Addiction, OCD, & riding a bike:
How opiates control your brain

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Introduction

Opiates, the class of molecules that includes morphine, heroin, and codeine, are arguably the most addicting drugs known to exist. This class of drugs has single-handedly started wars, forced international laws, and to this day is responsible for more drug-overdose deaths in the USA than every other drug of abuse combined. How do opiates do this? To exercise their profound influence on reward and behavior, these molecules hijack a natural system of ‘reward receptors’ in a brain area known as the striatum. What functions does the striatum normally carry out, and how does the presence of opiates in this brain region cause addiction? This talk will explore what roles the striatum normally plays in governing behavior and why it makes sense that the presence of opiates in the striatum act to powerfully inflict addiction. Along the way, I hope to provide some insight into how the root of addiction, the inflexibility of OCD, and the admirable ability of riding a bike are all deeply related in the brain.

Speaker

Shay Neufeld is a fourth year PhD student in the Harvard Program in Neuroscience. Armed with microscopes, lasers, and electrodes, he studies how circuit plasticity in the brain enables us to learn new behaviors that can be refined, remembered, and sometimes forgotten. Aside from doing experiments, he has a growing interest in how to effectively communicate science with the public – both through education and journalism. He also enjoys reading really old science papers and imagining how scientists figured things out hundreds of years ago. That being said, he is very thankful to be doing research now and not then.
Glossary of Important Terms

Addiction is considered a condition whereby a person continues to persistently and compulsively engage in rewarding stimuli despite adverse consequences.

Neurotransmitters released by neurons can bind specific receptors on other neurons to transmit information.

Opiates are any compound found in the opium poppy plant that bind opioid receptors (e.g. morphine).

An opioid is any molecule that binds opioid receptors, including those produced by your brain (e.g. endorphins & enkephalins), as well as those found in nature (i.e. opiates), or chemicals we synthesize (e.g. oxycodone).

Opioid receptors: There are actually 3 different kinds of opioid receptors in the brain. Morphine binds the mu-opioid receptor, which this talk will focus on.

Endogenous molecules that originate from within an organism, whereas exogenous molecules originate outside of an organism. For example, morphine is an exogenous opioid, whereas enkephalin is an endogenous opioid.

The cortex is the outer layer of the brain, composed of folded gray matter. The cortex plays a role in many functions, including all five sensory systems, motor movements & behavior, consciousness, decision-making, language, motivation, attention, and more.

The striatum is a brain region located in the middle of the brain, beneath the cortex. It integrates inputs from all over the cortex and controls the performance of appropriate, coordinated, goal-directed behaviors.

Obsessive Compulsive Disorder is an anxiety spectrum disorder characterized by persistent intrusive thoughts (obsessions) and repetitive actions (compulsions).

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