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Berkeley Scientific Journal

Title
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Permalink
https://escholarship.org/uc/item/1t62x63j

Journal
Berkeley Scientific Journal, 23(1)

ISSN
1097-0967

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Publication Date
2018

DOI
10.5070/BS3231042198

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OPIATE ADDICTION AND ITS CONFOUNDING CRISIS

BY ASHLEY JOSHI

Whether taken recreationally or as prescribed, ingested opiates alter our brain chemistry and pave a road to possible addiction. While the opiate crisis as we know it today has only come to the forefront in the last decade, the effects of opiate abuse on our society can be traced back to the nineteenth century, when drugs such as morphine came into mainstream use. Due to modern technology and the mass production of drugs, opiates are incredibly accessible and widespread in their use today. Therefore, educating individuals about the issue at hand can prevent the crisis of opioid addiction from escalating.

RECEPTORS

The first step in addressing the problem of opiate addiction is understanding how opiates rewire the brain.[1] Acting on a stimulus from the environment, neurotransmitters—chemicals passed through nerves in the body—activate receptors in the brain to perform a function. Dopamine is a neurotransmitter that floods the brain as a direct result of opiate ingestion. This neurotransmitter rewards natural behaviors by producing ecstatic effects such feelings of relaxation or intense joy. The over-activation of reward circuits is what generates addiction: the mind is neurally rewired to seek the elation that is brought about by opiates.[2]

But rewiring brain chemistry has harmful repercussions. Dopamine activates the μ-opioid receptor (MOR), which triggers social interaction and decreases hunger. This neurotransmitter also activates the κ-opioid receptor (KOR), which triggers uneasiness or agitation—sensations that are far from ecstatic. Problems with KOR function can lead to psychiatric disorders such as psychosis, a mental disorder in which thoughts and emotions become completely disconnected from reality.[3] Evidently, addiction distorts both behavior and perceptions of reality by disrupting the function of MOR and KOR. Medications for long-term treatment of addiction must address these repercussions.[4]

TREATMENT

The Food and Drug Administration (FDA) has approved three medications that treat opiate addiction: buprenorphine, naltrexone, and methadone. These drugs act on MOR and KOR receptors by producing or blocking a key physiological response of addiction. Buprenorphine, in particular, is able to work through both mechanisms.

In certain case studies, buprenorphine is a plausible medication for opiate addiction. Buprenorphine significantly lowered opiate and cocaine addiction in patients who had used these drugs for more than 10 years.[2] Notably, opiate addicts who take buprenorphine can discontinue opiate use without experiencing the withdrawal symptoms that are typical of most other opiate-countering medications. In rhesus monkeys, researchers found that buprenorphine reduced self-administration of cocaine for up to 120 days.[5] Thus, buprenorphine has the potential to kill two birds with one stone for drug addicts who consume cocaine or opi-

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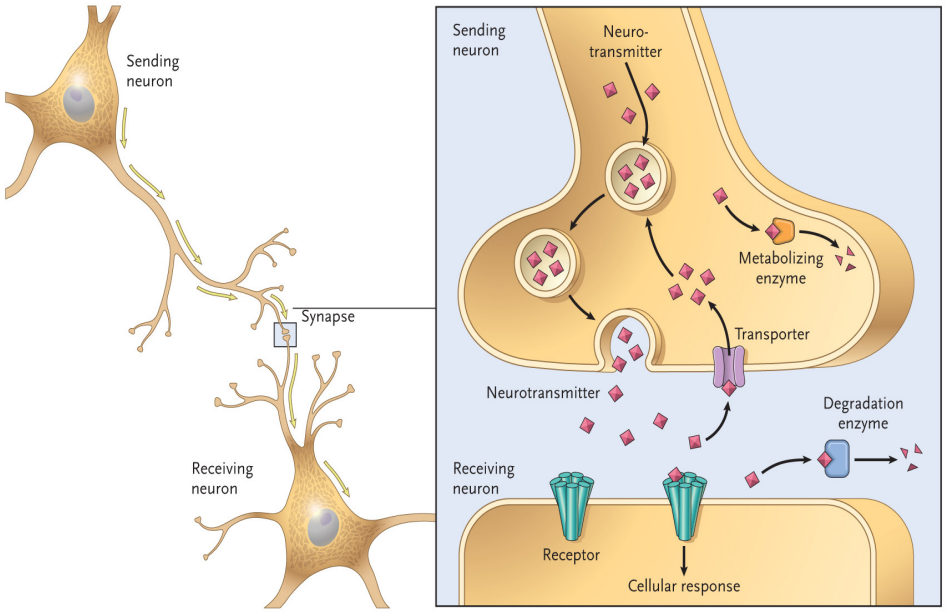

Figure 1: *Neuron and receptor activity. The presynaptic neuron releases neurotransmitters. These neurotransmitters travel across the synaptic cleft and bind to receptors on the postsynaptic neuron. This process happens in the area between the anterior end and posterior end of each neuron in a gap called the synapse.*

ates. Although buprenorphine seems to be a viable medication to depress symptoms addiction, scientists have yet to conduct postexperimental studies to corroborate these findings.

Another hot drug on the market, naltrexone, can be compared to buprenorphine as a feasible treatment for addiction. While buprenorphine appears to activate MOR and KOR receptors, naltrexone works as an inhibitor, blocking MORs and KORs entirely. Hence, overdose or misuse of naltrexone results in severe withdrawal symptoms. Naltrexone needs only to be taken as a shot once a month, whereas buprenorphine must be taken as a pill daily. However, naltrexone is still two to three times more expensive than buprenorphine. It seems as though the benefits naltrexone offers do not compensate for its flaws. For these reasons, naltrexone, like buprenorphine, is another feasible yet inadequate medication for opiate addiction.[6]

> "The brain is rewired through stimulative training exercises and becomes less vulnerable to addictive substances."

Methadone, another drug approved by the FDA, probably will not end the opiate crisis either. Methadone, like buprenorphine, produces minor addictive effects as well as mild withdrawal symptoms in patients. However, studies have found that consumers are more likely to abuse methadone as a prescription medication because it can be taken with addictive opiates without repercussions. In fact, many individuals take this drug with a regular dose of heroin. This phenomenon most likely accounts for the high mortality rates observed in methadone-prescribed patients in the United Kingdom during the 1990s.[7] Despite its potential benefits, the misuse of methadone highlights its inadequacy in alleviateing the opiate crisis.

IMPLEMENTATION OF WHAT IS LEARNED FROM THE OPIATE CRISIS

Despite the available treatments, opiate addiction remains a crisis, as there is no single medication that can "solve" the epidemic. Still, research shows that individuals can reduce their likelihood of addiction in a number of ways, while other findings reveal that understanding the mechanisms of addiction might be beneficial in treating other disorders.[8]

For instance, researchers at the University of California, Berkeley conducted behavioral experiments that demonstrated that engaging in mentally cognitive activities depresses the likelihood of addiction.[3] Mice trained to search for cereal pieces in cups filled with wood shavings avoided chambers where they were given cocaine injections, preferring chambers where they were given saline injections. As a result of the training they received, mice were able to withstand chambers they sensed were harmful to their body. Linda Wilbrecht, a professor of psychology and neuroscience at Berkeley, determined that "learning opportunities may provide additional benefits, enhancing resilience in response to drugs with abuse potential."[3] The brain is rewired through cognitively stimulative training exercises and becomes less vulnerable to substances with abuse potential. Hence, engagement in simulating activities may save present and future generations from the opiate crisis.[3]

Research pertaining to the opiate crisis may benefit narcoleptic patients, even though it is currently unclear how opiate addicts can be treated. Prior research has established that opiate and heroin addicts

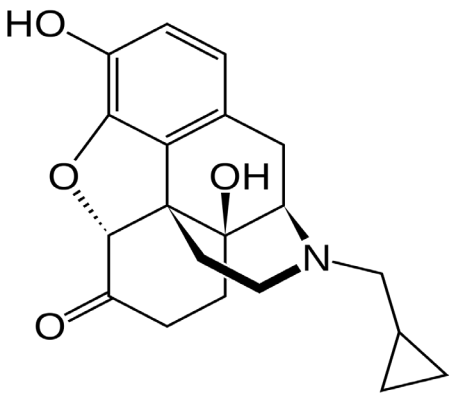

Figure 2: *Chemical structure of FDA-approved medication naltrexone. This drug is used for the treatment of opiate addiction. As the body ingests opiates, it changes from its prior state.*

"According to Dr. Siegel, the natural question to ask was whether opiates could treat narcolepsy."

have high levels of hypocretin cells that regulate arousal, wakefulness, and appetite. Jerry Siegel, a professor and chief of neurobiology research at the Brain Research Institute at the University of California, Los Angeles, led his team to apply this knowledge to studies involving narcoleptic patients: patients with generally low levels of hypocretin cells. Narcolepsy is a neurological disorder in which individuals frequently doze off during the day, although they sleep about the same number of hours as the average individual. According to Dr. Siegel, the natural question to ask was whether opiates could treat narcolepsy. By administering opiates to narcoleptic patients, the team found that patients had shorter episodes of dozing off during the day and increased levels of hypocretin cells.[9] However, scientists have not yet discovered the reverse: how treatment for narcolepsy may potentially benefit opiate addicts.

While numerous research studies have provided insights into the crisis of opioid addiction, researchers have yet to determine a solution. Efforts to resolve this problem will require patience. But understanding the evolution of the opiate addiction crisis and assessing the current situation is a critical start.

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