Immunity

This overall ability of the host to fight the disease-causing organisms

Types of Immunity: 1) Innate Immunity **2) Acquired Immunity**

Innate (Inborn) Immunity

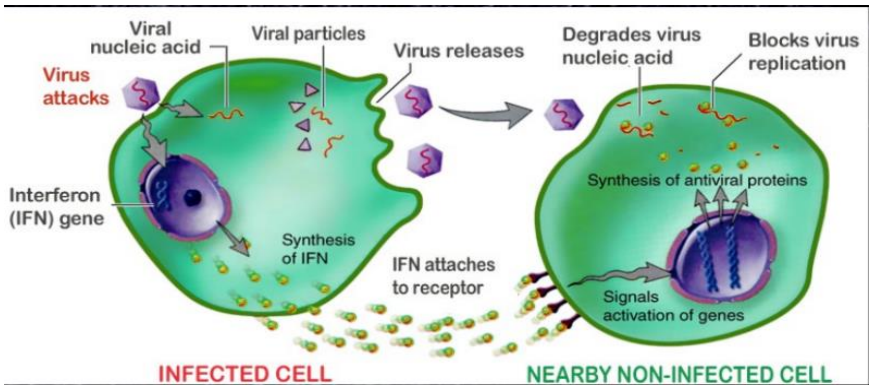
- Non-specific defence present since birth.
- Provides barriers to the entry of foreign agents.

1. **Physical Barriers**
   Skin: Prevent entry of foreign bodies.
   Mucus Coating: Lining respiratory. Gastro-intestinal and urogenital tract.

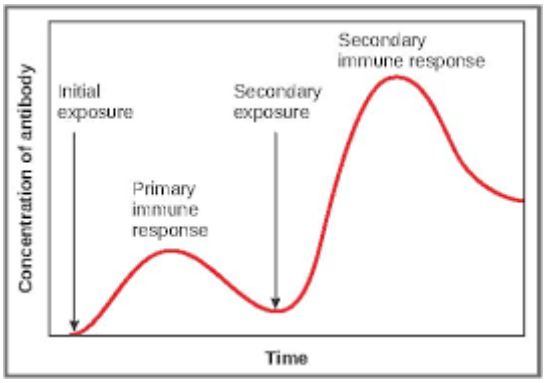
2. **Physiological Barriers:** Prevent microbial growth.
   Gastric HCL: Kills bacteria in stomach.
   Saliva: Lysozymes present kills foreign substances.
   Tears: Lysozymes present kills foreign substances.

3. **Cellular Barriers:** Phagocytes like WBCs
   Neutrophils
   Polymorphonuclear leucocytes (PMNL)
   Monocytes
   Natural Killer Cells (lymphocyte)
   Macrophages (in tissue)

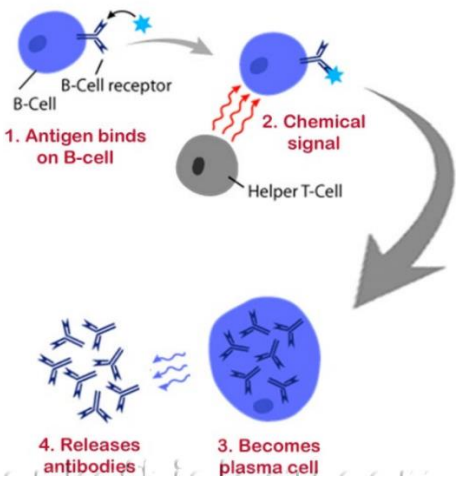
4. **Cytokine Barriers:** Virus infected cells secrete a cytokine protein called **interferon.** It protect non-infected cells from further viral infection.



Acquired (Adaptive) Immunity

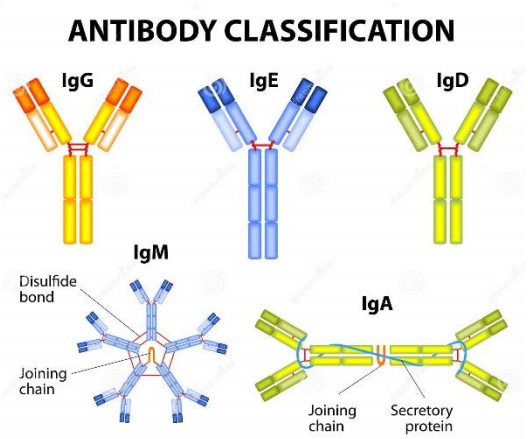


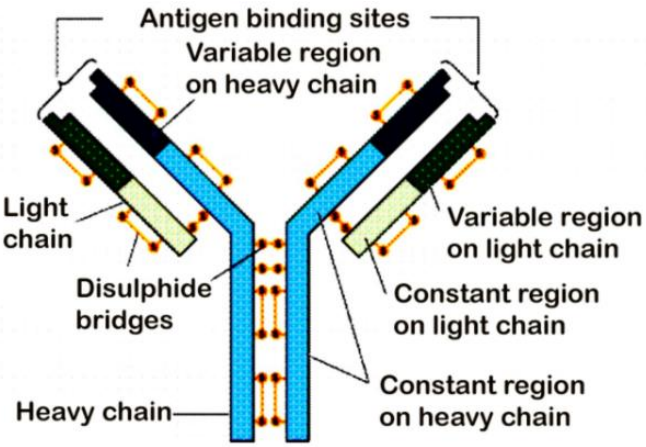
- Pathogen specific immunity develop during once life time.
- Based on memory.
- **Primary Response:** During first encounter of pathogen, body produces primary response in low intensity.
- **Secondary Response:** If same pathogen attack second time secondary (anamnestic) response in high intensity.



- B-lymphocytes and T-lymphocytes are immune cells that help in primary and secondary immune response.
- T-lymphocytes first come in contact with an antigen& helps/stimulate B cells to produce antibodies (protein) specific to these antigens.
- Antibody molecule has four peptide chains, two small called light chains and two longer called heavy chains **(H_2L_2)**

Note: For Primary Response- mainly B-Cells are responsible & for secondary response t-cells are responsible.





	IGG	IGM	IGA	IGD	IGE
	Monomer	Pentamer	Dimer	Monomer	Monomer
% in Serum only	80% Most Abundant	5-10%	10-15%	0.2%	0.002% Least Abundant
Placental Transfer	Yes	No	No	No	No
Molecular weight (g/mol)	150,000 Smallest in Size	9,70,000 Largest in Size	4,05,000	1,75,000	1,90,000
Location	Blood, Lymph, intestine	Blood, lymph, B-cell Surface (as Monomer)	Secretions- Mother Milk (Colostrum) , tears, Saliva, Intestine. Blood & Lymph	B-cell surface, Blood Lymph,	Bound to Mast & Basophil cells, Blood
Key Function	Responsible for Secondary (Second) response. Enhance phagocytosis, neutralizes toxins & viruses, protect foetus and new born.	First antibodies produce in Primary (First) response. Against Micro-organism and agglutinating antigens	Protection on Mucosal surface	Exact function is still unclear. B cell antigen receptor & B cell maturation, maintenance, activation, and silencing	Allergic Reaction, Lysis of parasitic worms

Types of Acquired immunity:

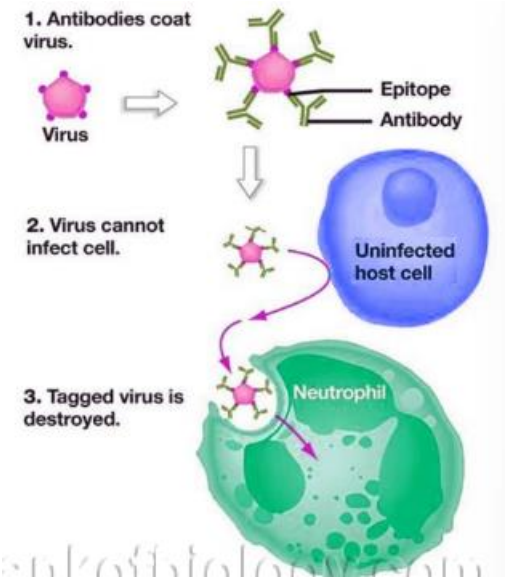
Humoral (fluid) or Antibody mediated Response/Immunity.

- Immune response mediated by antibodies found in blood plasma.

Cell mediated Response/Immunity

- Immune response mediated by T-lymphocytes.
- The body can differentiate between self and non-self.
- Cell mediated immunity causes Graft/organ rejection.

Tissue matching & Blood group matching are essential before undertaking any grafting/transplant. After this patient has to take immune-suppressant all his life.



On the basis of production of antibodies, immunity can be further categorised as –

- **Active immunity:** Body produces its own antibodies against antigens. It is slow and time taking.

Active Natural	Active Artificial
• Antibodies produce when pathogen entered the body of Host.	• It is developed by injecting microbes (dead/weakened) via Vaccination process.

- **Passive immunity:** Readymade antibody is transferred from one individual to another

Passive Natural	Passive Artificial
• Antibodies transfer to child through Colostrum (mother's milk) contains antibodies **IgA** • **Antibodies transfer from placenta (IgG**)to child.	• Readymade antibodies directly injected into the body. • Eg: Anti-tetanus serum (ATS), Anti- Venom (Snake), Ra, Anti-Rabies Serum (ARS)

Vaccination and immunisation Based on memory of immune system.
(i) **Vaccination:** The process of introduction of weakened or inactivated pathogens or proteins (vaccine) into a person to provide protection against a disease.
(ii) **Immunisation** : The process by which the body produces antibodies against the vaccine (primary response) and develop the ability to neutralise pathogens during actual infection (secondary response), i.e. the body become immune to that antigen or infection.
(iii) Vaccine generates memory B and T-cells that recognise the pathogens on subsequent exposure and produce an intense immune response.
(iv) **Passive immunization:** For quick immune response- preformed antibodies/antitoxin given to patient like tetanus infection, snake bite.

(v) Recombinant DNA technology has produced antigenic polypeptides of pathogen in bacteria or yeast. This allowed large scale production of vaccine, e.g. hepatitis-B vaccine from yeast, etc.

Human immune system includes

(i) lymphoid organs (ii) immune cells (iii) soluble molecules like antibodies (iv) lymphoid tissues.

Lymphoid organs – Here origin or maturation and proliferation of lymphocytes occur.
(a) **Primary lymphoid organs** are the sites where lymphocytes differentiate and mature to become antigen-sensitive,
e.g. i) **Bone marrow**- Site of production & maturation of **B-lymphocytes** & blood cells including lymphocytes
ii) Thymus - Site of production & maturation of **T-lymphocytes .**
It is a lobed organ, located near the heart & beneath the breastbone. It reduces as the age increases
(quite large at Birth and reduces by the age of puberty) (b) **Secondary lymphoid organs** - sites where lymphocytes interact with the antigen & proliferate to become effector cells, e.g**. i) Spleen-** large, bean-shaped organ which contains lymphocytes and phagocytes. Acts as a filter to trap blood-borne microbes and a large reservoir of erythrocytes
ii) Lymph nodes- Small solid structures located along the lymphatic system. Serve to trap microorganisms or other antigens (activates lymphocytes).
Mucosal Associated Lymphoid Tissue (MALT) (50% of lymphoid tissue) is formed of the masses of lymphoid tissue, lining the mucosa of respiratory, digestive and urogenital tracts.
iii) Tonsils
iv) Peyer's patches of small intestine
v) Appendix.

Allergy is a hypersensitive reaction of the immune system to certain antigens present in the environment.
(i) Allergens produce immune response in an individual, e.g. pollen grains, animal dander, dust, feathers, etc.
(ii) IgE antibodies are produced in response to allergens.
(iii) Allergy is due to chemicals like histamine and serotonin released from the mast cells.
(iv) Symptoms of allergy are sneezing, watery eyes, running nose, difficulty in breathing.
(v) Antihistamine, adrenaline and steroids are taken to reduce the symptoms of allergy.
(vi) To determined the person needs to exposed or injected small dose of vaccination

Autoimmunity – Abnormality of immune response in which the immune system of the body loss the ability to differentiate between self & non-self and it starts rejecting its own body cell or self-cells and molecules, e.g. Rheumatoid, arthritis.