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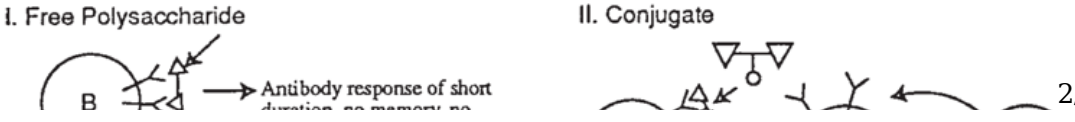
Hapten Conjugate Vaccine Design

A conjugate vaccine consists of a polysaccharide antigen that is conjugated to a carrier molecule. The conjugate vaccine is produced by covalently linking the poor antigens to the strong antigens, eliciting a stronger immune response to the poor antigen. This enhances the effectiveness and stability of the vaccine. Poor antigens are usually polysaccharides that are attached to strong protein antigens. However, peptide/protein and protein/protein conjugates have also been developed. Creative Biolabs offers all kinds of Hapten Conjugate Vaccine Design services and carrier proteins according to your requirements.

How Does Hapten Conjugate Vaccine Work?

Pure polysaccharides induce poor response to infants and young children, and the subsequent life of the reaction, the affinity does not mature and the duration is short. In order to overcome these problems, the polysaccharide must bind to the carrier protein to become an effective vaccine.

The hapten is a small chemical group that cannot cross-link the B-cell receptor and does not recruit T cells to help, so it cannot stimulate the antibody response in its free soluble form. When conjugated to the carrier protein, the hapten becomes immunogenic. The protein can carry multiple hapten groups which can now cross-link B-cell receptors and activate T cells through peptides derived from the carrier protein.



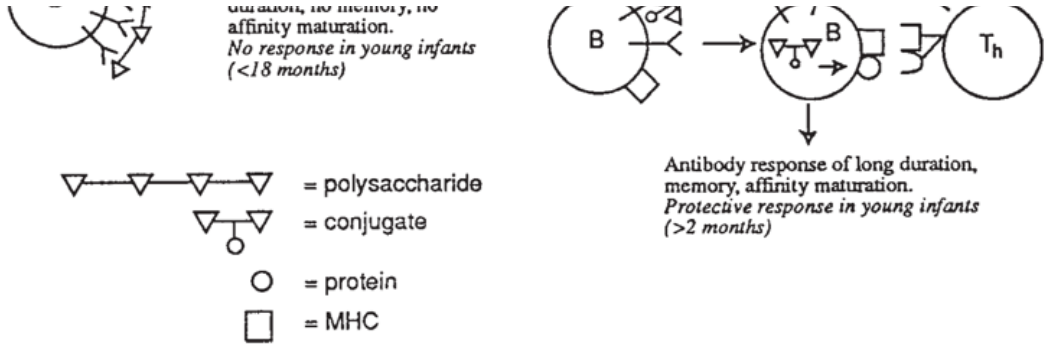
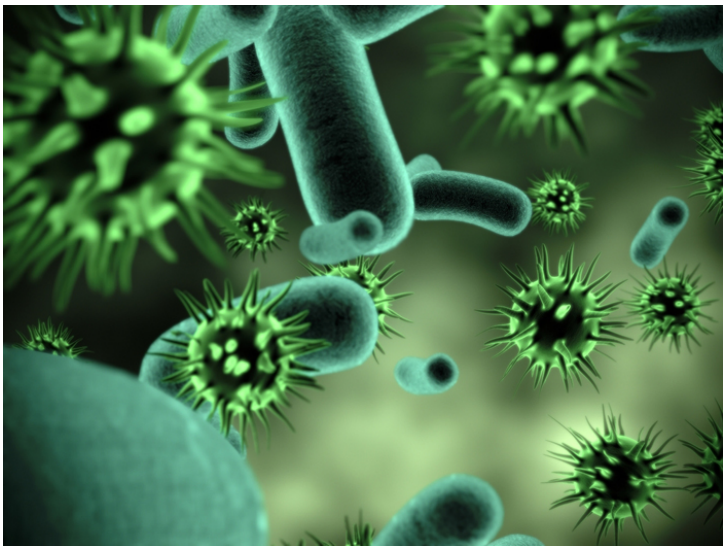


Fig.1 The carrier proteins ensure the involvement of T-helper lymphocytes in the activation of the hapten- or polysaccharide-specific antibody-producing B lymphocytes. [1]

Carrier Protein (/vaccine/carrier-protein-design.htm)

A variety of proteins, including outer membrane protein (OMP), bacterial pili, and excreted toxins of pathogenic bacteria, can be used as carriers for carbohydrate antigens. The most widely used carrier proteins are tetanus and diphtheria toxoid, which are readily available and easy to be accepted by humans.



The use of detoxified bacterial toxins as carrier proteins has some drawbacks. Chemical detoxification processes are likely to produce lot-to-lot variations, which may affect conjugation efficiency. The conjugation of these proteins with a large amount of saccharide may affect the conformation of the protein, thereby inactivating T cells and/or B cell epitopes. The precondition for conjugation is to maintain the T cell activating properties of the carrier protein, which may limit the amount of saccharide conjugate to the protein. Bacterial

toxins provide advantages over their corresponding toxoid if they can reduce cytotoxicity by conjugation itself.

Although diphtheria and tetanus toxin-derived proteins have been shown to be successful carrier proteins, problems such as hypersensitivity or suppression of anti-carbohydrate response caused by the pre-existence of anti-carrier antibodies are still present in animal and human studies. These negative effects may become more pronounced when the conjugated carrier proteins are tested in combination vaccine formulation. Alternative carrier proteins have been developed, such as CRM197, a non-toxic diphtheria toxoid. CRM197 is a well-defined protein and functions as a carrier for polysaccharides and haptens making them immunogenic. It is used as a carrier protein in a number of approved conjugate vaccines for diseases such as pneumococcal bacterial infections and meningitis.

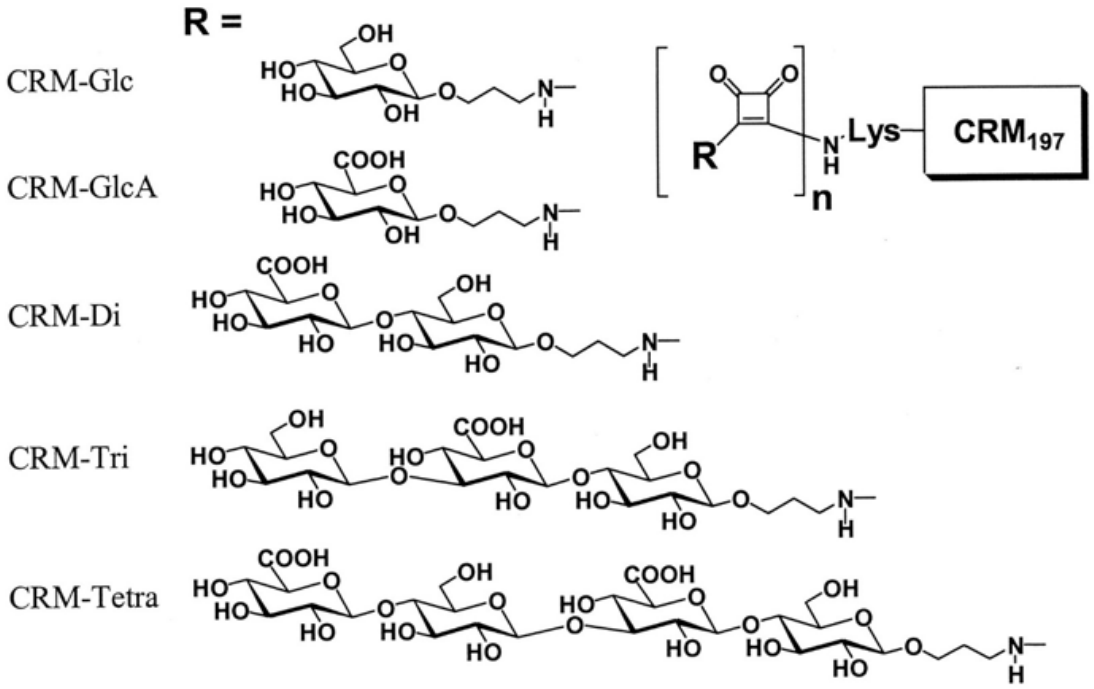


Fig.3 Schematic structure of the saccharide-CRM197 conjugates. [2]

In terms of the extensive experience in Hapten conjugate vaccine research, Creative Biolabs is proud to offer our customers professional design services and a series of carrier proteins with the best quality and most competitive price.

References

1. Peeters CC; Lagerman PR; *et al*. Preparation of polysaccharide-conjugate vaccines. *Methods Mol Med*. 2003, 87: 153-174.
2. Benaissa-Trouw B; Lefeber DJ; *et al*. Synthetic polysaccharide type 3-related di-, tri-, and tetrasaccharide-CRM(197) conjugates induce protection against Streptococcus pneumoniae type 3 in mice. *Infect Immun*. 2001, 69(7): 4698-4701.

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