Editorial

Food Allergy: Towards Understanding Allergenic Structures?

Food allergy is an increasing health problem for both children and adults. Amounts in the low milligram range of allergenic foods have been shown to cause serious reactions, and allergic reactions to foods can be life-threatening. The problem of food allergy is multifactorial and can only be solved by interdisciplinary approaches – a miscommunication among various components of the immune system in combination with several other factors are relevant for the development of food allergy. For example, structure, function, and stability of allergenic molecules, state of processing of the respective food, interactions of allergens with constituents of the food matrix, interactions of food components with the immune system, and genetic factors have all been identified or suspected as factors that are involved in the development of food allergies. The problem can only be approached by combining information arising from the scientific disciplines involved in molecular nutrition and food research. Thus, food allergy will be a key area of our new journal.

In the present and next issue of *Molecular Nutrition Food Research*, we have compiled contributions addressing several important topics from the field of food allergy, starting with a collection of reviews prepared by well-known experts. The contribution by Crespo and co-authors introduces the reader to the clinical background of the disease and reminds us that high-level clinical research is still required to address the unsolved problems in diagnosing and treating food allergy. We must face the fact that a therapy which has the potential to cure food allergy still does not exist.

Based on their immunological mechanisms, food allergies are categorized into classical and pollen-related food allergies. The immunoglobulin G (IgE) response to classical food allergens is initiated *via* the gastrointestinal tract, whereas primary sensitization to pollen allergens and subsequent IgE cross-reactivity to homologous food proteins results in pollen-related allergic reactions to these foods. Despite the fact that only very few of the thousands of food antigens that we ingest each day have been identified as allergens, structural features that determine allergenicity of food proteins have not yet been identified. However, as pointed out in the paper by Pastorello *et al.*, it appears that some protein structures in foods cause more severe allergic reactions than others. High stability to thermal treatment and resistance to digestive enzymes are likely to be linked to the strong allergenicity of lipid transfer proteins and 2S albumins from plant-derived foods. As pointed out in the review by Poulsen, such information is useful for approaches to assess potential allergenicity of novel foods and in particular of genetically modified (GMO) foods. So far, no GMO food has been found to have increased allergenic potential, but public concern continues, and in light of the lack of known molecular structures that predict *de novo* allergenicity, a certain level of uncertainty will remain with any assessment procedure.

T cells are key players in both the sensitization process as well as for redirecting immune responses towards tolerance. The importance and potential for food allergy of studies at the T cell level is highlighted in the review by Bohle. A deeper understanding of the cellular processes underlying food allergy will be essential to develop novel and efficient therapeutic approaches. In contrast to respiratory allergy and insect venom allergy, no specific immunotherapy (SIT) exists for food due to severe adverse effects that occurred in clinical studies with allergen extracts. However, one would expect that, in pollen-related food allergy, SIT with birch pollen extract would have a beneficial effect on associated food allergy, *e.g.*, to apple or hazelnut. Conflicting results have been reported, and several studies on that topic were relatively poorly controlled. The paper by Skamstrup Hansen *et al.* provides evidence that, under controlled conditions, it seems to be difficult to demonstrate a therapeutic effect of birch pollen SIT on food allergy to apple which contains a homologue (Mal d 1) of the major birch pollen Bet v 1.

Pure allergens produced as recombinant proteins have been found to be very powerful tools in molecular allergology, and led to an enormous increase in our understanding of allergenic structures including the first successful determination of high-resolution solution structures of food allergens and the biological function of allergen molecules. The paper by Marknell DeWitt and co-authors is a recent example from this field. The muscle protein tropomyosin which was identified as the major allergen of shrimp more than 20 years ago was cloned from the species *Penaeus aztecus,* produced as a recombinant protein in *Escherichia coli* and characterized with respect to IgE antibody binding properties in comparison to natural shrimp tropomyosin. Recombinant Pen a 1 displayed chromatographic and folding characteristics similar to those of purified natural shrimp tropomyosin. A similar IgE-binding capacity of recombinant and natural tropomyosin was found, and recombinant rPen a 1 was further shown to extensively and specifically compete for IgE binding to extracts of other crustacean species, house dust mite, and German cockroach. In the future, the protein will be used as a diagnostic marker for shrimp allergy, and may help us to come one small step further – towards understanding allergenic structures.

Stefan Vieths

