# Intranasal vaccine protects mice against West Nile infection

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Researchers from Duke University have developed a nasal vaccine formulation that provides protective immunity against West Nile virus (WNV) infection in mice after only 2 doses. They present their findings at the 2014 American Society for Microbiology Biodefense and Emerging Diseases Research Meeting.

"Our results demonstrate that a needle-free WNV vaccine using only 2 vaccine doses is able to induce protective anti-WNV immunity," says Herman Staats, a researcher on the study. "A nasally-administered, needle-free vaccine able to rapidly induce protective immunity with minimal vaccine doses per subject would be beneficial for use during WNV outbreaks."

WNV is a mosquito-borne virus that can cause febrile illness, encephalitis (inflammation of the brain) or meningitis (inflammation of the lining of the brain and spinal cord). Though the virus has been known to be a cause of severe human disease for decades in parts of the Middle-East, Africa, Europe and Australia, it only first appeared in the United States in 1999. It has since spread across the United States and Canada, causing a reported 2,374 cases of infection in people, including 114 deaths in the year 2013 alone, according the Centers for Disease Control and Prevention. While an injectable vaccine based on killed virus is available for horses, there is no vaccine available for humans.

In this study, Staats and his colleagues investigated optimizing the delivery of an antigen-based vaccine for WNV. Most vaccines that use

purified protein antigens such as the hepatitis B virus (HBV) vaccine or the human papillomavirus vaccine (HPV) utilize a total of three immunization to induce protective immunity. In this case, the researchers modified an existing experimental nasal vaccine formulation so that 2 doses of the vaccine administered over 14 days (instead of 3 doses over 21 days) could potentially provide immunity against WNV in mice.

The vaccine formulation was prepared by mixing the antigen and adjuvant compounds in a water based (saline) solution. The vaccine formulation was administered to the mice as nose drops using small volumes of the vaccine. For the 3 doses vaccine formulation, 15 micrograms of the West Nile Virus antigen was combined with the peptide and bacterial DNA adjuvants and administered to mice on day 0, day 7 and day 21. For the 2-dose vaccine, researchers tested both 45 and 60 micrograms of antigen administered on days 0 and 14.

"When mice were infected with West Nile Virus at day 60, the 2-dose vaccine utilizing 60 micrograms of antigen combined with adjuvants protected 100% of mice against morbidity and provided significant protection against weight loss. The 2-dose vaccine regimen using 45 micrograms of antigen combined with adjuvant and the 3-dose vaccine regimen utilizing 15 micrograms of antigen combined with adjuvants provided partial but not significant protection against morbidity or weight loss," says Staats.

Going forward, the researchers are planning future studies in rabbits to continue to develop the intranasal West Nile Virus vaccine. Rabbits have a nasal cavity size that is close to the size of the human nasal cavity and therefore is an ideal model to further develop needle-free intranasal vaccines.