

The Effects of Environmental Antibiotic Exposure on Epigenetic Regulation in the Brain

Erica Korb, PhD (PI)

Abstract

A fundamental challenge in neuroscience is understanding the mechanisms through which our external environment affects the brain. We work at the intersection of neuroscience and epigenetics with the overarching goal of understanding how the epigenetic regulation in neurons links external inputs to neuronal function. Our lab focuses on chromatin, the complex of DNA and histones proteins, which package DNA into organized structures and control access to genes. We seek to understand how the world around us influences the chromatin landscape and how these changes affect neuronal gene expression and animal behavior. Here, we will focus on the role of one specific environmental influence, antibiotic exposure, in modulating chromatin regulation and memory storage in the brain. It has become increasingly clear that the widespread use of antibiotics throughout the food production industry may affect human health. Recent work has demonstrated that antibiotic exposure has drastic effects on the gut microbiome which in turn affects chromatin modifications and gene expression. While this was previously only assumed to be relevant to cells in the digestive tract, our preliminary data demonstrate that the brain is also affected by these changes. Furthermore, a rapidly growing body of evidence suggests that changes in the gut microbiome can modulate brain function and behavior. However, the mechanisms through which this occurs largely remain a mystery. Our work suggests that depleting the microbiome through environmental exposure to antibiotics may affect epigenetic regulation in the brain. We propose to study the effects of antibiotic exposure on the neuronal epigenome and on our ability to learn and form lasting memories. The work we propose here will uncover new mechanisms linking the gut microbiome to the epigenetic landscape in the brain and elucidate how environmental perturbations disrupt complex neuronal functions such as information storage.