

Testing vaccines without laboratory animals

July 23 2020



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The quality of vaccines is still often tested by using laboratory animals. That has to change, according to researchers from Leiden University and the vaccinological institute Intravacc. Together they went on searching for a test method that makes animal testing unnecessary. The first promising results were published in *Scientific Reports*.

Immune, but not sick

The new method allows researchers to test whether a [vaccine](#) has been successfully inactivated. Inactivation makes viruses or toxins (toxins of bacteria) in a vaccine harmless, so you don't get sick. However, the body will still recognize an inactivated pathogen. As a result, an immune reaction occurs after which you are protected against future infection. Inactivation occurs by adding the compound [formaldehyde](#). Well-known inactivated vaccines are the vaccines against diphtheria, tetanus, and polio, together also known as the DTP injection.

The inactivation largely determines the quality of the vaccines: think of factors as efficacy, safety, and stability. Leiden Ph.D. student and first author Thomas Michiels explains: "When a vaccine enters the body, certain immune cells take up the pathogens. In order to combat the pathogens, these cells first cut them into small pieces. The speed at which they do this can influence the immune response that follows."

Protein mixture

The team mimicked a small step of the production process of vaccines in a test tube and analyzed the effects using mass spectrometry. By measuring the amount of cut proteins over time, the scientists were able to determine the breakdown rate of the vaccine. A tricky job, because formaldehyde chemically alters the proteins at dozens of places. This leads to a heterogeneous mixture that is difficult to analyze. "We therefore focused on the protein fragments that are not altered by formaldehyde," explains Michiels. "This allowed us to measure the rate of degradation without the changes caused by formaldehyde interfering with our measurements."

No more animal testing

"Now that we know that the formaldehyde treatment increases the rate of degradation, we can measure this rate of degradation to determine whether the inactivation has taken place correctly," says Michiels.

"Animal testing may then no longer be necessary in the future." And that's good news, because the effective and cheap inactivated vaccines against, for example, diphtheria or tetanus used extensively worldwide and there will not be an alternative soon. "And that means that a lot of laboratory [animals](#) are currently being used worldwide for quality control purposes. It's good to be able to offer an alternative to this."

More information: Thomas J. M. Michiels et al. Formaldehyde treatment of proteins enhances proteolytic degradation by the endo-lysosomal protease cathepsin S, *Scientific Reports* (2020). [DOI: 10.1038/s41598-020-68248-z](#)

Provided by Leiden University

Citation: Testing vaccines without laboratory animals (2020, July 23) retrieved 30 June 2024 from <https://medicalxpress.com/news/2020-07-vaccines-laboratory-animals.html>

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