Determinants of Food Allergy

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KEYWORDS

• Food allergy • Allergen • Plant food allergens
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• Cross-reactive carbohydrate determinants • Alpha-gal

As of September 2011, there were 12,273 recognized protein families in the Pfam database, yet only 255 (2.1%) of those families are represented among allergens. Among food allergens, only 71 (0.6%) families are represented (from ~400 described allergens); and among the top 20 families, a mere 0.16% of protein families, account for 80% of all described food allergens (**Table 1**).[1] At the same time, it is not the case that simple elements (ie, primary or secondary structure) are constrained among allergens. For instance, examples of all common polypeptide folds are found without apparent strong overrepresentation of some.[2,3] These observations suggest that there are determinants of food allergy, that is, structural or functional properties of certain proteins that play a significant role in determining what makes them allergens. In this review, the authors briefly review the categorization of food allergens and then draw on 3 examples of food allergies with disparate clinical presentations to discuss the potential relationships between allergen structure and function and the immune responses induced in humans.

WHAT IS A FOOD ALLERGEN?

The simplest definition of an allergen is a substance that causes an allergic reaction, broadly speaking, a hypersensitivity immune response, but usually refers to a type I– or

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Table 1
Common food allergy protein families ranked by number of identified allergens in each family

Family	Source	Rank by Number of Identified Family Members Associated with Food Allergy	Rank by Number of Identified Family Members Associated with Aero/Contact Allergy	Additional Notes
Prolamin superfamily	Plant	1	4	Includes cereal storage (gliadins), 2S albumin (eg, Arah 2/6), LTPs
Tropomyosin	Animal	2	5	Dominant crustacean allergen
Cupin superfamily	Plant	3	Rare; 1 described inhalant, 1 described contact	Dominant family of legume and nut allergens
Profilin	Plant	4	1	Highly cross-reactive
EF-hand domain	Plant, animal	5	2	For ingestion, exclusively associated with fish, shellfish
PR-10	Plant	6	18	Bet v 1 related
Alpha/beta-caseins	Animal, mammal	7	Not described	Milk allergens
Heveinlike domain	Plant	8	Latex allergy only	Includes some chitinases; latex, banana, avocado
Class I chitinases	Plant	9	Latex allergy only	Latex, banana, avocado (also chestnut, grape, corn)