
بسم الله الرحمن الرحيم

Anti- bacterial vaccines

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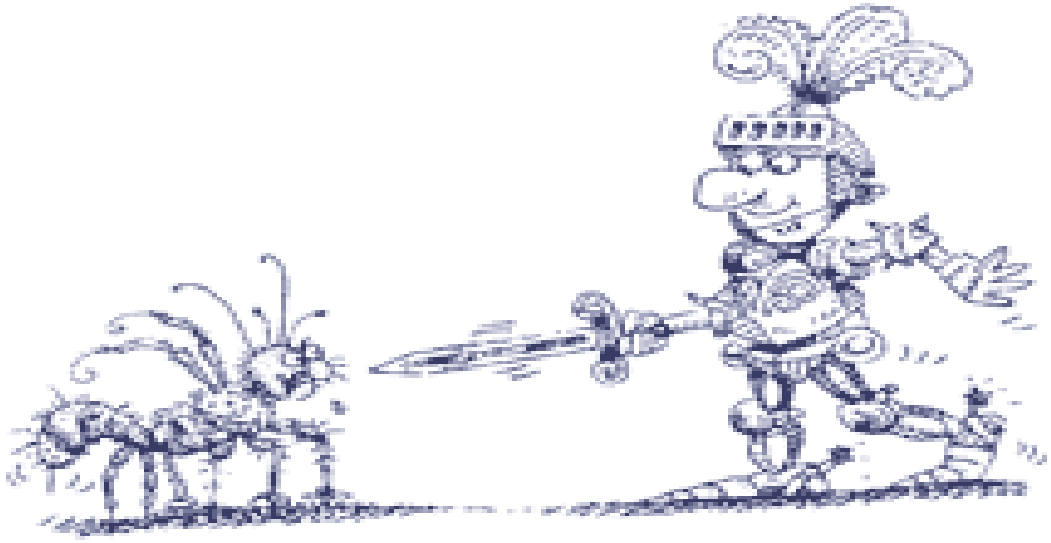
Aims & Objectives

At the end of the lecture, students of 3rd Year MBBS should be able to

1. Define immunization and vaccination.
2. Describe role of immunization in active and passive acquired immunity.
3. Enlist the current bacterial vaccines and their indications.
4. Describe various types of bacterial vaccines in term of composition, preparation, indications, route of administration and common side effects.

Be Wise... Immunise

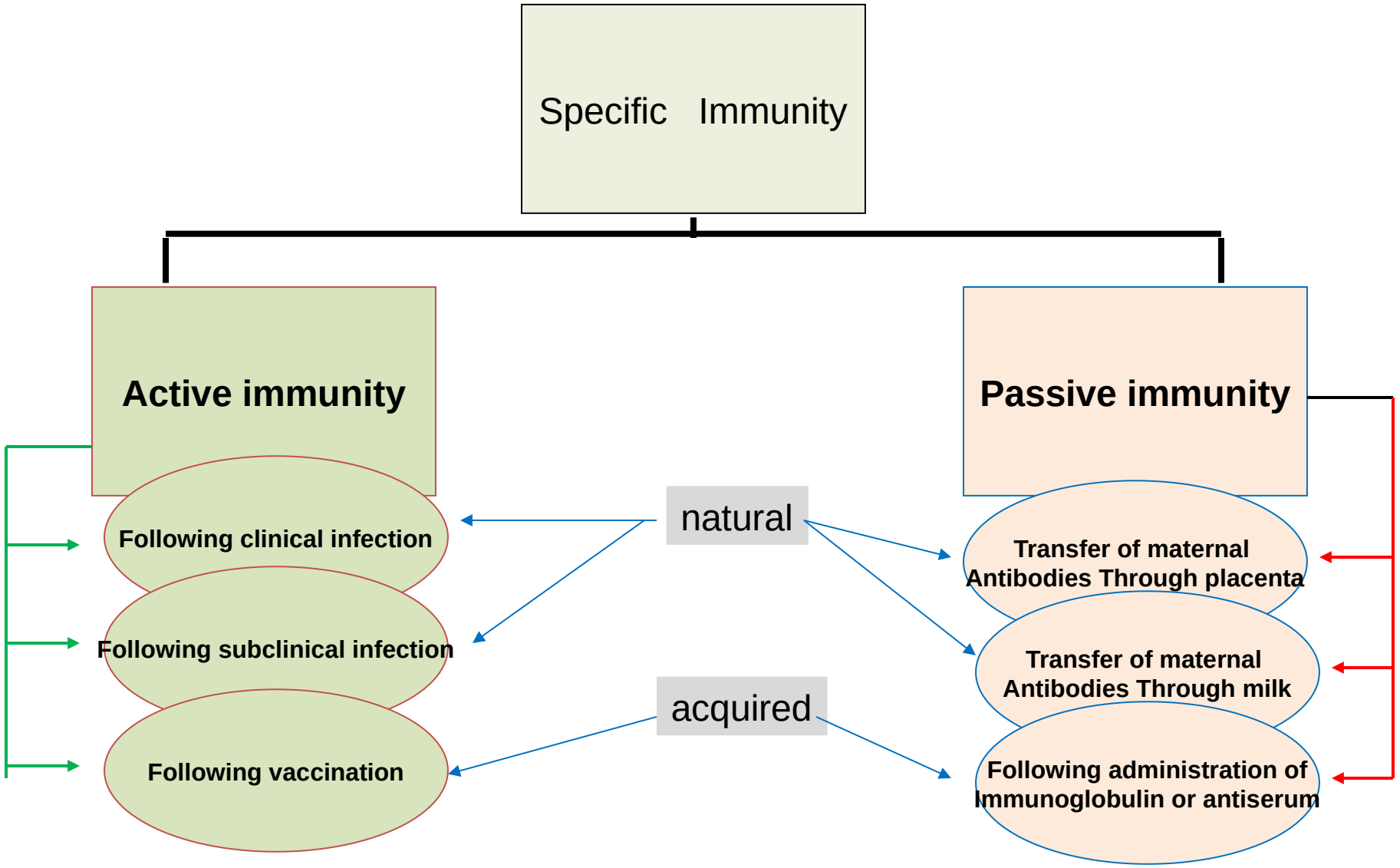


Immunization is a simple, safe and effective way to protect against infectious diseases that may cause serious illness, permanent damage or even death.

PRINCIPLES OF BACTERIAL VACCINES

Bacterial diseases can be prevented by immunization that induce either active or passive immunity.

- **Active** immunity is induced by vaccines prepared from bacteria or their products.
- **Passive** immunity is provided by the administration of preformed antibody (immune globulins).
- **Passive–active** immunity involves giving both immune globulins to provide immediate protection and a vaccine to provide long-term protection.


Specific Immunity
Active immunity
Passive immunity
natural
acquired
Following clinical infection
Following subclinical infection
Following vaccination
Transfer of maternal Antibodies Through placenta
Transfer of maternal Antibodies Through milk
Following administration of Immunoglobulin or antiserum

Immunization

- Immunization is the process by which a person becomes protected against a disease through vaccination.
- Individuals exhibit a primary immune response, with clonal expansion of B and T cells and formation of memory cells.
- Subsequent exposure to the same antigen will induce a secondary immune response.

Vaccination

- Vaccination is a form of active immunization that induces specific immunity to a particular pathogen.
- The aim is to produce a rapid, protective immune response on re-exposure to that pathogen.

VACCINE

- A vaccine is an immuno-biological substance designed to produce specific protection against a specific disease.
- Vaccine is “antigenic” but not “pathogenic”.
- A vaccine typically contains weakened or killed microorganisms or its toxins or its component.
- it stimulates the body's immune system to recognize and combat the microorganism, and develop memory cells for future encounters (re-exposure).

Immunizing agents

vaccines

immunuglobulins

Antisera or Antitoxin

- Normal human immunoglobulin
- Specific (hyper-immune) human immunoglobulin

Human normal Ig	Human specific Ig
Hepatitis A	Hepatitis B
Measles	Varicella
Rabies	Diphtheria
Tetanus	
Mumps	

These are serra prepared in animals or non human sources such as horses.

Diphtheria
Tetanus
Gas gangrene
Botulism
Rabies

Active immunization

- In active immunization the individual own immune system is stimulated to produce antibodies or lymphocytes. Vaccine provide a safe controlled way to create immune response. Immune system treat it like an exposure to the infecting microorganism. It works to stop the assault. Moreover immunologic memory is produced.

Passive immunization

- Immunity conferred by an antibody or lymphocytes that have been produced by another individual.

TABLE 12–1 Current Bacterial Vaccines

Usage	Bacterium	Disease	Antigen
Common usage	*Corynebacterium diphtheriae*	Diphtheria	Toxoid
	Clostridium tetani	Tetanus	Toxoid
	Bordetella pertussis	Whooping cough	Acellular (purified proteins) or killed organisms
	Haemophilus influenzae	Meningitis	Capsular polysaccharide conjugated to carrier protein
	Streptococcus pneumoniae	Pneumonia	Capsular polysaccharide or capsular polysaccharide conjugated to carrier protein
	Neisseria meningitidis	Meningitis	Capsular polysaccharide or capsular polysaccharide conjugated to a carrier protein
Special situations	*Salmonella typhi*	Typhoid fever	Live organisms or capsular polysaccharide
	Vibrio cholerae	Cholera	Killed organisms
	Yersinia pestis	Plague	Killed organisms
	Bacillus anthracis	Anthrax	Partially purified proteins
	Mycobacterium bovis(BCG)	Tuberculosis	Live organisms
	Francisella tularensis	Tularemia	Live organisms
	Rickettsia prowazekii	Typhus	Killed organisms
	Coxiella burnetii	Q fever	Killed organisms

Review of Medical Microbiology and Immunology

Current bacterial vaccines

Bacterium	Diseases or conditions	Vaccine(s)
Bacillus anthracis	Anthrax	Anthrax vaccines
Bordetella pertussis	Whooping cough	DPT vaccine
Brucella abortus	Brucellosis	Brucella vaccine
Clostridium tetani	Tetanus	DPT vaccine
Corynebacterium diphtheriae	Diphtheria	DPT vaccine
Coxiella burnetii	Q fever	Q fever vaccine
Haemophilus influenzae type B (Hib)	Epiglottitis, meningitis, pneumonia	Hib vaccine
Mycobacterium tuberculosis	Tuberculosis	Tuberculosis (BCG) vaccine
Neisseria meningitidis	Meningococcal meningitis	Meningococcal vaccine
Salmonella Typhi	Typhoid fever	Typhoid vaccine
Streptococcus pneumoniae	Pneumococcal pneumonia	Pneumococcal conjugate vaccine, Pneumococcal polysaccharide vaccine
Vibrio cholerae	Cholera	Cholera vaccine

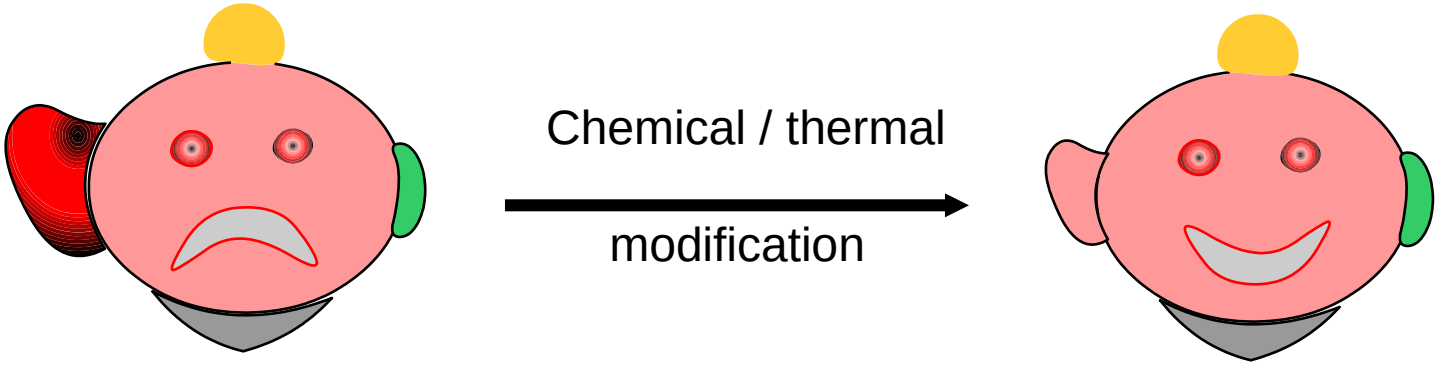
Different types of vaccine		
Vaccine	**Features**	**Examples**
Live attenuated	Attenuation achieved by repeated culture on artificial media or by serial passage in animals; immunogenicity is retained, but virulence is significantly diminished	Oral polio (Sabin), BCG, rubella, measles, mumps
Killed	Intact organisms killed by exposure to heat or chemicals (e.g., formalin)	Intramuscular polio (Salk), pertussis
Subunit	Purified, protective immunity-inducing antigenic components; often surface antigens	Influenza, pneumococcal
Recombinant	Genes encoding epitopes, which elicit protective immunity, are inserted into prokaryotic or eukaryotic cells; large quantities of vaccine are produced rapidly	Hepatitis B surface antigen (produced in yeast cells)
Toxoids	Bacterial toxins inactivated by heat or chemicals	Diphtheria, tetanus
Conjugates	Polysaccharide antigen is linked to protein carrier to enhance immunogenicity	*Haemophilus influenzae* type B (Hib), meningococcal

Modification of Toxin to Toxoid

(Diphtheria, Tetanus toxoid, Bordetella pertussis)

Toxin

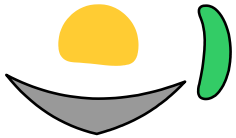
Toxoid



toxic !

non-toxic!

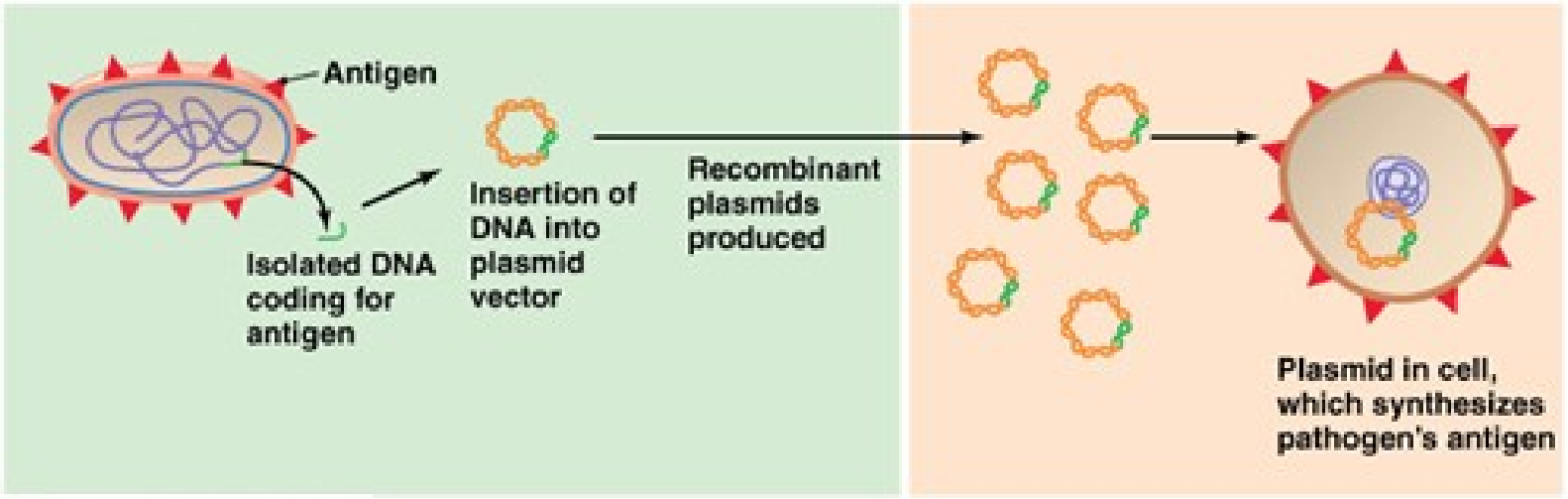
toxin moiety modified



antigenic determinants exist

Surface antigen (recombinant) vaccine

- It is prepared by cloning HBsAg gene in yeast cells. HBsAg produced is then used for vaccine preparations.



- Their efficacy and safety also appear to be high.

Possible side effect (adverse events) of vaccination

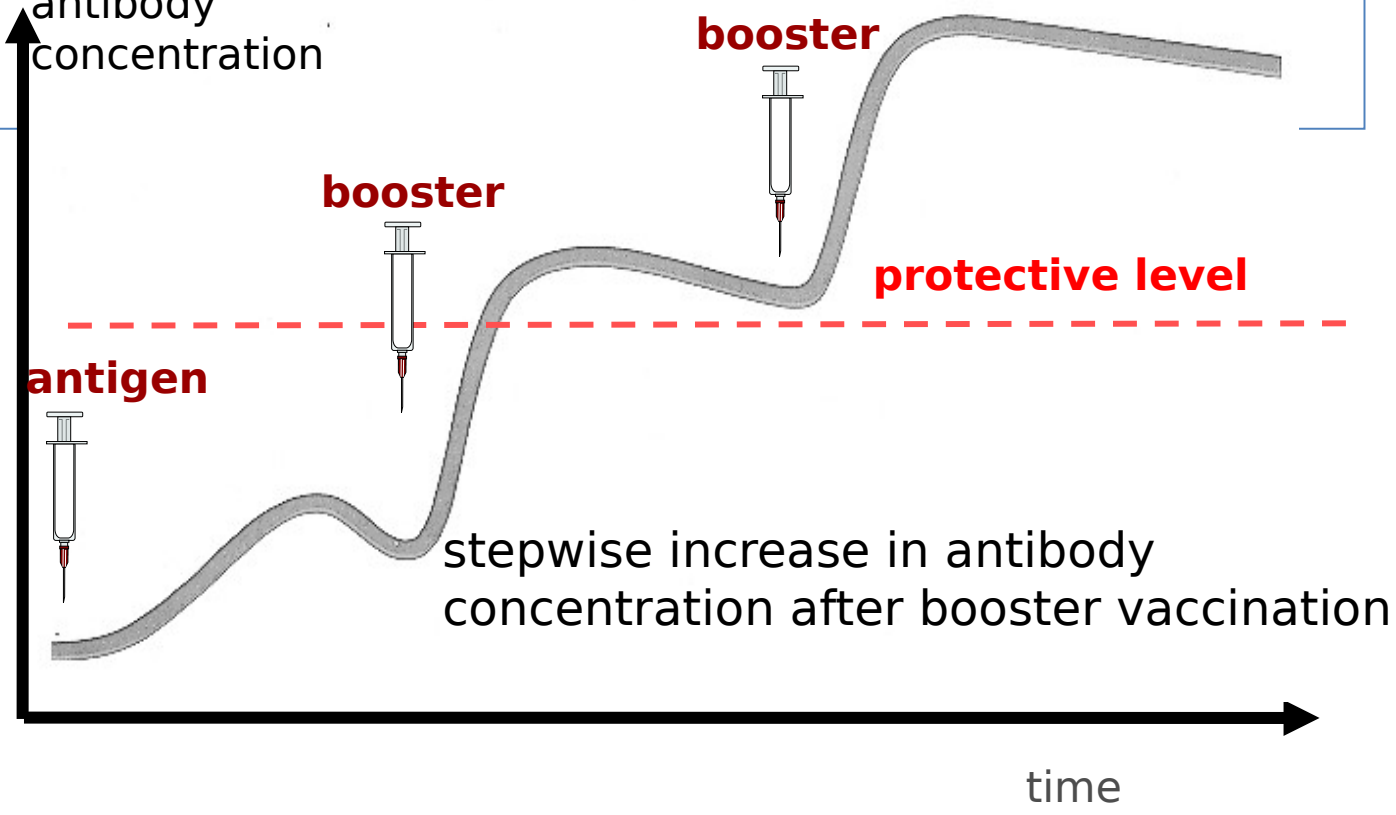
- Vaccine can cause side effects. Mostly these are minor and go away with in few days. These include
- Pain, swelling or redness or soreness at shot-site
- Mild fever, chills, rash
- Feeling tired
- Muscle & joints pain
- headache

Moderate to severe problems

- Serious eye infection or loss of vision
- Rash on entire body (1:4000)
- Encephalitis
- Severe infection,
- Hypersensitivity reaction
- Death

Schematic Vaccination Schedule

- Basic immunisation produces a baseline immunity
- antibody concentration



Scheme of immunization

- **Primary vaccination**
  - One dose vaccines (BCG, variola, measles, mumps, rubella, yellow fever)
  - Multiple dose vaccines (polio, DPT, hepatitis B)

- **Booster vaccination**

  To maintain immune level, when it declines after some time (DT, MMR).

TABLE 12–2 Vaccines Recommended For Children Aged 0–6 Years[1]

Bacterial Vaccines	Viral Vaccines
Diphtheria toxoid, tetanus toxoid, acellular pertussis (DTaP)	Hepatitis A
Haemophilus influenzae type b (Hib)	Hepatitis B
Meningococcal	Influenza
Pneumococcal	Measles, mumps, rubella (MMR)
	Poliovirus, inactivated
	Rotavirus
	Varicella

[1]Vaccines are listed in alphabetical order. A complete description of the vaccine schedule is available on the Centers for Disease Control and Prevention Web site, www.cdc.gov.

Typical Immunization Schedule

Age	
At birth	BCG + Polio
2 months	DPT + Polio
4 months	do
6 months	do
12 months	Measles, mumps & Rubella
18 months	DPT
5 years	Diphtheria + tetanus & Polio
10 –16 years	Rubella (girls)
15 years	Diphtheria + tetanus

Vaccinations in travel

- Varies according to the country of arrival and departure.
  - Primary vaccine series
  - Continuation of booster doses
  - Specific vaccine according to the country traveled to:
    - TAB, YF, cholera, meningiococcal, pneuomococcal, HIB, influenza, rabies, plague, Japanese encephalitis, polio.
    - Hajj for instance necessitates meningococcal and flue vaccination from all over, and YF from places like south Africa, and cholera from places like India, Bangladesh etc.

Vaccines against bioterrorism

- Anthrax vaccine
- Small pox vaccine
- Plague vaccine


Thank
You!