Abstract:

Computational psychiatry is emerging as a field that bridges basic and clinical neuroscience using computational and biophysical modeling. Current pharmacotherapies for psychiatric disorders are limited by our lack of understanding of underlying biological circuit and network dysfunction. Computational neuroscience originally emerged as a research field for the study of sensory processes, however, recent advances in single-unit recording, neuroimaging and computational modeling have opened up the study of executive functions related to decision-making, particularly within the prefrontal cortex. In this talk I will describe how advancements in the field of neuroeconomics can contribute to quantifying different categorical traits of psychiatric disorders, such as attention-deficit hyperactivity disorder (ADHD), and may lead to better prescription and dosing methods. Impulsivity is a cardinal symptom of ADHD, which has been linked to alterations within the dopaminergic system, and is treated predominantly with psychostimulants that alter dopamine neurotransmission. Approximately 11% of children 4-17 years of age are diagnosed with ADHD in the USA. Importantly, 70-75% of those children are treated with psychostimulants such as methylphenidate (MPH), one of the drugs most extensively used for the treatment of ADHD. Fundamental questions about the effects of psychostimulants on diminished cognitive flexibility, and aversion to delayed reward remain unanswered due to a general acceptance of clinical efficacy without rigorous models bridging the underlying biology and behavior. Our behavioral and electrophysiological efforts have focused on the study of Rhesus macaques that represent the closest model to human higher order cognitive functions such as decision-making and reward processing. I’ll describe our progress combining behavioral pharmacology, electrophysiology, and mathematical modeling techniques to move toward a rigorous computational characterization of impulsivity and a rigorous measure of the effects of MPH that can ultimately be related to humans.