

Vaccine with no jab: Protein vaccines for needle-free immunization through the skin

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(PhysOrg.com) -- Most immunizations currently involve an injection in the arm. In the future, vaccination may be accomplished without the unpleasant jab of a needle: a team led by Victor C. Yang at the University of Michigan (USA) has developed a method by which vaccines can pass directly through the skin without a needle. As the researchers report in the journal *Angewandte Chemie*, merely linking a special short peptide molecule to the vaccine, which can then be administered in the form of a patch, will do the job.

Vaccines usually consist of proteins, and only a few can be administered orally whilst most must be injected directly into a muscle. Therefore, [skin](#) is an attractive target for non-invasive vaccination. However, protein vaccines cannot pass through our skin, especially through its impermeable corneal layer. There are a few protein drugs that can currently be applied through the skin, but their production remains complex and expensive. They must be wrapped in special “transporters,” such as [liposomes](#), that can pass through the skin.

The goal of Yang and co-workers is to find proteins that can do the job without the packaging. Thus, his team has developed a short peptide, the low molecular weight protamine (LMWP) that is able to pass through cell membranes into the interior of cells. LMWP [peptides](#) can be produced quickly, easily, and inexpensively in large amounts from the protein protamine. Protamine is a pharmaceutical agent, given to treat hemorrhages that occur after treatment with heparin or elevated levels of [heparin](#) caused by disease.

When LMWP is linked to a [protein](#), it simply carries this “freight” along through the membrane into the interior of the cell. In this way, LMWP is also able to pass attached proteins through the corneal layer. The researchers were able to demonstrate this with various test proteins, linked to the LMPW, that were also labeled with a fluorescence dye. Particular accumulation of the proteins was observed in the epidermis. Activation of the immune system in mice was observed that was equivalent to that elicited by conventional immunization.

Our skin is not just our primary protection against infections because it presents a physical barrier; our epidermis is also rich in Langerhans cells, which participate in triggering an immune response. Therefore, it may be favorable for an immunization if the vaccine accumulates in the epidermis. One particularly interesting aspect of this new non-invasive method is that the “boosters” required for many vaccination protocols could be administered by the patients themselves. This could increase the success of vaccination campaigns in poor and remote regions of the world, where medical facilities are scarce.

More information: Victor C. Yang, Synthetic Skin-Permeable Proteins Enabling Needleless Immunization, *Angewandte Chemie International Edition* 2010, 49, No. 15, 2724-2727, [dx.doi.org/10.1002/anie.200906153](https://doi.org/10.1002/anie.200906153)

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