**Lec. 10 Immunology**

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**Antigens/** are substances that induce a specific immune response and subsequently react with the products of a specific immune response. The word originated from the notion that they can stimulate **anti**body **gen**eration. We now know that the immune system does not only consist of antibodies.

**Characteristics of Antigen**

**Immunogenicity/(The ability of a substance to induce specific immune response).**The capacity to stimulate the production of antibodies or cell-mediated immune responses.

**Antigenicity/ (The ability to bind antibody)**Implies both, the ability of a substance to induce specific immune responses and the ability to react with the products of that response.

**Properties of antigen**

**1-Foreigness :(Foreign substances are immunogenic)**. The immune system possesses the capacity to distinguish between self and nonself. An antigen must be a foreign substance to the host to elicit an immune response.

**2- Molecular size: (High molecular weight increase immunogenicity).**The size of the molecule is important to its ability to induce an immune response, usually, the larger the molecule, the better the immunogen.

**3- Chemical structure complexity: (High complexity increase immunogenicity).** Naturally occurring antigens are mainly proteins and some are polysaccharides. Proteins are more effective in stimulating antibody production than polysaccharides.

**4- Route of administration or route of entry of immunogen into the host: (The route of entry influences the type and intensity of the immune responses).**Various routs of entry of antigens into the animal body include:

1. Oral route / enter through mouth
2. Subcutaneous route/ enter the tissues just below the skin (by injury or infection).
3. Intramuscular route/ injected into the muscles.
4. Intravenous route/ injected directly into the veins.
5. Respiratory route/ inhaled through respiratory system.
6. Genitourinary route/ enter through the genital or urinary tract.

**5- Antigenic specificity/** Antigenic specificity depend on the specific active sites on the antigenic molecules (**antigenic determinants)**.

**Epitope –** Antigenic determinants- The immune system doesn’t recognize an infectious agents or foreign molecule as a whole but reacts specifically with structurally distinct areasknown as epitopes**.**

**Epitope /** can be defined as naturally occurring small chemical groups present on the surface of an antigen against which all immune activity is directed.

* **An epitope**(**Small part of an antigen that interacts with an antibody**) is the small site on the antigen ( e.g 5-10 amino acids in case of protein antigen and 3-6 sugar molecules in case of polysaccharides), which is recognized by the antibody.
* **Function of epitope**/ determine the specificity of the antigen, and therefore, they are also knownas determinant group.

**Valence of an antigen (Any given antigen may have several epitopes,Each epitope is recognized by a different antibody)** / antigens aremultivalent. That is an antigen molecule carries a number of different epitopes.

**Antigens can be classified in order of their origins**

* **Exogenous antigens/**  are antigens that have entered the body from the outside, for example by inhalation, ingestion, or injection. By endocytosis or phagocytosis, these antigens are taken into the antigen-presenting cells (APCs) and processed into fragments. **Types of exoantigens**

**1- Bacterial antigens:**

 a- Antigens related to bacterial cells

 - Somatic antigen (O): part of cell wall gm –vebacter.

 - Capsular antigen: usually polysaccharide

 - Flagellar Ag (H) : a protein made of flagellin

 - Fimbrial Ag: surface antigens in fimbriated bacilli

 b- Antigen secreted by bacteria: 1/ Exotoxins 2/ Enzymes

**2- Viral antigens:**

 a- protein coat viral antigens

 b- Soluble antigens (soluble nucleoproteins as in influenza)

**Endogenous antigens** /are antigens that have been generated within the cell, as a result of normal cell metabolism, or because of viral or intracellular bacterial infection. Human tissue antigens such as Blood group antigens: A, B and Rh antigens

**Auto antigens/** is usually a normal protein or complex of proteins (and sometimes DNA or RNA) that is recognized by the immune system of patients suffering from a specific autoimmune disease. These antigens should under normal conditions not be the target of the immune system, but due to mainly genetic and environmental factors the normal immunological tolerance for such an antigen has been lost in these patients.

**Types of antigen**

1. **Complete antigen or immunogen /** are used for substances which possess antigenic properties, i.e. they are able to generate an immune response by themselves, theses are high molecular weight (more than 10.000) proteins, but some are poly saccharides.
2. **Incomplete or hapten antigen /** is a low molecular weight (less than 10.000), usually non-protein substance, unable to induce an immune response by itself but can become immunogenic only when covalently linked to proteins (called carrier protein). However, haptens can react specifically with its corresponding antibody.Haptens are usually low molecular weight lipids and carbohydrates

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