Carbohydrate-based vaccine against cancer?

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Couldn't we be immunized against cancer? This sounds like a dream, but is in fact a thoroughly realistic research goal. American researchers have now taken an important step forward in the development of a cancer vaccine. Their fully synthetic vaccine candidate consists of an oligosaccharide, a peptide, and a lipopeptide.

How can the immune system be made to attack tumor cells, which though degenerate are part of the body? The immune system must be presented with a component characteristic of tumor cells in the form of a vaccine, so that it can form antibodies against this antigen, as it is called. If tumor cells then appear later, the antibodies recognize the antigen and bind to it, marking it as an enemy that must be destroyed. Among the differences between tumor cells and healthy cells is an abnormally high amount of certain oligosaccharides, which are involved in the formation of metastases. One of these saccharides would be a suitable antigen.

However, attempts to implement saccharides as the basis for a vaccine have thus far failed; unfortunately, carbohydrates are able to activate B-lymphocytes, but not T-lymphocytes. For successful immunization, the cooperation of both types of cells is needed. It is helpful to couple the sugar to a foreign carrier protein, but this is a poorly controllable reaction whose products can also trigger undesired immunological effects.

The research team headed by Geert-Jan Boons at the University of Georgia in Athens has found a clever alternative: They have synthesized a three-component vaccine. Component one is Tn antigen, an

oligosaccharide that is present in large numbers on the surface of certain human tumor cells. Tn is not present on healthy cells. Component two is the peptide YAF, which consists of a sequence of 20 amino acids found in a membrane protein of the meningitis pathogen Neisseria meningitides and activates T-lymphocytes. The third component is the lipopeptide Pam3 Cys, a peptide with a fatty section modeled on a lipoprotein sequence found in E. coli bacteria. This should act as an additional "danger signal" for the immune system. Its fat content also make is easier to insert into liposomes, tiny balls of fat that act as "packaging" for the vaccine.

"Mice that have been immunized with this new vaccine form antibodies against the Tn antigen," reports Boons. "We have proven that this saccharide, peptide, and lipid trio can, in principle, elicit an immune response - even against tumor antigens."

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