

Synthesizing a Vaccine for the Treatment of Addiction to the Fentanyl Opioid

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42	7	43	1	95	15
Mo	N	Tc	H	Am	P
15	1	76	15	67	44
P	H	Os	P	Ho	Ru
75	34	18	6	1	
Re	Se	Ar	C	H	



ABSTRACT: The objective of this project is to make a vaccine that will negate the effects of the powerful opioid fentanyl. Fentanyl is a strong synthetic opioid that is 50 to 100 times more potent than morphine. According to the CDC, there were over 70,000 deaths due to street drug overdoses, which has increased in the last ten years. More than 40 % of these deaths are related to fentanyl overdoses, therefore it is imperative that approaches are developed to combat this alarming increase in deaths. The vaccine against fentanyl will be synthesized out of molecules that will take advantage of fentanyl's amide functional group to be hydrolyzed into safe byproducts. Any patient that is administered with the vaccine, will not feel the effects of the opioid because the immune system will hydrolyze the drug as soon as it enters.

SCHEME 1. Proposed approach for vaccine creation involving catalytic antibodies

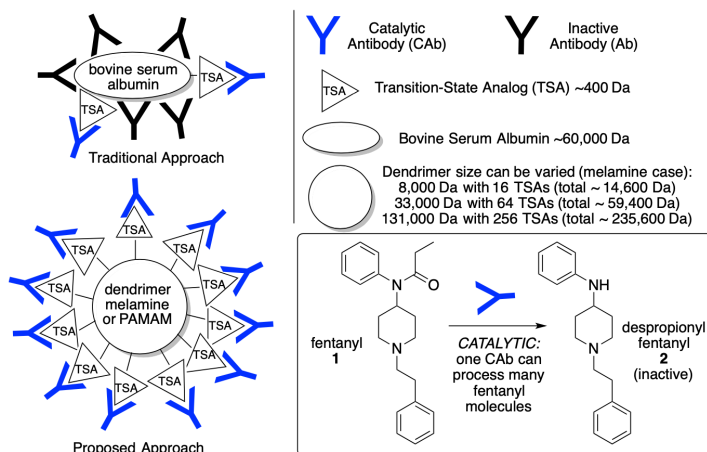
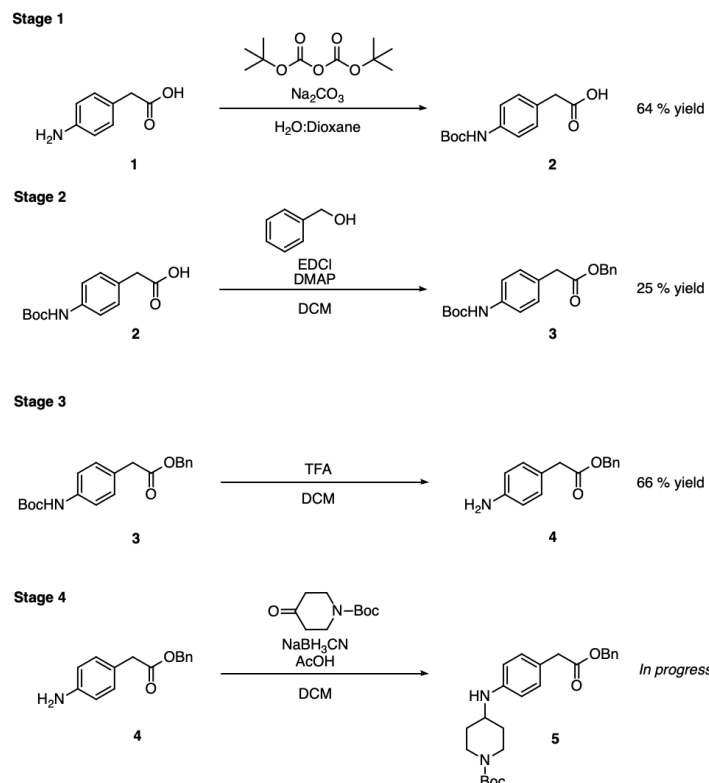


Figure 2. Proposed approach for a vaccine against fentanyl.

DESIGN: For an immune response to ensue, catalytic antibodies must be synthesized as haptens to hydrolyze fentanyl. Then, a large dendrimer will be attached, and the high molecular weight of the compound will trigger a response by the immune system, attacking the fentanyl.

SCHEME 2. Accomplished experiments



Graph of fentanyl related deaths

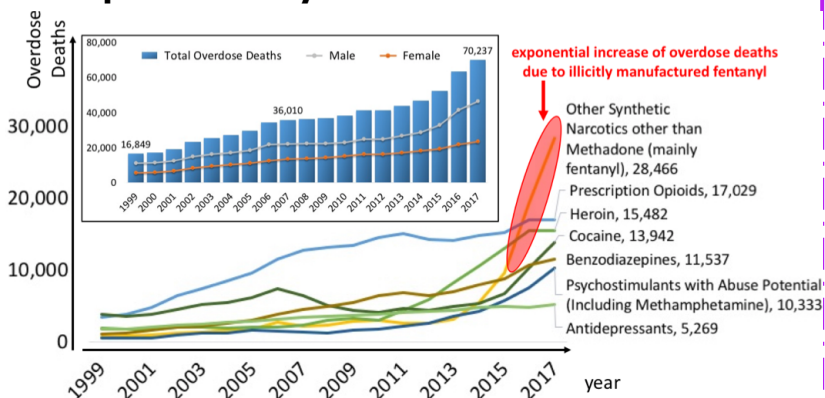


Figure 1: Demonstrates increases in fentanyl use and other narcotics between 1999-2017. Fentanyl has the fastest rate of growth.

Importance of a vaccine against fentanyl

According to the CDC's data, fentanyl use has increased exponentially beginning around 2015 (Figure 1). Fentanyl use seems to have originated from prescription pain killer use, but due to its less complex structure, illicit fentanyl continues to be made and distributed. (Figure 2). The opioid's high potency makes it highly addicting and deadly therefore, very small amounts of fentanyl can lead to overdoses. Currently, overdoses are treated by Naloxone, but the reversal agent must be given immediately due to fentanyl's rapid onset. A vaccine would be beneficial to provide a more long-term protection.

CONCLUSION: The next steps are to attach dendrimers of high molecular weight to the transition state analogs. The combination of high molecular weight will elicit an immune response. In the future, we look for a possible collaboration to test these potential vaccines and their efficacy in mice.

Acknowledgments

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