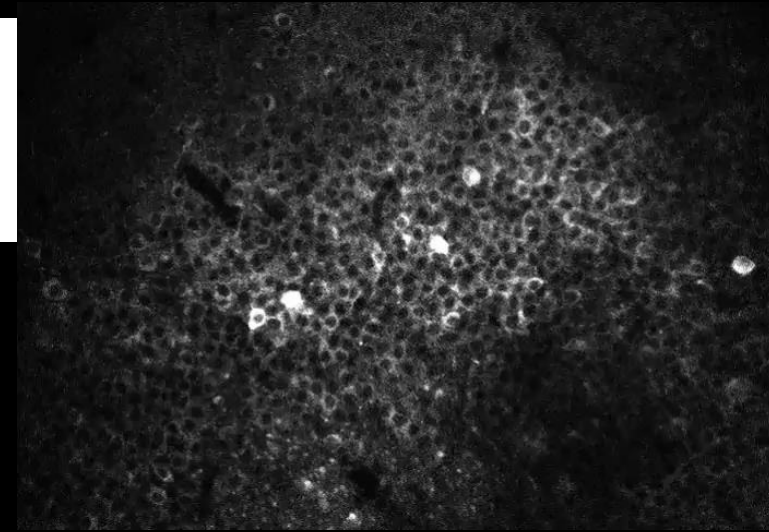
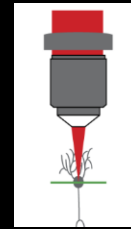


Active Dendrites Contribute to Hippocampal Place Field Formation
Mark Sheffield, Department of Neurobiology, The University of Chicago

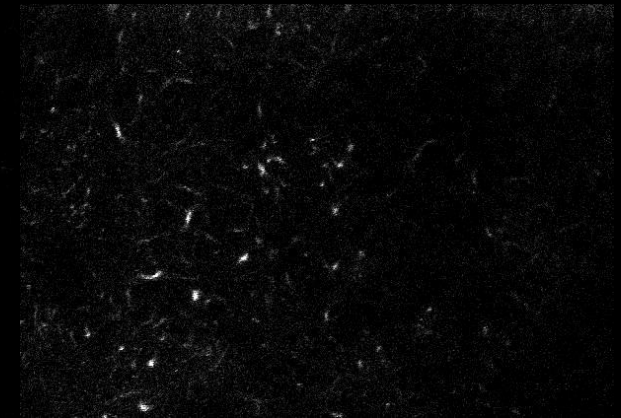
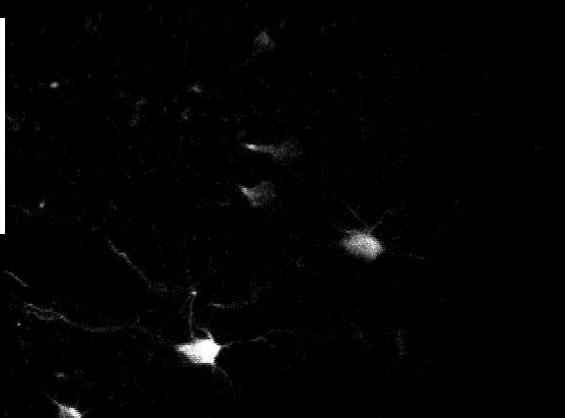
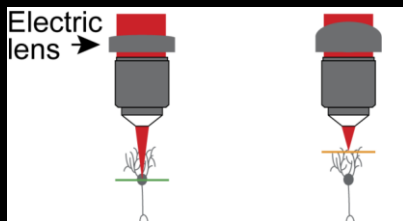
2 m linear VR track



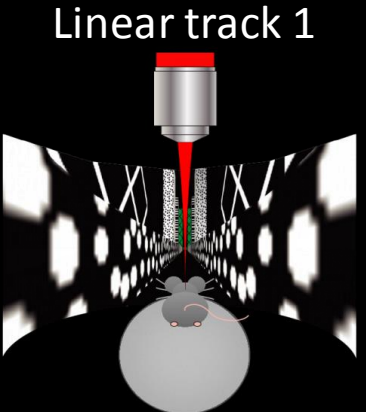
CA1 somatic population imaging



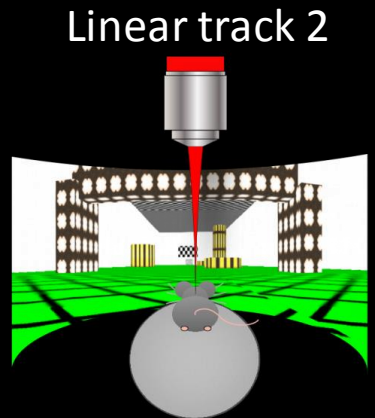
Co-acquired CA1 somatic and basal dendritic imaging



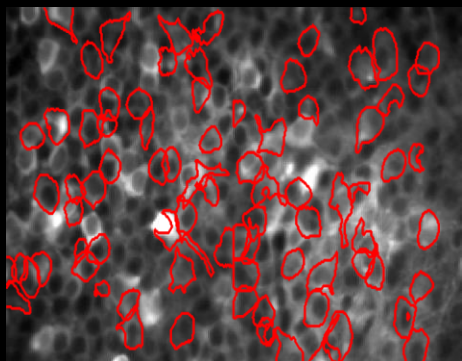
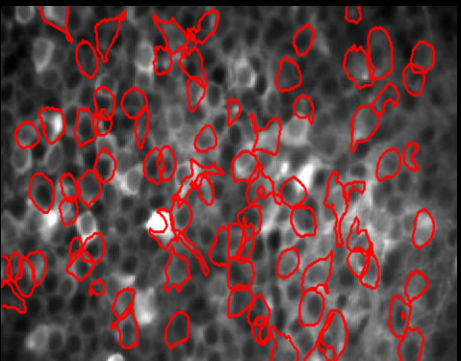
Switching the Virtual Environment Causes Remapping of the Hippocampal Cognitive Map



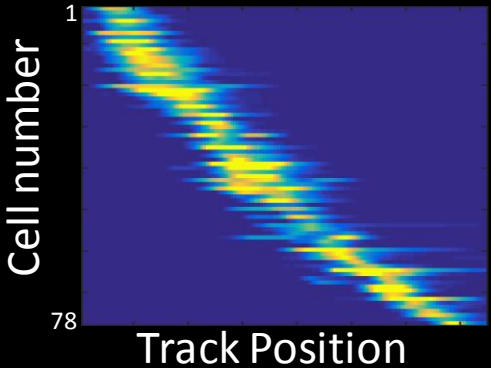
Virtual teleportation



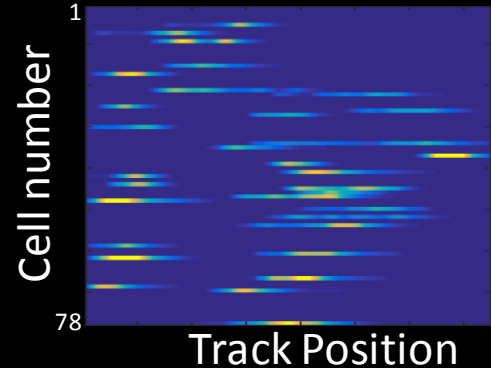
78 Place cells covering linear track 1

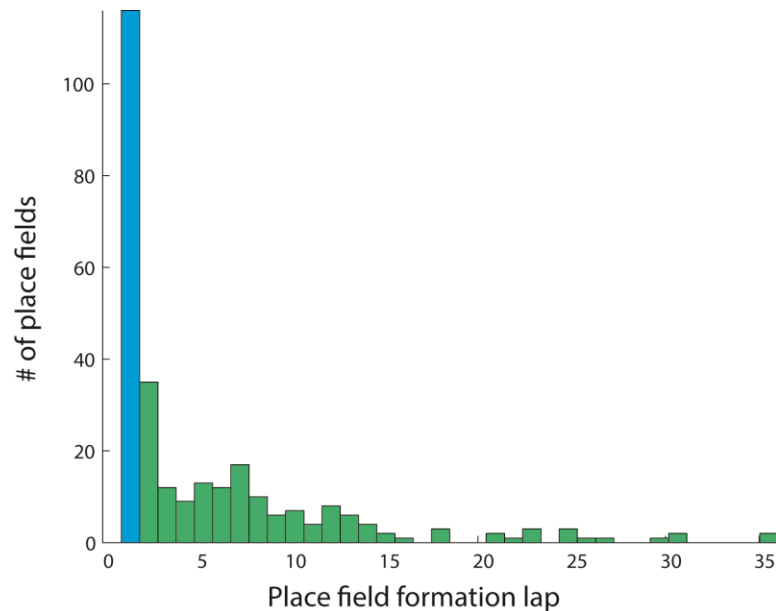
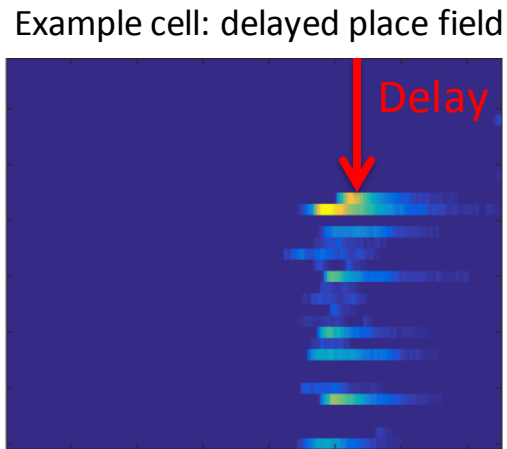
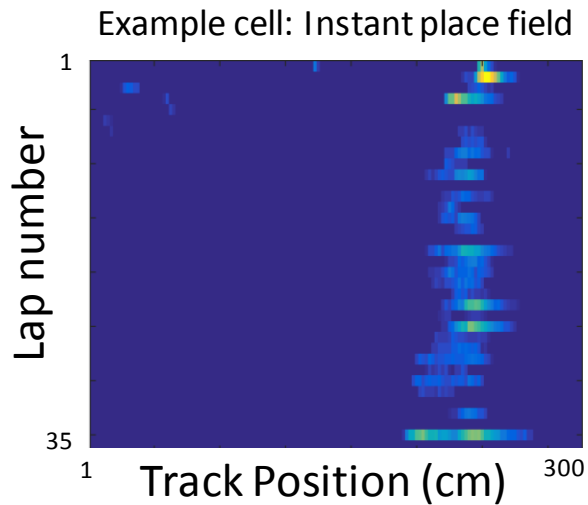


Mean place field position



Mean place field position





The majority of place fields appear within the first ~15 laps of exposure to a novel environment

Branch spiking throughout the arbor can vary between place field traversals

Soma & all branches

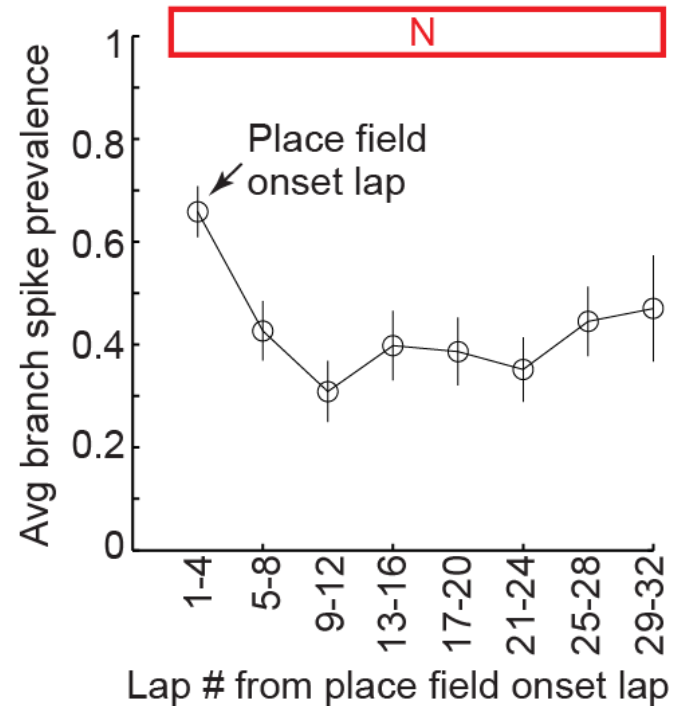
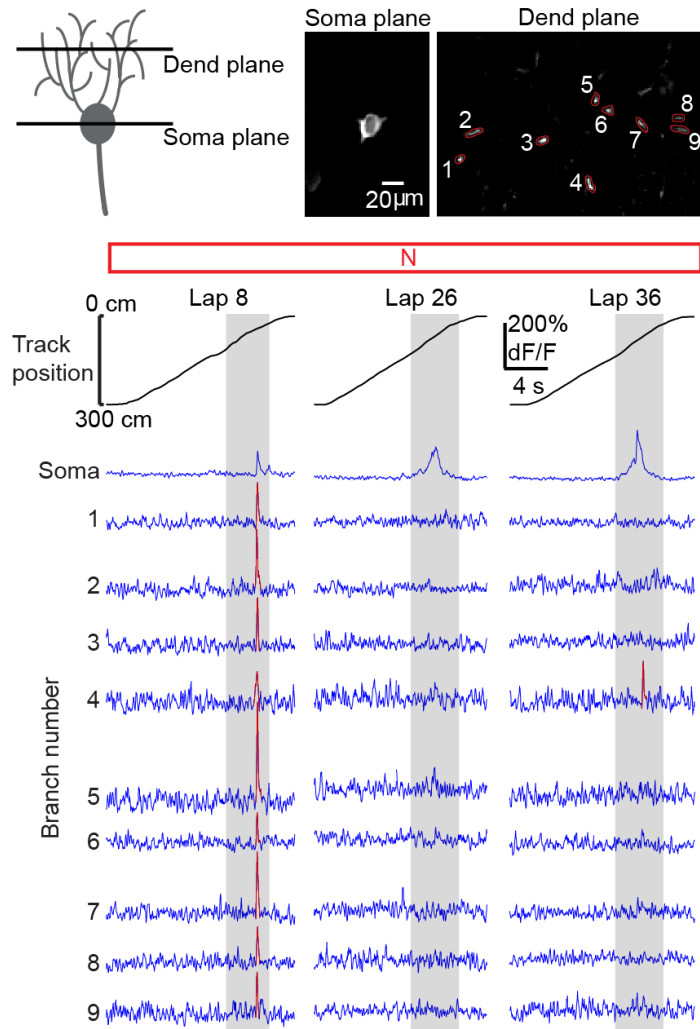
Soma & no branches

Place field transient 1

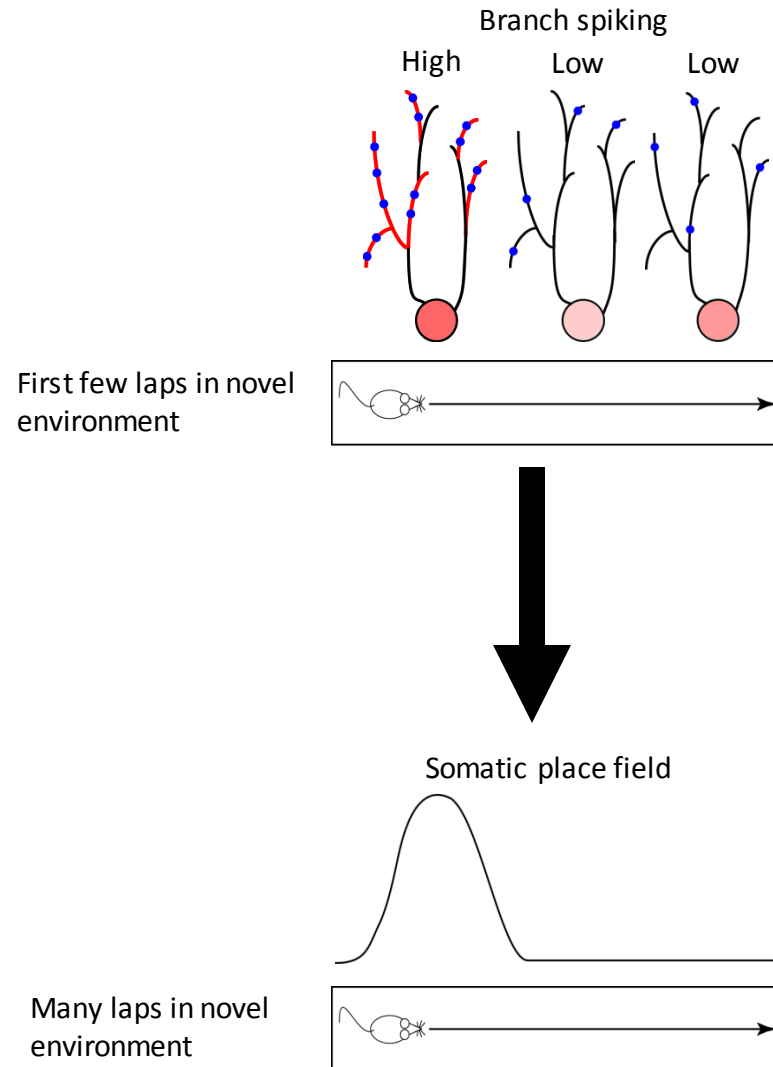
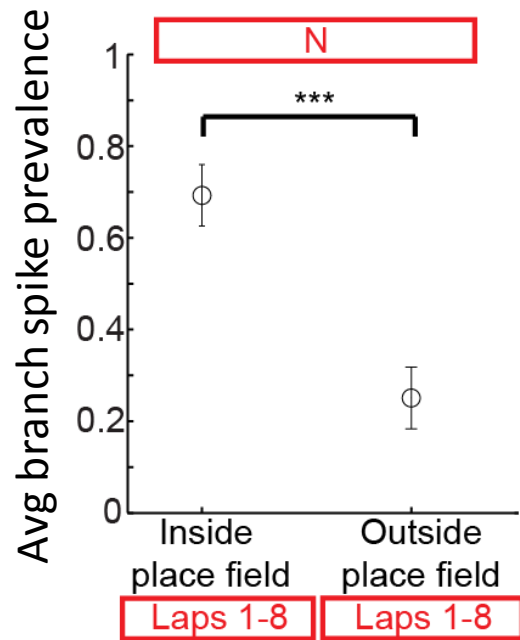
Place field transient 2
(same cell)



Branch spike prevalence across basal dendrites is highest when place fields first appear

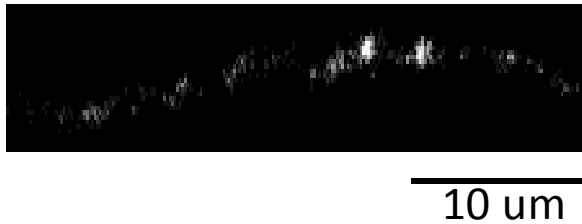


Branch spike prevalence predicts future place field location

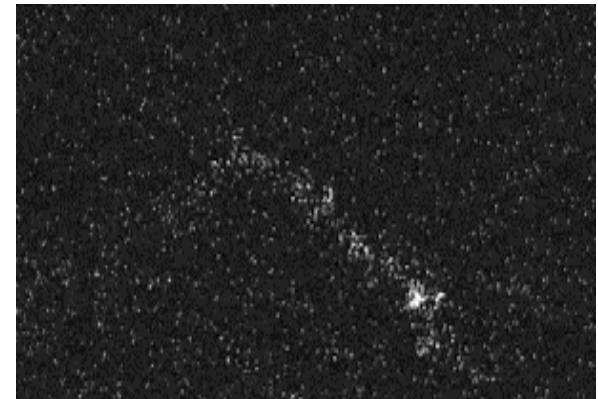


Localized dendritic branch spikes in CA1 basal dendrites

Ex-vivo evoked dSpike

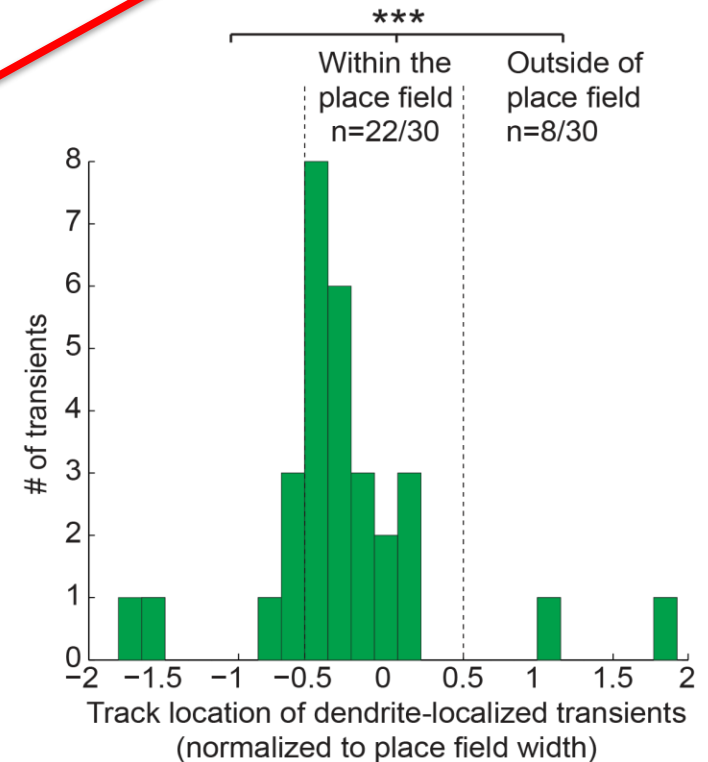
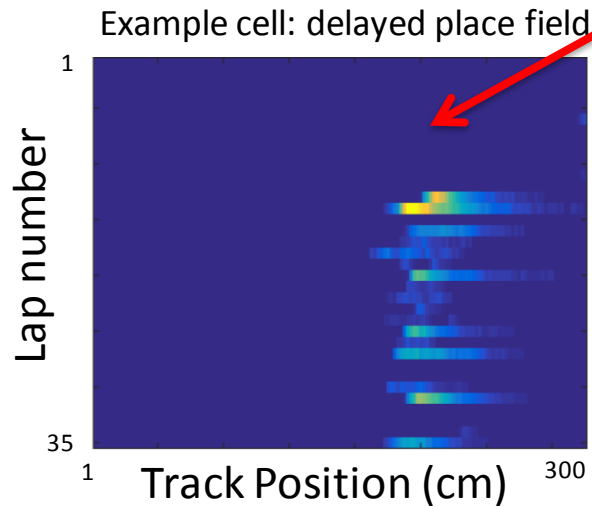
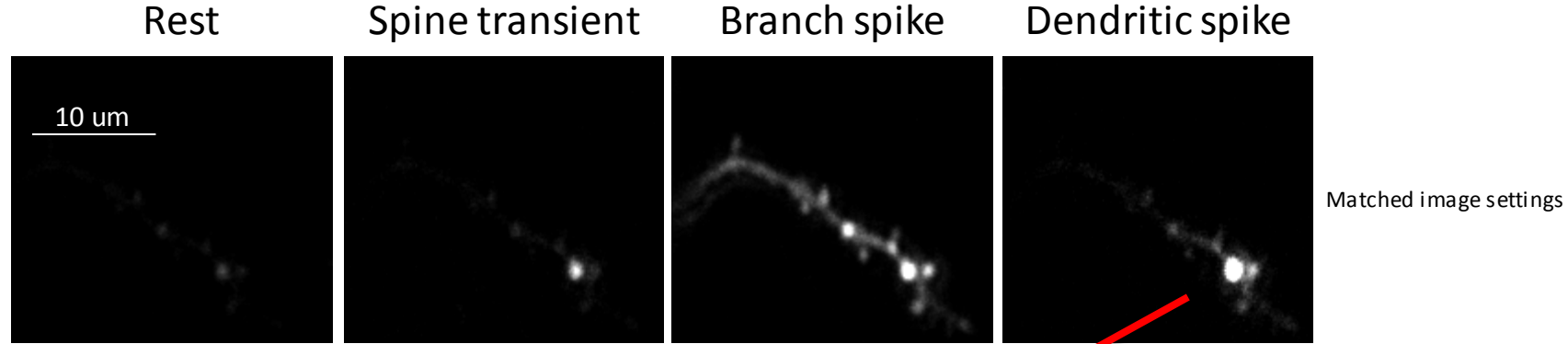


In-vivo spontaneous dSpike

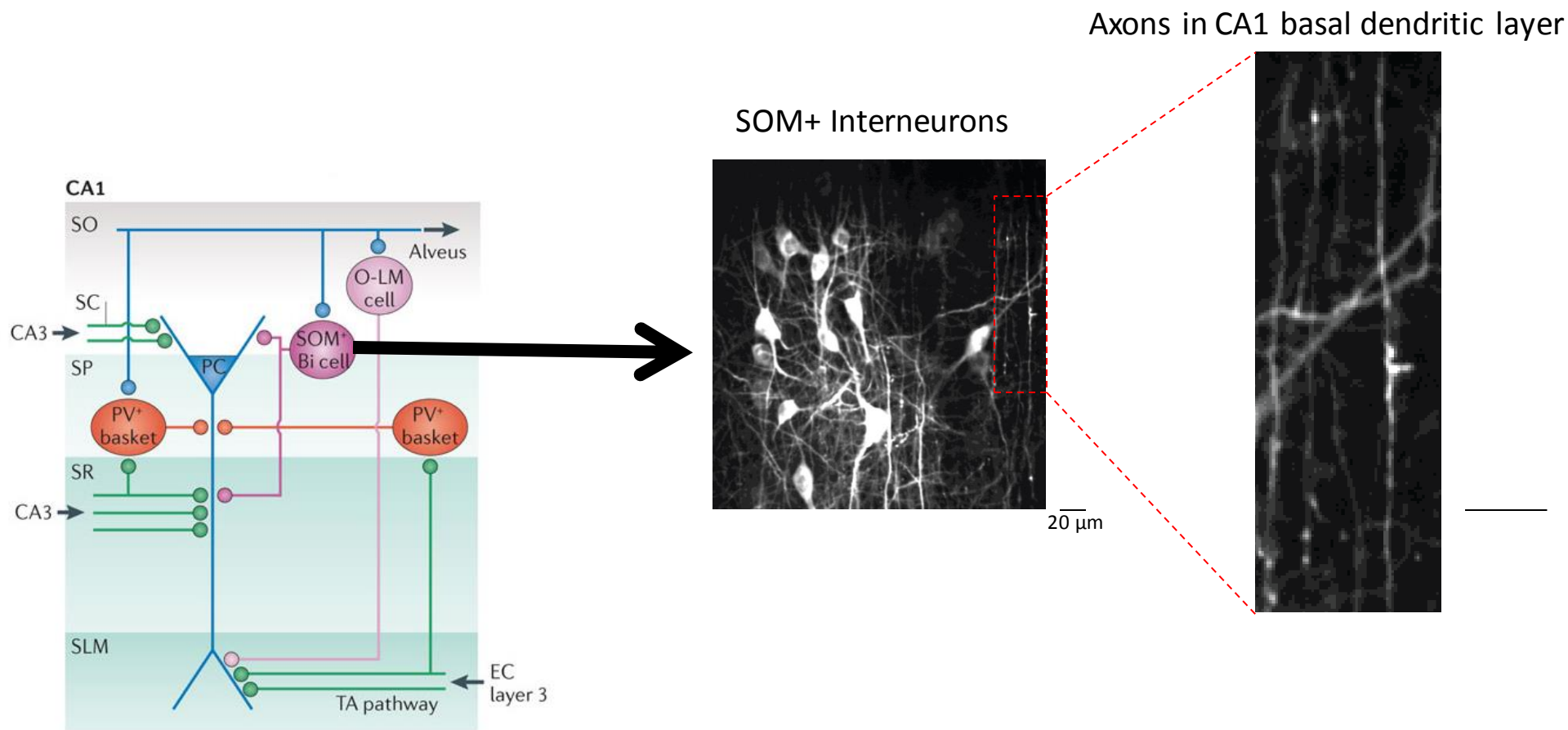


7 spines
0.5 ms laser duration
0.12 ms interstim interval
<0.5 ms to stimulate them all

dSpikes occur prior to the formation of delayed place fields



Interneurons that target CA1 dendrites could regulate dendritic spikes

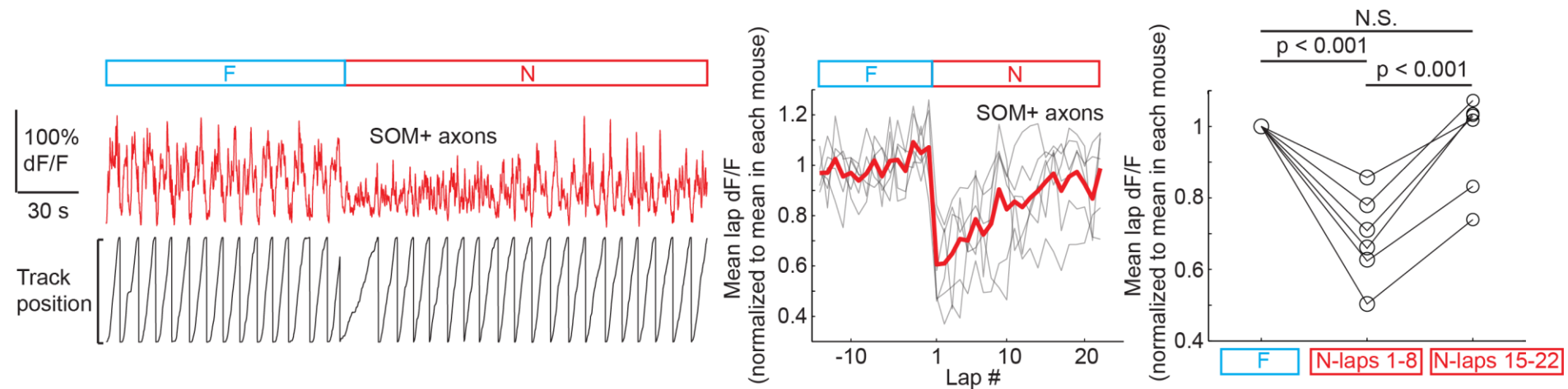


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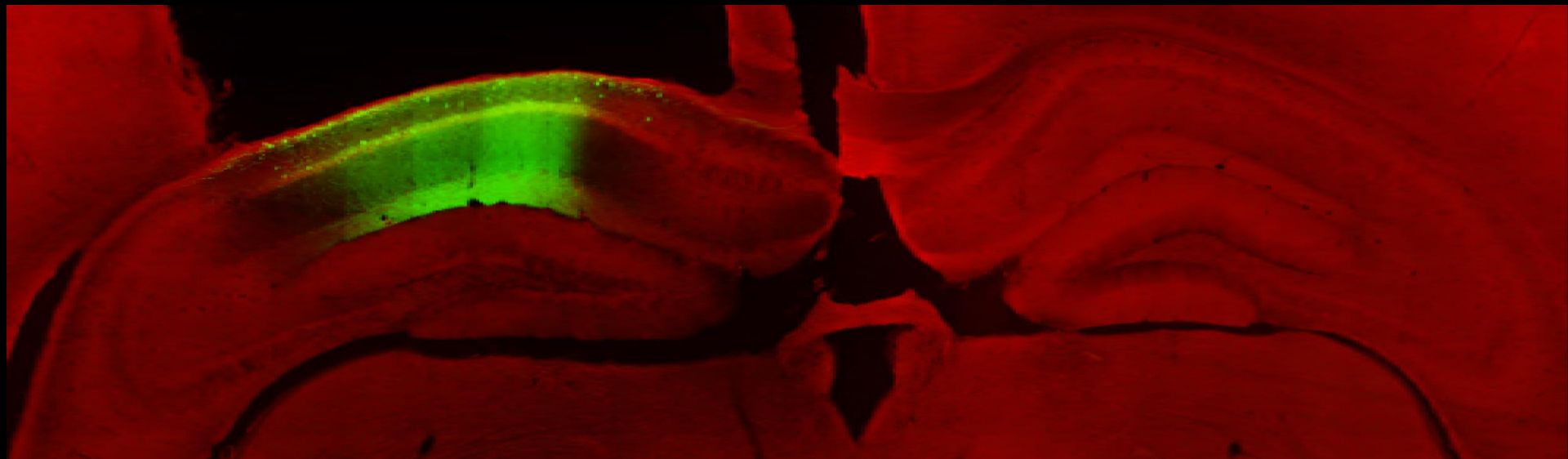
Ethan Goldberg & Douglas Coulter (2013)

Sheffield et. al., Neuron, 2017

Dendritic inhibition is transiently reduced during novel environment exposure

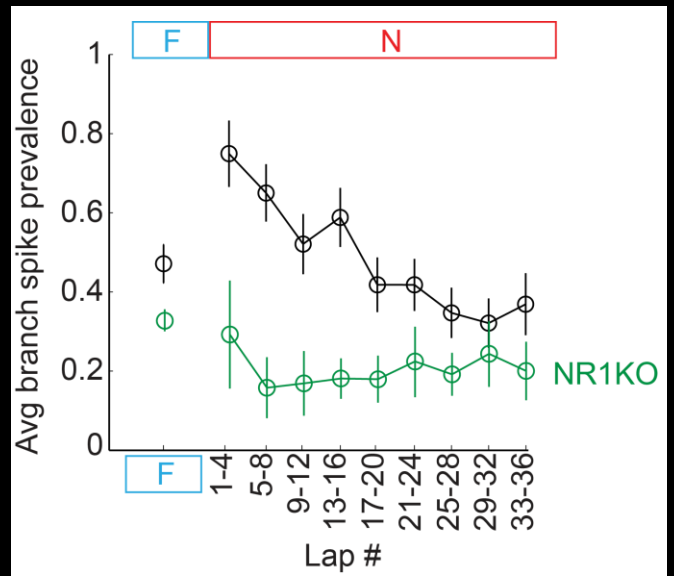


Inducible knock out of NMDA receptors in CA1 neurons disrupts active dendritic signals

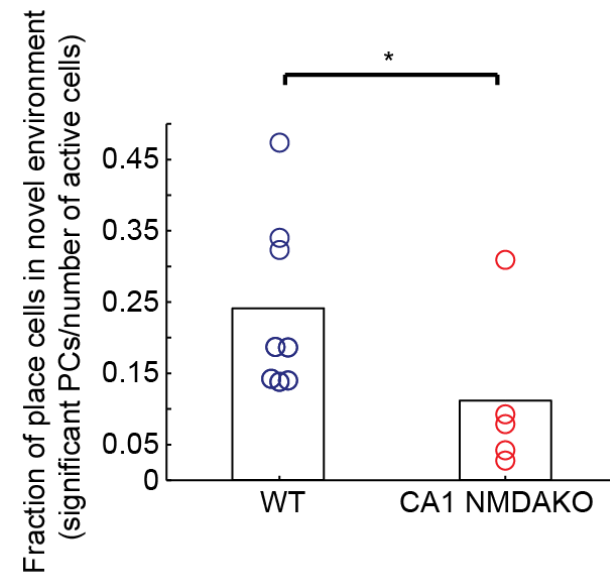
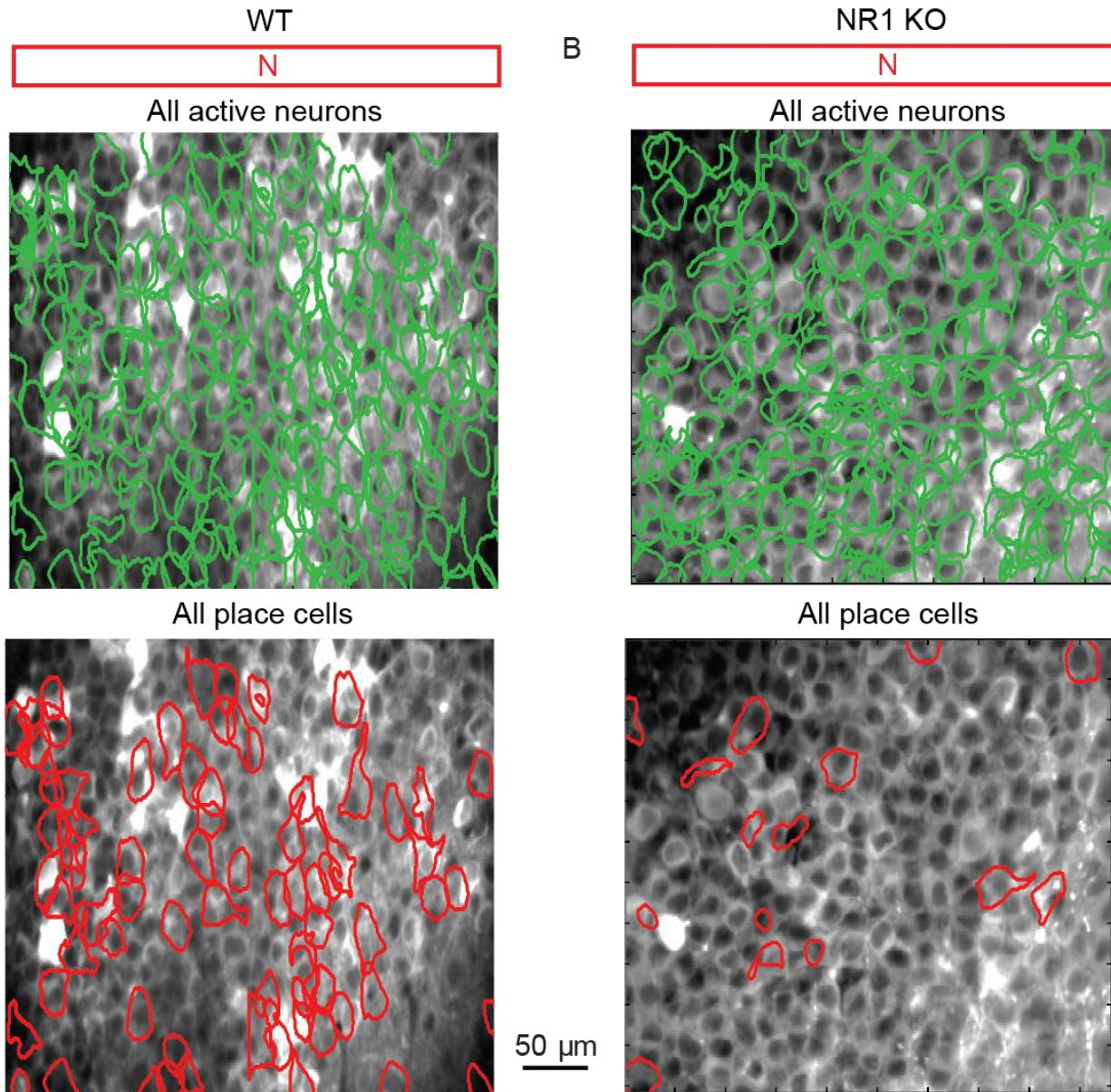


Branch spikes reduced during place field formation in NR1KO

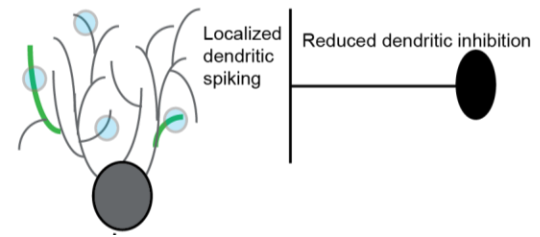
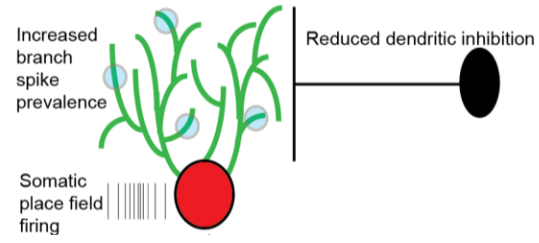
Localized dendritic spikes absent during place field formation in NR1KO



NMDA KO in CA1 neurons decreases the number of place fields that form



Initial exposure



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