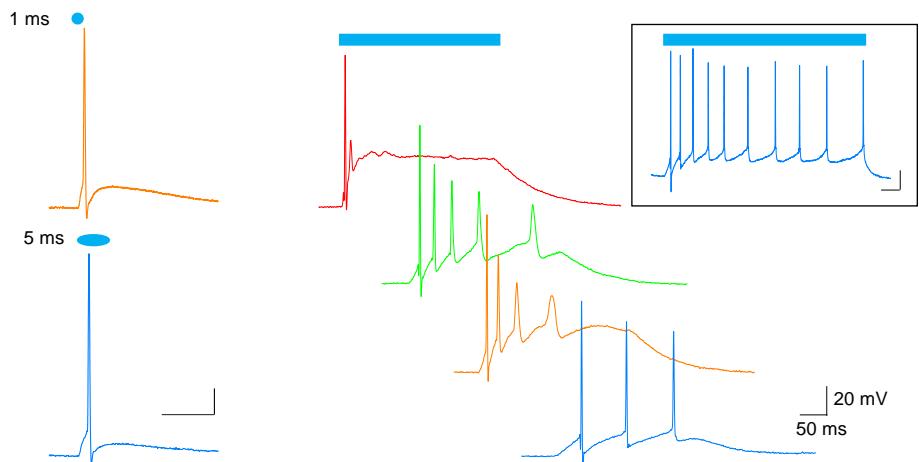
Home take message :

- The MHC allows to perform 2D spatial navigation task and gives enough stability to perform *in vivo* whole cell recordings.
- Our data show that CA1 pyramidal cell firing rate encode spatial information content.
- *In vivo* whole cell recordings present a wealth of submembrane dynamics behaviour that are suitable to be studied.



Future work:

- Introduce a mathematical model to predict EPSP that give form to submembrane dynamics.
- Modulate neuromodulator release onto the hippocampus to test how synaptic physiology and plasticity changes and shape neuronal output.



Acknowledgements



wellcome trust



Jack Mellor Group

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