Endowed Departments
Department of Environmental Allergy

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General Summary

This department was established in April 2019 with the aim of disseminating cedar pollen rice, which has few side effects and can be an effective immunotherapy against cedar pollinosis; elucidating the antigen recognition mechanism of T cells for contact dermatitis caused by small molecules, such as drugs and metals; and further evaluating the usefulness of plaster used as a building material from the viewpoint of antiallergic effects.

Research Activities

Rice-based oral peptide vaccine for Japanese cedar pollinosis

Previously transgenic rice seeds contains a hybrid peptide called 7Crp peptide consisting of 7 linked dominant human T-cell epitopes derived from Cry j 1 and Cry j 2, the 2 major allergens of Japanese cedar pollen. Recent clinical studies have shown that oral administration of transgenic rice seeds significantly suppresses specific T cell responses without side effects. This finding suggests that genetically modified rice will be an effective immunotherapy that can improve clinical symptoms.

To evaluate the oral tolerance mechanism and the improvement of clinical symptoms, we performed a randomized, placebo-controlled study of oral immunotherapy with the transgenic rice seeds for Japanese cedar pollinosis. The subjects were divided into 3 groups that were evaluated after having orally ingested 5 g of TG seeds plus 45 g of control rice seeds, 20 g of transgenic rice seeds plus 30 g of control rice seeds, or 50 g of control rice seeds. The transgenic rice was orally administered for 6 months from before to after pollen season for 2 years.

We found that the reactivity of allergen-specific T cells was significantly suppressed. Interestingly, oral intake of transgenic rice seeds reduced medication usage during the Japanese cedar pollen season, although clinical symptom during 2 Japanese cedar pollen seasons did not differ significantly among the 3 groups.

These results suggest that the administration of transgenic rice seeds will clinically improve pollen symptoms. Further studies are needed to analyze the use of transgenic rice seeds by increasing the number of subjects and the administration period.

Antigen-specific recognition mechanism of paraphenylenediamine-specific T-cells

Allergic contact dermatitis due to paraphenylenediamine (PPD) has recently increased in both hairdressers who dye hair and in people whose hair is dyed. Exposure to PPD, a central component of most permanent hair dye formulations, is associated with the development of T-cell-mediated allergic contact dermatitis. To analyze the characteristics of antigen-specific T cells, the characteristics need to be examined in the presence of autologous

antigen-presenting cells; therefore, analysis with human T cells is difficult.
The aim of the present study was to generate PPD-specific T-cell lines and explore the mechanism of antigen presentation to T cells in a mouse model. Mice of the C57BL/6 strain were immunized with PPD via subcutaneous injection once a week for 6 weeks, and antigen-specific T-cell proliferation of spleen cells was analyzed 7 days after the last immunization. After more than 7 cycles of antigen stimulation once every 2 or 3 weeks in the presence of the antigen-presenting cells, PPD-specific T-cell lines were established, and their antigen specificity was investigated with structurally related chemicals.
Established T-cell lines were CD4-positive, secrete interleukin 4, and cross-react with the oxidoconjugation product Bandrowski's base. In addition, the reactivity of PPD-specific T cells was suppressed in the presence of the chemicals with a thiol group. It remains unclear how PPD is presented to T cells, but the results suggest how PPD associates with self-proteins.

Publications

Takaishi S, Saito S, Endo T, Asaka D, Wakasa Y, Takagi H, Ozawa K, Takaiwa F, Otori N, Kojima H.
T-cell activation by transgenic rice seeds expressing the genetically modified Japanese cedar pollen allergens. *Immunology.* 2019 Oct; **158**(2): 94-103. doi: 10.1111/imm.13097. Epub 2019 Aug 23. PMID: 31323138; PMCID: PMC6742765.