

Basis of allergic reaction to birch pollen identified

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In Austria alone around 400,000 people are afflicted by a birch pollen allergy and its associated food intolerances. Why so many people have allergic reactions to birch pollen has still not been completely explained. It is known that a certain birch pollen protein causes an overreaction of the immune system. Researchers at the Messerli Research Institute, a joint establishment belonging to the Vetmeduni Vienna, the MedUni Vienna and the University of Vienna, have now discovered what makes this protein an allergen, that is, an allergy trigger.

According to the key result of the study, which has been published in the

leading periodical the *Journal of Biological Chemistry* the pollen protein can bind iron to itself. If the protein remains void of iron it becomes an allergen. Environmental influences are possibly responsible for this under-loading. This could be the explanation for the increasing number of those suffering from allergies.

Single birch pollen protein responsible for allergies

One of the most well-known allergens is the so-called "Bet v 1" from birch pollen (*Betula verrucosa*). The protein was manufactured synthetically for the first time in a laboratory in Vienna 25 years ago and since then has been used worldwide as an allergen model in research. "Bet v 1" is the main allergen amongst a hundred other proteins in birch pollen. It renders the immune system hypersensitive and, in 95 percent of the birch pollen allergy-sufferers, leads to the formation of pathogenic antibodies, the IgE immune globulins.

Up until now it was not known why harmless molecules trigger allergies at all. The researcher Franziska Roth-Walter and her colleagues have now found the potential cause.

The "Bet v 1" birch pollen protein is very similar structurally to the human protein, lipocalin 2, which is mainly found in the lungs. Lipocalin 2 and "Bet v 1" possess so-called molecular pockets with which they can bind iron firmly to themselves. If these pockets remain empty, the birch pollen protein becomes an allergen and can trigger allergic reactions in humans and animals. The protein manipulates the T helper 2 cells (Th2 cells), which are cells in the [immune system](#), towards allergy.

In allergic people and mammals alike, the Th2 cells predominate in contrast to Th1 cells. Th2 cells play a significant role in [allergic reactions](#) and in combating parasites. Th1 cells serve as a defence against bacterial and viral infections. "Allergies typically have an imbalance between the

Th1 and Th2 immune response", explains Erika Jensen-Jarolim, head of the Department of Comparative Medicine at the Messerli Research Institute. "Studies currently running indicate that we can apply the principle of the [birch pollen](#) allergen directly to other allergens with similar molecular structures. Consequently, we are starting to understand for the first time why allergies to pollen, foodstuffs and fungal spores actually arise in the first place."

Direct connection between the environment and rising allergy rates

Scientists are currently investigating which mechanisms could contribute to a reduced iron loading of the "Bet v 1". "The iron loading of the birch protein could be connected with aggravated environmental conditions to which the plants are exposed," says Jensen-Jarolim. "There is possibly even a direct connection between environmental pollution and rising allergy rates. In the future it will make sense to deliberately load allergenic molecules of the "Bet v 1" type with iron when they are deployed for immune therapy for allergy sufferers. This way, one could considerably shorten this treatment, which still lasts two to four years, and increase its effectiveness."

More information: "Bet v 1 from Birch Pollen is a Lipocalin-like Protein acting as Allergen only when devoid of Iron by promoting Th2 lymphocytes." Franziska Roth-Walter, Cristina Gomez-Casado, Luis F. Pacios, Nadine Mothes-Luksch, Georg A. Roth, Josef Singer, Araceli Diaz-Perales and Erika Jensen-Jarolim, *Journal of Biological Chemistry*. www.jbc.org/content/early/2014...M114.567875.abstract

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