From Rats to Primates to Networks and Back Again

With support from the NSF-sponsored CELEST Center for the Science of Learning, research led by **Kathleen Kantak** seeks to understand how rats with normal and abnormal brain function learn to achieve goals, form habits and behave flexibly. The first part of this project involves a comparison of normal rats and Spontaneously Hypertensive rats (SHR). Kantak had already found that the SHR rats had difficulty with working memory (keeping track of what they were doing), and that they had trouble changing their behavior and learning new habits (Kantak et al., *Behavioral Neuroscience* 2008.) To what degree were these problems related?

By comparing the two types of rat as they learn a cognitive task, Kantak will try to find out if changes in dopamine transmission in two different areas of the brain can affect how flexible an animal's behavior is and how it forms habits -- and whether these two parts of the brain influence each other, or whether they work independently. The results of these rat experiments will inform research led by other CELEST faculty, **Earl Miller** and **Daniel Bullock**. In the Miller lab, recordings of neural activity will be taken from monkeys trained in neurocognitive tasks similar to the ones the rats will learn. The experiments in rats and monkeys will help us understand if dysfunctions in one part of the brain are caused by dysfunction in another. Together, these findings will be used in neurocomputational research in the Bullock lab to refine a computer model of the brain circuits that help animals achieve goals, form habits and behave flexibly. Model predictions could then be tested in new experiments in rats and monkeys. This work has implications for how such circuits function in learning when the systems are normal as well as abnormal, as in Attention Deficit Hyperactivity Disorder (ADHD).

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Added Value

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High Risk Research

multiple approaches
multiple investigators
vibrant environment to help guide research and fully develop its potential

Iterative Research Process

**Linking Experimental and Computational Work is Possible
Only through CELEST**