

ANTIGENS

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PROPERTIES OF ANTIGEN

- ***IMMUNOGENICITY* (Immunogen)**: a stimulus that produces a humoral or cell-mediated immune response

A foreign substance, when introduced into human body, stimulate formation of specific antibodies or sensitized lymphocytes

- ***ANTIGENICITY* (Antigen)**: any substance that binds specifically to an antibody or a T-cell receptor. Eg. **Haptens**, small molecules
- ⊠ **ALLEROGENICITY**: Ag that induces an allergic response.
- ⊠ **TOLEROGENICITY**: Ag that induces specific immunologic nonresponsiveness.

All immunogens are antigens but not all antigens are immunogens

Epitope (Antigenic determinants): the portion of an antigen that is recognized and bound by an Ab or TCR/MHC complex (antigenic determinant)

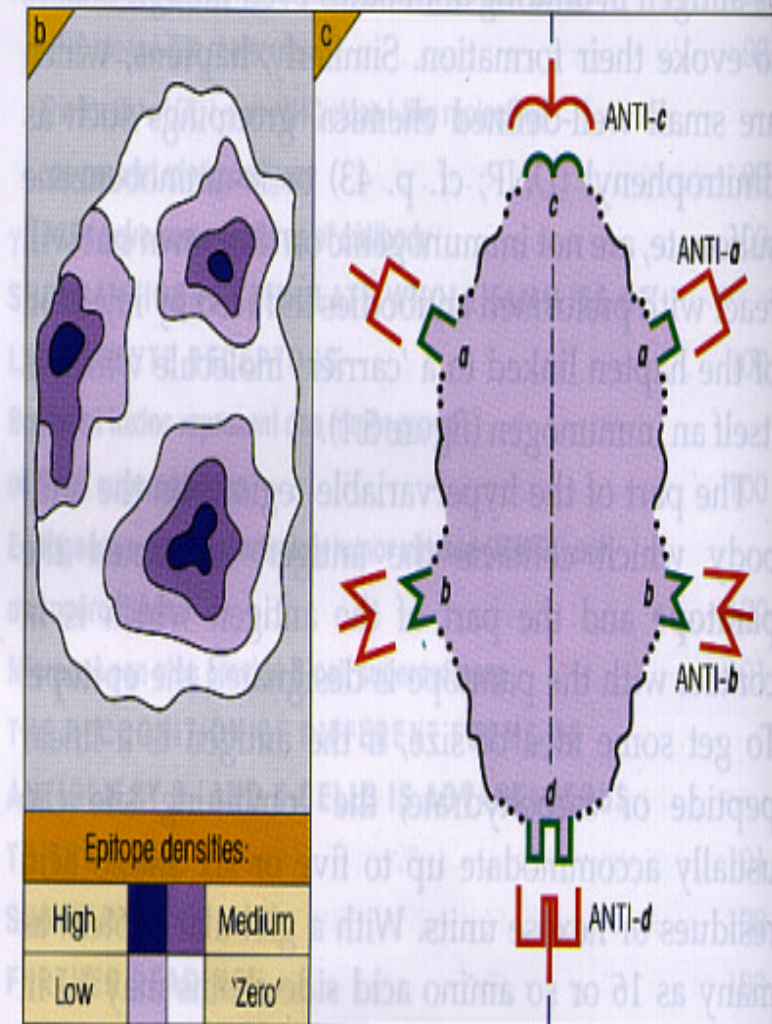


Figure 5.4. A globular protein antigen usually bears a mosaic of determinants (dominant epitope clusters) on its surface, defined by the heterogeneity of its amino acid sequence.

Two general classes of antigens

Exogenous Antigens

Bacterial antigens:

I - Antigens related to bacterial cells

- Somatic antigen (O): part of cell wall –ve bacteria
- Capsular antigen: usually polysaccharide
- Flagellar Ag (H) : a protein made of flagellin
- Fimbrial Ag: surface antigens in fimbriated bacilli

II - Antigen secreted by bacteria:

- Exotoxins
- Enzymes

Viral antigens:

i- protein coat viral antigens

ii- Soluble antigens (soluble nucleoproteins as in influenza)

Endogenous antigens

Human tissue antigens:

a- Blood group antigens:
A, B and Rh antigens

b- Histocompatibility antigens:

Glycoprotein molecules on all nucleotide cells:

- Major histocompatibility complex antigens (MHC)
- Human leukocyte antigen (HLA)

MHC has an important function in presentation of antigens to T-cells

* Helper T-cells recognize foreign antigens presented in the groove of MHC II molecule

* Cytotoxic T-cells will only recognize antigens presented in the groove of Class I molecule (MHC restriction)

Superantigens (SAgs)

They activate multiple clones of T-lymphocytes

* Bacterial toxins:

Staph. aureus toxic shock syndrome toxin (TSST) and enterotoxins

Strpt. pyogenes pyrogenic toxin A

- They have the ability to bind both class II MHC molecules and TCR β chain
- They act as a clamp between the two, providing a signal for T-cell activation
- They are active at very low concentration causing release of large amounts of cytokines
- The massive T-cell activation and release of large amounts of cytokines cause systemic toxicity
- This method of stimulation is not specific for the pathogen
- It does not lead to acquired immunity i.e no memory

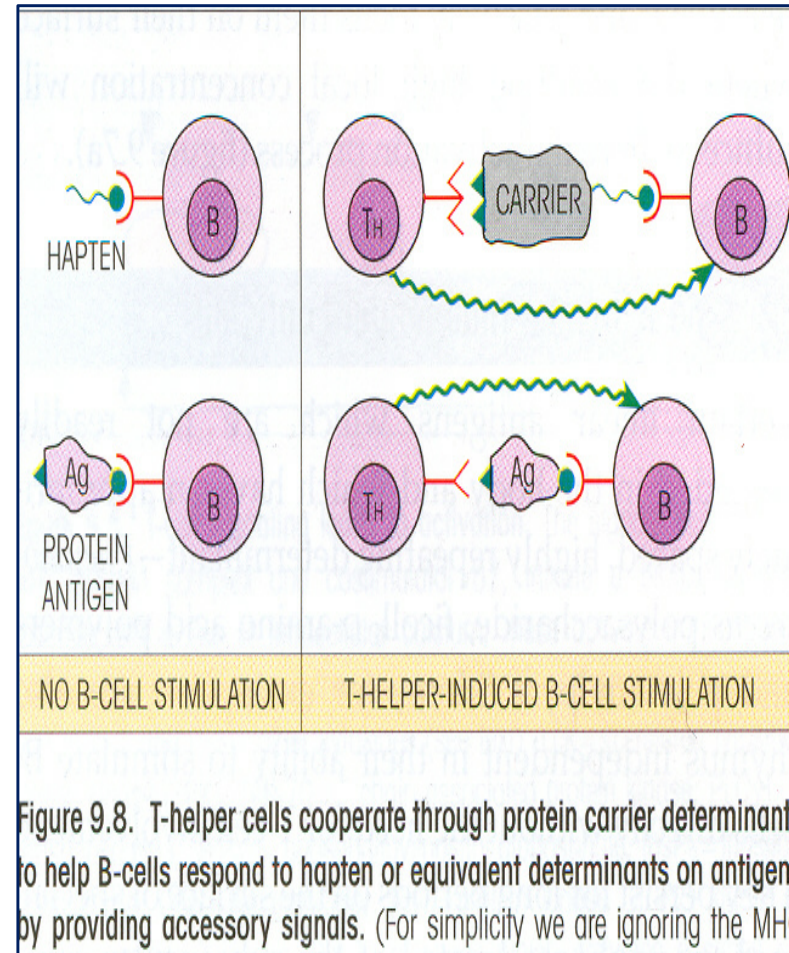
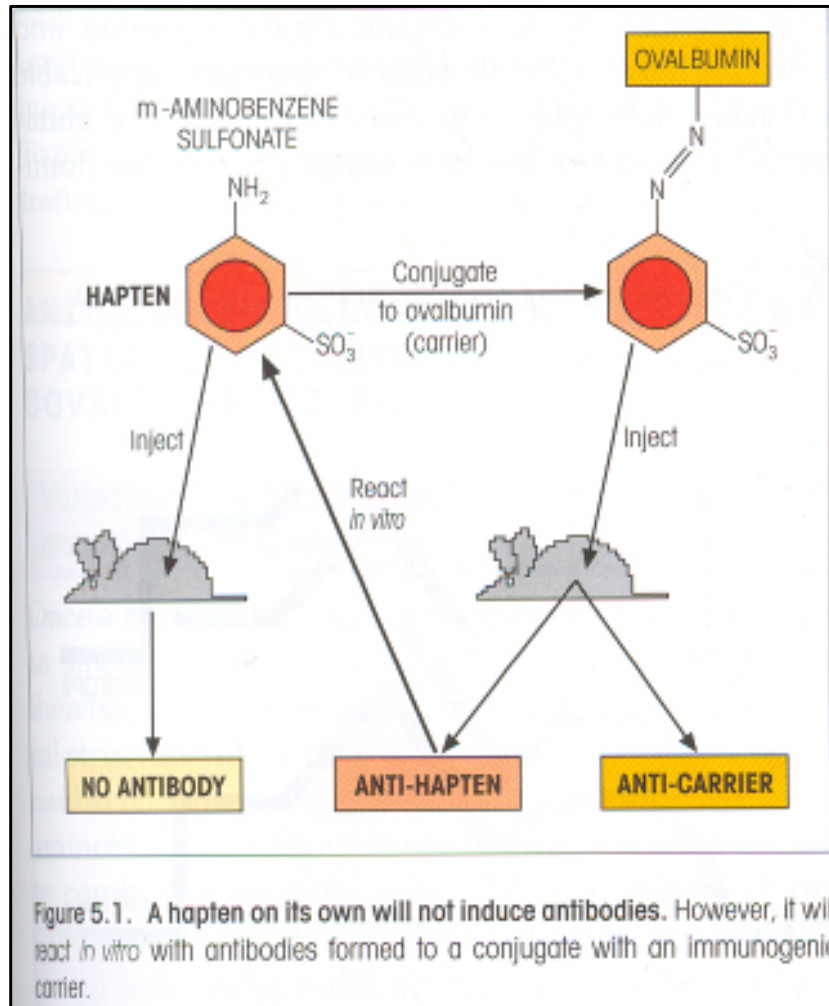
Mitogens and Lectins

Mitogens: Stimulate mitosis and cell division non-specifically (non-specific therefore stimulate polyclonally)

Examples of Mitogens

- ⊠ Concanavalin A (Con A) : Non-specific T-cell mitogen
- ⊠ Phytohemagglutinin (PHA): Non-specific T-cell mitogen
- ⊠ Pokeweed Mitogen (PWM): Non-specific T- and B-cell Mitogen
- ⊠ Lipopolysaccharide (LPS): Gram negative bacterial cell wall component. potent Polyclonal (non-specific) B-Cell Mitogen
- ⊠ Lectins: Proteins that bind to carbohydrate in glycoproteins (Can be potent mitogens)
- ⊠ Glycoproteins: Conjugated protein with covalently attached carbohydrate residues

HAPTEN



•A low molecular weight molecule called haptens can bind to Ab's or TCR's but they cannot initiate an immune response... (not immunogenic by itself)

•Hapten can be made immunogenic by conjugation to a suitable larger carrier molecule (albumin, globulins)

Examples :

simple chemicals and drugs:

penicillin, sulphonamid, aspirin, cosmetic, tranquillizers, neomycin skin ointment

⌘ Adjuvants: A substance that non-specifically enhances the immune response to an antigen

- Prolong the presence of the antigen
- Enhance production of “co-stimulatory” signals
- Non-specifically stimulate lymphocytes