



# **ANTIBODIES — IMMUNOGLOBULINS**

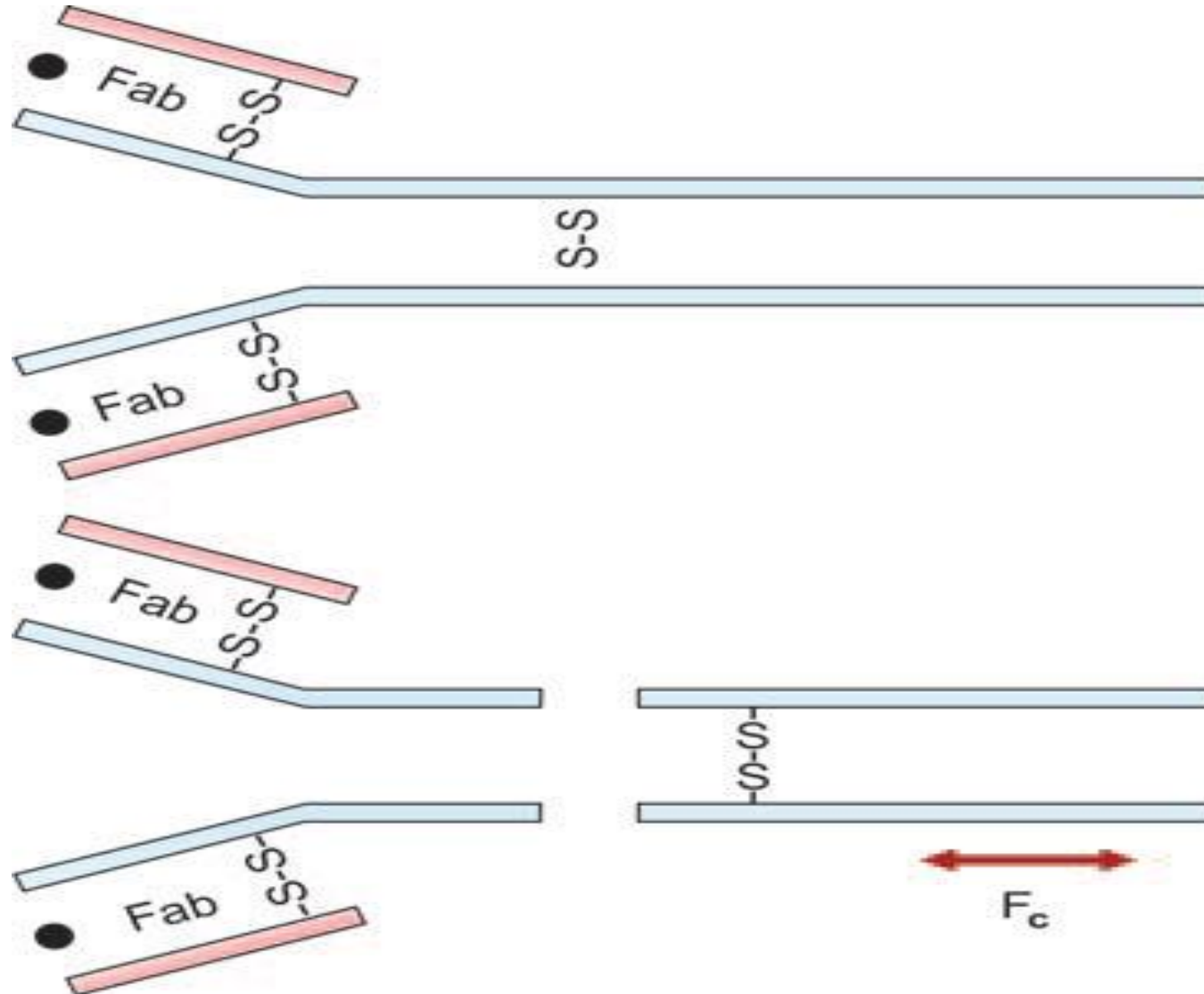
# Antibody

- A substance produced in response to an antigenic stimulus.
- It serves as protective agent against organisms.
- Antibodies are found in serum, lymph and other body fluids.
- Sera having high antibody levels following infection or immunization is called immune sera.
- Antibodies are:
  1. Protein in nature.
  2. Formed in response to antigenic stimulation.
  3. React with corresponding antigen in a specific and observable manner.

# IMMUNOGLOBULINS

- They are defined as proteins of known antibody activity .
- Immunoglobulins are synthesized by plasma cells and also by lymphocytes.
- Immunoglobulins make 20 to 25 percent of the total serum proteins.
- Immunoglobulin is a structural and chemical term, while antibody is the biological and functional term.
- All antibodies are immunoglobulins but not all immunoglobulins are antibodies.
- Based on their size, carbohydrate contents and amino acid analysis, five groups of immunoglobulins have been distinguished:  
IgG, IgA, IgM, IgD and IgE.

# BASIC STRUCTURE OF AN IMMUNOGLOBULIN MOLECULE



# Function of Immunoglobulins

The important functions of immunoglobulins are:

1. Complement activation
2. Opsonization resulting in phagocytosis
3. Prevent attachment of microbe to host cells
4. Neutralize toxins
5. Restrict motility of microorganisms
6. May result in agglutination of microbes.

## Some properties of immunoglobulin classes

	IgG	IgA	IgM	IgD	IgE
<b>Mol. wt.</b>	1,50,000	1,60,000	9,00,000	1,80,000	1,90,000
<b>Serum concentration (mg/ml)</b>	12	2	1.2	0.03	0.00004
<b>Half-life (days)</b>	23	6	5	2.8	2.3
<b>Daily production (mg/kg)</b>	34	24	3.3	0.4	0.0023
<b>Intravascular distribution (%)</b>	45	42	80	75	50
<b>Complement fixation</b>	+	–	+	–	–
<b>Placental transport</b>	+	+	–	–	–
<b>Present in milk</b>	+	+	–	–	–
<b>Examples antibodies</b>	Many anti-bodies to toxin, bacteria and viruses brane aggluti- lympho	Secretory anti-bodies to mucous membrane	Antipoly-saccharide antibody and cold agglutination	Mainly IgD on surface of beta lymphocytes in newborn	Antiallergic antiparasitic antibodies

# THE IMMUNE RESPONSE

- The specific reactivity induced in host by antigenic stimulus is called the immune response.
- Immune response includes reactions against any antigen living or non-living.
- Immune response may be beneficial, harmful or nonreactive (tolerance).
- Immune response is of two types:
  - I. Humoral immunity provides primary defence against extracellular pathogens, helps in defences against virus infections, immediate hypersensitivity and certain autoimmune diseases.
  - II. Cell mediated immunity protects against fungi, viruses, intracellular pathogens, participates in graft rejection, immunity against cells, delayed hypersensitivity and certain autoimmune diseases.

# HUMORAL IMMUNE RESPONSE

It consists of 3 steps:

- a. Entry and distribution of antigen in tissue and its contact with immunocompetent cells.
- b. Processing of antigen and control of antibody forming process.
- c. Secretion of antibody, its distribution in tissue, body fluid and manifestation of its effects.

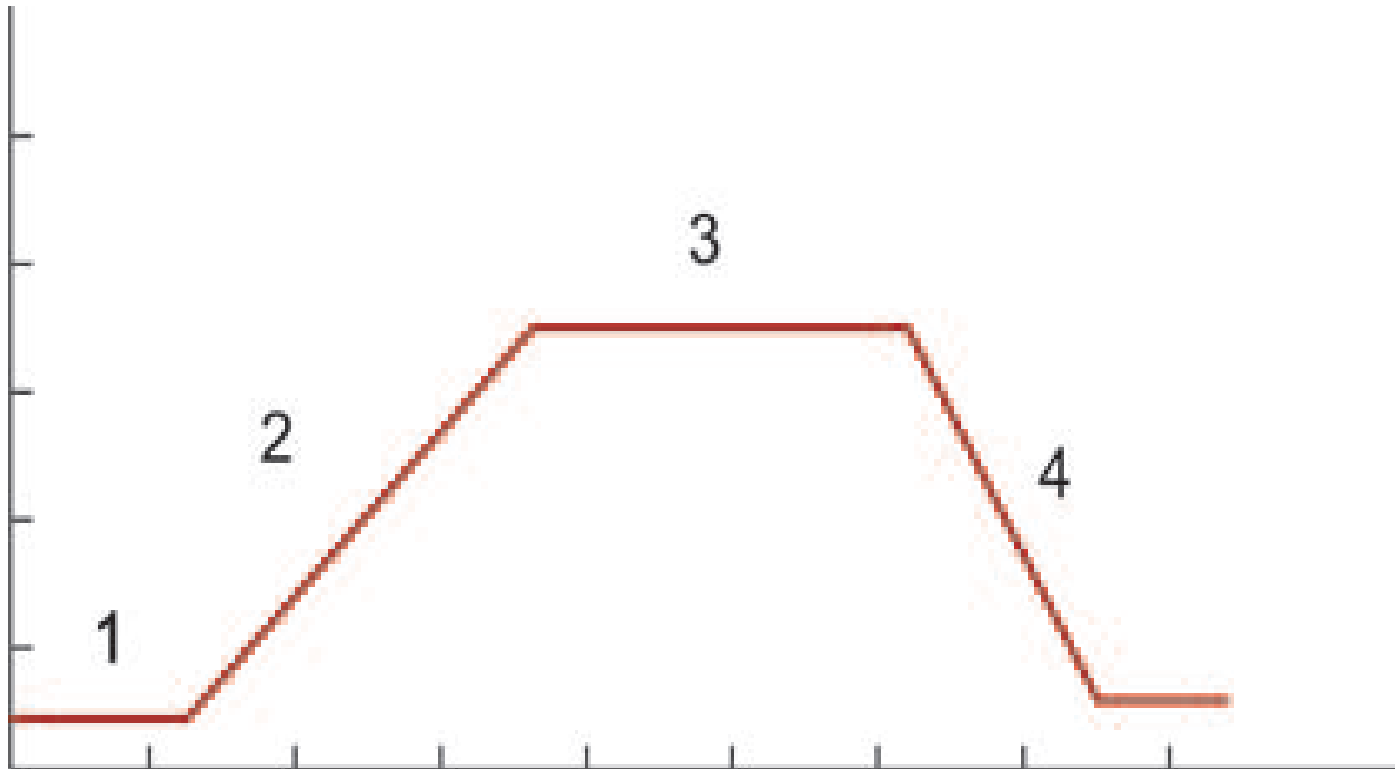


# Primary and Secondary Responses

- a. Primary Response to initial antigenic stimulus is slow, sluggish, short lived with a long lag phase and low antibody titer that does not persist for a long time. Antibodies formed are predominantly IgM.
  
- b. Secondary response to subsequent stimuli, is powerful prolonged, and with much higher level of antibody. It lasts for long time. Antibodies predominantly formed are IgG.

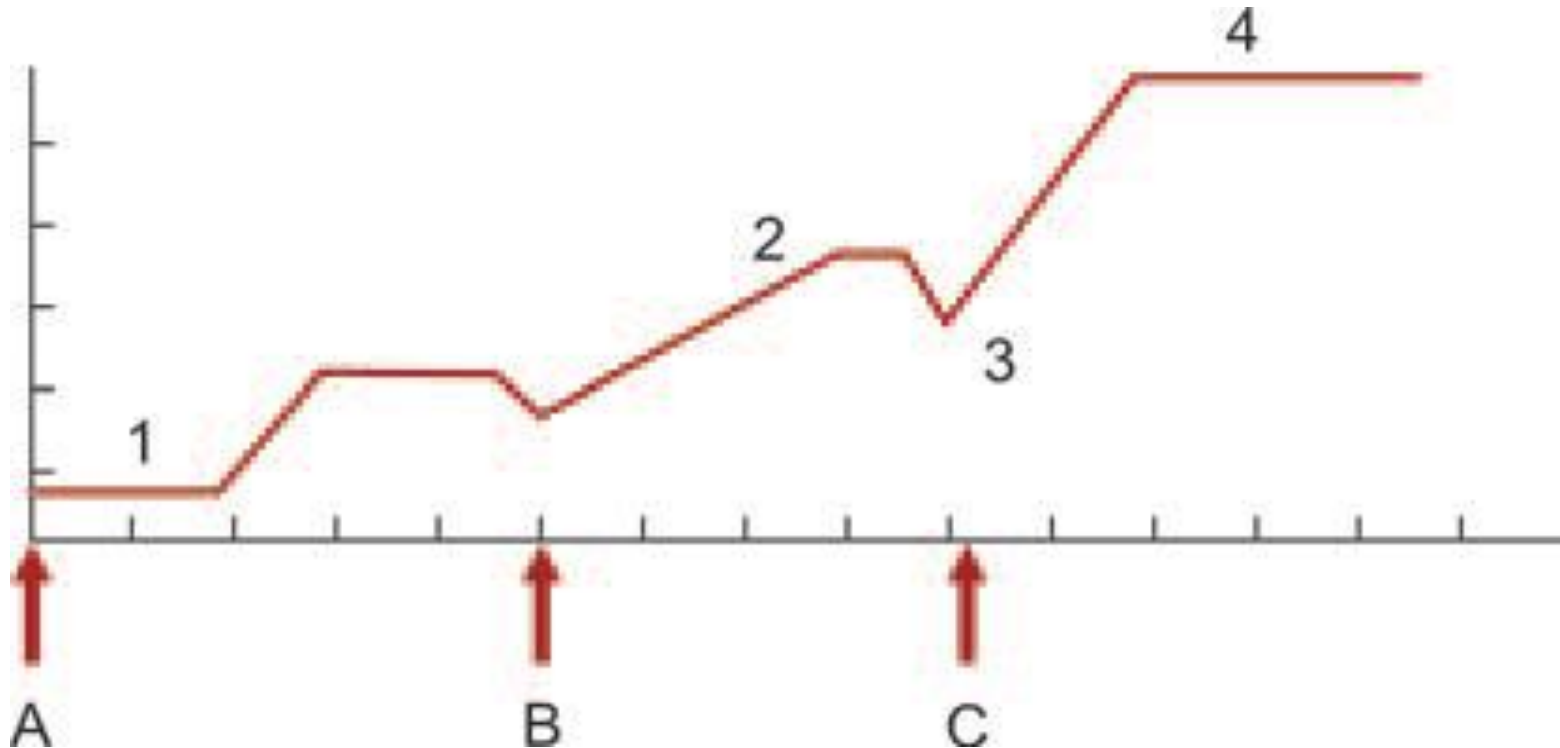
Primary immune response an antigenic stimulus.

(1) Latent period, (2) Rise in titer of serum antibody, (3) Steady state of antibody titer, and (4) Decline of antibody titer.



## Secondary immune response.

Effect of repeated antigenic stimuli A,B,C: (1) Secondary immune response, (2) Negative immune response,(3) Negative phase, (4) High level of antibody after booster dose.



# FACTORS INFLUENCING ANTIBODY PRODUCTION

## 1. *Age:*

- Embryo is immunologically immature, the infant has to depend on maternal antibody from 3 to 6 months of age.
- Full competence is acquired only by the age of 4 years.
- In old age capacity to produce antibody is reduced.

2. *Nutritional status:* Deficiency of amino acids and vitamins causes decrease in antibody synthesis.

3. *Route of administration:* The human immune response is better following parenteral administration of antigen than oral or nasal routes. However, for production of IgA antibody, oral or nasal route is suitable.

#### 4. *Size and number of doses:*

- An antigen is effective only above critical dose. Further increase in dose enhances antibody production.
- Secondary antigenic stimulus produces increased antibody response.

#### 5. *Multiple antigens:* When two or more antigens are administered effect can be:

- Antibody production against different antigens as they had been given separately.
- Antibody response to one or other antigen may be enhanced. In triple vaccine (diphtheria, tetanus, *Bordetella pertussis*), the response to diphtheria toxoid is enhanced.
- Response may be diminished .


## 6. *Adjuvant:*

- The term adjuvant refers to any substance that enhances immunogenicity of an antigen.
- The adjuvant commonly used in human vaccine are aluminium hydroxide, phosphate, endotoxin and mineral oils.

## 7. *Immunosuppressive agent:*

- X-rays and cortisone if administered before antigenic stimulus, suppress antibody formation.
- They do not change antibody levels if administered after antibody formation.
- In non-toxic dose they are important in suppressing homograft rejection.

# CELLULAR IMMUNE RESPONSE

- The term cell mediated immunity refers to the specific immune responses that do not involve antibodies.
- Induction of CMI (Cell Mediated Immunity ) consists of specifically sensitizing T lymphocytes against the antigen.
- When sensitized T lymphocyte comes in contact with antigen determinant  transformation and clonal proliferation in para cortical areas of lymph node.
- The activated lymphocytes release biologically active products (lymphokines) responsible for manifestation of CMI.
- Macrophages under the effect of lymphokines cause destruction of microorganism involved in CMI.

Cell mediated immunity plays role in following immunological functions:

1. Delayed hypersensitivity.
2. Immunity to infections caused by intracellular microbes, e.g. tuberculosis, burcellosis, leishmaniasis, measles, etc.
3. Transplantation ,graft and host reaction.
4. Oncogenic immunity.
5. Pathogenesis of autoimmune diseases .



## Some properties of immunoglobulin classes

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