

The effect of Medial Septum Stimulation on Hippocampal Place Cells and Behaviour



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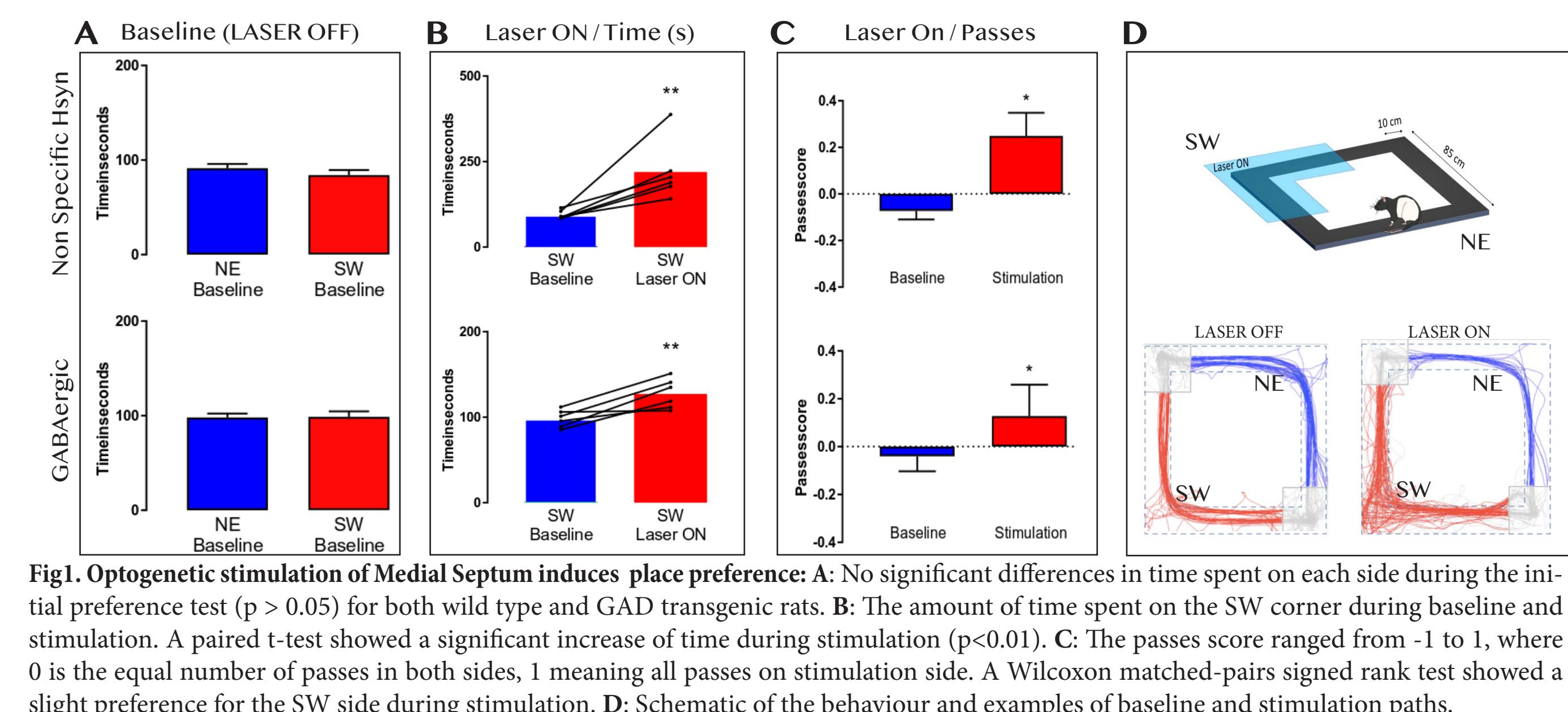
What is the Medial Septum?

The medial septum (MS) is anatomically and functionally connected to the hippocampus and essential to the maintenance of hippocampal oscillations.

It innervates the hippocampus with GABAergic, cholinergic and glutamatergic fibres which are intimately related to memory

Using optogenetic stimulation and electrophysiological recordings, we aimed to investigate how the MS is involved in reward-related behaviour and spatial memory processing.

MS stimulation induce place preference

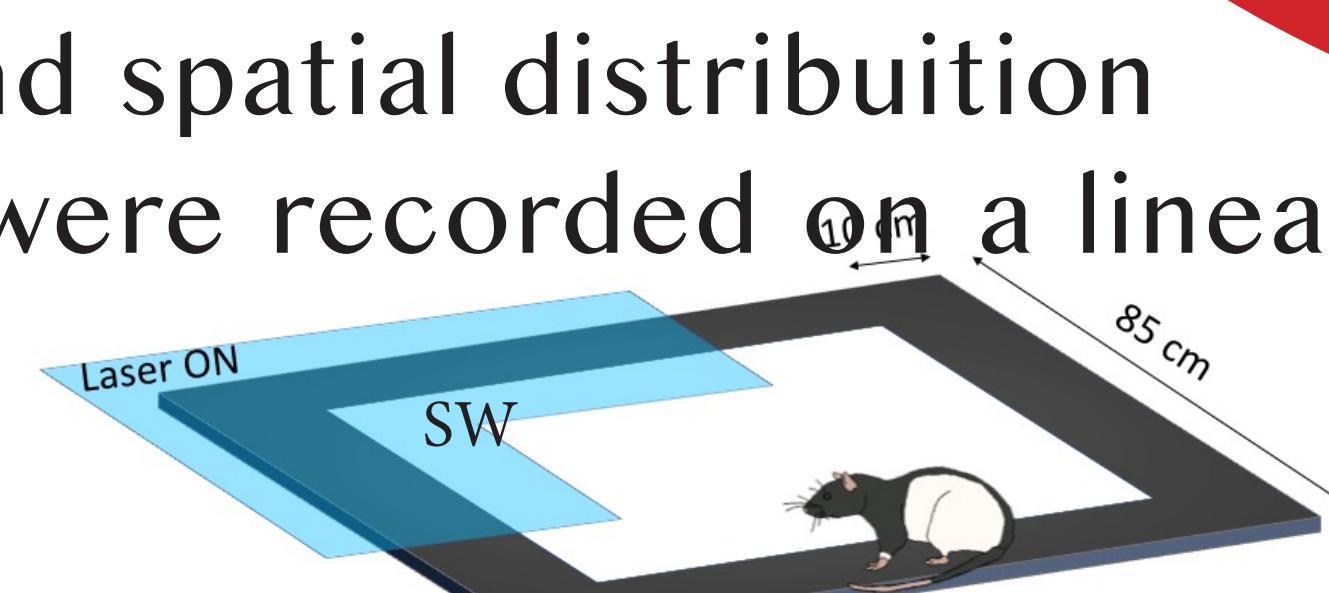


The Medial septum modulates place cells activity in the hippocampus

Our Approach

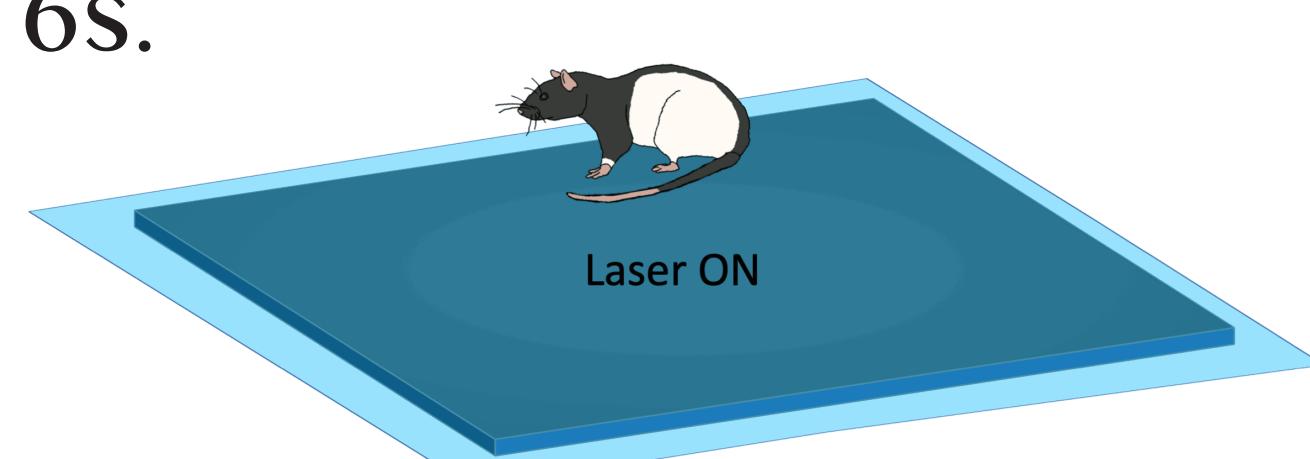
Wild type and transgenic GAD rats were injected with AAV virus to express channelrhodopsin 2 (ChR2) into MS.

Place preference and spatial distribution of the place fields were recorded on a linear squared maze.



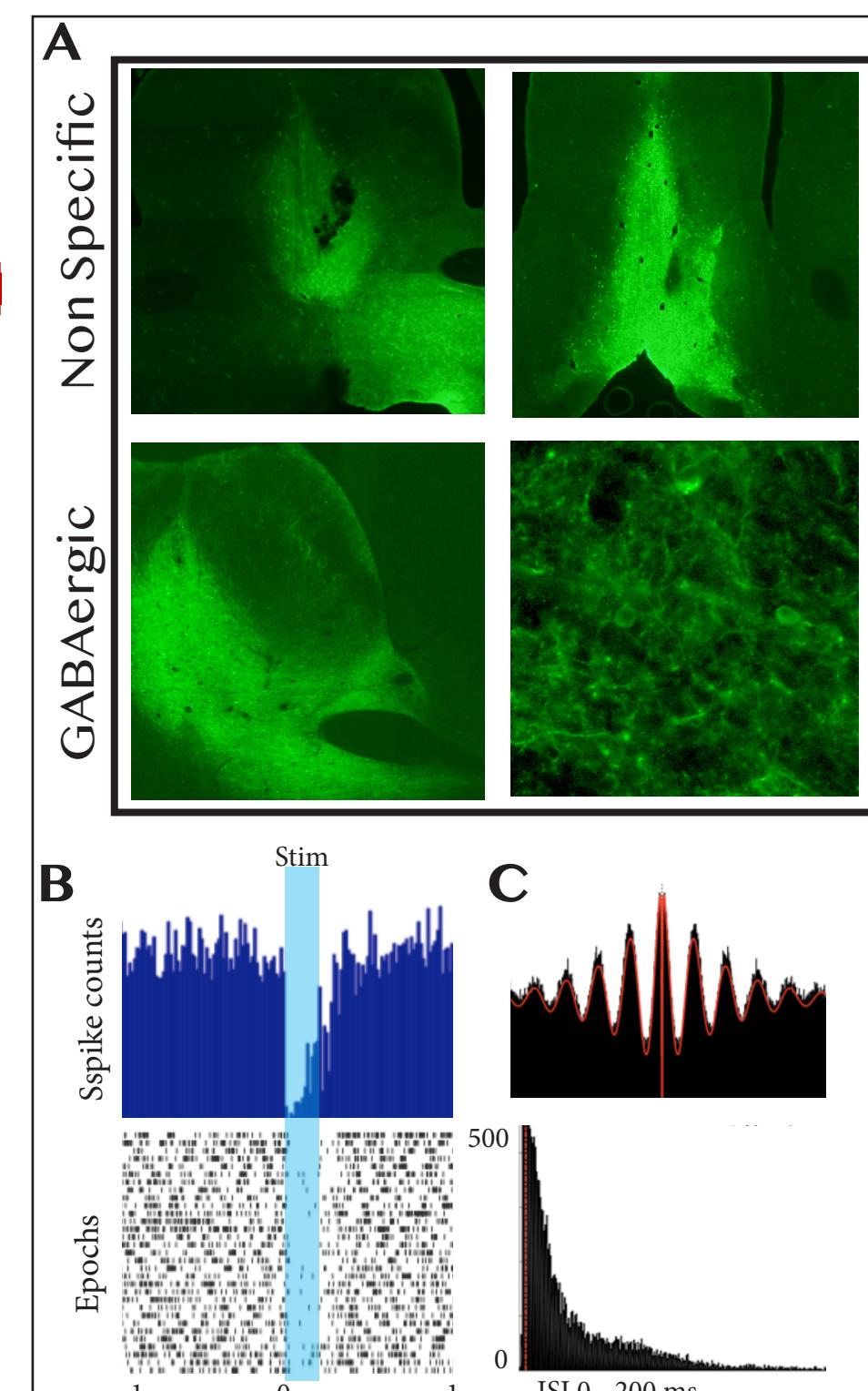
Laser was ON every time the rat entered the SW corner

MS neurons and CA1 activity were recorded during a Random Foraging Task. Where the MS was stimulated every 6s.



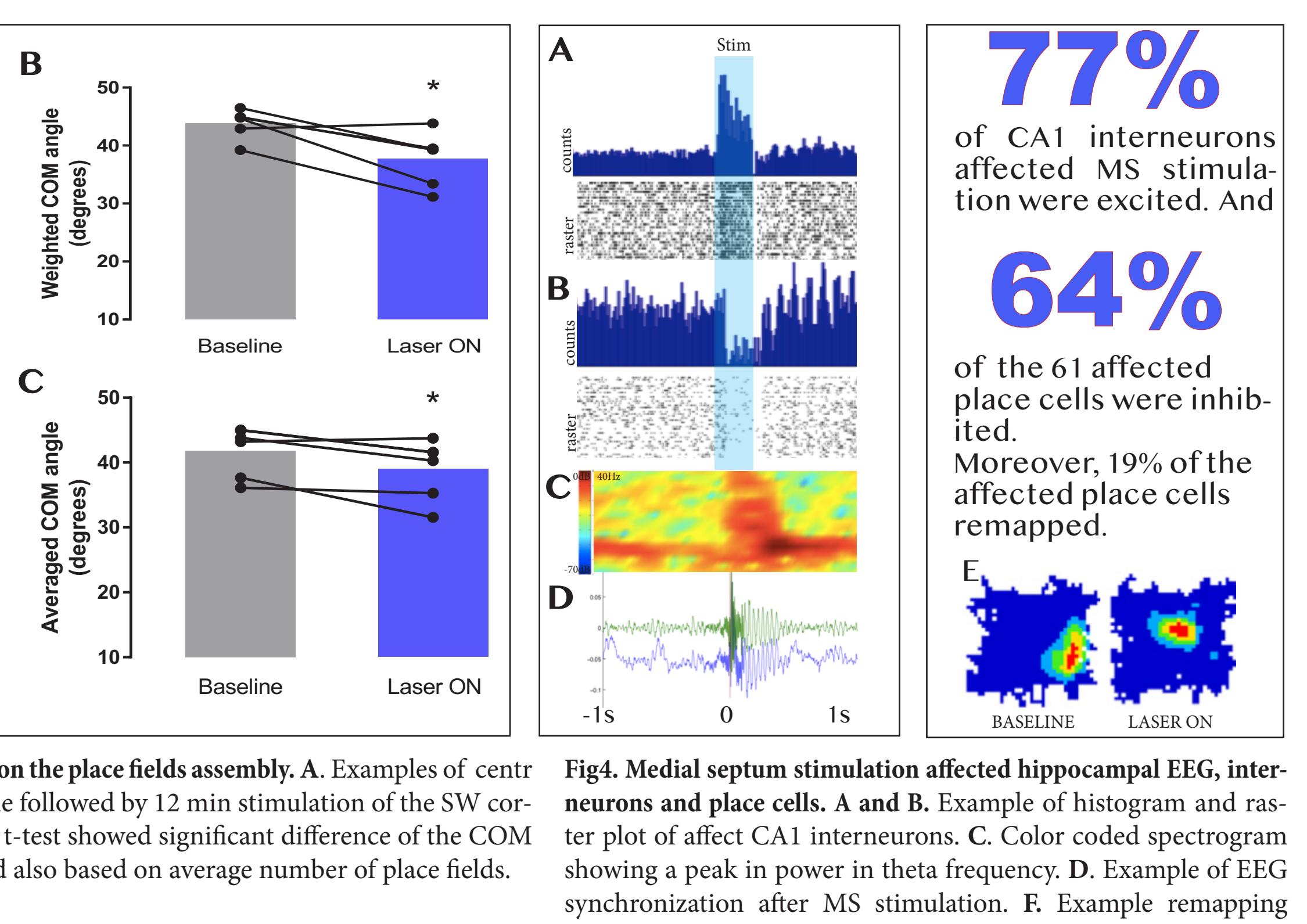
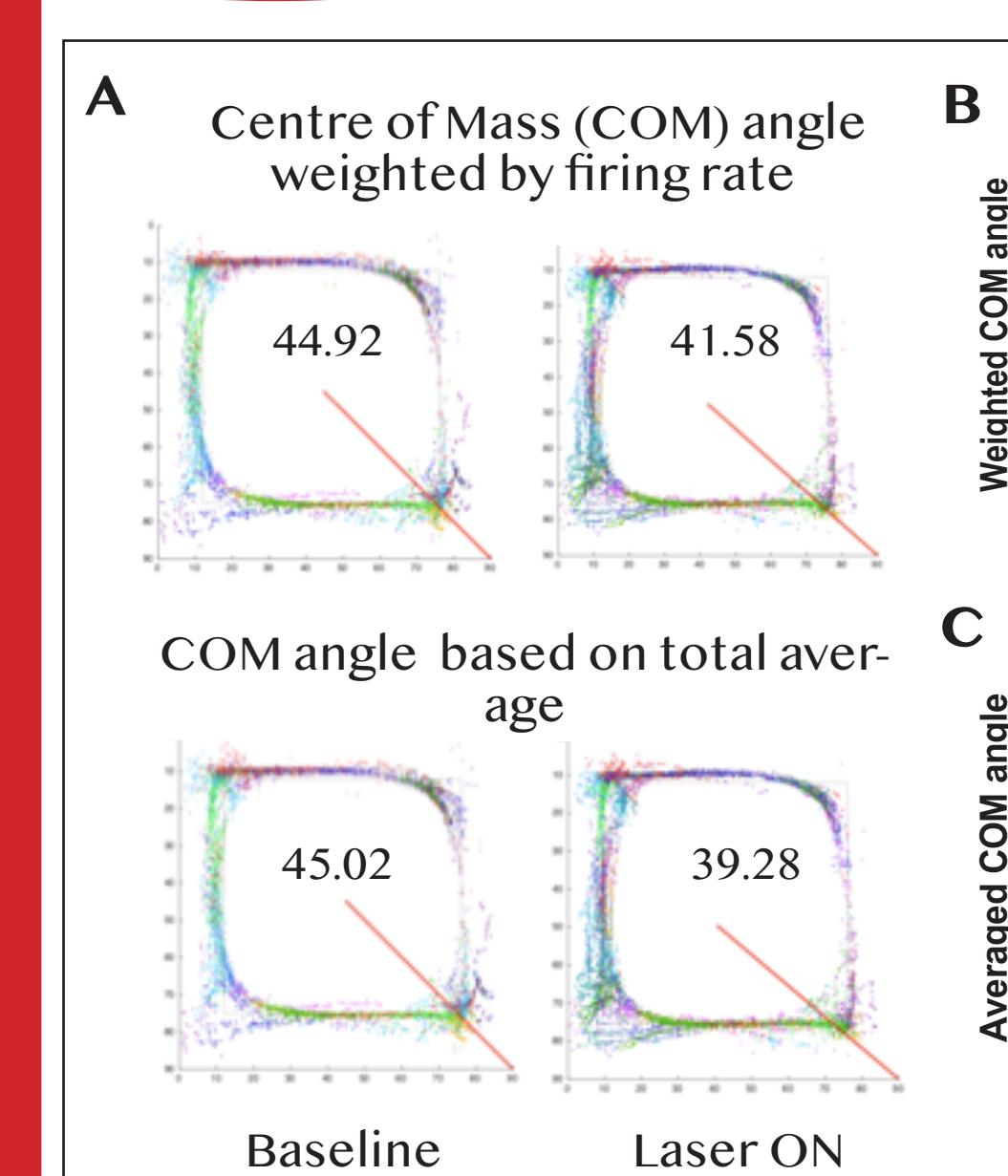
Intra Septal Effect

From 145 units recorded, 84% were affected. 42% were excited and 42% inhibited. Indicating an intra-septal circuit as the light only excites infected neurons.



76% of fast spiking theta modulated MS neurons were inhibited by MS stimulation. These cells have been described to contribute to hippocampal theta.

Effect on CA1 neurons and EEG



Conclusion

- Non-specific optogenetic stimulation of MS can induce place preference. A similar effect was observed during specific stimulation of MS GABAergic neurons;
- By calculating COM angle, we observed that the place field assembly moved towards the stimulation corner. Moreover, 77 % of recorded interneurons and 64% of recorded place cells were affected by MS

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