Allergies and Hypersensitivity

Sometimes the immune system may overreact, or react to the wrong substances instead of responding appropriately. This is termed **hypersensitivity** and the immunological response leads to tissue damage rather than immunity. Hypersensitivity reactions occur after a person has been **sensitised** to an antigen. In some cases, this causes only localised discomfort, as in the case of hayfever. More generalised reactions (such as anaphylaxis from insect venom or drug injections), or localised reactions that affect essential body systems (such as asthma), can cause death through asphyxiation and/or circulatory shock.

Hypersensitivity

A person becomes **sensitised** when they form antibodies to harmless substances in the environment such as pollen or spores (steps 1-2 right). These substances, termed **allergens**, act as antigens to induce antibody production and an allergic response. Once a person is sensitised, the antibodies respond to further encounters with the allergen by causing the release of **histamine** from mast cells (steps 4-5). It is histamine that mediates the symptoms of hypersensitivity reactions such as hay fever and asthma. These symptoms include wheezing and airway constriction, inflammation, itching and watering of the eyes and nose, and/or sneezing.

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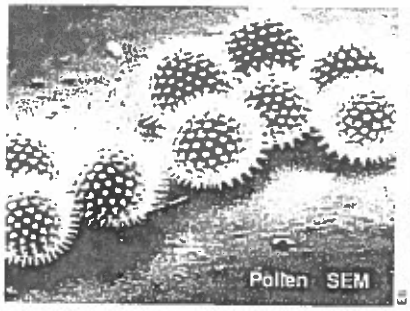
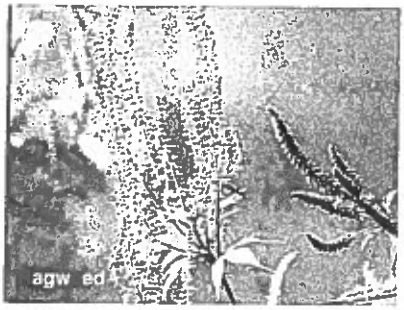


Pollen SEM



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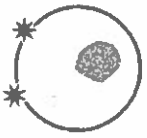
Hay fever (allergic rhinitis) is an allergic reaction to airborne substances such as dust, moulds, pollens, and animal fur or feathers. Allergy to wind-borne pollen is the most common, and certain plants (e.g. ragweed and privet) are highly allergenic. There appears to be a genetic susceptibility to hay fever, as it is common in people with a family history of eczema, hives, and/or asthma. The best treatment for hay fever is to avoid the allergen, although anti-histamines, decongestants, and steroid nasal sprays will assist in alleviating symptoms.

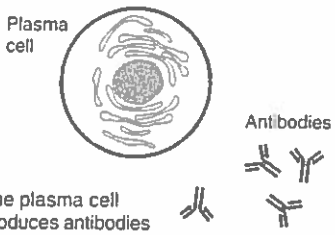
Asthma is a common disease affecting more than three million people in the UK alone. It usually occurs as a result of a reaction to allergens such as house dust and the faeces of house dust mites, pollen, and animal dander. As with all hypersensitivity reactions, it involves the production of histamines from mast cells (far right). The site of the reaction is the respiratory bronchioles where the histamine causes constriction of the airways, accumulation of fluid and mucus, and inability to breathe. During an attack, sufferers show laboured breathing with overexpansion of the chest cavity (photo, right).

Asthma attacks are often triggered by environmental factors such as cold air, exercise, air pollutants, and viral infections. Recent evidence has also indicated the involvement of a bacterium: *Chlamydia pneumoniae*, in about half of all cases of asthma in susceptible adults.

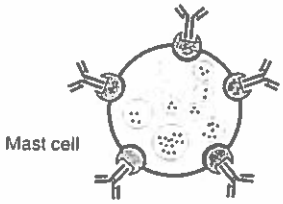
The Basis of Hypersensitivity



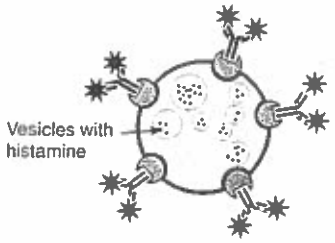
1. B cell encounters the allergen and differentiates into plasma cells



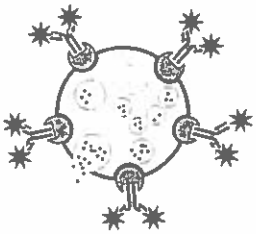
2. The plasma cell produces antibodies



3. Antibodies bind to specific receptors on the surface of the mast cells



4. The mast cell binds the allergen when it encounters it again.



5. The mast cell releases histamine and other chemicals, which together cause the symptoms of an allergic reaction.

1. Explain the role of histamine in hypersensitivity responses: _____

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2. Explain what is meant by becoming **sensitised** to an allergen: _____

_____

3. Explain the effect of **bronchodilators** and explain why they are used to treat asthma: _____

_____

4. Explain the process of Hypersensitivity. What cells are used, and what chemicals + structures of the cell (and allergen) are present. Explain.

5. What are the causes of Asthma? What is happening to a person that has astha? What bacteria is causing people to get asthma?