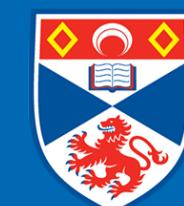


Graph matching with lobsters

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Introduction

THIS IS NOT THE ORIGINAL DOCUMENT, and was produced from a modified static source, in order to guarantee portability. The original source is available on bitbucket, and makes extensive use of PythonTeX. This also means you can expect PythonTeX to work nicely with this package and theme.

Monoaminergic systems are ensembles of neurons defined by the primary production of monoamine neurotransmitters (most prominently serotonin, dopamine, and norepinephrine).

- ▶ Their wide-spread projections have implicated them in numerous neuropsychiatric disorders (e.g. depression, anxiety, addiction, and schizophrenia).
- ▶ Their relevance to the control of neuronal function has made them targets of many therapeutic drugs (e.g. monoamine reuptake inhibitors) and drugs of abuse (e.g. amphetamines).
- ▶ A high degree of evolutionary conservation makes them excellent candidates for translational research in rodents.

The current project aims to establish opto-fMRI as an assay for monoaminergic systems. This assay will help elucidate the functional mechanisms of psychotropic drugs, and facilitate the establishment of functional connectivity and inter-connectivity models for these most pervasive neuronal systems.



Figure 1: Serotonergic (green), dopaminergic (red), and noradrenergic (blue) nuclei and significant projections [?]



Figure 2: Ascending serotonergic projections alone innervate the majority of cortical and subcortical areas [?]

Objectives

Obs

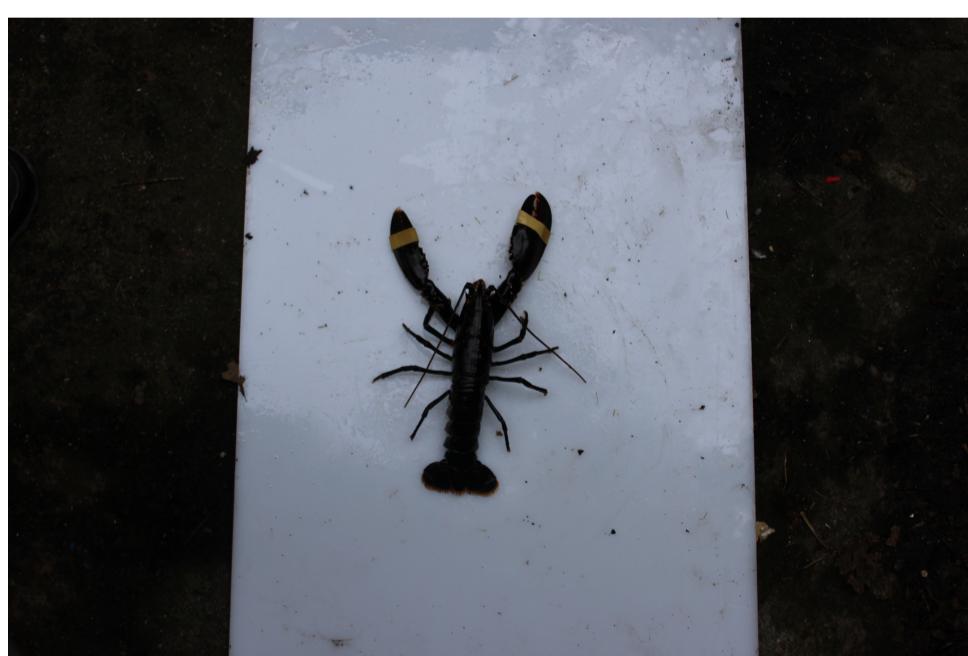


Figure 3: Band-pass filtered pulse-train-resolved first-level design model, with pulse trains represented in cyan.

- ▶ Opto-fMRI can be used to analyze chronic SSRI effects on serotonergic transmission - by modelling the effect of treatment on individual pulse trains, or the interaction effect of treatment and pulse train number on series of pulse trains (as seen in figure 3).
- ▶ The large-scale readout capacity of opto-fMRI can also detect whether there are regionally varying effects of chronic SSRI administration (and consequently allow a functional characterization of neuronal subpopulations of the dorsal raphe).

Methods

Optogenetic stimulation requires a number of preliminary procedures, including the breeding of genetically modified mice, the targeted infusion of a light-gated protein (ChR2) expressing viral vector, and the targeted implant of a durable optic fiber ferrule.



Figure 5: (a) Optic fiber implant targeted at the serotonergic dorsal raphe (DR); histological validation of the ChR2 construct expression: (b) localized to the DR and (c) colocalized with serotonin. Data from Saab and colleagues, unpublished.

For robust genotyping we have designed 2 multiplex-compatible primer pairs for the Cre recombinase (transgene construct) and GAPDH (positive control). These are listed below, alongside a genotyping assay featuring 3 controls (water, known transgene, and known wildtype - on the first, second-to-last and last non-ladder lanes respectively):

Direction	Target Construct	
	Cre	GAPDH
fw	ACCAGCCAGCTATCAACTCG	CTCCATTTCCTGTTCTCC
rv	TGCCCCCTGTTCACTATCC	GAGACCTGAATGCTGCTTCC



To facilitate multimodal and exploratory data analysis, LabbookDB - a relational database structure - was developed to replace the common lab book and integrate metadata directly with analysis tools. In order to facilitate rapid, cheap, and flexible access to the high computing power needed for exploratory fMRI analysis, a cloud-computing GNU/Linux image, NeuroGentoo was created; and populated with a multitude of neuroimaging package atoms.

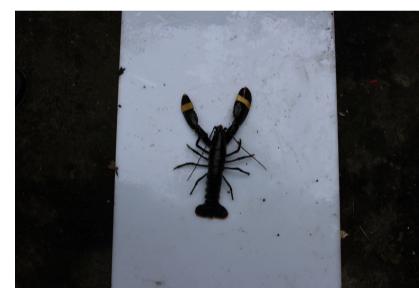


Figure 6: NeuroGentoo Logo; for the software repository see: github.com/TheChymera/neurogentoo



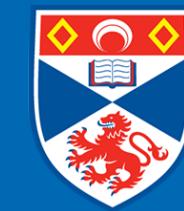
Figure 7: Generic DB logo (CC BY-NC-SA Barry Miény); for the software package see: github.com/TheChymera/labbookdb

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