

## Master thesis projects in Engineering, Physics and Mathematics at NTNU 2017-2018

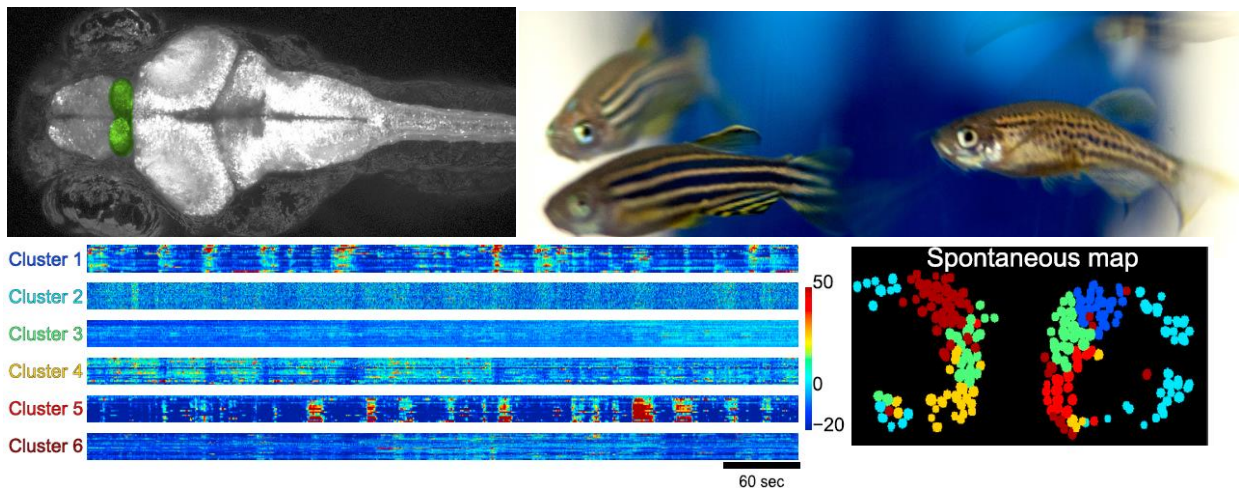
**Project title/topic:** Studying the function of neural circuits in zebrafish brain

**Number of students wanted:** 2

**Main supervisor:** Emre Yaksi, emre.yaksi@nerf.be

### **Background:**

The main goal of our laboratory is to understand the fundamental principles underlying the function and development of neural circuits in a small and genetically tractable model organism, the zebrafish. In order to accomplish this goal we exploit chemosensory systems. We develop and use novel technologies and analytical methods to monitor, dissect and perturb the neural circuits of developing and adult zebrafish brain.



### **Objectives:**

The main aim of our laboratory is to understand how the chemosensory world (smell and taste) is represented in the brain and how these computations regulate different behaviors (e.g. fear, arousal, feeding). Moreover, we are interested in understanding how these representations are modulated by the behavioral states of animals (e.g., hunger, stress) as well as other sensory modalities (e.g. vision or sound). We focus on the brain areas that integrate information from multiple sensory modalities and closely relate to behavior (e.g. habenula, brainstem, telencephalon). The small and accessible brain of zebrafish provides an exceptional framework for studying the neural circuit computations across multiple brain regions.

Together with the masters student

- 1) we will use applied mathematical tools to analyse neural data from thousands of individual neurons. Our goal is to find identify patterns of activity such data sets that are representing different behavioural states of animals (stress, learning, fear, hunger etc). Moreover we will use graph theory or similar approaches to infer brain connectivity and identify how this connectivity is changes as animals learn new tasks
- 2) We will build and use optical system to monitor and control brain activity using light switchable proteins. The optical systems will range from microscopes to spatial light modulators

**Methods:** The main methods that are used in our lab are: Two-photon microscopy, optical systems, Optogenetics, Electrophysiology, Applied Mathematics, Behavioral assays

**Student requirements:** Masters Students in Engineering, Physics and Mathematics with solid background in programming, optical systems or instrumentation are highly preferred.

**More information:** Please see [www.yaksilab.com](http://www.yaksilab.com)