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Vaccine prototype stronger than traditional vaccines

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Source: Brigham and Women's Hospital

Summary: Researchers have created a vaccine that is more potent than traditional vaccines available today. The glycoconjugate vaccine prototype is 100 times more effective than traditional glycoconjugate vaccines.

FULL STORY

Brigham and Women's Hospital (BWH) researchers have created a vaccine that is more potent than traditional vaccines available today. The glycoconjugate vaccine prototype is 100 times more effective than traditional glycoconjugate vaccines. Their work is published in the December 2011 issue of *Nature Medicine*.

A glycoconjugate vaccine is composed of covalently bound carbohydrate and protein molecules, and is the standard design for many vaccines used to protect against common diseases such as pneumonia and meningitis.

Researchers designed the vaccine prototype after discovering that immune cells, called T-cells, can recognize a vaccine's carbohydrates, and from that recognition elicit an immune response. This discovery challenges popular assumptions that immune cells only recognize the protein portion of glycoconjugate vaccines.

Proof that T-cells recognize carbohydrates came when researchers immunized mice with different types of glycoconjugate vaccines against the bacteria, group B *Streptococcus*. One group was immunized with vaccines containing different proteins. Another group was immunized with vaccines with the same proteins. For both groups, the carbohydrate chain in the vaccines was the same.

Researchers saw that mice given the vaccines with different proteins had just as good an immune response as those given vaccines with the same proteins-the variability in proteins did not change immune response. This told researchers that T-cells were recognizing carbohydrates to generate a consistent immune response. They further investigated the mechanisms responsible for how carbohydrate-containing glycoconjugate vaccines activate protective immunity to a bacterial infection.

"One thing that is tremendously novel here is that we were able to find T-cells within a mouse after immunization with a glycoconjugate [vaccine] that just recognized carbohydrates," said Dennis L. Kasper, MD, director of BWH's Channing Laboratory. "So these may be the first true carbohydrate-specific T-cells found."

The understanding that it was not only proteins, but also carbohydrates that were being recognized by cells led researchers to design a vaccine that yielded many carbohydrate particles when processed by the immune system-in turn creating a vaccine that generated a stronger immune response. Researchers believe that the more effective vaccine prototype they designed may one day assist in protecting high-risk populations susceptible of disease.

"For example, pneumococcal conjugate vaccines are good in children, but are not effective in protecting the elderly," explained Kasper. So we are hopeful that by designing vaccines like this, you'll make better vaccines that will be effective in all the at-risk populations."

Fikri Avci, PhD, lead study author and instructor in the Department of Medicine at BWH and Harvard Medical School adds that the findings on how the body's immune cells interact with carbohydrates will also lead to more effective vaccines in the future.

"Carbohydrates are among the most abundant and structurally diverse molecules in nature," said Avci. "They are extremely important in many biological functions. A better understanding of carbohydrate interaction is crucial. We are hoping that our findings will provide a framework for production of new-generation therapeutics and preventive medicines not only against bacterial infections, but also for cancer and viral diseases."

The research was supported by grants from the United States National Institutes of Health.

Story Source:

Materials provided by **Brigham and Women's Hospital**. *Note: Content may be edited for style and length.*

Journal Reference:

1. Fikri Y Avci, Xiangming Li, Moriya Tsuji, Dennis L Kasper. **A mechanism for glycoconjugate vaccine activation of the adaptive immune system and its implications for vaccine design**. *Nature Medicine*, 2011; DOI: 10.1038/nm.2535

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