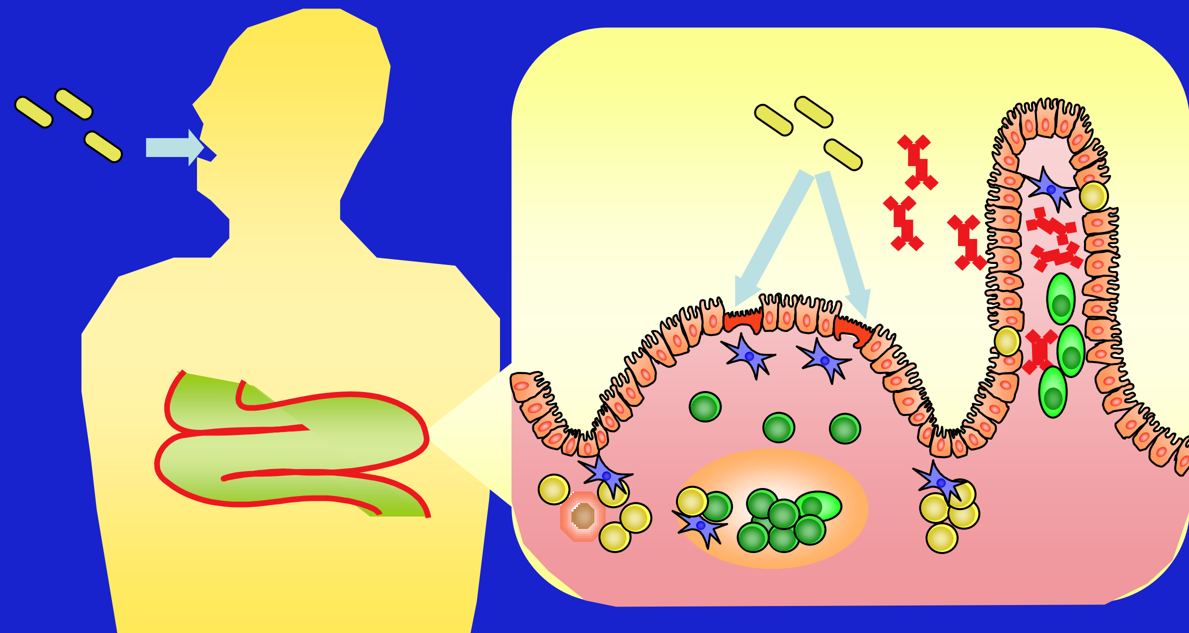
WOAH Food Safety Webinar

Understanding Allergy of Livestock Products

Approaches to control allergenicity through food and nutritional measures



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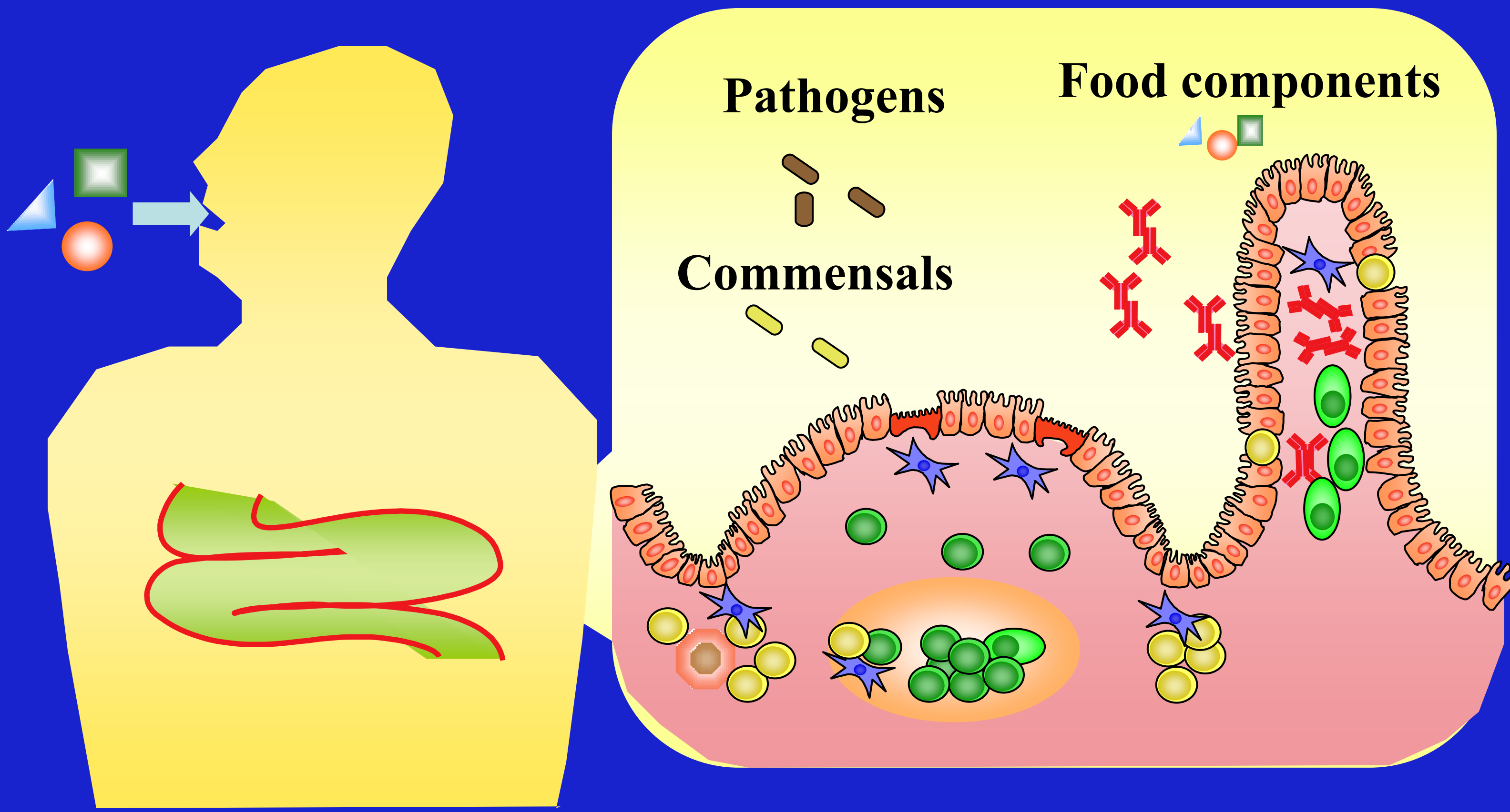
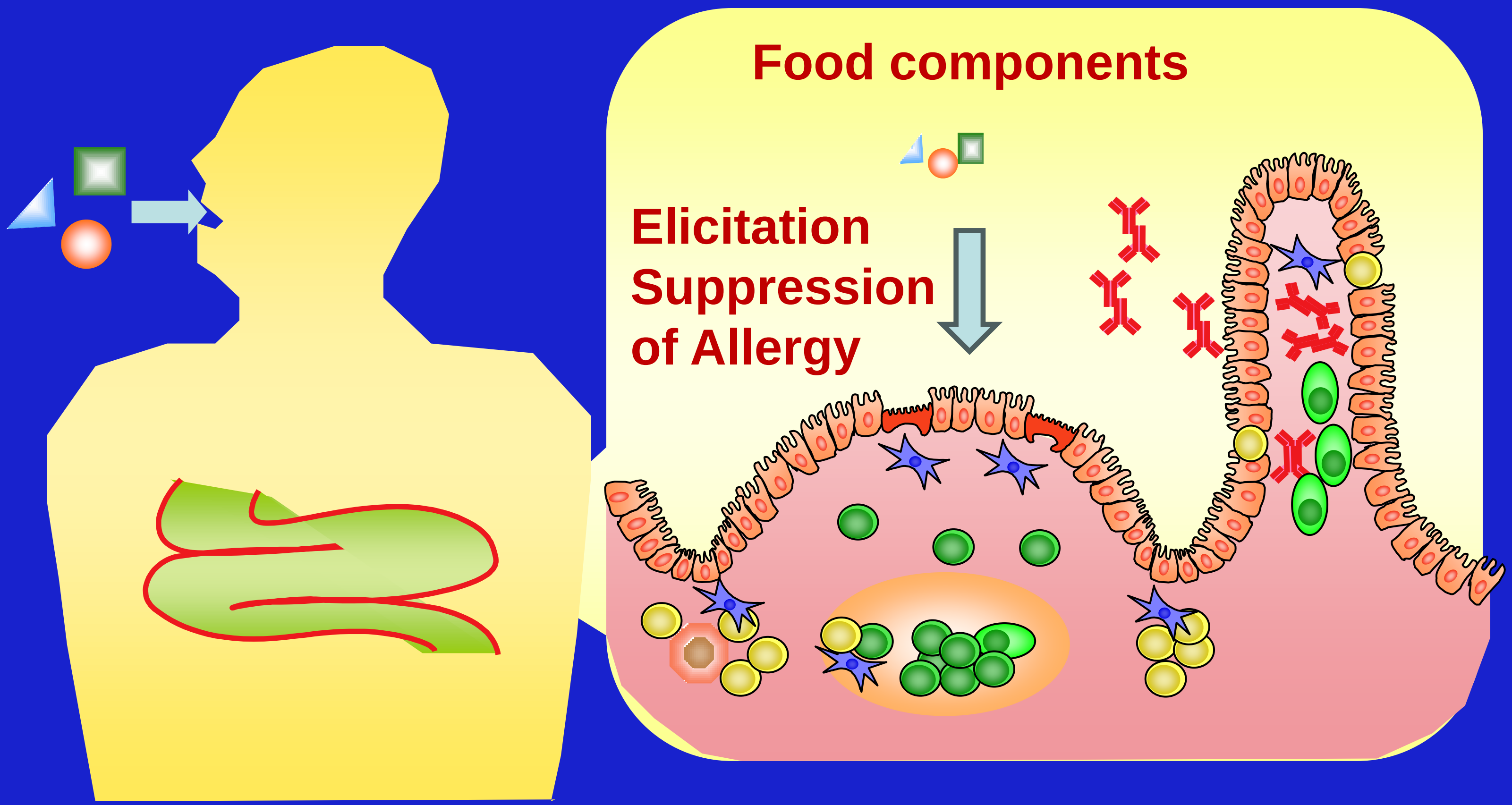
The University of Tokyo

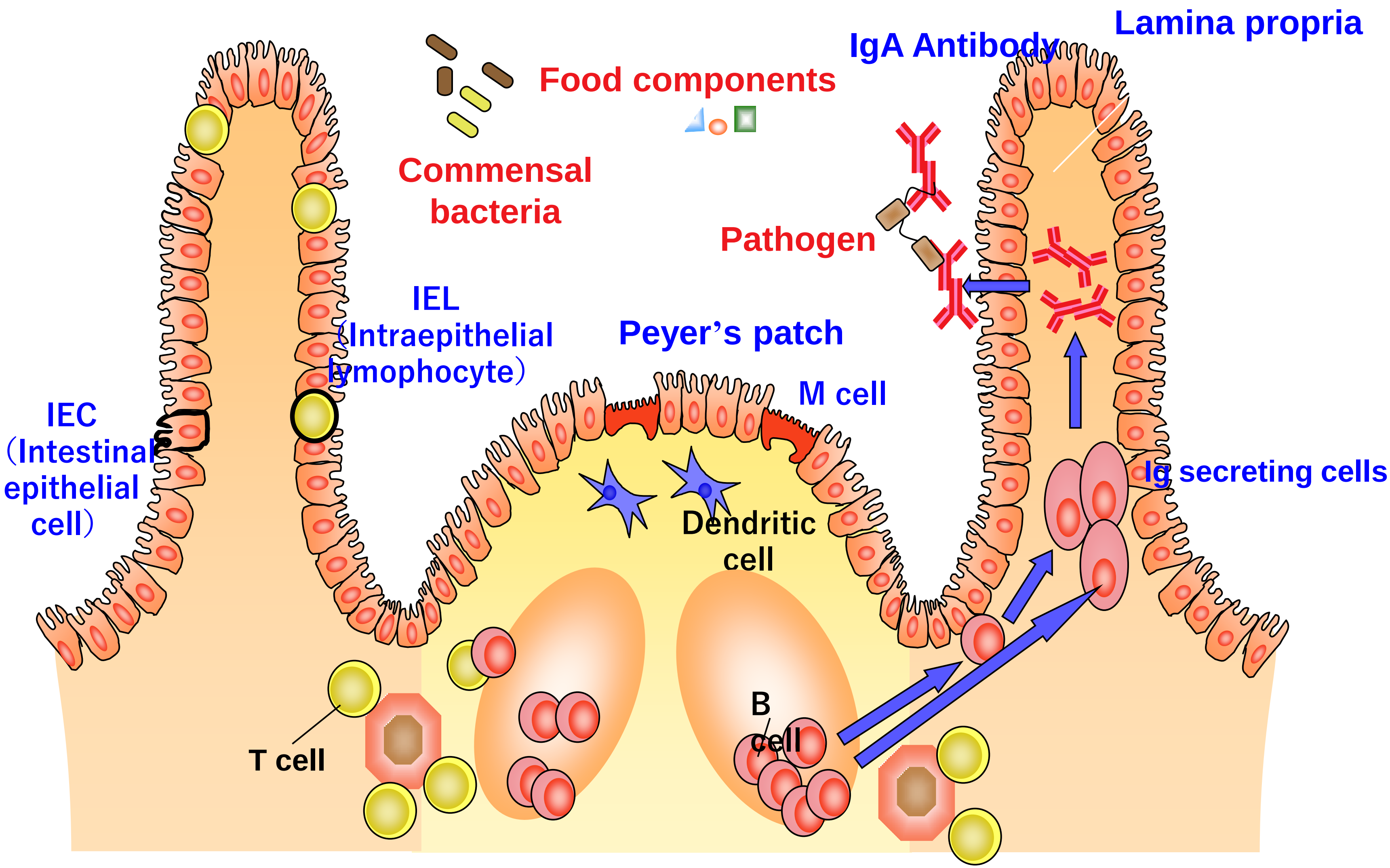
The intestine is a large immune organ



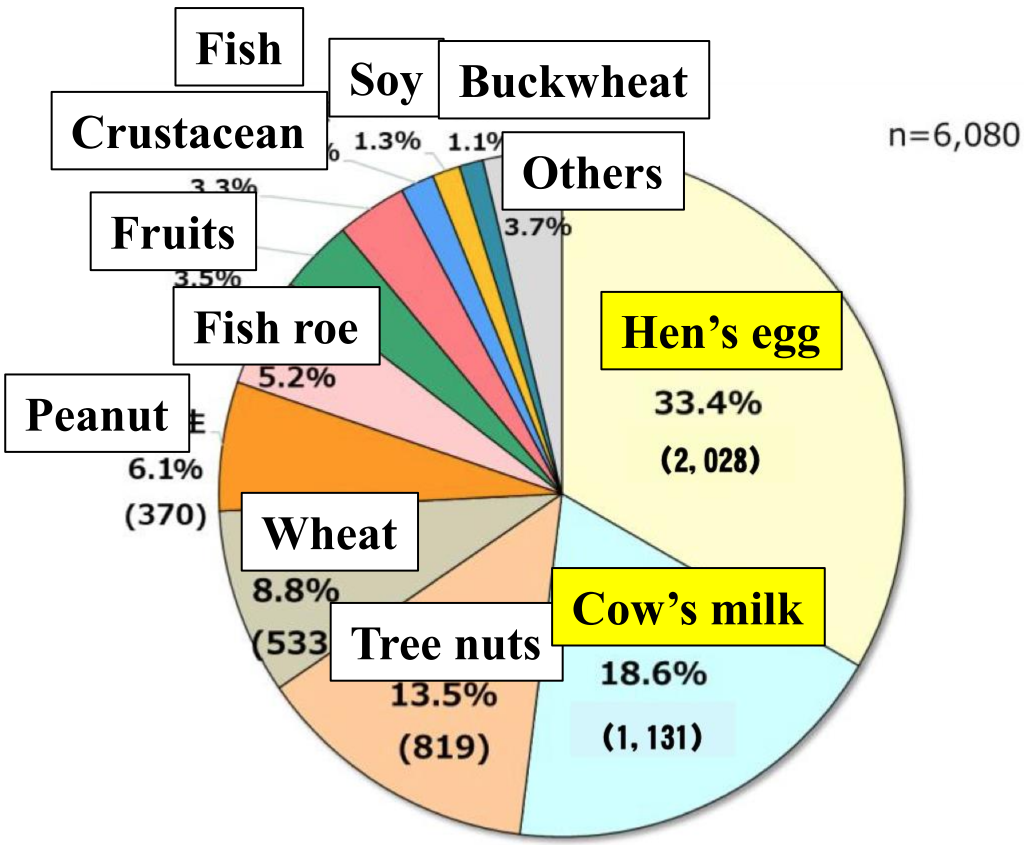
Elicitation and suppression of allergy via the intestinal immune system



The Intestinal Immune System



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

Consumer Affairs Agency, FY2021

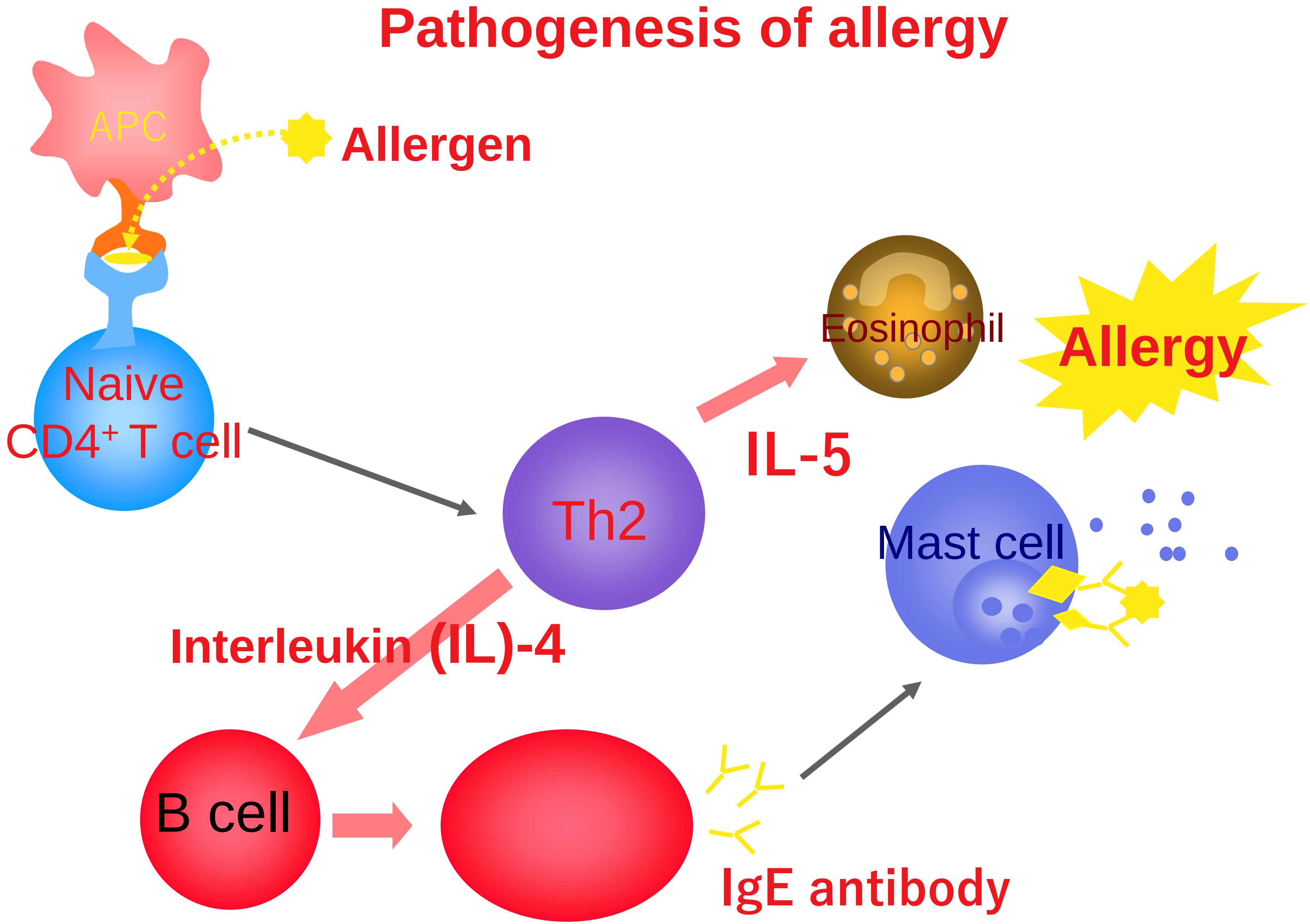
Report on Survey and Research Project on Food Labeling Related to Food Allergy

Food Allergy in Asia

TABLE 3 Food allergy in Asia

Year	Country	Age (y)	Population (N)	Overall Food allergy prevalence (%)	Cow's milk (%)	Egg (%)	Peanut (%)	Shellfish (%)	Reference
2011	Chongqing, China	0-1	477	3.8	1.3	2.5	0.41	-	Chen et al[35]
2015	Guangdong, China	1-7	2540	4	1.9	1.4	0.4	7.7	Zeng et al[36]
2012	Hong Kong	0-14	7393	4.8	0.5	0.7	0.3-0.5	1.4	Ho et al[37]
2001	Japan	0-6	101 322	5.1	1.4	3.8	0.3	0.1	Noda[38]
				~10					Ebisawa[39]
2011	Korea	0-1	1177	5.3	1.7	2.8	0.67 (nuts)	-	Kim et al[40]
2014	Korea	0-6	16 749	3.7	0.5	0.8	0.3	0.5	Park et al[41]
2012	Philippines	14-16	11 434	-	-	-	0.4	5.1	Shek et al[42]
2016	Singapore	0-3	1152	1.1-3.1	0.1-0.5	0.1-1.9	0.1-0.3	0.2-0.7	Tham et al[43]
2014	Singapore	11-30 mth	4115	~5	0.5	1.8	0.2	-	Lee and Shek[44]
2010		4-6	~4390				0.6	1.2	Shek et al[42]
		14-16	~6450				0.5	5.2	
2012	Taiwan	0-3	813	3.4	1.1	0.4	1.1	1.1	Wu et al[45]
		4-18	15 169	7.7	0.9	0.5	0.9	7.7	
		>18	14 036	6.4	0.5	0.3	0.5	7.1	
2012	Thailand	3-7	452	1.1	-	-	-	0.9	Lao-araya and Trakultivakorn[46]
2005	Thailand	3 m-6 y	656	-	-	0.2	-	0.3	Santadusit et al[47]

(Tham et al. Pediatr Allergy Immunol. 2018)

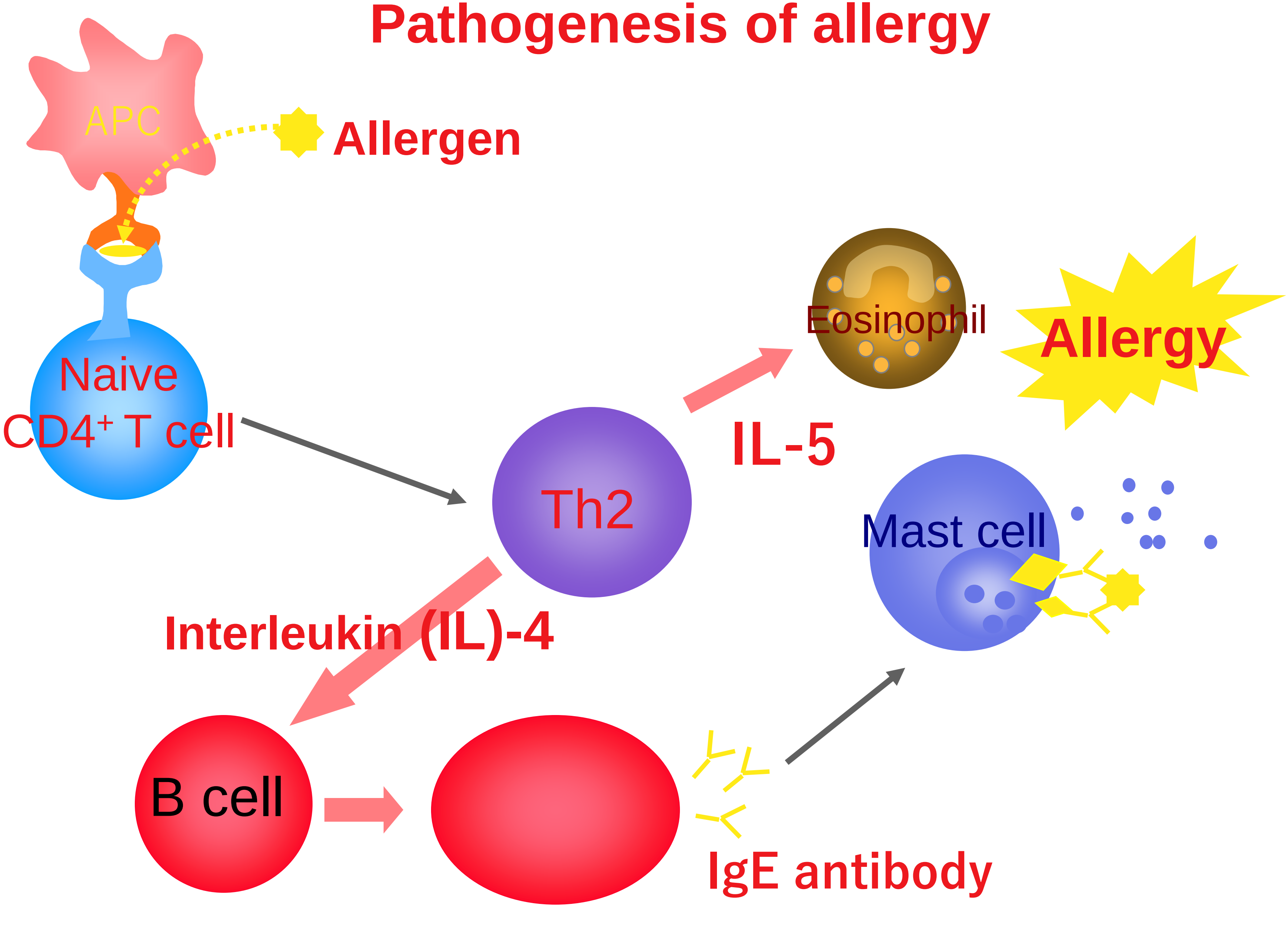


Pathogenesis of allergy
APC
Allergen
Naive
CD4+ T cell
Th2
IL-5
Eosinophil
Allergy
Mast cell
Interleukin (IL)-4
B cell
IgE antibody

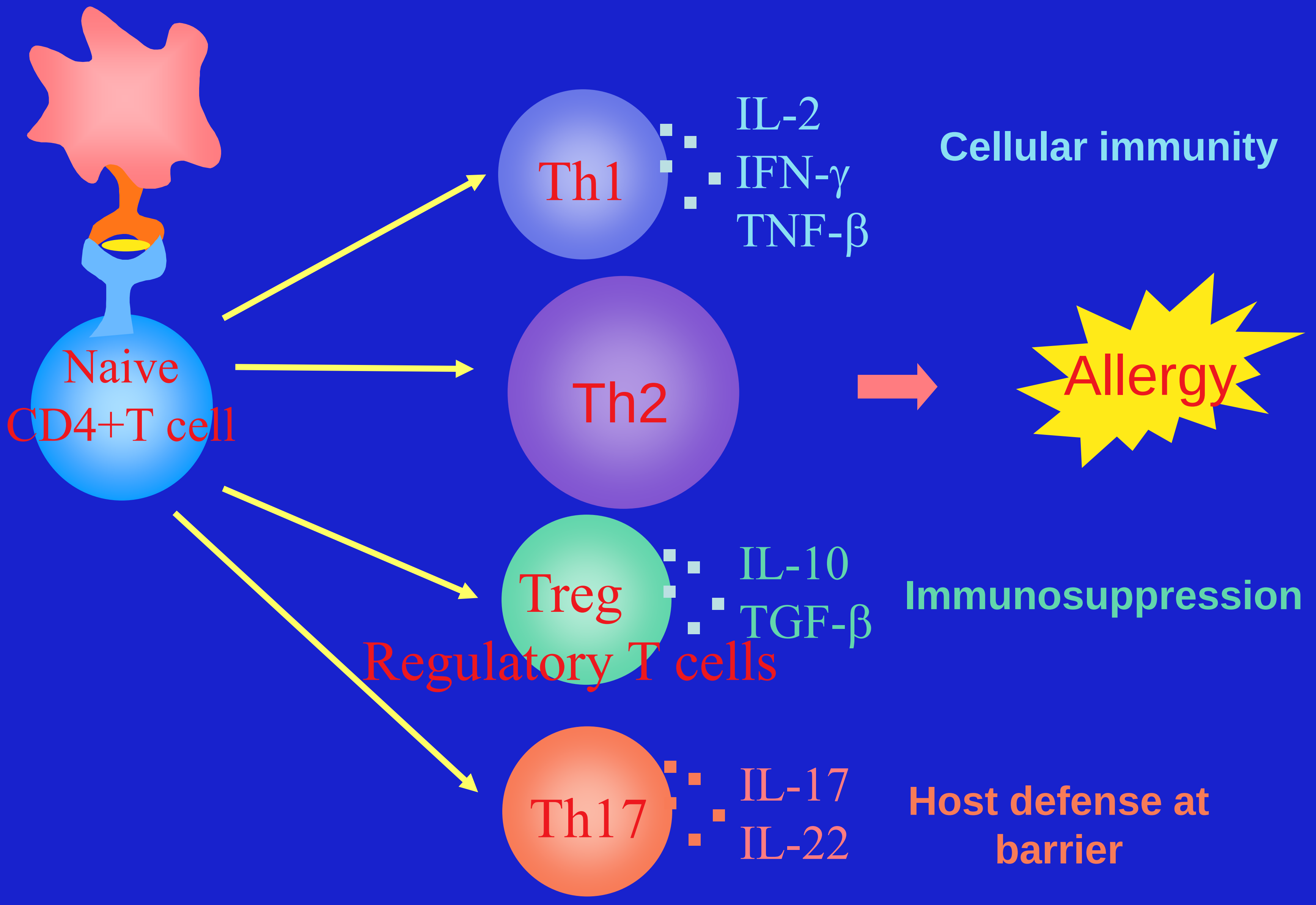
Major food allergen proteins

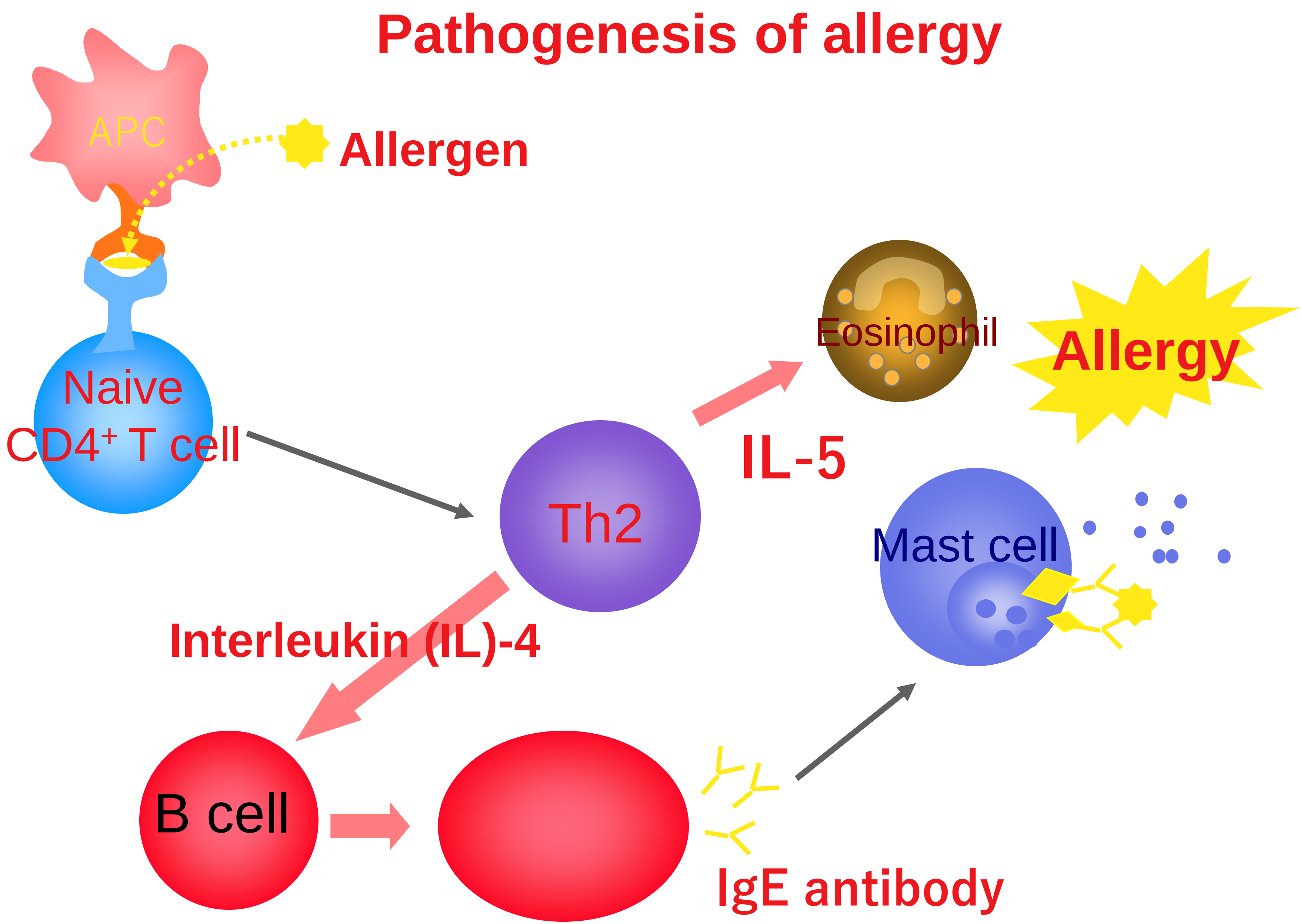
Food	Allergen protein
Egg	Ovomucoid, Ovalbumin, …
Milk	Casein, β-Lactoglobulin, …
Wheat	Gliadin
Soy bean	β–Conglycinin
Peanut	Ara h1, Ara h2
Shrimp	Tropomyosin
Salmon	Parvalbumin

Pathogenesis of allergy



T cell subsets and allergy

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Food and nutritional strategies to inhibit allergy

Vitamins

Fatty acids

Probiotics and bacteria
Prebiotics, oligo- and polysaccharrides

Polyphenols

Functional proteins and peptides

Diet diversity

Food and nutritional approaches may prevent food allergy (including allergy to livestock products)

Early Introduction

ω3 fatty acids

Probiotics and lactic acid bacteria

Functional proteins

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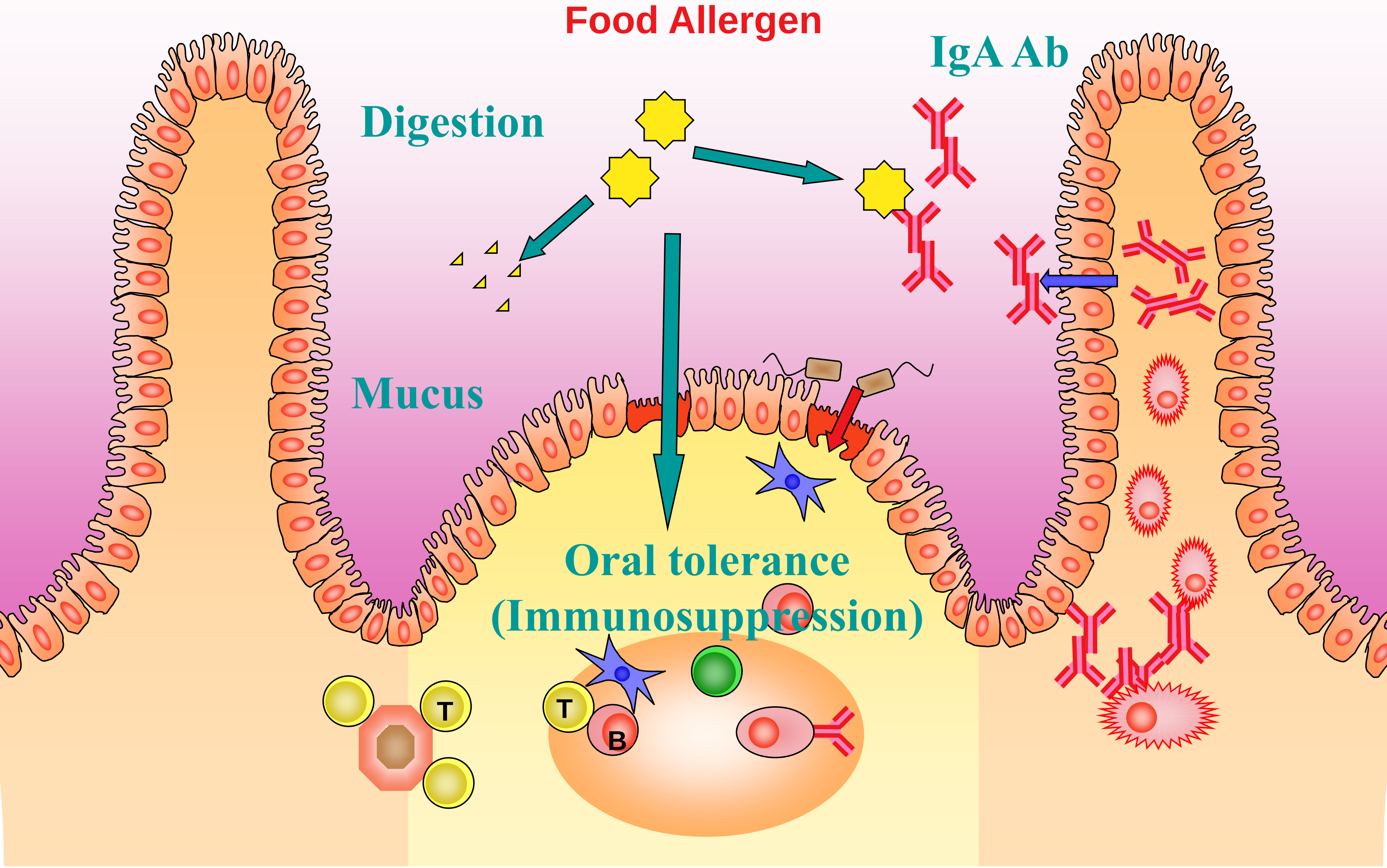
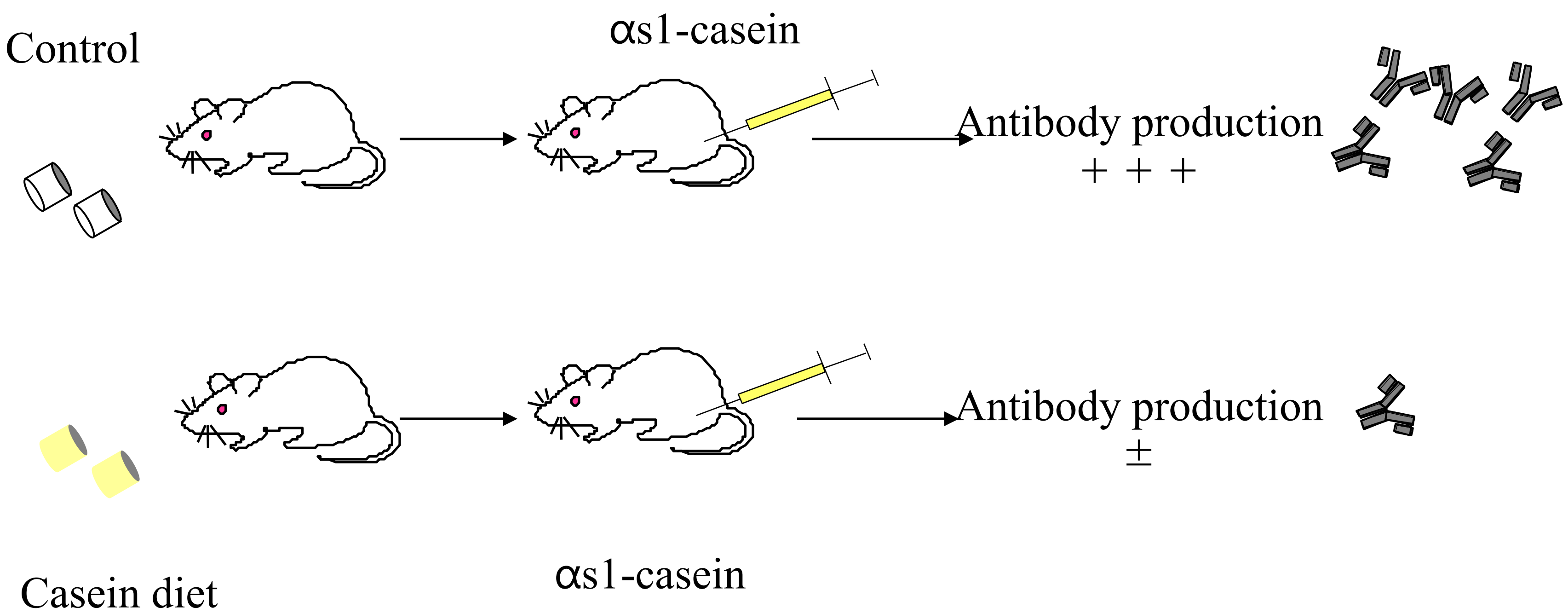
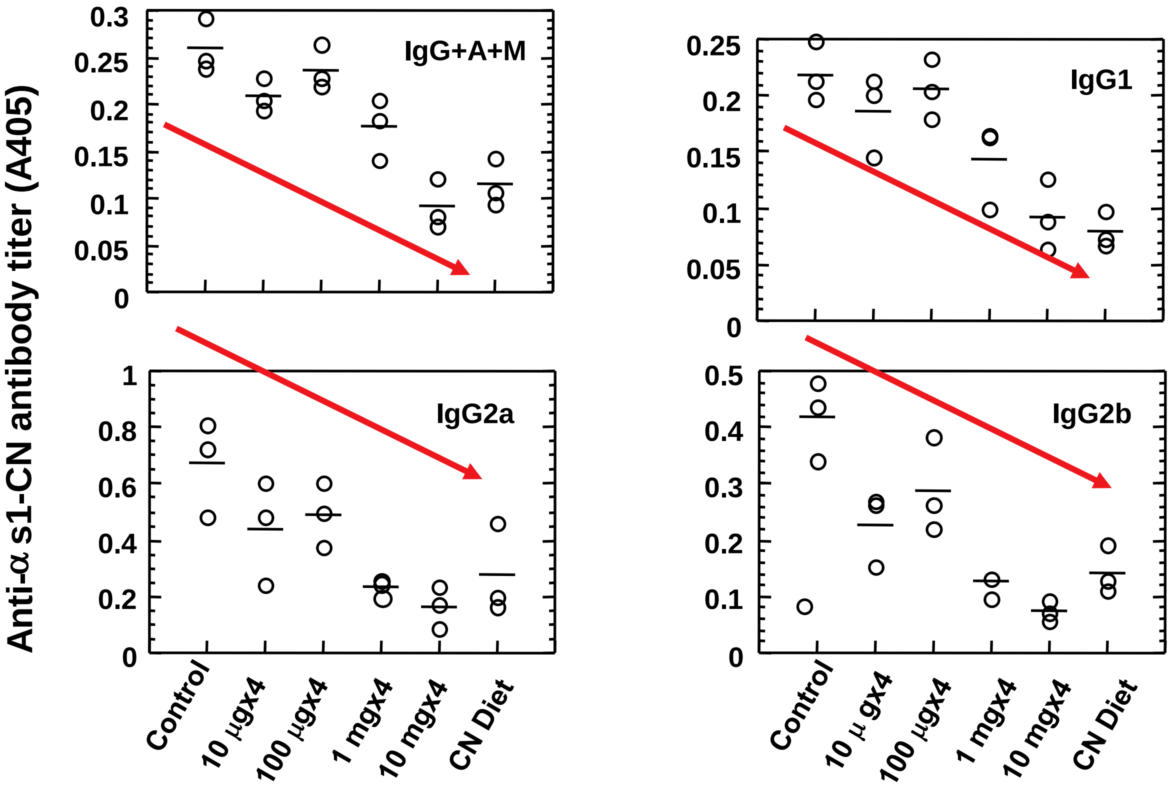


Suppressive mechanisms of food allergy in the intestine

Oral tolerance: immunological tolerance to ingested antigen

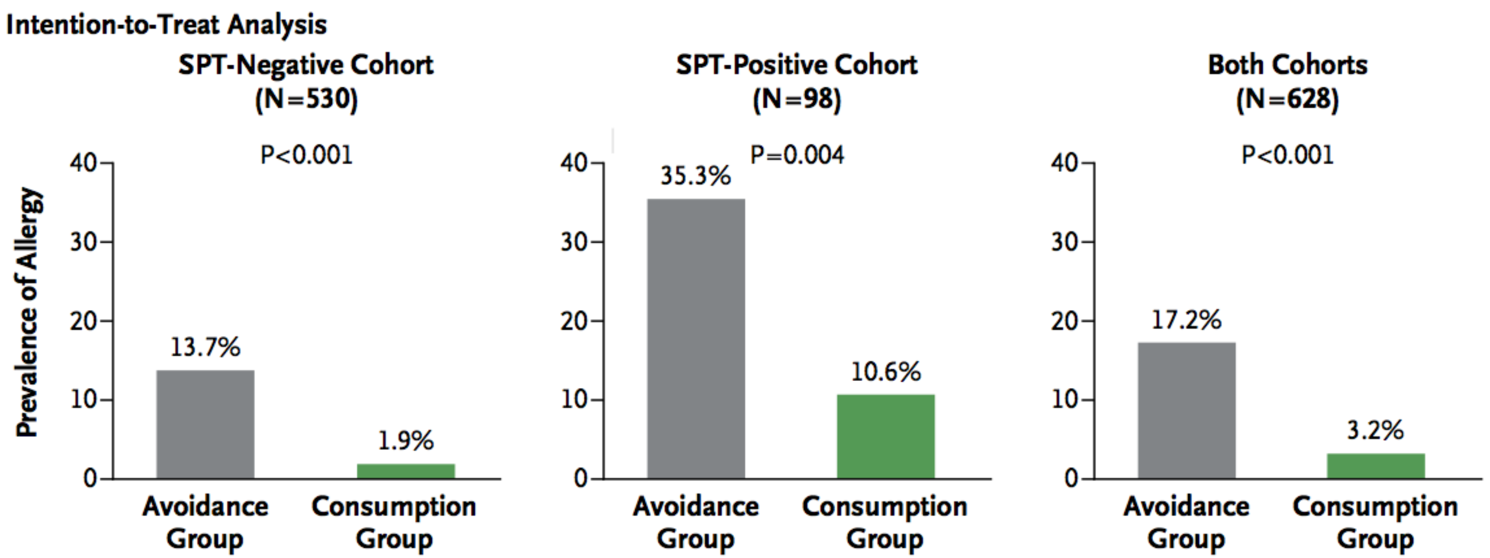


Antigen-specific antibody response is inhibited in oral tolerance



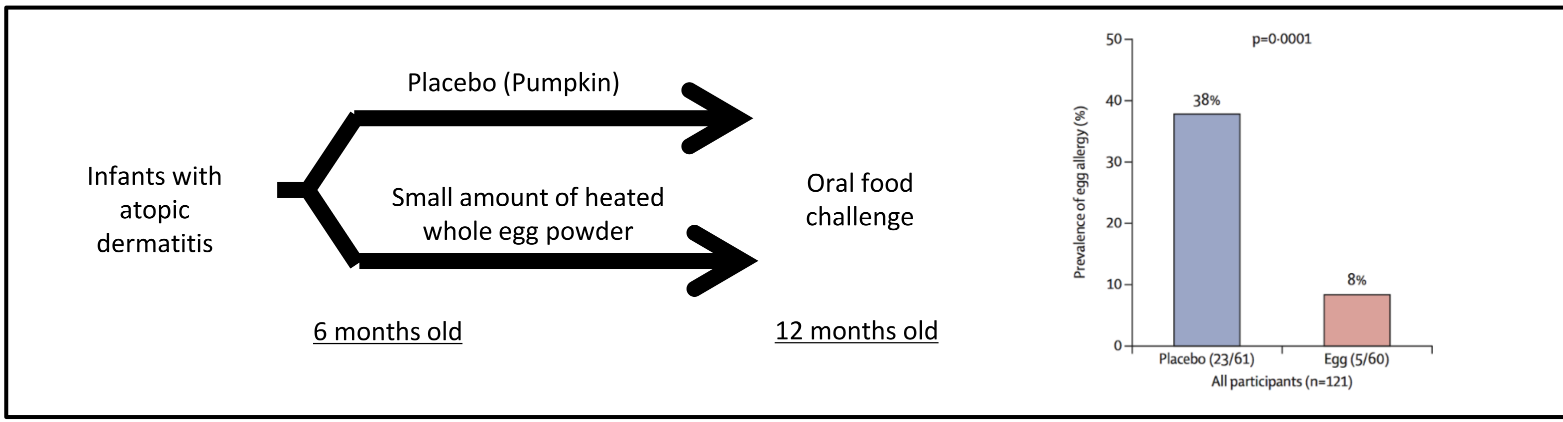
(Yoshida et al. Clin. Immunol. Immunopathol. 1997)

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

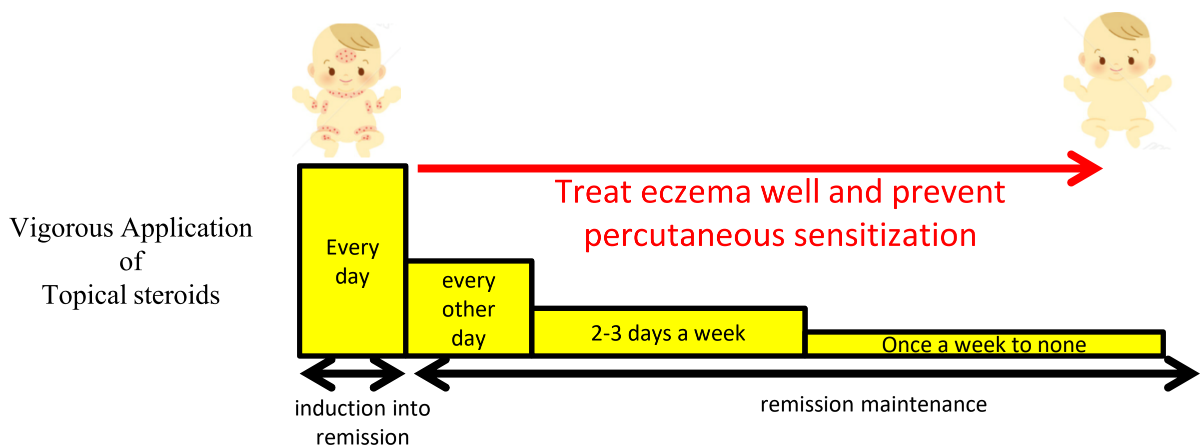


(DuToit G, et al. N Engl J Med 2015;372:803)

Research on prevention of chicken egg allergy in Japan



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



Food and nutritional approaches may prevent food allergy (including allergy to livestock products)

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ω3 polyunsaturated fatty acids (PUFA) and food allergy

ω3 PUFA: α-linolenic acid (ALA), eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA)

Dietary ω3 ALA-enriched linseed oil prevents intestinal allergy in egg allergy model

(Kunisawa et al. Sci Rep. 2015)

Maternal ω3 PUFA intake resulted in significant reduction in the incidence of "sensitization to egg," and "sensitization to any food" (SR)

(Best et al. Am J Clin Nutr 2016)

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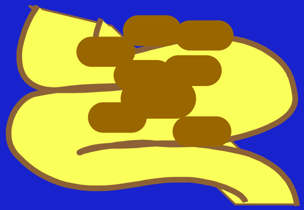
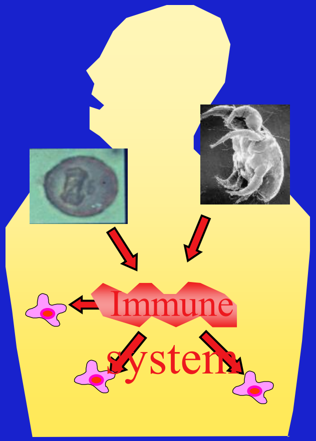
Use of probiotics and prebiotics





‘The hygiene hypothesis’

Inverse relation between allergy and infection

Different composition of microbiota in allergic patients

The use of PROBIOTICS

Living microorganisms that favorably influence health

Inhibition of allergy by intake of lactic acid bacteria

The use of PREBIOTICS

Substances that favorably influence
the intestinal microbiota improving health

Inhibition of allergy by intake of oligosaccharides

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Reduction in food diversity at 12 months was associated with increased risk of food allergy

TABLE 2 Associations of food diversity by 6 and 12 months of age with the risk of allergic outcomes during 1–2 years of age (*n* = 2,251)

Allergic outcomes	Food diversity by 6 months of age			Food diversity by 12 months of age		
	0 food group	1–2 food groups	3–6 food groups	1–5 food groups	6–7 food groups	8–11 food groups
Allergic disease						
N (%)	10 (9.9)	77 (6.6)	48 (4.9)	15 (8.8)	72 (7.2)	48 (4.4)
Unadjusted model	2.16 (1.06–4.41)	1.40 (0.96–2.02)	1	2.09 (1.14–3.81)	1.67 (1.15–2.44)	1
Adjusted model I[a]	2.19 (1.06–4.54)	1.43 (0.98–2.08)	1	2.05 (1.11–3.79)	1.68 (1.15–2.45)	1
Adjusted model II[b]	2.17 (1.04–4.50)	1.42 (0.98–2.07)	1	1.87 (1.01–3.48)	1.64 (1.12–2.40)	1
Allergic disease involving the respiratory tract						
N (%)	4 (4.0)	42 (3.6)	26 (2.6)	9 (5.3)	41 (4.1)	22 (2.0)
Unadjusted model	1.53 (0.52–4.47)	1.39 (0.85–2.29)	1	2.69 (1.22–5.59)	2.06 (1.22–3.49)	1
Adjusted model I[a]	1.28 (0.42–3.83)	1.38 (0.83–2.27)	1	2.50 (1.11–5.63)	2.01 (1.18–3.43)	1
Adjusted model II[b]	1.28 (0.43–3.84)	1.38 (0.83–2.28)	1	2.35 (1.03–5.32)	1.98 (1.16–3.37)	1
Allergic disease involving skin						
N (%)	6 (9.1)	36 (3.1)	24 (2.4)	6 (3.5)	34 (3.4)	26 (2.4)
Unadjusted model	2.54 (1.02–6.38)	1.29 (0.76–2.18)	1	1.49 (0.60–3.67)	1.43 (0.85–2.40)	1
Adjusted model I[a]	3.22 (1.25–8.27)	1.39 (0.82–2.36)	1	1.60 (0.64–4.00)	1.49 (0.88–2.50)	1
Adjusted model II[b]	3.17 (1.23–8.15)	1.38 (0.81–2.34)	1	1.41 (0.56–3.56)	1.45 (0.86–2.45)	1
Food allergy						
N (%)	9 (10.1)	122 (11.6)	96 (11.0)	34 (22.4)	102 (11.5)	91 (9.4)
Unadjusted model	0.91 (0.44–1.87)	1.06 (0.80–1.41)	1	2.78 (1.80–4.32)	1.26 (0.93–1.70)	1
Adjusted model I[a]	1.00 (0.48–2.07)	1.11 (0.83–1.48)	1	2.95 (1.88–4.61)	1.27 (0.94–1.73)	1
Adjusted model II[b]	1.37 (0.66–2.88)	1.06 (0.79–1.43)	1	2.10 (1.29–3.42)	1.07 (0.78–1.48)	1

Note: Data were shown as *N* (%) or OR (95% CI).

[a]Model I adjusted for maternal age, pre-pregnancy BMI, parity, ethnicity, allergic history, education, average personal income, cesarean section, gestational age at delivery, smoking during pregnancy, fetal gender, birthweight, season of birth, and full breastfeeding at 6 months of age.

[b]Model II adjusted for variables in model I and food allergy history of infants by 6 months of age when assessed the effect of food diversity at 6 months of age on allergic outcomes, and adjusted for model I and food allergy history of infants by 12 months of age when assessed the effect of food diversity at 12 months of age on allergic outcomes.

(Zhong et al. Pediatr Allergy Immunol 2022)

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