

FLAG-ERA JTC 2021 Proposal

Project Acronym

VIPattract

Project Full Title

The role of GABAergic neuron subtypes in stabilizing and flexibly resetting head-direction signals in the Presubicular cortex

Sub-call: ☐ Graphene – Basic Research ☐ Graphene – Applied research and innovation ☒ HBP – Basic and applied research

Kick-off 2022

Coordinator: Desdemona Fricker

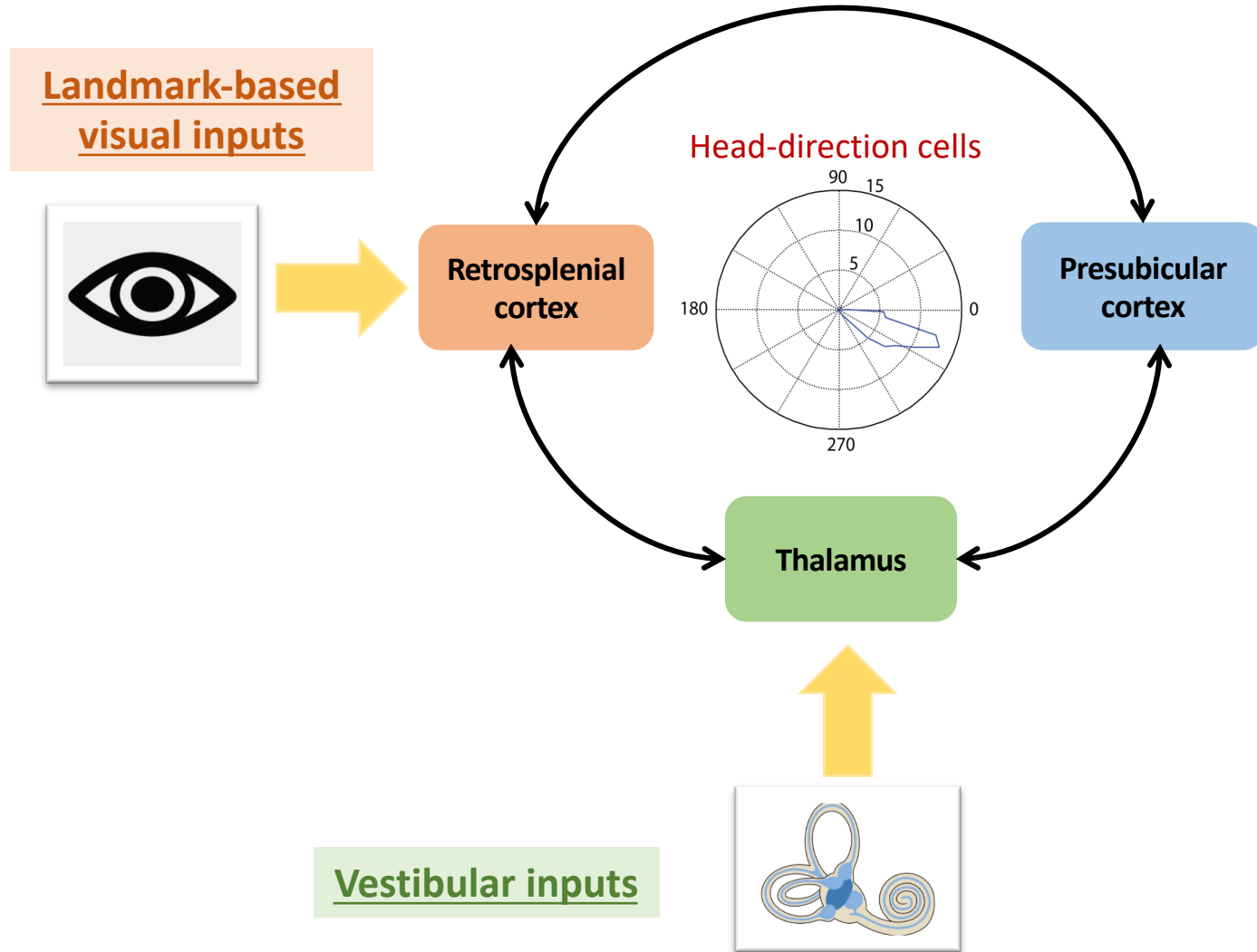
4 + 1 Partner teams:

Partners and participants involved in the realisation of the project

Partner Number	Country	Institution/ Department	Name of the Principal Investigator (PI) ¹	Name of the co-Investigators ²	Other participants ³
1 <i>Coordinator</i>	France	CNRS UMR8002 INCC	Desdemona Fricker	Merie Nassar	PhD
2	France	CNRS UMR8003 SPPIN	Michael Graupner		PhD
3	Netherlands	RU / Donders Center for Neuroscience	Francesco Battaglia	Federico Stella	Post-doc
4	Hungary	Research Center for Natural Sciences, Eötvös Loránd Research Network	Lucia Wittner		Post-doc
5	Japan	NIPS	Yoshiyuki Kubota	Jaerin Sohn	

Head direction neurons function as the brain's compass

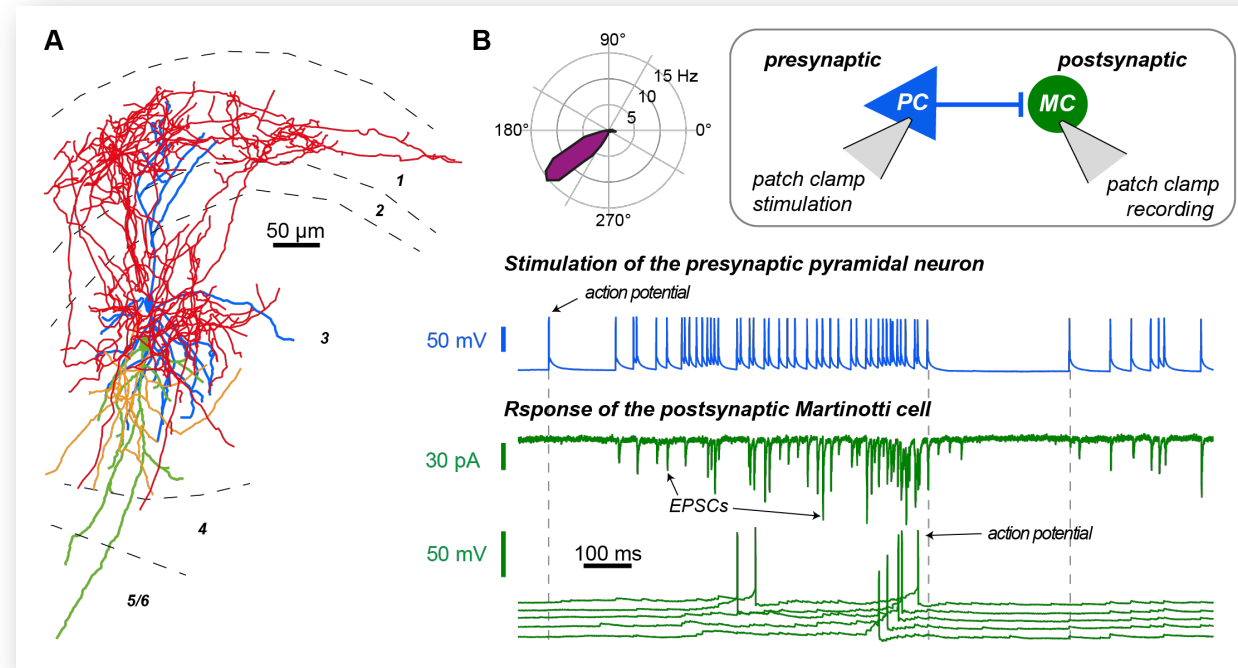
maintenance & flexibility upon reorientation



We will study this mechanism in the parahippocampal cortex, where vestibular based HD information and visual information converge.

Excitatory-inhibitory interactions support HD firing in Presubiculum

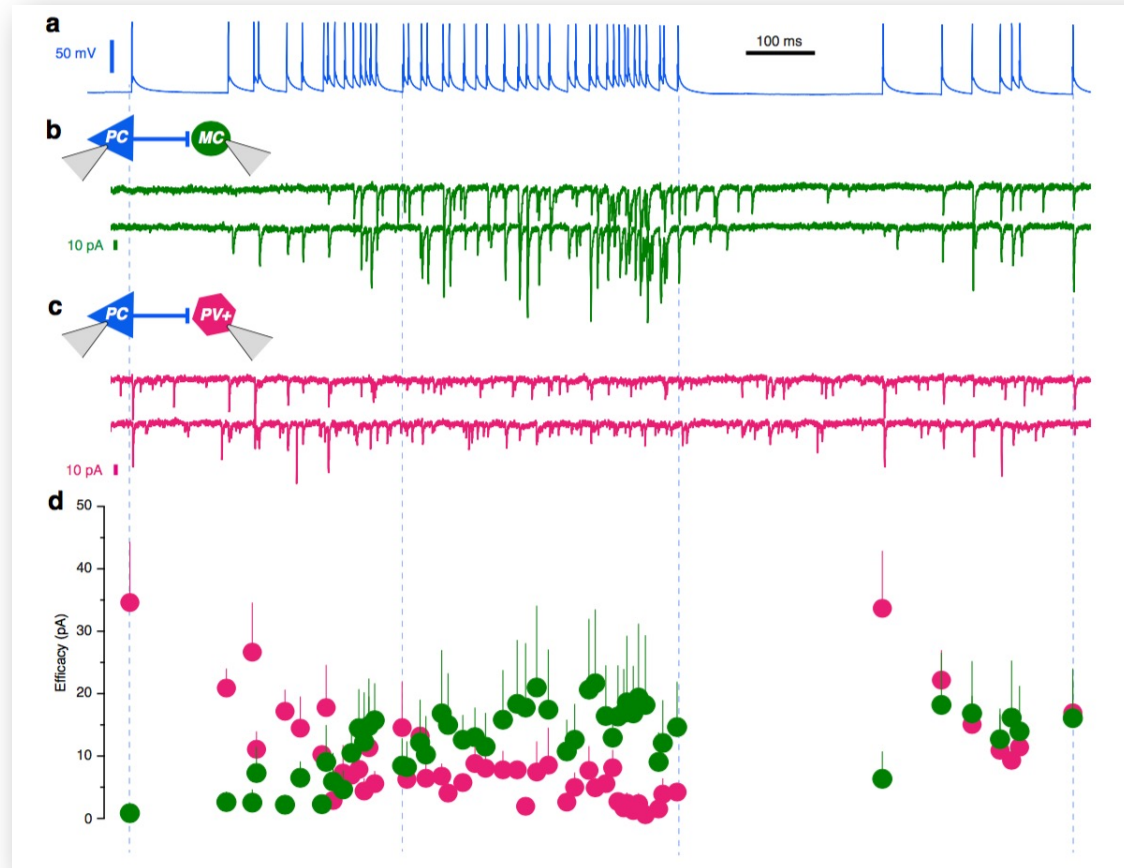
Paired recordings + probing synaptic response dynamics with HD spike trains



- Facilitating Martinotti cells provide activity dependent feedback inhibition
- Attractor dynamics emerge from timing sensitive excitatory-inhibitory interactions

Probing synaptic dynamics with HD spike trains

Paired recordings



Simonnet and Fricker, CTR 2018
Simonnet et al., Nat Comms 2017

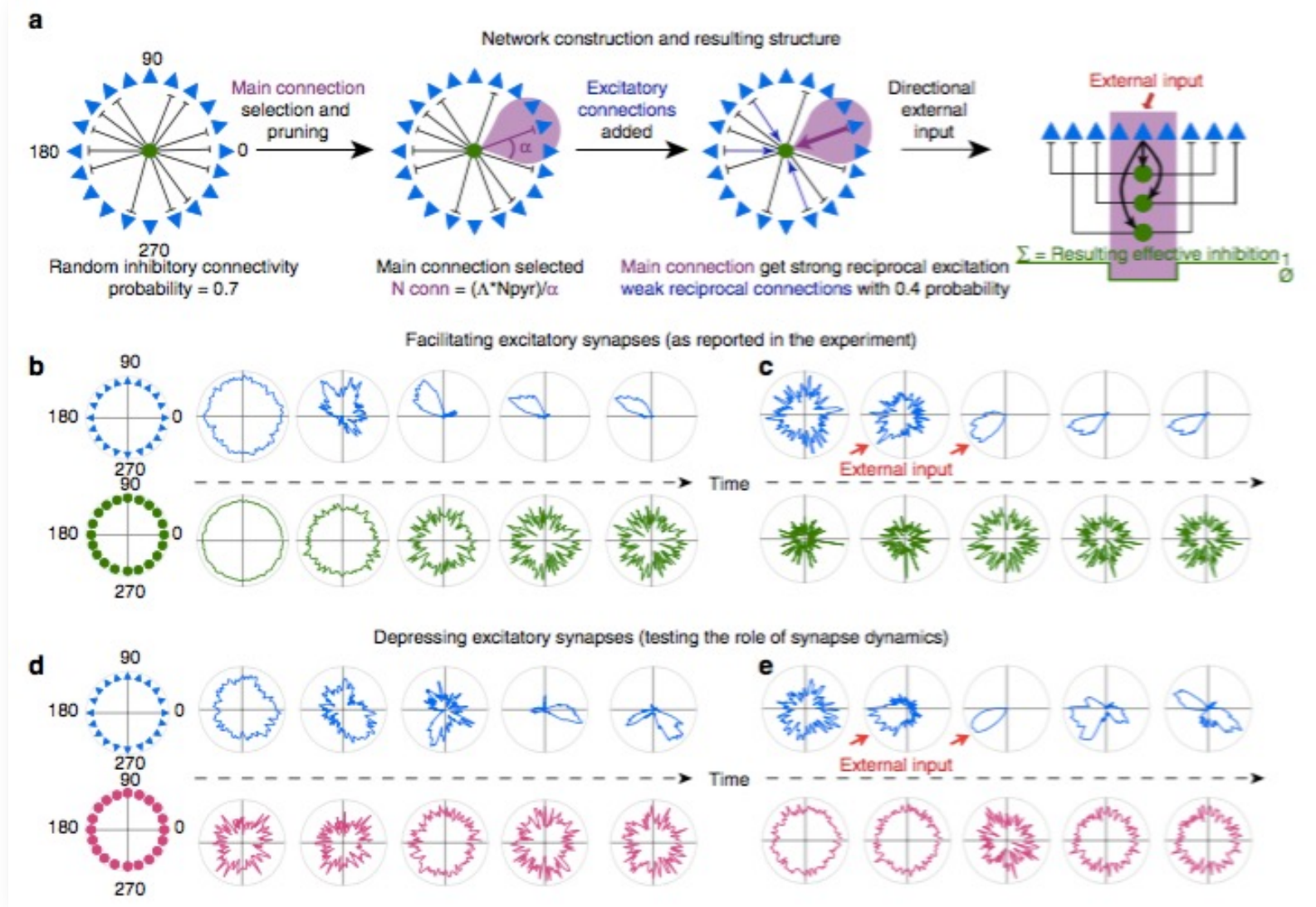
- Facilitating Martinotti cells provide efficient activity dependent feedback inhibition while PV neurons respond at the onset of a spike train

Attractor network model

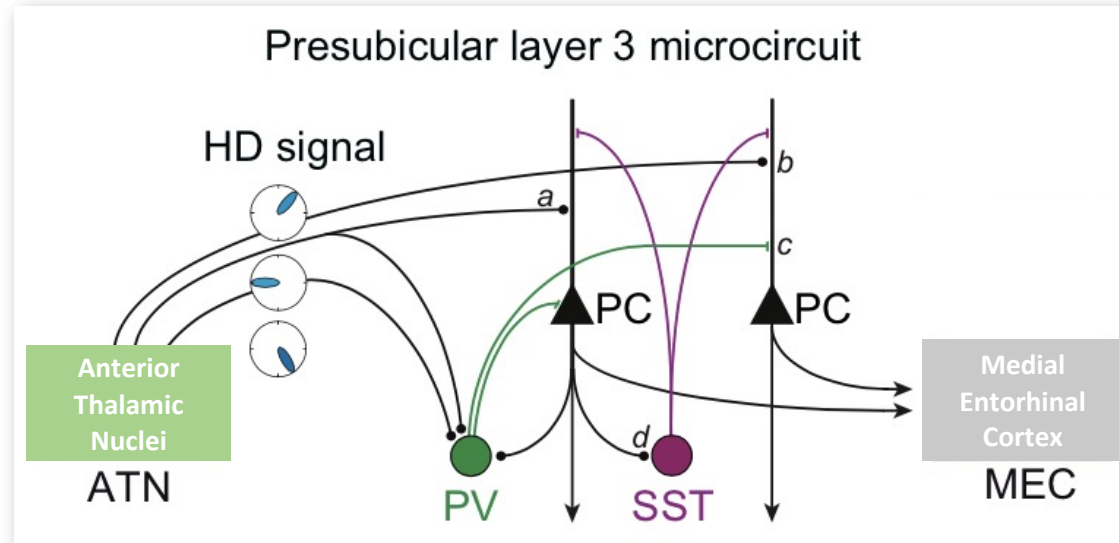
based on facilitating activity dependent feedback inhibition

Model:
Federico Stella

Spontaneous and externally-
driven formation of an
activation bump



Neuronal basis of the HD signal in the Presubiculum



Presubicular circuits switch between two regimes:

- During immobility, SST-pyramidal cell interactions support maintained HD firing: Attractor dynamics emerge from timing sensitive excitatory-inhibitory interactions
- PV interneurons may sharpen the HD signal during fast head turns.