

Better vaccines thanks to RNA

May 30 2011, By Hans Wolkers

(Medical Xpress) -- Vaccination can be just as effective with dead bacteria as with live ones, as long as you inject them with the RNA of live bacteria. This finding was published in *Nature* by a team of American, French, Amsterdam and Wageningen researchers, and has been available online (AOP) since on 22 May.

Doctors have known for some time that you obtain the best immunity after vaccination with live bacteria. The [immune system](#) recognizes certain parts of the bacteria and remembers them, so that you become immune to them. That is, if you survive the vaccination. Because someone who is injected with live pathogens runs the risk of falling prey to the very disease they aim to ward off. So for safety reasons, doctors usually work with dead bacteria. Safer but also less effective.

Michael Muller, professor of Nutrition and [Nutrigenomics](#) at Wageningen University, is co-author of the publication. He used genomics techniques and advanced computer analyses to study the difference in the response of the immune system to dead and to live bacteria. His team was looking for the answer to the big question: how can the immune cell know whether bacteria are dead or alive? Which substance is missing in dead bacteria, causing an incomplete [immune response](#)? And: Do you get complete immunity if you add that substance to the vaccine based on dead pathogens?

In order to identify the mystery substance, the research team embarked on a 'killing mission', killing off bacteria in various different ways. They used alcohol, [UV light](#), antibiotics and a type of formaldehyde. The idea

was that different killing methods would destroy different substances in the bacteria. The dead bacteria were then worked into a vaccine and injected into people. As expected, almost all the dead bacteria produced an incomplete immune response. Except for the group killed with formaldehyde: these bacteria did produce a complete response.

[Formaldehyde](#) was the only killing method that left the [Messenger RNA](#), a DNA-like molecule, intact, and this suggests that the RNA is the missing substance. Mission accomplished?

"Not quite," says the professor. "To make the evidence conclusive and really show that the RNA is responsible for the complete immune response, we have added RNA to a [vaccine](#) based on dead [pathogens](#).' After vaccination, this cocktail did turn out to give a complete immune response. The results of this research not only led to more effective vaccines, but are also extremely useful for the nutrition research done by Müller and his group. 'In our nutrigenomics research we are especially interested in how unhealthy eating derails the immune system and thus causes chronic inflammation and eventually disease, as well as in how healthy diet prevents that', explains Müller. 'We know from research at Wageningen and elsewhere that we carry large numbers of live bacteria in and on our bodies, including our intestinal flora. Because we now know more about exactly how the immune response to bacteria works at molecular level, in the longer term we may be able to keep infections under control."

Provided by Wageningen University

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