Antigens and Immunogenecity / Superantigen

Antigens → a molecule which reacts with antibody produced

Immunogenecity ⟶ A molecule that provokes an immune response.

⟹ Hapten is use for antigen and Immunogenecity. Heptens are small well defined chemical grouping such as dinitrophenyl (DNP), which are not immunogenic on their own, but will react with performed antibodies.

To make Haptens immunogenic it must be linked to carrier molecule which is itself immunogenic.

*** Antigenic determinants and Epitopes :—**

Epitopes :—

The part of antibody molecule which contacts the antigen is ~~some~~ termed as paratops and the part of antigen molecule that make contact with paratope is called epitopes.

Antibody + antigen ⟶ Paratope
Paratope + antigen ⟶ Epitope

⟹ Most of antigens are protein in nature thus they exists as three dimensional folded structure. Hence, they may be cluster of amino acid sequences on the three dimentional structure constituting a series of epitopes.

Each of these epitope clusters is antigenic determinant.

* Requirements for Immunogenesity :—
the first and primary requirement for any molecules to quality as an immogen is that the substance be genetically foreign to the host, sometimes body constituents are recognized as foreign leading to autoimmune disease

molecular size determines immunogenicity to some extents. the general rule is particles with a molecular weight less than 10,000 are only weak immunogenic or not immunogenic at all - the most potent immunogens are macromolecular proteins with molecular of more than 10,000.

Immunogenic molecules possess a certain degree of chemical complexity. only pure lipids are non immunogenic. A solution of monomeric protein may actually induce tolerance but is highly immogenic in the polymeric form.

Experiment shows that conformation of molecule could be important to its antigenicity.

ex → Lysozyme (tears) → molecule is good antigen in its native form, which consists of several amino acid folded into a loop with disulphide bond.

If the disulphid (S-S) bond of lysozyme was disturbed. i.e, loop formation distroyed. the antigenicity of lysozyme reduced.

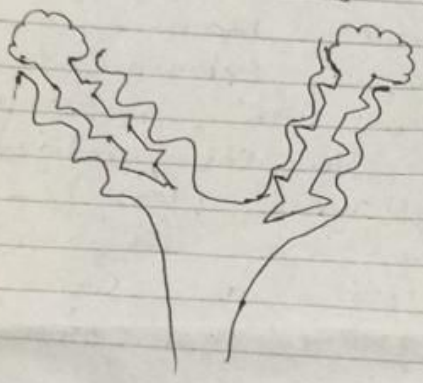
Some worker have shown that mobility of a segment of the antigen molecule influences its antigenicity.

Ex → In tobacco mosaic virus, certain segment with high mobility were more antigenic than non-mobile segments.

Antigen and antibodies intract by

(4)

Spatial complementarity and not by ~~Covant~~ covalent bonding. the idea that antibody recognize antigen through complementary shaped on paratopes and epitopes is as follows.



Antigen :—

The forces that bind antigen to antibody.

the forces that bind antigen to antibody become larger as intercellular distances decreases. these forces are, no different from the non-specific interaction which occurs between any two unrelated proteins..

these intermolecular forces are :—

(i) electrostatic forces as ionic forces
ii) Hydrogen bonding

(c) Hydrophobic bonding
(d) Vander waal forces.

these are two commonly used terms for binding of Antigen & antibody.

Abbinity
(Strength of binding of antigen & antibody)
→ those antibodies that bits closely to antigenic determinants and are not easily dissociates are called high abbinity antibody.

Avidity

or Avidity :—
It refers to overall strength of interaction between a large antigen with multiple epitopes and a polyvalent antibody molecular (such as IgM)

→ In univalent binding is weaker & easily dissociates, but in multivalent binding is greater and dissociation

It's not easily antigen - antibody specificity is not absolute.

We know that antigen antibody reactions are specific in nature.

An antibody raised to one determinant will not react with another determinant However, in practise, the term cross reactivity is widely used. An antiserum raised against a given antigen can cross react with a partially related antigen which bears on identical or similar determinants.

ex → Antiserum raised to Ag-1 will react with Ag-2 due to identical determinant shared by two antigens. Antiserum to Ag-1 will also react weakly to Ag-3 because determinants are similar in shape.

A Super - Antigens :—

Super antigen not requires antigen presenting cells and they directly

binds with variable region of α/β T-cell receptors.

In presence of several variable domains the T-cell would bind with super antigens.

the retroviruses such as Human immune deficiency virus (HIV) produces super antigens

the Retrovirus integrated into Human genome. Phillipa Marrack and John Kappler studied tolerance in Retro-virus super antigens in mammary tumor virus 7 (MTV-7) which give rise to super-antigens.

this super antigen binds with variable VB8.1 of TCR

Mice which are devoid of MTV-7 retrovirus, nearly 8% of cell possess VB8-1 super antigens in their TCR.

contrary to above the mice in which the virus MTV-7 integrated in their genome reveal no TCR with VB8-1 super antigen. Such cells must have been eliminated at certain stage of development.