

Paediatric Food Allergy

Introduction to the Causes and
Management



Allergic Reactions in Children



- Prevalence of atopic disorders in urbanized societies has increased significantly over the past several decades
- Initial sign of allergy seems to be development of allergic reactions to foods, and appearance of eczema
- Infants with these conditions run a higher risk of further sensitisation to aeroallergens and development of asthma and rhinoconjunctivitis (hay fever)

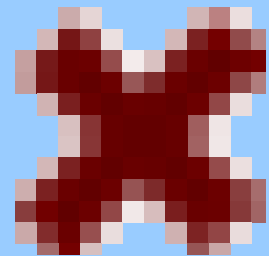
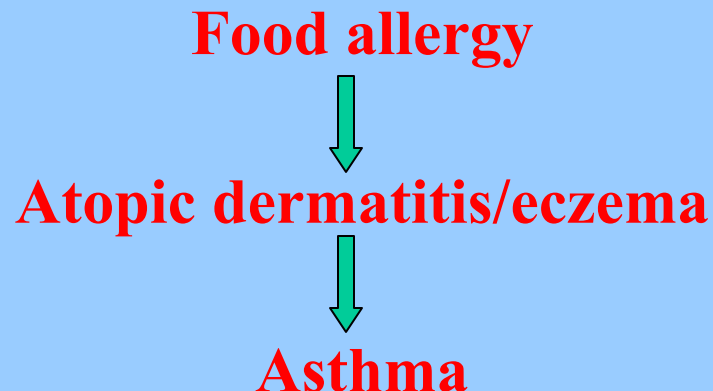
The “Atopic March”

Incidence of Allergy to Specific Foods

- Adverse reactions to foods occur in up to 8% of children [Bock, 1987]
- Cow's milk allergy afflicts 2% of an unselected population of children in the first 3 years of life [Host and Halcken, 1990]
- Cow's milk sensitivity is often the first symptom of an atopic condition

Perceived Risks Associated with Infant Food Allergy

- Anaphylaxis – may be life-threatening
- Nutritional insufficiency and failure to thrive
- Disruption of maternal/infant bonding and family dynamics
- Promotion of the “allergic march”:

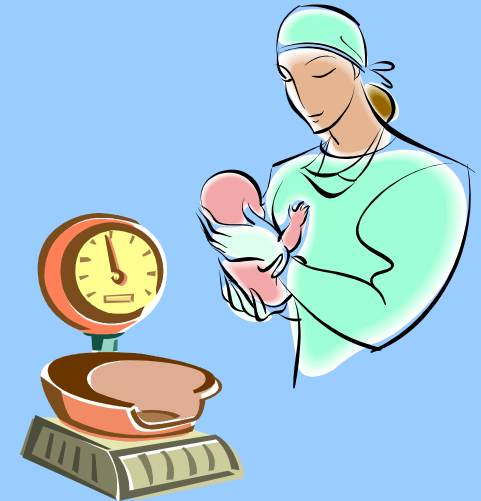


Symptoms Suggesting Allergy in the Infant

Gastrointestinal tract

- Persistent colic
- Diarrhea
- Frequent “spitting up”
- Feeding problems

Poor or no weight gain when all other causes have been investigated and ruled out



Symptoms Suggesting Allergy in the Infant

Skin

- **Urticaria (hives)**
- **Dry, itchy skin**
- **Persistent diaper rash**
- **Redness around anus**
- **Redness on cheeks**
- **Scratching and rubbing**
- **Rash**
- **Eczema**



Symptoms Suggesting Allergy in the Infant (continued)

Respiratory tract

- **Rhinitis**
- **Persistent cough**
- **Nose rubbing**
- **Noisy breathing**
- **Wheezing**
- **Sneezing**
- **Itchy, runny, reddened eyes**
- **Atopic conjunctivitis**
- **Serous otitis media (earache with fluid)**

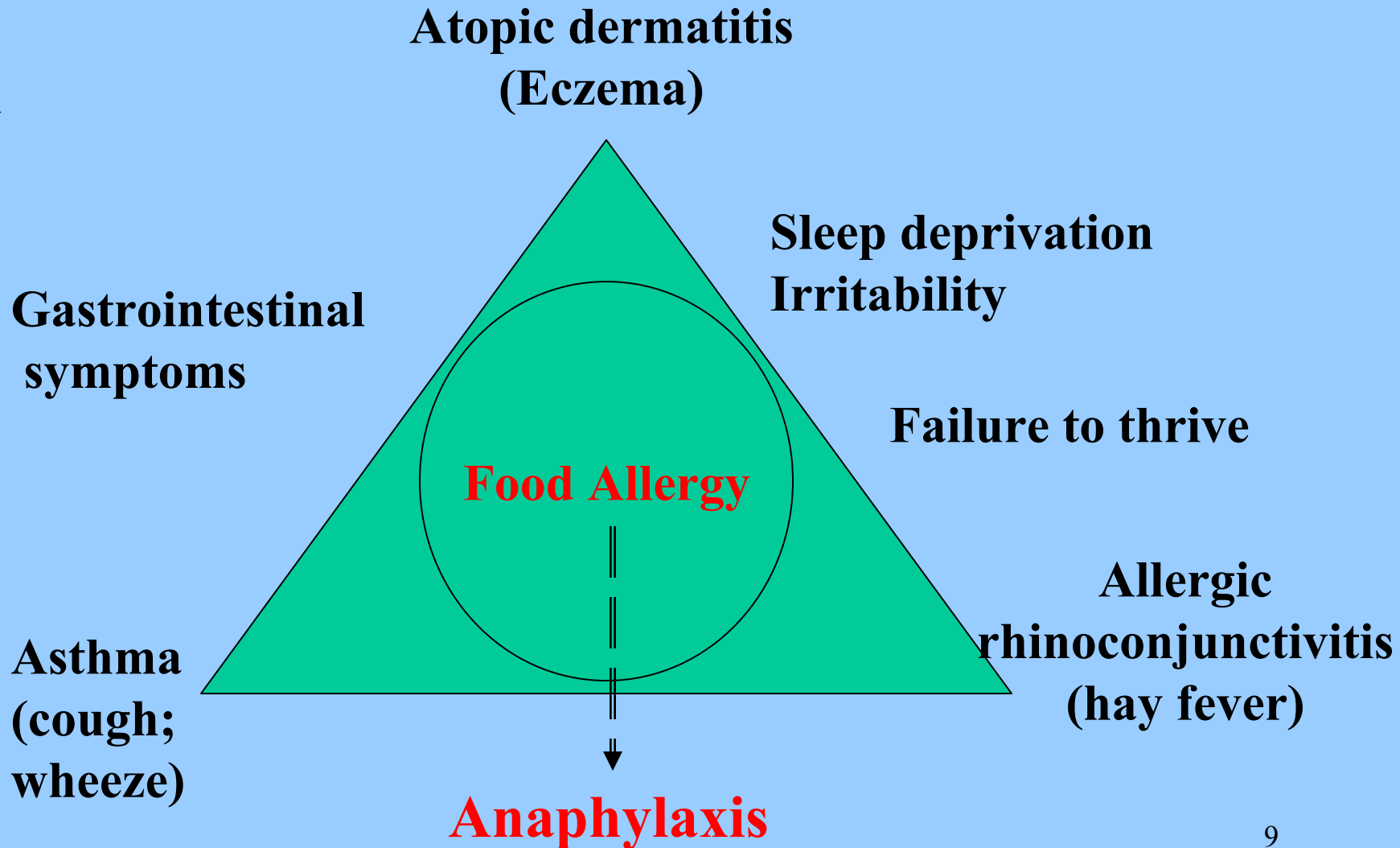


Common Allergy Symptoms Associated with Foods in Infancy

- Less than 20 months of age:
 - **Atopic dermatitis (eczema; skin rashes)**
 - **Gastrointestinal disturbances**
 - **Immediate food reactions**
- Later childhood:
 - **Wheezing**
- All stages:
 - **Rhinitis (stuffy, runny nose)**

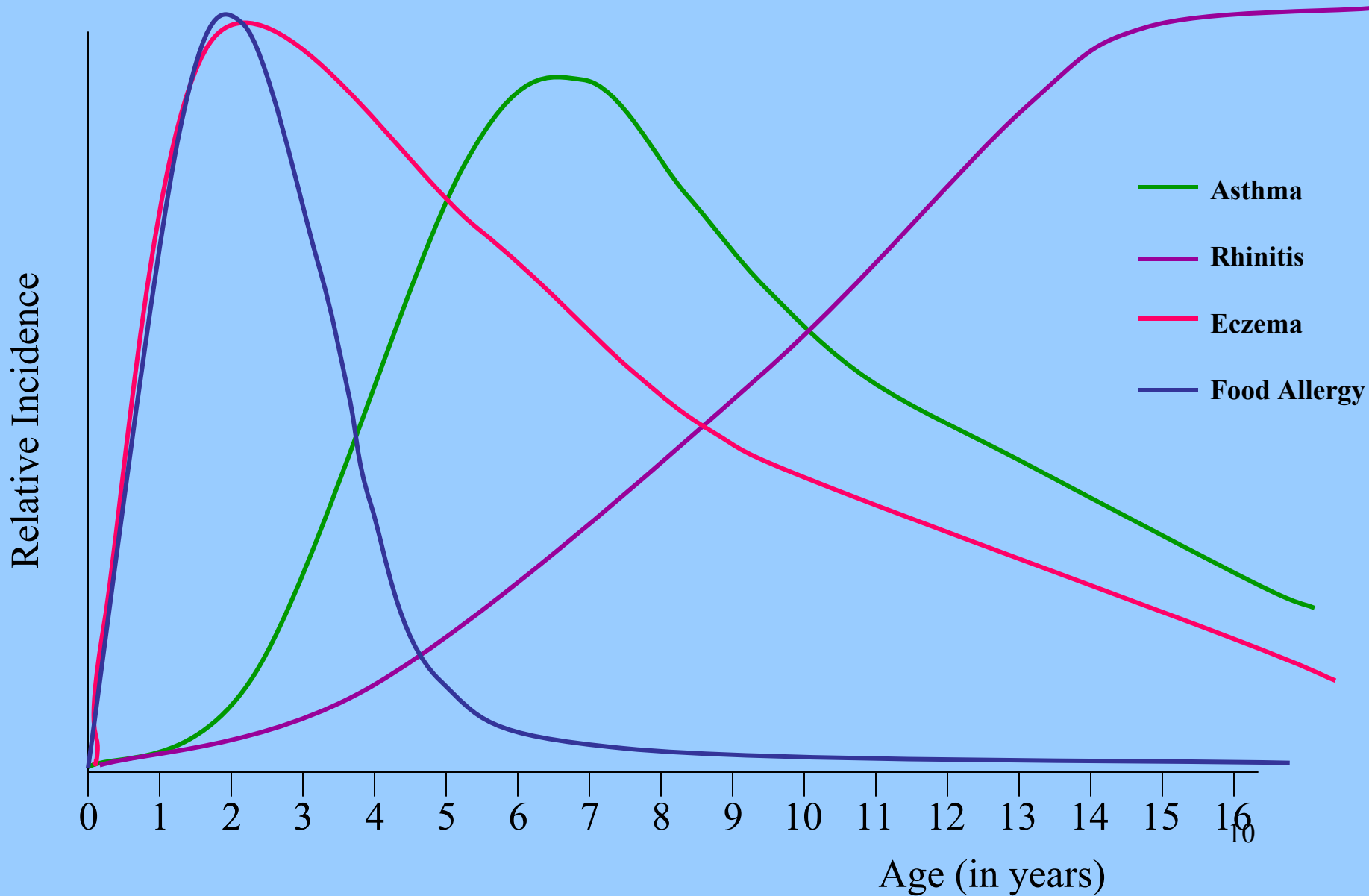


The Allergic Diasthesis



Age Relationship Between Food Allergy and Atopy

{Adapted from Holgate et al 2001}



Symptoms in Childhood Food Allergy

- Organ systems involved:
 - **Digestive tract**
 - **Skin**
 - **Mucous membranes (inside mouth; inside digestive tract)**
 - **Upper airways and lungs**
- Roles:
 - **Antigen absorption**
 - **Target of injury**

Immaturity of Organ Systems in Infant Allergy

Digestive tract:

- Lining is permeable, so allergenic molecules pass through easily to encounter immune cells
- Immaturity of the way in which the immune system responds to the food antigens
- Low levels of secretory IgA (the “first line defence antibody”) allows large molecules to pass through into circulation

Factors Contributing to Food Allergy in Infants

- **Family history of allergy**
- **Developmental immaturity in:**
 - **Digestive tract**
 - **Immune system**
 - **Enzyme systems**

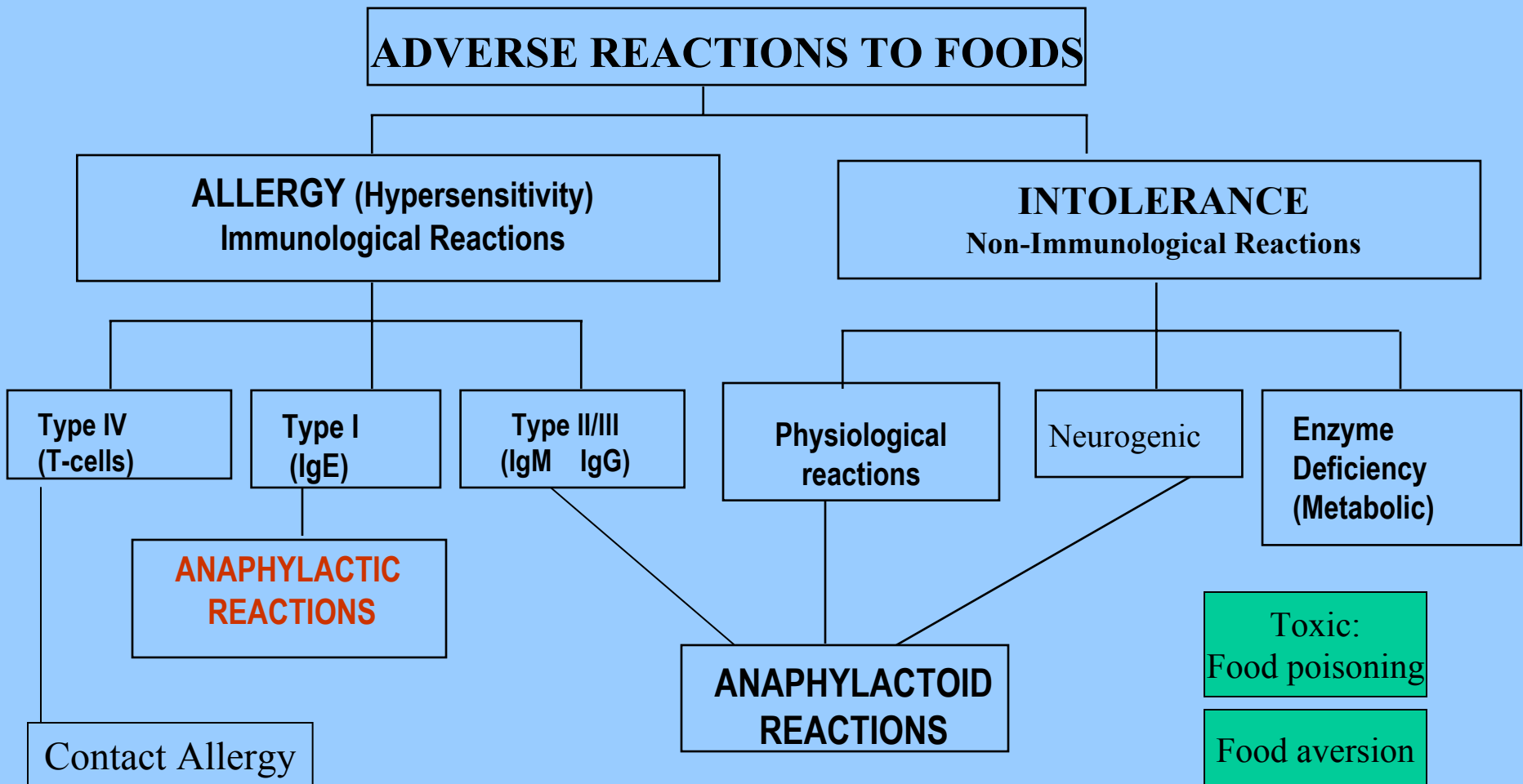


Factors Contributing to Food Allergy in Infants: Immunological Reactions

- Reactions include:
 - Type I hypersensitivity (IgE mediated)
 - Type III hypersensitivity (IgG and immune complex mediated)
 - Type IV hypersensitivity (Cell-mediated)
 - Non-immune mediated reactions: Usually classified as Food Intolerance (often associated with enzyme dysfunction)

Classification of Adverse Reactions to Foods According to the Pathogenic Mechanisms

Adapted from Wuthrich, 1993



Immune Response in Allergy

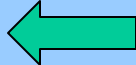
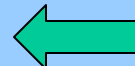
The Hypersensitivity Reactions: Antigen Recognition

- The first stage of an immune response is recognition of a “foreign antigen”
- T cell lymphocytes are the “controllers” of the immune response
- T helper cells (CD4+ subclass) identify the foreign protein as a “potential threat”
- Cytokines are released
- The types of cytokines produced control the resulting immune response

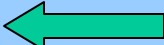
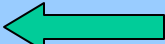
T-helper Cell Subclasses

- There are two subclasses of T-helper cells, differentiated according to the cytokines they release:
 - Th1
 - Th2
 - Each subclass produces a different set of cytokines

Significant Cytokines of the T-Cell Subclasses

- TH1 subclass produces:
 - » Interferon-gamma (IFN- γ) 
 - » Interleukin-2 (IL-2)
 - » Tumor necrosis factor alpha (TNF α)
 - » IL-12
- TH2 subclass produces:
 - » Interleukin-4 (IL-4) 
 - » Interleukin-5 (IL-5)
 - » Interleukin-6 (IL-6)
 - » Interleukin-8 (IL-8)
 - » Interleukin-10 (IL-10)
 - » Interleukin-13 (IL-13)

T-helper cell subtypes

- Th1 triggers the *protective response* to a pathogen such as a virus or bacterium
 - IgM, IgG, IgA antibodies are produced 
- Th2 is responsible for the *Type I hypersensitivity reaction (allergy)*
 - IgE antibodies are produced 

TH1 ↔ TH2 Interactions

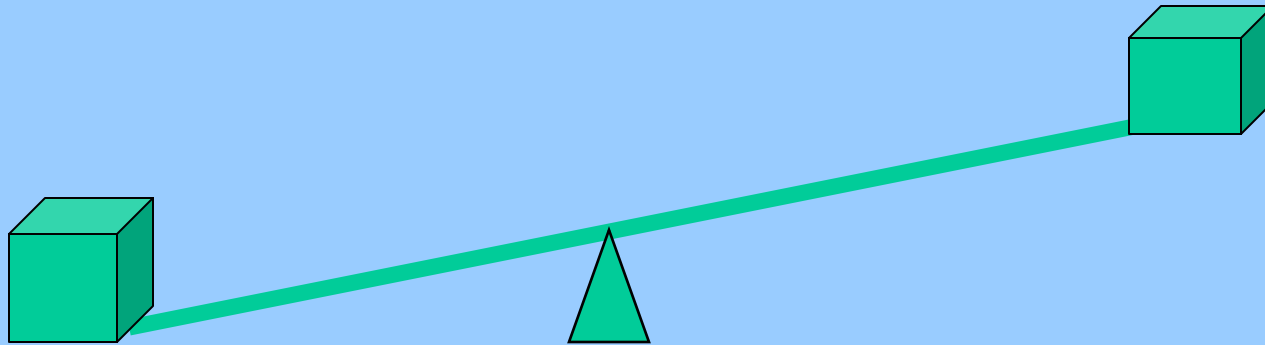
Factors promoting:

Th1

- Bacterial and viral infections
- Maturation of the immune system
- Antigen tolerance

Th2

- Parasite infestations
- Immature immune system
- Sensitization to antigen



TH1 ↔ TH2 Interactions

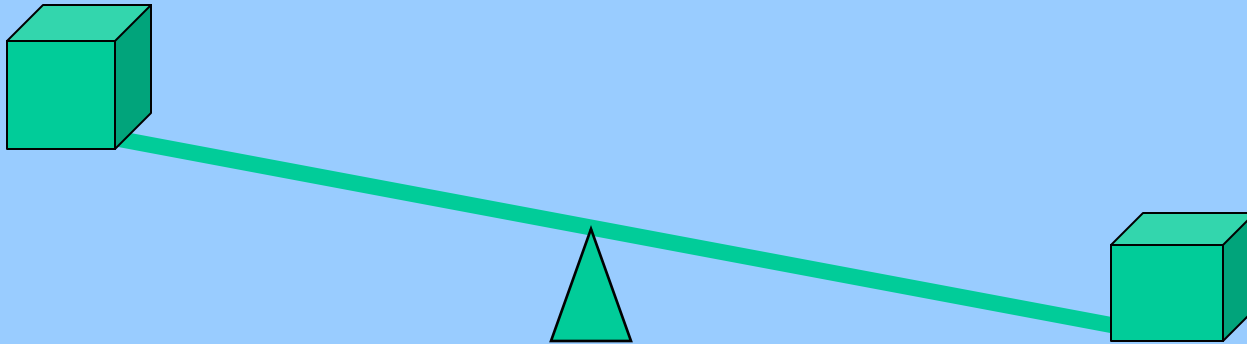
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Predisposing factors:

- Genetic inheritance
- Early exposure to allergen
- Increased antigen uptake

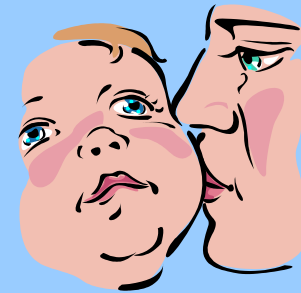
Example of Interaction of Cytokines

- When Th1 predominates, Th2 is suppressed: the “hygiene theory” of allergy
- Conversely, Th2 cytokines (allergy) suppress Th1 cytokines (protection against infection)
 - Results in decrease in the level of immune protection against microorganisms
 - Infection by normally harmless bacteria can occur

Example of Interaction of Cytokines (continued)

- Clinical example:
 - In atopic dermatitis (eczema) the Th2 response in skin tissues suppresses the protective Th1
 - Increase in IL-4; decrease in INF- γ
 - Results in high potential for infection by normally harmless bacteria on the skin

Approach to Infant Allergy



- **Prediction**
 - Identification of the atopic baby before initial allergen exposure may allow prevention of allergy
- **Prevention**
 - Measures to prevent initial allergic sensitization of potentially atopic infant
- **Identification**
 - Methods for identification of an established food allergy
- **Management**
 - Strategies for avoiding the allergenic food and providing complete balanced nutrition from alternative sources to ensure optimum growth and development