New vaccine technology shows promise as a tool to combat the opioid crisis

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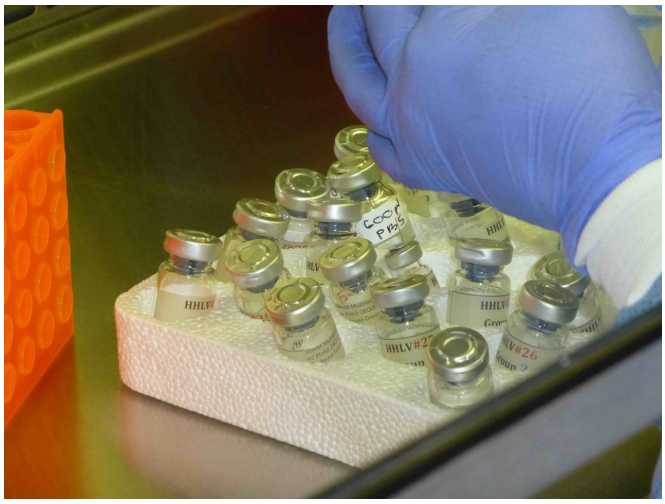

Dr. Gary Matyas' lab at the Walter Reed Army Institute of Research. Credit: MHRP

Researchers with the U.S. Military HIV Research Program at the Walter Reed Army Institute of Research (WRAIR) report that an experimental heroin vaccine induced antibodies that prevented the drug from crossing the blood-brain barrier in mice and rats. The vaccine was co-developed at the National Institute on Drug Abuse (NIDA), part of the National Institutes of Health, which funded the preclinical research.

"By eliciting antibodies that bind with heroin in the blood, the vaccine aims to block the euphoria and addictive effects," said Dr. Gary Matyas, Chief of Adjuvants and Formulations for the U.S. Military Research Program (MHRP), WRAIR. "We hope to give people a window so they can overcome their addiction."

The study, published in the *Journal of Medicinal Chemistry*, showed that the vaccine produced antibodies against other commonly misused opioids, including hydrocodone, oxycodone, hydromorphone, oxymorphone and codeine. The vaccine appeared to dampen the impact of heroin at a high-dose, which might indicate a potential to prevent overdose.

In clinical settings, it is essential that the antibodies induced by a heroin or opioid vaccine do not cross-react with the therapies for opioid misuse, such as methadone, buprenorphine and naltrexone. Researchers found that the antibodies did not react with these compounds and, more importantly, the antibodies induced by the vaccine did not cross-react with naloxone, which is used as the overdose rescue treatment to reverse respiratory depression due to heroin and other opioid overdose.

Although the use of opioids for pain management in people suffering from addiction is of concern, researchers found that methadone, tramadol, fentanyl, sufentanil, nalbuphine and buprenorphine did not bind to the antibodies, indicating that they could be used if acute pain treatment is required for emergency use in vaccinated patients. Researchers also found that there was no binding to the non-narcotic pain relievers like aspirin, ibuprofen and acetaminophen, so these would likely remain effective.

The misuse of opioids, which include heroin and fentanyl, is a growing problem in the U.S. According to the CDC, 91 Americans die every day from an opioid overdose. Most pharmacological treatments for opioid misuse involve opioid management therapy (OMT), but treatment access is an issue. In addition, adherence varies greatly and relapse rates can be high. To end the opioid overdose crisis, many different types of treatments and medications will be needed to meet the needs of individuals addicted to these drugs.

"Although we are still in the early phase, this study suggests that vaccination can be used together with standard therapies to prevent the withdrawal and craving symptoms associated with opioid

withdrawal," said Matyas.

WRAIR researchers leveraged their expertise in vaccine development and novel adjuvants research to develop this experimental heroin vaccine with their partners at NIDA. The vaccine includes a potent adjuvant to stimulate the immune system called the Army Liposome Formulation (ALF), which was also developed by researchers at WRAIR. The vaccine was developed jointly with intramural scientists at the Drug Design and Synthesis Section (Dr. Kenner C. Rice, Chief), Molecular Targets and Medications Discovery Branch, NIDA.

Provided by The U.S. Military HIV Research Program (MHRP)