

Immune prophylaxis and
immune therapy.
Microbiological Dg of infectious
disease

Immunization – terms and definitions

- **Immunization:**

- a procedure designed to increase concentrations of antibodies and/or effector T-cells against infection

- **Immunoprophylaxis:**

- Immunization performed before exposure to an infectious agent
- It is intended to prevent the infection
- Usually the immunizing agent is a vaccine

- **Immunotherapy:**

- Performed during an active infection
- It is intended to treat the infection
- Usually the immunizing agent is serum

Types of Immunization

- **Passive immunization:**
 - Protective Abs are introduced in the recipient to neutralize the infectious agent
 - No immunological memory; w/o T_h or T_c cells.
- **Active immunization:**
 - Induction of active adaptive immune response, with protection and memory.
 - Usually vaccines are introduced - stimulate host's immune system to produce specific antibodies or cellular immune responses or both which would protect against a disease.

How to induce passive and active immunization

Passive Immunization –

Natural - via placenta (IgG) or maternal milk

Artificial – via immune serum (human intervention)

Active Immunization –

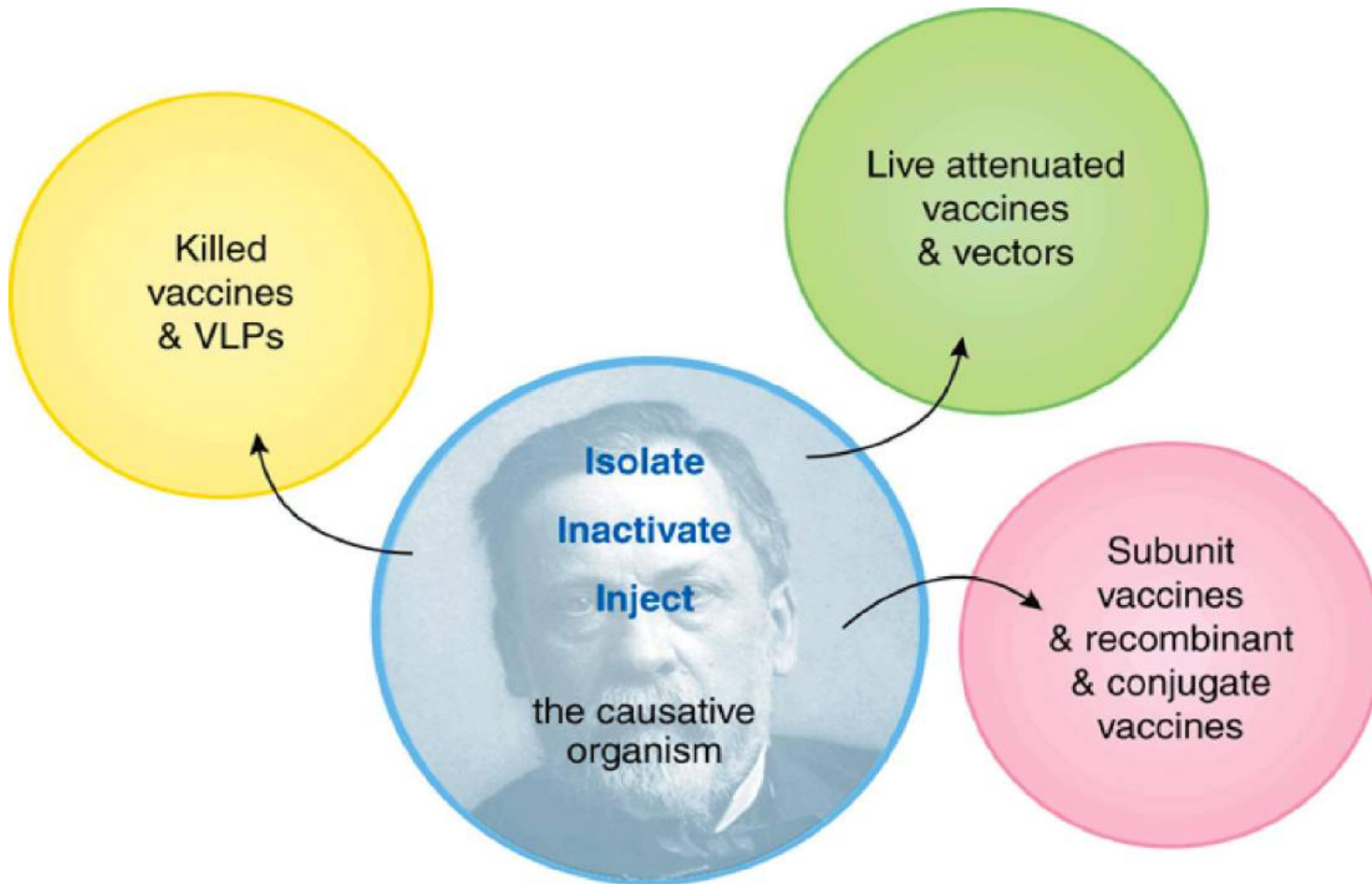
Natural infection - after cholera, grippe...

Artificial - through vaccines (microbial substances in non-infectious form; may contain bacteria or viruses)



- Performed either by i.m. or s.c. injection of killed or attenuated antigens (often with adjuvant) or by ingestion of attenuated live organisms.
- Antibodies and/or immune competent cells are generated

Types of Vaccines



Types of Vaccines



A. Inactivated (killed by phenol) – cholera

B. Attenuated (Live, non-infectious)

- example: BCG (against TBC)
- inactivated by heat, chemicals or genetic manipulation
- stimulate both cell mediated and antibody mediated immune responses
- risk - it could revert back to infectious agent

LIVE Vaccines are MORE EFFECTIVE THAN KILLED

C. Toxoids

- contain inactivated toxins which are purified proteins
- stimulate the antibody mediated response only
- examples - DT (diphtheria, tetanus toxoids)

Types of Vaccines

D. Component (subunit):

Contain purified components from bacteria and viruses instead of whole organism

Advantage: no pathogenic particles

Disadvantage: Is protein same as *in situ*? Cost!

E. Recombinant:

Hepatitis B vaccine – purified viral coat protein

Streptococcus pneumoniae – capsular polysaccharide

Hemophilus influenzae (HiB) – capsular polysaccharide,

Nisseria meningitidis – capsular polysaccharide,

stimulate the antibody mediated response only

Other vaccinations terms

○ **Booster Shots:**

- same vaccine given at a later date e.g. DT given every 10 years
BCG
- aim - to refresh the memory cell population

○ **Adjuvant:**

- chemicals in the vaccine solution that enhance the immune response
- Example: Alum – Ag
- gives more time for memory cells to form

Common Vaccinations in childhood

AGE

Birth- 2 months.
2 months.

4 mos.
6-18 mos.
12-15 mos.

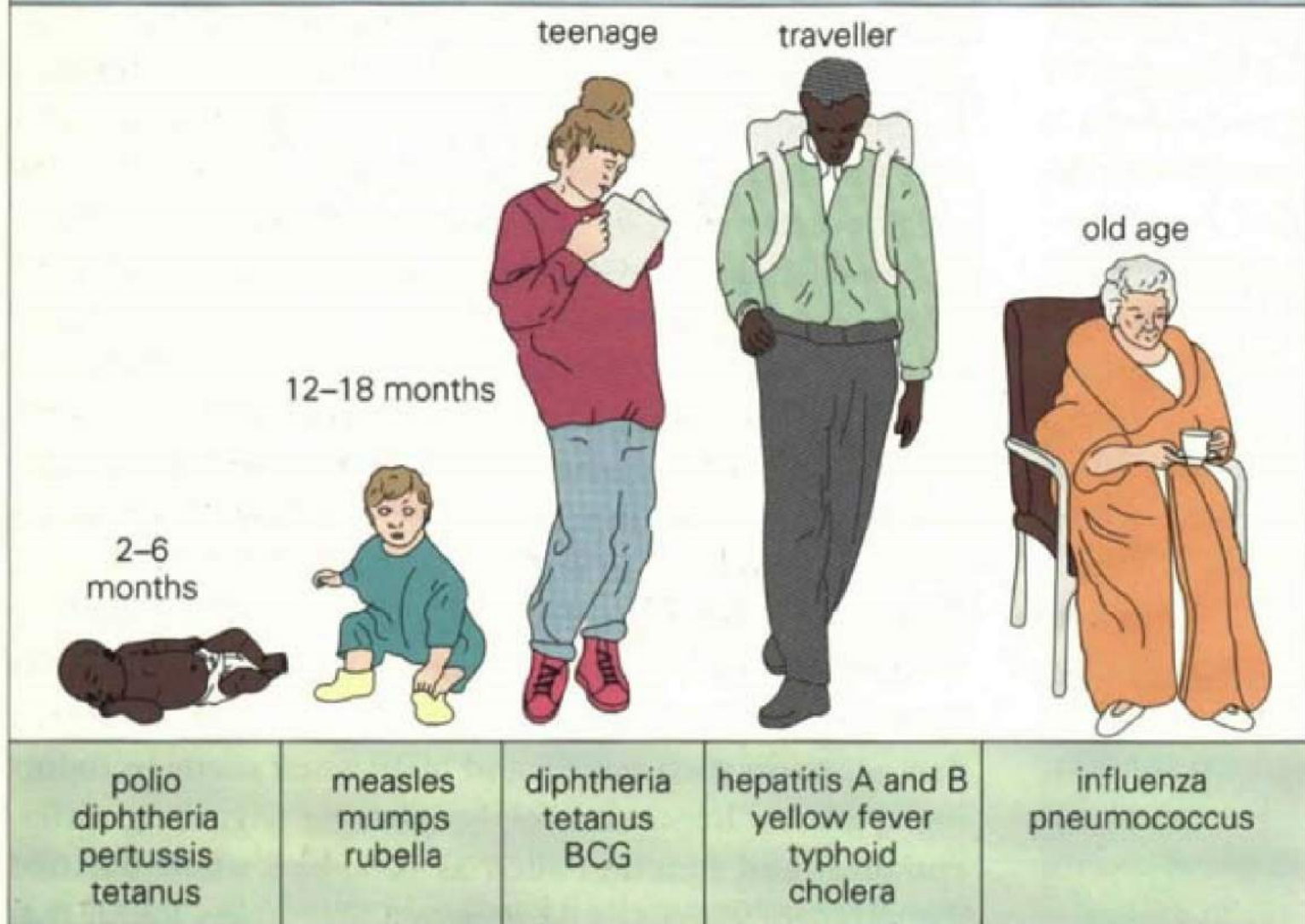
4-6 yrs
11-12 yrs

VACCINE

BCG and Hepatitis B (recombinant surface Ag)
Diphtheria, tetanus, acellular pertussis (DTaP)
Inactivated Polio virus (IPV)
Haemophilus influenzae b (Hib-conjugate)

DTaP, IPV, Hib, PCV
Hep B, DTaP, Polio (IPV), Hib
DTaP, Hib
Measles, mumps, rubella (MMR)
DTaP, IPV, MMR
DT

CURRENT VACCINE PRACTICE



Combinations of vaccines

Examples

influenza

trivalent OPV, inactivated IPV

DPT, DPT/Hib, etc.

MMR, MMRV

PnC/MnC

Advantages:

only one needle at a visit

may reduce number of visits

reduces costs of administration

geographic tailoring

Disadvantages:

technically more difficult to produce

higher production costs

Correlates ?

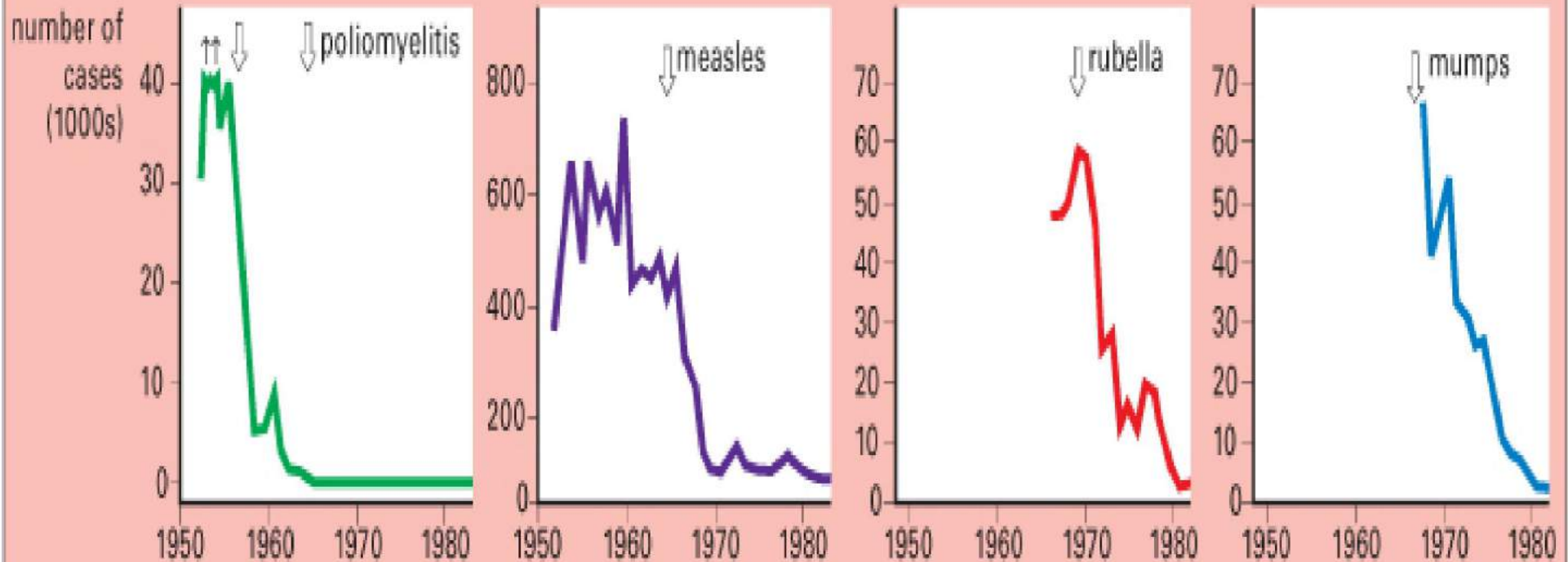
- **Humoral component**

- Tetanus
- Diphtheria
- *H. influenzae*
- *S. pneumoniae*

- **Cellular components**

- BCG
- Herpes type 1&2
- Shingles (herpes zoster)
- Influenza in elderly
- Varicella (herpes zoster)
- Measles

Effect of vaccination on the incidence of viral disease



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Vaccines provide an antigenic stimulus that does not cause disease but can produce long lasting, protective immunity

Immunotherapy – preformed Ab

May be introduced as:

1. Immune serum globulin – (gamma- globulin)

- Contains immunoglobulin extracted from the pooled blood of at least 1000 human donors
- Treatment of choice for preventing measles, hepatitis A and replacing Ab in the immune deficient
- Lasts 2-3 months

Immunotherapy – preformed Ab

May be introduced as:

2. Specific immune globulin - prepared from convalescent patients in a hyperimmune state

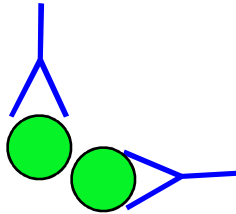
- contains high titer of specific Ab
- against causative agents of pertussis, tetanus, chickenpox or hepatitis B
- sera produced in horses are available for diphtheria, botulism, spider and snake bites
- acts immediately and can protect patients for whom no other useful medication exists

Effectors functions of antibodies

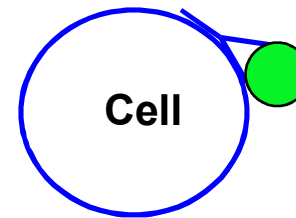
- Neutralization

prevent contacts with host cell

reduce the pathogen load



Inhibit bacterial toxins



- Complement mediated lyses

inhibits the pathogen
penetration of the host cell

↳ Complement binding → pathogen destruction

Anti-anthraxis gamma-globulin

Type of immunity created in an organism after introduction:

- Preparation contains antitoxins.
- It is gamma-globulin fraction of serum of the hyper-immunized animals.

Passive
Humoral
Antibacterial
Specific

Anti-diphtherial antitoxic serum

- preparation is by hyperimmunization of a diphtherial toxoid.
- Effective mean of specific therapy of diphtheria.
- The introduction of heterogenic serum may induce anaphylactic shock and serum illness.

Type of immunity

created in an organism after introduction

Passive

Humoral

Antibacterial

Specific

Sources of Passive Immunity

- Blood or blood products
- Homologous pooled human antibody (immune globulin)
- Homologous human hyperimmune globulin
- Heterologous hyperimmune serum (antitoxin)

Classification of serum preparations

- **homogeneous serum**: serum obtained from blood donor volunteers, that have been immunized.
- **heterogeneous serum**: serum obtained from blood of animals hyper-immunized.

Hypersensitivity reactions by injection of the heterogeneous serum

- **Anaphylactic shock**

within 2 to 30 minutes after a person sensitized to an antigen.

Anaphylactic responses can be:

- systemic reactions, which produce shock and breathing difficulties and are sometimes fatal,
- or localized reactions, which include common allergic conditions such as hay fever, asthma, and hives (slightly raised, often itchy and reddened areas of the skin).

- **Serum Sickness**

A systemic form of hypersensitivity of immediate reaction. It appears 7 to 12 days following single injection of high concentration of foreign serum