Allergic reaction: how the immune system identifies nickel

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The metal nickel is one of the most common triggers of allergic contact dermatitis in humans. This skin inflammation results from a gradual immune reaction in allergic people, e.g. if the skin repeatedly comes into contact with nickel-containing jewellery, piercings or jeans buttons. BfR scientists have gained new insights into how the body's defences react to nickel. Their results have been published in the journal "Allergy".

The cause of the allergic reaction are T lymphocytes (T cells). These cells are part of the body's defences and normally react to viruses or bacteria in the skin. In the case of a nickel allergy, they also respond to electrically charged nickel atoms (ions) that can be released from nickel-containing products. These ions are then "identified" by the T cells in the form of a metal ion complex together with the body's own proteins.

For explanation: Humans have a wide variety of T cells. Each of these T cells has unique docking sites (receptors) with which it can "identify" a very specific protein complex. The receptor consists both of variable subunits mainly concerned with the specific protein complex identification and of a selection of defined receptor segments. Together, the T cells have many millions of different receptors with which pathogens can be identified and combated with high precision (specific) in the event of an infection.

The BfR researchers discovered peculiarities in human receptors that react to nickel ions. About 43 percent of the corresponding T cells have the amino acid histidine in the specific identification part of the docking site (i.e. the variable subunit of the receptor). This amino acid can bind to nickel ions. In addition, a surprisingly large number of human T cells with a certain additional "component", a defined receptor segment was identified. This is the case for around 35 percent of the T-cells that react to nickel ions. These findings are an important indicator of how the human immune system identifies nickel ions - and potentially represents an explanation for why people suffer from nickel allergy so often.

The current findings were obtained using two new methods: The T-cells reacting to nickel ions were identified using an activation marker. At the same time, high-throughput sequencing detected many T-cell receptors.

The benefits of the new results for medical practice cannot yet be assessed. So far, no differences in the receptors in the blood in allergic and non-allergic people have been detected. However, the BfR is working on extending the new methods to other allergens and applying them to T cells that are associated with allergies.

Further information on the topic of nickel is available from the BfR website:

Summary page of all publications:
https://www.bfr.bund.de/en/a-z_index/nickel-130376.html

Contact allergy via nickel: Prize for BfR researcher
https://www.bfr.bund.de/cm/343/kontaktallergie-durch-nickel-preis-fuer-bfr-forscherin-katherina-siewert.pdf

About the BfR

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