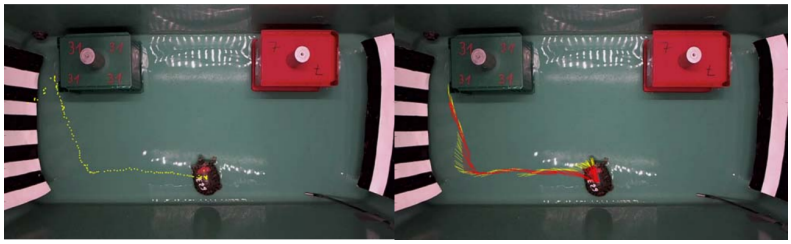
6-week projects

Animal tracking: Turtles in mazes: markerless tracking

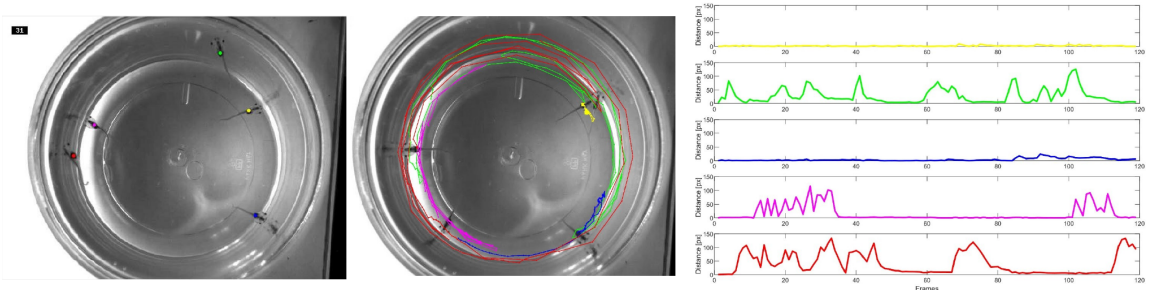
Data: Video data of turtles engaged in a visual discrimination task **Methods:** Use software tools (e.g. Deep Lab Cut) to track turtles (head, center of mass) **Analysis:** Use tracked data to determine head movement relative to center of mass during different behavioral states (e.g., visual exploration, movement), calculate speeds, task performance, other behavioral patterns. Can be extended to 9-weeks.



(a) Visual discrimination task; tracking

Animal tracking: Tadpole behavior: multi-animal tracking

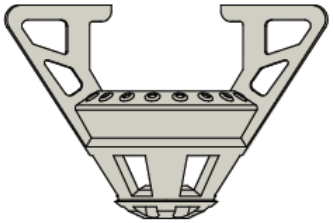
Data: Video data of small groups of tadpoles (3-10 animals) recorded continuously for 3-5 days **Methods:** Use image processing techniques to improve data contrast, develop software tools to track individual animals, compare to idtracker.ai, DLTdv digitizing tool. **Analysis:** Use tracked data to determine circadian rhythms, entrainment to light cycle, group dynamics. Can be extended to 9-weeks.



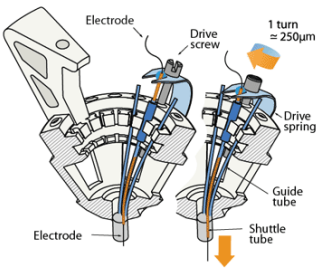
(a) Tadpole tracking (DLTdv tool)

Develop 3-d printable drive-body for 16-channel tetrode array

Methods: Using inspiration from the OpenEphys flex drive, design a 3-d printable tetrode drive body to interface with the Neuralynx EIB-16. Design for use and testing in zebra finch.



(a) OEPS drive body front



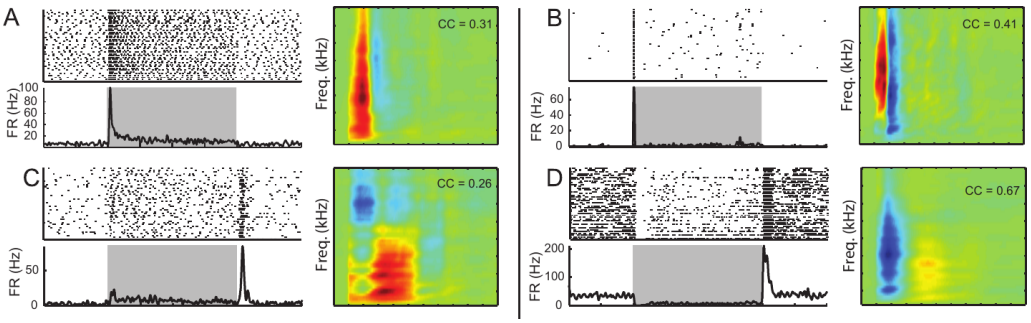
(b) OEPS drive body overview

(c) 16-channel EIB

9-week projects

Auditory forebrain data: receptive field estimation

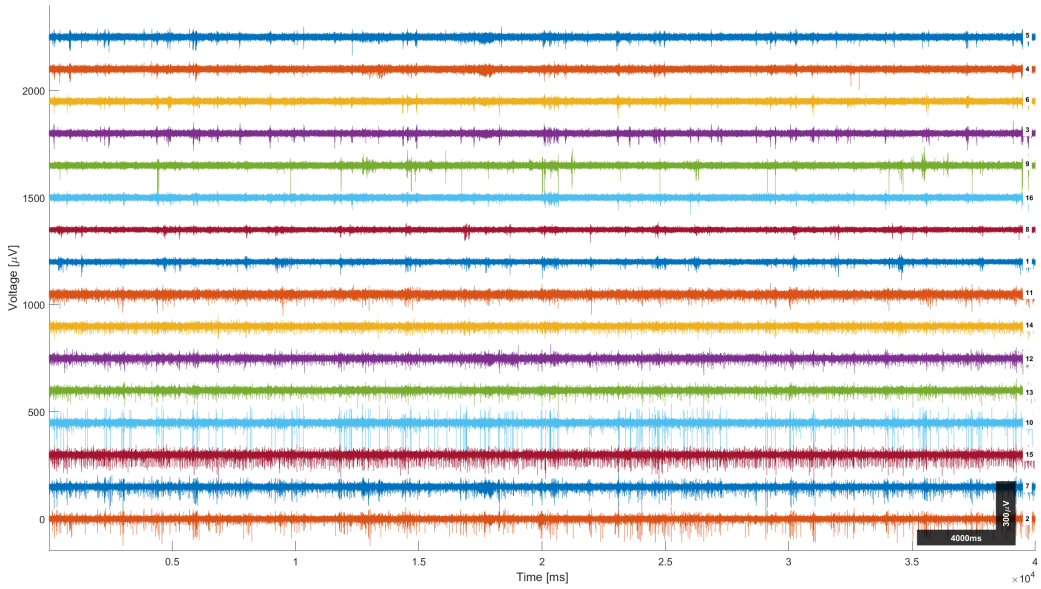
Data: Extracellular recording in response to natural, artificial sounds in anesthetized zebra finches **Methods:** Develop methods to estimate spectro-temporal receptive field (STRFs); generalized linear models, etc **Analysis:** Estimate auditory receptive fields



(a) White noise response and STRFs

Spike sorting methods

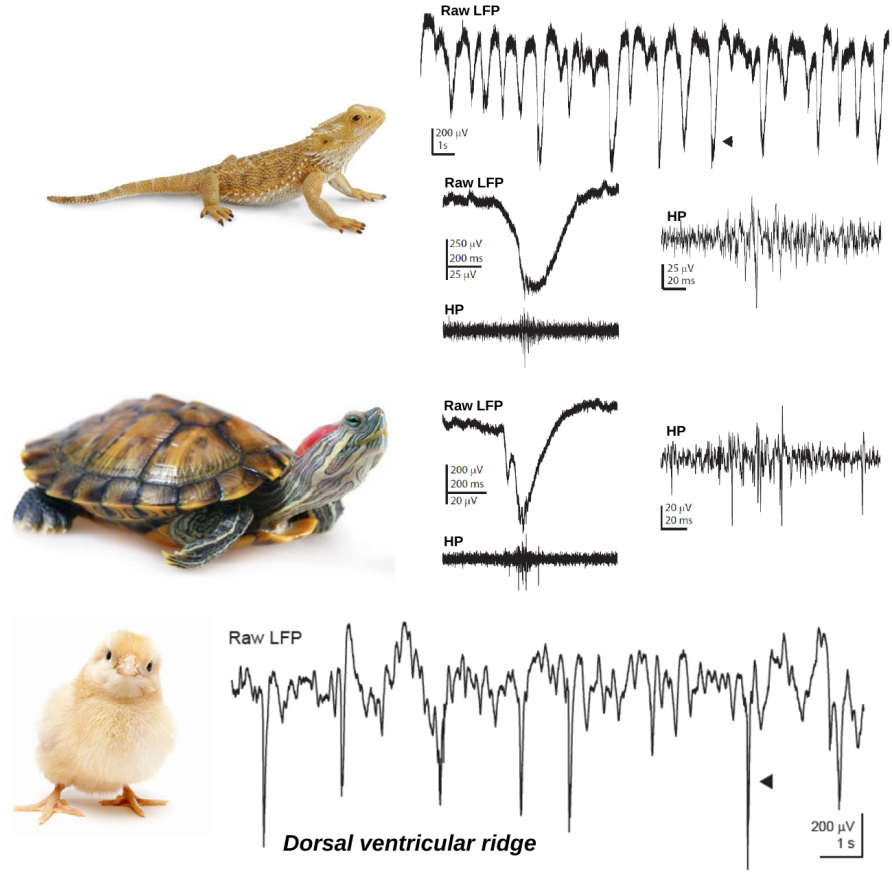
Data: 16/32-channel local field potential (LFP) recordings from turtle/birds **Methods:** Use existing software (e.g., Kilsort 2, IronClust, etc) to sort spikes, or develop own methods **Analysis:** Detect spikes, control for drift correction, processing speed, etc; requires gpu computing capabilities



(a) 16 channels, high-pass filtered LFP

Sharp wave detection across species

Data: LFP recordings from turtle/lizard/birds that contain sharp wave events **Methods:** Neural networks, random forest, unsupervised learning, etc **Analysis:** Robustly detect sharp waves based on spectral components of LFP signal **Analysis:** Extend python code (documentation, validation) written by Sebastian Burgkart (optional)



(a) Sharp waves in reptiles and birds

7. Develop closed-loop, real-time sharp wave detection and stimulation plugin

Methods: Using inspiration from open source initiatives, implement a closed-loop, real time sharp wave detection and stimulation plugin for use with the OEPS acquisition GUI. Detect detect sharp waves in real time and trigger electrical stimulus to perturb SWR. Test in anesthetized zebra finches.