

Cross-reactivity is a complex topic. To aid explanation we will first break it down to clarify some of the elements and mechanisms involved.

What are antibodies?

An antibody (or immunoglobulin), is a protective Y-shaped protein that is synthesised by the immune system in direct response to the detection of a foreign substance (specifically an antigen) within the bloodstream. The immune system produces five different types of antibodies: IgA, IgD, IgE, IgG and IgM, each of these having their own specific function and mechanism of action in relation to protecting the body. With relevance to food sensitivity and cross-reactivity, we are specifically interested in IgG antibodies, which make up approximately 75% of all antibodies within the human body including the bloodstream. Once produced, IgG antibodies can recognize and latch onto the specific antigens that originally stimulated their production, in order to ultimately remove them from the body. Thus, when an antigen enters into systemic circulation, the immune system is able to recognise it as a foreign invader, the molecules on its surface differing from those found naturally within the body. This response triggers its removal from the system. Let's look at this in more detail.

What are antigens?

An antigen is any foreign substance (usually a protein) that is capable of binding to an antibody. However, despite all antigens being recognised by specific antibodies, not every antigen can evoke an immune response. Antigens that are capable of inducing an immune response, either by specifically stimulating lymphocytes to synthesise antibodies in response to their presence or by attacking the antigen directly, are said to be immunogenic and are known as immunogens. In essence, an immunogen is always an antigen, but an antigen may not necessarily be an immunogen.

What are paratopes and epitopes?

A paratope is the part of an antibody that recognises an antigen and attaches itself specifically to small regions on its surface called epitopes. Epitopes are the components of an antigen that are able to trigger an immune response, as they are able to bind to specific antigen receptors on the surface of B cells. This binding can only occur if their relative structures are matched (like a lock and key), which consequently triggers the production of B cell antibodies. These antibodies are subsequently directed specifically to these epitopes, enabling them to bind and ultimately remove the antigen from the body.

What is cross-reactivity?

Cross-reactivity occurs when an antibody recognises not only the antigen for which it was originally formed, but also others that have a significant degree of epitope similarity to that of the original antigen. Cross-reactions are the degree to which various antigens appear alike to the immune system.

This structural similarity enables an antibody specifically raised against one particular antigen, to recognise another antigen as being identical and to bind with it. An individual who has elevated IgG antibodies to a specific food, may therefore show raised antibodies to other foods with similar protein antigens in an IgG-mediated food sensitivity test. It is important to understand this mechanism, as it can be confusing to clients if

a food is shown as positive but is not included within the diet. Additionally, there are other reasons why a food that has not been eaten may appear on the results, but this is outside of the scope of this document.

It is important to understand that while cross-reactions within the same food family may occur, it cannot be assumed. Therefore, if an individual has elevated IgG antibodies to a specific food, other potentially cross-reactive foods (which are not included in their FoodPrint® report) should be kept in the diet. Something else to consider is that, although antibodies produced against a specific food may cross-react with food antigens within the same food family, they can also cross-react with non-food items such as dust mites, pollen, latex or animal dander. This is known as concomitant food sensitivity.

What are pan-allergens, profilins, storage proteins and LTPs?

Pan-allergens encompass multiple protein families e.g., profilins, polcalcins, lipid transfer proteins (LTPs), tropomyosins etc, of both plant and animal origin, which share similar or identical gene sequences in a region. Although they are usually regarded as minor allergens, sensitisation to them increases the risk of developing multiple allergies and sensitivities. They are widely distributed throughout nature and, as they are vital for both plant and animal function, they are a common source of potential cross-reactions between both related and unrelated allergenic sources. This can include reactions between food, pollen, latex, dust or storage mites, animal dander and even bird feathers. Although published research into pan-allergens has focused only on IgE, the inherently intricate and complementary relationship between IgE and IgG antibodies indicates that an overlap in reactivity is likely.

Storage proteins are primarily located within seeds, nuts or kernels and, because they are comparatively stable to heat and stomach acidity, both raw and cooked foods are likely to be potential allergens in equal measure. This is also the case with LTPs which are prevalent throughout the plant kingdom and, similar to storage proteins, are heat stable and resistant to stomach acidity and proteolytic enzymes. Profilins however, are denatured when heated/cooked and therefore clinically significant reactions to these specific proteins tend to typically occur only with raw foods.

The clinical relevance of cross-reactions depends upon several factors, which would include:

- The degree of homology (similarity) of epitopes
- The amount of antigen present
- The resistance of the consumed protein to stomach acid and digestive enzymes
- The relative solubility of the consumed protein
- The impact of cooking and ripening on antigen expression

Table 1 key:

The following table identifies potential cross-reactions between different foods, and classifies them into one of 3 categories, according to the research:

* Demonstrated in vivo

** Demonstrated in vitro

Not yet demonstrated (list based upon potential similarity in antigens between foods in the same family)

Table 1:

Food	Possible cross-reactivity with the following foods
Agar agar #	Carrageenan, chlorella, dulse, kelp, spirulina
Almond * (11, 30)	Brazil nut, cashew, hazelnut, pistachio
Aloe vera	None
Amaranth #	Beetroot, quinoa, spinach, Swiss chard
Anchovy ** (15)	Mackerel
Aniseed #	Angelica, caraway, carrot, celeriac, celery, coriander, cumin, dill, fennel, parsley, parsnip
Apple * (27, 30)	Apricot, blackberry, cherry, nectarine, peach, pear, plum, prune, raspberry, rose hip, strawberry
Apricot * (24, 27, 30)	Apple, blackberry, cherry, nectarine, peach, pear, plum, prune, raspberry, rose hip, strawberry
Artichoke #	Camomile, chicory, dandelion, lettuce, sunflower seed, tarragon
Asparagus #	Yucca
Aubergine * (2)	Bell pepper, cayenne, chilli, paprika, potato, tomato
Avocado #	Banana, bay leaf, chestnut, cinnamon, kiwi, plantain
Banana #	Avocado, chestnut, kiwi, plantain
Barley #	Other gluten containing grains
Basil #	Marjoram, mint, peppermint, rosemary, sage, thyme
Bass #	Varieties of Bass
Bay Leaf #	Avocado, cinnamon
Bean (Broad) #	Black beans, borlotti beans, cannellini beans, pinto beans, red kidney beans, white haricot beans
Bean (Green) #	Black beans, borlotti beans, cannellini beans, pinto beans, red kidney beans, white haricot beans
Bean (Kidney) #	Black beans, borlotti beans, cannellini beans, green beans, pinto beans, white haricot beans
Bean (White Haricot) #	Black beans, borlotti beans, cannellini beans, green beans, pinto beans, red kidney beans
Beef ** (1) #	Lamb, veal, venison
Beetroot #	Amaranth, quinoa, spinach, Swiss chard
Blackberry #	Apple, apricot, cherry, nectarine, peach, pear, plum, prune, raspberry, rose hip, strawberry

Food	Possible cross-reactivity with the following foods
Blackcurrant #	Varieties of currant
Blueberry #	Cranberry, huckleberry
Brazil nut * (11, 30)	Almond, cashew, hazelnut, pistachio
Broccoli #	Brussels sprout, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rapeseed, rocket, watercress, turnip
Brussels Sprout #	Broccoli, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rapeseed, rocket, watercress, turnip
Buckwheat #	Rhubarb, sorrel
Cabbage (red) #	Broccoli, Brussels sprout, cabbage (white/savoy), cauliflower, mustard, rapeseed, turnip
Cabbage (white/savoy) #	Broccoli, Brussels sprout, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rapeseed, rocket, watercress, turnip
Camomile #	Echinacea, feverfew
Caper	None identified
Carob #	Guar gum
Carrot * (18) #	Angelica, aniseed, caraway, celeriac, celery, coriander, cucumber, cumin, dill, fennel, parsley, parsnip, watermelon
Cashew ** (3) * (10, 11, 30)	Almond, Brazil nut, hazelnut, peppercorns, pistachio
Cauliflower #	Broccoli, Brussels sprout, cabbage, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rapeseed, rocket, watercress, turnip
Caviar #	Sturgeon family
Cayenne #	Aubergine, bell pepper, chilli, paprika, potato, tomato
Celery * (18) #	Angelica, aniseed, caraway, carrot, celeriac, coriander, cucumber, cumin, dill, fennel, parsley, parsnip, watermelon
Chard #	Amaranth, beetroot, quinoa, spinach
Cherry * (24, 27, 30) #	Apple, apricot, blackberry, nectarine, peach, pear, plum, prune, raspberry, rose hip, strawberry
Chestnut #	Avocado, banana, kiwi, plantain
Chicken ** (16, 30)	Pheasant, quail, turkey (possibly duck and goose)
Chickpea ** (10, 30)	Lentil, pea
Chicory #	Artichoke, camomile, dandelion, lettuce, sunflower seed, tarragon
Chilli (red) #	Aubergine, bell pepper, cayenne, paprika, potato, tomato
Cinnamon #	Avocado, bay leaf
Clam ** (21)	Cockle, mussel, oyster, scallop, winkle
Clove #	Allspice, eucalyptus, guava
Cockle ** (21)	Clam, mussel, oyster, scallop, winkle
Cocoa bean ** (4) #	Chocolate, coffee, cola nut, karaya gum (vegetable gum)
Coconut #	Date, hazelnut, lentil, palm, walnut
Cod * (13) #	Haddock, hake, herring, mackerel, plaice, pollock, whiting
Coffee ** (4) #	Cocoa bean, cola nut
Coriander #	Angelica, aniseed, caraway, carrot, celeriac, celery, cumin, dill, fennel, parsley, parsnip

Food	Possible cross-reactivity with the following foods
Corn (Maize) #	Millet, polenta, rice
Couscous #	Other gluten-containing grains
Crab * (21, 30, 34)	Crayfish, lobster, prawn, shrimp
Cranberry #	Blueberry, huckleberry
Cucumber * (18) #	Carrot, celery, courgette, gherkin, marrow, melon, pumpkin, squash, watermelon
Cumin #	Angelica, aniseed, caraway, carrot, celeriac, celery, coriander, dill, fennel, parsley, parsnip
Curry (Mixed spices) #	Angelica, aniseed, arrowroot, caraway, cardamom, carrot, celeriac, celery, coriander, dill, fennel, ginger, parsley, parsnip, turmeric
Cuttlefish ** (21)	Octopus, squid
Date #	Coconut, palm
Dill #	Angelica, aniseed, caraway, carrot, celeriac, celery, coriander, cumin, fennel, parsley, parsnip
Duck * (16) #	Goose (possibly chicken)
Durum wheat #	Other gluten-containing grains
Eel * (31)	Varieties of eel and potentially codfish
Egg white (Chicken) * (10)	Partridge, peafowl, pheasant, quail, (possibly duck and goose)
Egg yolk (Chicken) * (10)	Partridge, peafowl, pheasant, quail, (possibly duck and goose)
Fennel #	Angelica, aniseed, caraway, carrot, celeriac, celery, coriander, cumin, dill, parsley, parsnip
Fig #	Breadfruit, hops, mulberry
Flaxseed #	Peanut, soybean, rapeseed, wheat
Garlic ** (29)	Chive, leek, onion, shallot
Ginger #	Arrowroot, cardamom, turmeric
Gliadin #	Avenin (found in oats)
Goat #	Beef, lamb, veal
Grape #	Raisin, sultana
Grapefruit #	Lemon, lime, mandarin (includes clementine, satsuma and tangerine), orange
Guava #	Clove, allspice, eucalyptus
Haddock *	Cod, hake, pollock, whiting
Hake *	Cod, haddock, pollock, whiting
Hazelnut * (11, 30)	Almond, Brazil nut, cashew, macadamia, pistachio
Herring * (13, 30) #	Cod, herring, mackerel, pilchard, plaice, sardine, shad, sprat
Hops #	Breadfruit, fig, mulberry
Horse #	Donkey, zebra
Kiwi #	Varieties of kiwi
Lamb ** (1) #	Beef, veal, venison
Leek ** (29)	Chive, garlic, onion, shallot
Lemon #	Grapefruit, lime, mandarin (includes clementine, satsuma and tangerine), orange
Lentil ** (10) * (30)	Chickpea, pea
Lettuce #	Artichoke, camomile, chicory, dandelion, sunflower seed, tarragon

Food	Possible cross-reactivity with the following foods
Lime #	Grapefruit, lemon, mandarin (includes clementine, satsuma and tangerine), orange
Liquorice #	Alfalfa, bean, carob, chickpea, lentil, pea, peanut, senna, soya bean
Lobster * (21, 30, 34)	Crab, crayfish, prawn, shrimp
Lychee #	Varieties of lychee
Macadamia nut ** (32)	Hazelnut (weak cross-reactivity)
Mackerel *(13, 30) ** (15)	Anchovy, cod, herring, plaice
Malt #	Other gluten-containing grains
Mango #	(Possibly cashew and pistachio)
Marjoram #	Basil, mint, peppermint, rosemary, sage, thyme
Marrow #	Courgette, cucumber, gherkin, melon, pumpkin, squash, watermelon
Melon/gala/honeydew #	Courgette, cucumber, gherkin, marrow, pumpkin, squash, watermelon
Milk (buffalo) ** (9, 10, 30)	Milk from cow, goat, sheep
Milk (cow) ** (9, 10, 30)	Milk from buffalo, goat, sheep
Milk (goat) ** (9, 10, 30)	Milk from cow, sheep
Milk (sheep) ** (9, 10, 30)	Milk from buffalo, cow, goat
Millet #	Corn (maize), polenta, rice
Mint #	Basil, marjoram, peppermint, rosemary, sage, thyme
Monkfish #	Varieties of monkfish
Mulberry #	Breadfruit, fig, hops
Mushroom #	Varieties of mushroom
Mussel ** (21)	Clam, cockle, oyster, scallop, winkle
Mustard seed #	Broccoli, Brussels sprout, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, radish, rapeseed, rocket, turnip, watercress
Nectarine #	Apple, apricot, blackberry, cherry, peach, pear, plum, prune, raspberry, rose hip, strawberry
Nettle	None identified
Nutmeg #	Mace
Oat #	Gluten-containing grains
Octopus ** (21)	Cuttlefish, squid
Olive #	Varieties of olive
Onion ** (29)	Chive, garlic, leek, shallot
Orange #	Grapefruit, lemon, lime, mandarin (includes clementine, satsuma and tangerine)
Ostrich	None identified
Oyster ** (21, 30)	Clam, cockle, mussel, scallop, winkle
Papaya #	Custard apple, pawpaw
Parsley #	Angelica, aniseed, caraway, carrot, celeriac, celery, coriander, cumin, dill, fennel, parsnip
Partridge ** (16) #	Chicken, pheasant, quail, turkey

Food	Possible cross-reactivity with the following foods
Pea #	Mange tout, marrow fat, petit pois, sugar snap, split pea
Peach * (24, 27, 30) #	Apple, apricot, blackberry, cherry, nectarine, pear, plum, prune, raspberry, rose hip, strawberry
Peanut #	Alfalfa, bean, carob, chickpea, lentil, liquorice, pea, senna, soya bean
Pear * (27, 30) #	Apple, apricot, blackberry, cherry, nectarine, peach, plum, prune, raspberry, rose hip, strawberry
Pepper (green/red/yellow) * (1) #	Aubergine, cayenne, chilli, paprika, potato, tomato
Peppercorn (black/white) #	Varieties of peppercorn
Peppermint #	Basil, marjoram, mint, rosemary, sage, thyme
Perch #	Varieties of perch
Pike #	Pickerel
Pine nut *	Almond, peanut
Pineapple	None identified
Pistachio ** (3) * (10, 11, 25, 30)	Almond, brazil nut, cashew, hazelnut
Plaice * (13, 30) #	Cod, flounder, halibut, herring, mackerel, sole
Plum * (24, 27, 30) #	Apple, apricot, blackberry, cherry, nectarine, peach, pear, prune, raspberry, rose hip, strawberry
Polenta #	Corn (maize), millet, rice
Pomegranate	None identified
Pork #	Wild boar
Potato * (2) #	Aubergine, bell pepper, cayenne, chilli, paprika, tomato
Quail ** (16, 30)	Chicken, partridge, peafowl, pheasant
Quinoa #	Amaranth, beetroot, chard, spinach
Rabbit #	Hare
Radish #	Broccoli, Brussels sprout, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, rapeseed, rocket, turnip, watercress
Raisin #	Grape, sultana
Rapeseed #	Broccoli, Brussels sprout, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rocket, turnip, watercress
Raspberry #	Apple, apricot, blackberry, cherry, nectarine, peach, pear, plum, prune, rose hip, strawberry
Redcurrant #	Varieties of currant
Rhubarb #	Buckwheat, sorrel
Rice #	Corn (maize), millet, polenta
Rocket #	Broccoli, Brussels sprout, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rapeseed, turnip, watercress
Rosemary #	Basil, marjoram, mint, peppermint, sage, thyme
Rye #	Other gluten-containing grains
Saffron	None identified

Food	Possible cross-reactivity with the following foods
Sage #	Basil, marjoram, mint, peppermint, rosemary, thyme
Salmon ** (15)	Pollock, trout, tuna
Sardine #	Herring, pilchards, shad, sprat
Scallop ** (21, 30)	Clam, cockle, mussel, oyster, winkle
Sea bream (Gilthead) #	Varieties of bream
Sesame seed * (12)	Poppy seed
Shallot ** (29)	Chive, garlic, leek, onion
Shrimp/prawn * (21, 30, 34)	Crab, crayfish, lobster
Sole #	Flounder, halibut, plaice
Soya bean #	Alfalfa, bean, carob, chickpea, lentil, liquorice, pea, peanut, senna
Spelt #	Other gluten-containing grains
Spinach #	Amaranth, beetroot, chard, quinoa
Squash (butternut/carnival) #	Courgette, cucumber, gherkin, marrow, melon, pumpkin, watermelon
Squid ** (21)	Cuttlefish, octopus
Strawberry * (27, 30) #	Apple, apricot, blackberry, cherry, nectarine, peach, pear, plum, prune, raspberry, rose hip
Sunflower seed #	Artichoke, camomile, chicory, dandelion, lettuce, tarragon
Sweet potato #	Morning glory, winter spinach
Swordfish #	Varieties of swordfish
Tangerine #	Grapefruit, lemon, lime, mandarin (includes satsuma and clementine), orange
Tapioca #	Yuca
Tarragon #	Artichoke, camomile, chicory, dandelion, lettuce, sunflower seed
Tea (black) #	Varieties of tea
Tea (green) #	Varieties of tea
Thyme #	Basil, marjoram, mint, peppermint, rosemary, sage
Tiger nut	None identified
Tomato * (2) #	Aubergine, cayenne, chilli, paprika, bell pepper, potato
Trout ** (15)	Pollock, salmon, tuna
Tuna ** (15)	Pollock, salmon, trout
Turbot #	Varieties of turbot
Turkey ** (16, 30)	Chicken, partridge, pheasant, quail (possibly duck and goose)
Turnip #	Broccoli, Brussels sprout, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rapeseed, rocket, watercress
Vanilla	None identified
Veal ** (1) #	Beef, lamb, venison
Venison ** (1) #	Beef, caribou, elk, lamb, reindeer
Walnut * (10)	Hazel nut, pecan
Watercress #	Broccoli, Brussels sprout, cabbage, cauliflower, Chinese leaves, cress, horseradish, kale, kohlrabi, mustard, radish, rapeseed, rocket, turnip
Watermelon * (18) #	Carrot, celery, courgette, cucumber, gherkin, marrow, melon, pumpkin, squash

Food	Possible cross-reactivity with the following foods
Wheat #	Other gluten-containing grains
Wheat bran #	Other gluten-containing grains
Wild boar #	Pork
Winkle #	Clam, cockle, mussel, oyster, scallop
Yeast (brewer's/baker's) **	Nutritional yeast
Yuca #	Tapioca

Cross-reactivity between food and non-food sources (Tables 2a and 2b)

Table 2a:

Food	Cat dander	Dog dander	Hamster/guinea pig dander	Cow dander	Bird feathers	Dust mites
Beef/veal	x	x		x		
Horse	x	x	x	x		
Lamb	x					
Molluscs and crustaceans						x
Pork/wild boar	x	x				
Poultry/pheasant egg yolk					x	

Table 2b:

Food	Birch pollen	Ragweed pollen	Timothy pollen	Mugwort pollen	Latex
Almond	x			x	
Aniseed				x	
Apple	x				x
Apricot				x	
Aubergine		x		x	x
Avocado					x
Banana		x			x
Blackberry				x	
Broccoli				x	
Cabbage				x	
Caraway				x	
Carrot	x			x	x
Cassava/tapioca					x
Cauliflower				x	
Celery	x			x	x
Cherry	x			x	
Chestnut					x
Cocoa bean		x	x		

Food	Birch pollen	Ragweed pollen	Timothy pollen	Mugwort pollen	Latex
Coriander				x	
Cucumber		x			
Fennel				x	
Fig					x
Garlic				x	
Hazelnut	x				
Kiwi	x				x
Leek				x	
Mango	x			x	
Melon		x	x		x
Onion				x	
Orange			x		
Papaya					x
Parsley				x	
Peach	x			x	
Peanut	x				
Pear	x			x	
Pepper				x	
Plum	x			x	
Potato	x			x	x
Raspberry				x	
Shallot				x	
Soya bean	x				
Strawberry				x	
Tomato			x	x	x
Watermelon		x	x		

(Table 2a & 2b references: 7, 8, 17, 20, 22, 23, 24, 25, 26, 27, 30)

References:

1. Ayuso, R. et al. (2000) Identification of bovine IgG as a major cross-reactive vertebrate meat allergen. *Allergy*, 55(4), 348-54.
2. Babu, B.N. and Venkatesh, Y.P. (2009) Clinico-immunological analysis of eggplant (*Solanum melongena*) allergy indicates preponderance of allergens in the peel. *The World Allergy Organization Journal*, 2(9), 192–200.
3. Bastiaan-Net, S. et al. (2019) IgE Cross-Reactivity of Cashew Nut Allergens. *International Archives of Allergy and Immunology*, 178(1), 19-32.
4. Becker, C. et al. (1981) Tobacco, cocoa, coffee, and ragweed: cross-reacting allergens that activate factor-XII-dependent pathways. *Blood*, 58(5), 861-7.
5. Blanco, C. et al. (1994) Latex allergy: clinical features and cross-reactivity with fruits. *Annals of Allergy*, 73(4), 309-14.
6. Chapman, J.A. et al. (2006) Food allergy: a practice parameter. *Annals of Allergy, Asthma & Immunology*, 96 (3 Suppl 2), S1-68.
7. Díez-Gómez, M.L. et al. (1998) Asthma caused by *Ficus benjamina* latex: evidence of cross-reactivity with fig fruit and papain. *Annals of Allergy, Asthma & Immunology*, 80(1), 24-30.
8. Díez-Gómez, M.L. et al. (1999) Fruit-pollen-latex cross-reactivity: implication of profilin (Bet v 2). *Allergy*, 54(9), 951-61.
9. Dixit, S.J. et al. (2012) Study of human allergic milk whey protein from different mammalian species using computational method. *Bioinformatics*, 8(21), 1035-41.
10. García, B.E. and Lizaso, M.T. (2011) Cross-reactivity syndromes in food allergy. *Journal of Investigational Allergology and Clinical Immunology*, 21(3), 162-70.
11. Goetz D.W. et al. (2005) Cross-reactivity among edible nuts: double immunodiffusion, crossed immunoelectrophoresis, and human specific IgE serologic surveys. *Annals of Allergy, Asthma and Immunology*, 95(1), 45-52.
12. Gloor, M. et al. (1995) Poppyseed anaphylaxis. *Swiss Medical Weekly*, 125(30), 1434-7.
13. Hansen, T.K. et al. (1997) Codfish allergy in adults: IgE cross-reactivity among fish species. *Annals of Allergy, Asthma and Immunology*, 78(2), 187-94.
14. Hauser, M. et al. (2010) Panallergens and their impact on the allergic patient. *Allergy, Asthma and Clinical Immunology*, 6(1), 1-14.

15. Helbling, A. et al. (1996) Immunopathogenesis of fish allergy: identification of fish-allergic adults by skin test and radioallergosorbent test. *Annals of Allergy, Asthma and Immunology*, 77(1), 48-54.
16. Hemmer, W. et al. (2016) Update on the bird-egg syndrome and genuine poultry meat allergy. *Allergo Journal International*, 25, 68–75.
17. Ibero, M. et al. (2007) Allergy to cassava: A new allergenic food with cross-reactivity to latex. *Journal of Investigational Allergology and Clinical Immunology*, 17(6), 409-12.
18. Jordan-Wagner D.L. et al. (1993) Cross-allergenicity among celery, cucumber, carrot, and watermelon. *Annals of Allergy*, 71(1), 70-9.
19. Konradsen, J.R. et al. (2015) Allergy to furry animals: New insights, diagnostic approaches, and challenges. *Journal of Allergy and Clinical Immunology*, 135(3), 616-25.
20. Kurup, V.P. et al. (1994) Cross-reactivity of food allergens in latex allergy. *Allergy and Asthma Proceedings*, 15(4), 211-6.
21. Lopata, A.L. et al. (2016) Allergens and molecular diagnostics of shellfish allergy: Part 22 of the Series Molecular Allergology. *Allergo Journal International*, 25(7), 210–18.
22. Moore, A. (2019) Oral allergy syndrome – pollens and cross-reacting foods. *American Academy of Allergy, Asthma & Immunology*. Available at: <https://www.aaaai.org/tools-for-the-public/conditions-lib> [Accessed 08 Mar 2022].
23. M'Raihi, L. et al. (1991) Cross-reactivity between latex and banana. *Journal of Allergy and Clinical Immunology*, 87(1, part 1), 129-30.
24. Pastorello, E.A. et al. (1994) Allergenic cross-reactivity among peach, apricot, plum, and cherry in patients with oral allergy syndrome: an in vivo and in vitro study. *Journal of Allergy and Clinical Immunology*, 94(4), 699-707.
25. Popescu, F-D. (2015) Cross-reactivity between aeroallergens and food allergens. *World Journal of Methodology*, 5(2), 31-50.
26. Reche, M. et al. (2001) Tomato allergy in children and young adults: cross-reactivity with latex and potato. *Allergy*, 56(12), 1197-201.
27. Rodriguez, J. et al. (2000) Clinical cross-reactivity among foods of the Rosaceae family. *Journal of Allergy and Clinical Immunology*, 106(1 part 1), 183-9.
28. Sareen, R. and Shah, A. (2011) Hypersensitivity manifestations to the fruit mango. *Asia Pacific Allergy*, 1(1), 43-9.

-
29. Shao-Hsuan, K. et al. (2004) Identification and immunologic characterization of an allergen, alliin lyase, from garlic (*Allium sativum*). *Journal of Allergy and Clinical Immunology*, 113(1), 161-8.
 30. Sicherer, S.H. (2001) Clinical implications of cross-reactive food allergens. *Journal of Allergy and Clinical Immunology*, 108(6), 881-90.
 31. Sten, E. et al. (2004) Cross-reactivity to eel, eelpout and ocean pout in codfish-allergic patients. *Allergy*, 59(11), 1173-80.
 32. Sutherland, M.F. et al. (1999) Macadamia nut anaphylaxis: Demonstration of specific IgE reactivity and partial cross-reactivity with hazelnut. *Journal of Allergy and Clinical Immunology*, 104(4, Part 1), 889-90.
 33. Wai, C.Y.Y. et al. (2014) Immunization with hypoallergens of shrimp allergen tropomyosin inhibits shrimp tropomyosin specific IgE reactivity. *PLoS One*, 9(11), e111649.
 34. Woo, C.K. and Bahna, S.L. (2011) Not all shellfish “allergy” is allergy! *Clinical and Translational Allergy*, 1(1), 3.