Integration of sensory-evoked and spontaneous activity in zebrafish forebrain

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Our core interest is to understand how sensory information interacts with the internally generated dynamics of the brain, representing animals' behavioral states. To achieve this, we image neural activity from thousands of individual neurons in behaving animals and try to interpret these neural data sets by using simple applied mathematics. We also perturb neural circuit activity by using genetic and optical methods.

We focus on habenula, a conserved brain region associated with predicting potential outcomes, learning and mood disorders. We revealed that habenula act as a major hub integrating sensory information with the internal dynamics of the brain. We showed that different subnetworks of this circuitry are born during distinct developmental stages and serve different functions. Finally, we showed that perturbation of these circuits interferes with the animals' ability to integrate new information during learning.