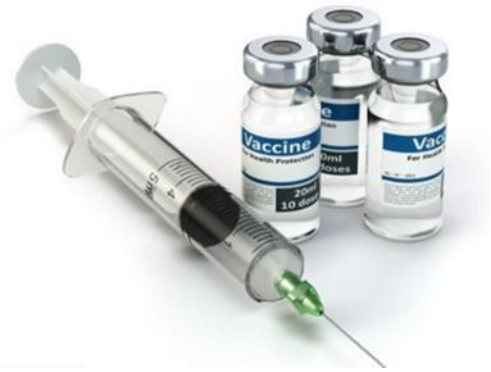
# Serology and vaccinology

# مصول ولقاحات

# Lec15

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## Recombinant subunit vaccines

The first protein-based vaccines also relied on natural (non-recombinant) sources of antigens. For example, a highly active vaccine to hepatitis B consisted of purified hepatitis B surface antigen (HBsAg) from human plasma.

The recombinant subunit approach is today dominating the vaccine research in the search for new vaccines. Identification of antigens involved in inducing protective immunity and isolation of the gene encoding these proteins makes it possible to use recombinant DNA technology or synthetic peptides to produce sufficient quantities of the antigen for vaccine studies.

- The first vaccine to be produced utilizing recombinant DNA technology was licensed in 1986 when the HBsAg was successfully expressed in yeast . This new vaccine efficiently elicited protective antibodies upon vaccination of chimpanzees and soon this vaccine replaced the plasma derived hepatitis B vaccine in human use.
- The use of recombinant DNA technology has made the development of subunit vaccines more efficient.
- The basics of this technology is to transfer a gene encoding an antigen, responsible for inducing immune responses sufficient for protection, to a non-pathogenic host, thereby making the production of the antigen safer and generally more efficient.
- Recombinant subunit vaccines can be delivered as purified recombinant proteins, as proteins delivered using live non-pathogenic vectors (bacterial or viral) or as nucleic acid molecules encoding the antigen

- There are several advantages in using recombinant subunit vaccines. No pathogen is present in the production and purification procedure, thus making the production procedure

1- By using recombinant DNA technology, the production and purification procedure can be carefully designed to obtain high yields of a well-defined product.
2- Recombinant strategies have also been employed for detoxification of toxins. Engineered inactivation of toxin can be obtained by mutational replacement of specific amino acids in the enzymatically active part of the toxin. Pertussis toxoid produced by Bordetella pertussis with specific mutations in its toxin gene is included as a component in an acellular pertussis vaccine. Chimeric composite immunogens can also be created by fusion of different toxins, such as the cholera toxin B subunit (CTB)-E. coli heatlabile toxin B subunit (LTB) hybrid molecules, which are candidate oral vaccines against both enterotoxic E. coli (ETEC) infections and cholera .

## Synthetic peptides

Subunit vaccine candidates can be produced by chemical synthesis of short polypeptides. The advantages of peptide vaccines are several such as:

1- a chemically well-defined product and a simple preparation
2- . Synthetic peptides representing parts of higher parasites, bacteria or viruses have indeed been used for immunizations in humans For example, it has been shown that a 12 amino acid long peptide from the

Plasmodium falciparum sporozoite is safe and induces humoral responses in healthy volunteers

3. some side effects encountered with other vaccine types, e.g. whole cell vaccines, may be circumvented, one major disadvantage of peptide vaccines is their low level of immunogenicity. One reason for this may be due to major histocompatibility complex (MHC) restriction i.e. one particular peptide can only be recognized with a particulate human leukocyte antigen (HLA) haplotype . Another reason could be that the peptides are rapidly degraded or excreted in vivo .

However, recent advances in chemical synthesis i.e. to introduce changes in the amine bond, have lead to the development of pseudopeptides that are more stable and as biologically active as normal peptides .