

## Webiner #2 “Understanding allergy of livestock products”



# The Pathogenesis of Food Allergy caused by Livestock Products

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Oct 25th, 2023

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- Clinical features of food allergy
- Mechanism of food allergy: Dual allergen exposure hypothesis
- Topics in allergy to livestock products

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# Two clinical types of food allergy

## Immediate-type

Reactions appearing  
within 1-2 hours



Hives, Facial edema  
Vomiting  
Respiratory distress  
Loss of consciousness, Shock  
Sometimes life-threatening

## Non-immediate type

Reactions appearing  
after several hours



Worsening of atopic dermatitis  
Gastrointestinal symptoms  
(vomiting, abdominal pain, diarrhea, etc.)

# Players in 2 types of food allergy

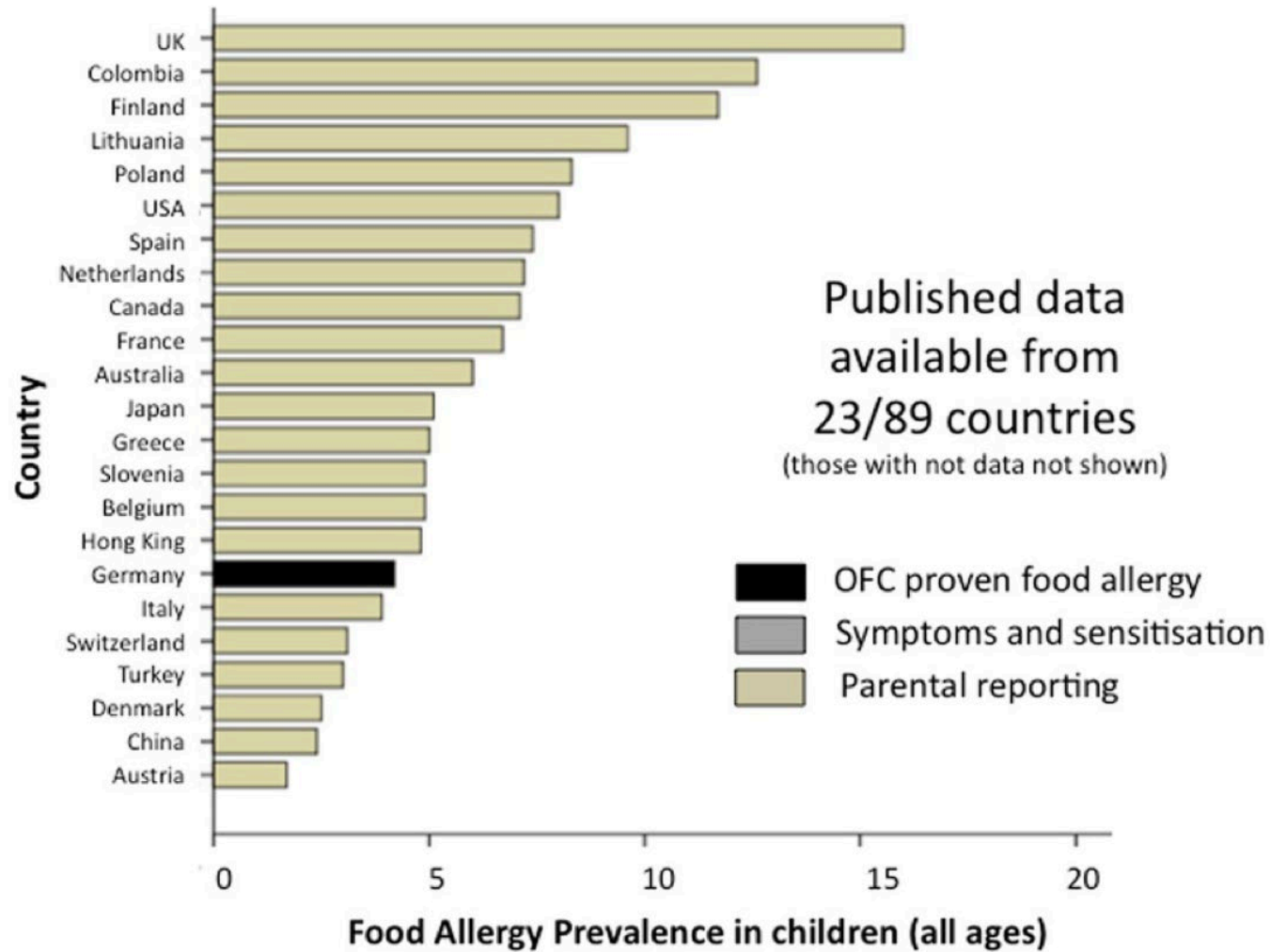
Immediate-type

IgE antibody-mediated

Non-immediate type

Cell-mediated  
(Th2 lymphocytes/Eosinophils)

# Prevalence of immediate-type food allergy in the world

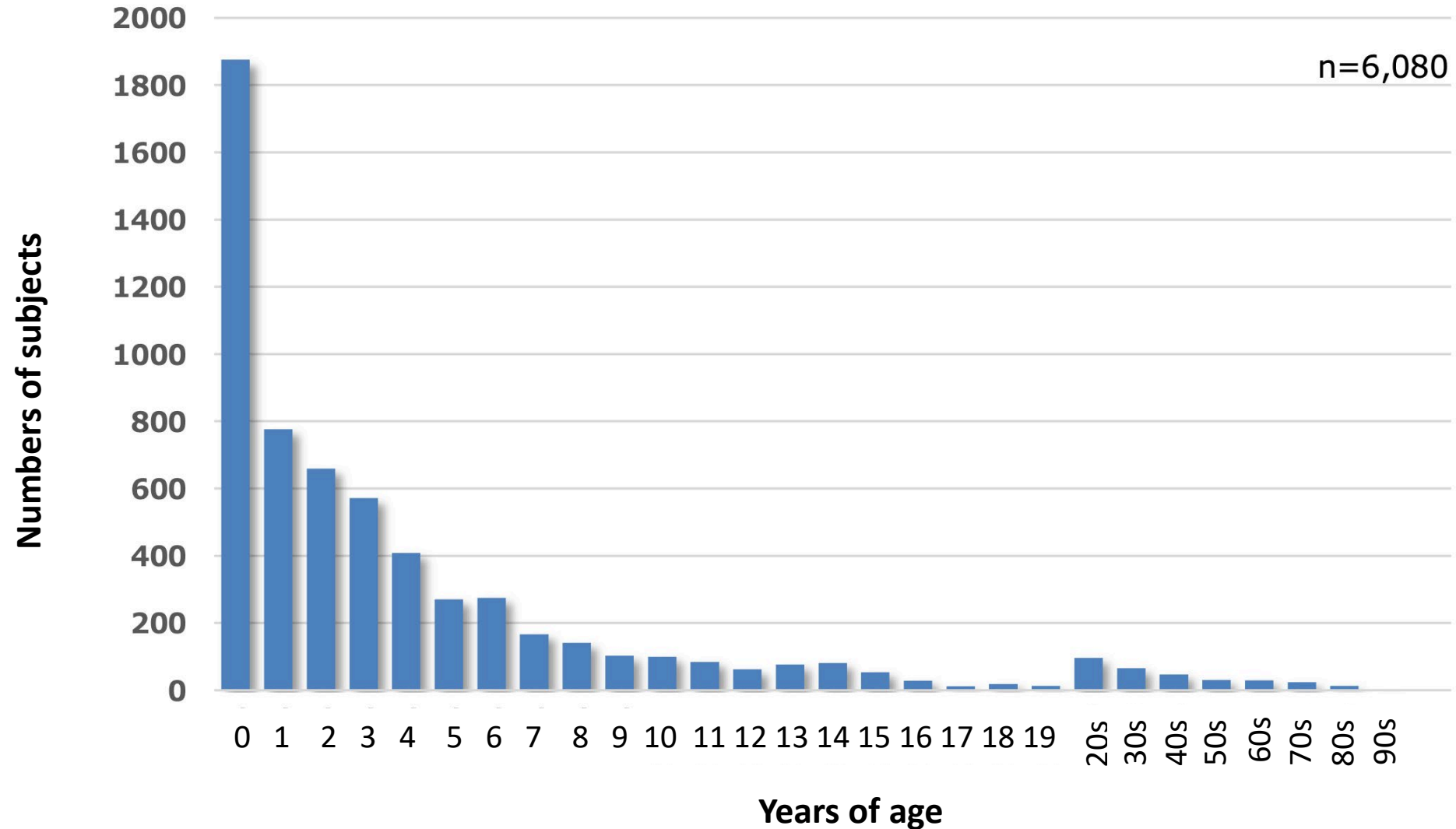


In Japan

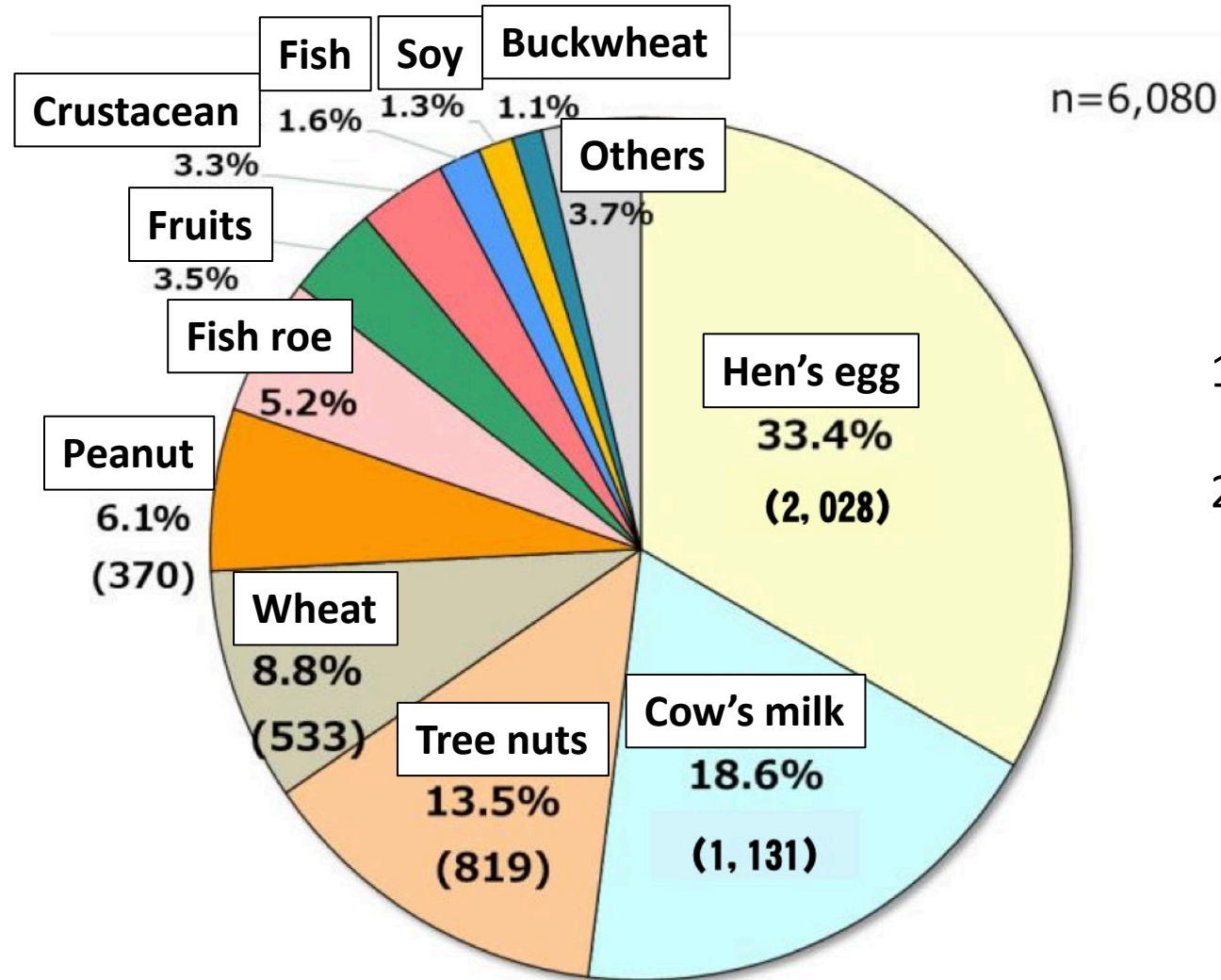
- 1-2% of whole population
- 10 % of Infants
- 5% of Preschool children
- 1 % of Adults

(Prescott S, et al. World Allergy Organization Journal 2013;6:21)

# Age distribution of immediate-type food allergy in Japan



# Food allergens in immediate-type food allergy in Japan: Latest data



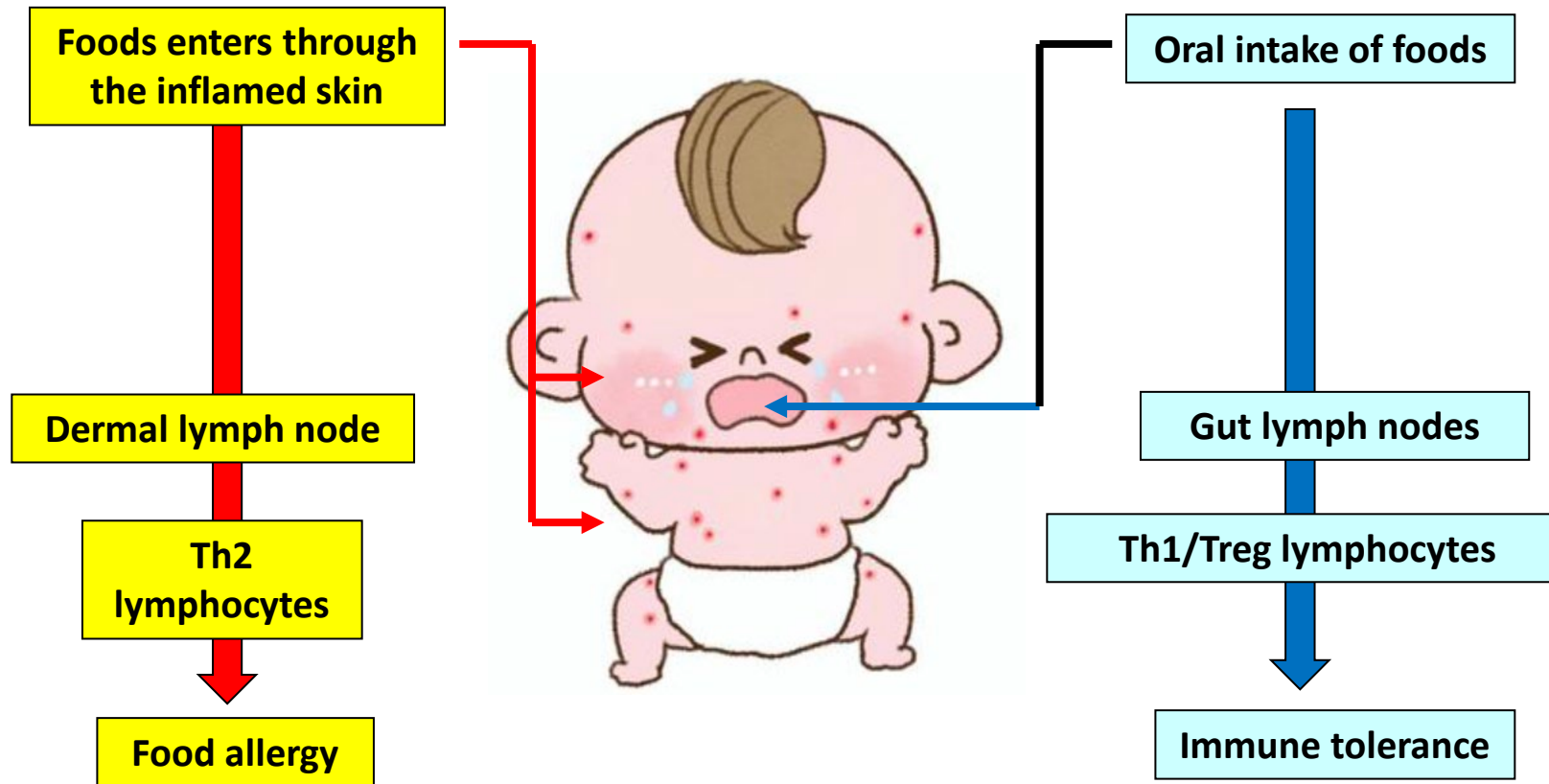
- 1) Products of livestock account for 50% of food allergens
- 2) Tree nuts and peanuts are increasing



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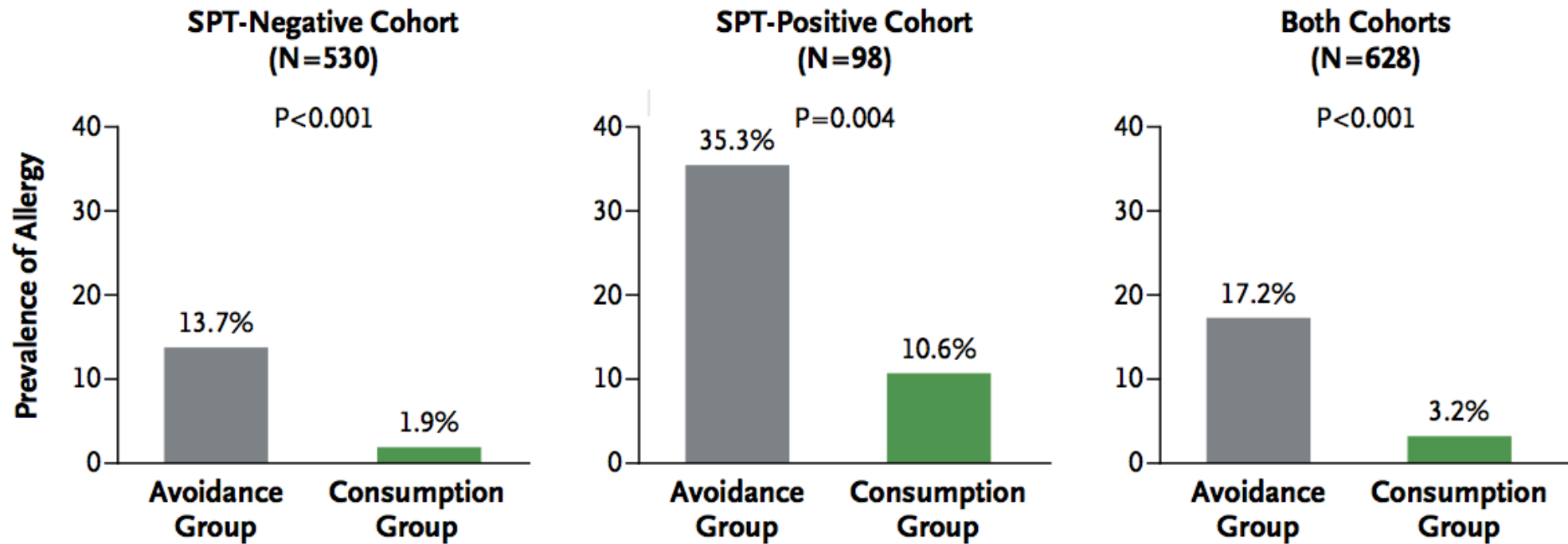
# Association of allergen exposure pathways with the development of food allergy



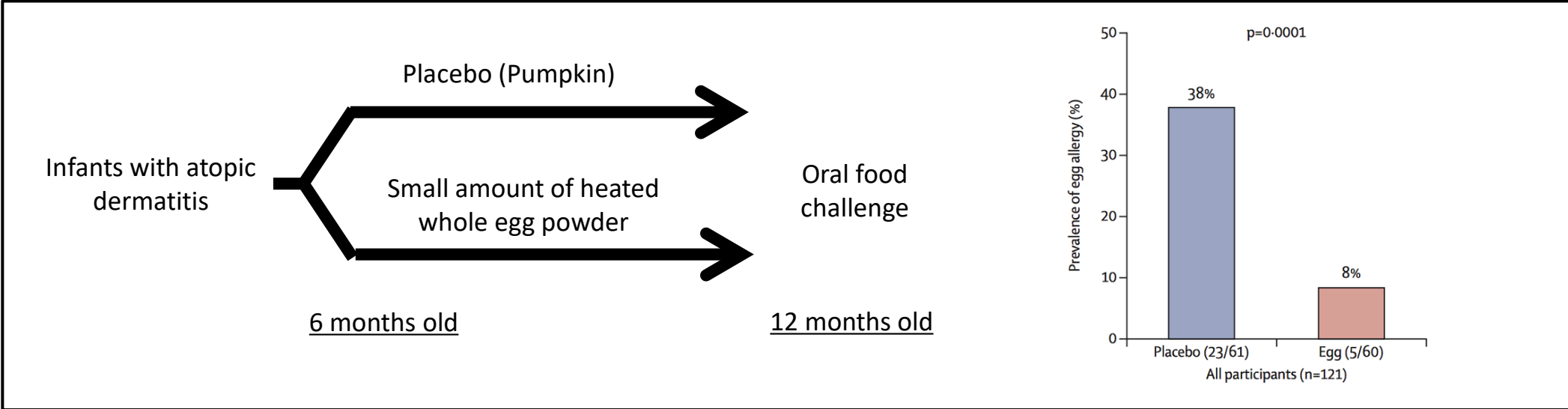
(modified from Lack G. J Allergy Clin Immunol 2012;129:1187)

# Prevention of Peanut Allergy by Peanut Consumption in Infancy (LEAP study)

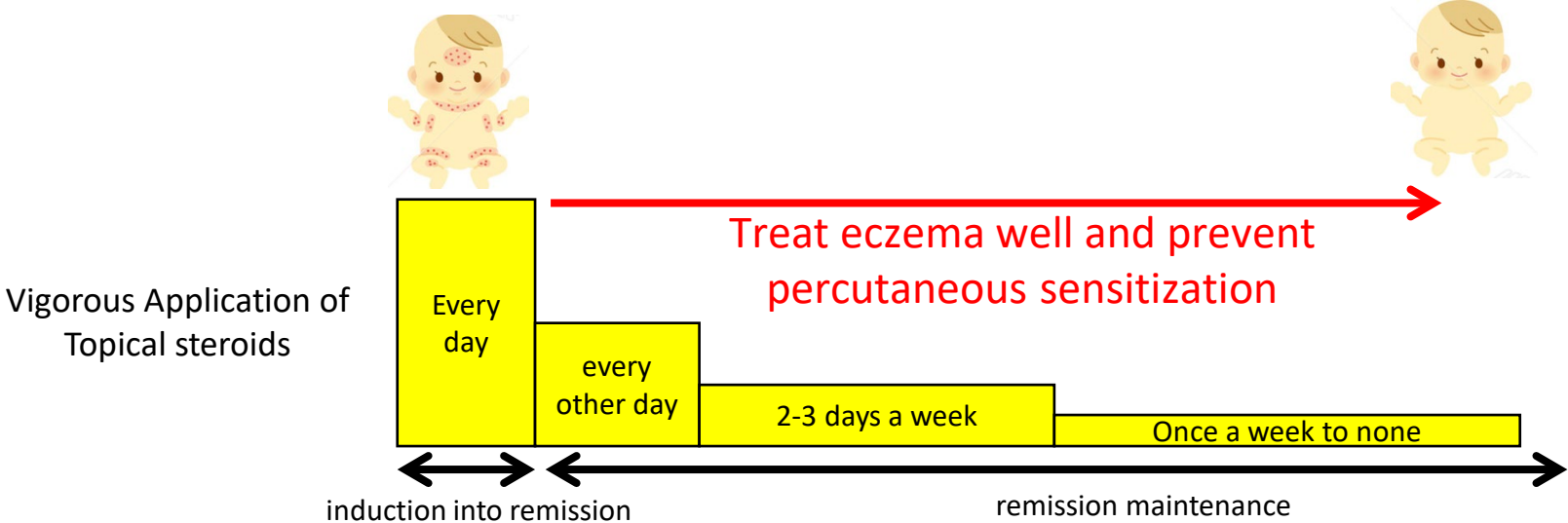
## Intention-to-Treat Analysis



# Research on prevention of chicken egg allergy in Japan



(Natsume O, et al. Lancet 2017;389)



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# **Meat allergy**

# Alpha-gal syndrome (red meat allergy)

## What is alpha-gal (galactose- $\alpha$ -1,3-galactose) ?

- A sugar molecule found in most mammals.
- Not found in fish, reptiles, birds, or human.
- Can be found in meat (pork, beef, rabbit, lamb, venison, etc.) and products made from mammals (including gelatin, cow's milk, and milk products).

# Alpha-gal syndrome (red meat allergy)

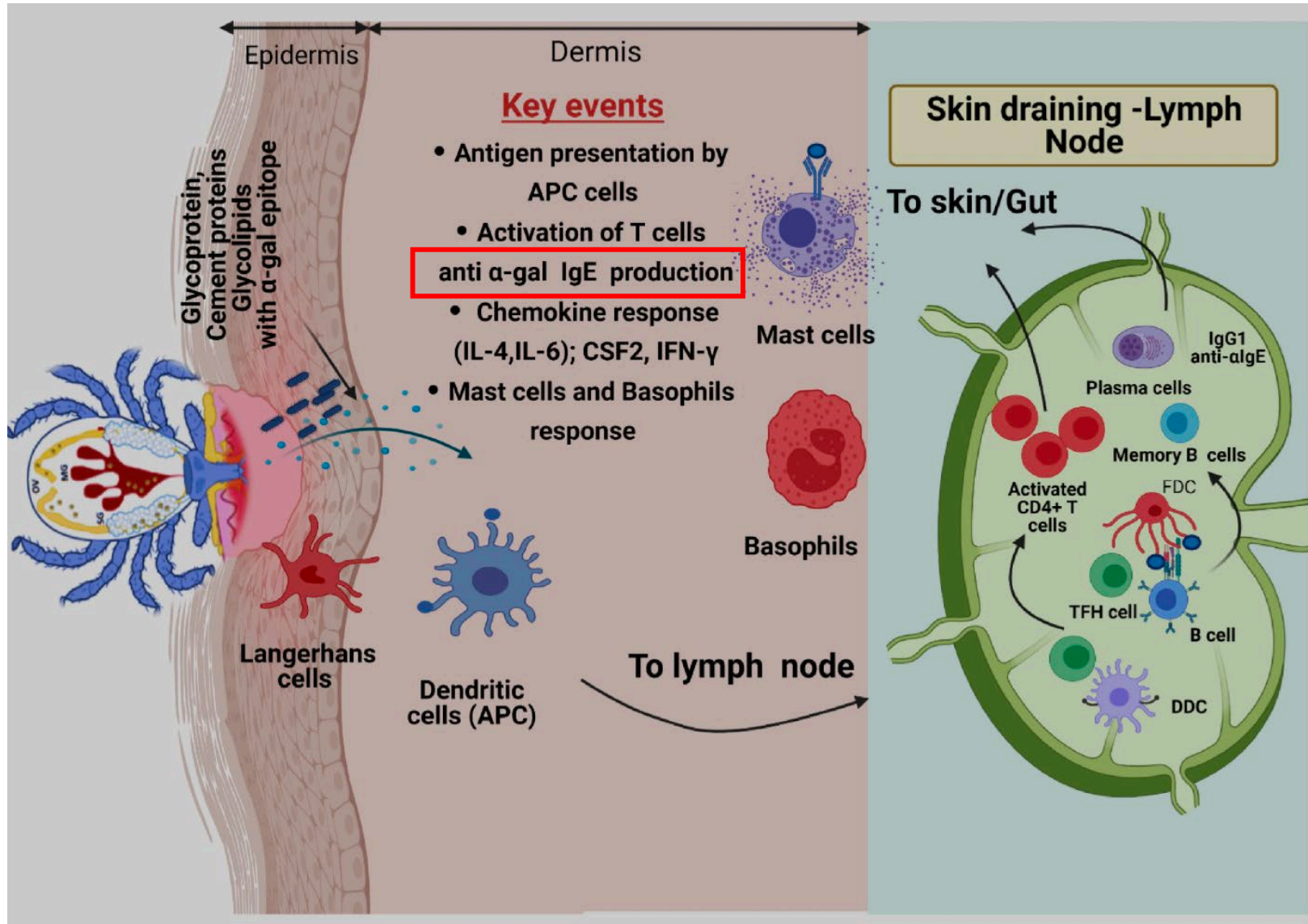
## Symptoms

- Hives or itchy rash, Swelling of the lips, throat, tongue, or eye lids, Nausea or vomiting, Diarrhea, Severe stomach pain, Heartburn or indigestion, Cough, shortness of breath, or difficulty breathing, Drop in blood pressure, Dizziness or faintness
- Symptoms commonly appear **2-6 hours** after eating meat or dairy products, or after exposure to products containing alpha-gal (for example, gelatin-coated medications).

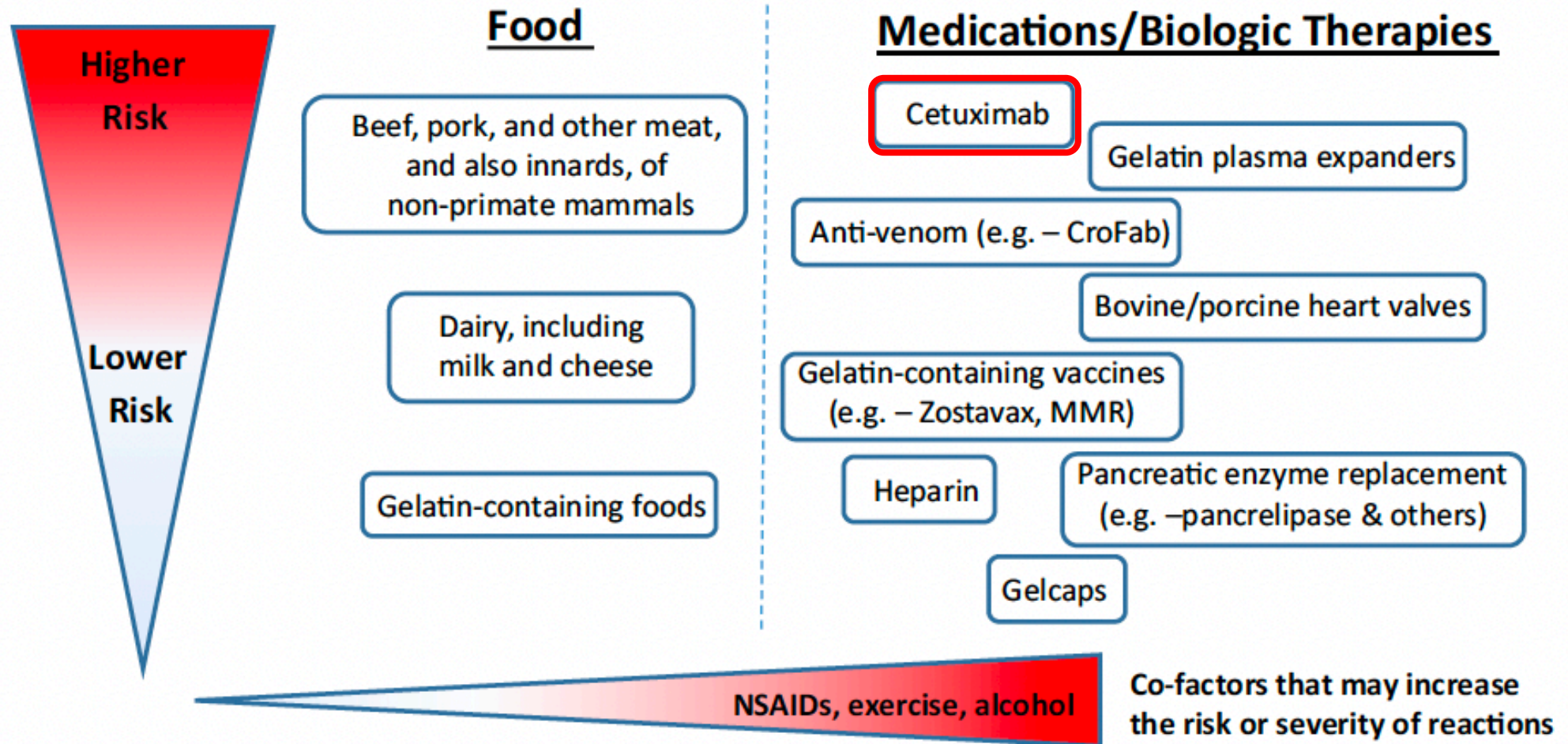


# Pathogenesis of Alpha-gal syndrome

Tick bite

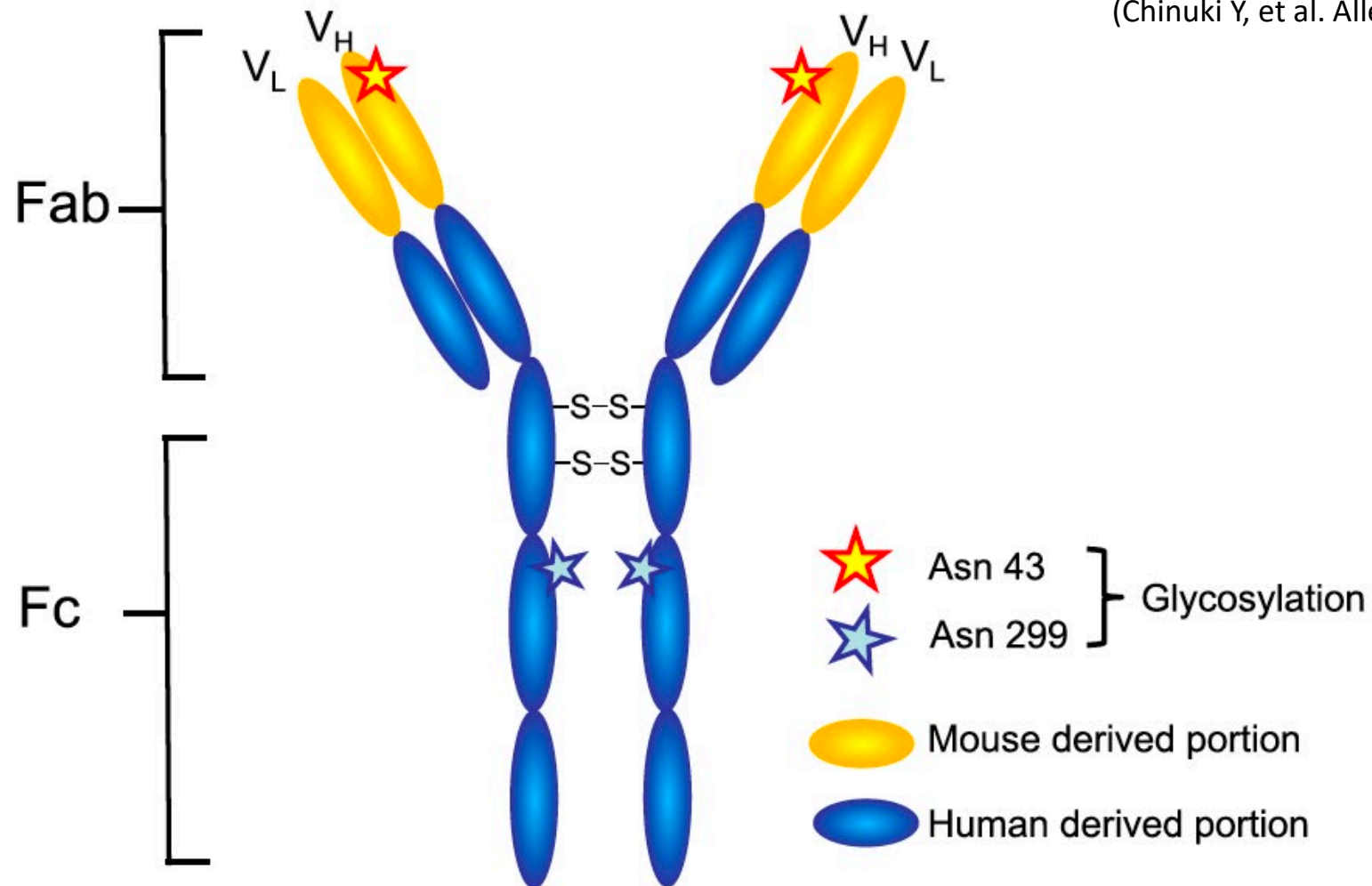


# The risk and severity of reactions in the alpha-Gal syndrome



# Cetuximab: a chimeric mouse-human monoclonal antibody containing galactose- $\alpha$ -1,3-galactose

(Chinuki Y, et al. Allergol Int 2019;68:296)



# Japanese cases of cetuximab-induced anaphylactic shock

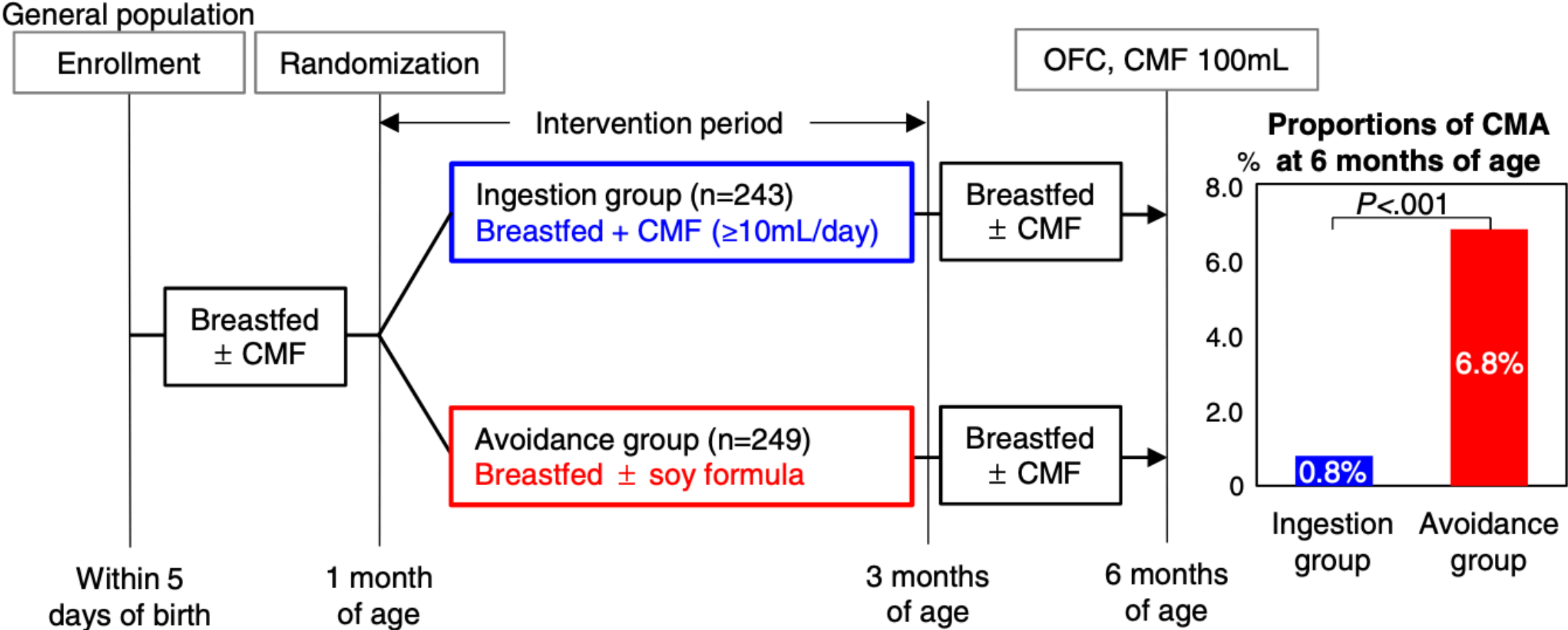
Case	Age (years) Sex	Primary disease	Food allergy history	History of tick bites	Beef-specific IgE (kU <sub>A</sub> /L)	α-Gal-specific IgE (kU <sub>A</sub> /L)
1	67 Female	Laryngeal cancer	None	None	<0.34	1.33
2	81 Male	Oropharyngeal cancer	Flatfish eggs	None	2.14	6.19
3	60 Male	Laryngeal cancer	None	None	0.48	6.62
4	67 Male	Epipharyngeal cancer	None	None	1.34	3.30
5	62 Male	Rectal cancer	Beef, pork, flatfish eggs	None	8.11	16.4
6	74 Male	Cancer of the floor of the mouth	None	None	1.04	4.64
7	81 Male	Laryngeal cancer	None	Yes	3.74	6.50
8	74 Male	Hypopharyngeal cancer	None	Yes	2.99	11.5
9	50 Male	Rectal cancer	Kiwi fruit, pineapple, oyster	Unknown	1.28	24.9
10	66 Male	Buccal mucosal cancer	None	None	<0.34	0.493

# Pork-cat syndrome

- Pork-cat syndrome is a disease that causes allergic symptoms upon ingestion of **pork** due to **cross-reactivity** after sensitization to **cat serum albumin**.
- 1994 was the first case reported from France, but reports are few and relatively rare.
- Symptoms of pork-cat syndrome have been reported to range from relatively mild symptoms such as urticaria and itchy throat to anaphylaxis, and some severe cases have been reported, so caution is required.
- Some patients with pork-cat syndrome are allergic not only to pork, but also to other meats such as beef and horse meat.

# **Cow's milk allergy**

# Randomized trial of early infant formula introduction to prevent cow's milk allergy



(Sakihara T, et al. J Allergy Clin Immunol 2021;147:224)

# Hen's egg allergy

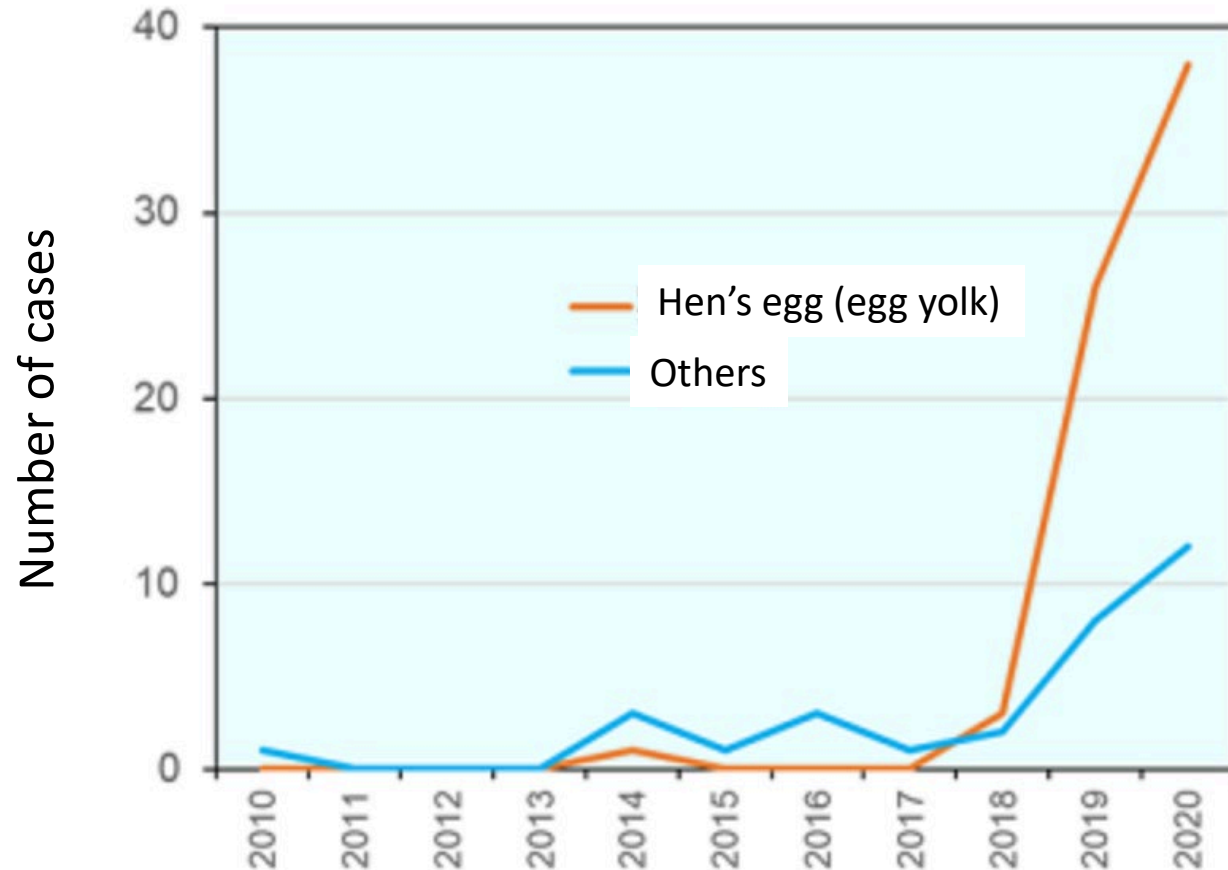


# Bird-egg syndrome

- Bird-Egg syndrome, first reported in 1985, is a disease in which people who keep budgies, canaries, parrots, etc. and become sensitized to their feathers develop a secondary allergy to chicken eggs due to **cross-reactivity**, resulting in allergic symptoms upon ingestion of chicken eggs.
- Unlike conventional chicken egg allergy, most cases occur in adults, and pediatric cases are rare.
- Gal d 5 ( $\alpha$ -livetin), **a serum albumin derived from egg yolk**, is thought to act as a cross antigen.

# Gastrointestinal allergy to solid foods in Japan

## Solid FPIES (Food protein-induced enterocolitis)



Cell-mediated food allergy  
(Th2 lymphocytes/Eosinophils)

# Summary

- Percutaneous sensitization is thought to be one of the major routes for sensitization and IgE-mediated FA.
- IgE-mediated food allergy could be prevented by combination of early introduction of food and treatment of atopic dermatitis.
- Unexpected sensitization to livestock products may occur via skin.
- Cross-reactivities between foods and other proteins may cause FA.
- Cell-mediated FPIES in early childhood is increasing.