2.1.6

Type I Hypersensitivity

Hypersensitivities

Hypersensitivity reactions are exaggerated or inappropriate immune responses against an antigen or allergen. There are four types of hypersensitivities that are characterized by the immune mechanism. One helpful way to remember them is by using our ABCs.

Type I: **A**llergies, **A**naphylaxis

Type II: Anti**B**ody

Type III: Immune **C**omplex

Type IV: **D**elayed

Watch the video Type I Hypersensitivity-Mechanism

Type I hypersensitivity reactions rely on the antibody IgE. This hypersensitivity is often referred to as IgE mediated or an immediate reaction. Most allergic reactions are type I. Allergies often run in families because genetic predisposition causes some people to be overly sensitive to certain antigens. An antigen that elicits an allergic immune response is called an allergen. Common respiratory allergens include pollen, fungal spores, feces of dust mites, and animal dander. Food allergies are a very common example of a type I hypersensitivity. Common food allergies include peanuts, eggs, tree-grown nuts, milk, soy, wheat, peas, and seafood. The processing and cooking of a food can affect its allergenicity.

Type I hypersensitivities are characterized by a first and a second exposure to the allergen. The first exposure could start with someone breathing in an allergen. If the allergen gets picked up by an APC in the mucous membranes of the airways, the APC then migrates to a lymph node where it can interact with T-cells and B-cells. The APC will express the allergen on an MHC-II and a naïve helper T-cell with a matching receptor will then bind the APC. The APC will release IL-4 which causes the helper T-cell to differentiate into a T_H2. The T_H2 will then bind to a B-cell expressing the same allergen as before and release IL-4. IL-4 causes the B-cell to experience a class switch and become an IgE producing plasma cell. IgE will bind to the Fc receptor on mast cells and basophils. Upon second exposure to the antigen, the allergen will bind to two IgE antibodies on a mast cell or basophil in what is called cross-linking. As a result, the mast cells and basophils will degranulate and release large amounts of pro-inflammatory mediators like histamine that cause inflammation. T_H2 also releases IL-5 which stimulates the activation and attraction of eosinophils. Eosinophils can cause further damage and inflammation to the area. T_H2 also releases IL-13 which increases mucus production by the epithelial cells of MALT tissue.

Systemic (anaphylactic) type I reactions include widespread edema, difficulty breathing (due to bronchoconstriction) and vascular shock from excessive vasodilation. These conditions can be life threatening. Some common allergens that cause them are bee stings and peanuts. Treatment of anaphylaxis is most effective with administration of epinephrine, most often through an EpiPen. EpiPens administer epinephrine through intramuscular injection. Upon transport in the

blood, epinephrine stimulates tissues expressing adrenergic receptors and causes relaxation of the smooth muscle within the airways (bronchodilation), increased heart rate and contractility, and systemic vasoconstriction. This is a lifesaving drug for those who experience severe type I hypersensitivities.

Local (atopic) reactions are a form of allergy in which the reaction may occur in a part of the body not in contact with the allergen. Common atopic disorders are urticaria (hives), allergic rhinitis (hay fever), food allergies, and some forms of asthma. It is important to remember that atopic individuals will have high serum levels of IgE and increased numbers of basophils and mast cells. Allergic rhinitis involves inflammation of the mucous membranes of the eyes, nose, sinuses, pharynx, eustachian tubes, and middle ear. Antihistamines and intranasal corticosteroids are useful in the treatment of allergic rhinitis because they block the inflammatory mediators that cause it.