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Science City Davos

## The memory of the immune system

At the Swiss Institute of Allergy and Asthma Research (SIAF) in Davos Wolfgang, the research team of professor Mübeccel Akdis and Dr. Willem van de Veen has developed methods to purify B cells. These are used in the study of immune memory.

### The immune system - the body's own defenses

Our immune system serves to fight parasites, bacteria, viruses and fungi. In some people, it reacts strongly to things that do not actually pose a threat to our health, such as pollen or strawberries. These unwanted reactions of our defenses can lead to the development of allergies (reaction against allergens). Thus, the immune system must distinguish between harmless and pathological (disease-causing) antigens to prevent unnecessary and self-destructive defensive reactions.

### Innate and adaptive immune responses

Our immune system can be broadly divided into two distinct branches: Innate and adaptive (acquired) immunity. The innate immune system includes our skin, mucous membranes, and some



*Mübeccel Akdis and Willem van de Veen from the Swiss Institute of Allergy and Asthma Research SIAF. Photo credit: SIAF*

immune cells such as natural killer cells and macrophages (phagocytes). These tissues and cells provide immediate protection against invading pathogens, but their response is not very specific. The adaptive immune system consists of two types of immune cells, T cells and B cells. These cells are very specific and have the ability to form an immunological memory.

## The memory of the immune system

When our immune system encounters something it has never seen before (a virus, a bacterium, or an allergen), our T and B cells are activated. It's a process that takes time. This is why it can take more than a week for antibodies to form when we are exposed to a new pathogen. The few specific T and B cells we have in our body become activated, begin to divide and greatly increase in number. Some of these cells also change their function. For example, B cells can develop into plasma cells and T and B cells can differentiate into memory cells. Whether a vaccine provides

lifelong protection depends on its ability to trigger our immune system to develop such plasma and memory cells.

### **Immune memory in allergies**

Although immune memory is very important to fight future infections with the same pathogen more efficiently, it can be a problem for allergy patients. It is well known that not everyone develops an allergy when exposed to an allergen. The mechanisms that determine whether someone develops an allergy are not yet fully understood. By studying memory T and B cells in allergic and non-allergic individuals, researchers are gaining a better understanding of these mechanisms. For example, high-dose bee venom exposure from natural bee stings in non-allergic beekeepers provides a model to understand the mechanisms of tolerance to allergens in healthy individuals. The ultimate goal of this research is to develop new treatments for allergic patients.

To find out which of the B cells have a B cell receptor specific for the bee venom allergen, the allergen is tagged with a fluorescent label. When these cells are then irradiated with a laser, the cells to which the allergen has bound light up. A so-called flow cytometer can be used to purify cells that have the allergen bound to them.

### **Allergen-specific immune memory lasts a long time**

Using the latest immunological techniques, it is possible to analyze the same cells that have been present in the body of an allergic or tolerant person for more than 20 years. When comparing beekeeper blood samples taken 20 years ago with current samples from the same individuals, the same allergen-specific B cells were found in both samples. This shows that immune memory for allergens can persist for at least 20 years and change after new bee stings. From a medical point of view, it is fascinating that one and the same cells can be analyzed and information in immune cells often persists for a lifetime.

*Mübeccel Akdis & Willem van de Veen/Swiss Institute of Asthma and Allergy Research SIAF*

The Swiss Institute of Allergy and Asthma Research SIAF is one of the world's most renowned research institutes in the field of human immunology, allergic diseases and asthma. As a partner in the Medical Campus at Davos Wolfgang, SIAF is committed to high-performance health care research for the benefit of allergy and asthma patients. The institute is associated with the University of Zurich and maintains a large national and international network with universities and institutions.

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