# Research

## Research Overview

The Mechanisms Underlying Behavior Lab is interested in understanding the neural, genetic and molecular mechanisms underlying animal behavior. We use a small, translucent vertebrate (zebrafish) that allows one to perform precise genetic manipulations and optical imaging of neural activity at a high resolution. The focus is on bringing ethologically relevant behaviors motivated by either appetitive or aversive cues into a laboratory setting, and analyzing them using a combination of behavioral assays, in vivo live, brain-wide or microcircuit activity imaging, neuroanatomy, electrophysiology, immunohistochemistry, and molecular biology. Behaviors of interest include social behavior, predator avoidance, and olfactory processing.

Studies in the Mathuru lab traverse multiple levels. At the level of molecules, a major interest is to identify the chemical nature of kairomones that function as alarm 'pheromones' in zebrafish. At the level of circuits, the lab is interested in dissecting the steps involved in olfactory processing of alarm cues eventually culminating in the alarm behavior.

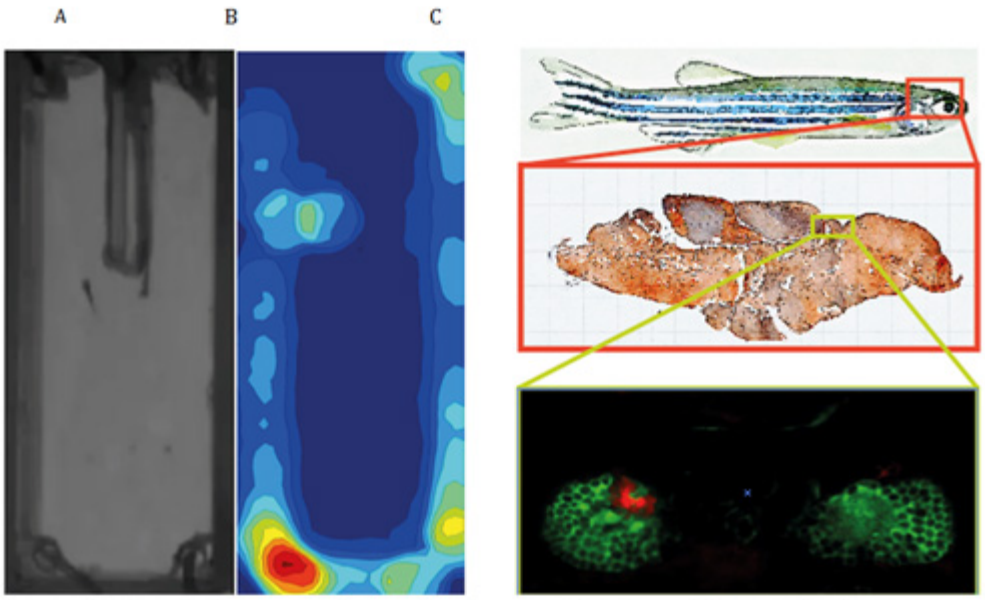
At a systems level, the interest is to understand the neural substrates processing rewarding and aversive events. The habenula-IPN circuit's role in either context is one such area of interest for the lab. This highly conserved vertebrate circuit has been proposed to have a role in depression as well as in developing smoking dependence in humans. Current studies in the lab focus on nicotine, an unusual psychostimulant with a direct route into the reward/aversion processing brain regions via the nicotinic acetylcholine receptors. This interest has sparked off both translation and societally important clinical objectives that the lab is now pursuing actively. More broadly, studies using nicotine are a window into the fundamental nature of addiction and decision-making.

Finally, at an organismal level the interest is to study the neural and genetic mechanisms by which social information is processed and how this information influences behavior of individuals.

For more information visit - https://mechunderlyingbehavior.wordpress.com/

http://www.yale-nus.edu.sg/about/faculty/ajay-s-mathuru/

Figure




To understand the neural mechanisms underlying different behaviors, we combine analysis of behavior using custom designed assays (examples on the left of – A) a 2-choice chamber setup and B) heatmap showing place-preference), with C) genetic manipulation and physiological studies of neural activity (artistic rendering depicting studies of specific circuits of interest involed in reward processing such as the habenula–indeterpeduncular nucleus.)