

# A vaccine for heart disease? New discovery points up this possibility

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Most people probably know that heart disease remains the nation's No. 1 killer. But what many may be surprised to learn is that cholesterol has a major accomplice in causing dangerous arterial plaque buildup that can trigger a heart attack. The culprit? Inflammatory cells produced by the immune system.

A number of research studies have demonstrated inflammation's role in fueling [plaque buildup](#), also known as atherosclerosis, which is the underlying cause of most heart attacks and strokes, but knowledge of which immune cells are key to this process has been limited – until now.

Researchers at the La Jolla Institute for Allergy & Immunology have identified the specific type of immune cells (CD4 T cells) that orchestrate the inflammatory attack on the artery wall. Further, the researchers discovered that these immune cells behave as if they have previously seen the antigen that causes them to launch the attack. "The thing that excites me most about this finding is that these immune cells appear to have 'memory' of the molecule brought forth by the antigen-presenting cells," said Klaus Ley, M.D., a renowned expert in vascular immunology, who led the study in mouse models. "Immune memory is the underlying basis of successful vaccines. This means that conceptually it becomes possible to consider the development of a vaccine for [heart disease](#)."

Dr. Ley said he believes the antigen involved is actually a normal protein that the body mistakes as being foreign and therefore launches an

immune attack resulting in inflammation in the arteries. "Essentially, we're saying that there appears to be a strong autoimmune component in heart disease," he said, explaining that autoimmune diseases result from the body's mistaken attack on normal cells. "Consequently, we could explore creating a "tolerogenic" vaccine, such as those now being explored in diabetes, which could induce tolerance by the body of this self-protein to stop the inflammatory attack."

The study was published online Monday in the *Journal of Clinical Investigation* in a paper entitled "Dynamic T cell–APC interactions sustain chronic inflammation in atherosclerosis."

Dr. Ley cautions that creating a vaccine is a complex process that could take years to develop. However it offers exciting potential. "If successful, a tolerogenic vaccine could stop the inflammation component of heart disease," he said. "This could probably be used in conjunction with the statins (cholesterol-lowering drugs) that have already taken a significant chunk out of the numbers of people with heart disease. Together, they could deliver a nice one-two punch that could be important in further reducing heart disease."

Dr. Ley said antigen-presenting cells take up infectious organisms, foreign materials and self-proteins (in the case of autoimmune diseases) and "chop them into little pieces called epitopes" and then display the pieces on the surface of the cell. "The T cell comes along, and if it has the correct receptors, it will recognize the epitope pieces and make cytokines (a type of [immune system](#) soldier molecule) that attack the material and cause inflammation." Autoimmune diseases include such illnesses as type 1 diabetes, rheumatoid arthritis and multiple sclerosis.

In the study, Dr. Ley and his team used live cell imaging techniques to track [immune cells](#) in normal and atherosclerotic mouse aortas. He said in mice with [atherosclerosis](#), there are a large number of antigen-

experienced T cells that have already seen certain epitope pieces (from self proteins) that they perceive as foreign. "The T cells talk to the antigen-presenting cells and, in response, make cytokines that launch an attack. This is what makes the [inflammation](#) in the vessel wall persistent." [Inflammatory cells](#) join fat and cholesterol to form artery-clogging plaque that can eventually block blood flow, leading to a [heart attack](#).

"It wasn't previously known that antigen-experienced T cells existed in the vessel wall," said Dr. Ley. "This experiment makes me now believe that it may be possible to build a vaccine for heart disease."

Provided by La Jolla Institute for Allergy and Immunology

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