

Eric Kandel, MD



Columbia University
Molecular Biology, Neuroscience

Summer Lab Size: 30

Local Summer Program: <http://www.spurs.columbia.edu/index.html>
Program Dates: June 5-August 4, 2017 (Dates for 2018 should be similar; Note: 10 weeks will be required)

Molecular Basis of Drug Abuse and Posttraumatic Stress Disorder

The lab works on two interrelated projects concerning the molecular basis of drug abuse, the molecular basis of post-traumatic stress disorder (PTSD), and the factors leading to comorbidity of drug abuse and PTSD. The Gateway Hypothesis describes the sequence of steps whereby use of one class of drug, for example, cigarettes (nicotine), precedes the use of other drugs, such as cocaine. We test the molecular basis of this model in mice and rats. Our approach is further based on the evidence that addiction shares molecular steps and molecular logic with long-term memory. We have also identified a mouse model of PTSD where loss of a particular gene leads to a sex-specific increase in stress response. The student will be performing basic biochemistry and molecular biology to further elucidate the role that the molecules involved in memory play in addiction and PTSD.

Molecular Mechanisms of Synaptic Plasticity, Learning, and Memory

Neurons communicate with one another via physical connections known as synapses, and it is widely believed that stable changes in synaptic strength underlie our ability to learn and to establish long-term memories. These enduring changes in synaptic efficacy are brought about by both transcriptional and translational processes, which together regulate the composition of proteins in the neuron. Multiple projects in the lab aim to gain a better understanding of the molecular underpinnings of these processes. Foremost is our discovery that the molecules involved in the persistence of memory storage seem to act as functional prions. We also examine how these processes break down with age, leading to age-related memory loss, and how deficits lead to psychiatric disorders such as schizophrenia. Students will gain experience with a variety of molecular and biochemical techniques, including recombinant protein purification, quantitative PCR, Western blotting, immunoprecipitation, and fluorescence in situ hybridization. Opportunities may also exist for learning confocal microscopy and neuronal cell culture.