IMMUNITY AGAINST PARASITIC INFECTIONS

The term immunity refers to the resistance of a host to invasive pathogens and their toxins.

Immunity may be:
I. Innate immunity (nonspecific immunity): acts as the first line of the defensive mechanism, so it prevents the majority of organisms from being pathogenic to man.

II. Specific immunity: This is formed of two major components:
1. Humoral immune response:
Carried out by B-lymphocytes which differentiate into antibody producing cells.

2. Cellular immune response:
-Carried out by T-lymphocyte populations which have been found to be constituted by 3 main subpopulations:

a. A first subpopulation is constituted by the helper T-lymphocytes which assist the triggering of humoral and cellular immune responses.

b. A second subpopulation is constituted by the cytotoxic T-lymphocytes which are able to destroy cells expressing non self or altered cell antigens.

c. A third subpopulation of suppressor T-cells which are able to turn down unnecessary responses, such as those directed against self or against one antigen which has already been eliminated.

-Other cells such as the monocytes, macrophages and specialized macrophage derived cells found in many tissues. They play important roles by modifying and presenting antigens to lymphocytes and releasing soluble factors (interleukins) which regulate the activity of lymphocytes.

-The regulatory populations (helper and suppressor) of T-lymphocytes

also release a variety of interleukins which participate in activation and suppression circuits.

Types of the most important antibodies:

IgM:

- Large-sized molecule.
- Is more potent than IgG.
- Increases in early and acute infections.

IgG:

- Small-sized molecule (only one that can pass placenta).
- Is the largest amount in serum.
- Increases in late and chronic infections.

IgA:

- Presents in secretions of gastrointestinal and urinary tracts.
- Resistant to proteolytic digestion.

IgE (reagenic antibody):

- Responsible for immediate hypersensitivity reaction.
- Binds tightly to mast cells and basophils.
- When IgE coated mast cells interact with specific antigen, they release potent mediators, including histamine and chemotactic factors attracting eosinophils. The released mediators may affect parasite directly or the accumulated eosinophils may be cytotoxic to parasite.

Types of parasitic antigens:

1. Somatic: either pieces of injured parasites or cuticular antigens from the tegument of the parasites.

2. Excretory or metabolic may be:
   - Metabolic products of the parasites.
   - Enzymes.
   - Secretory products.

Evasion and suppression of immune mechanisms

A. Site of parasite:

1. Intracellular parasites:

-RBCs: Malaria infected RBCs have a variety of plasmodial antigens on the erythrocytes surface, but the covering of RBCs by MHC (major histocompatibility) antigens prevents recognition of parasitized cells by T- lymphocytes.

- **Macrophages:** Pathogenic protozoa proliferating within macrophages are covered with a membrane, called phagosomal membrane, which when get in contact with lysosomes, they fuse together leading to release of lysosomal enzymes toxic to parasite.

These parasites can avoid lethal effects of this fusion by various mechanisms:

a) *Trypanosoma cruzi* —> lyses the phagosomal membrane and once released into cytoplasm, can replicate progressively.

b) *Toxoplasma* —> prevents fusion of phagosomal membrane with lysosome due to modification in phagosomal membrane.

c) *Leishmania* —> does not affect fusion process but it resists damage by generation of enzymes and metabolic products which neutralize lysosome enzymes.

2. Parasite surrounds itself by fibrous tissue: as hydatid cyst and *Coenurus cerebralis*.

B. Modification of parasite antigenicity:

1. Antigenic variations: African trypanosomes are present in parasitaemic waves due to the recurrent formation of variable surface glycoproteins which are changeable from time to time. This explains

periodicity of fever in African trypanosomiasis.

2. Shedding and renewal of surface antigens: This process is common among protozoal and helminthic pathogens e.g. in *Schistosoma*, viable schistosomulae shed the majority of cercarial membrane soon after skin penetration including their surface antigens.

3. Antigenic masking (Molecular mimicry): Schistosomes mask themselves by taking host antigens on their surfaces e.g. MHC antigens —> these are called **eclipsed antigens**.

- Also, schistosomes are able to synthesize antigens which cross react with host molecules, thus sharing the same host antigens —> this phenomena called **molecular mimicry**.

C. Modification and suppression of host immune response:

1. Antibody cleavage: *Schistosoma mansoni* is able to produce proteolytic enzymes which can cleave antibody at FC region.

2. Consumption of complement: Some parasites as *Echinococcus granulosus* produces antibodies which consume serum complement —> abolishing its effect.

3. Immune suppression:

Some parasites induce specific immune suppression in the host e.g.

a) *Leishmania donovani:* suppresses T-cell responses, although there is large amount of specific antibodies produced.

b) African trypanosomes: suppress or diminish both humoral and cell mediated responses, although IgM is constantly raised.

4. Modification of leucocytic function: *Schistosoma mansoni* adults modify leucocytic function by secretion of SDIF *(Schistosoma* derived inhibitory factor) and formation of immune complexes which inhibit lymphocyte transformation and mast cell degranulation.