

Allergic Rhinitis

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Definition of Allergic Rhinitis

- Rhinitis is an **inflammation of the mucous membranes of the nose.**
- Allergic rhinitis involves reactions in the nasal mucosa from **repeated** allergen **exposures** that cause **hypersensitivity.**
- These reactions may be **seasonal or perennial.**
- In people with allergies, the immune system is overly sensitive to substances such as animal dander, molds, pollen, etc.
- With repeated exposure they build up a sensitivity to these allergens. This sensitivity then causes allergic reactions.

Components of the immune system

:Antigens

An antigen is any substance that can induce an immune response.

Specific molecules on bacteria, viruses, pollen, plants, insect venom and transplant tissue can all act as antigens.

the epitope:

The specific region of the antigen molecule that initiates the immune response.

A hapten :

is a small-molecular-weight molecule that can only trigger an immune response if bound to a larger antigenic macromolecule called a *carrier*.

Major histocompatibility complex (MHC)

A group of unique glycoproteins found on the surface of cells.
Two distinct types of MHC are found on cells: MHC I and MHC II.

MHC I

Found on the surface of nearly all nucleated cells within the body.

Serve as markers of “self” for the immune system.

Foreign organisms like viruses will often express some of their foreign antigens on the MHC I of the cells they infect.

MHC II

Found primarily on the surfaces of macrophages and other immune cells.

Can be used by immune cells to present foreign antigens to other immune cells.

:*Monocytes and macrophages*

Monocytes are produced in the bone marrow and released into circulation.

Monocytes migrate into tissues during injury. In the injured tissues, monocytes change shape and mature into macrophages.

Macrophages that exhibit foreign antigens on the MHC II are called *antigen-presenting cells* (APC).

The antigen presented on the surface of the macrophages may be recognized by specific lymphocytes called *helper T cells*.

that, in turn, will activate other lymphocytes.

Macrophages also produce *cytokines* such as *interleukin-1* (IL-1) that enhance the inflammatory reaction.

Lymphocytes

Derived from stem cells in the bone marrow.

Two distinct types of leukocytes are found in the human body: *T lymphocytes* and *B lymphocytes*.

T lymphocytes (T cells)

70% of all lymphocytes.

Function in *cell-mediated immunity*.

Two distinct subsets of T lymphocytes are present: *helper T cells* and *cytotoxic T cells*.

Helper T cells

Express a unique protein group on their surface called *CD4*.

Helper T cells are activated when they encounter foreign antigens presented on the surface of antigen-presenting cells such as macrophages.

Once activated, helper T cells produce cytokines that stimulate the activity of macrophages, *cytotoxic T cells* and *natural killer cells*

Helper T cells interact with *B lymphocytes* to stimulate their differentiation and eventual production of antibodies.

Cytotoxic T cells

Express CD8 protein on their cell surface.

Cytotoxic T cells are “activated” by cytokines from helper T cells.

Activated cytotoxic T cells recognize and bind to foreign antigen presented on MHC I of infected cells.

Cytotoxic T cells directly destroy any infected host cells they encounter by releasing *cytotoxic cytokines*, *cytolytic enzymes* and proteins called *perforins* that perforate and destroy the infected cell.

B lymphocytes (B cells)

Responsible for *humoral-mediated immunity*.

When B lymphocytes encounter a foreign antigen, they bind to it .

under the influence of cytokines released by helper T cells, mature into *plasma cells* that produce antibodies

Antibodies

Also called *immunoglobulins*

Antibodies bind viruses, bacteria and toxins to inactivate them.



Types of antibodies:

IgA

Predominant antibody in body secretions such as saliva, respiratory secretions and breast milk

Protects mucous membranes

Accounts for approximately 10 to 15% of all antibodies

IgG

Major class of antibody responsible for immune response

Exhibits antiviral, antibacterial and antitoxin activities

Accounts for approximately 80% of all antibodies

Crosses the placenta and provides antibody protection to newborns

IgM

Largest antibody

First antibody produced in an immune response

Responsible for natural immunity such as ABO blood antigen reactions Accounts for approximately 10% of all antibodies

IgE

Binds to mast cells and is involved in allergic reactions Accounts for significantly less than 1% of all antibodies

IgD

Role in immune function is not clear but is required for maturation of B cells Accounts for less than 1% of all antibodies

Natural killer cells

A nonspecific type of lymphocyte that destroys all foreign invaders by releasing cytotoxic chemicals and cytokines.

Binds to any cells it identifies as “foreign” (e.g., that have altered or missing MHC I).

Can also bind to and destroy antibody-coated target cells.

Cytokines

Small proteins produced primarily by T cells and macrophages.

Complement proteins

A system of more than 20 circulating plasma proteins that are activated in a cascade fashion.

Complement proteins may be activated by IgM or IgG that is bound to a pathogen.

Functions of activated complement proteins include the following:

Mast cell degranulation

Bacterial cell lysis

Opsonization (neutralization) of bacteria similar to antibodies

Cytokine Actions

Interleukins (IL-1 to IL-17)

Inflammatory mediators

Stimulate proliferation and differentiation of T cells, B cells, macrophages and natural killer cells

“Chemotactic” factors for T cells and leukocytes

Interferons (α , β , γ)

Natural antiviral agents

Tumor necrosis factors (α and β)

Inflammatory mediators

Cytotoxic to tumor cells

Increase the activity of phagocytic cells

Transforming growth factor β

Produced by lymphocytes, macrophages and platelets
Chemotactic for macrophages

Stimulates the activity of fibroblasts for wound healing .

Colony-stimulating factors

Produced by monocytes, fibroblasts and lymphocytes

Stimulate proliferation and growth of white blood cells and macrophages

IMMUNE SYSTEM

Two distinct, cooperative systems

- Natural/Innate Immune System is a generalized defense system against any foreign invaders.
 - Everyone is born with a functioning Natural/Innate Immune System
- Learned/Acquired Immune System is gained through both passively and actively being exposed to a foreign pathogen.
 - Everyone develops their own Learned/Acquired Immune system specific to that individual.



Natural “Innate” Immunity

1. Common to all individuals “Non specific”
2. Anatomical barriers *“First line”*
 - 1- Skin
 - 2- Mucous membranes [Mucosal sloughing]
 - 3- Secretions [Saliva – Gastric HCl – Acidic urine]
 - 4- Reflexes [Swallow – Cough – Sphincters]
 - 5- Commensals of gut
3. Inflammation *“Second line”*

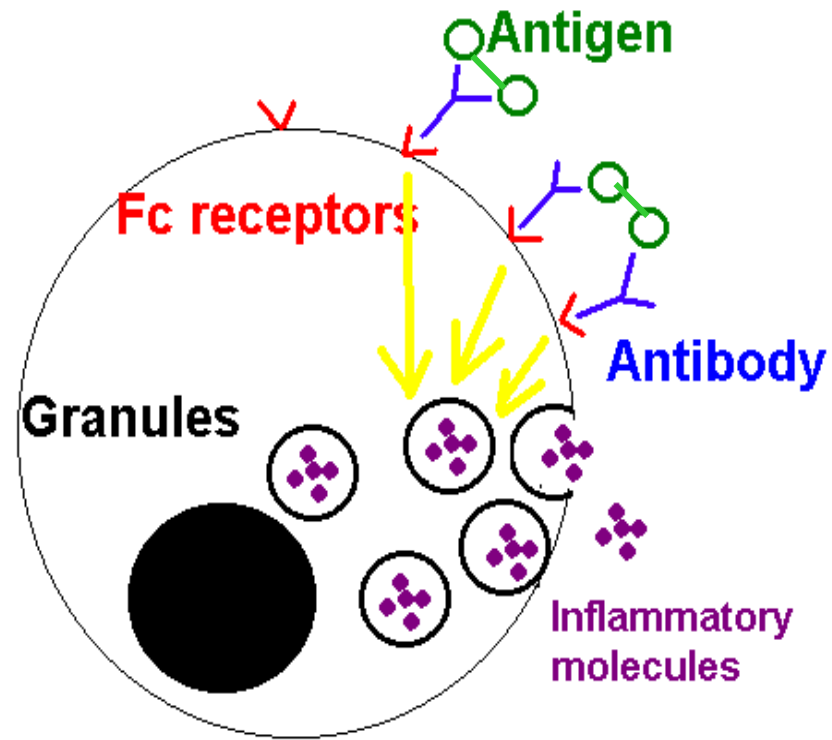
LEARNED/ ACQUIRED IMMUNE RESPONSE

- Third Line of Defense in Immune Response
- Elite Group of soldiers - Antibodies
- High tech weapons
- Specific targets
- Takes time to mobilize
- Depend on inflammation to begin battle



Allergy

- **Allergy** is an immune response to harmless antigens.
- Mechanism: **IgE bind Fcε receptors** on **mast cells and basophils**, and causes release of **granules** with inflammatory agents.
- The “real” role of IgE is probably to fight parasites such as **helminths**. (In developing countries, people hardly ever suffer from allergies.)



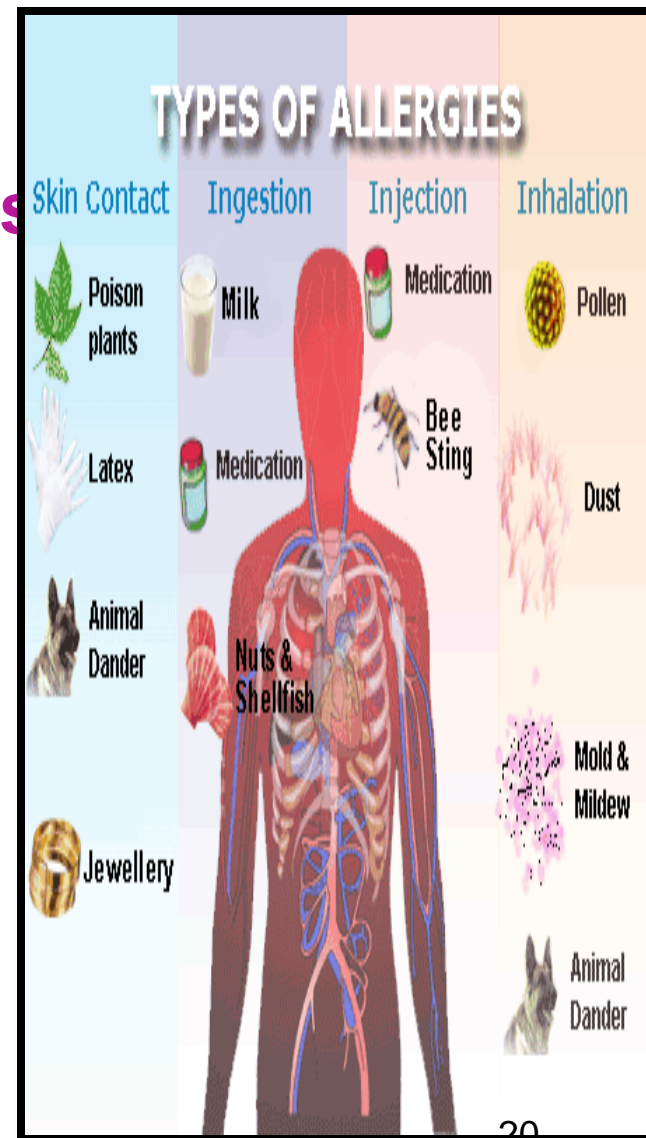
Allergens

Requirements “

- 1- **Significantly Complex**
- 2- **Significantly Large Amounts**
- 3- **Significantly Large sized**
- 4- **Significantly Foreign**

Examples

- 1- Antibiotics
- 2- Food [Eggs – Shellfish]
- 3- Insect stings
- 4- Hormones
- 5- Blood products
- 6- Preservatives
- 7- X-ray contrast media



Immune System

Immune system can differentiate between self and non-self antigens

Immunologic tolerance is the loss of immune response to a specific antigen

Autoimmunity

 Normal part of immune system:

Low autoantibodies **concentration** in **serum and tissue** in **healthy** people

 Response against self antigens

Antigen-antibody complex removed by macrophages





6 **'RIGHTS'** OF MEDICATION USAGE

Before giving any medications be sure you know:

- Right Medication
- Right Route
- Right Time
- Right Patient
- Right Dosage
- Right Documentation



Types of Hypersensitivity Allergic Reactions

Item	Type I Immediate Anaphylactic, hypersensitivity  <small>Type I Hypersensitivity: IgE-Mediated Allergic Reaction</small>	Type II Cytotoxic hypersensitivity Antibody-dependent cytotoxicity  <small>Type II Hypersensitivity: Cytotoxic Type II Allergic Reaction</small>	Type III Immune complex hypersensitivity  <small>Type III Hypersensitivity: Immune Complex Type III Allergic Reaction</small>	Type IV Cell-mediated  <small>Type IV Hypersensitivity: Delayed Type IV Allergic Reaction</small>
Onset	30-60 minutes Quicker Delayed after initial reaction: 3-4 hours Peak: 6-12 hours Subside: 24 hours	Minutes-hours	3-10 hours	48-72 hours
Antibodies	IgE	IgM IgG	IgG IgM	Specific T cells No antibodies
Triggering factors & Models	Penicillins Cephalosporins Quinolones Chlorhexidine NMBs NSAIDs Proton pump inhibitors Heparin Insulin Chimeric monoclonal antibodies	Penicillins Quinidine α-Methyldopa Cephalosporins Vancomycin Sulfonamides Acetaminophen	Systemic lupus erythematosus Farmer's lung Filarial worms Dengue virus Dapsone in Leprosy Penicillins in Syphilis	Crohn's disease Sarcoidosis T.B. Graft rejection Tumors Leprosy Toxoplasmosis Leishmaniasis

Statistics

- 2 million school days lost per year
- Allergic rhinitis in up to 40% of children

Recent study showed:

73% of classrooms contained 4 or more allergens

87% of classrooms contained irritants

10% of classrooms had live pets

23% of classrooms had cockroaches

Seasonal Rhinitis

Common allergens:

- Grass pollens
- Tree pollens
- Weed pollens
- Mold spores

Seasonal allergies tend to be due to **outdoor allergens** that only occur at certain times of the year.

Symptoms include:

- Watery nasal drainage
- Nasal congestion
- Repetitive sneezing
- Itchy eyes, nose, ears and throat
- Nose rubbing
- Allergic salute

Perennial Allergic Rhinitis

- Show little or **no seasonal variation**
- Symptoms are intermittent or continuous throughout the year
- Watery nasal drainage and sneezing are less prominent than seasonal allergic rhinitis
- Nasal congestion is often the primary symptom
- Perennial allergens are **indoor allergens**. The most common are dust mites, furry pets, cockroaches, and molds.

Chronic nasal congestion may produce

- Allergic rhinitis can sometimes cause or be associated with these symptoms and/or conditions.

Dry irritated or sore throat

Snoring

Pain around eyes

Mouth breathing

Orthodontic disturbances

Frontal headaches / sinusitis

Chronic cough

Otitis media / possible hearing loss

Altered smell and / or taste

Sleep disturbance, with or without daytime fatigue

Asthma exacerbation

Systemic Symptoms of Allergic Rhinitis

Some patients with allergic rhinitis experience:

Weakness

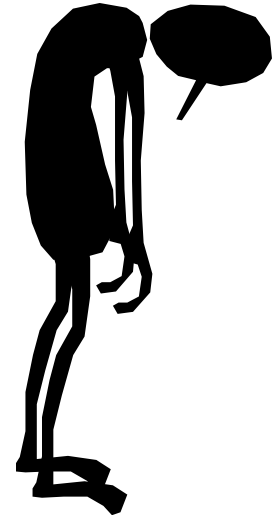
Discomfort or restlessness

Irritability

Fatigue

Difficulty concentrating

Decreased appetite



- Some of the symptoms associated with allergic rhinitis you may see in school children are irritability, fatigue, and difficulty concentrating due to not sleeping well or over the counter (OTC) medications. OTC medications often have a sedating quality.

Allergic triggers

Dust mites

- Carpeting, upholstered furniture

Animals

- Furry or feathered

Pollens

- Physical exercise, recess

Cockroaches

Molds

- Water damage, leaking roofs, poorly maintained heating / cooling systems
- Can be encountered outdoors as well as indoors

Foods

- Uncommon for chronic symptoms