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CAMBRIDGE NEUROSCIENCE

Early Career Investigator Data Blitz

#ABC2019 #DataBlitz

Poster #15

Mat Evans

Limits on the capacity for independent neural population codes in somatosensory cortex

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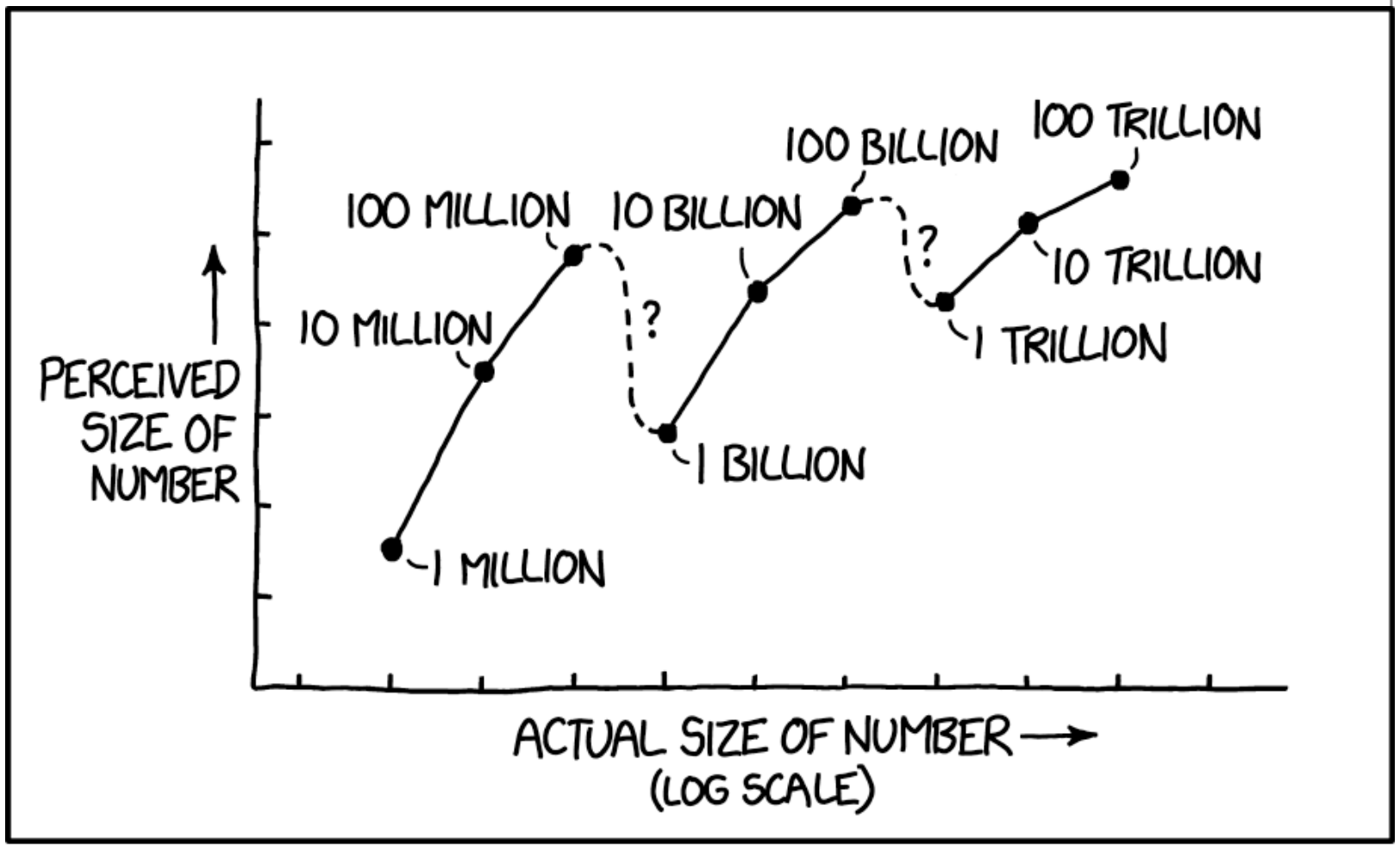
Poster #15
Mat Evans

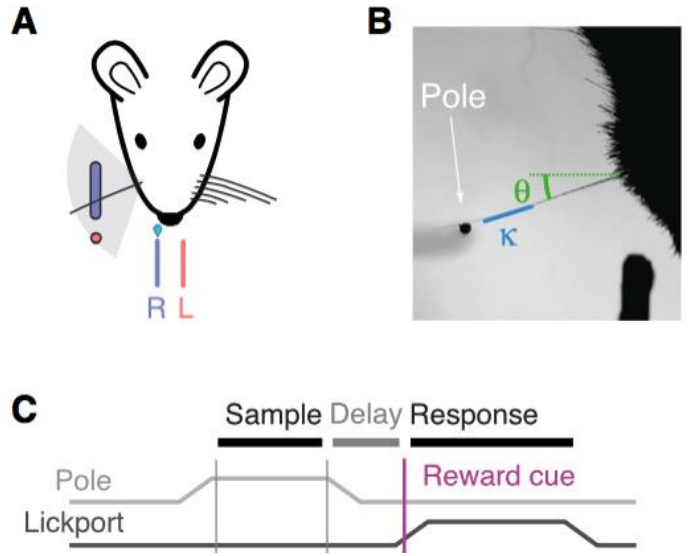
MANCHESTER 1824
The University of Manchester

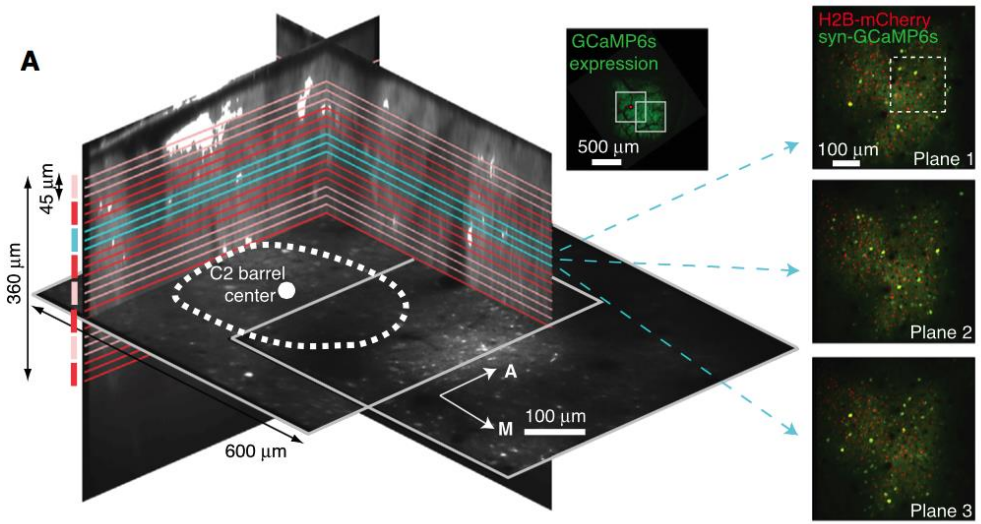


TALKING ABOUT LARGE NUMBERS IS HARD

MRC Medical Research Foundation

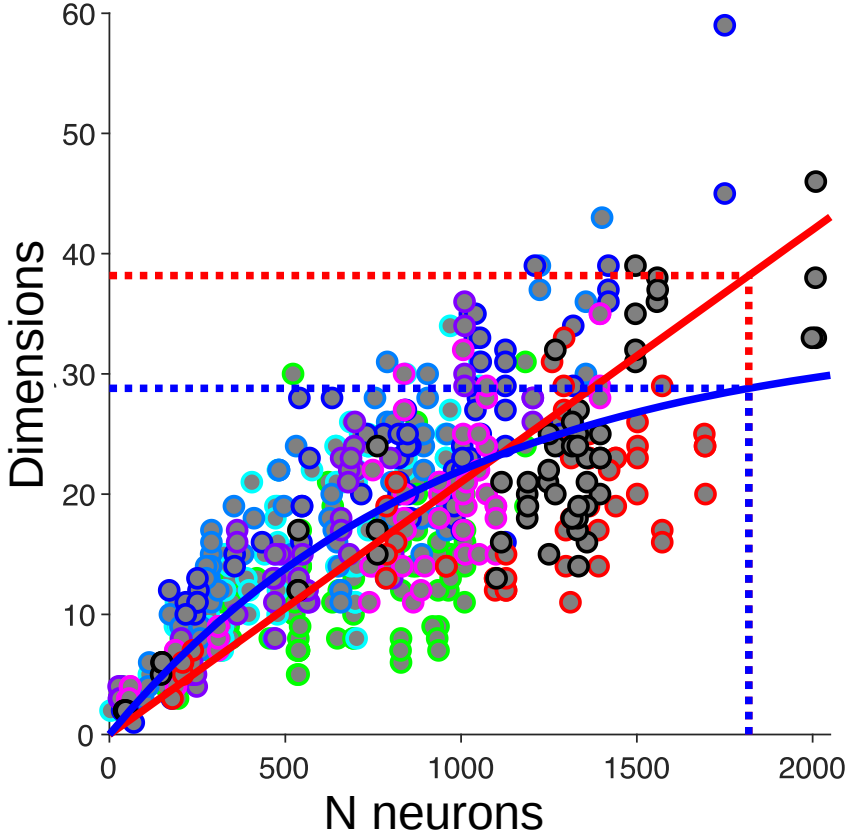
University of Nottingham
UK | CHINA | MALAYSIA

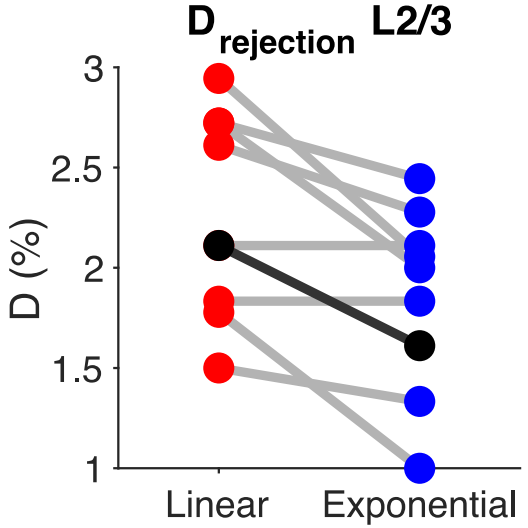


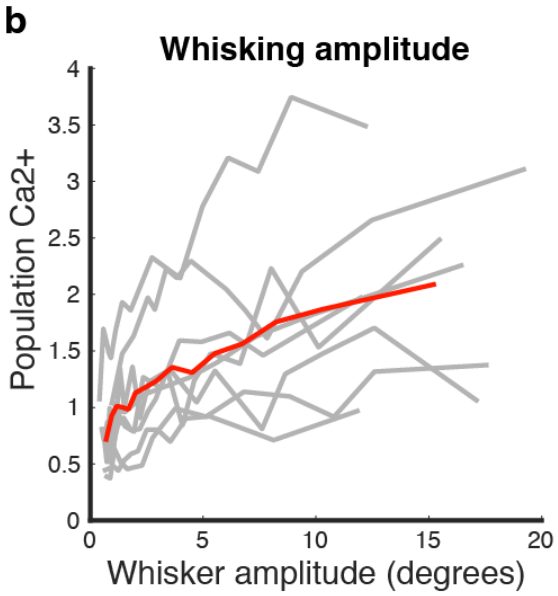


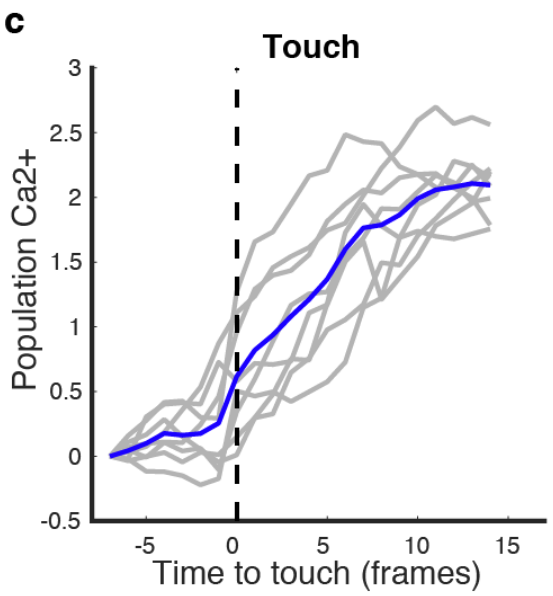
Data from Peron, Freeman, Iyer, Guo, and Svoboda. A cellular resolution map of barrel cortex activity during tactile behavior. Neuron, 86(3):783–799, May 2015.

Available on crcns.org









Poster #24

Alexandre Javier

Neural substrates of individual variability in *Drosophila*'s innate fixation behaviour

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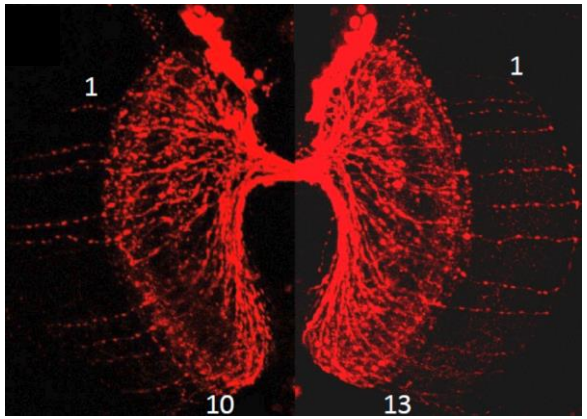
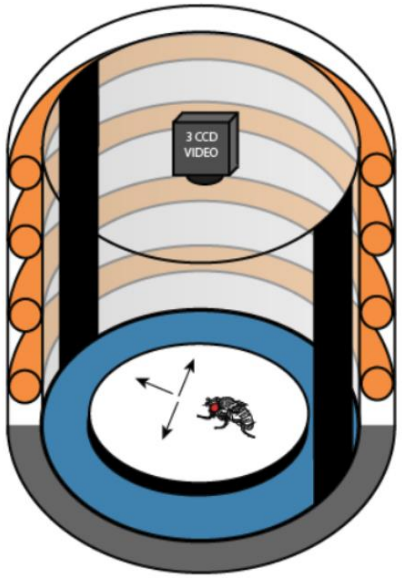
Neural substrates of individual variability in *Drosophila*'s innate fixation behaviour

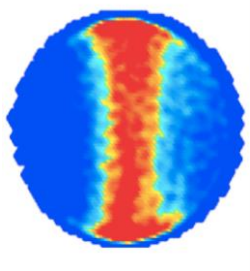
Alexandre Javier | University of Cambridge, Dept. of Zoology #24



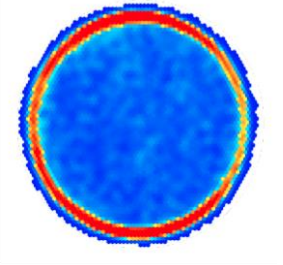
Langen et al. 2013 *ELife* 2013



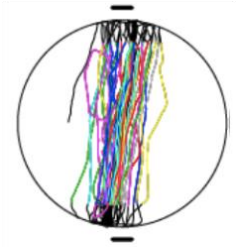
Population WT



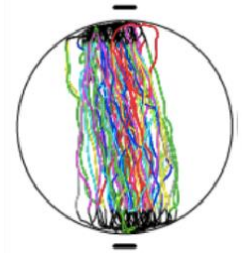
Population Silenced



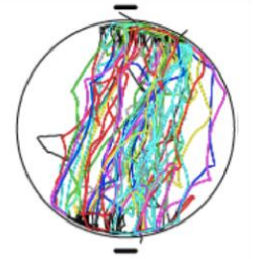
Individual 1



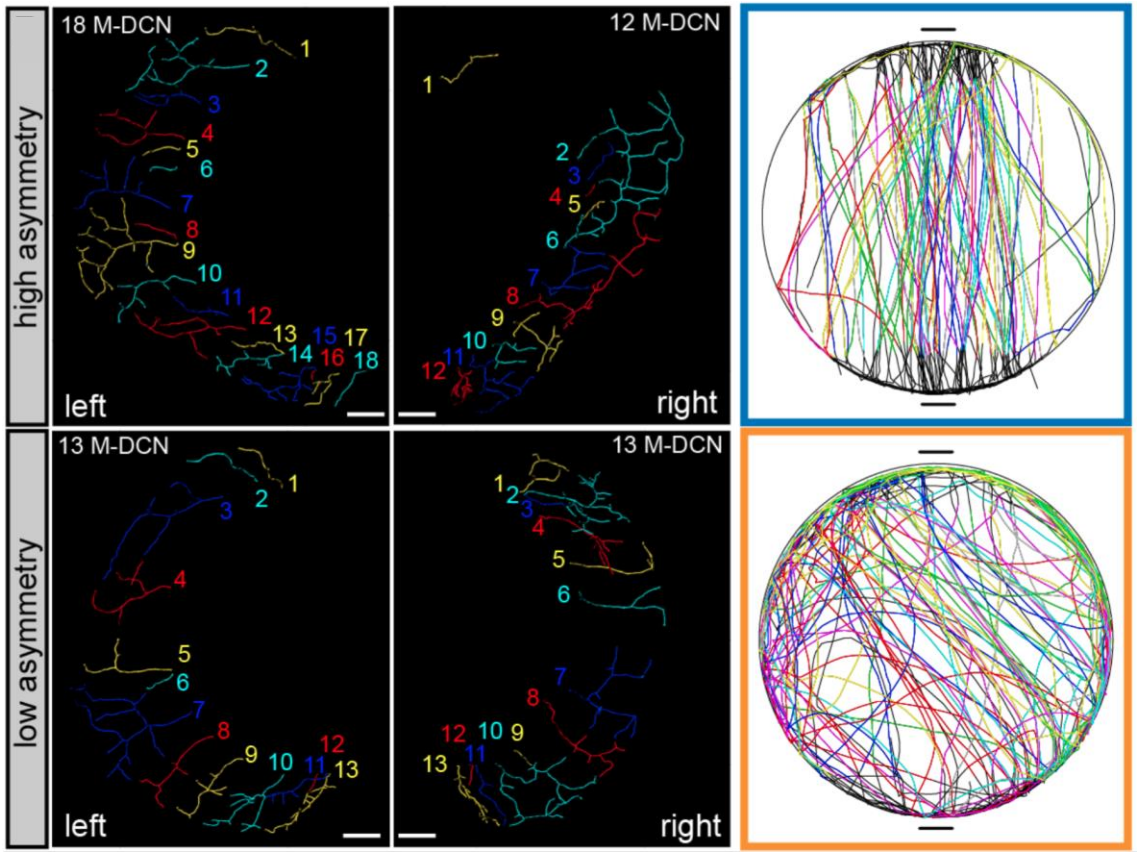
Individual 2



Individual 3



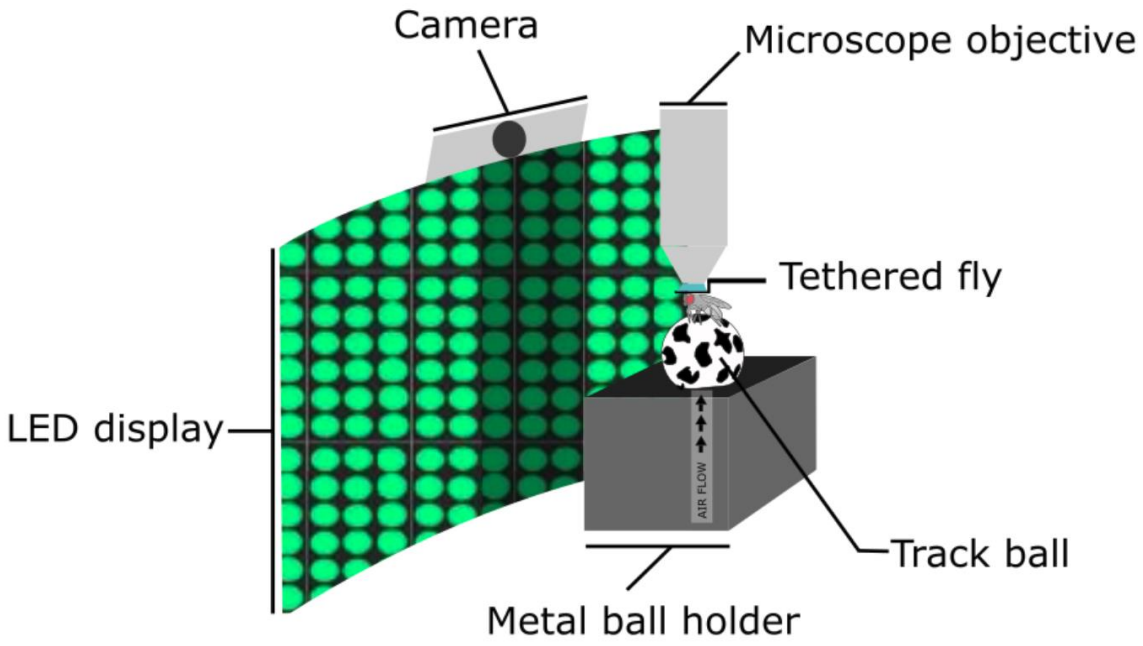
Individual 4



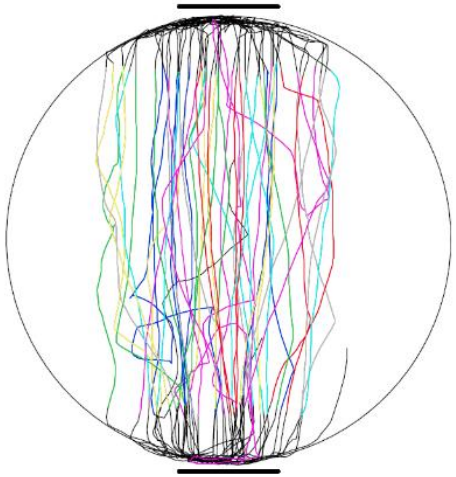
Linneweber et al. BioRxiv 2019

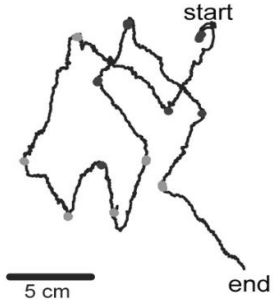
Neural substrates of individual variability in *Drosophila*'s innate fixation behaviour

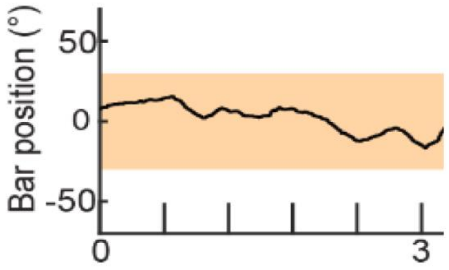
Alexandre Javier | University of Cambridge, Dept. of Zoology #24



Seelig et al. Nature methods 2010

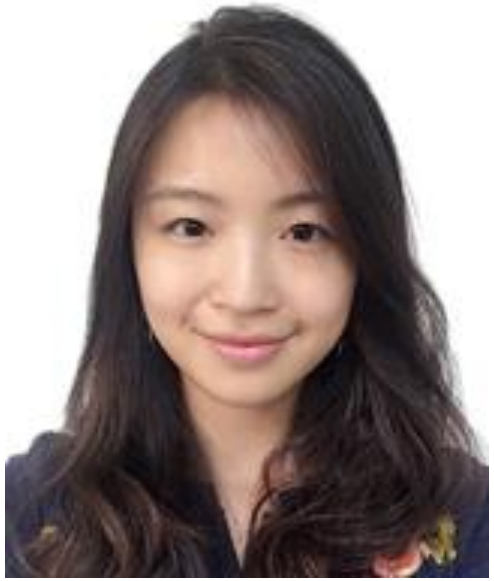






Thank you to Bassem Hassan & Mercedes Bengochea

Poster #31



Xizi Li

Inhibitory hebbian plasticity for robust stabilisation of recurrent circuits

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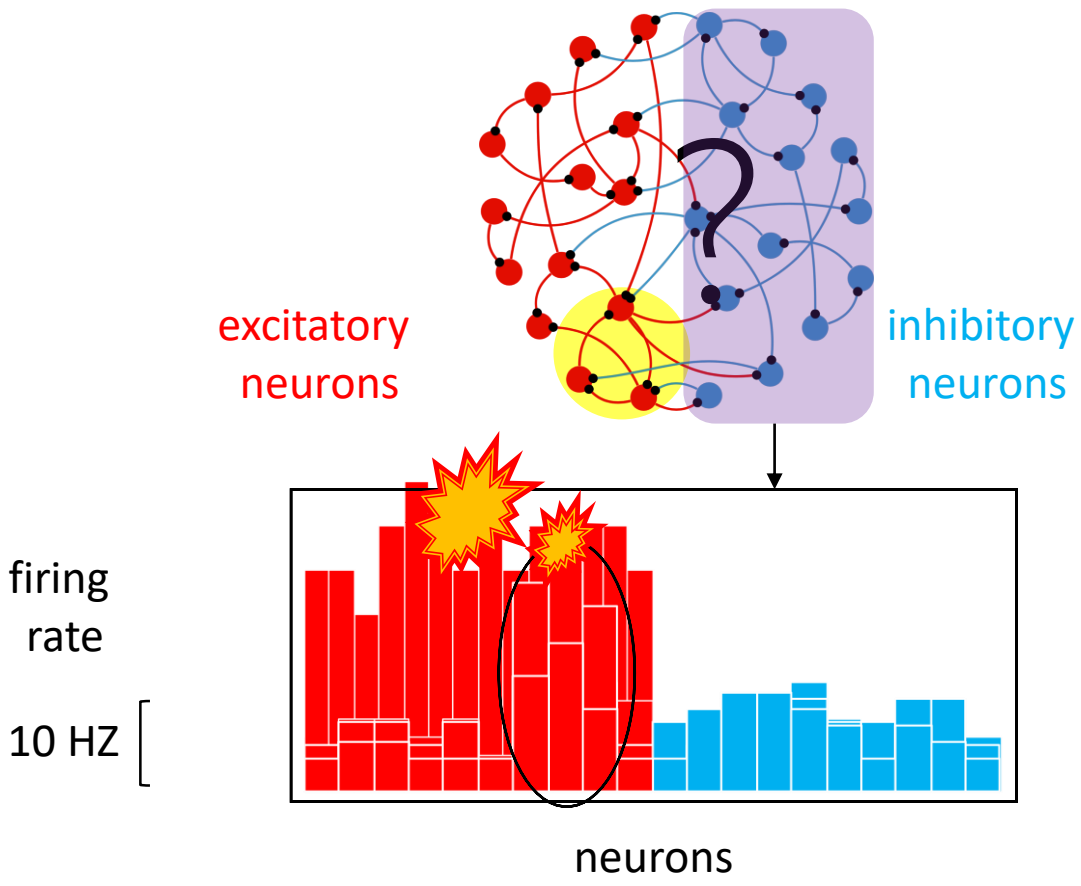
Poster #31



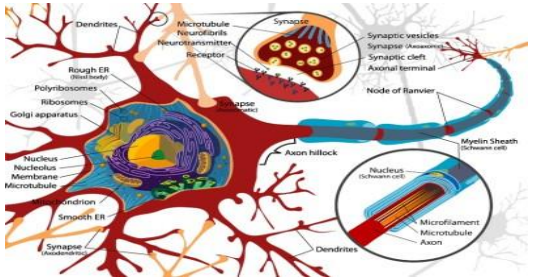
Can plasticity of inhibition maintain detailed, network-wide stability?
If so, how?

Poster #31

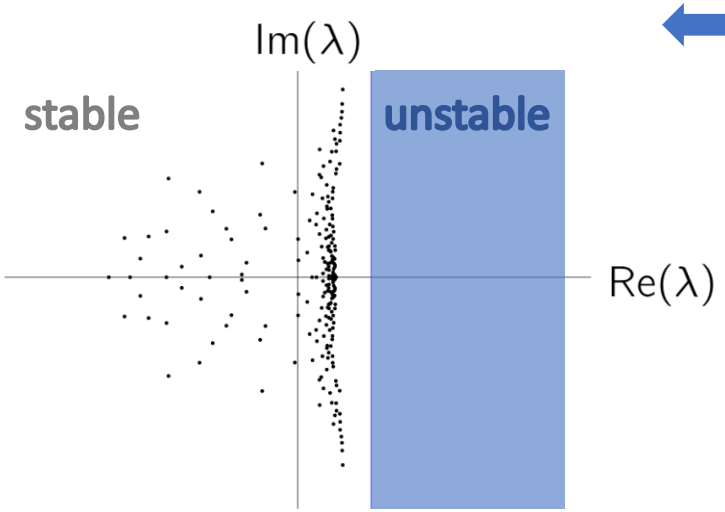
If the brain could precisely modulate its inhibitory synaptic pathways, how would it exploit this?

Engineering: optimal systematic balancing rule

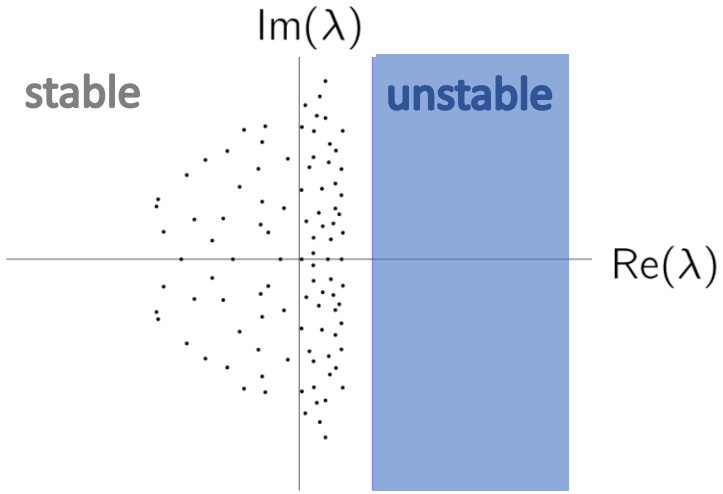
Biology: inhibitory Hebbian plasticity rule



Mathematical link



activity modes



as excitatory connections are strengthened

as excitatory connections are strengthened

Poster #43

Emma Morris

Neurochemical topology of the mammalian suprachiasmatic nucleus

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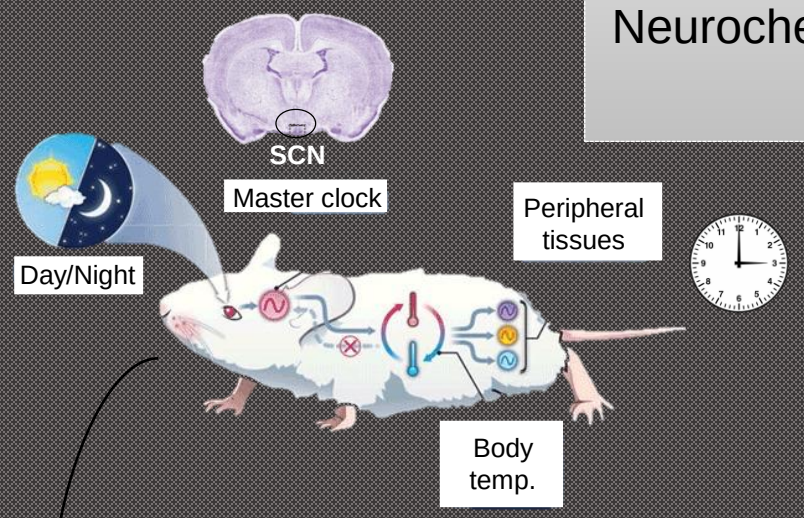
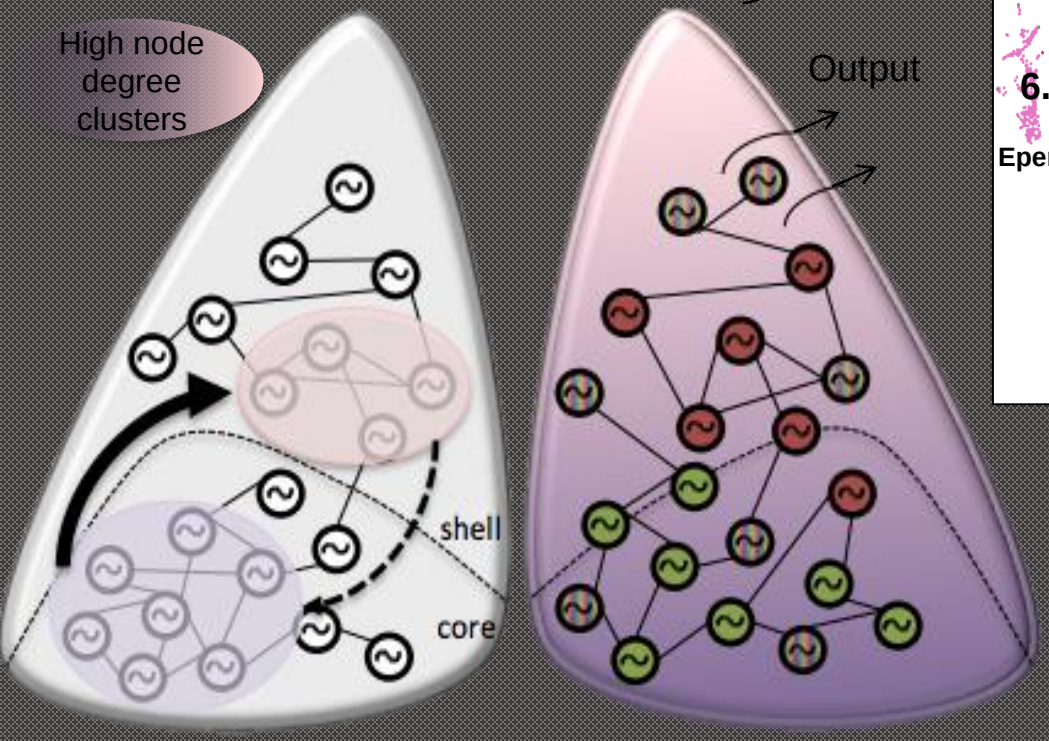
Neurochemical Topology of the Mammalian Suprachiasmatic Nucleus

Emma Morris
Dr Michael Hastings Lab, MRC LMB

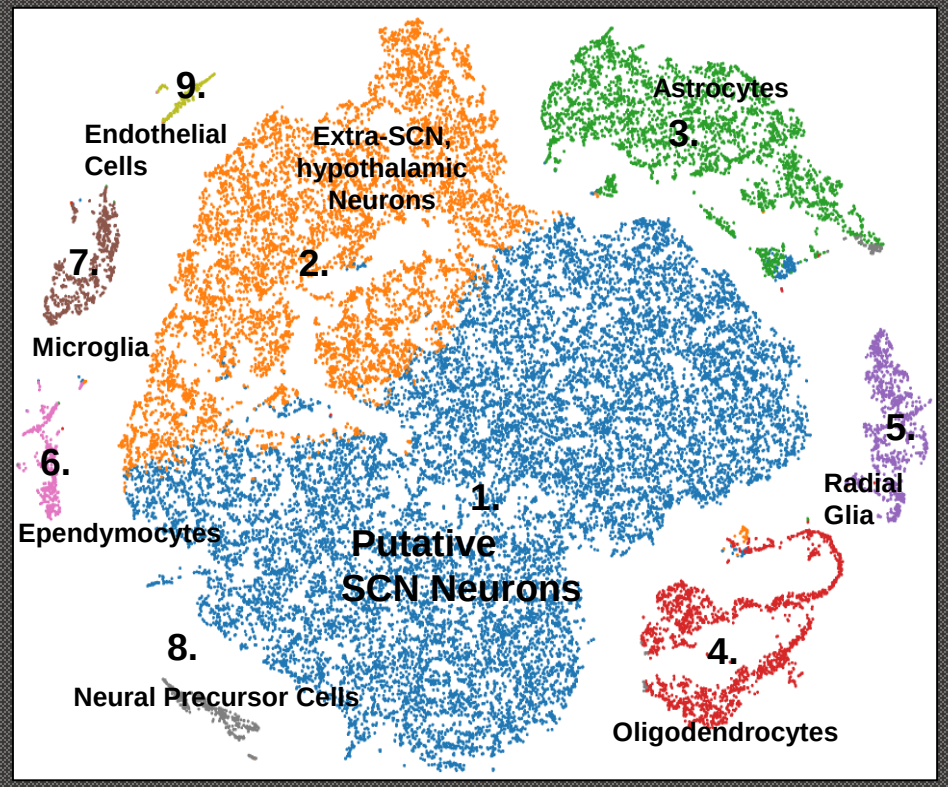
MRC Laboratory of Molecular Biology

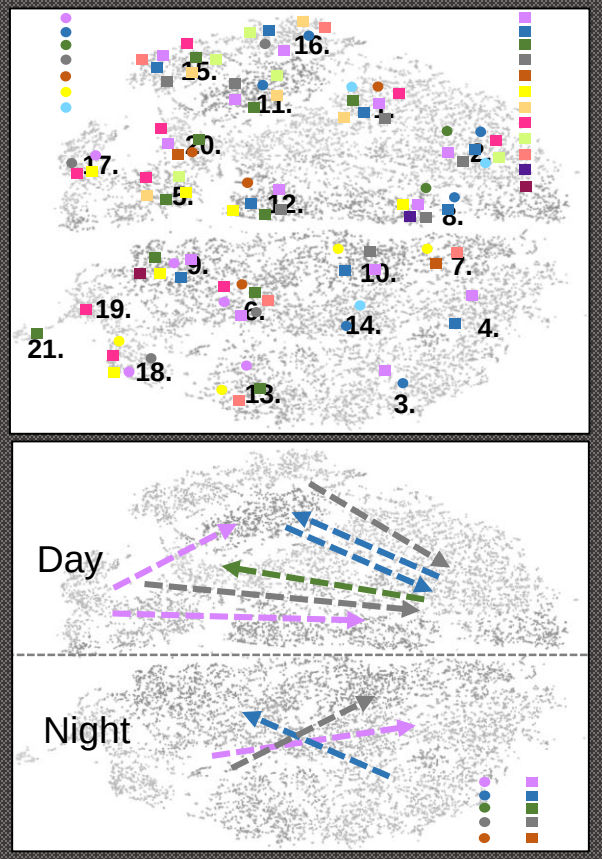


A putative SCN Network



Single Cell RNA Sequencing





a) molecular elements defining functional network components
b) signaling molecules connecting SCN network components
c) shift in neurochemical topology across circadian time

Poster #44

Tim Pearce

Representing uncertainty in biological and artificial neural networks

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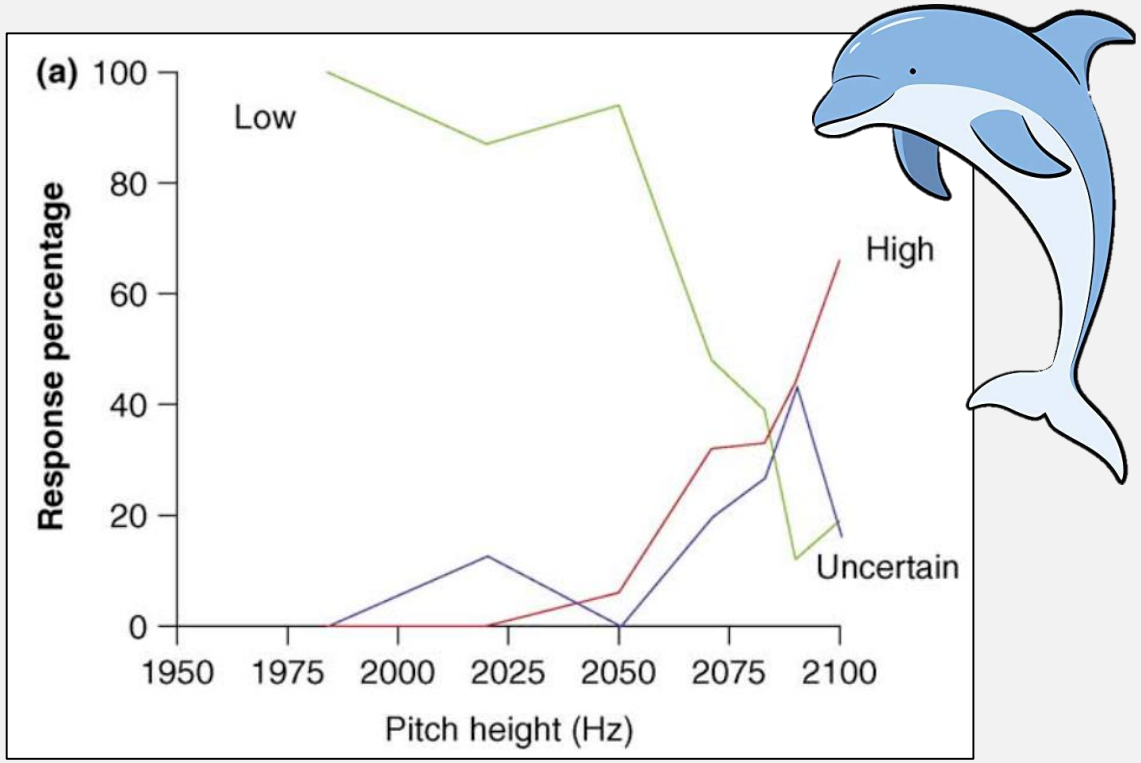
Brains as Bayesian Inference Machines

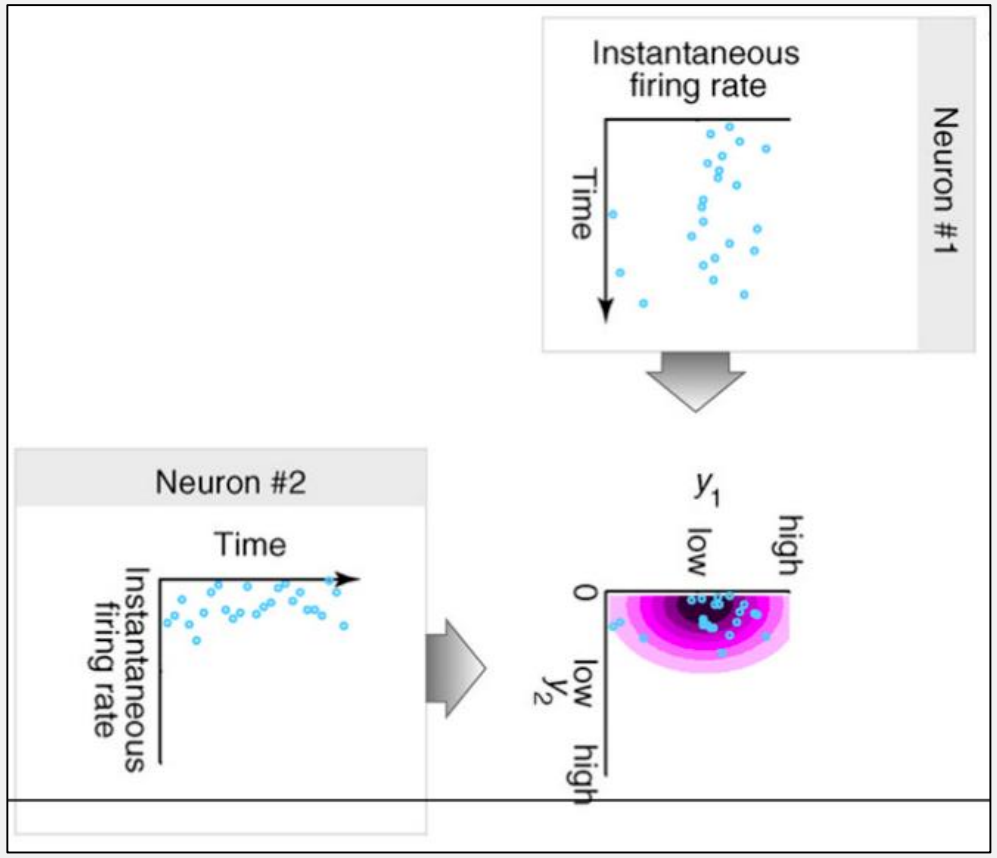
The brain represents sensory information in the form of probability distributions, updating by approximations of Bayes rule

Behavioural studies show some awareness of uncertainty



J. Smith, The study of animal metacognition, TiCS 2009

Plausible computational mechanisms for how this could be implemented in the brain



Fiser et al., Statistically optimal perception and learning, TiCS 2010

Representing Uncertainty in Biological and Artificial Neural Networks

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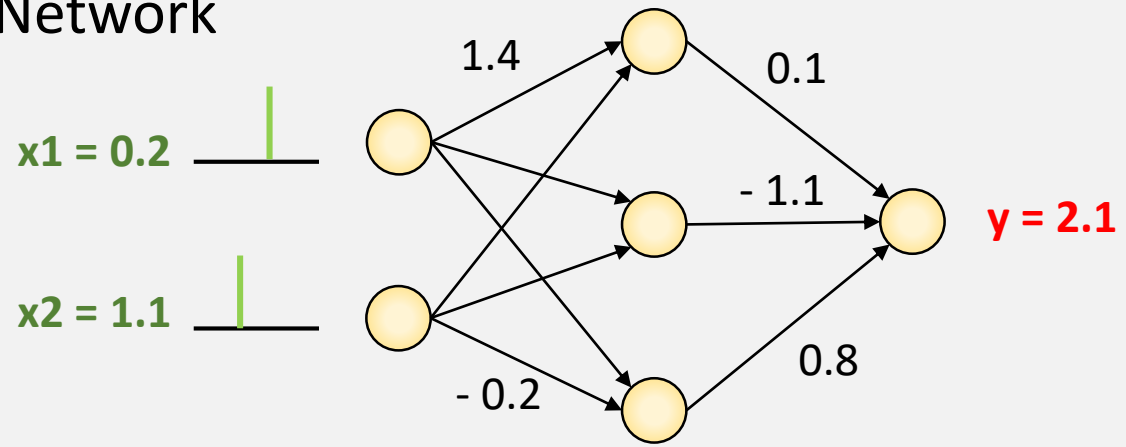
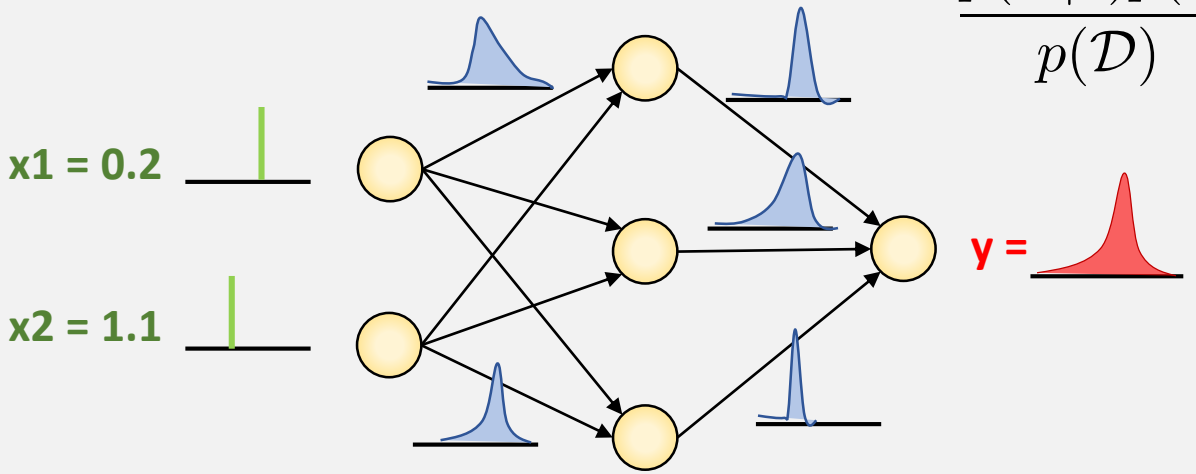
Tim Pearce @Tea_Pearce

Artificial Neural Network



Bayesian Artificial Neural Network

$$\frac{p(\mathcal{D}|\theta)p(\theta)}{p(\mathcal{D})}$$ Bayes Rule



How can an intelligence operate with uncertainty over its perceptions and knowledge?

Poster #55

Charline Tessereau

Towards understanding one-shot place learning in spatial navigation: A reinforcement learning approach

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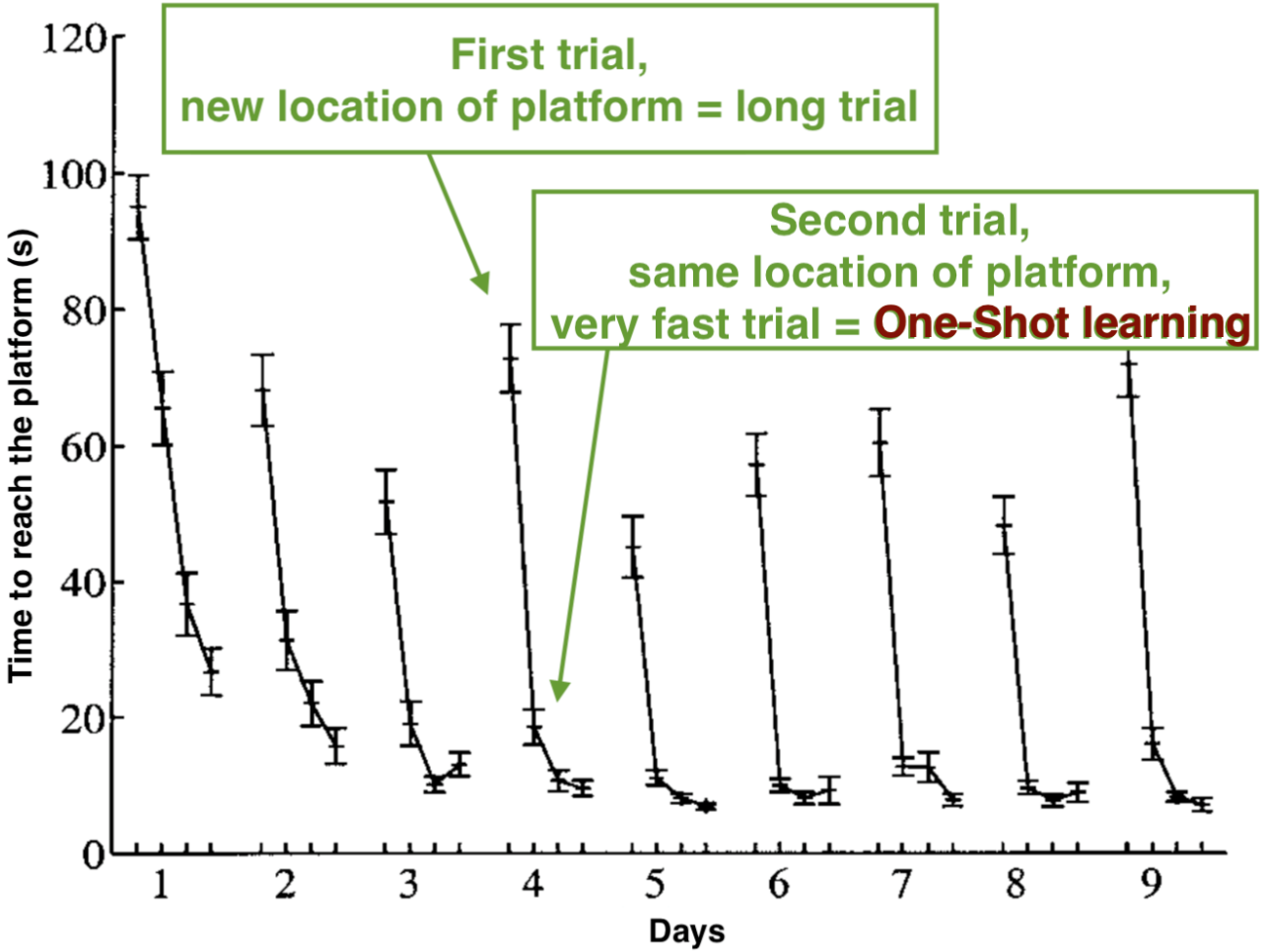
Towards understanding one-shot place learning: reinforcement learning approaches

Charline Tessereau| Maths @Nottingham | #55



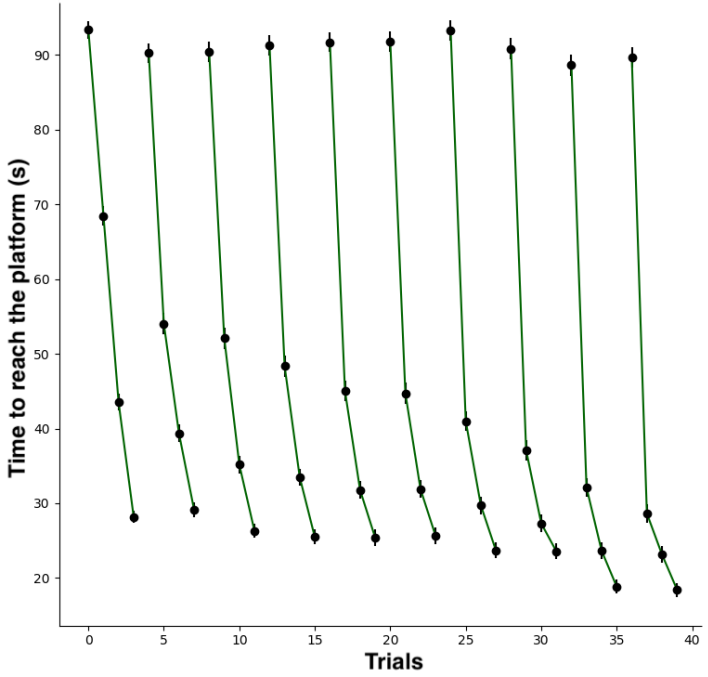
→ **Can we build biologically plausible models that would allow to reproduce these behaviours?**

University of Nottingham
UK | CHINA | MALAYSIA

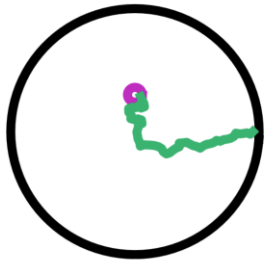
Towards understanding one-shot place learning: reinforcement learning approaches

Charline Tessereau| Maths @Nottingham | #55

Using Temporal-Difference learning :



Trajectory generated from the model:



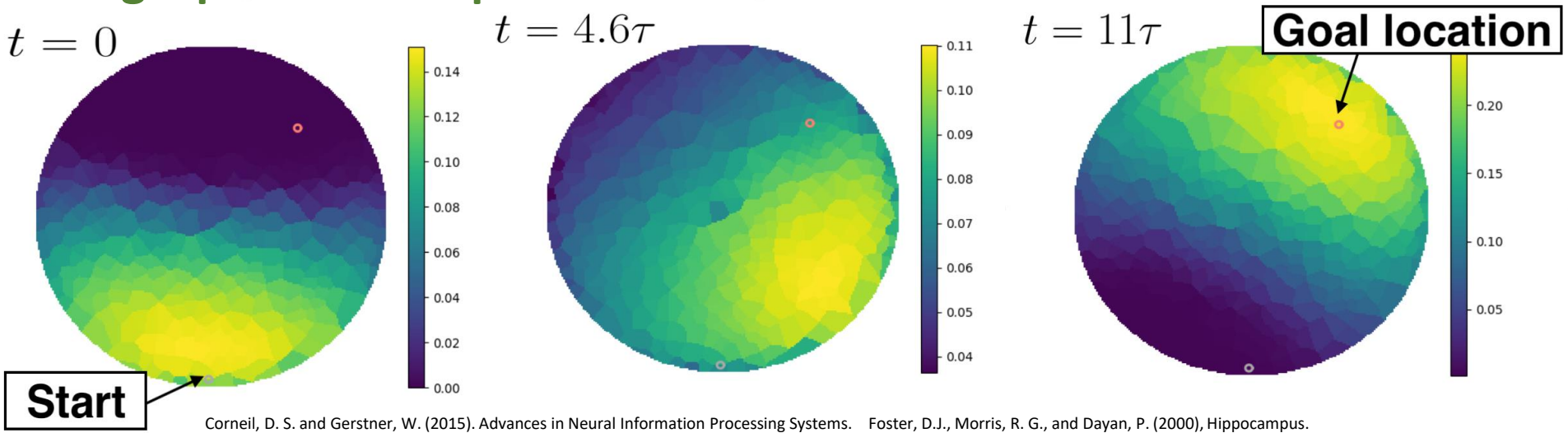
TD learning :
→ Quick, easy to compute
→ Low in flexibility

Predictive representation :
→ Biologically realistic
→ Long and costly to train

How to improve flexibility and biological realism?

What is a good representation for learning?
How do representations evolve with experience?

Using a predictive representation of the locations :



With :
Reuben O'Dea
Tobias Bast
Mark Van Rossum
Stephen Coombes

Corneil, D. S. and Gerstner, W. (2015). Advances in Neural Information Processing Systems. Foster, D.J., Morris, R. G., and Dayan, P. (2000), Hippocampus.

University of Nottingham UK | CHINA | MALAYSIA

Poster #60

Maggie Westwater

An examination of stress responses and inhibitory control in women with eating disorders

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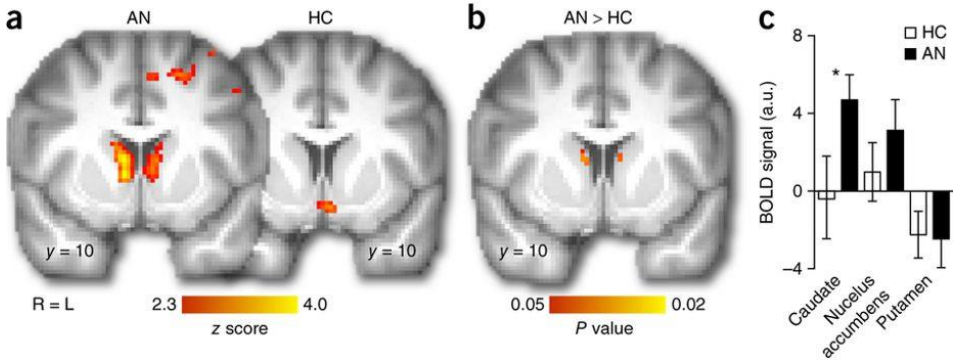
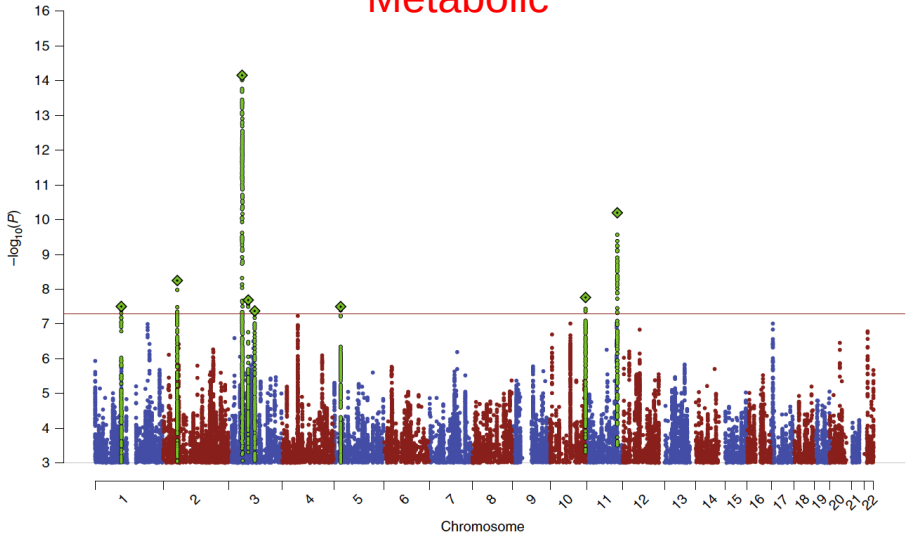
Eating disorders are serious psychiatric conditions with complex aetiology

Cognitive



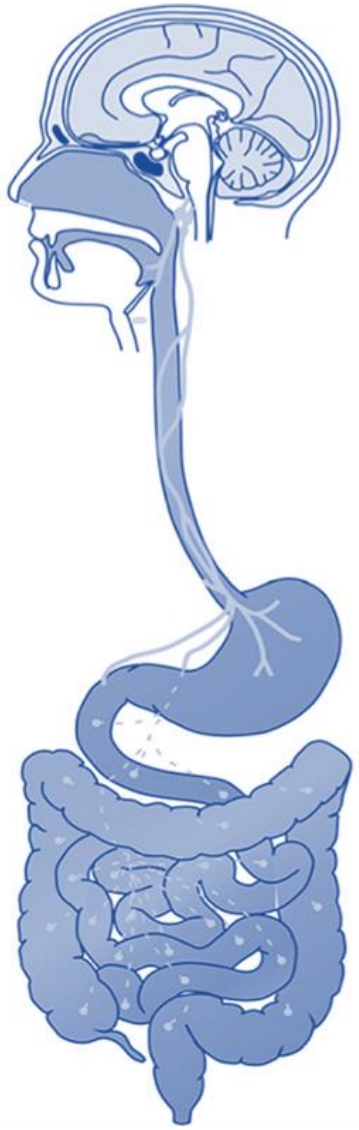
Foerde et al., 2015 *Nature Neuroscience*

Metabolic



Watson et al., 2019 *Nature Genetics*

Gut-brain axis



?

Stress

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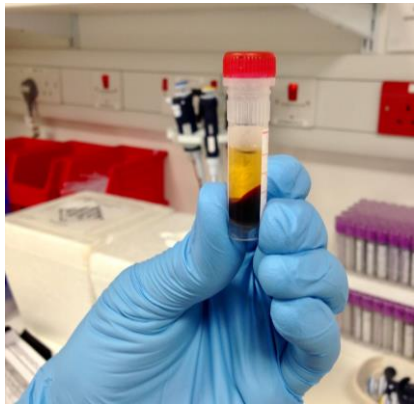
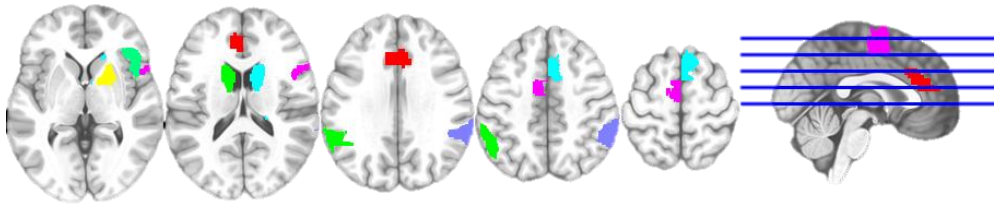
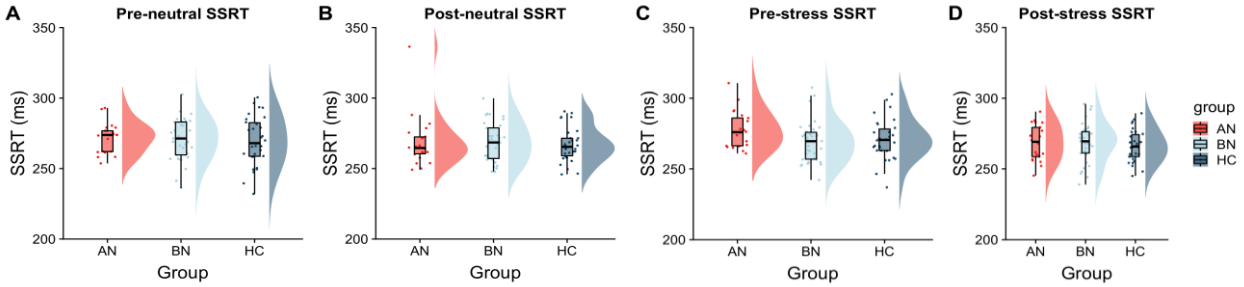
NIH Oxford-Cambridge Scholars Program

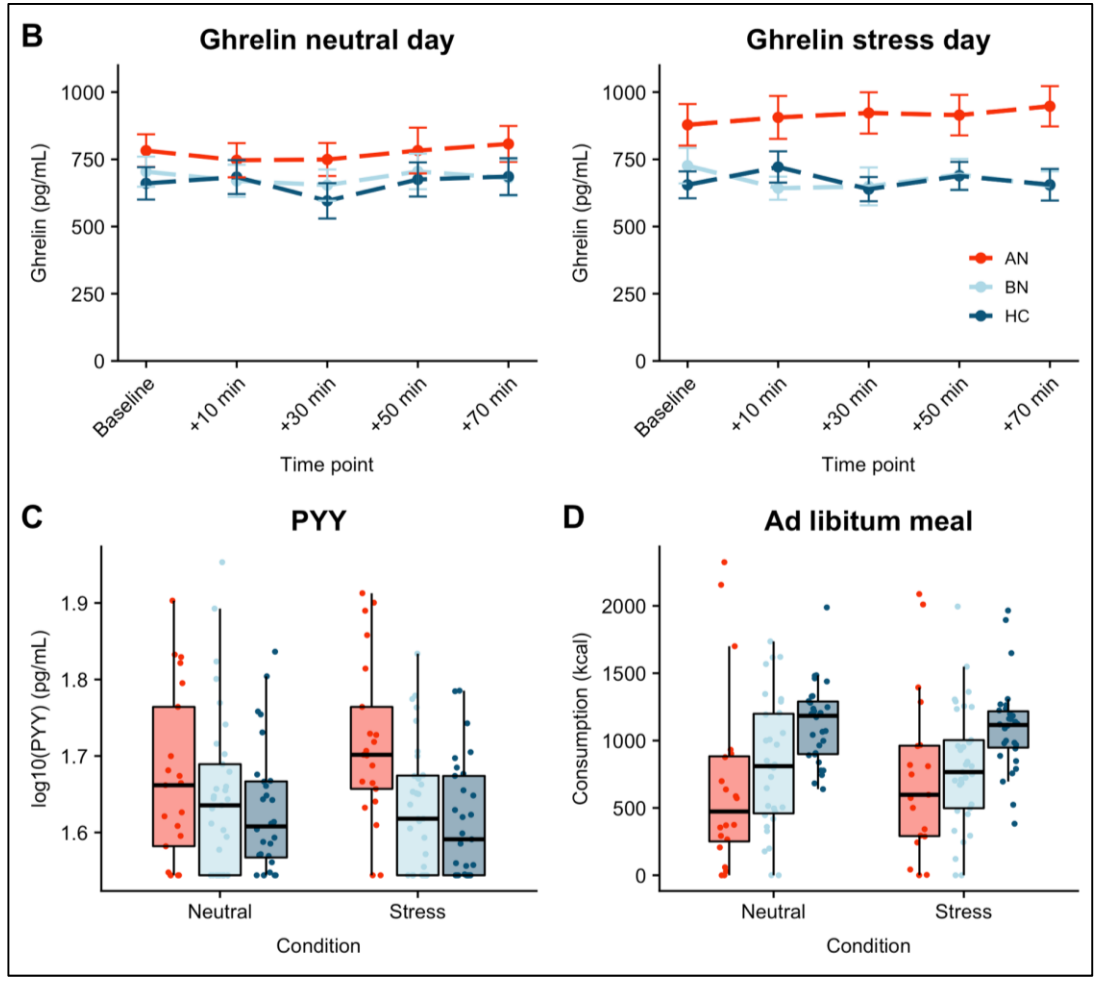


Response inhibition





Gut hormone disturbances in anorexia nervosa under stress



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Thank you!

Please enjoy all the posters

https://doi.org/10.6084/m9.figshare.9810551

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