Allergy Ontology

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Research Goals

- Disambiguate terms and define classes in the domain of allergic diseases
- Develop general approaches and best practices for curating ontologies of allergic diseases
- Determine what other ontologies to draw from or link to

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A. ***Hypersensitivity Disorders***

- 1. Rhinitis
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 2. Sinusitis
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 3. Otitis
- 4. Conjunctivitis
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 5. Eczema / Atopic Dermatitis
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 6. Asthma
  - a. Children
    - i. Epidemiology and Risk Factors
    - ii. Pathogenesis
    - iii. Diagnostic Criteria
    - iv. Differential Diagnosis
    - v. Treatment
  - b. Adults
    - i. Epidemiology and Risk Factors
    - ii. Pathogenesis
    - iii. Diagnostic Criteria
    - iv. Differential Diagnosis
    - v. Treatment
- 7. Occupational Diseases
- 8. ABPA / AFS
- 9. Hypersensitivity Pneumonitis
- 10. Interstitial Pneumonitis
- 11. COPD
- 12. Food Allergy
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment

- 13. Anaphylaxis (including Idiopathic, Exercise, Latex)
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 14. Stinging Insect Allergy
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 15. Drug Reactions
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 16. Urticaria
  - a. Epidemiology and Risk Factors
  - b. Pathogenesis
  - c. Diagnostic Criteria
  - d. Differential Diagnosis
  - e. Treatment
- 17. Contact Hypersensitivity
- 18. Vaccine (Principles and Reactions)
- 19. Bronchiolitis
- 20. Croup

B. ***Immunological Disorders***

- 1. Hereditary and Acquired Angioedema
- 2. Congenital (Primary) Immunodeficiencies
  - a. Complement Deficiencies
  - b. Neutrophil Deficiencies
  - c. T Cell Deficiencies
  - d. B Cell / Antibody Deficiencies
- 3. Acquired (Secondary) Immunodeficiencies
  - a. HIV/AIDS-related
  - b. Non-HIV/AIDs-related
- 4. Systemic Autoimmune Disease
  - a. RA
  - b. SLE
  - c. Vasculitis
  - d. Other Disorders
- 5. Immunologic Rejection / Organ Transplantation
- 6. Stem Cell Transplantation (Bone Marrow, Cord Blood, etc.)
- 7. Graft vs. Host Reaction
- 8. Immune Endocrinopathies (Thyroid, Diabetes, Adrenal)
- 9. Immunologic Renal Diseases
- 10. Immunologic Skin Diseases
- 11. Immunologic Eye Diseases
- 12. Inflammatory Gastrointestinal Diseases
- 13. Immunologic Neuropathies
- 14. Hypereosinophilic Syndromes
- 15. Leukemias, Lymphomas, Myelomas

- 16. Granulomatous Diseases
  1. Sarcoidosis
  2. Wegner Granulomatosis
- 17. Amyloidosis
- 18. Mastocytosis
- 19. Immunohematologic Diseases
- 20. Cystic Fibrosis
- 21. Reproductive Immunology
- 22. Immunologic Aspects of Infectious Diseases (Lyme Disease, TB, Leprosy, Hepatitis, Syphilis)

OGMS: Disorder

(OGMS reference document, OGMS development group)

- Disorder: A material entity which is clinically abnormal and part of an extended organism
  - Material basis of a disease
  - BFO material entities
  - For every disorder, there is a corresponding quality that makes it a disorder
  - An organism undergoes a pathological process in which a certain ordered configuration becomes a disordered configuration of parts

OGMS: Disease

(OGMS reference document, OGMS development group)

- Disease: a disposition (i) to undergo pathological process(es) that (ii) exists in an organism because of one or more disorders in that organism
  - Can be borne without being realized (like all dispositions)
  - A disease is borne when the clinical significance threshold is crossed and the organism bears a tendency towards such processes
  - Diseases are borne by whole organisms*
  - Are related to disorders by the has_material_basis relation
  - Are related to qualities using the has_qualitative_basis relation

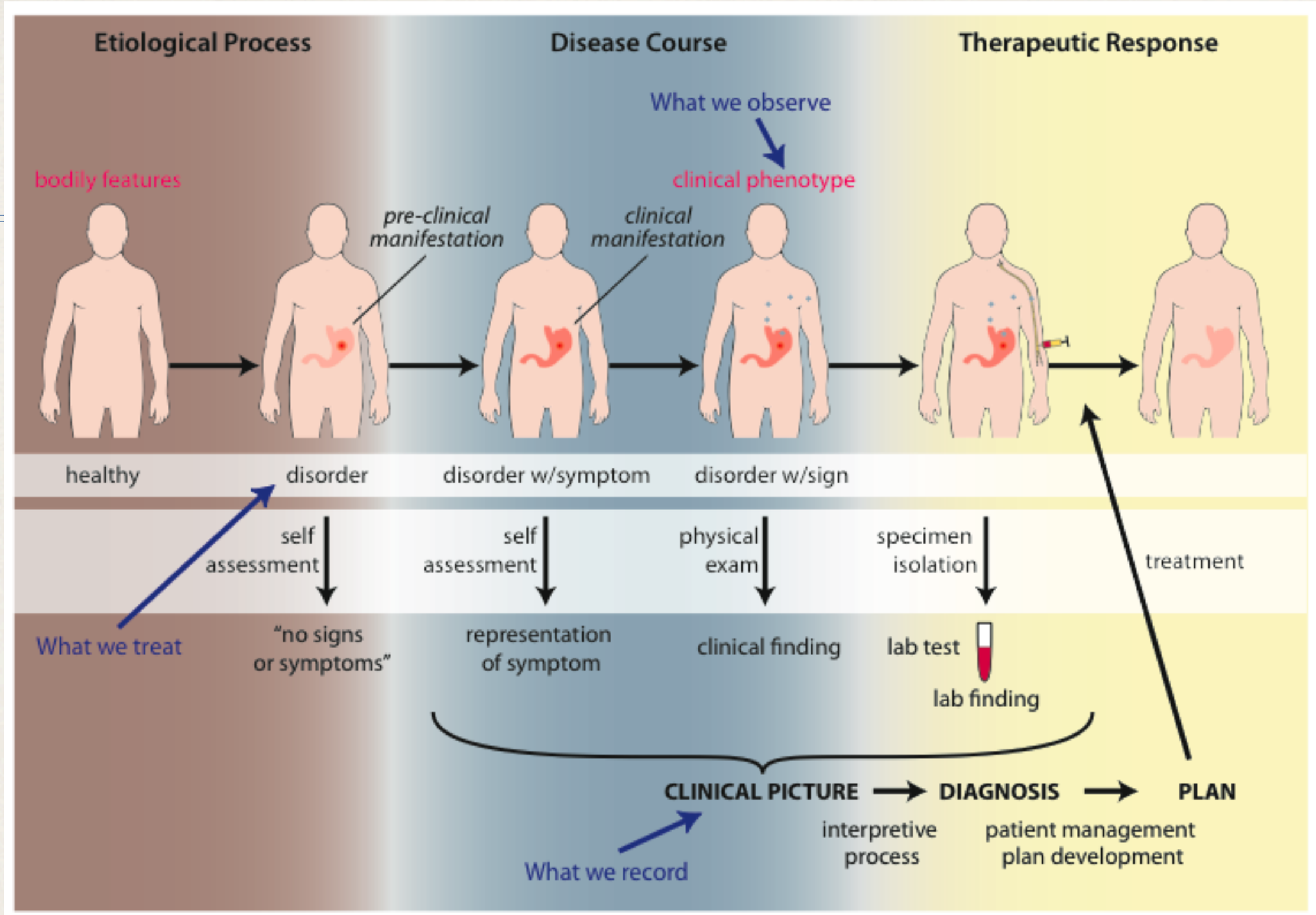
OGMS: Disease

(OGMS reference document, OGMS development group)

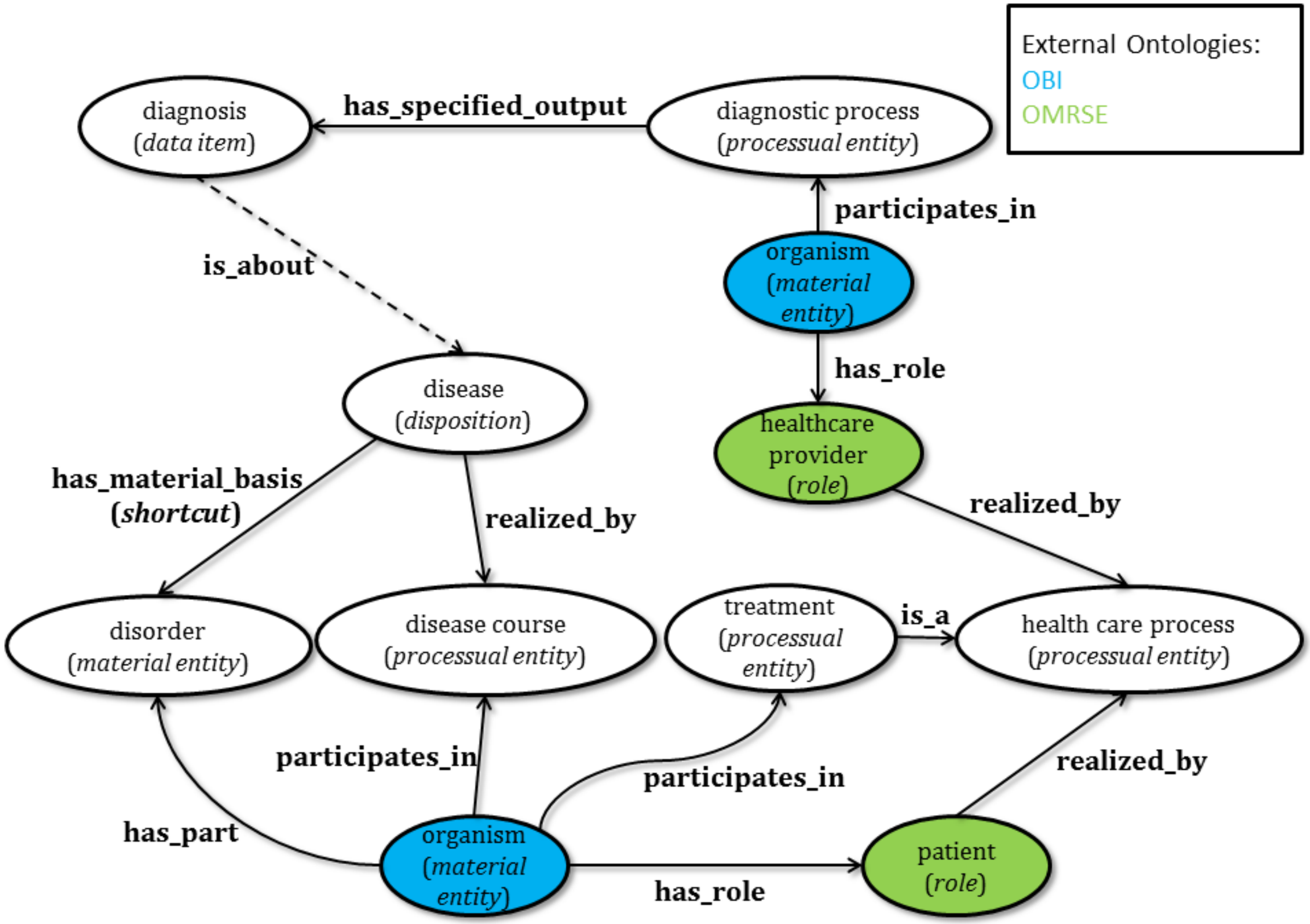
- Relies on the BFO definition of dispositions
- Disambiguates different usages of the term ‘disease’ (disease course, underlying disorder, diagnosis).

OGMS: Diagnosis

- Diagnosis: the representation of a conclusion of a diagnostic process
  - Information entity; it is about a disease



Scheurmann et al., 2009

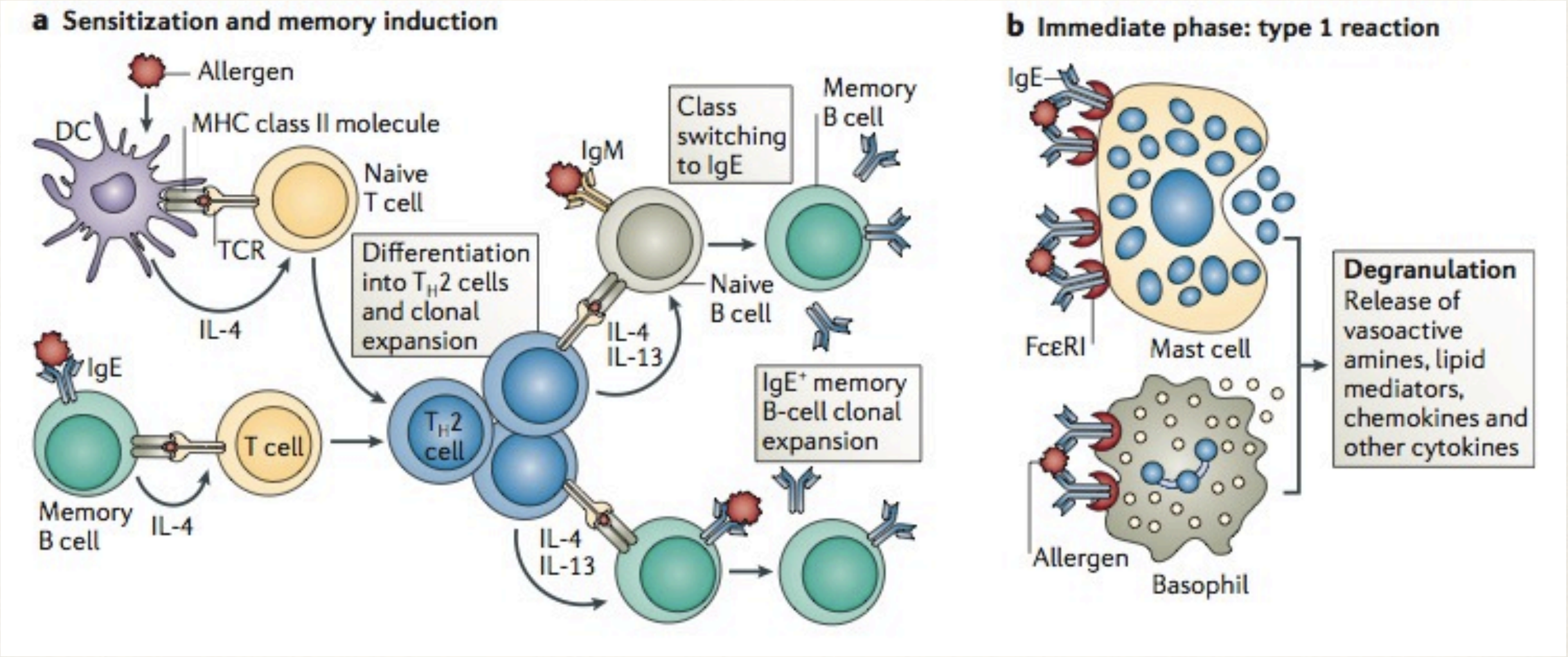


OGMS development group

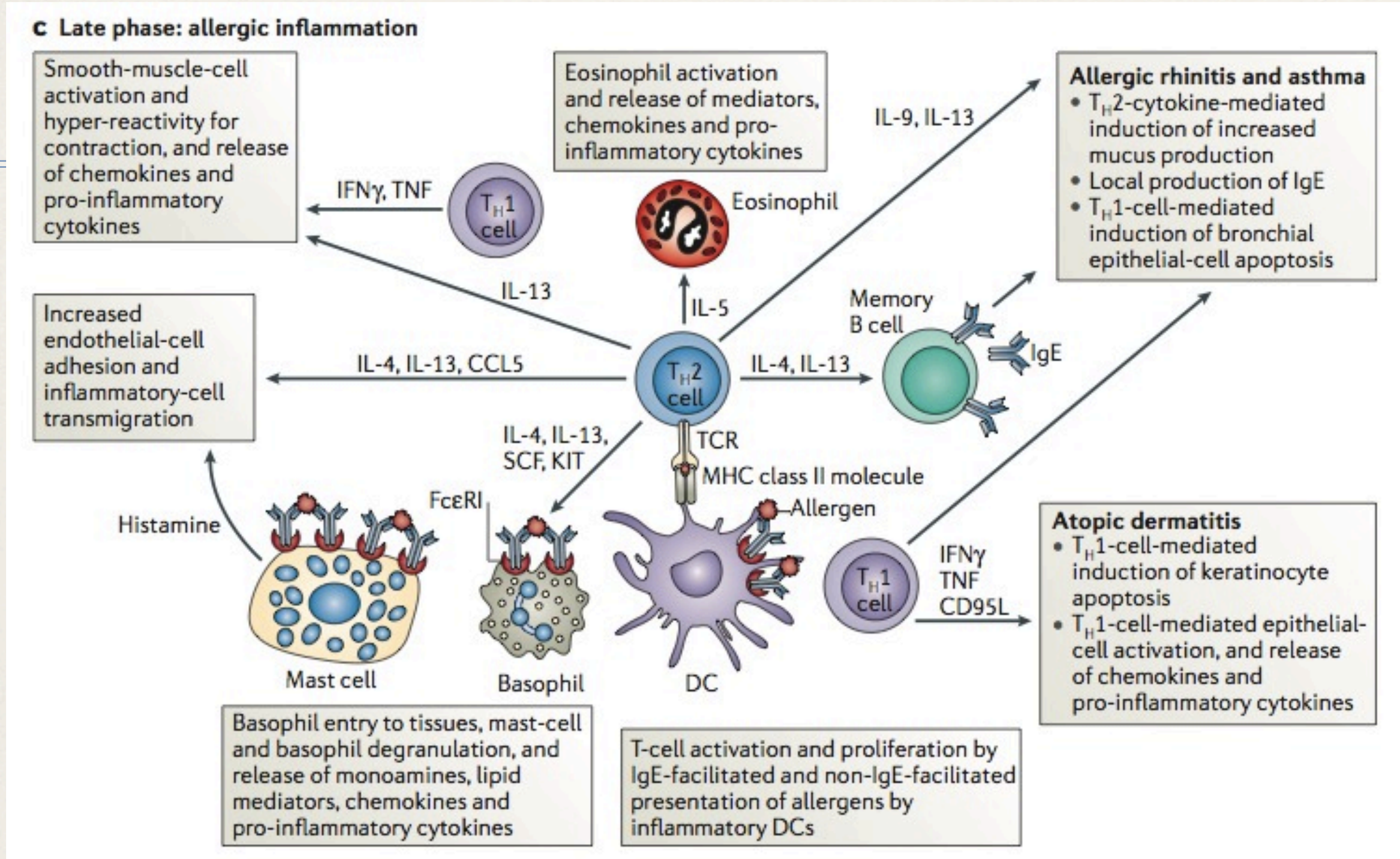
BOX 1.1 PATHOGENIC MECHANISMS OF IMMUNE REACTIONS[65]

1. Allergic reactions – IgE mediated
2. Cytotoxic or cytolytic antibody reactions
3. Immune complex reactions
4. Delayed hypersensitivity reactions
5. Inactivation/activation antibody reactions
6. T cell cytotoxic reactions
7. Granulomatous reactions

Middleton Allergy, 2008



Larché M, Akdis CA, Valenta R. Immunological mechanisms of allergen-specific immunotherapy. Nat Rev Immunol. 2006 Oct. 1;6(10):761–71.



Larché M, Akdis CA, Valenta R. Immunological mechanisms of allergen-specific immunotherapy. Nat Rev Immunol. 2006 Oct. 1;6(10):761–71.

IgE-mediated hypersensitivity

- Disease (IgE mediated hypersensitivity) - a disposition for the organism's mast cells and basophils to degranulate with exposure to the allergen (i.e. allergen binds to IgE), leading to allergic pathologic processes
  - *has_material_basis*
    - Disorder - mast cells and basophils with allergen-specific IgE bound to membrane receptors (FcεRI)
  - *realized_by*
    - IgE-mediated allergic pathological process - IgE-mediated allergic reaction (mast cells degranulate, release preformed mediators, increase production of other mediators, etc.)

http://ontology.buffalo.edu/smith/ppt/OGMS/OGMS_Applied.ppt

- Disorder - individuals are sensitized, but not necessarily allergic (i.e. not necessarily *bearing* allergic disease)
- Disease - individuals are hypersensitive (may or not actually be *realized* in pathological processes until exposed to the allergen)
- OR
- Disorder - all individuals with the disorder also bear the disease (are allergic)
- Disease - individuals with the disease are hypersensitive (may or not actually be *realized* in pathological processes until exposed to the

Table 65.5 Food allergic disorders

Disorder	IgE-mediated	Mixed mechanism: IgE- and cell-mediated	Non-IgE-mediated
Generalized	Anaphylaxis, food-dependent exercise-induced anaphylaxis		
Cutaneous	Urticaria, angioedema, flushing, acute morbilliform rash, acute contact urticaria	Atopic dermatitis, contact dermatitis	Contact dermatitis, dermatitis herpetiformis
Gastrointestinal	Oral allergy syndrome, gastrointestinal anaphylaxis	Allergic eosinophilic esophagitis, allergic eosinophilic gastroenteritis	Allergic proctocolitis, food protein-induced enterocolitis syndrome, celiac disease, infantile colic
Respiratory	Acute rhinoconjunctivitis, acute bronchospasm	Asthma	Pulmonary hemosiderosis (Heiner's syndrome)

Adapted from Reference 7.

Middleton Allergy, 2008

Peanut allergy

- Disease (IgE mediated peanut allergy) - a disposition for the organism's mast cells and basophils to degranulate with exposure to peanut allergen (i.e. allergen binds to IgE) leading to allergic pathologic processes
  - *has_material_basis*
    - Disorder (IgE mediated peanut allergy disorder) - mast cells and basophils with peanut-specific IgE bound to membrane receptors (FcεRI)
  - *realized_by*
    - IgE-mediated allergic pathological process - IgE-mediated allergic reaction (mast cells degranulate, release preformed mediators, increase production of other mediators, etc.)

TABLE I. Sensitivity and specificity* for Ara h 2 and whole peanut extract

Test	Cutoff point (kU_A/L)	Sensitivity (%)	Specificity (%)	Correctly classified (%)
Ara h 2	0.30	100.00	90.20	93.75
	0.32	100.00	94.12	95.00
	0.35	100.00	96.08	97.50
	0.38	96.55	96.08	96.25
	0.40	93.10	98.04	96.25
	0.55	93.10	100.00	97.50
	0.87	89.66	100.00	96.25
Whole extract	0.35	96.55	26.92	51.85
	3.91	79.31	84.62	82.72
	5.00	75.86	90.38	85.19
	5.30	75.86	94.23	87.65
	5.96	72.41	94.23	86.42
	7.81	72.41	96.15	87.65
	15.00	55.17	96.15	81.48
	43.86	34.85	98.08	75.31

Analysis included all children with available data (81 for sIgE to whole peanut extract and 80 for sIgE to Ara h 2).

*Sensitivity refers to the proportion of subjects who have peanut allergy and give positive test results. Specificity refers to the proportion of subjects without the target condition and a negative test result for peanut allergy.

Nicolaou et al, JACI 127 (3): 684-5, March 2011

Peanut allergy

- Disease (IgE mediated Ara h 2 peanut allergy) - a disposition for the organism's mast cells and basophils to degranulate with exposure to Ara h 2 allergen (i.e. allergen binds to IgE) leading to allergic pathologic processes
  - *has_material_basis*
    - Disorder (IgE mediated peanut allergy disorder) - mast cells and basophils with Ara h 2-specific IgE bound to membrane receptors (FcεRI)
  - *realized_by*
    - IgE-mediated allergic pathological process - IgE-mediated allergic reaction (mast cells degranulate, release preformed mediators, increase production of other mediators, etc.)

(Aeroallergen) Allergic Rhinitis

- Allergic Rhinitis (Disease) - a disposition for nasal mast cells and basophils to degranulate with exposure to the aeroallergen (i.e. allergen binds to IgE)
  - *has_material_basis*
    - Allergic Rhinitis Disorder - mast cells and basophils with allergen-specific IgE bound to membrane receptors (FcεRI) in nasal mucosa
  - *realized_by*
    - Pathological process - IgE-mediated allergic reaction (mast cells degranulate, release preformed mediators, increase production of other mediators, etc.)

What is an allergen?

- A role
  - The same molecule can be an allergen, immunogen, tolerogen
  - In the same way that a human can take on different roles in different contexts

Table 65.3 Major class 1 food allergens

Protein fraction	Approx. % of total food protein	Mol weight (kDa)	Nomenclature
Cow's milk			
Caseins	76–86	19–24	
α_{s1}-casein	53–70	27	Bos d 8
α_s-casein	45–50	23	
β-casein	25–35	24	
κ-casein	8–15	19	
Whey	14–24		
β-lactoglobulin	7–12	36	Bos d 5
α-lactalbumin	2–5	14	Bos d 4
Serum albumin	0.7–1.3	69	Bos d 6
Chicken egg white			
Ovomucoid	11	28	Gal d 1
Ovalbumin	54	45	Gal d 2
Ovotransferrin	12–13	78	Gal d 3
Peanut			
Vicilin		63	Ara h 1
Conglutin		17/19	Ara h 2
Glycinin		64	Ara h 3
Soybean			
Glycinin G1 acidic chain		40	
Profilin		20	Gly m 3
Fish			
Parvalbumin		12	Gad c 1
Shrimp			
Tropomyosin		36	Pen a 1
Lipid transfer proteins (pathogen-related proteins group 14)			
Apple		9	Mal d 3
Apricot		9	Pru ar 3
Peach		10	Pru p 3
Plum		9	Pru d 1
Corn		9	Zea m 14

Middleton Allergy, 2008

What is anaphylaxis?

- A syndrome
  - def: A serious allergic reaction that is rapid in onset and might cause death
  - Considered to be highly likely when any one of 3 clinical criteria is fulfilled

TABLE I. Clinical criteria for diagnosing anaphylaxis

Anaphylaxis is highly likely when any 1 of the following 3 criteria is fulfilled:
1. Acute onset of an illness (minutes to several hours) with involvement of the skin, mucosal tissue, or both (eg, generalized hives, pruritus or flushing, and swollen lips-tongue-uvula) AND at least 1 of the following:
A. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)
B. Reduced BP or associated symptoms of end-organ dysfunction (eg, hypotonia [collapse], syncope, incontinence)
2. Two or more of the following that occur rapidly after exposure to a likely allergen for that patient (minutes to several hours):
A. Involvement of the skin–mucosal tissue (eg, generalized hives, itch-flush, swollen lips-tongue-uvula)
B. Respiratory compromise (eg, dyspnea, wheeze-bronchospasm, stridor, reduced PEF, hypoxemia)
C. Reduced BP or associated symptoms (eg, hypotonia [collapse], syncope, incontinence)
D. Persistent gastrointestinal symptoms (eg, cramping abdominal pain, vomiting)
3. Reduced BP after exposure to a known allergen for that patient (minutes to several hours):
A. Infants and children: low systolic BP (age-specific) or greater than 30% decrease in systolic BP*
B. Adults: systolic BP of less than 90 mm Hg or greater than 30% decrease from that person's baseline

Anaphylaxis. Journal of Allergy and Clinical Immunology. 2010 Jun. 6;125(S2):S161–81.

Atopy

- Atopy
  - def: a predisposition toward developing IgE-mediated hypersensitivity disorders
  - has_material_basis: congenital genetic disorder for atopy ?

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